12-1976

Bone Flutes and Whistles from Archaeological Sites in Eastern North America

Katherine Lee Hall Martin
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a thesis written by Katherine Lee Hall Martin entitled "Bone Flutes and Whistles from Archaeological Sites in Eastern North America." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

Charles H. Faulkner, Major Professor

We have read this thesis and recommend its acceptance:

Major C. R. McCollough, Paul W . Parmalee

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Accepted for the Council:

Hilton A. Smith

Vice Chancellor
Graduate Studies and Research

BONE FLUTES AND WHISTLES FROM ARCHAEOLOGICAL SITES IN EASTERN NORTH AMERICA

A Thesis

Presented for the

Master of Arts

Degree

The University of Tennessee, Knoxville

Katherine Lee Hall Martin

December 1976

ACKNOWLEDGMENTS

The author is grateful for the assistance, guidance and patience of Dr. Charles H. Faulkner and of Dr. Major C. R. McCollough and Dr. Paul W. Parmalee. Appreciation is also expressed to Dr. William Bass for his support and assistance in completing the museum research for this thesis. In addition, the author thanks the staff members of the Rochester Museum and Science Center, Rochester, New York, the Ohio State Museum in Columbus and McClung Museum in Knoxville, Tennessee.

ABSTRACT

The purpose of this study was to systematically classify perforated bone tubes known as flutes or whistles which had been recovered from archaeological sites in eastern North America. A sample was established from specimens described in the literature and additional specimens examined by the author. Sizeable collections in the Rochester Museum and Science Center in Rochester, New York, and the Ohio State Museum in Columbus, Ohio, were measured and photographed by the author. Specimens were also viewed at the McClung Museum in Knoxville, Tennessee.

A descriptive typology was constructed and spatial-temporal and functional correlations were tested against it. Spatial-temporal factors were seen to correlate most highly with factors of morphological construction as reflected in the typology. Functional factors correlated less directly with typological categories. Functional attributes were reviewed under the formal categories of functional performance, functional context and functional use. Under the third category, evidence for use of perforated bone tubes as game calls was found to support such a function in addition to the traditionally ascribed ceremonial function for these artifacts. No spatial-temporal correlations with functional factors could be discerned.

The primary value of this study was in the typological description of a class of artifacts for the first time. Further research using a larger sample was recommended.

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CHAPTER I

INTRODUCTION

Origin of the Study

Archaeological excavations in eastern North America have yielded artifacts which have been labeled flutes or whistles. Generally these artifacts consist of tube-shaped specimens of bone with one or more perforations of varying shape, which are capable of making some kind of sound when blown. Perforated bone tubes called flutes or whistles have been reported from archaeological sites at locations ranging east to west from New York (Ritchie 1932) to Iowa (Henning 1974), and, south to north, from Tennessee (Lewis and Kneberg 1947) to Newfoundland (Tuck 1971). Examples reported in the literature include those from at least 31 sites in 12 states and provinces. While most of these citations are merely descriptive entries in the archaeological reports, there are two exceptions.

Schweinsberger (1949:28-33) attempted to catalogue flutes and whistles from nine archaeological sites in the Ohio Valley. The article reviewed a few morphological and tonal aspects of these artifacts. Several recommendations were made for more extensive descriptions of these items in other site reports, but only one attempt was made to actually test two of the specimens discussed. Winters (1969:70-74) reviewed bone flutes or whistles reported in the literature in his discussion of the Late Archaic Riverton Culture. He merely listed the examples and drew a few comparisons of one or two attributes before generalizing about the flutes or whistles in the Riverton sample. However, neither Schweinsberger nor Winters attempted to directly analyze these bone artifacts in a systematic way.

Roberts (1936) discusses regional distributions of various aboriginal musical instrument types. Under wind instruments, Roberts (1936:17) lists six kinds of whistles and three types of open flutes for the eastern United States as a musical area. These include occurrences of whistles called mouth-blown stopped bone whistle, pottery plain whistle, wooden flageolet or whistle, flute with finger holes, single reed pipe, eastern type whistle and eastern type whistle with reed (Roberts 1936:17). The open flute is represented by the simple vertical tube, the skin-covered vertical flute and the elaborate flute, in the same musical area (Roberts 1936:19). No photographs nor descriptions of these types were included in this publication.

Roberts (1936:20) describes eastern North America as producing "some forms which appear not to occur west of it." Presumably this statement refers to the "eastern type" whistles mentioned above. All of the examples listed by Roberts show a distribution in the extreme northern and southern parts of eastern North America with little or no representation in the central area. No specific sites or locations were given for the examples.

The ethnographic literature also includes numerous accounts of flutes and whistles which were used in diverse activities: love songs (Densmore 1932a:208), welcoming parties (Swanton 1946:628), in ceremonies, for burial or healing, and during ball games (Densmore 1934b:129). Few bone flutes or whistles are mentioned. In one instance, however, the Seminole apparently used a deer tibia for making a flute (Densmore 1956:40; Swanton 1946:628). The ethnographic literature dealing with flutes and whistles refers to several types of materials (wood, cane and, less frequently, bone) used in making musical instruments and describes numerous cultural activities in which they were employed. These descriptions provide one form of evidence for various functions of artifacts known as bone flutes and whistles.

Other published information on the occurrence of flutes and whistles is found in archaeological site reports. This latter resource extends the temporal range of these artifacts into the prehistoric period. Preservation of the specimens through time is often a problem in the archaeological record. Flutes and whistles made from wood and cane are more perishable and are less likely to be encountered in archaeological excavations. While bone is also not always preserved, there are numerous bone artifacts dubbed flutes or whistles recovered from archaeological excavations and surface collection in North America, which have been reported in the literature.

Parameters for the Study

Four basic parameters were established to limit the sample for this study. First, only bone examples were considered. Secondly, the bone tube must have at least one perforation or possess some other definite indication of the intended manufacture of perforations. Thirdly, only specimens from archaeological sites were chosen. Two sources were used for this information. A review of the literature revealed a number of perforated bone tubes called flutes and whistles. Based on this sampling of the literature, a number of museum collections and privately owned examples were sought for direct examination. From this second sampling effort, a study sample of 90 perforated bone tubes was gathered. The fourth parameter was to limit the area of study to eastern North America.

Following the definitions given by Sokal and Rohlf (1969:10), the population for the study could be described as a limited population bounded by the parameters listed above and drawn from the universe of all perforated bone tubes. The study sample was then assembled and the auxiliary examples from the literature gathered as a part of that population.

Collection of the Data

The large number of these artifacts described in the literature indicated that a study might be structured so that an examination of them could be made in a more systematic way. This approach would allow a summary of the dimensions of the specimens and provide a means for establishing similarities and differences within the sample which might justify a classification.

A series of inquiries revealed that there were several museum collections which contained a large enough number of examples to warrant further investigation. Efforts were made to examine as many examples as possible in order to obtain measurements and to test the playing or sounding potentials of the specimens. A data recording sheet was devised for the collection of this information. Approximately 90 specimens were measured and photographed.

The procedure followed to obtain the sample was influenced somewhat by several factors. Since the examples came from archaeological sites, differential preservation of the bone was an uncontrolled variable. The literature search was conducted as a random process in the sense that no attempt was made to consider any specific published source of information on archaeological sites from eastern North America over any other for the same area. However, the choice of museum collections as a source of actual specimens to examine was guided by the knowledge derived from published sources.

Another factor against any assumed random distribution of these artifacts within the specified parameters for the study was the spatial clustering of the artifacts as they appeared on the sites (locations determined by the prehistoric inhabitants). The sampling procedure has already skewed the randomness by choosing clustered groups in New York and Ohio. This could affect results if types correlate with cultures (see Spaulding 1960:61; Binford 1965:42). Therefore, it was possible to maintain only a degree of randomness at the outset, given the four parameters listed above. The size of the study sample is sufficient in the classic sense of a sample, that is, it contains over 30 specimens (Ellis 1975; Knoosis 1972; Walpole 1974). However, due to the vastness of the spatial and temporal aspects involved it is difficult to assume classic behavior for the sample as a whole in reviewing frequency distributions and strengths of other associations without some caution.

The Hypothesis

In order to focus the information which was being derived from the sample, the following hypothesis was formulated. The group of artifacts from prehistoric contexts in eastern North America, referred to and casually interpreted as "bone flutes and whistles," can be methodically tested with reference to their morphology, potential tonal attributes, anthropological contexts, and temporal and spatial distributions. This can be done with the aid of data from the fields of ethnology and organology, and these artifacts may be sub-classified in a manner which will reflect numerous specified functions and tonal systems and will constitute a significant culture-historical document and provide a useful model for subsequent archaeological interpretation and testing.

This hypothesis can be broken down into a number of constituents which may be evaluated separately. The published sources for these artifacts to date will be reviewed first to establish the background for the discussions presented in these references. The existing interpretations will be evaluated and as much information obtained as possible about each example. The study sample which was actually tested by the author will then be discussed. Results of the measurement and observation of this study sample as to morphological and tonal attributes will form the basis for a proposed typological classification. The attributes to be considered at this point will lend themselves primarily to a descriptive morphological/stylistic typology.

The remaining constituents of the hypothesis will offer the opportunity to reorient the typology differently in a later section. Distributions in the temporal and spatial dimensions will be examined to see whether any correlations are significant within either dimension, or between the two dimensions. Any existing correlations will be tested against the descriptive typology first proposed.

Information available from the archaeological record as to the provenience or context and associated items will be reviewed for each specimen in the combined sample. The archaeological context is very specific when artifacts are found with a burial. In other cases, the context may be general (from a midden or refuse pit), or ambiguous (from a surface collection or in private collections). Functions for these artifacts have been interpreted based upon these contexts. Other functional interpretations combine archaeological inference with information from ethnographic or organological literature. With the advantage gained through the larger sample obtained in this current study, some of the earlier speculations may be seen as too broad or untenable or too restricted for these types of artifacts from eastern North America.

The proposed typology will be compared with these functional factors to determine its validity from another standpoint. A reformulation of the typology based on the additional input from the chapters discussing spatial, temporal and functional factors will be considered at this point in the study. The extent to which the initially proposed typology agrees with the results from the discussions of temporal-spatial and functional dimensions will indicate the degree to which the hypothesis can be supported.

A final assessment of the hypothesis will be made from a synthesis of the distributional, functional and typological data discussed so far into an evaluation of the cultural and chronological singificance of the derivative correlations. The correlations and typology thus obtained will provide a reference for future evaluation of new discoveries of similar artifacts.

Development of Concept and Method

A major proposed objective is to determine whether data collected systematically for the sample may be logically classified and interpreted under three different approaches and to what degree the results of these three approaches will concur. The tentative typology advanced under the first perspective will use morphological characteristics as well as the tonal potential. The method employed will test the extent to which the attributes isolated for this first typology remain relevant with the addition of their frequency distribution through space and time, as well as consideration of factors known about the cultural contexts or assumed functions for the artifacts. This general method of dealing with this class of artifacts which are described as perforated bone tubes will offer the opportunity to view this sequential presentation and subsequent evaluation of the interaction among several kinds of attributes.

Early archaeological work attempted to group artifacts into typologies based mainly on a general arrangement of characteristics into categories which could be called classification (Watson, LeBlanc and Redman 1971). However, a type and what it might represent became an issue as archaeological data became useful for comparative studies over broader geographical areas. Questions arose as to the meaning of the word "typology" and whether or not typology and classification were synonomous (Spaulding 1953). One position would place similar requirements on both of these words. The numerical taxonomist uses the word "classification" with the assumption he will derive classes of items which can be replicated by another scientist using the same procedure (Sokal 1966:107). While a few archaeologists mirror this concept in their writing (cf. Hodson 1970), many feel there is a distinction between classification and typology. Classification would be the act of grouping items, while "empirically verifiable units" are derived only through typological procedure (Watson, LeBlanc and Redman 1971:126).

The word "typology" will receive an initially neutral definition for this study. The descriptive typology proposed in the second chapter carries mainly morphological and stylistic rather than functional implications (Tugby 1970:638). However, the spatial-temporal and functional factors to be discussed in the subsequent two chapters may modify the validity of the descriptive typology. The final goal for the typology would fall within the latter position described above, with typology distinguished from classification. The typology will be established in such a way that it may be expanded to include additional examples of similar artifacts even if the new items differ somewhat.

Identifying the similarities as opposed to differences in a group of items in order to establish a type of artifact seemed to be a basic requirement for a typology. However, the isolation or identification of these similarities is still subject to debate. Many archaeologists supported the definition of a "type" as requiring relationships between two or more attributes (Binford 1965; Rouse 1960; Spaulding 1953, 1960). This position left both the definition of the attributes and the characteristics of the relationships between them open to interpretation (Rouse 1960:316). Since 1951 (Brainerd 1951; Robinson 1951), published articles have included more and more mathematical methods for describing the relationships among attributes and have dealt with either stylistic or functional attributes in various combinations (Binford 1972; Tubgy. 1970).

The initial descriptive typology in the current study will be established through the evaluation of several discrete or discontinuous variables which can be defined or described as stylistic variables. Continuous, metric attributes of modification such as perforation size and spacing are limited by the biological morphology of the bone utilized. These variables, in addition to the metric attributes of the biological morphology of each bone tube taken together, represent the total morphological attributes for each specimen. The two types of morphological attributes do not combine easily into any linear progression of association. The aspects of tonal potentials or attributes will be combined with discussion of stylistic or cultural morphological attributes.

The functional aspects of these tonal attributes may be distinguished from the functional attributes of cultural usage (often equated with the context of the artifacts as discovered in excavation). These two varieties of functional attributes correspond to the difference between primary and secondary functional attributes as described by Binford (1972:202-203). However, Binford's breakdown of these factors in relationship to technological, morphological, design and decorative attributes does not fit this current study as well as it does ceramic artifacts. For instance, perforated bone tubes begin as biological entities characterized by the species from which the bone was taken. This factor is virtually non-existent for ceramics. Binford's categories may be adjusted somewhat to include stylistic morphology, primary functional (tonal) attributes, biological morphology, and secondary functional (cultural context) attributes.

The information about temporal-spatial aspects of the artifacts and of selected attributes will be the second focus. Here the examples described in the literature and the study sample examined by the author will be combined to explore frequency distributions for perforated bone tubes in space and time. The results of these distributions will be compared with those from the descriptive typology for tentative generalizations.

The third perspective will involved functional attributes for the combined sample. These attributes will be grouped under discussions of the functional performance, functional use and functional context for each artifact. The functional performance corresponds to primary functional attributes, while the functional context is limited to the evidence obtained upon archaeological discovery. Thus, the secondary functional attributes will be broken into those factors obtainable from archaeological provenience, and those other factors which may be established by inference from functional performance, functional context or ethnographic evidence as potential functional use. The secondary functional attributes or cultural context has sometimes been assumed from either the archaeological context alone, or with the addition of limited reference to enthnographic literature. A systematic tabulation of these factors for the study sample and for the examples from the literature will be examined for relevant trends in the distributions of context and of types. Again, this information will be tested in relationship to the results of the previous two chapters.

The attempt to synthesize the results obtained under each of the three perspectives (morphological, spatial-temporal and functional) will serve both as a cumulative summary, and as an additional level of interpretation. This sequential classificatory scheme is similar to Rouse's model or the analytical approach to classification wherein the technological, stylistic and functional modes are derived from various attributes (Rouse 1960:315). These modes are the recommended bases for the construction of taxonomic classification "instead of going back again to the original attributes" (Rouse 1960:315). The essential difference is that the present study proposes a typology on the basis of one of the modes and then tests its validity in terms of the other two modes.

Under each of the three modes or perspectives, the attributes considered will be handled in more than one way for two reasons. First, the basic need to describe the class of artifacts called bone flutes or whistles for eastern North America calls for as broad or comprehensive a treatment as possible for any and all attributes which can be listed for these artifacts. Further, this multiple approach allows a preliminary or limited comparison of the various attributes. While functional or morphological attributes might receive greater or exclusive attention for establishing a typology, this study attempts to provide consideration of the attributes in terms of each one of these, and, also, compares all categories of attributes.

Thus, a particularizing perspective will be taken to examine the three categories of stylistic, spatial-temporal and functional attributes. A generalizing perspective can then be reached through a comparison of the particular attributes in each category. The effort to acknowledge and utilize both the particularizing and generalizing approaches when possible has been encouraged for archaeologists (Watson 1973:120-122). There is no logical conflict between the two approaches and both are needed in archaeological interpretation. The design of the present study attempts to integrate the two by means of examining the data in the three categories prior to a synthesis.

CHAPTER II

A TYPOLOGY OF PERFORATED BONE TUBES FROM PREHISTORIC SITES IN EASTERN NORTH AMERICA

The perforated bone tubes considered in this study are described in the archaeological literature or were examined in museum and private collections by the author. According to published reports, about 30 sites in eastern North America have produced perforated bone tubes described as "flutes" or "whistles." Although these published descriptions were detailed in some cases, it was necessary to restudy as many of these specimens as possible to establish the actual function and cultural associations of perforated bone tubes variously called flutes or whistles in the literature. Ninety specimens were examined by the author and these constitute the sample used as the basis for this study. The data were recorded on a form which was devised to obtain the maximum information about these artifacts. These data were then used to construct a typology of these artifacts which is based on morphological and tonal attributes.

Perforated Bone Tubes Described in the Literature

Perforated bone tubes from 31 sites in eastern North America represent ten different states and two Canadian provinces. References from the southeastern states of Kentucky, Tennessee and West Virginia will be described first, followed by those from the midwestern states of Illinois, Indiana, Ohio, Wisconsin, and Iowa. Additional examples of these artifacts were reported from sites in Maine and New York in the Northeast as well as from Newfoundland and Ontario in Canada.

The Southeast

Kentucky. One of the first published references to include so-called bird bone flutes or whistles was in a report on the excavation of the Fox Farm site in Macon County, Kentucky (Smith 1910). In this report are illustrations of a bone fragment with four perforations from Mound 2, a bone tube with seven perforations from Mound 1, and two bone whistles with two perforations from the general excavation (Smith 1910:Plate 37, Fig. 5; Plate 42, Fig. 2; Plate 51, Fig. 13; Plate 51, Fig. 14). In addition to these artifacts, another bone flute or whistle from Mound 1 and three examples from the surface collection (one artifact with four perforations and the other with an undetermined number of perforations) are listed for this site in the American Museum of Natural History Catalogue (Volume 20:57).

A number of perforated bone tubes have come from the so-called "Shell Mound Archaic" sites in Kentucky. A perforated bone tube was found at the Indian Knoll site in Ohio County (Webb 1946). The bone was tentatively identified as the ulna of a whooping crane, although both ends of the shaft had been removed. The shaft is 250 mm. long and 14 mm. in diameter at the proximal end. A rectangular perforation about mid-shaft is 18 x 15 mm. with a circular hole 2 mm. in diameter on each side of the rectangular perforation (Webb 1946:304-306). However, Webb (1946:305) feels the Indian Knoll example is unfinished with one end section only partially cut through as if to be removed, creating a shaft length for the Indian Knoll example coinciding with that of a similar specimen from the Carlson Annis site in Butler County. This correspondence was obtained by aligning the two main rectangular perforations on the two shafts. The Carlson Annis specimen, also identified as the ulna of a whooping crane, is 212 mm. long and 15 mm. in diameter with its rectangular perforation 6 x 13 mm. and circular perforations, 2 mm. in diameter, on either side. This latter example is elaborately decorated with engraved designs (Webb 1946: 304-306).

Two additional perforated bone tubes came from the Carlson Annis site. These were smaller bones, one with a single oval perforation in the center and the other with a central oval perforation and a second smaller oval perforation directly opposite it on the reverse side of the tube (Webb 1950a:295, 321). Four bone fragments are identified as possible flute fragments because they exhibited incised decoration similar to that found on the large carved crane ulna (Webb 1950a:324-325).

Bone whistles were also reported from the Barrett shell-heap in McLean County, Kentucky (Webb and Haag 1947); five of these are illustrated. Each has a single large oval perforation, either at mid-shaft or near one end. Two have a second smaller perforation on the opposite side visible through the front oval perforation (Webb and Haag 1947:25 and Fig. 8A).

One other Butler County site produced a bird bone flute. The Read Shell Midden yielded one example in the general excavation

(Webb 1950a:382), but no photograph or description of the item is included in the report.

Hanson (1966) listed nine flutes or whistles fashioned from hollow bird bones from the Hardin Village site in Greenup County, each with four to six holes appearing in random distribution. The author commented that these are apparently "musical instruments, but they might also have served as signaling devices" (Hanson 1966:155).

Griffin (1966) listed bone flutes from the Fullerton Field site, located four miles from the Hardin Village site in Greenup County, Kentucky. This village and cemetery is on the west bank of Tygart's Creek three-quarters of a mile from its mouth. Griffin (1966:80) placed this site in the Feurt Focus of the Fort Ancient Aspect.

Tennessee. T. M. N. Lewis and Madeline Kneberg (1947; 1959) illustrated a bird bone whistle from the Cherry site in Benton County in the upper Big Sandy River Valley which was interpreted by them as representing the Big Sandy Phase of the Mid-Continent Archaic Tradition. The whistle has two perforations situated longitudinally across the shaft. One perforation is broken upwards along the shaft, giving it the appearance of an inverted "T." While whistles or flutes were listed for the Kays Landing site in Henry County and the Oak View Landing site in Decatur County, both in the western valley of the Tennessee River, none was illustrated or discussed (Lewis and Kneberg 1947:27; 1959:177).

In the Hoover-Beeson Rockshelter report Butler (1971) described a bone tube which was polished at each end and possessed a single oval hole in the middle. Butler (1971:59) described this whistle from Cannon County as "almost identical" to the whistles mentioned from the Lamoka and Frontenac phases in the Northeast, described below.

Another perforated bone tube described as a flute was recovered with Burial 2 at the Spring Creek site in Perry County in the western Tennessee Valley. Two rectangular perforations are evident in this flute fragment. This infant burial was found in the Kirby Zone dated 1400-800 B.C. (Peterson 1973:11).

West Virginia. The Wells village site in Mason County, West Virginia, yielded many bone artifacts including bone flutes (Griffin 1966:242). Another West Virginia site on the Ohio River in Cabell County, called the Clover site, also contained bone flutes (Griffin 1966:244). No descriptions are available for these specimens.

The Midwest

Illinois. Parmalee (1964) mentions two bird bone whistles, one fashioned from a swan humerus and the other from the ulna of a bald eagle. Each specimen exhibited a triangular perforation which had been cut out of the shaft near the distal end. Perforated bone tubes have been found at the historic Sauk-Fox Crawford Farm site in Rock Island County (Parmalee 1964:171).

Bone flutes or whistles have been found at three Late ARchaic Riverton culture sites in the central Wabash Valley (Winters 1969). A flute or whistle fragment with two circular perforations came from the Robeson Hills site, with another fragment probably of the same type. A number of possible flute fragments were obtained at the Riverton site; three additional surface specimens from private collections were also available to Winters for examination. These latter three artifacts were grouped with the one from Feature 1, Area X at the Riverton site to draw generalizations about their common characteristics. These artifacts, presumably the leg bones of large birds, had two perforations in a line along the long axis of the bone. Winters (1969:71) further noted bands of notching and encircling grooves on the ends of some examples as well as variation in perforation pattern between two perforations which were circular or slightly elliptical and the contrasting pattern of rectangular perforations.

A copper-wrapped bone whistle was excavated in Mound 5 of the Gracey Mound group on the northern bluffs overlooking the Macoupin Valley near Chesterfield, Illinois (Farnsworth 1973:40). This artifact was considered possible evidence of association with the Hopewell Interaction Sphere (Farnsworth 1973:21). Unfortunately, the whistle was subsequently lost.

Indiana. Lilly (1937) illustrated two perforated bone tubes from an Indiana site, one with a single, roughly square perforation, and the other with two elliptical perforations. The exact site location was impossible to determine from these specimens. The artifact assemblage from the Fifield site in Porter County included an unfinished bone whistle (Skinner 1951:41). This site, considered a component of the Upper Mississippi Fisher Focus, also yielded some non-Fisher material. A drilled hair-spreader similar to Madisonville Focus artifacts and a bone rasp "reminiscent of some Feurt forms" (Skinner 1951:44) indicate possible influences from the Fort Ancient culture in the Ohio area. No photograph or description of this bone whistle was given.

The Angel site which lies on the border of Vanderburg and Warrick counties is located on the Ohio River just above the confluence of the Green River with the Ohio (Black 1967:5-7). Ten whistles were reported from this Mississippian site, only one of which was completely preserved. Three perforations were drilled into one side of this artifact; the other examples exhibited one to three perforations with one "instance where two of the three penetrate both walls of the bone tube" (Black 1967:454).

Ohio. Mills (1917) reported a number of whistle-like objects from the Feurt site (Scioto County) which is situated on the east side of the Scioto River. Most of these specimens had three holes drilled in the cut shafts of radii of large birds, while the others exhibited two or four holes. Most of the cut perforations were round and some had been enlarged by burning. Nearly all of the specimens had the holes drilled in a line. On one specimen, the center hole was out of line with the other two on the shaft (Mills 1917:433).

Bird bone flutes have been found in the Whittlesey Focus sites of northeastern Ohio in Lake and Cuyahoga counties bordering Lake Erie

(Morgan 1952:97). The artifact illustrated (Fig. 36) shows three perforations widely spaced along the shaft. The exact site from which this example came is not indicated in the reference, but is probably one of those described by Greenman below.

The excavation of the Reeve village site in Lake County produced two artifacts described as bird bone flutes (Greenman 1935). One had three perforations and the other, four; the former specimen produced sounds when blown. Greenman described the procedures used to obtain the tones.

> This specimen has three tones, but the number of tones does not correspond to the number of stops. The central stop does not alter the tone, and when it is closed, alone or with either or both of the others, there is no musical note. The notes A, B and C may be produced respectively by closing the two end stops, then releasing one or the other, then releasing both (Greenman 1935:18).

The other example from the Reeve village site produced no sound when air was blown into it, and Greenman (1935:19) attributed this to the fact that the flute which produced a sound had a long axis which was curved, "while that of the smaller one is nearly straight."

Bone flutes were also found at the South Park and Tuttle Hill sites (Greenman 1937). The flute from South Park had three perforations on one side, two at one end and one at the other, and a fourth perforation on the opposite side of the shaft. The example from Tuttle Hill had three perforations on one side and two on the other. Greenman (1937:343) found this latter specimen could not be played but designated its use as a game call.

A bone whistle from the Bourneville Mound in Ross County was made from a right human radius with one triangular and two elliptical perforations at the distal end and two small, circular perforations at the proximal end. A copper band and an engraved geometric design contributed to the unusual character of this specimen (Baby 1961:108).

Several sites in Hamilton County produced artifacts variously called flutes or whistles. About 20 perforated bone tubes were found on a large site near Madisonville, Ohio (Hooten and Willoughby 1920:62). These specimens had five to nine perforations with a one-fourth inch spacing between them on most examples. At the Turpin site, located on the south bank of the Little Miami River, a number of bone flutes with three or four perforations were recovered (Griffin 1966:146-148). The Sand Ridge and Hahn's Field sites also produced flutes which were neither pictured nor described. These two sites, originally explored by C. L. Metz, are discussed by Griffin (1966) along with the Turpin site as a part of the Madisonville Focus of the Fort Ancient Aspect.

Wisconsin. A bone whistle was discovered at the back of the head of a child buried in an Old Copper cemetery known as the Oconto site, Oconto County (Ritzenthaler and Wittry 1952). The six-inch long specimen has one central rectangular perforation with a smaller circular perforation on either side of the main one. Three rows of incised lines run the length of the tube (Ritzenthaler and Wittry 1952:211).

Iowa. A perforated bone tube fragment was found at the Cherokee Sewer site on the Little Sioux River in Iowa (Henning 1974). This example has two complete perforations and one broken perforation on one side of the shaft.

The Northeast

Maine. Hadlock (1943) listed six bone flutes or bird call implements taken from shell heaps in the Frenchman's Bay region of Maine. Three from the Ewing and Bradgon shell heaps and two from the Tranquility Farm shell heap had three or four circular perforations and a larger oblong perforation. Another smaller specimen, also from the Tranquility Farm shell heap, was only two inches long and had a single circular perforation. The multi-perforated bone tubes came from the upper strata of their respective shell heaps while the latter, smaller item was from the "lowest horizon of beach gravel and fire dirt" (Hadlock 1943:349). Hadlock (1943) mentioned other occurrences of such bone implements in various shell heaps from all levels (leading him to view the culture which produced them as common to the area as a whole).

An unidentified object appeared among the bone artifacts described by Moorehead (1922) from archaeological sites in Maine. In the drawing accompanying the report, this perforated bone tube appears to have a long, rectangular central perforation and a smaller irregular perforation near the broken distal end, with possibly another perforation at that end (Moorehead 1922:205, Fig. 106). This perforation pattern is similar to that described by Hadlock (1943) for specimens from shell heaps in the Frenchman's Bay area.

<u>New York</u>. Ritchie (1932) illustrated four bone flutes or whistles (one with four finger holes, one with three finger holes and two with a large sound-hole in the middle) from the Lamoka phase of the Laurentian tradition in New York State. Frontenac phase sites from the same area contained six bone flutes or whistles (one with four finger holes, two with three finger holes and three with one large sound hole) (Ritchie 1945). Ritchie (1969) also mentioned a bone tube, which he said is possibly a whistle, in the Brewerton phase. Ritchie (1936) listed three flageolets or whistles from the Sackett Farm site, Ontario County. These were omitted in a later discussion of this site (Ritchie 1969).

Ritchie (1969) illustrates some interesting variations in perforation patterns on these artifacts. The examples in the illustration from the Lamoka phase which have more than one perforation exhibit approximately even spacing of the holes, while the single perforations in the remaining examples are oval with the long axis of the hole parallel to the long axis of the bone tube. For the Frontenac site, Ritchie pictured single-perforation specimens which conform to the Lamoka style with some overall size variations. However, the multiple-perforation examples show three very different treatments. The smallest bone tube in this group has three circular holes placed in a line. The largest representative has four holes in a line at one end and one larger triangular perforation at the other end. The final multi-perforation flute or whistle from the Frontenac site has two tiny holes at one end and one oval perforation just past the mid-line of the tube and not at the extreme end as in the previous example. These variations indicate a wider range of construction morphology and perhaps usage than most samples reviewed so far.

Canada

Newfoundland. The Port au Choix cemetery is a Maritime Archaic tradition site in Newfoundland (Tuck 1970, 1971). Grave goods found with the burials included a number of bone tube artifacts. Parmalee (n.d.b:3) has identified the bird wing bones which had the ends cut off, were scraped, drilled or engraved "or otherwise altered for use as whistles and the like." The ulnae of swan, goose and eagle were used in making nine whistles; there was one main roughly oval perforation in all examples and additional smaller perforations in three specimens. Further, in many instances a second smaller circular perforation opposite the main oval perforation can be seen through the larger hole. Two whistles have what Parmalee (n.d.b:Plate 2) refers to as "shallow scored cuts" in parallel rows at one end of the shaft.

James Tuck (personal communication to Paul Parmalee, 1974) mentioned a bone flute or whistle recently obtained on a site in the southern part of the Labrador peninsula which has been dated at 5525 B.C. No published information is currently available on this site or specimen.

Ontario. Six flute-like bone objects were recovered during work on the Middleport site on the Grand River in Brant County (Wintemberg 1948). Two specimens had two perforations. One of these had conically-shaped perforations and the other, oblong perforations (Wintemberg 1948:Plate XV, Fig. 31 and 32). These were identified as the tibiae of small mammals. Three sections of bird radii had three perforations each (Wintemberg 1948:Plate XV, Fig. 27, 28, 29 and 30). Wintemberg (1948:28) reports five other similar bone objects from Iroquois sites of the Neutral Focus in Ontario.

Schweinsberger (1949) surveyed about fifty bone flutes and whistles found on Ohio Valley sites. These artifacts ranged in length from two to just under ten inches and had from one to eight perforations (round, rectangular, or oval, appearing either on one side of the tube, or, occasionally, on the opposite sides of the tube). This synthesis of Ohio Valley specimens grouped these bone flutes and whistles for summary in a table accompanied by a brief discussion. The article was mainly descriptive, but some observations were advanced that deserve comment. The insistence that "certain measurements, observations, and photographs or drawings" (Schweinsberger 1949:32) be included in archaeological reports is commendable. The need for exact measurements of perforations is important for any detailed study of acoustical aspects, and the identification of the type of bone utilized is important, not only for classification, but also for possible functional interpretation. However, the statement that "no musical note can be attained from a perforated tube which is straight" (Schweinsberger 1949:32) echoed the excuse Greenman (1935:19) offered for a mute flute from the Reeve site. This conclusion is not supported by acoustical engineering principles nor by comparative testing of specimens.

Winters' study (1969) attempted to review reported occurrences of bone flutes and whistles and to ascribe a ceremonial function to these artifacts. General remarks relating to the correspondences of certain morphological characteristics were noted. A distinctive perforation pattern was reported from the Kentucky sites, this being one central perforation with a smaller perforation on each side. Another recurrent pattern of two perforations was described for other sites. The perforation pattern of two rectangular slits, which was designated as the prevalent Riverton style, was compared with the example from the Cherry site in Tennessee (Winters 1969:71-72).

After noting these similarities, Winters (1969:73) turned to consideration of the possible functions of these artifacts. The archaeological contexts of the various examples (particularly when found with burials) were used to support the idea of a ceremonial function. He also concluded that there was likely a "sensitive typology linking particular flute forms to specific regional Archaic manifestations" (Winters 1969:72). This conclusion was not supported by any quantitative compilation of data.

Despite these two studies, no comprehensive listing of all of these published reports on bone whistles and flutes exists. An attempt has been made to organize what information may be gleaned from the published sources as to the attributes of these perforated bone tubes. Due to the obvious lack of uniformity by the authors in reporting such artifacts, some attributes could not be determined from a study of the literature.

Each site was coded for the total number of specimens per site, the type of bone utilized for the artifacts, the archaeological contexts in which these artifacts were found, the number, shape and pattern of perforations on each specimen, and an indication of whether or not the specimen produced a sound when blown. Table 1 lists these attributes as they were tabulated for the examples mentioned in the literature. In most cases a good deal of this general information was available, but it was partially or entirely lacking in others. This collated information will be discussed further after the proposed typology has been presented. Some of these examples from the literature are included in the sample to be defined below and, thus, provide part of the basis for the typology.

In such cases, the perforated bone tube described in the literature was located in a museum or private collection and available for direct examination. An additional number of examples existed in the collections, but had not been described in the literature. A third group remained which was discussed in published sources, but was not available for examination by the author. Thus, some of the specimens from the literature were examined by the author and will be discussed as part of the sample described below. The items which remain in the third category, those which are known only from the literature, will be considered after the descriptive typology is derived from the study sample.

The Study Sample

The study sample came from three museum collections plus specimens in private collections from five additional sites. Several museums

TABLE 1

CODES FOR SITES FROM THE LITERATURE

Code	Explanation
1.	Total number of specimens from the site.
2.	Type of bone identified: B = bird, M = mammal, H = human; R = radius, U = ulna, T = tiba, and H = humerus.
3.	Archaeological context in which found: B = burial; M = midden; P = pit; GE = general excavation; MD = mound; S = surface collection.
4.	Number of perforations in first specimen.
5.	Shape of perforations in first specimen: OB = oblong; OV = oval; CR = circular; SQ = square; RC = rectangular; EL = elliptical; TG = triángular; IR = irregular; PS = pear-shaped.
6.	Perforation pattern on specimen No. 1: l = in a line o = opposite sides of the shaft s = adjacent, going around the shaft
7.	Sound obtained when blown: Y = yes; N = no.
8-11.	Same as 4-7 as applied to second specimen.
12-15.	Same as 4-7 as applied to third specimen.
16-43.	Same as 4-7 as applied to the remaining specimens.

held sizeable collections of perforated bone tubes reported as flutes or whistles in the literature. The items described by Ritchie (1932, 1936, 1945) are housed in the Rochester Museum and Science Center, Rochester, New York, and the specimens from the Feurt site as well as several other important Ohio sites are in the collections of the Ohio State Museum, Columbus. A third source was the McClung Museum in Knoxville, Tennessee, which possesses artifacts from numerous sites in Tennessee. Additional examples were obtained for direct examination, including the specimens from the Riverton culture sites, one unfinished example from the Rhoads site and two from the Cahokia site (all in Illinois), the Rankin site in East Tennessee and the Port au Choix site in Newfoundland.

Twenty-nine perforated bone tubes were examined in the Rochester Museum and Science Center. Seventeen came from Lamoka Lake, one from Woodchuck Hill, nine from Frontenac Island, and two from Sackett Farm. The first three sites are Late Archaic, while the latter is a Late Woodland Owasco site. Perforated bone tubes from two other Owasco sites were listed in the museum catalogue, but were not available for study at the time the author visited the museum.

Thirty-five bone flutes or whistles from Ohio sites were in the Ohio State Museum. The most spectacular specimen was the human bone whistle from the Bourneville Mound (Baby 1961). Two other examples came from the Reeve site, and one each from the Tuttle Hill and South Park sites. The other thirty specimens were from the Feurt site.

Several bone tube fragments described by Winters (1969) were made available for study, but only one showed clear evidence of perforations. The others exhibited some decoration, but the small size of the fragments made their actual form and function difficult to determine.

Three examples from Illinois were measured. One specimen from the Rhoads site, tentatively identified by Parmalee as the ulna of a swan, was probably unfinished. One triangular perforation was cut through while another was clearly marked for cutting on the surface of the bone. Two small perforated bone tubes were recovered at the Cahokia site during the 1973 and 1974 field seasons. These exhibit evidence of modification by cutting and scrapping on one example, and by drilling or cutting an incomplete perforation on the other. The former example was the tibia of a small mammal, and the latter, the ulna of a bird (Paul W. Parmalee, personal communication 1974).

Seven perforated bone tubes from the Cherry, Kays Landing and Oak View Landing sites described by Lewis and Kneberg (1947, 1959) are catalogued in the McClung Museum card file as bone flutes and whistles. The example from the Hoover-Beeson Rockshelter (Butler 1971) is also in the McClung Museum collections.

Three whistles were collected from the Rankin site in Cocke County on the upper French Broad River in Tennessee. The predominance of Watts Bar series pottery on this site indicates it dates to the Early Woodland period (Smith and Hodges 1968). The published report of the excavation does not include the whistle specimens, but they were kindly loaned for examination by Mr. D. C. Smith. The final collection examined and measured for the study sample was the group of eleven perforated bone tubes from the Port au Choix site in Newfoundland (Tuck 1970, 1971). The total number of examples measured from all sources was 90.

Photographs of the specimens are contained in Appendix A. Several of the 90 specimens were excluded for various reasons. Photography equipment was unavailable when one of the three Rankin site specimens was examined; the other two were photographed at another time. Several specimens included in the collection at the Rochester Museum and Science Center do not appear in the photographs taken in this study since these specimens are on permanent display in the museum. The first two of these appeared in the report on the Lamoka Lake site (Ritchie 1932:Plate IX), and the latter two were in another photograph in Ritchie's (1945) description of the Frontenac Island site. These two photographs were presented as Plates 20 and 41, respectively, in Ritchie (1969).

Three flageolets or whistles are listed from the Sackett site (Ritchie 1936:47), and one of these is pictured in that text as Plate IX, #5. A perforated bone tube from this site was on permanent display when the author visited the Rochester Museum and Science Center. This specimen (79) was not photographed. Another specimen (78) was also measured but not photographed, and a third specimen (95) was photographed but could not be located while the author was in Rochester (the photograph and measurements for Specimen 95 were supplied later by the museum).

Figure A.10 in Appendix A includes four specimens (91, 92, 93 and 94) identified by Winters (1969:70) as flute fragments from Riverton culture sites in Illinois. While this function is indeed possible, the parameters for this study were established as requiring some evidence of perforation of the bone tube. The Riverton fragments labeled specimens 91, 92, 93, and 94 in the current study are not large enough to provide such evidence. However, specimen 39 from Robeson Hills, another Riverton culture site, does exhibit perforations and was included in the study sample.

Two perforated bone tubes in the Port au Choix sample do not lend themselves to designation as actual flutes or whistles. Although specimen 46 has two oval perforations at one end the broken area adjacent to these makes it difficult to assess the functional potential of this area of the tube, (Appendix A, Figure A.4, 46). A similar perforation pattern appeared on an antler artifact illustrated for the Fort Ancient culture (Griffin 1966:Plate LII).

Specimen 49, also from the Port au Choix site, bears incised patterns similar to specimens 42, 47 and 48, all from the same site, although the diamond-shaped mark is below only one perforation, the smaller of the two opposing ones. The perforations near one end of the bone are so small that they appear to have been from suspension of the tube rather than for its use as a whistle. No sound was obtained when specimen 49 was tested. Thus, the morphologies of specimens 46 and 49 from the Port au Choix site do not support the contention of their being flutes or whistles.

Several of the specimens listed by Lewis and Kneberg as flutes or whistles from Tennessee sites exhibit unusual variations although they may technically fall within the parameters for the current study. Specimen 81 from Kays Landing and specimens 84 and 85 from Oak View Landing each have some attributes which vary from most examples in the sample. Specimen 81 (Appendix A, Figure A.9) has one circular perforation near one end and, while this tube may have functioned as a whistle, it has no direct resemblance to specimens which were sounded during this study. Likewise, specimen 85 from the Oak View Site (Appendix A, Figure A.9) in Tennessee, made from the right mandible of a gray fox, is unique among all examples considered for this study. While it is impossible to entirely rule out its use as a whistle, it is equally impossible to support its use for that purpose without reservation. The perforation in specimen 84 (Appendix A, Figure A.9) may be the result of breakage rather than direct attempts at artifact manufacture (Parmalee, personal communication 1975).

Two specimens (30 and 50) from the Feurt and Port au Choix sites, respectively, exhibit a deteriorated condition. The perforations which exist in these specimens are not in any organized pattern and several of them in each case appear due to breakage, erosion of the bone or rodent gnawing (see Appendix A, Figure A.16, 30; Figure A.3, 50).

These eleven specimens have been removed from the original sample and one specimen (number 95, discussed above) has been added giving a corrected total of 84 for the study sample. The totals for various categories in the proposed typology will be based on this sample of 84.

These specimens will be discussed as to their morphological attributes and possible clustering of those attributes in consistent patterns.

A data recording sheet was used to tabulate these attributes for the specimens examined from museum and private collections. An example of the data sheet appears in Appendix B. Morphological data were recorded for four attributes. Bone identification was noted as to whether bird or mammal, and the specific bone and species were listed when known. A number of the specimens were identified by Dr. Paul W. Parmalee, Department of Anthropology, University of Tennessee.

Each specimen was measured for total length and for maximum, minimum, and mid-shaft widths. The perforations were described as to number, shape, pattern and placement on the shaft. The perforations were also measured for inside and outside length parallel to the length of the shaft; inside and outside width; and, the spacing of perforations in a line, measured from the center ofone perforation to the center of the adjacent one. The sounding capabilities were tested on specimens examined by the author. If the perforated tube produced a sound, the number of pitches and fingering system used were recorded. The fragile or clogged condition of many specimens prevented exhaustive testing for sound. The attributes coded for each specimen are listed in Table 2.

Only one specimen of the 84 was made from human bone. The example from the Hopewell Bourneville Mound was carved from a radius and elaborately decorated. The other perforated bone tubes were fashioned from either large bird or small mammal bones. Only three specimens were identified as having been made from small mammal bones while nearly

TABLE 2

ATTRIBUTES FOR PERFORATED BONE TUBES

Code	Definition	Code	Definition
1.	Total length	25.	Perforation No. 4 inside width
2.	Maximum width	26.	Perforation No. 4 outside width
3.	Mid-shaft width	27.	Perforation No. 4 shape
4.	Minimum width	28.	Length perforation No. 3 to No. 4
5.	Number of perforations	29.	Whole specimen/fragment
6.	Perforation No. 1 inside length	30.	Bone: bird/mammal
7.	Perforation No. 1 outside length	31.	Bone: ulna, etc.
8.	Perforation No. 1 inside width	32.	Species
9.	Perforation No. 1 outside width	33.	Pattern in a line: yes/no
10.	Perforation No. 1 shape	34.	Sounded: yes/no
11.	Perforation No. 2 inside length	35.	Number of tones
12.	Perforation No. 2 outside length	36.	Fingering system
13.	Perforation No. 2 inside width	37.	Geographic position on map
14.	Perforation No. 2 outside width	38.	Temporal identification
15.	Perforation No. 2 shape	39.	Context: burial, etc.
16.	Length perforation No. 1 to No. 2	40.	Cultural period
17.	Perforation No. 3 inside length	41.	Cultural phase
18.	Perforation No. 3 outside length	42.	Site Name
19.	Perforation No. 3 inside width	43.	Type
20.	Perforation No. 3 outside width	44.	Decoration
21.	Perforation No. 3 shape	45-49.	Perforation No. 5
22.	Length perforation No. 2 to No. 3	50.	Distance 4-5
23.	Perforation No. 4 inside length	51-55.	Perforation No. 6
24.	Perforation No. 4 outside length	56.	Distance 5-6

all of the others were manufactured from bird bone. Nine items were undeterminate as to the class of animal bone employed.

Numerous measurements were recorded for each specimen; each such attribute can be considered a continuous variable. However, the independence of these units as variables is questionable. For instance, the size of any perforation is dependent on the size of the bone tube into which it was drilled. Therefore, a ratio or a dependent relationship of some sort would have to be established in order to deal with these factors in a realistic fashion.

In contrast, attributes measurable as discrete variables obtained from the sample can be dealt with as being independent of the relative size of the individual specimen. The number of perforations per specimen, and their shapes and placement on the shaft in various patterns remain identifiable as similar or different without consideration of their size. The three attributes of number, shape, and arrangement of perforations on the shaft of each bone tube in the sample provided the basic data in formulating the categories in the following proposed typology.

The Typology

This descriptive typology is inclusive of all specimens within the sample without consideration for chronological, functional or contextual attributes. Roman numerals were used to designate the number of perforations on the specimen or the number of main, large perforations when a definite pattern of one large perforation plus associated smaller ones was evident. The capital letter which follows the Roman numeral indicates the position of the perforation on the shaft. For example, Type IA refers to a bone tube with one main perforation at one end or the other of the shaft, and Type IB indicates the perforation is positioned in the middle of the shaft.

The Arabic numeral following the capital letter designates additional, but smaller perforations in some adjunctive position to the main perforation. Thus, Type IA2 labels those specimens with a second perforation on the side of the shaft opposite the main perforation. Often these smaller perforations can be seen in the photographs as a light area appearing through the darkened area of the main perforation (see Appendix A, Figure A.4). Type IA3 describes a perforated bone tube with one main perforation flanked by a smaller perforation on each side, and Type IA4 has smaller perforations on the shaft in addition to the main one, but in any arrangement other than the one in the preceding type.

One example, from the Bourneville mound, has a combination of the two Types IA3 and IA4, so it has been designated Type IA5. Similarly, four of the specimens from Port au Choix seem to be related to these types for they have one large perforation near one end of each bone tube. However, they also have a duplication on the reverse side of the shaft of the patterns called Type IA1 and Type IA4 on two specimens, respectively (see Appendix A, Figures A.1 and A.2). Two additional sub-types have been added to describe these variations. Type IA6 is Type IA1 duplicated on two sides of the shaft, while Type IA7 is the pattern of Type IA4 duplicated on two sides of the shaft.

All the IB types have the central perforation in mid-shaft position. The change of the Arabic numeral from numbers one through four indicates the addition of satellite perforations in various places on the shaft. Types IC1 and IC2 deal with one circular perforation on the shaft, and Types ID1 and ID2 describe single rectangular perforations with their long axes perpendicular to the shaft axis.

The Type II specimens have two oval, triangular, rectangular or elliptical perforations (A), circular perforations (B) or rectangular perforations perpendicular to the long axis of the shaft (C). Type IIIA covers examples with three oval, triangular, rectangular or elliptical perforations on the shaft. Types IIIB1 includes perforated bone tubes with three circular perforations along the shaft, while Types IIIB2 and IIIB3 have, respectively, one or two additional perforations on the reverse side of the shaft. Type IIIC indicates three rectangular perforations with their long axes perpendicular to the shaft axis.

Type IV specimens may have four oval, rectangular, triangular or elliptical perforations (A), four circular perforations (B) or four rectangular perforations with their long axes perpendicular to the shaft axis (C). Types VA to VC repeat the same sequence for bone tubes with five perforations along the shaft. The same variations in perforation patterns are represented under Types VI, VII and VIII. These types are itemized in Table 3.

Some clustering of specimens occurs within sub-types (see Table 4). The single sub-type with the most specimens is Type IB1 with 19 examples. The sub-class under the IB label also has the greatest total

TABLE 3

A PROPOSED DESCRIPTIVE TYPOLOGY

Type	Definition
TYPE I	
IA1:	One main perforation of oval, rectangular, elliptical or triangular shape with long axis parallel to the long axis of the shaft and near one end of the shaft.
IA2:	One main oval, rectangular, elliptical or triangular perforation with long axis parallel to the long axis of the shaft and near one end with another perforation on the opposite side of the shaft, smaller than the main one.
IA3:	One main oval, rectangular, elliptical or triangular perforation with long axis parallel to the long axis of the shaft and near one end with a smaller perforation on each side of it.
IA4:	One main oval, rectangular, elliptical or triangular perforation at one end and with long axis parallel to the shaft length with one or more smaller perforations along the shaft toward the opposite end.
IA5:	One main oval, rectangular, elliptical or traingular perforation at one end with long axis parallel to the shaft length with a smaller perforation on each side of it and with one or more smaller perforations along the shaft toward the opposite end.
IA6:	One main perforation of oval, rectangular, elliptical or triangular shape with long axis parallel to the long axis of the shaft and near one end of the shaft; repeated on the reverse side.
IA7:	One main oval, rectangular, elliptical or triangular perforation at one end and with long axis parallel to the shaft length with one or more smaller perforations along the shaft toward the other end; repeated on the reverse side.
IB1:	One oval, rectangular, elliptical or triangular perforation in a mid-shaft position.

TABLE 3 (Cont'd)

Type	Definition
IB2:	One oval, rectangular, elliptical or triangular perforation at mid-shaft with long axis parallel to the shaft length with another smaller one on the opposite side of the shaft.
IB3:	One oval, rectangular, elliptical or triangular mid-shaft perforation with long axis parallel to the shaft axis with a smaller perforation on each side of it.
IB4:	One main oval, rectangular, elliptical or triangular mid-shaft perforation with one or more smaller or lesser perforations along the length of the shaft.
IC1:	One main mid-shaft, circular perforation.
IC2:	One main circular perforation at one end of the shaft.
ID1:	One rectangular perforation positioned mid-shaft with its long axis perpendicular to that of the shaft.
ID2:	One rectangular perforation with long axis perpendicular to the shaft axis, toward one end of the shaft.
TYPE II	
IIA:	Two oval, triangular, rectangular or elliptical perforations with long axes parallel to the long axis of the shaft.
IIB:	Two circular perforations along the shaft.
IIC1:	Two rectangular perforations with long axes perpendicular to the long axis of the shaft.
IIC2:	Two rectangular perforations toward one end of the shaft with long axes perpendicular to the long axis of the shaft.
TYPE III	
IIIA:	Three oval, triangular, rectangular or elliptical perforations with long axes parallel to the long axis of the shaft.
IIIB1:	Three circular perforations.

TABLE 3 (Cont'd)

Type	Definition
IIIB2:	Three circular perforations on one side and one on the reverse side.
IIIB3:	Three circular perforations on one side and two on the reverse side.
IIIC:	Three rectangular perforations with long axes perpendicular to the long axis of the shaft.
TYPE IV	
IVA:	Four oval, rectangular, triangular or elliptical perforations with long axes parallel to that of the shaft.
IVB:	Four circular perforations along the shaft.
IVC:	Four rectangular perforations with long axes perpendicular to that of the shaft.
TYPE V	
VA:	Five oval, rectangular, triangular or elliptical perforations with long axes parallel to that of the shaft.
VB:	Five circular perforations along the shaft.
VC:	Five rectangular perforations with long axes perpendicular to that of the shaft.
TYPE VI	
VIA:	Six oval, rectangular, triangular or elliptical perforations with long axes parallel to that of the shaft.
VIB:	Six circular perforations along the shaft.
VIC:	Six rectangular perforations with long axes perpendicular to the long axis of the shaft.

TABLE 3 (Cont'd)

Type	Definition
TYPE VII	
VIIA:	Seven oval, rectangular triangular or elliptical perforations with long axes parallel to that of the shaft.
VIIB:	Seven circular perforations along the shaft.
VIIC:	Seven rectangular perforations with long axes perpendicular to the long axis of the shaft.
TYPE VIII	
VIIIA:	Eight oval, rectangular, triangular or elliptical perforations with long axes parallel to that of the shaft.
VIIIB:	Eight circular perforations along the shaft.
VIIIC:	Eight rectangular perforations with long axes perpendicular to the long axis of the shaft.

TABLE 4

TYPOLOGY TABULATION FOR STUDY SAMPLE

Type	Number of Specimens	Type	Number of Specimens
IA1	8	IIIA	6
IA2	2	IIIB1	10
IA3	0	IIIB2	1
IA4	3	IIIB3	1
IA5	1	IIIC	0
IA6	1	Total	18
IA7	2		
		IVA	2
IB1	19	IVB	5
IB2	2	IVC	0
IB3	3	Total	7
IB4	1		
		VA	1
IC1	0	VB	1
IC2	1	VC	0
		Total	2
ID1	0		
ID2	2	Type I	45
Total	45	II	12
		III	18
IIA	4	IV	7
IIB	7	V	2
IIC1	1	Total	84
IIC2	0		
Total	12		

number, 25. Some other clusterings are noticeable, though with lower frequencies. The category with three circular perforations, labeled Type IIIB1, has ten members. Type IIB with two circular perforations has seven, and Type IA1 with one oval, triangular, rectangular, or elliptical perforation toward one end of the shaft has eight. It is interesting to observe that the sub-types with one perforation (under Types IA and IB) but with the shapes of oval, elliptical, rectangular or triangular have greater representation than other shapes for those types. In contrast, the types with two, three or four perforations (Types II, III, and IV) have greater numbers under the sub-types with circular perforations (Types IIB, IIIB1, and IVB).

Perforated bone tubes within the Type I sub-classes totaled 45 while the Types II, III, IV and V had 39 specimens together. Types IIA to IIC and Types IIIA to IIIC have 12 and 18 total examples, respectively. Types IVA to IVC and Types VA to VC have much lower frequencies, with only seven and two for their totals. These distributions will be investigated further in relationship to spatial-temporal and functional factors. No examples of proposed types VI, VII or VIII were present in the study sample.

A tabulation of the gross number of perforations per specimen appears in Table 5. This tabulation of the number of perforations per specimen shows some variations in the totals under each perforation number when compared with type categories in the typology (see Table 4). The specimens with one perforation total 30 while the total under Types IA to ID equals 45. This discrepancy is due to certain sub-types

TABLE 5

PERFORATIONS PER SPECIMEN, BY STATE, IN THE STUDY SAMPLE

State or Province	Number of Perforations 1	2	3	4	5	6	Total
Illinois	3	1	0	0	0	0	4
Newfoundland	2	4	0	1	0	1	8
New York	18	3	5	3	1	0	30
Ohio	3	10	12	5	4	0	34
Tennessee	4	1	3	0	0	0	8
Totals	30	19	20	9	5	1	84

which focus on perforation patterns with one main or large perforation, and one or more smaller ones in association. If the sub-types IA1, IB1, IC2 and ID2 from Table 4 were added together, the total will be 30, or the same as the total under one perforation in Table 5. These sub-types are the ones which identify perforated bone tubes with one perforation only, including any shapes or position on the shaft. The remaining sub-types under Roman numeral I cover the patterns of one main or larger perforation with associated smaller ones. The total number for these is 15, and this number should be the difference between the total for one perforation in Table 5 and the totals for Types IA through ID in the proposed typology tabulation. The larger totals under two to six perforations in Table 5 also reflect this same stylistic variable in reverse. Some of the perforated bone tubes with a total of two to six perforations listed in the table were grouped under Types IA2 through IB4 typologically.

The typology tabulation and tabulation of perforation numbers of specimens by states for the examples encountered only in the literature are included in Tables 6 and 7. As could be seen in similar tabulations for the study sample (see Tables 4 and 5), the typology, by taking patterns of perforations into consideration, does not correlate in totals between columns for types and those based on the number of perforations per specimen alone.

There are several reasons for the inclusion of certain specimens with more than one perforation in the typology under Types IA2 to IA4 and IB2 to IB4. First, the arrangements of smaller perforations in

TABLE 6

TYPOLOGY TABULATION FOR LITERATURE SAMPLE

Type	Number of Specimens	Type	Number of Specimens
IA1	3	VA	0
IA2	1	VB	1
IA3	0	VC	0
IA4	5	Total	1
IA5	0		
IA6	0	VIA	0
IA7	0	VIB	2
		VIC	0
IB1	4	Total	2
IB2	2		
IB3	3	VIIA	0
IB4	1	VIIB	3
		VIIC	0
IC1	1	Total	3
IC2	1		
		VIIIA	0
ID1	0	VIIIB	2
ID2	0	VIIIC	0
Total	21	Total	2
IIA	4	Type I	21
IIB	4	II	10
IIC1	2	III	11
Total	10	IV	5
		V	1
IIIA	1	VI	2
IIIB1	8	VII	3
IIIB2	1	VIII	2
IIIB3	1	Total	55
IIIC	0		
Total	11		
IVA	1		
IVB	4		
IVC	0		
Total	5		

TABLE 7

PERFORATIONS PER SPECIMEN, BY STATE, IN THE LITERATURE SAMPLE

State or Province	Perforation Number 1	2	3	4	5	6	7	8	Total
Kentucky	4	5	4	4	0	1	1	1	20
Tennessee	0	1	0	0	0	0	0	0	1
Illinois	2	3	0	0	0	0	0	0	5
Iowa	0	0	1	0	0	0	0	0	1
Indiana	2	2	2	0	1	0	1	1	9
Ohio	0	0	1	1	1	1	1	0	5
Wisconsin	0	0	1	0	0	0	0	0	1
Maine	1	0	1	3	2	0	0	0	7
Ontario	0	2	3	1	0	0	0	0	6
Totals	9	13	13	9	4	2	3	2	55

relationship to the main perforation looks stylistically closer to the sub-types for one main perforation (Types IA and IB). Secondly, these patterns of one main plus smaller perforations is very different from a bone tube perforated with the same number and size of perforations in a line along the shaft. Further, the arrangement of a larger perforation at one end or mid-shaft would likely reflect the use of the larger perforation somehow in the tone-producing mechanism with the smaller perforations elsewhere on the shaft used as finger holes. Especially in the cases of Types IA4, IA5, IA6 and IA7, the positions of the various perforations would preclude using one's fingers to stop all the perforations, and would leave the larger perforation as the one involved in sound production.

Another instance in which the morphology of the human hand provides a logical basis for assigning sub-types is evident in Types IIIB2 and IIIB3. These designations are considered valid because the thumbs fall more comfortably under rather than over the shaft. So Types IIIB2 and IIIB3 with three perforations on one side and one or two on the other are included in the Type III class rather than Types I and II, respectively.

A similar attempt was made to explain the prevalence of three finger holes on many perforated bone tubes from European archaeological sites. Megaw (1960:12) stated that this situation "may also be explained by the fact that this is the maximum number which can be utilized when holding the instrument with one hand." Perforated bone tubes with three perforations have the second highest total both in the typology tabulation (Table 4, page 44) and in the tabulation of perforations per sample (Table 5, page 46), with only the class of one-perforation examples exceeding this total.

Another aspect of perforated bone tube morphology which could have been influenced by the dimensions of the human hand is the spacing of the perforations. Megaw (1960:12) felt the spacing of perforations "probably resulted not so much from a desire for symmetry as the natural spread of the fingers on the bone." Looking at the study sample the spacing of perforations might support this premise on a number of examples. Often the measurements between perforations are nearly, but not exactly, equal, which would argue for governing factors of comfort or some relationship to the morphology of the human hand.

An additional possibility is found in the description of the construction of Kiowa flutes (Wead 1902). The distances between and positions for finger holes were measured in two ways. Both finger breadths and a short stick which was cut as a measure were used as methods to space the holes on Kiowa flutes of the late nineteenth century period. Wead (1902:427) felt the measurement of 32 mm. was about equal to two medium finger breadths. However, the theory of using finger breadths as a measure would lead to an expected variation in these dimensions, varying with the physical dimensions or the size of the artisan's fingers. In the sample examined for this paper, the distances between perforations varied in proportion to the total size of the specimen. However, in all cases with three or more perforations, the distances were close but not exact, when comparing the distances between perforations one to two and two to three. Nearly all of these dimensions were in the 20 to 35 mm. range, which would loosely fit Wead's idea of finger breadths, but not conclusively support it. A measuring stick cut to replicate the perforation pattern from one example to another would also be reasonable even if the original was set up to accommodate the human hand. Wead (1902:430) summarized his philosophy for the construction of such instruments in the following way:

> The primary principle in the making of musical instruments that yield a scale is the repetition of elements similar to the eye; the size, number and location of these elements being dependent on the size of the hand and the digital expertness of the performer.

This statement reiterates the idea of construction procedures based on the human hand and adds the factor of structuring the spacing in order to produce a scale of equally tempered notes.

The obvious question follows as to just what effects the spacing of finger holes has on the sounds produced by these perforated bone artifacts. Testing of European examples has indicated the absence of any early fixed tonal system (Coles 1973:160; Megaw 1960:12). Megaw (1960:12) pointed out that the evenness of spacing the finger holes "by no means produces a scale of notes of equally spaced intervals." He felt that conformity to a regular spacing of finger holes was due to "accidental reasons of manufactures" and "may have led to the fixing of certain basic scales or modes" after a long period of conformity to such a pattern (Megaw 1968:353). Another factor clouding the possibility of determining the actual notes used by prehistoric flute or whistle players is the potential for micro-tonal effects which "can be obtained by the player only partly covering finger holes" (Megaw 1960: 12), and also the advantage gained by over-blowing (creating a higher pitch by blowing to double or triple the air pressure).

Tonal Attributes

Fifteen of the specimens in the study sample of 84 readily produced a sound when blown. Seven of these had three perforations, one had four, one had only one, and six had one central perforation plus several smaller ones on the shaft in various positions. All seven specimens which were under Type I sub-types sounded generally as whistles with some variation possible by stopping or opening the end of the tube or any smaller perforations on the shaft. However, on the whole these produced shrill, whistle-like tones. Thus, the sounding potential of these specimens would support a generic functional typlogical assignment as well as a descriptive one.

In contrast, the sub-types under Types III or IV exhibited a wider number of tonal potentials. Three specimens (Numbers 4, 9, and 32, as listed in Appendix A) sounded with the first and third perforation covered, or with one end perforation and that end of the tube covered. The specimen (37) from the Reeve site produced three tones, "by closing the two end stops, then releasing one or the other, then releasing both" (Greenman 1935:18). The Tuttle Hill example (35) sounded with all perforations and the end closed. Other combinations of perforation stopping were tried but produced no sound.

Two specimens (11 and 52), respectively, from the Feurt site and the Lamoka Lake site, produced similar tones. The finger patterns used were: all three perforations closed, the first two perforations closed and the first or first and third perforations closed. These combinations produced three separate tones (approximately do, re, fa in the context of a moveable-do tonal system). The pitches from these specimens approximate this tonal pattern although they are not exact replications in terms of any fixed pitch. This fact corresponds to Megaw's finding of no fixed tonal system in his sample. This lack of a standard tonal pattern also reflects minor variations in the measurements of the specimens from the study sample. Another example from Feurt (27) which had four perforations utilized this same pattern for fingering the second through fourth perforations with the first perforation left open throughout. The resulting pitches were similar to those of the examples above.

Two possible reasons might be offered for the difference in fingering patterns used for the Reeve site specimen (37) and the three just described (11, 27 and 52). The ratios of the measured spacing of the three finger stops on the latter three examples is somewhat different from that of Greenman's example. Also, the comparison of the ratio of spacing measurements to total length and width measurements is vastly different for the three than for the Reeve site example. As Megaw (1960:12) stated, "accoustically the all-important elements for a pipe are its length and its internal diameter." The different placement on the tube of the perforations for the four specimens in question would mean lesser distances from the tube ends to the perforations in the group of three as opposed to the Reeve Village item when that distance is greater. These factors would alter the lengths in which the air columns would vibrate, thus causing the variation in the pitches obtained.

These perforated bone tubes were sounded by the simplest technique available. One open end of the tube was used as the edge-tone mechanism to start the sound. Megaw (1968:355) described this mechanism for the notched flute. "The player's breath must be directed against the edge of the open tube instead of being channeled by an inserted block or fipple." One exception to this technique was one example from Port au Choix (42). This perforated bone tube gave a sound when the end with a large triangular perforation on each side of the shaft was placed into the mouth to any extent as long as some of the double triangular perforation was left open. Different pitches were obtained with both smaller circular perforations closed, one perforation open and both circular perforations open.

This variability in manner of starting the sound from a bone tube challenges the position maintained in most studies of these artifacts that the tube must be curved in order to produce a tone. Basically a sound is produced when the air inside the tube is set into vibration in regular waves. The excitation of this air column can be accomplished in a number of ways. Modern woodwind instruments have either a cylindrical (parallel-sided) bore or a conical (tapered) bore with varying mouthpieces to start the sound. Baines (1957:31) describes the generation of the sound of the modern transverse flutes in the following way:

> With the flute, it is due to the rapid fluttering of the whirlpools or eddies that form in the air in quick succession as the player's breath leaves his lips in a thin stream directed against the far edge of the mouth-hole in the flute. These eddies have been shown to follow one another alternately below and above the direction of the stream, and hence to exert a kind of alternate pushing and sucking effect on the head of the air-column, setting the air-particles in oscillation and so dispatching pressure-waves down the tube.

The physical and mathematical properties of this edge-tone mechanism which "sets a column of air vibrating inside a cylindrical pipe" (Backus 1969:184) are discussed also by Nederveen (1969) and Olson (1967). The basic sound-producing mechanisms are consistently described and illustrated as cylindrical pipes with the sound generator being a separate factor. The node or break in the air stream which occurs when an air stream enters a curved tube and hits the opposite side might be the reason a curved tube will produce a sound, and a straight one will not, for persons experimenting without knowledge of ways to position their lips in embouchure variations to produce a sound. Descriptions for operating turkey callers drawn from historic sources provide instructions for positioning the mouth (embouchure) in order to derive different kinds of sounds from a straight or curved bone tube.

Schorger (1966) lists many instances of the use of a bone tube to call turkeys. A turkey wing bone was often used. One description from New Mexico included playing instructions:

> The opening at the top of the bone is placed tightly against the lower lip, a little below the opening of the mouth; then drawing the upper lip down with a slight puckering of the whole mouth, and sucking in with a short, chirping breath, the tone produced will resemble that of a mother turkey calling its young. By careful practice in covering and uncovering, more or less, the hole in the side, and a slight difference in the forming of the lips, it is an easy matter to imitate all of the calls of the wild turkey (Schorger 1966:395).

Another method used the second section of a turkey's wing bone inserted into a tube of cedar or elder. Fancier turkey callers appeared in historic times including a wing bone plus cow horn. The experimentation with the examples of bone tubes obtained from archaeological excavations in the sample has yielded additional information on the acoustical potentials of various treatments of bone tubes. Schorger's description for sounding a turkey caller was systematically tried on the sample. The basic sucking sound was greatly amplified by use of the bone tube even with smaller examples (3, 88, and 89). However, lack of further knowledge of various turkey calls prevented extensive testing of this method.

A sounding mechanism was discovered inside two perforated bone tubes from an archaeological site in the Southwest. Kidder and Morris (Kidder 1951) found two specimens buried in loose sand with a "little mound of dark brown, gummy substance" (Kidder 1951:256) inside the tube directly below a single oval perforation centered on the shaft. The gummy substance had a groove in it which throws "trough-canalized air, blown from either end, up against the sharp edge at the opposite end of the perforation, producing a shrill whistling note" (Kidder 1951:256).

The photograph accompanying this brief article by Kidder showed perforated bone tubes very similar to certain ones in the study sample. Specimens 51, 53, 54, 58, 59, 64, 65, 75, 80 and 87 could easily have been adapted in a similar fashion, although this is speculation based on gross morphological similarities, and no specific check was made for any deposit inside these examples in the study sample.

Another possibility for producing a sound from a bone tube was set forth by Megaw (1968:356) as follows:

> Some bone pipes with no apparent voicing lip may represent the surviving part of an instrument originally fitted with a simple split straw or "beating reed" working on the same principle as the old children's trick of blowing on a blade of grass held upright between the palms of the hands.

Some whistles with one stop, or perforation, from California were recovered with asphaltum (or pitch) reeds in place below the stop, and some examples still contained asphaltum end plugs (Gifford 1940:181). Megaw (1968:343) further mentioned that a bone cylinder too narrow to be effective as a freely blown flute could still have been used with a straw beating-reed. The evidence from the sample considered in this paper does not allow any evaluation of these possibilities. The sample was tested in terms of end-blown or open, notched flutes without any experimentation with the possible role that reeds might have played. The option of stopping one end of the tube with a plug was exercised, however, during the testing by using one finger to stop the end of the tube. This produced audible results in several cases, as was discussed earlier.

Perforation Techniques

Another aspect of manufacture which showed some variation was the technique used to perforate the bone tubes. In many cases there was a measurable beveled area adjacent to each perforation and these areas are evident in the differences between inside and outside measurements for the length and width of each perforation (see Appendix A). In some cases these were polished and in others they were left quite ragged. The presence of beveling adjacent to the perforations occurred with no correlation to any particular perforation shapes. All shapes had incidences of beveled and non-beveled areas around the perforations. A small number of specimens (40, 48, 63, 68, 70, 75 and 87) had perforations with edges which were neither tapered nor beveled. The edges of these perforations were left ragged or broken, or smoothed but without any tapering.

Smith (1910:212) described the manufacture of whistles using stone drill points. This drilling technique "usually resulted in a perforation tapering from the side from which it was drilled" (Smith 1910:206). One specimen from the sample (11) showed evidence of holes drilled straight into the bone with the beveled or angled effect going downward and inward from the surface of the bone as described by Smith. Another specimen (69) showed drilling straight into the bone (implying use of a cylindrical drill) and bore two circular perforations without any tapering inside or on the surface of the bone.

However, many other specimens in the study sample exhibited an irregular beveled or tapered area as if the perforation had been chipped or broken around the edge with a tool. In a few cases this technique may have followed initial drilling of a perforation, or perhaps a punch technique for perforating the bone. Parmalee et al. (1972) discussed similar variations in the perforation techniques used on shell artifacts from the Apple Creek site. Shell artifacts from this site exhibited perforations which were "not uniformly circular and appear to have been 'punched' or broken through rather than drilled" (Parmalee, Paloumpis and Wilson 1972:7). While it is impossible to reconstruct the exact manufacturing techniques used on the prehistoric flutes and whistles examined, the evidence observed during examination of the specimens would support the idea of at least three different techniques utilized at some point in perforating these bone tubes. The various perforations show regular drilling with a lithic tool, chipping or scraping around the perforation achieving a beveled effect on the surface of the bone around the perforations, and a punching or breaking to effect the hole or possibly to enlarge or shape it.

One additional technique was used on a few specimens to shape or alter the perforation in some way. Mills (1917) noted the burning of holes to enlarge them, and one specimen from Feurt examined in the study sample (12) seemed to match the technique described by Mills. Mills observed perforations that were "enlarged from the round hole by burning" (Mills 1917:433). This description fits specimen number 12 in the study sample. Another specimen from the Feurt site (29) had burned areas around all three perforations but in one of these cases the cutting had not completely penetrated the bone. This incomplete perforation would seem to indicate the burning technique might have in some cases been used to make perforations and, in other instances, to enlarge the perforations.

The areas adjacent to or between the perforations on some specimens were noticeably scraped flat. Specimens 19, 22, 31, 32, and 33 from the Feurt site in Ohio, and specimen 83 from Oak View Landing in Tennessee bear this attribute (see Appendix A, Figures A.13, A.14 and A.17). The photograph of two examples from the Southwest described by Kidder (1951) also show this flattened or scraped area adjacent to the perforations.

Exterior Modifications

The exterior surfaces of the tubes in the sample studied were modified in several ways. Besides the perforation techniques discussed above, various combinations of incising and punctation appear on a number of specimens. Copper bands and red ochre had been applied to some of the bones.

A simple incised design was used on the specimen from the Carlson Annis site in Kentucky. Incised lines circle the shaft and other lines run parallel to the shaft length creating a geometric design of perpendicular lines. Webb (1950b:324) identified a representation of the equal armed cross symbol encircling one end of this specimen. This symbol was also found on shell gorgets from the Indian Knoll and Carlson Annis sites (Webb 1946:318, Fig. 54; 1950b:325, Fig. 15); all these motifs are developed by repetitions of a basic line. The sequence of repeated lines in most cases is a straight or right angeled progression forming a grid pattern. A carved antler artifact from Indian Knoll carries the pattern of repeated lines, but the design is expressed through curved lines in contrast to the other examples (Webb 1946:318, Fig. 54, B).

A noticeable grid pattern of shallow incising appears on specimen 44 from the Port au Choix site (Appendix A, Figure A.3). Two other incised patterns occur on specimens from the Port au Choix site.

Parallel incised lines were used on both sides of one end of specimens 42, 47, 48 and 49 (Appendix A, Figure A.1). These lines were adjacent to large perforations at the same end of the bone tube. Specimen 42 shows a deviation from the pattern in that the incising was done along the edge of the perforations rather than across the entire end of the tube itself. Specimen 49 has the lines running above and below the perforations in contrast to specimens 47 and 48.

Parallel incised lines along the shaft appeared on two additional specimens reviewed for this study. Specimen 74 from the Frontenac Island site in New York has a row of incised parallel lines running the length of one side of the shaft. The example from the Oconto site in Wisconsin also had these parallel lines along the shaft in three sequences (Ritzenthaler and Wittry 1952:211). Ritzenthaler (1957) suggested this decoration technique resembled "the type of ornamentation sometimes found on copper implements" (Ritzenthaler 1957:319). Further research on this particular aspect would be needed to determine if there are any correlations among artifacts with this decoration or between sites or cultures in eastern North America during the Late Archaic period.

The four perforated bone tubes from Port au Choix with parallel incised lines have one other incised design in common, and it appears on a fifth specimen as well (Appendix A, Figure A.4, 46). Just below the large perforations and series of parallel incised lines, an incised diamond with a dot in the center can be observed on the specimens in Figures A.1 and A.2, Appendix A. The meaning of this design or why it appears on perforated bone tubes which can be sounded (42, 47, and 48) as well as some which cannot (46 and 49) is unknown. In addition, a pair of gannet humeri had this same design incised on each side at one end of the elements. Also, successive parallel incised marks were carved from the ends of the gannet bones to the diamond designs. These gannet humeri were recovered in association with Burial 22 (Parmalee n.d.b:20).

Unique incising appears around the perforations on one of the specimens (6) from the Feurt site. Incised lines appear along the shaft and around two perforations radiating out in a partial sunburst design. The effect is not visible in the photograph (Appendix A, Figure A.11, C) since the scored lines were shallow. It was not possible to determine whether these marks represented a decoration or were simply tool marks.

Three surface treatments of the ends of the bone tubes were observed on several examples considered in this study. Incising and polishing had been done vertically to the edge of the tube to produce a scalloped effect. The specimen from the Oconto site in Wisconsin (Ritzenthaler and Wittry 1952:213, Fig. 14) and several items from Riverton Culture sites (Winters 1969:Plates 36 and 37; Appendix A, Figure A.10, 92 and 93) exhibit this characteristic.

A second version of incised lines near the ends of perforated bone tubes can be seen on specimens from Ohio sites (10, 11, 24, 31 and 34), New York sites, (57, 58, 72 and 78), and on two of the Riverton artifacts (Winters 1969:Plate 37, B and C). Circular incised lines around the shaft can be seen on these specimens. Repetition of circular incised lines was discussed above as a part of the design on the example from the Carlson Annis Mound in Kentucky (Webb 1950a:305, Fig. 51, C).

The third decoration technique observed on ends of bone tubes appears only in the Riverton culture (Winters 1969:Plate 36). Examples from the Robeson Hills site (Appendix A, Figure A.10, 91 and 92) and from the Riverton site (Winters 1969:Plate 36, G) have punctations in a line around the tube.

Two of the specimens considered in this study had been wrapped with copper bands. The specimen reported from the Gracey Mounds in Illinois is listed as a copper-wrapped bone whistle (Farnsworth 1973:40) but no further description is included. The second specimen (38) from the Bourneville Mound in Ohio was wrapped with two copper bands, one near each end beyond the perforations (see Appendix A, Figure A.20, 38). The band around the proximal end is missing, but a copper stain remains. This specimen (38) also exhibits an elaborate engraved geometric design along the shaft which contains motifs typical of the Hopewell culture (Baby 1961:109).

Three specimens (41, 43 and 44) from Port au Choix showed evidence of the former application of a dark reddish, dusty pigment. Tuck (1971:345) reported all burials on the site were accompanied by red ochre. Two specimens (9 and 11) from the Feurt site exhibit a reddish stain; these are illustrated in Figures A.12 and A.19, Appendix A. An effort to obtain field notes regarding these latter two specimens proved unsuccessful.

Construction Procedure

Some bone tubes have been found which show evidence of intended or partial alteration similar to that of the completed perforated bone tubes. Mills (1917:433) found a number of unfinished bone tubes at the Feurt site "marked for drilling." A perforated bone tube from the Fifield site was described as "an unfinished whistle" (Skinner 1951:41). A third example mentioned in the literature came from Indian Knoll. Webb (1946:304) compared this specimen with one of similar size and identical perforation pattern from the Carlson Annis site. Differences between these two included a partially cut end on the Indian Knoll specimen the removal of which would make the length of the two specimens equal from the perforations to that end. The Indian Knoll specimen also lacked the geometric incising which covered the Carlson Annis example. These differences led Webb (1946:304) to conclude the Indian Knoll specimen was an unfinished version of the one from Carlson Annis.

The study sample specimen (1) from the Rhoads site seems to have had one triangular perforation completed and its edges polished before that end of the bone tube was broken. A second triangle with its apex touching the first one was marked for drilling (see Appendix A,

Figure A.10, 1). Another specimen from Illinois in the study sample shows partial modification; this tube, Specimen 2 from Cahokia, still retains the unmodified ends, but the perforation is roughly done in contrast to the neatly cut and polished condition of Specimen 3 from the same site.

From the examination of the combined sample it would appear that in many cases the central perforations were made before the ends of the bone tube were removed. The examples from Indian Knoll and Cahokia seem to support this conclusion. The Rhoads specimen had had the ends already cut, but the marked triangular perforation may represent a second attempt after breakage of the original perforation.

Specimen 29 from the Feurt site has one perforation partially burned through the tube. The spacing of that perforation is irregular in comparison to other examples from that site, and may represent an error in construction. The ends of this specimen are broken at points where other perforations may have been located, and it is difficult to determine at what point of manufacture the specimen was discarded. Thus, several specimens in the combined sample (Numbers 2, 40, 41 and 43) indicate a procedure similar to that exhibited by the two examples from Indian Knoll and Carlson Annis, which characterized the manufacture of these artifacts. Polishing and other modifications of the exterior surfaces followed perforation and removal of the ends of the tube; this would seem to have been the basic sequence of construction.

CHAPTER III

TEMPORAL AND SPATIAL DISTRIBUTIONS OF THE SAMPLE

Another body of data which may reflect typological delineations of perforated bone tubes can be obtained by a review of their spatial and temporal distributions. Distributional patterns for spatial and temporal data will be examined separately based on occurrences of perforated bone tubes on archaeological sites. The geographic location and chronological position for each site from which the perforated bone tubes in the sample were reported will be determined as accurately as possible. Distribution patterns will be sought for comparisons among the spatial and temporal attributes, and between these attributes and the proposed typology.

The accumulation of the sample both from the literature and in the study sample offers an opportunity to test hypotheses about bone flutes and whistles proposed by Winters (1969) in his excellent treatise on the Wabash Valley Riverton Culture. Two hypotheses which may be tested are contained in the following statement by Winters that:

> the flute became important in eastern Archaic sites after 3000 B.C. and that it persisted relatively unmodified for some four thousand years (Winters 1969:72).

The first suggestion that the flute became important in eastern Archaic sites may be evaluated by checking the earliest dates within the combined sample and will be discussed under the consideration of the temporal dimension. The second part of Winter's statement quoted above is also included in his hypothesis espousing the "continuity in general form for several Archaic ceremonial items such as flutes, rattles, and tubular pipes, into succeeding Woodland cultures, or even into historic Indian cultures" (Winters 1969:74). Winters feels that the ceremonial items found on the Riverton sites are "growing evidence" for this hypothesis. An examination of the study sample combined with the additional examples from the literature as to their distributions through time as individual items and as typological members could lend support for this hypothesis as it applies to these artifacts.

Winters would also draw a geographical meaning from the data he presents on bone flutes and whistles. Winters reported that:

> present evidence indicates the possibility of a rather sensitive typology linking particular flute forms to specific regional Archaic manifestations (Winters 1969:72).

This proposition may be checked against the data from the current sample for the Archaic period. And the idea of regional manifestations may be extended into other time periods as a question to be considered.

Temporal Distributions

Archaeological reports and other publications contain descriptions of bone flutes and whistles from sites in eastern North America dating from the Archaic to Mississippian periods which fall into the following chronology, grouped by state or province:

ARCHAIC PERIOD

Kentucky

Carlson Annis (3366 BC Mean of corrected radiocarbon dates for depths at which perforated bone tubes were found, Winters 1974:xviii.)

Read
Indian Knoll (3236 BC Mean of corrected radiocarbon dates for site, Winters 1974:xviii.)
Barrett

Tennessee

Kays Landing (1865 BC ± 300 Mean radiocarbon date, Lewis and Kneberg 1959:174.)
Spring Creek (1375 BC Single radiocarbon date, Peterson 1973:18.)
Oak View Landing (1200 BC to 500 AD Estimated date for Ledbetter Phase, Lewis and Kneberg 1959:174.)
Cherry (1200 BC Estimated age for Big Sandy Phase, Lewis and Kneberg 1959:178.)

Iowa

Cherokee Sewer (4326 BC ± 90 UCLA 1877B Henning 1974:9.)

Illinois

Riverton (1100 BC Estimated from the range of radiocarbon dates, Winters 1969:72.)
Robeson Hills (1300 BC Estimated from the range of radiocarbon dates, Winters 1969:72.)

Wisconsin

Oconto (3644 BC ± 400 Wittry and Ritzenthaler 1952:250.)

New York

Lamoka (3433 BC ± 250 C-367 Ritchie 1969:43.)
Woodchuck Hill
Frontenac Island (2980 BC ± 269 C-191 Ritchie 1969:108.)

Maine

Moorehead Complex
Tranquility Farm
Ewing-Bradgon

Newfoundland

Port au Choix (2340 BC ± 110 I3788 Tuck 1971:349.)
Labrador (5525 BC Tuck, personal communication to Parmalee, 1974.)

WOODLAND PERIOD

Tennessee

Hoover-Beeson
Rankin

Illinois

Gracey Mound

Ohio

Bourneville Mound

New York

Sackett (1130 AD ± 150 M-1076 Ritchie 1969:275.)

MISSISSIPPIAN PERIOD

Kentucky

Fox Farm
Fullerton Field
Hardin Village (1500-1675 AD Estimated dates, Hansen 1966:175.)

West Virginia

Wells
Clover

Illinois

Cahokia (1135 AD ± 85 GX0859 Anderson 1969:92.)

Indiana

Fifield
Angel Mounds (1430 AD ± 100 M-4c Black 1967:272.)
Blackford County

Ohio

Feurt
Turpin
Hahn's Field
Sand Ridge
Madisonville
Tuttle Hill

Ohio Cont'd

South Park
Reeve

Ontario

Middleport

HISTORIC PERIOD

Illinois

Crawford Farm (1790-1810 AD Estimate based on historic artifacts, Parmalee 1964:167.)
Rhoads (1780-1815 AD Estimated date, Parmalee personal communication, 1974)

A rough graph of the temporal distribution of these sites appears in Figure 1. In order to show the general time periods where sites clustered, the sites have been grouped for plottings into these falling within any five hundred year interval. The combined sample shows a trimodal distribution with the modes falling into the Late Archaic and Mississippian periods.

The bimodal character of the graph line in the segment between 4000 and 1000 BC reflects a point brought out by Winters (1974) in the introduction to the 1974 republication of the Indian Knoll report (Webb 1946, 1974). Winters called attention to the fact that a period of time separates the Riverton cultures from the Indian Knoll florescence. Both of these cultures had perforated bone tubes. The examples from these cultures are included in the two peaks in the Late Archaic (Figure 1).

A similar separation in time exists for the New York Lamoka and Frontenac examples as opposed to the later specimens from Archaic sites

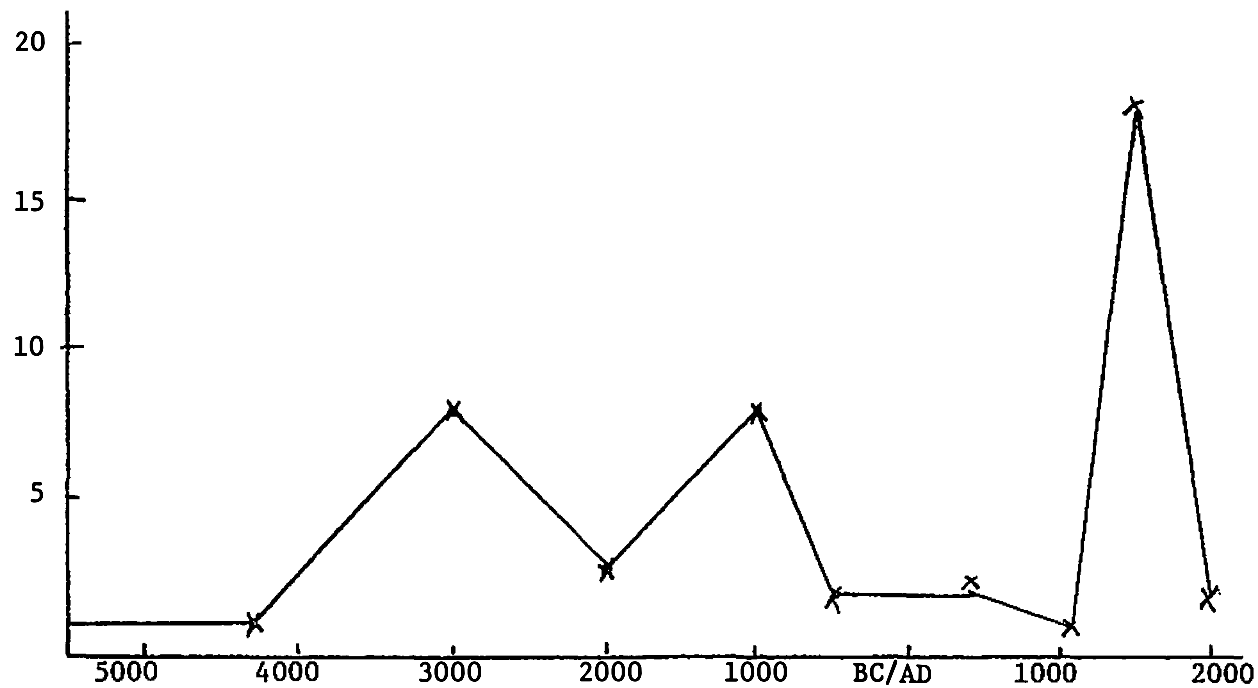


Figure 1. Number of sites through time.

in the western Tennessee Valley. The combinations of these earlier and later sites from New York and Tennessee, respectively, added to the ones mentioned by Winters, and all within the period commonly designated Late Archaic, created the double peaks on the graph (Figure 1) for that segment of time.

These two clusters of sites are listed in Table 8 under Late Archaic I and II.

When the number of specimens per site are plotted on a line graph (Figure 2), peaks similar to those formed in Figure 1 become evident. However, the characteristic of the bimodal distribution for the Late Archaic segment is somewhat different in Figure 2. The total number of specimens is less for the sites listed under Late Archaic II (see Table 8). The remainder of the distribution curves for specimens (Figure 2) and for sites (Figure 1) through time are quire similar with the low points in the Woodland and Historic time periods separated by the numerical crests in the Mississippian period.

As can be seen in these distribution curves, the temporal limits of the sample are quite broad. However, the bone flute or whistle can be seen, as Winters suggested, as becoming "important in eastern Archaic sites after 3000 BC" (Winters 1969:72). While there are earlier examples of these artifacts (for instance, the perforated bone whistle from the Cherokee Sewer site in Iowa dated 4326 BC (Henning 1974), a much larger representation appeared after 3000 BC on a number of sites which have been described as falling in the Late Archaic period. Most of these occurrences were discussed above as being responsible for the biomodal peaking during that time period.

TABLE 8

LATE ARCHAIC SITES

Late Archaic I	Late Archaic II
Kentucky	Tennessee
Carlson Annis (3366 BC)	Spring Creek (1375 BC)
Read	Oak View (1200-500 BC)
Indian Knoll (3236 BC)	Cherry (1000 BC)
Barrett	Kays Landing (1865 BC)
Wisconsin	Illinois
Oconto (3644 BC)	Riverton (1100 BC)
	Robeson Hills (1300 BC)
New York	Maine
Lamoka (3433 BC)	Moorehead Complex
Woodchuck Hill	Tranquility Farm
Frontenac (2980 BC)	Ewing-Bragdon
Newfoundland	
Port au Choix (2340 BC)	

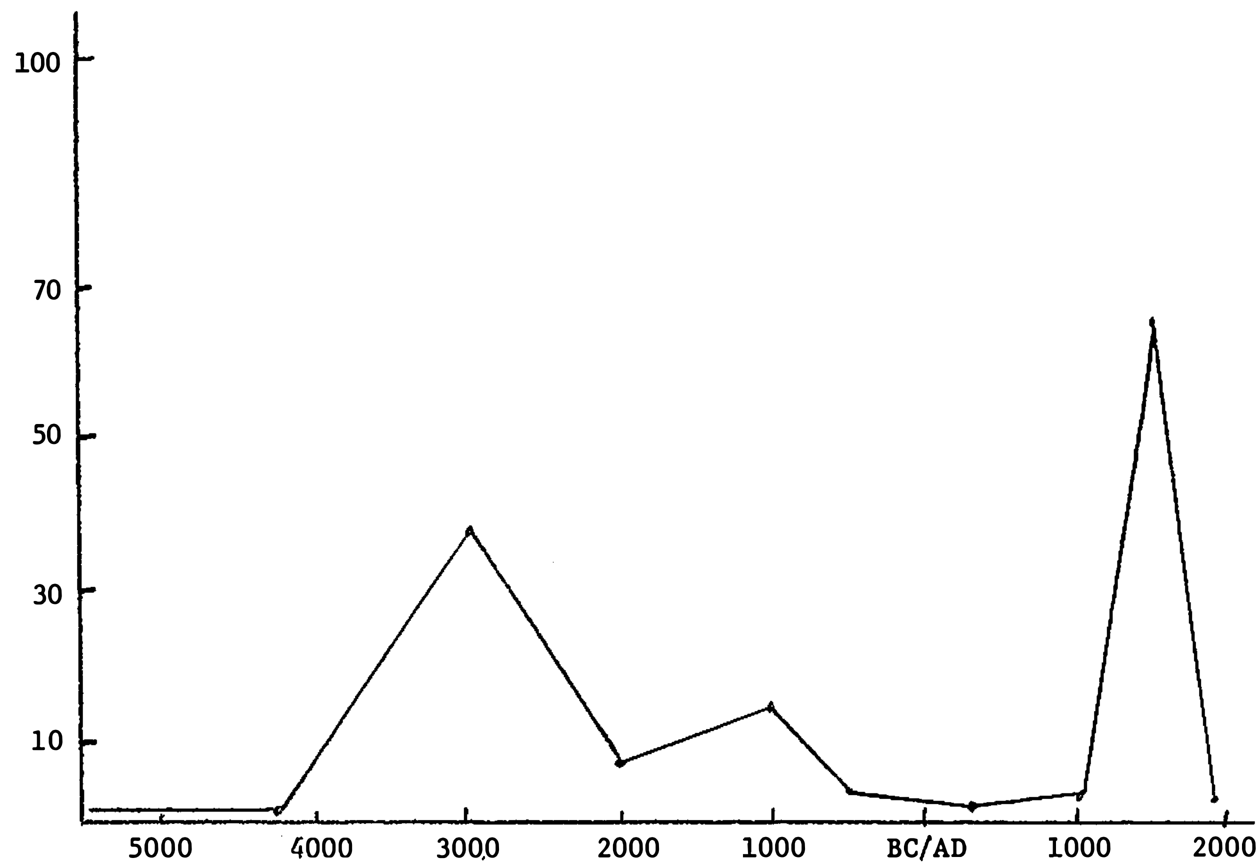


Figure 2. Number of specimens through time.

The question of whether the perforated bone tube "persisted relatively unmodified for some four thousand years" (Winters 1969:72) cannot be answered on the basis of this basic temporal distribution. The persistence or modification of these artifacts can be examined more directly by consideration of proposed morphological types through time.

Temporal Distribution of Types

Table 9 shows the number of specimens in the combined sample which were ascribed to the Archaic, Woodland, Mississippian and Historic periods. The specimens are listed by types as described in Chapter II.

The 62 specimens from the Archaic period fall under Types I to IV. The majority of the Archaic items are Type I with fewer numbers of Types II, III and IV, respectively. This pattern is somewhat reversed in the Mississippian period which exhibits the other large total of specimens through time. The 66 examples in this latter period are spread among all eight types. However, the heaviest concentration falls under Types II and III with the next highest categories in Types I and IV.

These totals seem to indicate a trend toward use of more perforations in later periods. However, the fact that perforated bone tubes with several perforations exist much earlier would refute any idea of a simple chronological progression from the single-holed whistle to more complex flutes with up to eight perforations. Since specimens in the Lamoka collection with three perforations easily sounded, the proficiency of the multi-perforated type can be established from then

TABLE 9

TEMPORAL DISTRIBUTION OF TYPES

Type	Archaic	Woodland	Mississippian	Historic	Total
I	49	6	8	3	66
II	7	0	15	0	22
III	4	1	24	0	29
IV	2	1	9	0	12
V	0	0	3	0	3
VI	0	0	2	0	2
VII	0	0	3	0	3
VIII	0	0	2	0	2
Total	62	8	66	3	139

on. However, the methods of covering various perforations to obtain different pitches varies among the Lamoka specimens and those from Ohio as discussed in Chapter II (pages 53-54). For these reasons, it is difficult to see the perforated bone tubes as having "persisted unmodified for some four thousand years" (Winters 1969:72). The variation of perforation patterns as reflected in the various subcategories of the proposed typology along with the substantial variation in exterior modifications of the bone tubes does not readily support Winter's hypothesis.

As shown in Table 9, two periods are scantly represented. Whistles or flutes from Historic period sites are too few to draw any conclusions. The two specimens from this period simply confirm the continuance of Type IA1 onward to the Historic time period. A larger sampling could have been derived from this period from enthnological collections. However, the inclusion of such information would have violated the parameter for this study which was established to only include data from archaeological sites.

The Woodland period also has a meager total as compared with the Archaic and Mississippian periods. The question of peresence and type of bone flutes or whistles on Woodland period sites may reflect sampling error. However, Winters indicates from his search (Winters 1969:72) an existing lack of reported examples in the literature for eastern North America much beyond that discussed here. Another possibility is that:

> our sample may be skewed for eastern sites by preservation of bone flutes and the total disappearance of any other forms in the shell middens (Winters 1969:72).

Also, additional flutes or whistles may exist in private collections as was found with those from the Rankin and Riverton sites. Some further points relating to differential preservation and to the temporal hiatus during the Woodland period will be discussed in the third section of this chapter.

Utilizing temporal distributions of the subtypes under Type I, further support for the variation among specimens can be established. Table 10 contains a tabulation of these subtypes within each archaeological time period. The totals for each time period correspond to those in Table 9 with the exception of one specimen for the Archaic which was added. In this case the specimen was described as having one perforation but no information was given as to its location so no specific typological assignment beyond Type I could be made. The tabulation in Table 10 reveals Type IB1 as having the largest total overall and as having the most specimens in the Archaic and in the Mississippian periods. The examples from the Woodland period include one more IB3 than IB1, and all three Historic period specimens were Type IA1. Types IA1 and IA4 had the second highest totals for the Archaic period.

These figures can be assembled to show the subtypes for the concentrated time segment in the Late Archaic and Early Woodland periods. As was done above, the Late Archaic is split into periods I and II (see Table 10). The specimens are listed in these three time units for Types I to IV in Table 11. Type IB1 once again carries the heaviest representation with 14 specimens in the Late Archaic I. Types IA1 and IB2 follow in totals.

TABLE 10

TYPE I SUBTYPES THROUGH TIME

Subtype	Archaic	Woodland	Mississippian	Historic	Total
IA1	7	0	1	3	11
IA2	3	0	0	0	3
IA3	0	0	0	0	0
IA4	7	0	1	0	8
IA5	0	1	0	0	1
IA6	1	0	0	0	1
IA7	2	0	0	0	2
IB1	15	2	6	0	23
IB2	4	0	0	0	4
IB3	3	3	0	0	6
IB4	1	0	0	0	1
IC1	1	0	0	0	1
IC2	2	0	0	0	2
ID1	0	0	0	0	0
ID2	2	0	0	0	2
Total	48	6	8	3	65

TABLE 11

SUBTYPES IN LATE ARCHAIC AND EARLY WOODLAND

Type	Late Archaic I	Late Archaic II	Early Woodland	Total
IA1	5	2	0	7
IA2	3	0	0	3
IA3	0	0	0	0
IA4	2	5	0	7
IA5	0	0	0	0
IA6	1	0	0	1
IA7	2	0	0	2
IB1	14	1	1	16
IB2	4	0	0	4
IB3	3	0	3	6
IB4	1	1	0	2
IC1	1	0	0	1
IC2	1	1	0	2
IC1	0	0	0	0
ID2	2	0	0	2
IIA	0	1	0	1
IIB	1	2	0	3
IIC1	0	3	0	3
IIC2	0	0	0	0
IIIA	0	0	0	0
IIIB1	3	0	0	3
IIIB2	0	0	0	0
IIIC	0	0	0	0
IVA	0	0	0	0
IVB	2	0	0	2
IVC	0	0	0	0
Total	45	16	4	65

The proportion of Type IB1 specimens for the Late Archaic I is greater in comparison with the total number of Type I specimens for that time period than is the same subtype for the Late Archaic II in comparison with Type I total specimens from this second time period. If the same ratio of Type IB1 specimens to total Type I specimens were placed under both time periods, the totals would have to be adjusted from 14 and one to 14 and four, or to four and one, to balance with the Type I totals of 39 and 10, respectively. The following numerical ratios summarize these alternative proportional adjustments:

	Late Archaic I		Late Archaic II			Late Archaic I		Late Archaic II
Type IB1 / Type I Totals	$\frac{x}{39}$	:	$\frac{1}{10}$	OR		$\frac{14}{39}$	:	$\frac{x}{10}$
	$x = 4$					$x = 4.5$		

Two interesting shifts occur in the Late Archaic II. Type IA4 has its heaviest representation in this temporal span. Also, Type II which had only one example in the Late Archaic I now has a range of six specimens under Type II varieties in Late Archaic II times. In addition, no Type III specimens were sampled for Late Archaic II. In the Early Woodland column, the specimens reflect only Type IB1 and IB3 usage.

These figures, although based on a somewhat limited number, seem to indicate an early florescence in which perforated bone tubes were made with numerous perforation patterns. The earliest example with a known perforation pattern discussed here was the example from the Cherokee Sewer site dated at 4326 BC. This specimen had at least three circular perforations. The Late Archaic I period exhibits an elaboration of perforation patterns around a central or main perforation, as shown by the 39 specimens under Type I subtypes (see Table 11). Type III specimens from this time are capable of producing a sound when blown, and these specimens certainly outnumber Type II specimens in the Late Archaic I period.

Although the sample size diminishes in the Late Archaic II, the representation under Type II increases noticeably, while those categories under Types III and IV are empty. Fewer examples were avilable from the Late Archaic II period under Type I, also, except for Type IA4. No Early Woodland specimens of Type II were in the sample, reducing this time segment to Type I examples.

Subtypes from later time periods exhibit other variations in frequencies. Only two examples from Woodland period sites were not Type I specimens; they represented Types IIIB1 and IVB, respectively. All three examples from Historic sites were Type IA1. Reference to the type distribution from the Mississippian period (Table 9, page 77) shows a shift toward Types II, III and IV. Also, Types V through VIII are represented for the first time during this period. The subtypes for Mississippian examples, Types II to VII are found in Table 12.

The information from Tables 10, 11 and 12 shows the disappearance of several subtypes through time. Types IA2, IA6, IA7, IB2 and ID2 are not represented after Late Archaic I. Types IB4 and IIC1 disappear following the Late Archaic II. In contrast, Types IIA and IIC1 appear for the first time in the Late Archaic II. Other subtypes do not occur

TABLE 12

MISSISSIPPIAN PERIOD SUBTYPES

Subtypes	Examples	Subtypes	Examples
IIA	7	VA	1
IIB	8	VB	2
IIC1	0	VC	0
IIC2	0		
		VIA	0
IIIA	7	VIB	2
IIIB1	12	VIC	0
IIIB2	2		
IIIB3	2	VIIA	0
IIIC	0	VIIB	3
		VIIC	0
IVA	2		
IVB	6	VIIIA	0
IVC	0	VIIIB	2
		VIIIC	0

during the Late Archaic I or II periods, but appear later. Type IA5 had its single example recovered from a Middle Woodland Hopewellian burial mound. The first examples for Types IIIA, IIIB2, IIIB3 and IVA, as well as Types V through VIII are from Mississippian sites.

This temporal variation by types as presented in Tables 9, through 12, pages 77, 80, 81 and 84, respectively, does not support the concept of lack of modification through time. Other aspects of this apparent modification through time can be discussed when spatial factors are included below.

Spatial Distributions

Forty-five locations in eastern North America have been identified which had one or more perforated bone tubes. These sites are indicated on the Figure 3 map. Although the area for this study was defined as eastern North America, the sites actually identified as having perforated bone tubes included in the sample fall within an area sometimes designated as northeastern North America. Ford (1974) described the area covered by northeastern archaeology as "a geographic area ranging from Minnesota to Newfoundland and from Ontario to Tennessee" (Ford 1974:385). Nearly every site in the present study would fall within this northeastern area. However, the site distribution extends into states commonly considered within the Southeast such as Tennessee.

The 45 sites lie in three physiographic provinces in the United States and one in Canada. The New England province, the Central Lowlands, and Interior Low Plateaus contain the heaviest concentration of sites in the study (Fenneman 1938). In Canada, two sites are located

Figure 3. Map of eastern North American sites from which perforated bone tubes have been recovered.

ARCHAIC PERIOD SITES

1. Labrador
2. Port au Choix
3. Tranquility Farm
4. Woodchuck Hill
6. Lamoka
7. Frontenac Island
10. Ewing-Bragdon
19. Carlson Annis
20. Read
21. Indian Knoll
22. Barrett
25. Spring Creek
26. Oak View Landing
27. Cherry
28. Kays Landing
35. Oconto
36. Cherokee Sewer
41. Riverton
42. Robeson Hills
44. Moorehead

WOODLAND PERIOD SITES

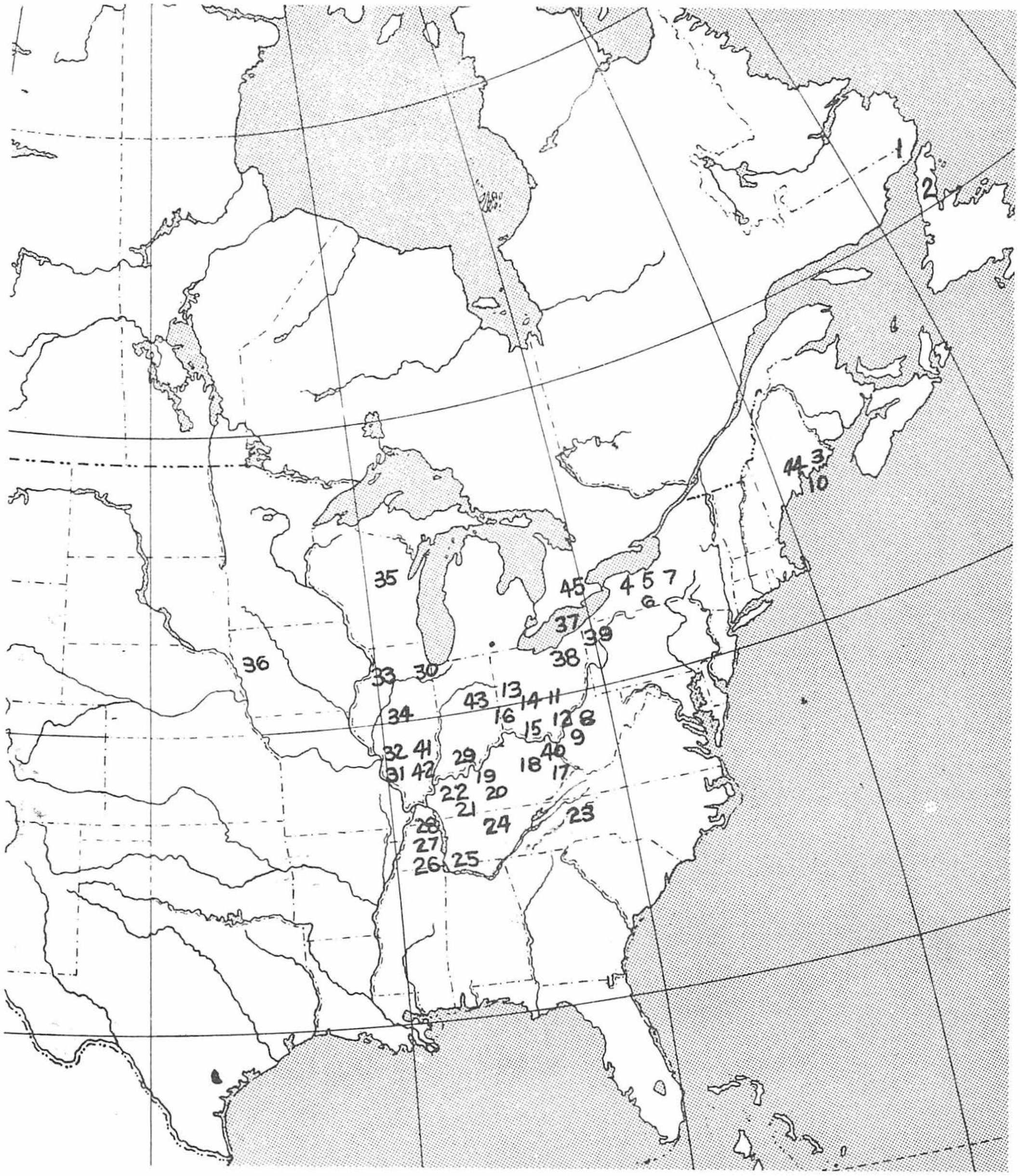
5. Sackett
11. Bourneville
23. Rankin
24. Hoover-Beeson
32. Gracey Mounds

MISSISSIPPIAN PERIOD SITES

8. Wells
9. Clover
12. Feurt
13. Turpin
14. Hahn's Field
15. Sand Ridge
16. Madisonville
17. Fullerton Field
18. Fox Farm
29. Angel Mounds
30. Fifield
31. Cahokia
37. Tuttle Hill
38. South Park
39. Reeve Village
40. Hardin Village
43. Blackford County
45. Middleport

HISTORIC PERIOD SITES

33. Crawford Farm
34. Rhoads


1
2
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26
25

Figure 3.

in the Canadian Shield province and one in a continuation of the Central Lowlands north of the Great Lakes (Kroeber 1963).

The Banks of Newfoundland are considered part of the Atlantic Coastal Plain which, north of New York City, becomes submerged with only occasional islands visible above the water (Fenneman 1938:13). Thus, the sites on Newfoundland Island and in southern Labrador are inadequately characterized as equivalent to other areas in the Canadian Shield province. The northern coniferous forest stretches across the Canadian biotic province. This boreal forest also surrounds the Great Lakes and extends into New England but here contains northern hardwoods including beech and maple (Dice 1943). This latter area provides the base for three additional sites in Maine containing perforated bone tubes.

The Central Lowlands province includes the Great Lakes section, the Till Plains east of the Mississippi River and north of the Ohio River, and the driftless or Osage section west of the Mississippi River (Fenneman 1938:449-450). The Carolinian biotic area covering these sections includes the northern hardwoods around the Great Lakes, and the southern hardwood forest in much of the remaining sections. Forests of beech-maple and oak-hickory climaxes characterize the Till Plains area; maple-basswood predominates in the driftless section (Dice 1943: 17). Eleven sites are located in the Great Lakes section, 15 in the Till Plains and one in the Osage driftless section. These 27 sites cluster as the heaviest concentration in any one physiographic province.

The Illinoian biotic province which is the eastern extension of the prairies has oak-hickory forests associated with it alternating with prairie (Dice 1943:21). This area, designated the Illinoian biotic province by Dice, falls into the Central Lowland province of Fenneman (1938:450) who recognizes the difficulty of assigning a single line to separate the Plains and Central Lowlands. One way to picture this intermittent occurrence of the prairie is to view these areas as islands in the Central Lowlands. Another is to draw the forests as following the rivers westward into the Plains (Stefferud 1949:113).

The Appalachian Plateau is mainly covered with northern hardwoods due to altitudes in which the climate approximates that in more northerly latitudes in North America. One site, the Hoover-Beeson rockshelter, is located on the western edge of this physiographic province. Another Tennessee site (Rankin) lies in the Ridge and Valley province along the French Broad River.

The Interior Low Plateau province is similar in many ways to the Till Plains of the Central Lowlands, but differs in being characterized by a dissected plateau topography (Fenneman 1938:450). The boundary between these two physiographic provinces runs along the southern edge of the glacial drift. This line is approximately the Ohio River, but runs several miles north of it in some places (Fenneman 1938:413, 450). Within this province lie twelve sites appearing in the current study.

The forest vegetation which covers the Mississippi River bottoms is shown as extending up the Mississippi and Ohio Rivers, then southward along the Tennessee River nearly to Alabama, and northward up the

Wabash River (Stefferud 1949:113). At least six sites fall within this biotic extension. Winters (1969:6) called attention to this fact for the location of his Wabash Valley Riverton Culture sites. Four western Tennessee sites would also lie within this area along the Tennessee River.

The number of sites in each physiographic province is summarized in Table 13. The sites are mainly in the Central Lowlands and Interior Low Plateau which are covered with deciduous forests. This distribution emphasizes the areas with a biotic base of mixed deciduous forest over the areas with coniferous boreal forest or the northern hardwoods.

The micro-environmental factors for each site in this study are often difficult to determine. Ideally, these factors would have been included in the original site analyses. However, many of the sites which are a part of the study sample were excavated a number of years ago. In these cases, particularly, only general ecological information about the site can be discussed without extensive further research which would be beyond the scope of the present study.

Geological information available from areal maps comprises the attributes which would be considered to reflect the macro-environment of those areas. The classifications by physiographic or biotic provinces only describe general characteristics for an area. These classifications do not give specific information, or give very limited information, about the natural setting of a site. Therefore, while reference to these overall geological classifications does indicate the range of potential for carrying capacity or life-support systems within an area,

TABLE 13

SITE DISTRIBUTION BY PHYSIOGRAPHIC PROVINCE

Physiographic Province	Number of Sites
Canadian Shield	2
New England Seaboard	3
Central Lowlands	
Great Lakes	10
Till Plains	15
Osage Driftless	1
Interior Low Plateaus	12
Ridge and Valley	1
Appalachian Plateau	1
Total	45

additional factors of site location are important to consider. The aboriginal decision for site location was no doubt heavily influenced by the micro-environmental factors observable to a man on foot.

<u>Site Location</u>

While severe limitations do exist as to the specificity of the current research data on micro-environmental factors for the entire sample, several additional factors bearing upon the spatial variables governing site location may be discussed. One of these specific factors is site location in relation to water resources.

Most sites cluster in the area covered by the Mississippi drainage system. The sites in Canada, Maine, New York and Wisconsin are the only locations not included strictly in that area. Four sites near Lake Erie in Ohio, four in New York, one in Ontario and the two in Newfoundland and southern Labrador lie within the area affected by the St. Lawrence drainage system. Table 14 shows the relationship to water sources for the sites in this study. Since most of the sites were generally on rivers or streams, further distinctions were sought among these 29 sites.

An additional factor which was tabulated for these sites was the general elevation of the site above the water level where it could be determined from the literature. Sometimes general information was given as in the case of the sites along the Tennessee River. These sites were situated on the west bank of the Tennessee River as it flows north through western Tennessee. The west bank location utilizes an area "where some bottom land exists, rather than the east bank which

TABLE 14

SITE LOCATION AND WATER SOURCES

Site Location	Number of Sites
Rivers or streams	30
Springs or creeks	1
Bluff or ridge over river valley	4
Island in lake	1
Salt-water bay	4
1.5 to 10 miles from water	2
Undetermined	3
Total	45

is mainly rough, poor uplands" (Lewis and Kneberg 1959:62). This calls upon another micro-environmental factor of site location, that is, the existence of floodplain and bluffs as well as the location of river or stream terraces which is difficult to obtain from macro-environmental classifications such as general physiographic descriptions.

About half of the sites were described in more detail as to their specific relationship to the water source. Three sites were on the floodplain (T-0), three were on the first terrace (T-1) and four on the second terrace (T-2) above rivers. Three additional sites were on a stream or creek and four were on bluffs above the rivers. Insufficient information was available to pinpoint similar site locations for the remaining 17 river sites. The following tabulation in Table 15 gives total numbers of sites and specimens for each geographic site position in relationship to the water sources.

Most categories in the preceding table fall within a logical ratio with the number of sites increasing proportionately as specimen totals are greater. The "stream or creek" category had a slightly larger number of specimens with 28 from four sites. Likewise, the one site on an island had a somewhat larger sample of ten. Under the general river category, one site had 29 specimens which doubled the total for that category. Many sites for which specific information on exact site location was lacking also did not reveal exact information on the perforated bone tubes listed for those sites.

TABLE 15

TOTAL SPECIMENS PER SITE LOCATION

Location	Total Sites	Total Specimens
T-0	3	8
T-1	3	8
T-2	4	10
Stream/creek	4	28
Bluffs	4	4
Island in lake	1	10
Salt-water bay	4	15
1.5 to 10 miles away	2	4
River	17	53
Undetermined	3	4

Typological and Spatial Correlations

When the study sample and the sample drawn from the literature are combined, the following correlations between spatial factors and the types proposed in the preceding chapter can be made. First, the types were tabulated by state. Due to concentrations or clusters of absolute numbers for sample totals at a few sites, certain types were also more numerous on those sites with large totals. Therefore, one occurrence of a type was recorded per place it appeared and any additional examples of the same type were not counted. Table 16 shows spatial locations for types.

Over 50 percent of the states or provinces in the study had examples of Types I, II and III. Type I had the highest percentage of representation with 81 percent or only two of these locations lacking some example of Type I. Types IV and VII were the next highest with 36 and 27 percent, respectively. Types VI and VII followed with only two states or 18 percent and Type V had the lowest tabulation with an occurrence only in Ohio.

The addition of the types assigned to 140 of the specimens results in the compilations for physiographic provinces seen in Table 17. Incomplete information for specimens from 10 sites did not allow these to be included in the typological tabulations here as elsewhere in the present study. The sizeable totals in the right column of Table 17 are of the expected proportion based on information in the preceding tables. These sums, along with the large total under Type I, would then lead to the prediction that Type I would substantially outnumber other types

TABLE 16

TYPES OF PERFORATED BONE TUBES BY STATES

	Type							
State	I	II	III	IV	V	VI	VII	VIII
Kentucky	x	x	x	x	o	x	x	x
Tennessee	x	x	o	o	o	o	o	o
Illinois	x	x	o	o	o	o	o	o
Iowa	o	o	x	o	o	o	o	o
Indiana	x	x	x	o	o	o	x	x
Ohio	x	x	x	x	x	x	x	o
Wisconsin	x	o	o	o	o	o	o	o
Maine	x	o	o	o	o	o	o	o
New York	x	x	x	x	o	o	o	o
Newfoundland	x	o	o	o	o	o	o	o
Ontario	o	x	x	x	o	o	o	o

x = presence; o = absence.

TABLE 17

TYPES BY PHYSIOGRAPHIC PROVINCE

Physiographic Province	Type I	II	III	IV	V	VI	VII	VIII	Total
Canadian Shield	8	0	0	0	0	0	0	0	8
NE-Seaboard	7	0	0	0	0	0	0	0	7
Central Lowlands	0	0	0	0	0	0	0	0	0
a. Great Lakes	25	3	10	5	0	0	0	0	43
b. Till Plains	11	14	12	4	3	1	0	0	45
c. Osage Driftless	0	0	1	0	0	0	0	0	1
Interior Low Plateaus	13	5	6	3	0	1	2	2	32
Appalachian Plateau	1	0	0	0	0	0	0	0	1
Ridge and Valley	3	0	0	0	0	0	0	0	3
Total	68	22	28	12	3	2	3	2	140

in the Central Lowlands, Great Lakes and Till Plains, and in the Interior Low Plateaus. For two of the three specified totals this prediction is true. Totals for Types I to IV in the Great Lakes and Interior Low Plateaus reflect, generally, the relationships among those same four totals for all physiographic provinces. In the Till Plains, however, the Type I total should reach about 30, or Types II and III should have dropped to around three or four if the expected pattern were to be repeated for the Till Plains. This increase in specimens of Types II and III is a result of the large number of specimens from the Feurt site which are Types II and III with a correspondingly lower number of Type I examples.

The presence of Types I through VIII were tabulated for the various site locations in relationship to water sources (Table 18). Each type was counted only once per site if it was present rather than the total number of specimens per site.

The site locations in Table 18 have as few as one type represented in salt-water bay locations to as many as six types represented for all undifferentiated river sites. The contrast between these two extremes in total numbers of sites in the two categories would seem the obvious explanation for the range in types present at such sites. The salt-water bay locations total four while the river sites in the latter category number 18. However, this principle does not apply throughout all other categories in the table. For example, all categories with less than four sites have more than one type occurring with five types present in sites within two locations, on first terraces above rivers, and from one and one-half to ten miles from waterways.

TABLE 18

SINGLE OCCURRENCES OF TYPES BY SITE LOCATION

Site Location	Type I	II	III	IV	V	VI	VII	VIII	Total Sites
T-0	2	1	0	0	0	0	0	0	3
T-1	1	0	0	1	1	1	1	0	3
T-2	2	0	2	0	0	0	1	1	4
Stream/creek	2	2	3	3	0	0	1	1	4
Bluffs	1	1	0	0	0	0	0	0	4
Island in lake	1	1	1	0	0	0	0	0	1
Salt-water bay	4	0	0	0	0	0	0	0	4
1.5 to 10 miles	2	0	1	1	0	0	0	0	2
River (undifferentiated)	6	5	8	4	1	1	0	0	17
Undetermined	2	1	0	0	0	0	0	0	3
Total									45

The one site located on an island in a lake has three types represented. This situation raises the question of the degree to which the variety of types is linked to the size of the sample at any given site. Obviously, a site containing fewer than eight examples would offer no possibility for all eight types to be represented. Therefore, sites having eight or more specimens reported were compared. From the study sample alone, four sites had over eight examples, and from the sites described in the literature, three more were added. In several cases the published report mentioned numbers as large as 20 or 30, but only described a smaller number specifically.

One such case was the Feurt site. However, perforated bone tubes from the Feurt site were also included in the study sample actually measured and did include the larger number mentioned in the published report. The seven sites in Table 19 had the largest totals per site. The assumption is made that the authors of the various archaeological reports chose to emphasize differences among the perforated bone tubes rather than similarities, and thus the variety would have been reflected even when the specific artifacts described or pictured did not total up to the number mentioned earlier in that same report.

Again the salt-water bay site of Port au Choix has the least variation in typology with only one type represented by all eight specimens. For the Madisonville site, which allegedly yielded over 20 perforated bone tubes, only four different types were described in the published report.

TABLE 19

INTRASITE TYPOLOGICAL VARIATION

Site Location	Type I	II	III	IV	V	VI	VII	VIII	Total
Angel	1	1	3	0	0	0	1	1	7
Feurt	4	9	11	3	2	0	0	0	29
Fox Farm	0	2	2	2	0	0	1	1	8
Frontenac	6	1	2	0	0	0	0	0	9
Lamoka	15	0	.1	2	0	0	0	0	18
Madisonville	0	0	1	1	1	1	0	0	4
Port au Choix	8	0	0	0	0	0	0	0	8

In contrast to the Port au Choix sample, five different types represent the seven specific artifacts described for Angel site. The two New York sites each exhibited only three different types within their larger numbers per site of 10 and 18 specimens. The Feurt and Fox Farm sites each had five types, although not the same five, from among the two largest totals of perforated bone tubes recorded at any one site. Thirty specimens were measured from Feurt; only eight Fox Farm artifacts from a supposedly much larger collection were described in the published report.

Thus, two sites with large samples, Feurt and Fox Farm, predictably had a spread of types while two with fair-sized groups from New York had only three types each. In contrast to these latter two, Angel had five types among seven artifacts. Also contrary to the expected correlation, Madisonville showed only four types in the published description.

A greater degree of diversification exists for these sites within the subtypes under Type I. These subtypes are specified in Table 20 for the four sites with large Type I totals in the preceding table. The distribution of Type I subtypes is greatest for the Port au Choix site with six subtypes represented by eight specimens. Frontenac and Feurt sites have their specimens spread in a similar manner, but Lamoka specimens cluster, even when subtypes rather than general types are considered. Ten of Lamoka's Type I specimens are classified as Subtype IB1.

TABLE 20

INTRASITE TYPE I SUBTYPES

Subtype	Port au Choix	Frontenac	Lamoka	. . Feurt
IA1	1	2	1	1
IA2	1	1	0	0
IA3	0	0	0	0
IA4	0	2	0	1
IA5	0	0	0	0
IA6	1	0	0	0
IA7	2	0	0	0
IB1	1	1	10	2
IB2	2	0	0	0
IB3	0	0	0	0
IB4	0	0	0	0
IC1	0	0	0	0
IC2	0	0	1	0
ID1	0	0	0	0
ID2	0	0	2	0

The other site which had over 10 specimens under one type in Table 19, page 102, was the Feurt site with 11 Type III examples. This total includes only two subtypes: six IIIA and five IIIB1 examples. While no other site had enough Type III specimens for comparison, the clustering within subtypes for Feurt (Type III) and Lamoka (Type I) does provide an interesting similarity. These types have the largest totals for the sites, respectively, with fewer examples of the other types. Type II for the Feurt Site is broken into four IIA specimens and five IIB specimens, thus showing a similarity to IIIA and IIIB1 subtypes for the same site. These distributions will be discussed again with the addition of temporal factors later in this chapter.

The spatial attributes for the 45 sites in this study have been reviewed and then compared with the types assigned the perforated bone tubes from those sites. Geographically most sites fall into the Mississippi Valley with a smaller group in the St. Lawrence drainage area. The greatest concentration of sites lies in the Ohio Valley in the states of Ohio and Kentucky. In general, the sites lie near rivers, the majority being on adjacent terraces with only a few sites on bluffs or at any substantial distance from a water channel.

The comparison between typological and spatial attributes brought to light several points which will receive further consideration below in conjunction with temporal and functional factors. Types I to III seem to be represented in all geographical locations when segregated by states. Only four categories contained all three types when broken down by distance from water sources. However, this latter analysis fell short on this point due to the 17 sites which were identified only as along a river, and which may have spread the various types among the categories for river terrace locations more evenly. As a whole, no strong correlation between type and site location in relationship to waterways could be established at this point. Type V had the smallest representation in every category and appeared only in the central Ohio Valley. Types VI through VIII were represented in Ohio, Kentucky and Indiana. This geographic focus will be examined further in light of temporal correlations. A final aspect considered from this review of geographic factors was the seeming lack of typological variation from sites located in salt-water bays and northernmost areas. This situation is not without exception and additional factors may be operating to create such a correlation.

Spatial-Temporal Correlations

The relationships among spatial and temporal attributes are most graphically apparent when plotted on a map of North America and grouped by time periods. The map in Figure 3, pages 86-87, shows the geographic distributions of the 45 sites considered in this study during the Archaic, Woodland and Mississippian archaeological periods and the Historic period.

The site distributions show some variation through time. The Archaic sites on the one hand are clustered in Kentucky and Tennessee, and, on the other, are spread across the northern portion of the map. During the Woodland period the sites, although fewer, are more widely spread in the central areas. The two Tennessee sites are Early Woodland, the sites in Illinois and Ohio fall into the Middle Woodland time span, and the New York site is Late Woodland. All the Mississippian period sites cluster in the Ohio Valley and Great Lakes area. The two historic sites are in Illinois.

The distribution of sites within the various physiographic provinces can be broken into four general time periods identified in the first section of this chapter. This distribution is outlined below in Table 21. Subperiods I and II are indicated under Late Archaic. The 45 sites are spread throughout most of the designated cells in Table 21. The two northern physiographic provinces, the Canadian Shield and New England, contain no sites for the Woodland, Mississippian or Historic periods. The small number of sites in the Historic Period leaves additional blank spaces for the remaining provinces, excluding the two sites in the Till Plains. Since the Osage Driftless, Appalachian Plateau and Ridge and Valley physiographic provinces have only one site each, the distribution under these categories is necessarily localized to one cell in the table. The two units with highest totals are located under the Mississippian period in the Till Plains subdivision of the Central Lowlands with nine sites, and under the Late Archaic in the Interior Low Plateau with eight sites. The other 12 sites from the Late Archaic fall within the Central Lowlands, New England and Canadian Shield provinces. Nine additional Mississippian Period sites lie within the Great Lakes area of the Central Lowlands and in the Interior Low Plateaus. This site

TABLE 21

SITE DISTRIBUTION BY PHYSIOGRAPHIC PROVINCE THROUGH TIME

Physiographic Province	Late Archaic I	Late Archaic II	Woodland	Mississippian	Historic
Canadian Shield	2	0	0	0	0
New England-Seaboard	0	3	0	0	0
Central Lowlands					
a. Great Lakes	4	0	1	5	0
b. Till Plains	0	2	2	9	2
c. Osage Driftless	1	0	0	0	0
Interior Low Plateau	4	4	0	4	0
Appalachian Plateau	4	4	0	4	0
Ridge and Valley	0	0	1	0	0

distribution seems to show a transfer of the heaviest site concentration from the Interior Low Plateau region during Late Archaic times slightly northward to the Till Plains of the Central Lowlands, while diminishing the geographic spread which reached considerably farther north in the Late Archaic.

A related set of factors can be seen in the total numbers of specimens through time listed, also, by physiographic province in Table 22. The specimen totals under the Mississippian Period in the Till Plains are predictably large based on site totals in the preceding table (see Table 21). However, the specimen totals under the Late Archaic in the Great Lakes Subdivision of the Central Lowlands is double that found under the same period in the Interior Low Plateaus. This latter region would have been expected to claim the larger specimen totals based on the site totals described above. If a ratio of roughly twice the site total is taken as a standard to arrive at specimen totals, the majority of caregories in Table 22 approximately reflect this standard. Only three specimen totals depart from the expected range. The total of 30 specimens in the Great Lakes area of the Central Lowlands in the Late Archaic was mentioned previously. The other two deviations occur during the Mississippian Period in the Till Plains and in the Interior Low Plateaus. The inflated totals display the unusually large number of specimens from Lamoka (18), Frontenac (10) and Feurt (29) sites individually for the first two areas. The remaining specimen total for the Interior Low Plateaus in Mississippian times accumulated on the combined strengths of Fox Farm (8) and Angel Mounds (7).

TABLE 22

TEMPORAL DISTRIBUTION OF SPECIMENS BY PHYSIOGRAPHIC PROVINCE

Physiographic Province	Archaic I	Archaic II	Woodland	Mississippian	Historic	Total
Canadian Shield	9	0	0	0	0	9
New England Seaboard	0	7	0	0	0	7
Central Lowlands						
a. Great Lakes	30	0	3	11	0	44
b. Till Plains	0	4	2	38	3	47
c. Osage Driftless	1	0	0	0	0	1
Interior Low Plateaus	10	5	0	20	0	35
Appalachian Plateau	0	0	1	0	0	1
Ridge and Valley	0	0	1	0	0	1
Totals	50	16	9	69	3	147

Site locations in relation to water sources which were tabulated earlier (see Table 14, page 93) occurred through time as seen in Table 23. A slight increase on river sites from the Archaic to the Mississippian period can be seen with a corresonding decline in sites in a variety of locations including locations on salt-water bays and an island in a lake.

Kroeber's (1963) description of the aboriginal cultural areas in North American utilized archaeological and ethnographic data to define areas characterized by distinctive cultural traits distributed within natural geographic areas. The sites in the current study are found in Kroeber's (1963:Map 6) cultural areas as shown in Table 24.

Twenty-one, or nearly half, of the sites are in Kroeber's Ohio Valley zone. Inclusion of the 8b category of Illinois and 9, the Lower Great Lakes, raises the total to 32 sites. Kroeber's other areas are represented by a few sites each during the Late Archaic and Early Woodland periods. While this classification does call attention to broad zones, it obscures some of the spatial-temporal and typological patterns which have been described for the artifact sample. The designation "Appalachian Summit" for the area including the Rankin site is misleading, for this riverine site is in the Ridge and Valley Province. Separating the sites in the Eastern Subartic and North Atlantic Slope areas might suggest a difference between these sites which did not exist. The Hoover-Beeson site seems to fall within the Ohio Valley area, but this affiliation is of questionable value. In contrast, this breakdown ignores the physiographic similarities which were accompanied

TABLE 23

SITE DISTANCE TO WATER THROUGH TIME

Site Location	Late Archaic I	Late Archaic II	Woodland	Mississippian	Historic	Total
T-0	1	1	0	1	0	3
T-1	0	0	1	2	0	3
T-2	2	0	0	2	0	4
Stream/creek	1	0	1	2	0	4
Bluffs	1	1	1	1	0	4
River	3	4	0	9	1	17
Island in lake	1	0	0	0	0	1
Salt-water bay	4	0	0	0	0	4
1 - 10 miles from water	0	0	2	0	0	2
Undetermined	1	0	0	1	1	3
Total	14	6	5	18	2	45

TABLE 24

SITE DISTRIBUTION WITHIN KROEBER'S CLASSIFICATION

Area	Archaic	Woodland	Mississippian	Historic
1a Southeast	Cherry			
	Kays Landing			
	Oak View			
	Spring Creek			
7 Wisconsin	Oconto			
6a Southern Prairie	Cherokee Sewer			
8b Ohio Valley	Indian Knoll	Hoover-Beeson	Fox Farm	
	Barrett	Bourneville	Sand Ridge	
	Read		Turpin	
	Carlson Annis		Hahn's Field	
	Riverton		Madisonville	
	Robeson Hills		Hardin Village	
			Fullerton Field	
			Feurt	
			Blackford County	
			Fifield	
			Angel	
			Wells	
			Clover	
8b Illinois		Gracey Mound	Cahokia	Crawford Farm
				Rhoads

TABLE 24 (Cont'd)

Area	Archaic	Woodland	Mississipian	Historic
9 Lower Great Lakes	Lamoka Woodchuck Hill Frontenac	Sackett	Reeve South Park Tuttle Hill Middleport	
10 North Atlantic Slope	Tranquility Ewing-Bradgon			
13 Appalachian Summit		Rankin		
15 Eastern Subartic	Labrador Port au Choix			

by some typological similarities for the Riverton and western Tennessee Valley Late Archaic sites.

The site concentration for this study in the Ohio Valley focuses attention upon an area sparsely populated at the time of European contact. Kroeber (1963:90) commented on the apparent drop in population for this area between prehistoric and historic times. The wider geographic distribution of sites during the Archaic period followed by a more limited distribution during the Mississippian period is reiterated by the findings in the present study. Since Kroeber drew his cultural boundaries based on historic populations alone, it will not be possible to further utilize his classification for the present study which includes considerable time-depth.

A traditional method of summarizing the relationships between cultural components found in this study would be to follow McKern's (1939) taxonomic framework with hierarchical designations of component, focus, phase and tradition for archaeological evidence. The 45 sites in the present study are outlined in such a framework in Table 25.

In most cases, these categories were assigned to the sites by the authors reporting the archaeological discoveries (see Chapter II, pages 15-25). Tuck's suggestion was followed in placing the Maine sites under Maritime Archaic rather than the previously-used term, Coastal Archaic (Byers 1959). The organization of sites under the Fort Ancient Aspect follows that suggested by Griffin (1943). The Hardin Village site was added under the Madisonville Focus due to correspondences in pottery (Hansen 1966:110) and the physical type of the population

TABLE 25

CULTURAL TAXONOMY OF SITES

Period	Tradition or Aspect	Focus or Phase	Site or Component
Archaic	Prairie		Cherokee Sewer
	Laurentian	Lamoka	Lamoka Woodchuck Hill
		Frontenac	Frontenac Island
		Old Copper	Oconto
	Maritime		Labrador Port au Choix Tranquility Farm Ewing-Bradgon
	Mid-Continent	Green River	Indian Knoll Carlson Annis Barrett Read
		Ledbetter	Oak View
		Big Sandy	Cherry
		Weldon	Kays
		?	Spring Creek
		Riverton	Riverton Robeson Hills
Woodland	?		Hoover-Beeson
Early	Middle Eastern	Watts Bar	Rankin
Middle	Havana	Hopewell	Gracey Mound
	Scioto	Hopewell	Bourneville
Late	Owasco	Owasco	Sackett

TABLE 25 (Cont'd)

Period	Tradition or Aspect	Focus or Phase	Site or Component
Middle Mississippian			Cahokia
Upper Mississippian	Fort Ancient	Feurt	Feurt
			Fullerton Field
		Madisonville	Fox Farm
			Hardin Village
			Madisonville
			Hahn's Field
			Sand Ridge
			Turpin
		West Virginia	Clover
			Wells
	Oneota	Fisher	Fifield
	Iroquois	Whittlesey	Reeve
			South Park
			Tuttle Hill
		Neutral	Middleport
		Indiana	Blackford County
Historic	Central Area Algonkin	Sauk-Fox	Crawford Farm
		Kickapoo	Rhoads

(Robbins and Neumann 1972:107). The two historic sites were associated with historic tribes by Parmalee (1964; n.d.a). The category of Central Area Algonkin was adopted from Wissler (1938).

Typological Correlations with Spatial-Temporal Factors

Four physiographic provinces or subprovinces were represented by such low site totals, namely one each, that comparisons of the spatial, typological and temporal factors for these sites is fairly simple. Since the only type present in each case was Type I, these four areas were combined into one table. A fifth region having three sites but only Type I was also included. Table 26 presents these five spatial categories through time. No Mississippian or Historic period sites occurred in these areas. The ratio of total sites to total specimens of one to three is repeated for the Ridge and Valley and New England areas. The two sites in Osage Driftless and Appalachian Plateau, having only one specimen each, are offset by the one site in the Canadian Shield area with eight examples.

The remaining physiographic areas with more complex typological data appear in Table 27. Only four types are represented in the Great Lakes subprovince through all time periods. Six types appear in the Till Plains during the Mississippian era, but only two in other time periods. The full range of eight types, minus Type V, occurs in the Interior Low Plateaus also during Mississippian times, and with the corresponding restriction of the Late Archaic to two types. No examples from the Woodland and Historic periods are available for this physiographic area.

TABLE 26

TYPE I DISTRIBUTIONS IN FIVE AREAS THROUGH TIME

Physiographic Province	Late Archaic I	Late Archaic II	Woodland	Total
Canadian Shield	8	0	0	8
New England	0	7	0	7
Osage Driftless	1	0	0	1
Appalachian Plateau	0	0	1	1
Ridge and Valley	0	0	3	3
Total	9	7	4	20

TABLE 27

SPATIAL-TEMPORAL DISTRIBUTION OF TYPES

Type	Late Archaic I	Late Archaic II	Woodland	Mississippian	Historic	Total
			A. Central Lowlands - Great Lakes			
I	24	0	1	0	0	25
II	1	0	0	2	0	3
III	3	0	1	6	0	10
IV	2	0	1	2	0	5
V-VIII	0	0	0	0	0	0
			B. Central Lowlands - Till Plains			
I	0	0	1	7	3	11
II	0	4	0	10	0	14
III	0	0	0	12	0	12
IV	0	0	0	4	0	4
V	0	0	0	3	0	3
VI	0	0	0	1	0	1
VII	0	0	0	0	0	0
VIII	0	0	0	0	0	0
			C. Interior Low Plateaus			
I	9	3	0	1	0	13
II	0	2	0	3	0	5
III	0	0	0	6	0	6
IV	0	0	0	3	0	3
V	0	0	0	0	0	0
VI	0	0	0	1	0	1
VII	0	0	0	2	0	2
VIII	0	0	0	2	0	2

The distribution of types through time for site locations in relationship to water sources can be seen in Table 28. The shift from a greater total for Type I in the Archaic Period to one for Type III during the Mississippian Period can be seen in combination with the shift of sites from a variety of site locations during the Archaic to one of greater concentration along rivers in the Mississippian Period. Types V to VIII are restricted spatially and temporally in the manner predictable from the separate spatial and temporal distributions seen in prior tables (see Tables 9, page 77, and 16, page 97).

Another aspect of spatial distributions which may be compared with temporal distribution of sites and artifact types would be intra-site variation set forth in Table 29 as positioned through time.

A clustering for Types I and III, respectively, for the Lamoka and Feurt sites was noted earlier under the discussion of spatial factors. This pattern shows a shift from concentration of Type I to Type III in a later time period. The behavior within subtypes was also surveyed in the discussion above. Both the Lamoka and Feurt sites had a substantial clustering of examples for subtypes within their large totals for a particular type. The Lamoka site had 10 Type IIIA and IIIB under Type III. Distributions were more dispersed for Type I subtypes from the Port au Choix, Frontenac and Feurt sites. This distribution pattern may indicate a greater diversity with time after an initial concentration within subtypes for whichever type is dominant in a particular time period. This pattern of development would explain the greater variety of subtypes under Type I from the Late Archaic II

TABLE 28

TYPES THROUGH TIME TABULATED BY SITE DISTANCE TO WATER

Site Location	T-0	T-1	T-2	Stream	Bluffs	River	Island	Salt Bay	1-10 Miles	Undeter-mined	Total
Type I											
A	3	0	1	15	1	9	6	15	0	0	50
W	0	3	0	1	0	0	0	0	2	0	6
M	2	0	1	0	0	4	0	0	0	1	8
H	0	0	0	0	0	2	0	0	0	1	3
Type II											
A	3	0	0	0	1	2	1	0	0	0	7
W	0	0	0	0	0	0	0	0	0	1	1
M	0	0	1	2	0	11	0	0	0	0	0
N	0	0	0	0	0	0	0	0	0	0	0
Type III											
A	0	0	1	1	0	0	2	0	0	0	4
W	0	0	0	0	0	0	0	0	1	0	1
M	0	0	3	2	0	18	0	0	0	0	23
H	0	0	0	0	0	0	0	0	0	0	0

TABLE 28 (Cont'd)

Site Location	T-0	T-1	T-2	Stream	Bluffs	River	Island	Salt Bay	1-10 Miles	Undeter-mined	Total
Type IV											
A	0	0	0	2	0	0	0	0	0	0	2
W	0	0	0	0	0	0	0	0	1	0	1
M	0	1	0	2	0	6	0	0	0	0	9
H	0	0	0	0	0	0	0	0	0	0	0
Type V											
A	0	0	0	0	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0	0	0	0	0
M	0	1	0	0	2	0	0	0	0	0	0
H	0	0	0	0	0	0	0	0	0	0	0
Type VI											
A	0	0	0	0	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0	0	0	0	0
M	0	1	0	0	0	1	0	0	0	0	1
H	0	0	0	0	0	0	0	0	0	0	0
Type VII											
A	0	0	0	0	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0	0	0	0	0
M	0	1	1	0	0	0	0	0	0	0	0
H	0	0	0	0	0	0	0	0	0	0	0

TABLE 28 (Cont'd)

Site Location	T-0	T-1	T-2	Stream	Bluffs	River	Island	Salt Bay	1-10 Miles	Undeter-mined	Total
Type VIII											
A	0	0	0	0	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0	0	0	0	0
M	0	0	1	0	0	0	0	0	0	0	1
H	0	0	0	0	0	0	0	0	0	0	0

TABLE 29

INTRASITE VARIATION IN TYPOLOGY THROUGH TIME

	I	II	III	IV	V	VI	VII	VIII	Total
Mississippian									
Madisonville	0	0	1	1	1	1	0	0	4
Fox Farm	0	2	2	2	0	0	1	1	8
Feurt	4	9	11	3	2	0	0	0	29
Angel	1	1	3	0	0	0	1	1	7
Late Archaic									
Port au Choix (2340 BC)	8	0	0	0	0	0	0	0	8
Frontenac (2980 BC)	6	1	2	0	0	0	0	0	9
Lamoka (3433 BC)	15	0	1	2	0	0	0	0	18

sites of Port au Choix and Frontenac after the predominance of Type IB1 from Lamoka. The dispersion among subtypes under Type I can also be seen for the Feurt examples, while a restriction to subcategories A and B can be seen for this site under Types II and III. The existence of such a pattern would need to be tested against additional samples with greater numbers from other Mississippian Period sites to see whether or not subtype diversification would become apparent in later periods for Types II and III. The four specimens from the Reeve, Tuttle Hill and South Park sites do show subtype variation into Types IIIB2 and IIIB3, but these single examples are not sufficient evidence to confirm or deny a pattern.

It is possible that such diversification is limited for those types with larger numbers of perforations by the smaller number of areas left free on the shaft of the bone tube with the addition of more perforations. Thus, a tube with six to eight perforations, establishing the basic type (Types VI to VIII), would leave less room for variation in perforation pattern in the manner of subtypes such as IA6 or IB3 which reflect perforations placed in positions adjacent to the main perforation. If this restriction were found to operate for Types III through VIII, the pattern of development suggested above would still be present for the Archaic sites as demonstrated.

Similarity in certain features has been noted among various sites and cultures included in this study. Winters (1969:107) mentioned some likenesses among the Late Archaic cultures of Riverton, Lamoka, Indian Knoll and those in the western Tennessee River Valley. Typological similarities within the combined sample reflect these likenesses. Rectangular perforations placed at right angles to the shaft were observed on specimens from the Riverton and Cherry sites (Type II) and the Lamoka site (Type I).

Other typological correspondences during the Late Archaic can be seen for Type IB3 specimens from the Indian Knoll, Carlson Annis, and Oconto sites and for Type IB2 from the Carlson Annis and Port au Choix sites. Parallel incised lines along the length of the shaft were found on examples from the Frontenac, Oconto and Port au Choix sites. During the Early Woodland period, additional, and final, examples of Type IB3 were found on the Rankin site in East Tennessee. The authors of the Rankin site report feel that "some relationships with Late Archaic cultures in the Northeastern United States is highly probable" (Smith and Hodges 1968:89).

The noticeable lack of Woodland period specimens for this study has been mentioned. During this time period, numerous copper panpipes with two to four tubes of bone, cane, clay or wood were present on sites in eastern North America. Fifty-five Hopewellian panpipes are listed from 27 sites (Griffin, Flanders and Titterington 1970:98-99). The distribution of these panpipes follows the greater Mississippi-Ohio drainage, plus additional examples found in Wisconsin, Michigan, Ontario, Alabama, Georgia and Florida. Nine additional copper panpipes were recently uncovered in association with six burials at the Tunacunnhee site in Dade County, Georgia (Jefferies 1975:30). Most often these artifacts had been placed on the chest of a burial.

Shetrone (1926:267) described the construction of these panpipes as being made of copper, containing "tubes either of bone or reed, the interstices being filled with clay."

The two Middle Woodland examples in the combined sample of the current study reflect this trend toward use of copper. The Gracey Mound specimen was reported to be a copper-wrapped bone tube, and the Bourneville Mound specimen had copper bands at the top and bottom. Copper panpipes have been used as a time-marker for the Hopewell Interaction Sphere in the eastern United States (Griffin et al. 1970:100). If these items were musical instruments, their disappearance is puzzling as they might have been expected to continue "in use up to the European colonization in the southeast and Mississippi Valley" (Griffin et al. 1970:113).

While the data available in the form of the two Middle Woodland examples included in the combined sample is severely limited, two possibilities for the change in construction and subsequent disappearance might be suggested. The construction of Hopewellian panpipes included the use of bone tubes which, particularly in the case of the copper-wrapped bone from Gracey Mound, show affinity to the single bone flutes or whistles of earlier and later periods in eastern North America. The use of copper bands on the Bourneville example and that specimen's typological similarity to Archaic period examples, further supports this link backward in time.

However, the Hopewellian specialization in copper artifacts included copper panpipes which disappeared along with other Hopewellian artifacts. The degree of specialization and widespread popularity of these artifacts may have also been instrumental in their obsolescence due to their strong association within cultures participating in the Hopewellian Interaction Sphere. The Late Woodland and Mississippian period bone flutes and whistles sampled in this study indicate a resurgence of the use of bone rather than copper for artifacts of this class.

The Late Woodland examples from the Sackett site of the Owasco culture or tradition (Ritchie 1969:274) bear a strong resemblance to somewhat later examples from the Whittlesey and Neutral sites. These similarities would be expected given the cultural development of Owasco into Iroquois in the northeastern United States and southeastern Ontario (Ritchie 1969:301).

Specimens from Fort Ancient sites in the combined sample show some variation among examples in the Feurt and Madisonville foci. Types I-V are represented at the Feurt site while Type I is absent, and Types VI through VIII occur on Madisonville focus sites. The trend on Madisonville sites is repeated for Iroquois aspect sites of the same period. The two historic period sites with Type I specimens may counter the Mississippian period evidence against later use of Type I patterns, or it may indicate a westward shift of Type I usage in later periods. A larger sample for the Historic period is needed to deal properly with this question.

Inspection of temporal factors has revealed two trends. A shift from Type I to Type III specimens from the Late Archaic to the

Mississippian period, and the appearance of Types V to VIII during Mississippian times were noted. This second characteristic is more clearly a significant factor than is the first. If the shift from Type I to III was weighted too heavily, it would obscure two additional facts. Extensive subtype variation within time periods has been demonstrated and, if this situation was adjusted for, the existence of Types I to IV through time would still present a problem. Thus, the techniques available within the present study would not allow an unambiguous use of these factors as typological determinants in a direct manner.

Spatial factors were reviewed for a number of different spatial divisions. Site and specimen totals and types were tabulated for physiographic provinces, relationship to water sources, states, and intrasite variation. The fact that no geographic measuring unit was immediately obvious for spatial factors, in contrast to temporal factors, indicates difficulties in properly weighing spatial factors for sites scattered over large areas. Any effort to emphasize spatial variables would need to deal with morphological similarities over great distances such as those shown in Type IB1 (specimens from Newfoundland, Tennessee, Western Illinois, and New York), and IB3 (Wisconsin, Kentucky and East Tennessee).

Spatial-temporal correlations revealed several changes through time. Late Archaic sites were found throughout most of the study area and in a variety of locations in relation to water sources. These distributions narrowed through time until sites were found in fewer physiographic provinces and more often along rivers during the Mississippian period. There was a corresponding shift in point of greatest site concentration from the Interior Low Plateau to the Till Plains during that same time span. These spatial-temporal patterns were viewed in conjunction with a shift in typological focus from Type I to Type III with the addition of Types V through VIII in later time periods.

The persistence of Types I to IV through time prevented any clear-cut correlation of typology with spatial-temporal factors. Certain subtypes were seen to appear or disappear at various temporal points, but these occurrences did not form any significant pattern. The frequencies for subtypes within the sizeable totals observed for Types I and III seemed to suggest production of a smaller number of subtypes followed in time by a proliferation of subtype variation. However, the restricted size of the present sample would only allow this suggestion as a possibility for further testing.

Use of spatial-temporal attributes as a starting point for a typology would have hit the snags of unwieldly spatial classification, and would have obscured certain morphological similarities across space and time as well as diversities within spatial units. The categories outlined in Chapter II seem adequate for the investigation of spatial-temporal factors. Further comment will be made on these points from the broader perspective considered in Chapter V after the intervening examination of functional factors.

CHAPTER IV

FUNCTIONAL SUMMARY OF THE SAMPLE

In order to assess the possible functions for perforated bone tubes in this study, it is first necessary to outline the senses in which the word "function" will be used. The determination of function for some artifact classes is less enigmatic than for others. Scrapers discovered in a workshop area leave, primarily, the question of presence or absence of use wear. Perforated bone tubes, often with incised decorations, stimulate more numerous questions about function.

Various functions have been ascribed to perforated bone tubes by the authors reporting such archaeological discoveries (see Chapter II). The artifacts were called flutes or whistles in 39 instances, bird calls five times and musical instruments three times. Twice, a religious or ceremonial function was designated, and on four occasions the artifacts were described as unverified flutes or whistles, or simply not designated by any special name. Smith suggested several functions for the artifacts from the Fox Farm site: animal calls (1910:186), amusement (1910:214) and "whistles in religious ceremonials" (1910:212).

A general methodological framework is needed for assembling the functional evidence. Since the most easily obtainable data is that information taken directly from the artifact itself and from the specific context in which it was found, two categories will be outlined for processing the data input from these two sources. These two sources for evidence might be seen to parallel the designations of primary and secondary function discussed in Chapter I (see page 11). However, this classification scheme has at least two apparent drawbacks. There is no category for handling any intermediate possibilities of other usage which might be inferred, and there is no formalized way of dealing with all three types of data in relationship to one another. An additional category is necessary to provide a flexible means for considering those possibilities not directly accessible through field or laboratory work. These three data sources could be described as the functional performance, functional context and functional use.

Functional performance (hereafter designated as FP) describes the utilization potential based on the manufactured structure of the artifact, or what can be done with the item that could not be done before modification by man. These factors can be obtained from testing the performance of the artifacts or be inferred from ethnographic sources or from replication techniques (production and testing of modern day examples). To establish the FP for perforated bone tubes, the potential of the specimen to produce a sound would be a critical factor.

Functional context (FC) or provenience is based on the information recorded at the time of archaeological recovery. Inferences of the artifact's use at the time of deposition and its meaning or significance in the culture can be constructed from data in ethnographic sources or from interpretation of items associated with the artifacts at the time of discovery.

The category of functional use (FU) covers any number of uses to which the artifact may have been put after its manufacture. These functions must be posited and are difficult to prove except in cases of the appearance of use-wear or other physical evidence on the artifact. Heavy reliance on ethnographic data is necessary unless inferences can be drawn from the FC or FP of associated identical items in the same or a similar cultural complex. The broader the geographic and temporal distances involved, the more difficult it is to firmly establish this evidence.

By utilizing the same word "functional" as the first part of all three terms, some sort of relationship among these categories is implied for any given artifact. At the same time, the designation of three separate terms indicates the three categories may or may not have any actual degree of correspondence or varying degrees of interdependence. Any two of the FC, FU and FP can be identified or not, or all three could be impossible to determine.

The tripartite division should allow a clearer examination of functional factors and also serve to facilitate consolidation of the evidence in a less ambiguous fashion by first providing a sorting mechanism which may or may not correlate with interpretational results. Sorting the evidence into these categories will assign labels to the data which are more specific than those used in previous discussions. The possibility that this procedure will yield results similar to those obtained through a more generalized functional analysis certainly exists. The utility of the alternative proposal in the present study lies in the clarity of data recording and the explicitness of the assumptions made in securing results.

The FC and the FP can be determined for many of the specimens in this study. The factors governing FP evaluations were described in Chapter II. After the FC relationships have been established in Chapter IV, the distances between the FP and FC for the specimens will be examined for ways to explore the less accessible FU interpretation. The final comparative effort in this chapter will be to align the functional findings with those spatial-temporal factors from the preceding chapter and with the typology proposed in Chapter II.

Functional Performance

Several aspects of the functional performance for the perforated bone tubes in the combined sample have been discussed under "tonal attributes" in Chapter II (pages 53-57). There were 15 specimens in the study sample which produced sounds when tested. Several specimens in the study sample could not be tested because the tubes were clogged and the airflow impeded; in other cases, broken ends made it impossible to produce a sound. Positive sound production or functional performance was confirmed by testing specimens 3, 4, 9, 11, 25, 27, 32, 35, 37, 42, 45, 47, 52, 88 and 89.

Two additional specimens reported in the literature produced a sound. When nothing was indicated by the author as to playing potentials, a negative rating was given. Schweinsberger (1949:29) found one specimen from the Angel site produced musical notes. Henning (1974:8) reported the Cherokee Sewer site example could be played. All of these examples for which the functional performance was determined are listed in Table 30.

While it would be tempting to assume certain other specimens also have the capacity to produce a sound based on their typological similarities to various specimens listed in Table 30, this may not be advisable. Measurements of the exact dimensions of all aspects of each acoustical chamber formed by the perforated bone tubes could yield data which would provide mathematical justification for sound production. Such extensive measurement was not undertaken in this study. The measurements which were obtained serve to reinforce the impression of exterior morphological relationships among perforations and other points of similarity which may be visually observed as well. However, these gross morphological similarities are not recorded precisely enough as to acoustical engineering principles to definitely establish the acoustical potential of examples within the study sample which could not be sounded or played.

Gross morphological similarities between specimens from the study sample and examples reported or illustrated in the literature are even more difficult to substantiate and discuss. Therefore, the listing of examples bearing typological resemblances to those specimens of definite FP capacity seen below in Table 31 must be viewed as a rough postulation of relationships. The distinction between those specimens with FP verification and those with inferred FP will be maintained for comparisons of the FC and FU of the artifacts. The specimens listed

TABLE 30

FUNCTIONAL PERFORMANCE

Site	Specimen Number	Type
Port au Choix	42	IA7
	45	IB2
	47	IA6
Lamoka	52	IIIB1
Feurt	4	IIIA
	9	IIIB1
	11	IIIB1
	25	IA4
	27	IVA
	32	IIIA
Rankin	88	IB3
	89	IB3
Cahokia	3	IB1
Tuttle Hill	35	IIIB3
Reeve	37	IIIB1
Angel		VIIB
Cherokee Sewer		IIIB1

TABLE 31

FUNCTIONAL PERFORMANCE ASSOCIATIONS OF SPECIMENS WHICH PRODUCED NO SOUND

Site	Specimen Number	Type	No Sound Produced	
			Tested	Not Tested
Feurt	25	IA4	2	5
Port au Choix	47	IA6	1	0
Cahokia	3	IB1	18	4
Port au Choix	45	IB2	1	2
Rankin,	88, 89	IB3	1	3
Feurt	4, 32	IIIA	4	1
Feurt	9, 11			
Reeve	37	IIIB1	6	7
Lamoka	52			
Cherokee Sewer				
Tuttle Hill	35	IIIB3	0	1
Feurt	27	IVA	1	1
Angel	—	VIIB	0	2
Total	17		34	26

by site along the lefthand column of Table 30 are those which produced a sound. The numbers under the headings at the right represent the other examples tested, or not tested, from the combined sample aligned with the specimens of similar type on the left.

About half of the Type IIIB1 specimens which were tested produced a sound. The five specimens which sounded came from four different sites, showing the broadest representation among the types with positive FP. The only other large total under one subtype was for IB1, but only one of the 19 specimens of Type IB1 tested produced a sound. In contrast, the one specimen tested for each of Types IA6, IIIB3 and VIIB, did produce a sound. This evidence would strengthen the assumption that the untested specimens of these types would also have a positive FP rating. The percentage of specimens tested which sounded would encourage similar consideration for examples of Types IA4, IA7, IB2, IB3, IIIA and IVA, which could not be played. However, the association of these examples with the specimens which did produce a sound is based on gross morphological similarity and, thus, is not conclusive but only suggestive.

The increase in potential gained through modification by man is reflected in the greater volume and variety of pitches which may be produced by blowing on the perforated bone tube. The shrill whistle obtained from several specimens in the study sample (see page 53) and a similar description from ethnographic sources (Swanton 1946:628) both support the advantages gained by some alteration of the basic bone tube. The multi-perforated examples such as the one reported by Greenman

(1937:18) and retested by the author as specimen number 37 in the study sample shows the increased range of pitches which can be obtained from the multi-perforated structure. Such a specimen could have been a candidate for use as accompaniment or echo of the human voice as mentioned by Skinner (1921:357). The playing potential which can be established as FP is employed by the members of the society who utilize the artifact in ways which are discussed under the following sections on FC and FU attributes.

Functional Context

The archaeological provenience for each specimen has been defined as its functional context. The skill which was exercised in recovering the artifact largely determines the degree of accuracy for the FC. The most often reported context is that of inclusion with a burial. The larger framework or kind of site on which the artifact was discovered also contributes to the evidence. Factors which indicate the general status or meaning of an artifact to the society, whether drawn from the two previously mentioned sources or elsewhere, places the artifact in its social context in the broadest sense of the word "function." The type of site and intrasite location of the various examples of perforated bone tubes in the sample are summarized in Table 32. Table 32 lists the sites under the proper category as to habitation, ossuary or other type of site. The descriptive terms used to label the nature of the sites overlap with one another, but provide a more specific sorting in this fashion.

TABLE 32

SITE FUNCTION FOR THE COMBINED SAMPLE

Kind of Site	Number of Sites
Village	10
Cemetery	3
Village and Cemetery	7
Mound	2
Mound and Occupation	4
Shell Midden	8
Shell Midden and Village	2
Shell Midden, Village and Cemetery	1
Hunting Camp	1
Rock Shelter	1
Undetermined	6
Total	45

Within these 45 sites over 140 perforated bone tubes were found with burials, in middens and in other contexts. Table 33 summarizes the numbers of specimens in the various intrasite contexts. Incomplete provenience data in numerous reports has limited the extent to which this can be tabulated for the combined sample. The site total is higher than the actual number of different sites involved in this tabulation. Nine sites had specimens in two different contexts, and one site had specimens in three different contexts, reducing the total sites for these specimens to 34 rather than 45. Whenever the author of a site report used the term "general excavation" without further provenience specification, it was necessary to retain the term or be without any provenience data for specimens from that site. In other cases, the term "general excavation" was used to designate excavation areas which were not specific features such as pits, burials, etc., nor any particular kind of fill such as a midden.

The only category in Table 33 with more specific information available is that of the burial context. These burials are described in Table 34.

Inclusion with a burial has sometimes been interpreted as meaning the artifact had a ceremonial function. Winters (1969) extensively discusses the examples found in burial association and the resulting concept of a ceremonial function for flutes and whistles. The Riverton flutes were found not with burials but rather in midden deposits (Winters 1969:73). These flutes which were discarded in the midden were broken "as though they had been deliberately rendered useless" (Winters

TABLE 33

FUNCTIONAL CONTEXTS OF SPECIMENS IN THE COMBINED SAMPLE

Context	Specimens	Sites
Burial	32	14
Midden	24	7
Pit	11	7
Mound	6	2
General Excavation	22	12
Surface Collection	7	3
Totals	102	45

TABLE 34

PERFORATED BONE TUBES IN BURIAL CONTEXT

Site	Burial	Age	Sex	Specimen No.
Barrett	B52	26	Male	
	B398	28	Male	
Carlson Annis	B42	19-20	Female	
	B381	11	Male	
Frontenac	B59	40-44	Male	69
	B77	Adult	Male	70
	B78	18-19	Male	71
	B132	?	?	73
	B111	Adult	Male	74
	B111	Adult	Male	75
	B111	Adult	Male	76
	B113	Adult	Male	77
Hoover-Beeson	B1	12-18 mo.	?	87
Indian Knoll	B59	12	Female	
Oconto		Child	?	
Port au Choix	B44B	Adult	Male	40
	B42	Infant	?	41, 44
	B19	12-18	?	42
	B34	Adult	Male	43
	B18B	Young Adult	Female	45
	B22	Adult	Male	47, 48
	B22	Child	?	
	B22	Infant	?	
Rankin	B6	Adult	?	88
Spring Creek	B2	Fetal (8 mo.) Stillborn Infant		

1969:73). However, Winters ends by continuing to support a ceremonial function, concluding:

> Thus, we shall continue the placement of flutes in the ceremonial category, as opposed to utilitarian, ornamental, or recreational equipment. But at the same time, it is obvious that flutes were not regarded in precisely the same manner as turtle shell rattles, which in most Archaic cultures were rarely discarded in the midden. It may well be that the flute was employed for purposes of a more secular nature (Winters 1969:73).

Certainly, the inclusion of bone flutes and whistles with a burial indicates a ceremonial function at the time of burial. While the inclusion of an item with a burial does argue for its worth in the opinion of that society, the lack of inclusion of similar items in a burial or their occurrence in a midden does not establish the lack of ceremonial function for an artifact. Breakage or other malfunction could have brought about the rejection of an artifact for ceremonial activities. The question of whether breakage was deliberate is very difficult to assess. Total restriction to the ceremonial category does not seem wise as not all examples are found with burials, and even evidence of occurrence with burials does not dictate that the items could not have served utilitarian purposes prior to burial.

Functional Use

This functional category will be investigated in two ways. First, ethnographic information gathered from the eastern United States will be reviewed for facts relevant to the combined sample. Secondly, the specimens with additional FU properties will be discussed. In the southeastern United States, aboriginal wind instruments are variously labeled as flutes, flageolets, fifes, pipes, whistles or recorders in the sources quoted (see Swanton 1946). These instruments were used, according to early European visitors, by groups of as many as 20, or by single persons such as a chief, in situations ranging from greeting to attack. A common custom throughout the Gulf area, described from the Timucua territory, was "to welcome strangers of quality coming in peace by sending men forward, usually including the chief himself, blowing upon flutes, or rather flageolets" (Swanton 1946:628). Use of these artifacts by Florida tribes in marriage ceremonies and social gatherings is also recorded. The examples cited indicate that men played these instruments, with their use being restricted to young men in the case of the Seminole (Swanton 1946:628-629).

Less peaceful intentions connected with the use of whistles have been reported for war whistles used by the Chickasaw (Swanton 1946:628), the Menomini of the Great Lakes area (Skinner 1921:356; Densmore 1923:11), and the North Dakota Mandan and Hidatsa tribes (Densmore 1923:9).

Whistles were often observed in use in ceremonial contexts. The Menomini use whistles in their war-bundle ceremonies "to call the Thunderers to the assistance of the braves" (Skinner 1921:356). Another Menomini ceremony was reported to use a whistle inside an otter medicine bag "to give the impression, when blown, that the spirit of the dead animal was, indeed, inside the bag" (Hoffman 1896:262). The following list briefly summarizes some additional ceremonies in which whistles were used:

Blackfoot: Sundance and social dances (Wissler 1910:86)
Omaha: Wa-Wan Ceremony (Densmore 1970:97)
Shawnee: Absentee Man's Dance, Peyote Meetings (Voegelin 1942:475)
Pawnee: The Hako Ceremony (Densmore 1970:97)
Choctaw: Ballgame Opening (Densmore 1943b:129)

Courting or love songs were played on flutes or whistles by the Mandan and Hidatsa (Densmore 1923:9), and the Shawnee (Voegelin 1942:475).

Use of a turkey call whistle during hunting was reported for the Shawnee (Voegelin 1942:475). Ethnographic evidence can be combined with historic descriptions and archaeological evidence to demonstrate the possibility of using some bone whistles as game calls. The type of bone whistle which may have been a turkey caller has been recovered in excavations in areas that had substantial populations of wild turkeys in prehistoric times. The published descriptions of artifacts from the Lamoka Lake, Fox Farm, Tranquility Farm, Ewing-Bradgon and Sackett sites referred to perforated bone tubes (called flutes or whistles) as bird calls or animal calls used in hunting.

The range of the wild turkey covered mainly the eastern and middle United States with two subspecies, the Florida turkey, _Meleagris gallopavo osceola_, and the eastern turkey, _Meleagris gallopavo silvestris_, in the eastern states. The line separating these two forms cuts across northeastern Florida, including a portion of the panhandle area occupied by _silvestris_ but with some mixing of the two (Schorger 1966). Estimates of pre-Columbian turkey populations by states indicate 10 turkeys per square mile for Alabama, Georgia, Kentucky, Louisiana, Mississippi, North and South Carolina, and eight per square mile for

Florida, Ohio, Tennessee, Virginia, West Virginia, Maryland and Indiana. The five-to-seven per square mile category covers the remaining eastern states except the most northern ones (Schorger 1966).

The need for forest cover and food seems to be correlated with wild turkeys in some areas utilizing swamps or shores of other bodies of water. Resorting to trees and swamps may have resulted from intensive hunting practices as Shorger notes:

> Under primitive conditions, trees were not essential to turkeys except for roosting. The open prairies were used extensively for feeding. Thick grass also offered protection (Shorger 1966:221).

Faunal remains reported for many of the sites under consideration support the idea that turkey hunting may have been a substantial part of the subsistence base for these groups. The faunal list for the Lamoka Lake site (Ritchie 1969) shows mammals as providing the greatest total poundage of meat, but among game of a smaller size turkey accounted for a large proportion with a better yield of meat poundage per turkey than exists for the other bird heavily represented at the site, the passenger pigeon. The bone flutes found on the Lamoka site were identified as "the wing bones of large birds, chiefly the turkey" (Ritchie 1969:69). The faunal list from Frontenac Island shows a different hunting focus centering even more on large game, and this difference is reflected by the bird remains. The number of passenger pigeons dropped to a very few, leaving turkey as the only bird significantly represented; 69 percent of the estimated meat poundage from birds was that of turkey (Ritchie 1969:107).

The description by Parmalee (1969) of the animal remains from the Riverton sites suggests a similar role for the turkey. Turkey remains accounted for an average of over half of the bird remains at the Riverton sites, and many of the unidentifiable fragments were probably turkey. Parmalee (1969:139) then concludes:

> Since the turkey is a local and non-migratory species, they were present at all seasons and the Indian apparently not infrequently hunted them whenever they were available.

The literature has been swayed toward discussions of the ceremonial aspects of bone artifacts due to burial associations and decoration. Often the information on flutes and whistles is not correlated with economic information such as hunting practices, bone preservation and recovery procedures, and the idea of dual or changing use has not been used in interpretation. Modern description of turkey callers and their historic use support the possibility that one type of construction of turkey callers may have been identical to that of the items grouped most often under a ceremonial category. An examination of the distribution of these artifacts in relation to turkey hunting practices might be done in greater detail.

Since the subsistence pattern of the Indians occupying the eastern United States is generally recognized as a mixed hunting base during the Archaic period which continues into the later periods due to the available forest, and with the high concentration in prehistoric times of wild turkeys listed for the area, especially in the Southeast, it is possible that artifacts with the general construction observed in much of the combined sample were used for hunting at least initially.

But this does not fully limit their cultural use. A bird call may have also served as a war whistle or functioned in some other group activity. Since ceremonies often celebrated aspects of the hunt, it is hard to segregate some items as ceremonial or non-ceremonial merely on the basis of use in the hunting activities in an area. The existence in historic times of a variety of flutes and whistles with varied uses indicates multiple lines of development and use.

Multi-purpose use of perforated bone tubes as instruments and non-instruments by the same group of people has been noted. The Thompson Indians of British Columbia used a perforated bone tube both as drinking tubes for pubescent girls and as a whistle (Hooten and Willoughby 1920: 62). The use of perforated bone tubes to hold feathers as decorative items has also been suggested (Wintemberg 1948:27). Since no examples with more than four perforations on a side were examined in the study sample, no evidence for actual use of Types V to VIII as flutes or whistles was gathered by the author. The multi-perforated examples described in archaeological reports may or may not have served additional functions such as that described for the Thompson Indians.

Several specimens measured in the study sample were labeled as having more than one function by the archaeologists who discovered and catalogued them. A number of perforated bone tubes in the Rochester Museum and Science Center collection were designated (Ritchie 1932; Follett 1927:Rochester Museum and Science Center Catalogue Cards) as drill handles or, sometimes, as merely a part of a fire-making kit. While none of these specimens (Study Sample Numbers 54, 56, 58-61 and

63-65) produced a sound, the poor preservation of the bone could have easily affected this as several specimens were cracked or broken (see Figure A.6, Appendix A). Specimen 54 was catelogued as part of a fire-making kit, but described by Ritchie (1969:67, Plate 20) as a flute or whistle. Ritchie (1932:105) described the implement as a "handle for drill thongs or drags, a knotted cord being passed through the orifice from the inside."

This description suggested examination of the artifacts in question for evidence of wear around the perforation which might have been caused by abrasion of a knotted cord such as Ritchie described. The measurements for Specimen 54 show a slightly beveled exterior area of two millimeters on each end, and one and one-half millemeters on the sides of the central perforation. Two specimens (63 and 65) had no tapered or beveled area around the perforation, and in another specimen (61) beveling was evident only at one end of the perforation. The remaining five specimens had one to five millemeters of beveled area around the perforations. However, in nearly every case this tapered area was quite irregular and tended to refute the idea of a worn area smoothed by the friction of a knotted cord.

Winters (1969) noted a similar morphological characteristic for the examples from the Robeson Hills site.

> Narrow polished zones adjacent to the exterior and the interior margins of the perforations suggested that a thong or some other pliable substance had been drawn diagonally through the perforations. The significance of the polish is obscure (Winters 1969:70).

This description might be interpreted in several ways depending upon the exact location of these polished areas. However, if they do parallel the outline of the perforations, then the polished zones might serve the same function as the beveling found around the finger holes or perforations on most bone flutes and whistles. This beveling is also present on cane or wooden flutes. Densmore (1956) discusses beveled edges of the finger holes on a Seminole cane flute. Calling this trait "unusual," Densmore offers a functional explanation for the construction saying it "permits a tight sealing of the finger, stopping the hole completely" (Densmore (1956:39). This function does operate in the playing of wind instruments, but whether this goal was the intent of the makers of the bone artifacts described in this study is difficult to determine.

Another group of specimens have had their function questioned as to mechanical or technical possibilities besides their use as flutes or whistles. Webb (1946) describes the perforation patterns (Type IB3 under the proposed typology) found on specimens from Indian Knoll and on one from Butler County, Kentucky. In addition to the main oval or rectangular perforation, two smaller circular holes are bored transversely to the larger perforation. Webb suggests:

> that some shaft with perforated end might have been thrust into this notch, and if a bone pin could have been thrust through the side holes, the shaft might have been held in position (Webb 1946:306).

Winters notes that the specimen from Burial 381 at the Carlson Annis site has the same construction (Winters 1969:72). A fourth occurrence of this perforation pattern was observed in the three whistles from the Rankin site in Tennessee. Although two of these Rankin site whistles are of turkey bone rather than, for example, the whooping crane ulna identified for the Indian Knoll specimen and, thus, much smaller, the positioning of the large oval perforation with two smaller side holes is identical. An additional example with this perforation pattern (Type IB3) was discovered on the Oconto site in Wisconsin (Ritzenthaler and Wittry 1952:211).

One ethnographic source mentions a similar arrangement of transverse side holes on the cane flutes produced by the Seminole. Densmore (1956:39) describes a cane flute with four finger holes exhibiting the:

> boring of two holes transversely through the cane at right angles to the sound holes and equally distant from them, the transverse holes occurring between the locations of the finger holes.

No comment is made by Densmore as to the function of the transverse holes. The position of the side holes relative to the main finger holes is different in this last example as they lie between the finger holes rather than adjacent to the larger perforations as they do on the specimens from the Kentucky, Tennessee and Wisconsin sites. The reason for this pattern of construction remains problematic.

Combinations of Functional Factors

The three functional categories discussed above must overlap in a number of ways as they apply to single artifacts in actual use. Some of these interrelationships can be seen by comparing the specimens which were examined, separately under each category. Other relationships may exist among the specimens for which there is insufficient information available. In addition to comparing the separate categories, some provision for the combination of the functional factors might be sought. Concrete results of the combination of FP and FC attributes are possible for a limited number of artifacts in this study. The FU data requires a much more complex series of data manipulations to establish any definite conclusions.

A tabulation of the FP and FC factors is most easily obtained by combining the data listed separately under these two categories. This procedure excludes those specimens for which neither FP nor FC information was available. Table 35 combines the data for these specimens with either FP or FC attributes.

Among the 17 specimens with a positive FP classification four were found in burials, three during general excavation, one in a pit and nine in unknown or "lost" provenience. FC data show that only four specimens from burials could be played, while 21 produced no sound. Seven additional specimens were said to have been found in burials, but the descriptions in the various site reports were too general to determine which specimens within the site sample were meant in these instances. The FP was also indeterminate for these seven artifacts.

The remaining specimens which could be sounded were distributed by FC as described above. Table 33 (page 143) shows 29 other specimens recovered in pits or from general excavation areas which produced no sound. The inability to produce a sound may be due to various causes, those of poor preservation and breakage the two most common. Factors

TABLE 35

TABLULATION OF FUNCTIONAL PERFORMANCE AND FUNCTIONAL CONTEXT

Site	Specimen Number	Functional Performance	Functional Context	Type
Angel		yes	?	VIIB
Barrett		no	B52	IA2
		no	B398	IB1
Cahokia		yes	Pit	IB1
Carlson Annis		no	B42	IB2
		no	B381	IB3
Cherokee Sewer		yes	GE	IIIB1
Feurt	4	yes	?	IIIA
	9	yes	?	IIIB1
	11	yes	?	IIIB1
	25	yes	?	IA4
	27	yes	?	IVA
	32	yes	?	IIIA
Frontenac	69	no	B59	IA4
	70	no	B77	IA1
	71	no	B78	IA4
	73	no	B132	IIIB1
	74	no	B111	IA1
	75	no	B111	IB1
	76	no	B111	IIB
	77	no	B113	IA2
Hoover-Beeson		no	B1	IB1
Indian Knoll		no	B59	IB3
Lamoka	52	yes	?	IIIB1
Oconto		no	B?	IB3

TABLE 35 (Cont'd)

Site	Specimen Number	Functional Performance	Functional Context	Type
Port au Choix	40	no	B44b	IA1
	41	no	B42	IA2
	42	yes	B19	IA7
	43	no	B34	IB1
	44	no	B42	IB2
	45	yes	B18b	IB2
	47	yes	B22	IA6
	48	no	B22	IA7
Rankin	88	yes	B6	IB3
	89	yes	GE	IB3
Reeve	37	yes	GE	IIIB1
Spring Creek		no	B2	IIA
Tuttle Hill	35	yes	?	IIIB3

resulting from incorrect or faulty manufacture were not possible to assess in this study.

The various functional categories impinge on one another in numerous ways. The structural dimensions which determine the success of FP would have influenced the FU of the artifact as well. Bone tubes with a single perforation could not have been used to play a melody to imitate or accompany the human voice as was noted for courting conventions under FU. On the other hand, a multi-perforated example could have had the stops covered or filled with pitch to reduce the FP to that of a single-perforation example. Thus, the simpler melodic requirements of a game call could have been produced by a wide variety of morphological structures, although arguments favoring the principle of least effort might be advanced to support construction of artifacts tailored for one use alone.

The specimens which were briefly considered as possible drill handles under functional use were noted as not having produced a sound when tested (see page 151). None of these specimens were found with burials; two were discovered in pits and seven were in a midden deposit. Thus, no decisive evidence for FU can be gained from the FC of these artifacts.

Winters (1969:74) suggests that bone flutes may have differed functionally from similar artifacts made of other materials such as cane or wood. While the existence of such a dichotomy has been reported in ethnographic sources, it is not possible to project this functional differentiation reliably to the combined sample in this study due to the parametric limitation to bone examples. This possibility could be explored for artifact assemblages from numerous sites. Information gained from examination of total artifact assemblages at each site might be used for comparisons among all bone artifacts and a study of associations among the bone specimens and other artifacts in the assemblages.

Functional and Typological Correlations

The two categories of FP and FC are, again, more easily compared with other data than is the third division of FU factors. The FP tabulation seen in Tables 30 and 31 (pages 137 and 138, respectively) included the typological designations for the specimens which produced a sound when tested. The FC tabulation by types is seen in Table 36. Twenty-three Type I specimens were found with burials and 16 Type I examples in midden deposits. More specimens of Types II and III were found with burials than in middens, also. However, under Type IV, a greater number were discovered in midden context. More of the Type III examples reviewed here occurred in general excavation than any other category. Also, Type III specimens had a larger total within general excavation than those of any other type.

The correlation of FP and FC factors listed in Table 35, page 155) included the type designations for those artifacts. The information for those specimens which were discovered with burials occurs with the following typological correlations in Table 37.

TABLE 36

FUNCTIONAL CONTEXT BY TYPE

Context	Type I	II	III	IV	V	VI	VII	VIII	Total
Burial	23	2	3	1	0	1	0	0	30
Midden	16	1	1	3	0	0	0	0	21
Pit	8	1	0	1	0	0	0	0	10
Mound	0	2	0	1	0	0	1	0	4
General Excavation	4	2	6	2	0	0	0	0	14
Surface Collection	1	3	0	1	0	0	0	0	5

TABLE 37

TYPOLOGICAL CORRELATIONS WITH THE FUNCTIONAL CONTEXT

Type	Site	Specimen Number	Burial	Age	Sex
I	Barrett		B52	26	Male
			B398	28	Male
	Carlson Annis		B42	19-20	Female
			B381	11	Male
	Frontenac	69	B59	40-44	Male
		70	B77	Adult	Male
		71	B78	18-19	Male
		74	B111	Adult	Male
		75	B111	Adult	Male
		77	B113	Adult	Male
	Hoover-Beeson	87	B1	12-18 mo.	
	Indian Knoll		B59	12	Female
	Oconto		B?	Child	
	Port au Choix	40	B44b	Adult	Male
		41	B42	Infant	
		42	B19	12-18	
		43	B34	Adult	Male
		44	B42	Infant	
		45	B18b	Young Adult	Female
		47	B22	Adult	Male
		48		Infant Child	
	Rankin	88	B6	Adult	

TABLE 37 (Cont'd)

Type	Site	Specimen Number	Burial	Age	Sex
II	Frontenac	76	B111	Adult	Male
	Spring Creek		B2	Fetal (8 mo) Still-born Infant	
III	Angel		B?		
	Frontenac	73	B132	?	
	Hardin Village		B?		
IV thru VIII	Insufficient or no information				

Specific information on age and sex are lacking for the three burials yielding Type III specimens, all three specifically Type IIIB1. The two Type II specimens were found with burials of differing sex and age characteristics. The Type IIA specimen from the Spring Creek site was with an infant while the Type IIB specimen from Frontenac accompanied an adult male. No significant information exists for Types IV to VIII.

The more numerous examples of Type I specimens show a majority of adult males (12) in the burials with which they were discovered, and only three females. Two burial contexts were specified as containing children and four contained infants. The Type I subtypes occurred with the following totals: IA1-3, IA2-3, IA4-2, IA6-1, IA7-2, IB1-3, IB2-4 and IB3-4. Other Type I subtypes were not represented.

Spatial-Temporal and Functional Factors

While it is difficult to deal with multiple factors in simple tabulations, a few correlations will be reviewed for the spatial-temporal factors in relation to functional performance and context. Table 38 lists the temporal order for the two functional categories.

The largest number of specimens occur during the Late Archaic I in burial context. Later periods are more scantily represented from burial, pit and general excavation contexts.

The spatial factors were viewed in Chapter III under several perspectives. The denominator of physiographic province is seen for functional factors in Table 39. None of the sites were in the New England-Seaboard province, but all other provinces were represented

TABLE 38

TEMPORAL SEQUENCE OF FUNCTIONAL PERFORMANCE AND FUNCTIONAL CONTEXT

Site	Specimen Number	FP	FC	Type
Late Archaic I				
Cherokee Sewer		yes	GE	IIIB1
Oconto		no	B	IB3
Lamoka	52	yes	?	IIIB1
Indian Knoll		no	B	IB3
Frontenac	69	no	B	IA4
	70	no	B	IA1
	71	no	B	IA4
	73	no	B	IIIB1
	74	no	B	IA1
	75	no	B	IB1
	76	no	B	IIB
	77	no	B	IA2
Carlson Annis		no	B	IB2, IB3
Barrett		no	B	IA2, IB2
Port au Choix	40	no	B	IA1
	41	no	B	IA2
	42	yes	B	IA7
	43	no	B	IB1
	44	no	B	IB2
	45	yes	B	IB2
	47	yes	B	IA6
	48	no	B	IA7
Late Archaic II				
Spring Creek		no	B	IIA
Woodland				
Hoover-Beeson		no	B	IB1
Rankin	88	yes	B	IB3
	89	yes	GE	IB3

TABLE 38 (Cont'd)

Site	Specimen Number	FP	FC	Type
Mississippian				
Cahokia	3	yes	P	IB1
Angel		yes	B	VIIB
Feurt	4	yes	?	IIIA
	9	yes	?	IIIB1
	11	yes	?	IIIB1
	25	yes	?	IA4
	27	yes	?	IVA
	32	yes	?	IIIA
Reeve	37	yes	GE	IIIB1
Tuttle Hill	35	yes	?	IIIB3

TABLE 39

FUNCTIONAL DISTRIBUTION BY PHYSIOGRAPHIC PROVINCE

Physiographic Province	Site	Specimen Number	FP	FC	Type
Canacian Shield	Port au Choix	40	no	B	IA1
		41	no	B	IA2
		42	yes	B	IA7
		43	no	B	IB1
		44	no	B	IB2
		45	yes	B	IB2
		47	yes	B	IA6
		48	no	B	IA7
New England-Seaboard	None				
Central Lowlands					
a. Great Lakes	Lamoka	52	yes	?	IIIB1
	Frontenac	69	no	B	IA4
		70	no	B	IA1
		71	no	B	IA4
		73	no	B	IIIB1
		74	no	B	IA1
		75	no	B	IB1
		76	no	B	IIB
		77	no	B	IA2
	Oconto		no	B	IB3
	Tuttle Hill	35	yes	?	IIIB3
	Reeve	37	yes	GE	IIIB1
b. Till Plains	Feurt	4, 9	yes	?	IIIA, IIIB1
		11, 25	yes	?	IIIB1, IA4
		27, 32	yes	?	IVA, IIIA
	Cahokia	3	yes	P	IB1
c. Osage Driftless	Cherokee Sewer		yes	GE	IIIB1

TABLE 39 (Cont'd)

Physiographic Province	Site	Specimen Number	FP	FC	Type
Interior Low Plateau	Indian Knoll		no	B	IB3
	Carlson Annis		no	B	IB2, IB3
	Barrett		no	B	IA2, IB2
	Spring Creek		no	B	IIA
	Angel		yes	?	VIIB
Appalachian Plateau	Hoover-Beeson		no	B	IB1
Ridge and Valley	Rankin	88	yes	B	IB3
		89	yes	GE	IB3

in Table 39. The Great Lakes of the Central Lowlands the Interior Low Plateau province contained five sites each, reiterating the sizeable totals from these two areas for all sites in the study. In contrast, the Till Plains area had a proportionately greater number of total sites than is exhibited in this functional tabulation. The FP and FC factors were spread throughout all areas. Since the FP and FC factors were limited in this listing, the Till Plains results, having no burial contexts and a 100 percent representation of specimens with FP ability, are probably skewed. The two areas with more sites have nearly all specimens from burial context, and a balanced representation of specimens which could and could not produce a sound.

Table 40 reviews the water sources for sites with specimens selected for FP and FC attributes.

The spatial-temporal trends which were discussed in Chapter III are repeated in a lesser degree for the functional categories under consideration. The reduction in geographic spread for site locations in physiographic provinces and in relation to water sources can be seen in Tables 38, 39 and 40. Seven provinces are represented during Late Archaic and Early Woodland and three in the Mississippian period. Eight different relations to water sources are filled during the earlier period, lessening to three during Mississippian times. The corresponding shift of site concentration from the Interior Low Plateau to the Till Plains through time is not evident, however. The sites selected for FP and FC factors are distributed differently with five each in the Great Lakes and Interior Low Plateau, but only two in the Till Plains

TABLE 40

FUNCTIONAL ATTRIBUTES IN RELATION TO WATER SOURCES

Water Source	Site	Specimen Number	FP	FC	Type
T-0	Carlson Annis		no	B	IB2, IB3
	Cahokia	3	yes	P	IB1
T-1	Rankin	88	yes	B	IB3
		89	yes	GE	IB3
T-2	Indian Knoll		no	B	IB3
	Cherokee Sewer		yes	GE	IIIB1
	Angel		yes	?	VIIB
Stream/ Creek	Lamoka	52	yes	?	IIIB1
	Hoover-Beeson		no	B	IB1
Bluffs	Oconto		no	B	IB3
River	Barrett		no	B	IA2, IB2
	Spring Creek		no	B	IIA
	Tuttle Hill		yes	?	IIIB3
	Reeve		yes	GE	IIIB1
	Feurt	4, 9, 11	yes	?	IIA, IIIB1, IIIB1
		25, 27, 32	yes	?	IA4, IVA, IIIA
Island in Lake	Frontenac	69, 70, 71	no	B	IA4, IA1, IA4
		73, 74, 75	no	B	IIIB1, IA1, IB1
		76, 77	no	B	IIB, IA2
Salt Water Bay	Port au Choix	40, 41,	no	B	IA1, IA2
		42	yes	B	IA7
		43, 44,	no	B	IB1, IB2
		45, 47	yes	B	IB2, IA6
		48	no	B	IA7

1.5 to 10 miles away: None

area. Temporally, these areas have representatives of three, four and zero sites during the Archaic period followed by two, one and two, respectively, during the Mississippian period. The FC factor of burial context which was emphasized in these tabulations may have weighted the results. This pattern possibly reflects a prevalent use of these artifacts in burial ceremonialism in the northeastern areas during the Late Archaic and Early Woodland periods.

Typological Evaluation

When dealing with the reduced number of specimens having identifiable functional characteristics, the problems of typological correlations with other factors are apparent. More than one-half of the specimens were in the FC classification of burial or midden, but divided between these two categories (see Table 36, page 159). Most of the specimens with burials, as with the other contextual categories, were Type I. Only one category, general excavation, had a higher total for Type III than for Type I. No Type I specimens were reported from mound fill in the study. Earliest and latest sites have Type III and Type I specimens. The Cherokee Sewer, Lamoka, Reeve (all Type IIIB1) and Tuttle Hill (Type IIIB3) sites begin and end the chronological list of the specimens with FP and FC classification (see Table 38, page 163).

Winters (1969:106) noted that some artifacts from the Riverton culture were similar in some characteristics to those found at the Lamoka site. Perforated bone tubes called flutes or whistles were discovered on both sites. Specimens from the Lamoka site were designated as Types I, III and IV, while those from the Riverton sites were

Type II. Winters explained this situation as exhibiting "artifacts that are functionally equivalent in both cultures, but typologically different" (Winters 1969:107).

It would be extremely difficult to base typological attributes on the FP and FC characteristics of the artifacts in the combined sample. More sophisticated measurements would be needed to prove the original FP potential of the examples before their deterioration through time. More detailed information on archaeological provenience, possibly for a larger sample, could assist in further examination of FC attributes. The one pattern noted for FC and FP correlations with spatial-temporal factors showed a heavier representation of burial FC in the northern areas during the Archaic.

An extensive tabulation of ethnographic sources and comparison of those examples with an expanded sample from archaeological research might provide a better delineation of FU factors. A broader functional context could also be established by examination and comparisons of complete artifact assemblages. Alternative typological perspectives might be gained through such studies.

CHAPTER V

EVALUATION OF THE STUDY

To summarize this study, a review of the main points from Chapters II to IV will be examined in reference to the objectives proposed in the hypothesis stated in Chapter I. An evaluation of the study will review the execution of the proposals in the hypothesis in terms of the research methods, typological structure and exposition of the results. Theoretical implications which might be drawn from a synthesis of these results will be discussed as to how they might bear on future studies of such artifacts.

Summary

The various ideas advanced in the hypothesis in Chapter I (see pages 6-7) have been discussed separately in Chapters II through IV. At this point it is necessary to review the hypothesis and to ask to what degree it has been confirmed. The hypothesis was stated as follows:

> The group of artifacts from prehistoric contexts in eastern North America, referred to and casually interpreted as "bone flutes and whistles," can be methodically tested with reference to their morphology, potential tonal attributes, anthropological contexts, and temporal and spatial distributions. This can be done with the aid of data from the fields of ethnology and organology, and these artifacts may be sub-classified in a manner which will reflect numerous specified functions and tonal systems and will constitute a significant cultural-historical document and provide a useful model for subsequent archaeological interpretation and testing.

The first part of the hypothesis required that the specimens be methodically tested as to morphology, potential tonal attributes, anthropological contexts, and temporal and spatial distributions. The data collected for the combined sample was examined as to temporal and spatial distributions in Chapter III, and as to anthropological contexts in Chapter IV. The artifacts had been sub-classified in Chapter II in a proposed typology. These classifications did reflect a variety of functions and tonal systems. The morphological aspects of these attributes were discussed in the latter portion of Chapter II with pertinent documentation from organology and ethnology. Ethnology again played a role in Chapter IV where the cultural functions (functional use) of the artifacts were under consideration.

Spatial-temporal correlations showed that sites from which perforated bone tubes were recovered were widely distributed in all physiographic areas during the Archaic periods. In contrast, such sites were distributed in fewer physiographic provinces in the later periods. An additional change through time was seen in the shift in greatest site concentration from the Interior Low Plateau region during the Archaic period to the Till Plains during the Mississippian period. Types with higher numbers of perforations seemed to predominate in the Mississippian period as seen in the apparent shift from Type I to Type III and the addition of Types V through VIII from the Archaic to the Mississippian periods. However, Types I through IV were present consistently from the earliest through latest occurrences of bone flutes or whistles which counters any posited constructional evolution from simple to complex. In addition, the subtype totals indicated a proliferation of subtype variation during the Late Archaic and Mississippian periods, subtypes were more uniform in other time periods.

Functional attributes were identifiable for a smaller percentage of the combined sample. These artifacts are most often encountered with burials. The large proportion of these artifacts which occurred during the Late Archaic and Early Woodland periods seemed to reflect utilization of bone flutes and whistles in burial ceremonialism. However, the overall morphological features and functional performance factors did not offer conclusive support for any single function such as burial ceremonialism. The functional performance of most of these artifacts would not restrict their use to hunting calls or prohibit their use in ceremonial activities or in burials.

Functional attributes were formally examined under three categories (FC, FP and FU) which explicitly increased the number of functional descriptions possible and also the number of discrete functions for these artifacts. A strong case can be built for use of some of these artifacts as hunting calls based on their form of construction, their presence on sites where significant numbers of turkey bones were recovered and parallels in the ethnographic literature. However, no significant frequencies for FU as hunting calls were tabulated in comparison to FC or FP. Further, a comparison of the FP and FC factors with spatial-temporal factors in the present study involved too few artifacts to provide conclusive results. No simple developmental progression from one function to another could be established. More extensive support for utilitarian uses of these artifacts might be established by more detailed correlations of economic aspects such as hunting practices based on evidence of faunal remains and on lithic artifacts present on sites with the types of bone flutes or whistles also recovered there.

Elaborate incising of bone flutes or whistles during the Late Archaic period may have reflected an ideological concern with burial ceremonialism rather than any stylistic sophistication or constructional complexity for the artifacts. The persistence of Types I to IV through time meant that artifacts capable of being used as hunting calls and of producing melodies were constructed in all time periods. The increased number of these artifacts of Late Woodland and Mississippian sites and the addition of Types V to VIII may show a musical refinement to expand the tonal potential or it may reflect stylistic variation to include ornamental perforations (see page 150). These functional factors were seen to cross-cut those of morphological types more than did spatial-temporal factors. No tight framework for all these factors was achieved, but further work on the details of each aspect was suggested.

Evaluation

The various proposals set forth in the hypothesis were executed as planned by dealing with the morphological, spatial-temporal and functional factors in separate chapters. The results have been summarized above. Conclusions and comparisons were drafted more within each chapter than between chapters. The lack of complete information on all artifacts severely reduced the sample size to a different total representation of artifacts under each category. This numerical reduction was particularly evident under the three functional categories (FP, FC and FU). The artifacts for which FC was established often lacked FP data, and FU factors could only be inferred. Significant spatial-temporal patterns became less clear-cut when combined with the small number of artifacts exhibiting conclusive functional attributes. The size of the sample wherein every artifact carried information on all attributes was extremely small. Thus, the conclusions drawn in this study must be tested further with larger samples andmore sophisticated mathematical techniques to produce more comprehensively reliable results.

These limitations do not refute the value of this study. The previous absence of any formal description of this class of artifacts from eastern North America made such a descriptive undertaking necessary before more detailed comparisons could be attempted. The descriptive typology proposed in Chapter II was the initial step in this plan.

The usefulness of a sub-classification such as that outlined in the proposed typology raises the question of what a "type" communicates to present-day observers in comparison to what it may have communicated or meant to aboriginal populations. Knowledge of morphological properties in terms of the functional performance and of the stylistic factors as they carried cultural meaning would be useful to both the original users and current researchers. Likewise, some comprehension of the utility of the artifacts was necessary in the past as it is today. However, the spatial and temporal factors which exist within a sample of artifacts would have had little relevance for aboriginal man.

It is interesting to note that these last attributes, the spatial-temporal factors, bear the closest relationship to patterns of stylistic change. The distinctions created by the spatial-temporal factors are mirrored in the categories, at least at the subtype level, of the proposed morphological typology and support the relationship between space-time and stylistic variables suggested by Sackett (1968: 74). The additional coupling of economic analysis and "functionally significant typological variation" (Sackett 1968:74) was explored in Chapter IV. No direct correspondence could be established between the functional factors and the typological categories. This problem seemed linked to the relationship between the descriptive typology and spatial-temporal patterns mentioned above.

The explicitness of the typology as outlined in Chapter II exhibits morphological variation as expressed in the letter and numeral labels assigned to each category. This stylistic variation can be seen as related within types for subtypes due to the combinational designations of IA1, IB3, etc., at a glance without reference to the master list of categories. The purpose of such a typology is dependent upon the kind of attribute it is advantageous to emphasize, and this, in turn, determines the typological structure chosen. The question of a theoretical framework for a descriptive typology for these artifacts may indicate directions for future research.

Implications for Future Research

While it is not always entirely possible to adequately project all future theoretical implications for a study, some statements may be advanced based on the needs generated by the present study. The classification and interpretation of the data for the combined sample were discussed under three separate approaches in Chapters II to IV. These results were compared in a cumulative fashion at the conclusions of these chapters and have been summarized and evaluated above. Some difficulty arose in formally coordinating the various attributes.

Part of the difficulty may lie in the question of the relevancy of the various attribute categories to each other and their roles within anthropological interpretation. Can a descriptive typology be constructed which will mirror patterns of cultural change? Stylistic or morphological change will often be exhibited most clearly when spatial and temporal attributes are primary determining factors. This kind of cultural change was seen in the appearance and disappearance of certain subtypes and decoration techniques through time, and in the proliferation of new and more numerous subtypes at certain points (see pages 139-145).

Typological correlations with functional factors was less productive than those with spatial-temporal factors. Different techniques of analysis might highlight subfactors and lead to correlations. However, the basis for a functional typology of bone flutes and whistles may not be as accessible as one for other artifact classes. Demonstration of a progression in musical complexity would need support from changes in morphological construction which was not apparent from this study. It is as difficult to demonstrate any development in musical practices within the time range currently studied by archaeology as it is to seek the early forms of spoken language. Correlation with economic factors such as hunting practices or with socio-religious factors such as burial ceremonialism can establish multiple functions for these artifacts. However, the variety of morphological construction would have allowed multiple functionings throughout all spatial-temporal units examined in this study.

Further study of such artifacts using a diversified approach such as the one in this study and including a larger sample for other descriptive or inductive statistical analysis might answer some of the questions raised by this study. While a number of the artifacts did produce sounds when tested, a large part of the specimens could not be definitively tested. The information to directly support various functions for the artifacts from archaeological provenience was also unavailable for much of the combined sample. General performance potential and functional parameters were inferred from this limited number of examples, but further research could profitably extend and strengthen support for such inferences.

Further field research is needed to enlarge the sample of perforated bone tubes. A larger sample might alleviate the problems which arise from quantifications of small numbers of specimens per site.

A multiple approach is recommended due to the freedom it allows at the outset. Correlations were directly observed under each of the three separate perspectives in Chapters II, III and IV. Until a larger number of such artifacts have been assembled it would be counter-productive to narrow the attribute field. Simple statistical tests for correlations of attributes among a larger sample could quickly indicate a direction for more detailed analysis. The current study has supplied the descriptions outlined in the hypothesis, and has provided a guide for future investigation of similar artifacts.

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APPENDICES

APPENDIX A

SPECIMEN FIGURES

Figure A.1. Port au Choix, Newfoundland, specimens 49, 42, 47 and 48 (top to bottom).

Figure A.2. Port au Choix, Newfoundland, reverse of specimens 49, 42, 47 and 48.

Figure A.3. Port au Choix, Newfoundland, specimens 50, 41 and 40 (top to bottom).

Figure A.4. Port au Choix, Newfoundland, specimens 44, 45, 46 and 43 (top to bottom).

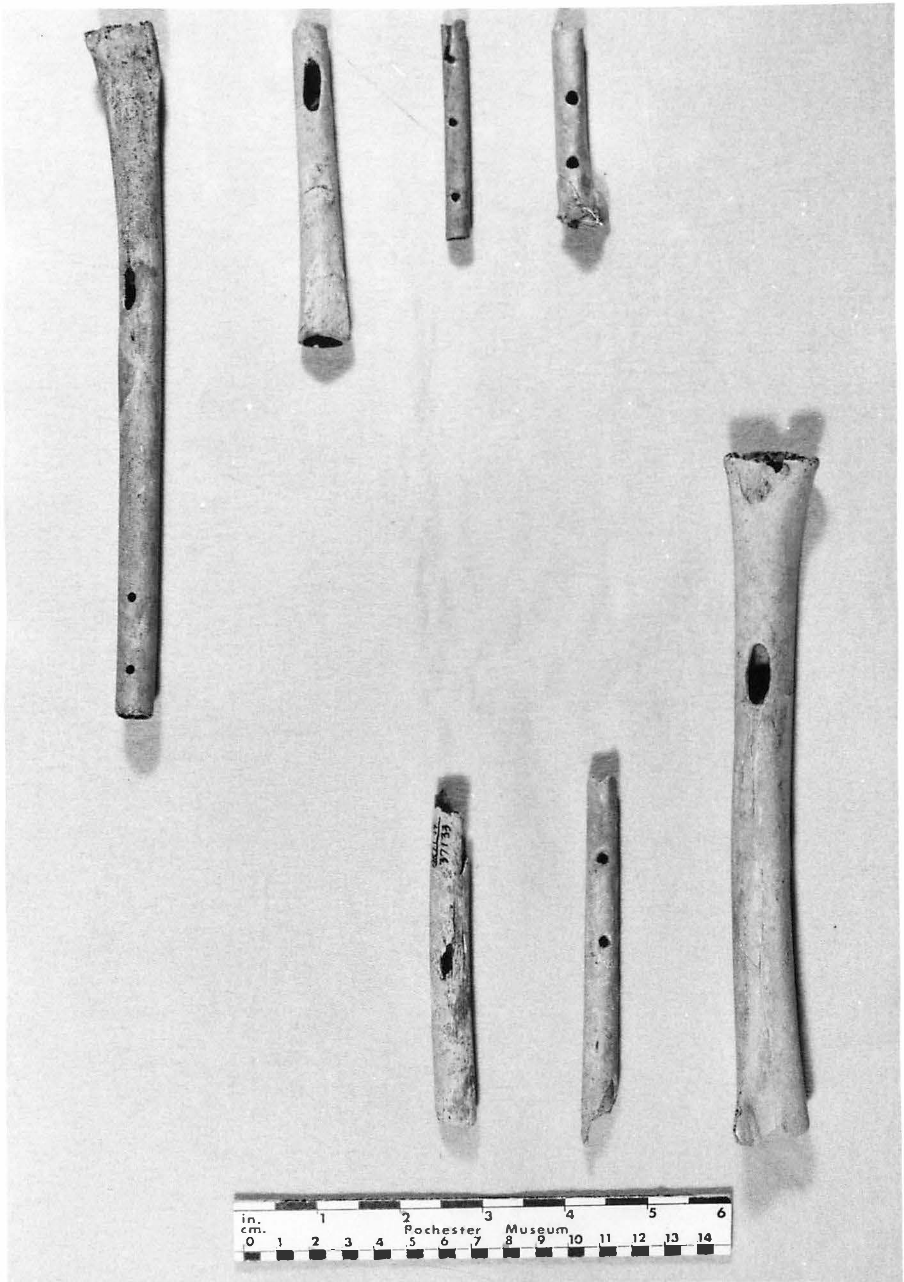

Figure A.5. Frontenac Island, New York, specimens 69, 70, 72 and 73 (top row). Specimens 75, 76 and 77 (bottom row).

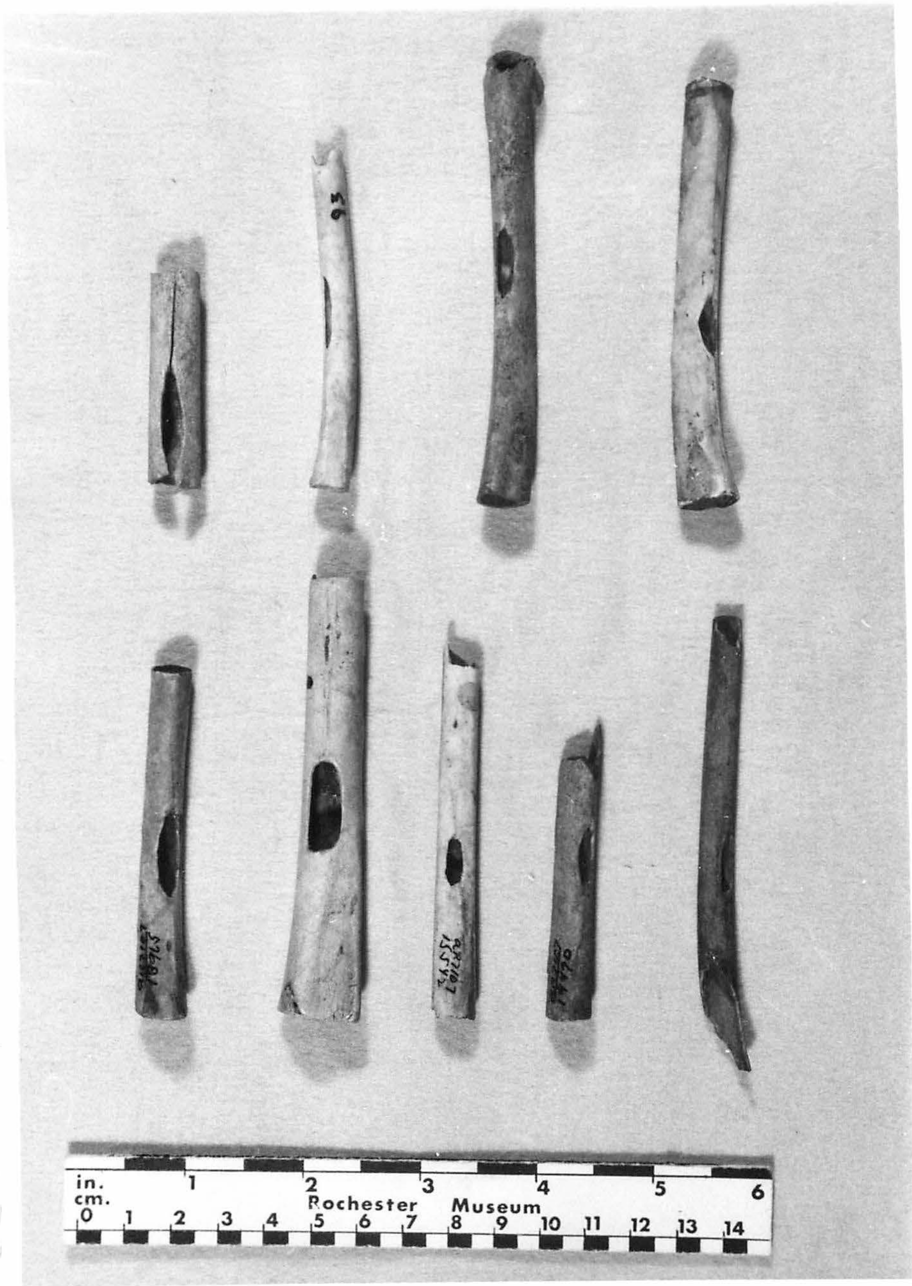

Figure A.6. Lamoka Lake, New York, specimens 65, 53, 61 and 58 (top row). Specimens 59, 54, 63, 60 and 56 (bottom row).

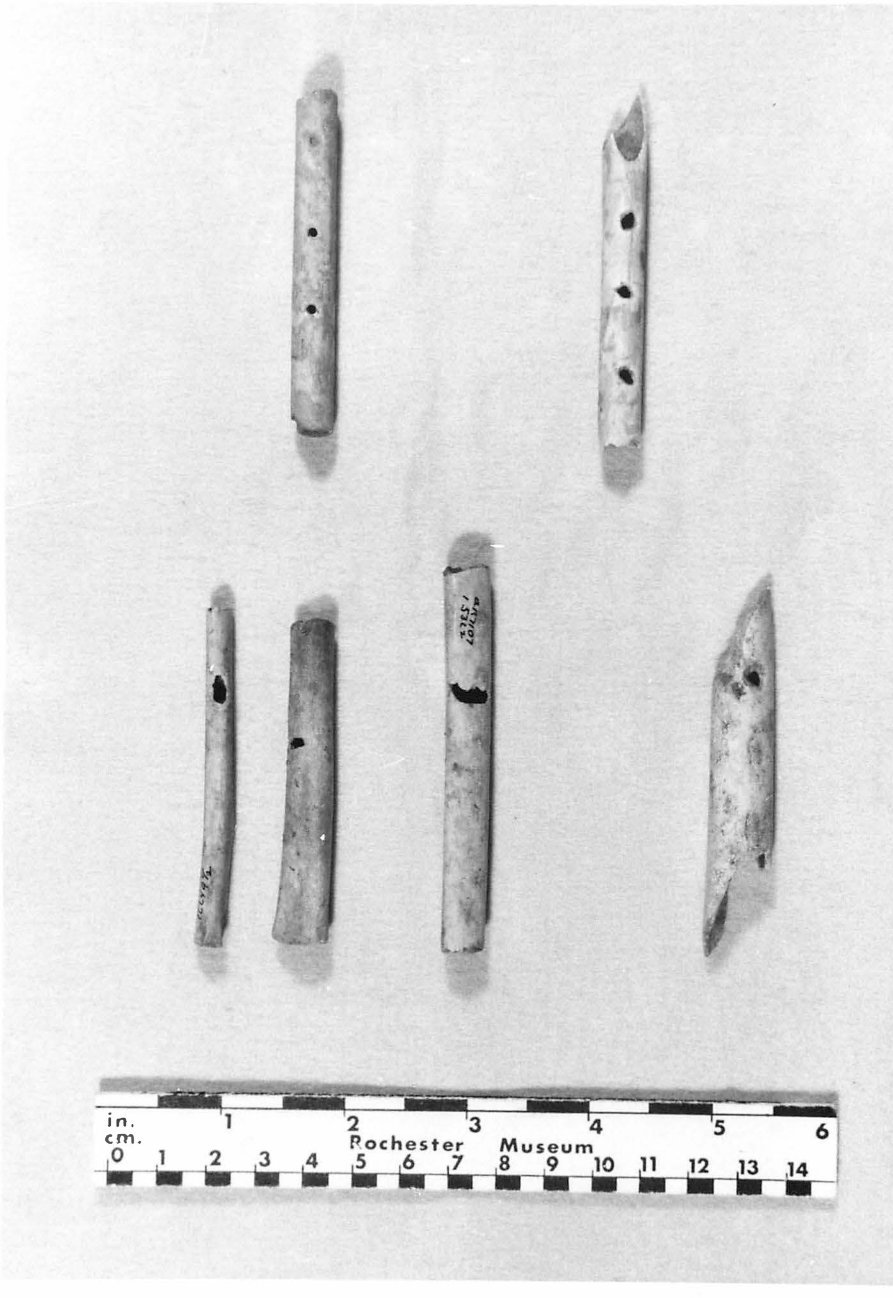

Figure A.7. Lamoka Lake, New York, specimens 52, 57 (top row). Specimens 66, 55, 62 and specimen 68 from Woodchuck Hill, New York (bottom row).

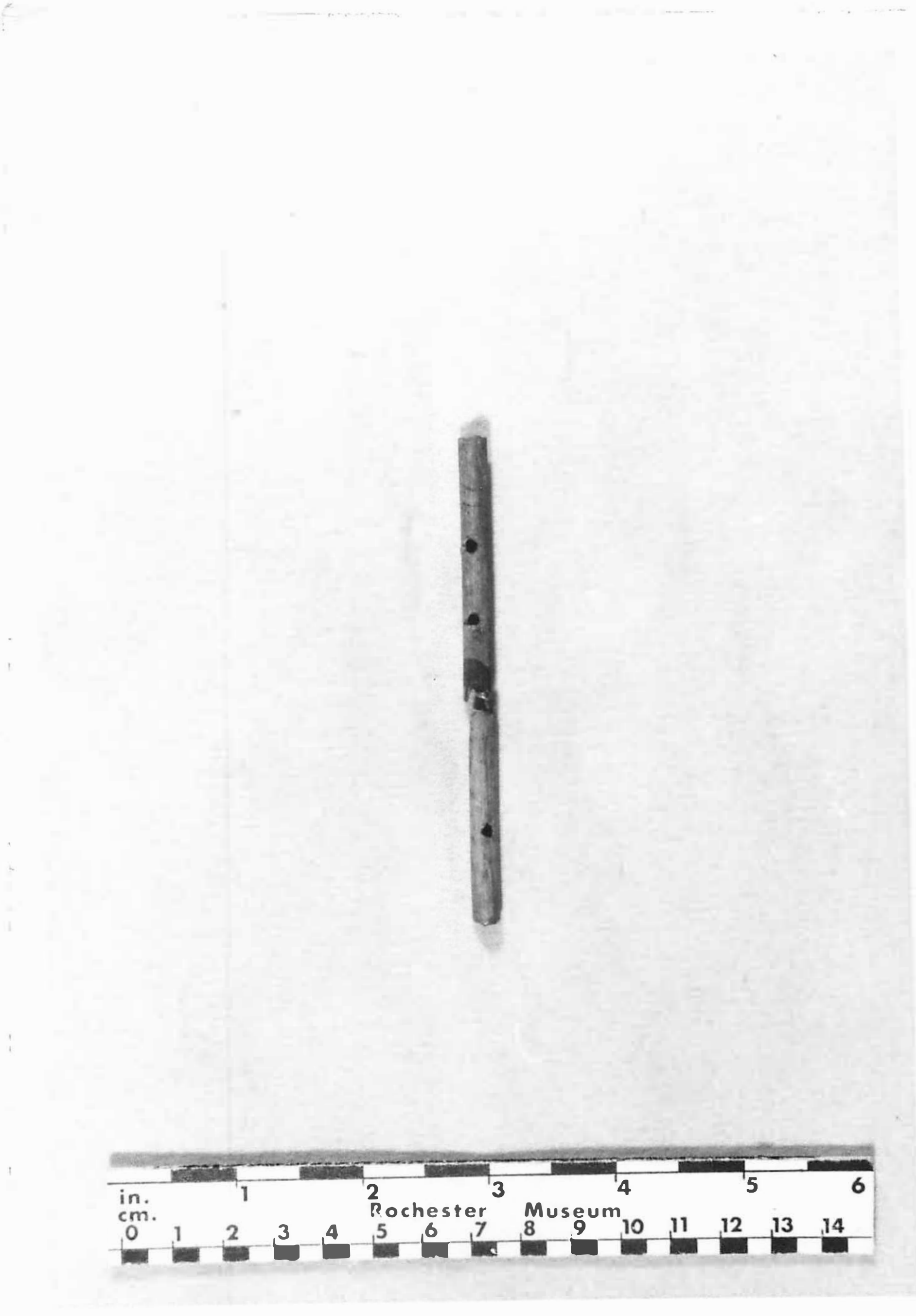

Figure A.8. Sackett Farm, New York, specimen 95.

Figure A.9. Top row left to right: specimen 86, Oak View Landing; specimen 80, Kays Landing; specimens 85, 83, 84, Oak View Landing. Lower half, top to bottom: Cherry site, specimen 82; Hoover-Beeson Rockshelter, specimen 87; Kays Landing, specimen 81. All these sites are in Tennessee.

Figure A.10. Top row, left to right: Rhoads Site, Illinois, specimen 1; Riverton Culture fragments, specimens 91, 92, 93 and 94. Bottom row: Cahokia Mounds, Illinois, specimens 3 and 2; Robeson Hills, Illinois, specimen 39.

Figure A.11. Feurt Site, Ohio, specimens 4 (A), 5 (B), 6 (C), 7 (D) and 8 (E).

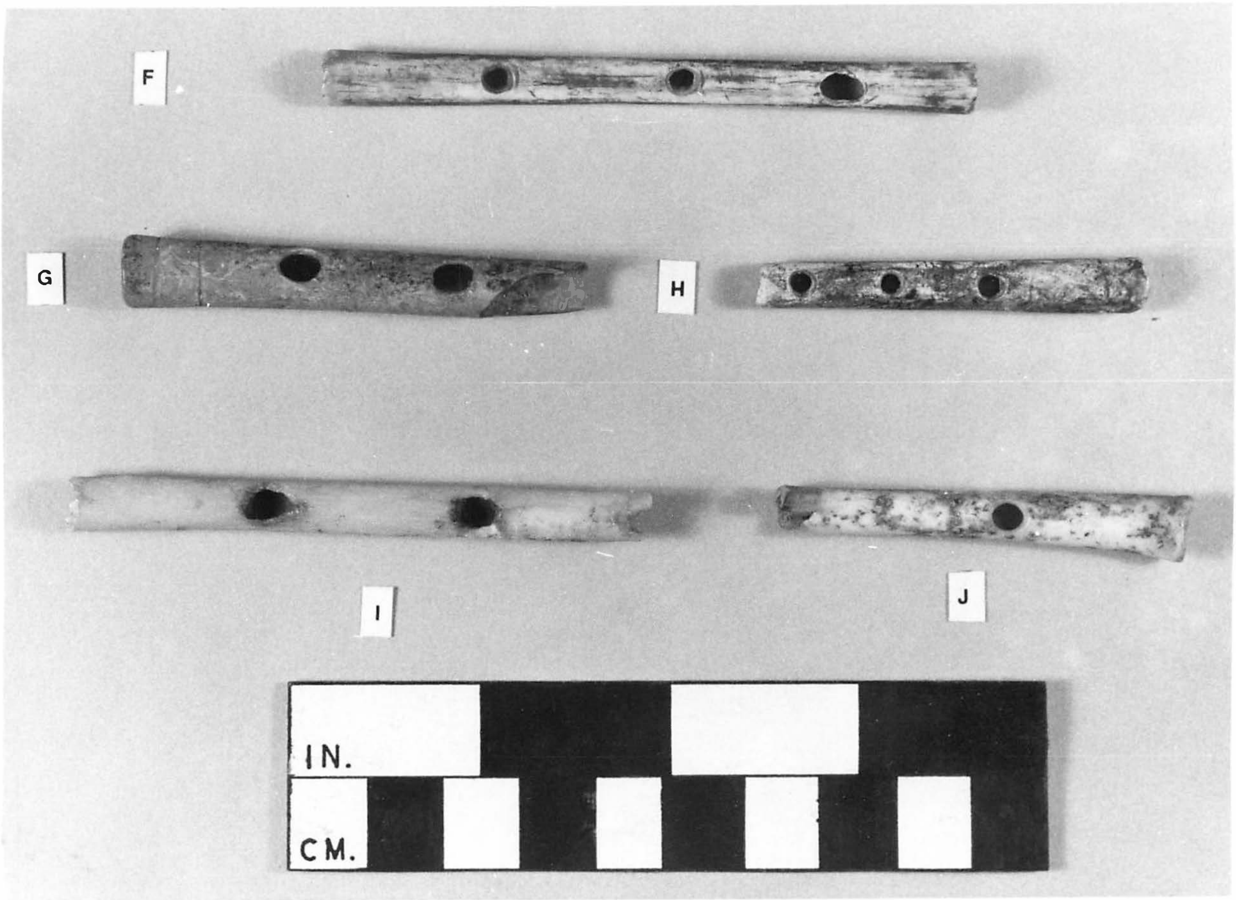

Figure A.12. Feurt Site, Ohio, specimens 9 (F), 10 (G), 11 (H), 12 (I) and 13 (J).

Figure A.13. Feurt Site, Ohio, specimens 14 (K), 15 (L), 16 (M), 17 (N), 18 (O) and 19 (P).

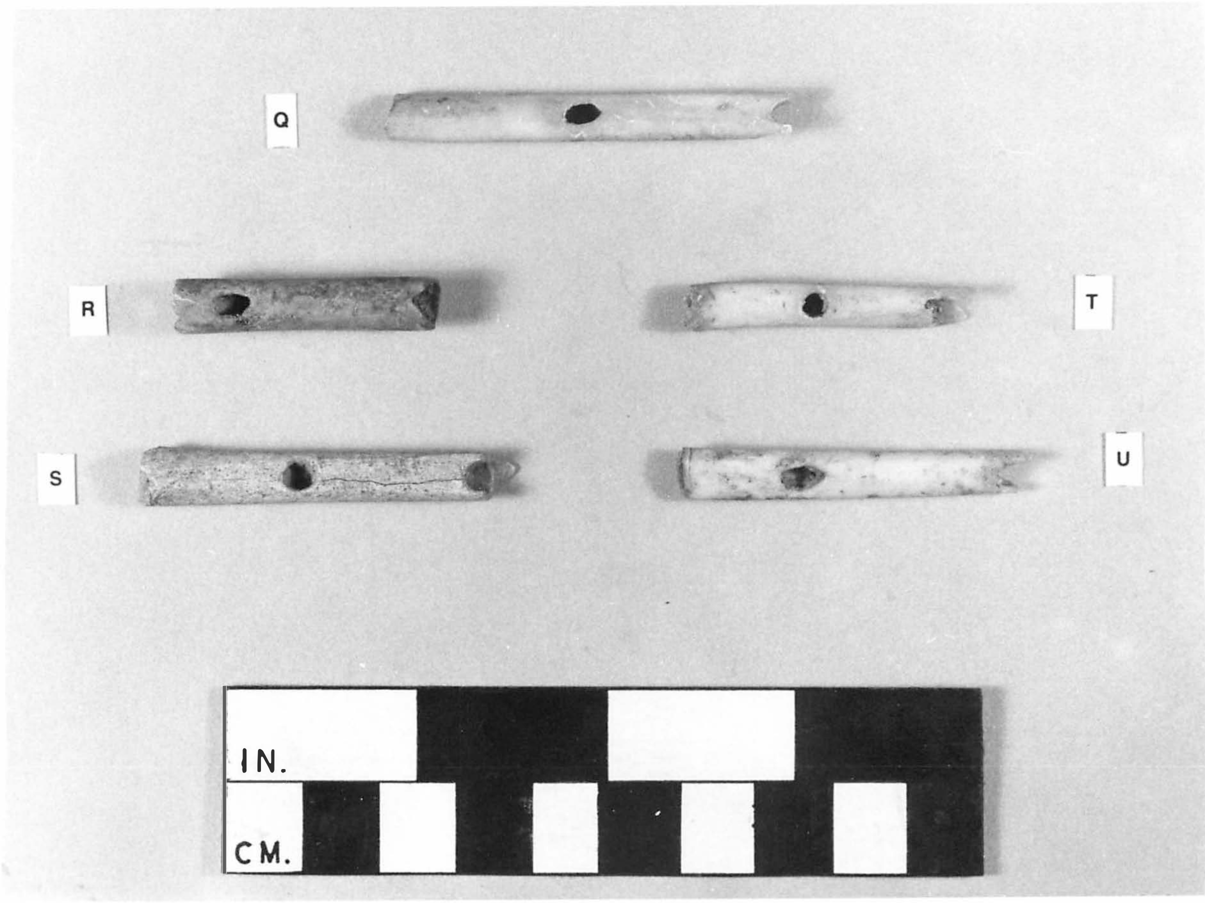

Figure A.14. Feurt Site, Ohio, specimens 20 (Q), 21 (R), 22 (S), 23 (T) and 24 (U).

Figure A.15. Feurt Site, Ohio, specimens 25 (A), 26 (B) and 27 (C).

Figure A.16. Feurt Site, Ohio, specimens 25 (A reverse), 28 (D), 29 (E) and 30 (F).

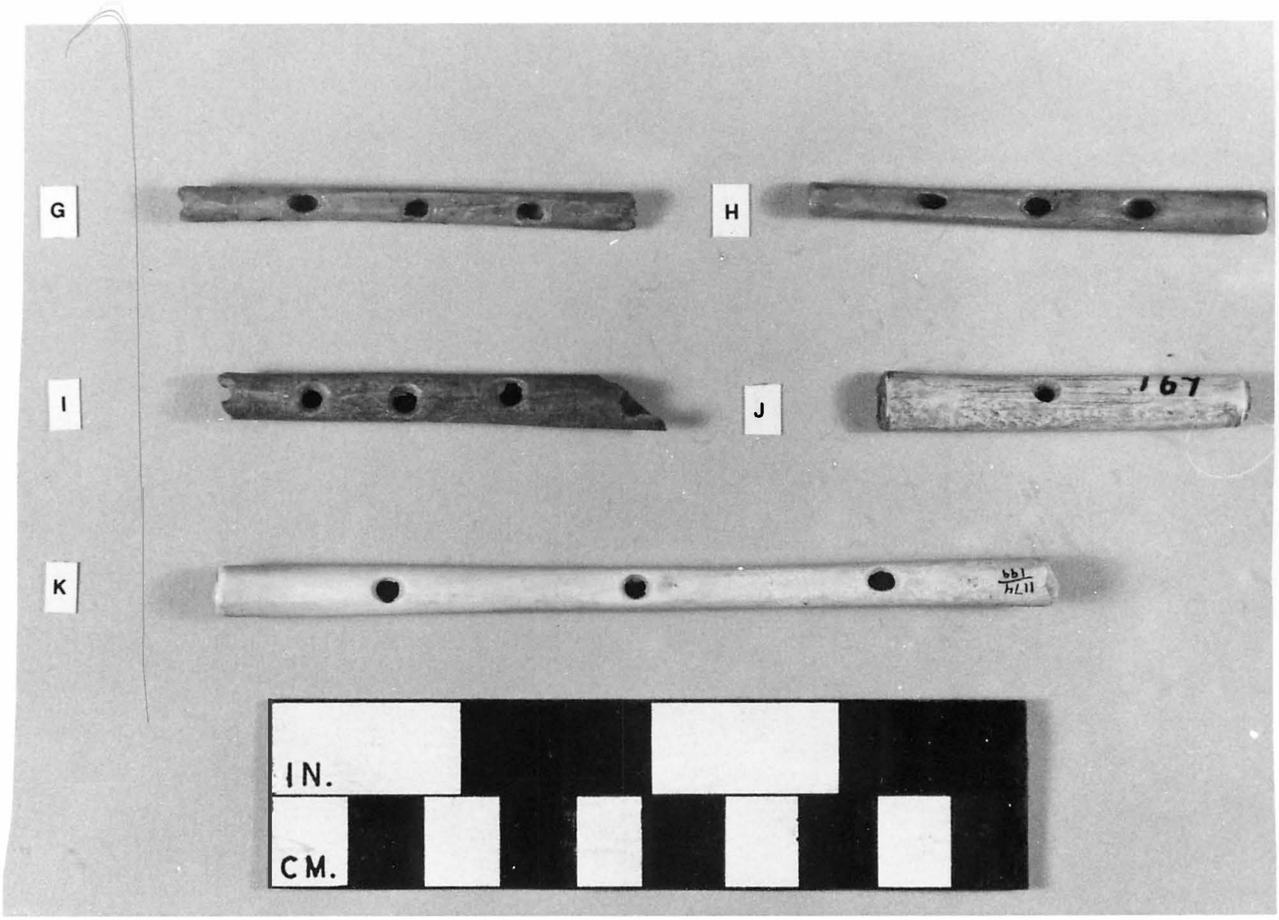

Figure A.17. Feurt Site, Ohio, specimens 31 (G), 32 (H), 33 (I); South Park, Ohio, specimen 34 (J); Tuttle Hill, Ohio, specimen 35 (K).

Figure A.18. Tuttle Hill, Ohio, specimen 35 (K reverse); South Park, Ohio, specimen 34 (J reverse); Reeve Village, Ohio, specimens 36 (L) and 37 (M).

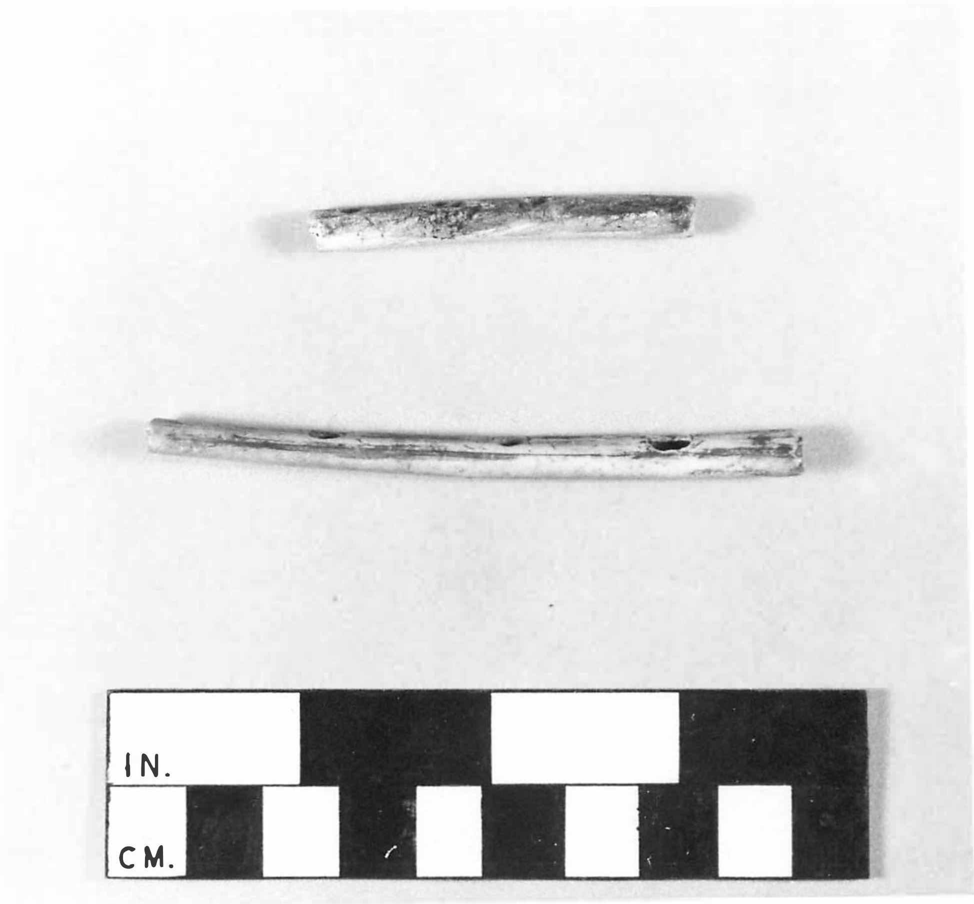

Figure A.19. Feurt Site, Ohio, specimens 9 (F) and 11 (H).

Figure A.20. Bourneville, Ohio, specimen 38.

Figure A.21. Rankin Site, Tennessee, specimens 88 and 89.

APPENDIX B

PERFORATED BONE TUBE DATA SHEET

I. SITE____

LOCATION____

COUNTY____________________STATE____________________

EXCAVATION UNIT____

PROVENIENCE____

CULTURE CONTEXT (burial, feature, etc.)____________________

____

ASSOCIATED MATERIAL____

____

____

CULTURE PERIOD____________________PHASE____________________

FOCUS____

II. BONE: BIRD OR MAMMAL?____

SPECIES____________________SPECIFIC BONE____________________

III. PERFORATION PATTERN

TOTAL NUMBER________________

POSITION OF SHAFT: MIDDLE________________

DISTAL END________________

PROXIMAL END________________

PATTERN:______IN A LINE

_______ EVEN SPACING

_______ UNEVEN SPACING

_______ OPPOSITE SIDES OF SHAFT

DECORATION (incising, carving, inlay) ______________________________

IV. MEASUREMENTS (in mm.)

TOTAL LENGTH ____________________ MAXIMUM WIDTH ______________________

WIDTH AT CENTER OF SHAFT ________ MINIMUM WIDTH ______________________

PERFORATION	1	2	3	4	5
length: inside					
outside					
width: inside					
outside					
shape (round, etc.)					
spacing (center of one hole to next)					

V. SKETCH OR PHOTOGRAPH (place bone on page and trace)

VI. FORM COMPLETED BY: NAME ______________________________________

ADDRESS OR INSTITUTION ________________________

____

DATE ______________________________________

RETURN TO: KATHERINE DUERKSEN MARTIN

VITA

Katherine Lee Hall Martin was born in Milwaukee, Wisconsin on June 5, 1943. She completed elementary school in Osawatomie, Kansas, and graduated from Topeka High School, Topeka, Kansas in June 1961. The following September she entered Wichita State University, and in August 1965 she received a Bachelor of Music Education degree. In the fall of 1965 she entered The University of Michigan and received a Master of Music degree from that institution in 1968.

After several years of teaching in public schools in Michigan and Tennessee, she enrolled in Anthropology at The University of Tennessee, Knoxville. She received the Master of Arts degree in December 1976.

The author is a member of the Society for American Archaeology and the Tennessee Archaeological Society. Mrs. Martin has accepted a teaching assistantship and is continuing graduate work at Washington University in St. Louis, Missouri.

She is married to Lynnewood Martin and has one daughter, Ginger.