SPRING 1977 VOLUME XXVIII, No. 1

THE ARCHEOLOG

PUBLICATION OF THE SUSSEX SOCIETY OF ARCHEOLOGY AND HISTORY

Price $2.25

THE ARCHEOLOG

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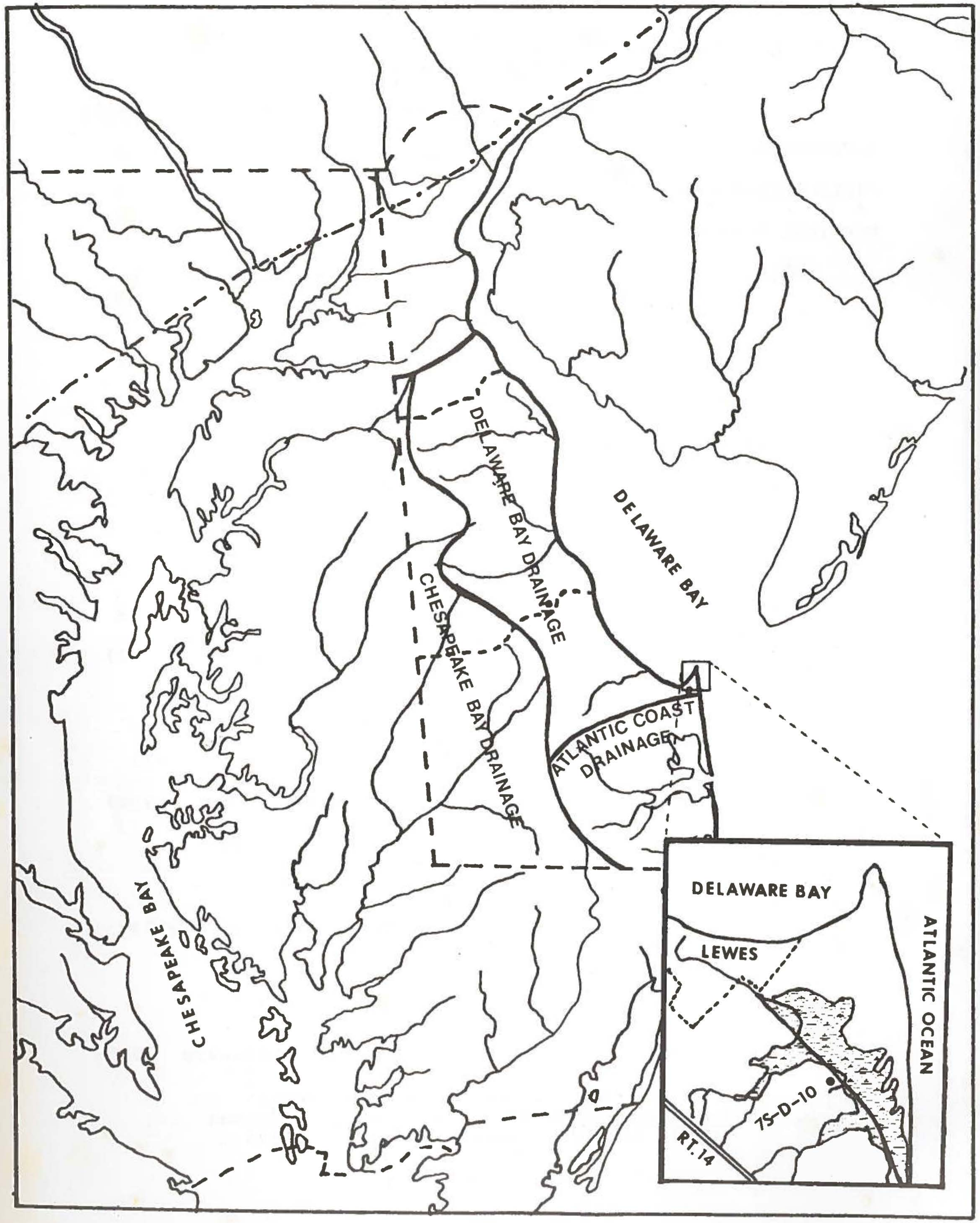

Figure 1: Location of Wolfe Neck Site

MIDDLE WOODLAND CERAMICS FROM WOLFE NECK, SUSSEX COUNTY, DELAWARE

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BACKGROUND

Archaeologists are concerned with the study of material culture and an explanation of its distribution in time and space. It is these dimensional contexts of the data which must be controlled before complex inferences may be attempted. A great deal of morphological and functional variability is present in the archaeological record in any study area and the nature of this variability differs both within and between regions. In order to expand interpretation of regional or continental culture history, local variability must be placed in its spatial and temporal contexts. The development of local artifact types and sequences is, for this reason, essential. The spatial dimension is relatively simple to control given adequate field techniques, but the temporal dimension is often a matter of inference. Before radiocarbon dating, relative artifact sequences were developed through stratigraphic contexts, or by inferential assumption that the cruder technologies are earlier. Both approaches have their limitations. The first approach, though generally valid, is not applicable to situations outside the major river valleys of the interior or certain caves and rockshelters, while the basic premise in the latter approach should be a focus of study in itself and not the framework on which to build a chronology. The advent of radiocarbon dating has made possible the temporal ordering of sites and artifacts in situations other than those of geological stratification. This control encouraged the widespread development of local cultural sequences which permitted the comparison of cultural developments inter and intra-regionally. Ultimately, areal syntheses are built on firmer ground and questions of current interest to anthropological archaeologists may be addressed.

Mid-Atlantic Coastal Plain archaeology in general and Delaware in particular has suffered in the past from the lack of useful local cultural sequences. Historically, this has been due to lack of stratified sites and more recently to the difficulty in locating isolated cultural components in datable contexts. The attempt to develop such a sequence has been a long and sometimes exasperating project. Relative chronologies based on morphological similarities to dated types to the north and west have existed for some time (Cross 1956; Ritchie and McNeish 1949). Truly indigenous sequences, however, have been sketchy and incomplete. The situation is slowly improving but much remains to be done especially at the early end of the time scale.

The current search for discrete and datable components led to the Wolfe Neck Site, 7S-D-10 (Fig. 1). It is located in Sussex County, Delaware nearly equidistant between the cities of Lewes and Rehoboth Beach. It is situated at the confluence of Wolfe Glade and Lewes Creek Marsh. The field is generally flat yet it is elevated 5 - 10 feet above the surrounding marsh and streams. The banks are steeply inclined along a once open bay, Lewes Creek Marsh, and only slightly less inclined along the tributaries where the midden occurs.

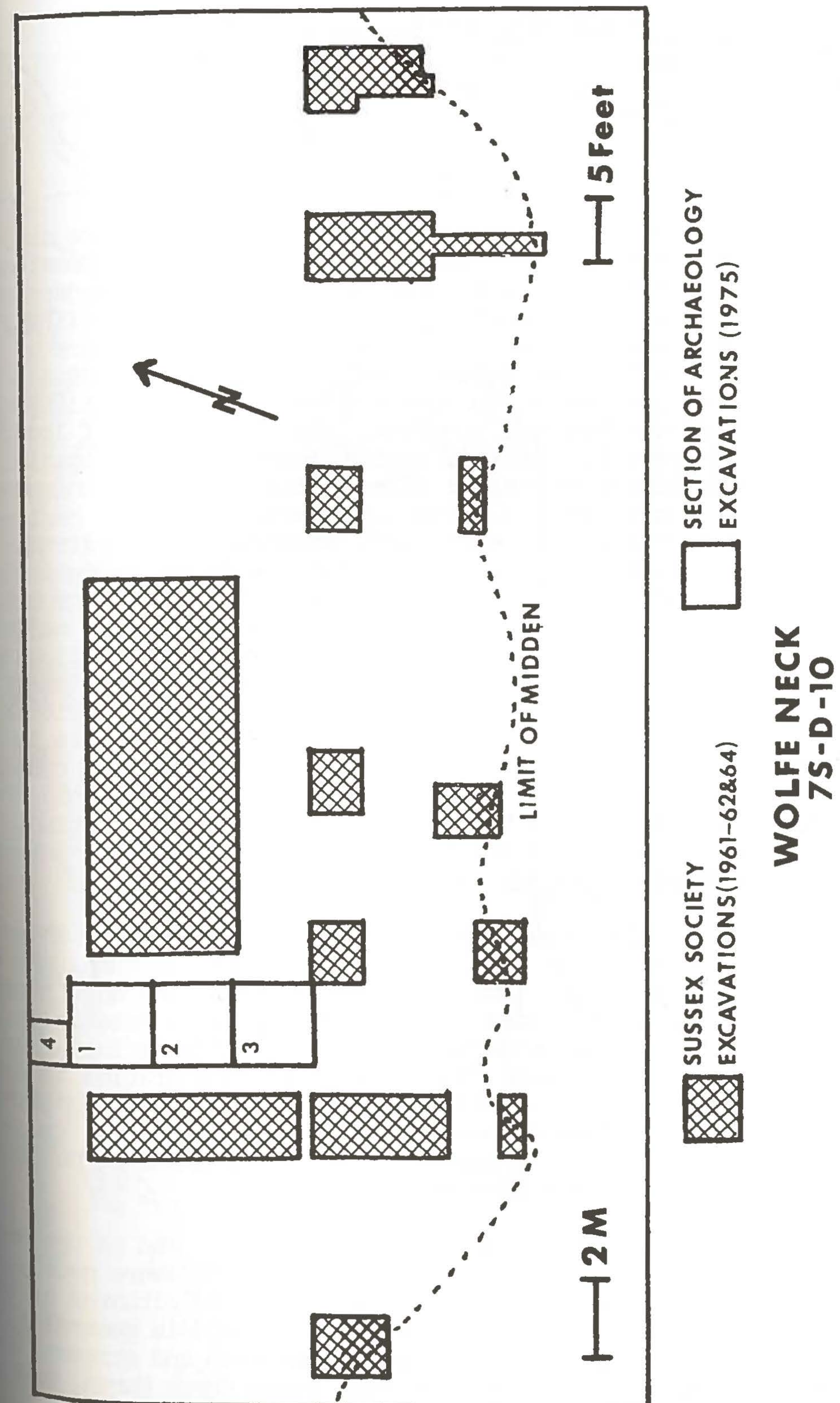

Figure 2: Sussex Society of Archaeology & History and Section of Archaeology Excavations

The archaeological potential of the site has long been recognized. Weslager (1944:71) first noted the existence and extent of the site in his report on early fieldwork in Delaware. At that time, a series of sub-surface features and scattered shell middens were mapped and tested. A formal report has never been issued on this work, however, from the brief descriptions available, a dense occupation is apparent. It was not until 1961 that further mention of the site appeared in the literature (Peets 1961:14). The Sussex Society of Archeology and History, an organization founded in 1948 during the excavation of the Townsend Site, conducted some background research and commenced a testing program on one of the smaller overbank shell middens at 7S-D-10 (Peets 1962:15). Their extensive mapping and testing (Fig. 2) indicated the presence of three kinds of ceramics common in southern Delaware (Marine, Hutchinson, Peets and Parson 1965; Marine,Bryn and Bell 1966). Their original interpretation of a non-stratified, multi-component midden seemed to be supported by their artifact counts and profile drawings. The tabulated data however, indicated some horizontal differences in the distribution of the ceramics. This led the authors to believe that there may be sufficient horizontal and/or vertical separation of the components to obtain reliable radiocarbon dates on the ceramics. In 1975, the Section of Archaeology approached the Wolfe Neck Site with the goal of establishing a local ceramic sequence for the Middle Woodland. The following report contains the results of this effort.

FIELD TECHNIQUES

A brief reconnaissance of the site in the fall of 1975 disclosed the location of the previous test excavations. An area was selected near the Sussex Society of Archeology and History excavations that appeared to have a minimum of disturbance from previous work and had produced that greatest amount and widest range of ceramics. A 2M by 8M trench was established perpendicular to the bank and tied into the previous excavations (cf. Fig. 2). The brush was cleared and excavation began in test unit #2, south one-half. As was indicated by the excavations of the Sussex Society of Archeology and History, a great deal of slope wash had covered the uphill portion of the midden. This overburden was removed unsifted as a single strata. The midden was troweled and an attempt was made to sift it through 3/8" mesh. However, sifting was not possible due to the texture of the midden and the lack of facilities for wet screening. Additionally, the high water table made excavation difficult. The midden, therefore, was carefully removed unsifted by strata.

The prehistoric levels were catalogued as each unit, or a portion thereof, was excavated, so that the same physical level may have several catalog numbers within the same unit and across the several units of the test trench. Consequently, level 2 in one unit may not correspond physically or culturally to level 2 of a neighboring unit; the numerical designation refers only to the order of its identification and excavation in the field. This technique of locational control permits a constant recheck of recognized levels and is designed to alleviate some of the problems of component mixing caused by uneven or "hummocky" physical levels inherent in shell midden accretion, by treating each excavation segment as a separate analytical unit. These different level designations can then be regrouped into physical strata by reference to profile drawings, field notes and photographs. The physical levels within the shell mass were determined by a combination of factors including the shell species present, condition of the shell, amount of earth matrix within the shell mass and to some extent the orientation of the shells in relation to the underlying and overlying levels. Those attributes utilized in the identification of each level are discussed in the next section. The

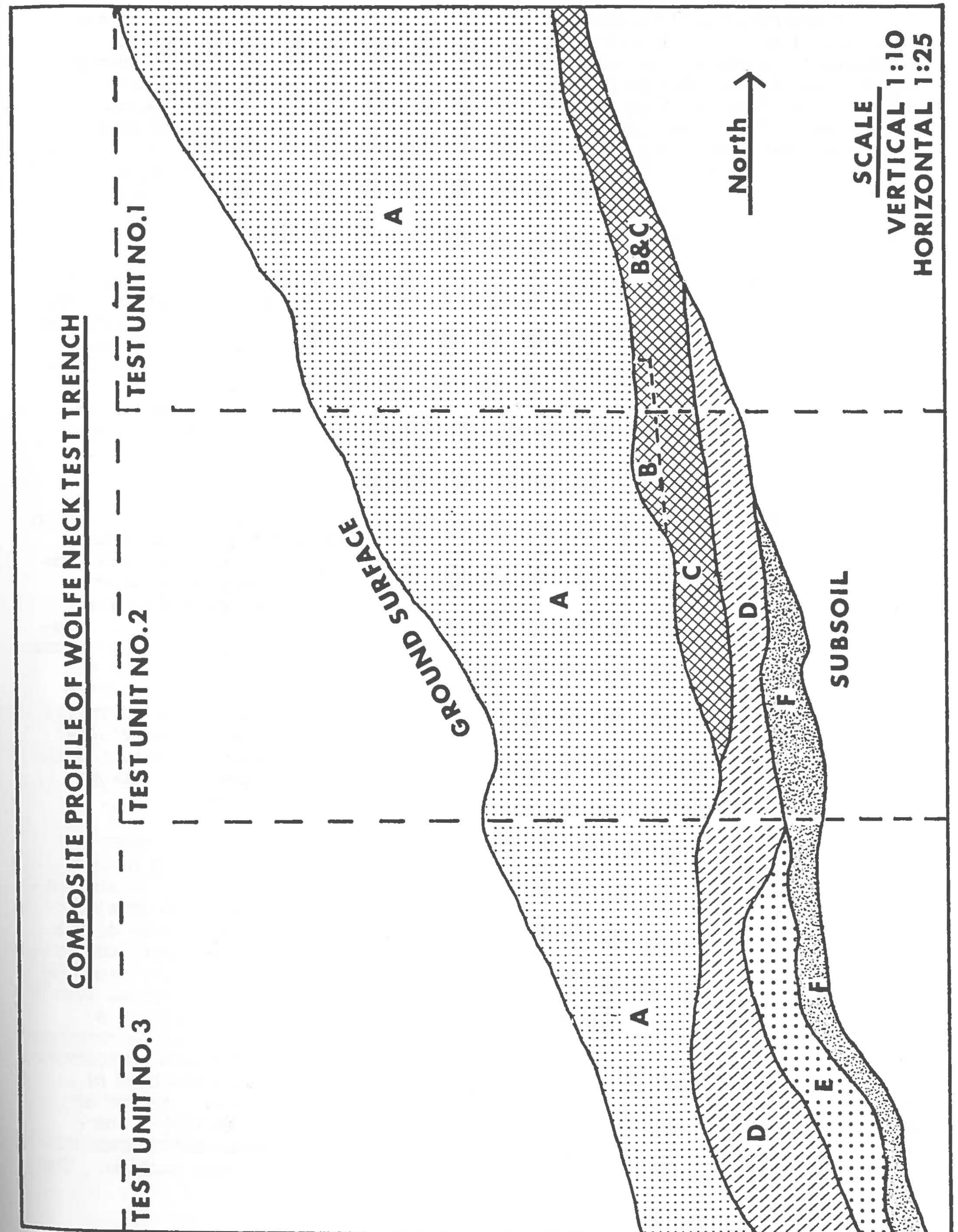

Figure 3: Composite Profile of Wolfe Neck Test Trench

characterization of some levels by shell species is somewhat subjective, though such labels were used only for those levels where one species' dominance was overwhelming. At the outset, there was a plan to collect large flotation samples, and to calculate precise species ratios for each shellfish level, but this was abandoned due to uncertain boundaries between several of the levels. One pound soil samples were, however, collected for each level. These are on file to be sorted for micro-faunal and floral remains.

THE PHYSICAL STRATA

Definitions

The strategy of the excavation was to isolate definable physical strata. These strata, as the assumption goes, represent discrete depositional activities of a single cultural group or single sedimentological process. An analysis of the contents of each level should reveal the sequence of occupation. The following definitions of the Wolfe Neck strata are based solely on their physical attributes and are lettered from latest to earliest in order of superposition (Fig. 3). Following the level definitions is a reconstruction of the depositional sequence from the pre-occupational land surface to the post-occupation erosion with a few notes on the dates of deposition and cultural content.

Level A (Cat. #1)

This level consists of medium brown sandy loam displaying several intermittent sand lenses. The bottom of the level is a continuous yellow-orange sand lens, varying from 1 to 4 cm thick, directly overlying the shell deposits. This combined level extends across the entire trench with its thickness decreasing away from the hill crest.

Level B (Cat. # same as level C)

This level consists of dense concentrations of periwinkle (*Littorina irrorata*) and crushed mussel shells (*Modiolus dimissus*) with a few clams (*Venus mercenaria*) and oysters (*Ostrea virginiana*). There is very little soil matrix present. The level extends over most of the eastern half of unit 2, the southeastern half of unit 1 and partially into unit 4. This level interdigitates with and partially overlies level C.

Level C (Cat. #4,12,14,16,10)

The shell in level C is clam and oyster with more earth matrix than the overlying and interfacing level B. This level covers the western half of unit 2, the northwestern half of unit 1 and the southern one-third of unit 4 though it is often mixed with level B in unit 1. It does not occur in unit 3.

Level D (Cat. #3,5,6,7A,9,11)

Level D consists of a loosely packed shell level that is predominantly clam with a dark grey soil matrix. It is the uppermost level in unit 3 and interfaces complexly with levels B and C somewhere along the east-west dividing line between units 1 and 2. It does not appear in the majority of unit 1 or in unit 4. The boundary between levels D and E is rather gradational in the west half of unit 3.

Level E (Cat. #7B,13)

This level consists of a mixture of partially burned ribbed mussel shell with some clam and oyster in a dark grey soil matrix. It is distinguishable from the overlying level by the presence of crushed and burned mussel shell and the increased amount of soil matrix. Level E occurs only in unit 3.

Level F (Cat. #8,15)

This level consists of dark grey-brown soil underlying the shell mass in units 2 and 3. Its distribution roughly corresponds to the limits of the modern water table thus suggesting a causal relationship. Level F represents the original ground surface that was stained by organic leaching from the shell midden above. The staining was most pronounced in the areas of the reducing environment below the water table.

The Depositional Sequence

There appears to be a direct correspondence between the physical levels and cultural material in all cases except level F, the original ground surface prior to occupation. Level F contains an occasional shell fragment and a moderate amount of cultural debris. However, based on the ceramics from several units, the cultural material represents a mixture of components which are easily related to the overlying levels. Level F apparently does not represent a single cultural level. It should be noted in the profile drawings that the ground surface is stepped. This indicates some type of prehistoric erosional activity and it is the authors' contention that this was caused by wave action and/or stream cutting along the shores of this once open tributary of the Lewes Creek Marsh sub-estuary.

The first prehistoric occupation is represented by level E in unit 3. This thin shellfish level conforms to the slope of level F and pinches out irregularly along the incline leading to unit 2. In spite of the thinness of this level, it is culturally rather pure. The majority of the net impressed/crushed quartz and cord marked/crushed quartz tempered ceramics are found in this level. A radiocarbon date of 505 B.C. was obtained on shell collected in contact with one of the larger sherds of the net/crushed quartz ceramics (2455 ± 60 B.P., UGa-1223). In the remaining units, level F (pre-occupation ground surface) was still exposed. It is therefore, not surprising to find some sherds of the level D and E ceramics on the basal level of units 1, 2 and 4.

Overlying level E in unit 3 is a thick shell concentration, level D, representing the next period of occupation. Level D is thickest in unit 3 and tapers uphill where it lenses out in the northwestern quarter of unit 2 and southeastern quarter of unit 1. Seventy-five per cent of the net impressed/clay tempered sherds and ninety per cent of the cord marked/clay tempered sherds occurred in this level. Shell collected in contact with several of the larger sherds yielded radiocarbon dates of 375 B.C. for this level (2325 ± 65 B.P., UGa-1224). In units 1 and 4 scattered ceramics from this occupation are limited to level F.

Sometime after 375 B.C., and probably around 330 A.D., level C, one of the final periods of occupation occurs. This shell level (C) is located in units 1, 2 and 4, directly overlying level D in unit 2 and lying directly on the sub-soil level F in units 1 and 4. There is very little mixture of cultural material from this level with either of the preceding levels. Ninety-five per cent of the shell-tempered, net impressed ceramics as well as numerous flakes and fire-cracked rock originated from this level. Radiocarbon dates of 325 and 330 A.D. were obtained from shell in this level (1625 ± 160 B.P., UGa-1273b and 1620 ± 65 B.P., UGa-1273a).

That last physical prehistoric level (B) partially overlies and intermingles along the interface with level C in units 1 and 2. This level is of uncertain cultural affiliation as it did not contain much cultural material. Due to the uncertain boundaries between B and C and the paucity of cultural material in B, these levels are combined in the following ceramic analysis.

The entire shell midden is then capped with level A. Scattered throughout level A, but predominantly in the lower sand lens , are 18th and 19th century ceramics, metal and brick fragments and an occasional heavily weathered prehistoric ceramic sherd. This level corresponds to historic land clearing and the beginning of intensive modern agriculture.

The depositional sequence reveals a time trend from bottom to top and from downslope towards the hill crest. The partially overlapping cultural levels demonstrate that the earliest occupations occurred farthest from the bank of this "unnamed" stream. We would expect, therefore, that the earliest occupation as represented by level E in unit 3 should be more intense downhill from unit 3. The Sussex Society of Archeology and History excavation in that area did uncover a large number of crushed quartz tempered sherds (surface treatment not designated) and it is the authors' belief that this is the predominant location of the 500 B.C. occupation. A logical extension of this trend is that there may be even earlier components. This is unlikely, however, as the Sussex Society of Archeology and History excavations located the downhill extreme of the midden and they did not recover any ceramic types in the lower pits that were not found in the Section of Archaeology test trench. Based on the Section of Archaeology excavations and an evaluation of the Sussex Society of Archeology and History fieldwork, it may be concluded that the entire depositional process represented by this midden occurred intermittently over the 830 year span between 500 B.C. and 330 A.D.

CERAMICS

Organization and Approach

The goal of this analysis is to define and describe a meaningful ceramic sequence for the period 500 B.C. to 300 A.D. To accomplish this goal, the ceramics excavated from the Wolfe Neck midden are used to define the ensuing ceramic typology, while an analysis of sherds from sites of each of the major geographic divisions in southern Delaware will be used to flesh out or describe the types. The reasoning behind this two step approach to ware and type construction, is that too often ware and type descriptions have been based on a single "type site". When this occurs, variability within the type construct is limited and subsequently minor variances at other sites are excluded from the type rather than viewed in terms of localized variance or slight temporal variations of the same type. Unfortunately, time will not allow us to treat this within-type variability but future work will attempt to locate and analyze this variance.

The procedure for the typological analysis of the ceramics is conducted in two steps. First, all sherds greater than 2 cm on a side are analyzed for 13 variables and then statistical tests are used to produce significant combinations of variables. Of the thirteen variables, five are continuous and eight are discrete. The continuous attributes are those for which metric values can be obtained. In this study, maximum vessel wall thickness, element thickness (vessel interior and exterior) and distance between elements is measured. Element thickness is defined as the maximum width of cords, while distance between elements is measured from the center of one cord to the center of the adjacent cord. Care was taken not to measure this attribute where obvious cord lapping had occurred. The goal of these measurements is to determine the element size and placement on the paddle. As element thickness and distance can not be determined for most net impressed sherds, only those with an open net impression are measured.

The discrete attributes are those states or characteristics that can be observed on a qualitative basis. The discrete attributes recorded in this study are 1) sherd location (rim, body or base), 2) temper, 3) exterior and interior element or treatment (cord, net, fabric, scraped or smoothed), 4) interior and exterior element orientation in reference to the rim, 5) interior eveness and 6) physical level within the midden. The degree of subjectivity in qualitative analysis varies widely. Attributes "1", "2", "3" and "6" are relatively simple to determine, but "4" and "5" are more difficult to precisely define and identify. For this reason, some further clarification of terms is needed. Element orientation in relation to rim is recorded as perpendicular, horizontal, oblique or any combination. Where a rim is not present, the orientation is recorded in relation to any coil breaks. The assumption is that the coil breaks are parallel to the rim. Where neither rim or coil breaks can be determined, the attribute is not recorded. Eveness is a subjective attribute based on the sample at hand. Universal standards for this attribute do not exist or are difficult to apply. What may be considered uneven in one sample may be even in another. This attribute should therefore be considered relative to this sample.

In the second stage of analysis, the data is organized by physical strata as defined in the previous section. These strata, levels B/C, D and E, represent isolated depositional episodes of known temporal position. The discrete attributes are compared between levels to determine which attribute or group of attributes displays the most systematic variation between sherds and levels. It is reasoned that significant attribute shifts between levels should be definitive for chronologically sensitive types. Chi-square and Fisher Exact (Siegel 1956) tests are used to measure the significance of discrete attribute changes between levels. Those discrete attributes that either occur without change through time, as represented by the sequence of levels, or change in no apparent pattern are included in the descriptive discussion of each type as are the continuous attributes.

Analysis

The test of discrete attributes produces highly significant differences between levels in the temper category. Chi-square and Fisher Exact (Fig. 4A, B & C) tests indicate that the type of temper is strongly correlated with the different physical/temporal levels. It should be noted that the expected chi-square values in several cells fall below the recommended value of 5 (Siegel 1956:110). This calls into question the reliability of the obtained possibilities. Whallon (1972:20) does not see this as a crucial factor for determining the direction or relative strength of a correlation. However, to avoid this problem of low cell frequencies, Fisher Exact scores are also given. These

Figure 4: Chi square & Fisher Exact tests for temper and physical strata

A

LEVEL	QUARTZ	SHELL	CLAY	
B&C	O-0 E-1.9	O-18 E-4.9	O-2 E-13.2	20
D	O-2 E-4.3	O-0 E-11.2	O-44 E-30.5	46
E	O-5 E-.8	O-0 E-1.9	O-3 E-5.3	8
	7	18	49	74

$X^2 = 88.9$ df:4 $p < .001$

B

$X^2 = 55.40$ df:1 $p < .001$
Fisher Exact $p = 5.27 \times 10^{-14}$

LEVEL	O	E	O-E	$\frac{(O-E)^2}{E}$
C CLAY	2	14.5	-12.4	10.67
C SHELL	18	5.6	+12.4	27.46
D CLAY	44	31.6	+12.4	4.87
D SHELL	0	12.4	-12.4	12.40
			$X^2 =$	55.40

C

$X^2 = 20.37$ df:1 $p < .001$
Fisher Exact $p = 3345 \times 10^{-4}$

LEVEL	O	E	O-E	$\frac{(O-E)^2}{E}$
D CLAY	44	40.03	+3.97	.39
D QUARTZ	2	5.97	-3.97	2.64
E CLAY	3	6.97	-3.97	2.26
E QUARTZ	5	1.04	+3.96	15.08
			$X^2 =$	20.37

O = OBSERVED FREQUENCY
E = EXPECTED FREQUENCY
df = DEGREES OF FREEDOM
P = PROBABILITY
X^2 = CHI SQUARE

are exact probabilities for small samples and in this case indicate that the chi-square approximation would have led to the same conclusion of significance in spite of the violation of the expected frequency rule.

A chi-square comparison of surface treatments by level, also indicates a significant association. This finding, however, is misleading. Initially, the table suggests that there is a strong aversion for cord-marking to occur in levels B/C or for net to occur in D while for E the evidence leans towards a significant correlation with net. The paucity of cord-marking in level B/C is so overwhelming as to weight the calculation in favor of a significant outcome. To test this probability, levels D and E were compared on the basis of surface treatment alone and the results were also significant at the .02 level, though when E is compared to level B/C significant results are not obtained. Level B/C can be distinguished from D, but can not be separated from E. The earliest level in the midden, therefore, can not be distinguished from the most recent on the basis of this attribute alone. This is clearly not the most useful attribute for defining time sensitive types in this sample. In addition, the significant results obtained may be anomalous due to sample size. This will be discussed further on in this analysis.

The results of the chi-square comparison between interior surface treatment and level produced mildly significant results. There seems to be a correlation between scraped interiors, smoothed interiors and smoothed over scraped interiors with the physical levels. The most pronounced association is between smoothed over scraped and level B/C. Again, however, there is the problem of sample size (N=53) for a 9 cell table so that several expected values fall below the recommended five referenced above. This factor in addition to the mild significance of the test limits the reliability of the outcome. For this reason, interior surface treatment can not be considered a definitive attribute for chronologically sensitive types.

The two remaining discrete attributes, element orientation and interior eveness, could not be used as defining criteria. Exterior element orientation could not be determined on most net-impressed sherds or a large enough number of cord marked sherds to make this measure meaningful. Interior elements do not occur on enough sherds to include this in a definition. Eveness presents a different kind of problem. Though interior eveness can be determined for each sherd, the measure is too subjective for type definitions that are useful outside this sample. More objective scales are necessary for this attribute. Both of these attributes however, will be included in type descriptions.

From the foregoing analysis, it is evident that the attribute which most consistently distinguishes between the physical/temporal levels is temper. Shell is characteristic of the 330 A.D. level, clay temper of the 375 B.C. level and crushed quartz of the 505 B.C. level. That is, these tempers vary dependently with time and can therefore be used as the defining criteria for temporally sensitive types. For the remainder of the analysis, comparisons will be conducted within and between these classes of temper using the combined Section of Archaeology and Sussex Society of Archeology and History data from 7S-D-10.

Returning to the problematical significant correlation between certain levels and surface treatment, a solution can be offered. Since temper is significantly correlated with each level, then a sample including the Sussex Society of Archaeology and History data can be used to check the earlier results by

interchanging temper in this data with the Section of Archaeology level designations. This assumes that the other tempers found in each level are due to post-deposition mixture and are not contemporaneous with the dominant type. Thus, quartz tempering could be substituted for level E, clay tempering for level D and shell tempering for level B/C. When a chi-square value is computed on the Sussex Society of Archeology and History data, correlation between temper/level and surface treatment is not significant. The chi-square test indicates that equal percentages of net and cord marked exteriors should occur with each temper type in nearly 60% of the observed samples. As is immediately noticed, a disparity exists between these two samples. This can readily be explained. First, the Section of Archaeology data is restricted to one small area of the midden while the Sussex Society of Archeology and History data is obtained from test units scattered throughout. Additionally, the count is based on sherds and not vessels which can easily skew the sample if sherds from a single vessel constitute a majority recovered from a single level. Therefore, surface treatment cannot be considered the most important attribute for distinguishing between the levels within this sample.

In order to address the problem of the mild significance between time/level and interior surface treatment, a comparison is made between tempers and surface treatments using the combined Sussex Society of Archeology and History and Section of Archaeology data. This sample indicates that there is no significant correlation between any of the possible combinations. Again, the results obtained with the Section of Archaeology data appear to be the result of sample bias as discussed above.

Definitions and Descriptions

The definition of temporally sensitive "types" is based on discrete attributes, those without overlapping ranges of variation, so that formal definitions are precise. From the preceding analysis, temper has proved to be the most, if not the only, sensitive discrete attribute for problems of chronology, while the remaining discrete attributes vary independently from temper and level. There are, therefore, three different kinds of ceramics based on temper. Interestingly enough, this demonstration of important temporal variations in paste (temper) characteristics reinforces the traditional use of the ware concept in Mid-Atlantic archaeology. The stratigraphic/temporal control and statistical analysis of the Wolfe Neck material has essentially verified the utility of the ware concept in defining temporally sensitive units during the Middle Woodland in Delaware.

The use of the ware concept in Mid-Atlantic literature goes back at least twenty years. In his study of Virginia ceramics, Evans employs it as the first level of analysis (Evans 1955:34). His definition of ware ("series") includes the attributes of vessel shape, rim profile, temper, paste and firing characteristics. This is followed by an analysis of surface treatment and decoration to further subdivide the "series" "...into usable and meaningful units" (Evans 1955:35). Following Evans' lead, the second major ceramic classification in the Mid-Atlantic is presented by Stephenson on materials collected from the Accokeek Creek site (Stephenson 1963). Although the concepts of ware and type are employed, they are scaled down from Evans' approach. Ware is simply defined on the basis of paste, and type on the basis of surface treatment so that any ware can have several types (Stephenson 1963:35). The Wolfe Neck classification is similar to Stephenson's in that the definition of ware is restricted to the attribute of paste or temper.

In the sample of ceramics at Wolfe Neck, the attributes of construction technique, vessel shape, rim form and firing conditions are constant through the sequence. That is, they are universal attributes in this sample and do not vary noticeably between these wares. They are useful, however, when comparing these wares with others on a broader time and space scale.

From the information above, three wares can be defined from the Wolfe Neck site ceramics. The key defining criteria in an otherwise homogeneous manufacturing tradition is temper. However, two temper categories, crushed quartz and shell, have known temporal and spatial distributions outside of the Middle Woodland on the Delmarva Peninsula. The statistical analysis has shown that surface treatment does not vary significantly with temper within this sample. But other surface treatments do occur on these tempers outside this sample. If, for example, the Wolfe Neck midden included a Townsend ceramics level (shell-tempered, fabric impressed), significant statistical tests would result in the separation of the fabric impressed, shell tempered wares of the Late Woodland from the cord marked and net impressed shell tempered wares of the Middle Woodland. Thus, the additional defining criteria of surface treatment permits a definition of two temporally sensitive types within each broadly defined ware; a net impressed and a cord marked type.

The following section presents formal ware and type definitions with descriptive and statistical information on the ranges of variation within each type. Distributional data and additional temporal data within Delaware and the Middle Atlantic region is presented for each type. Within Delaware, the great majority of ceramics occur in the southern half of the state. From this area, 366 sites, for which we have artifacts at the Island Field Museum, are analyzed on a plus-minus basis for distributional purposes only. These sites are divided into three geographic areas based on drainage: Delaware Bay (147 sites), Atlantic Coast (76 sites) and Chesapeake Bay (143 sites). Sherds randomly sampled from sites in each of these drainages are used in the type descriptions while the distribution of a type within each drainage is presented on presence-absence basis. The Middle Atlantic region is subdivided into five sub-areas for presenting type distributions which literature searches indicate are similar physically and/or temporally to types from the Wolfe Neck site. These five areas are the Delmarva Peninsula, coastal Virginia and Maryland, Susquehanna River Valley, Upper Delaware River Valley and coastal New Jersey and New York.

WOLFE NECK WARE

This is a crushed quartz tempered, coil constructed, conoidal ware. The quartz temper is roughly broken with large pieces often one-half the thickness of the vessel wall (Plate 2B). Rims are direct with no other distinguishing characteristics. Lips are both rounded and flattened but tend to be smoothed. All vessels appear to have been fired in an oxidizing atmosphere. Wolfe Neck Ware consists of two types based on exterior surface treatment: cord marked and net impressed (Plate 1A). A radiocarbon date from the Wolfe Neck midden for this ware is 505 B.C. (2455 ± 60, UGa-1223).

Wolfe Neck Cord:

DEFINITION: Cord marked exterior surfaces (N=46)

DESCRIPTION:

Exterior Attributes:

Element thickness - mean=2.04 sd=.67 n=36

Distance between cords - mean=4.10 sd=1.56 n=36

Orientation to rim - Based on a sample of twenty-two sherds, four classes of orientation occurred. Cords were either parallel to the rim (n=3), perpendicular (n=11), oblique (n=7) or combinations of two. On one case overlapping cords produced element impressions that were both parallel and oblique. While all four classes are present, the modal class was perpendicular to the rim.

Interior Attributes:

Treatment - Four classes of interior treatment occur in the sample of 46 sherds analyzed for this attribute; scraped over cord impression (n=1), scraped (n=4), smoothed over scraped (n=7) and smoothed (n=34). The modal class is smoothed, indicating that vessels of this type were intended to have a smoothed interior. The frequencies of each class of treament include the steps involved in and direction of interior treatment; an integral part of the manufacturing process. The first step in the process produces a paddled interior. The next step is scraping, presumably to thin the vessel walls. Finally, the scraping marks are smoothed over, or partially so, to finish the interior of the vessel.

Eveness -

Uneven: n=26
Even: n=20

Vessel Wall Thickness: n=46

Mean=9.15

sd=1.42

DISTRIBUTION:

Wolfe Neck Cord occurs at 53 sites in Delaware or 14% of all sites for which we have collections; 24 or 16% of the collected sites in the Delaware Bay drainage, 4 or 5% of the collected sites in the Atlantic Coast drainage and 25 or 17% of the collected sites in the Chesapeake Bay drainage. An additional C-14 date at the Dill Farm Site (7K-E-12) of a fluvial deposit, overlying a Wolfe Neck Cord and Net level is dated at 380 B.C. ± 85 (I-6886) and 500 B.C. ± 85 (I-6891) placing the Wolfe Neck Cord level prior to 500 B.C.

Wolfe Neck Cord is found outside of Delaware on the Delmarva Peninsula. At the Nassawango Creek Site, four carbon dates occur from three features which contain Wolfe Neck Cord. Feature 19 is dated at 785 B.C. ± 75 (SI-2191), feature 6 is dated at 240 B.C. ± 100 (SI-2190) and feature 1 is C-14 dated at 495 B.C. ± 100 (SI-2188) and 240 B.C. ± 70 (SI-2189) (Bastian 1975). Each of the three features contain Delmarva Adena related artifacts.

Similar types both physically and temporally found in the Middle Atlantic region include Prince George Cord Marked (Evans 1955:63), Stoney Creek Cord Marked (Evans 1955:69-71) and Accokeek Cord Marked (Stephenson 1963:96-100) in coastal Virginia and Maryland; Sheep Rock Cord Marked (Michels and Smith 1967: 467-471) in the Susquehanna River drainage; Exterior Corded/Interior Smooth (Kinsey 1972:454-455) in the Upper Delaware River Valley; and Vinette 2, the grit tempered sherds of Thick Paddled Cord (Cross 1956:134-135) and Modified Interior Cord Marked (Salwen 1968:326) in coastal New Jersey and New York.

Wolfe Neck Net:

DEFINITION: Net impressed exterior (N=40)

DESCRIPTION:

Exterior Attributes: (This includes both "net roughened" (47%) and "open" net (53%).

Element thickness - (open net only) = $\bar{X}$=1.2 sd=.33 n=13

Knot to knot distance - (open net only) = $\bar{X}$=8.7 sd=1.67 n=12

Orientation to rim (open net only) - Of the five sherds analyzed, two were perpendicular and three were oblique.

Interior Attributes:

Treatment - Five classes of interior treatment are recorded, net impressed n=1, net impressed and partially scraped and smoothed n=2, scraped n=6, smoothed over scraped n=6, and smoothed n=24. Four of the classes are noted above in the Wolfe Neck Cord description. A fifth class exhibiting net impressions that have been partially scraped and smoothed is noted on two sherds. The process of interior treatment, from impression of net to the modal class of smoothed interiors parallels that noted for the cord marked type.

Eveness -

Uneven: n=22
Even: n=17

Vessel Wall Thickness: n=40
$\bar{X}$=10.59
sd=1.36

DISTRIBUTION:

Wolfe Neck Net occurs at 36 sites in Delaware, ; 18 or 12% of the collected sites in the Delaware Bay drainage, 5 or 7% of the collected sites in the Atlantic Coast drainage and 13 or 9% of the collected sites in the Chesapeake Bay drainage. The radiocarbon dates at the Dill Farm Site also place Wolfe Neck Net prior of 500 B.C.

Wolfe Neck Net is found at several sites outside of Delaware on the Delmarva Peninsula. A survey of available collections in this area shows a distribution similar to Wolfe Neck Cord. Similar types both physically and temporally found in the Middle Atlantic region include Pottery Hill Net (Evans 1955:61-62), Popes Creek Net Impressed (Stephenson 1963:92-96) and Albemarle Net Impressed (Stephenson 1963:102-103) in coastal Virginia and Maryland; Susquehanna Net Impressed (Smith 1971:41) in the Susquehanna River drainage; Broadhead Net Marked (Kinsey 1972:455-456) in the Upper Delaware Valley; the grit tempered sherds of Net Impressed (Cross 1956:139-140) and North Beach Net Marked (Salwen 1968:326) in coastal New Jersey and New York.

COULBOURN WARE

This is a clay tempered coil constructed, conoidal ware. Rims are direct and undecorated with both rounded and flattened lips which are predominantly smoothed (cf. Wise n.d.). The clay temper of this ware characteristically has rounded to sub-rounded edges with occasional angular fragments and is sometimes a slightly different color than the paste. The particles do not appear to be crushed sherds. This ware has also been referred to as one containing "no obvious temper" or "no visible temper" (Wise n.d. and Wise 1974). The description of the paste in these references, however, match that for the clay temper noted above. All vessels in this sample appear to have been fired in an oxidizing atmosphere. This ware consists of two types based on exterior surface treatment; one cord marked and the other net impressed. A radiocarbon date from the Wolfe Neck midden for this ware is 375 B.C. (2325 ± 65 B.P., UGa-1224), (Plate 1B,2C).

Coulbourn Cord:

DEFINITION: Cord marked exterior surfaces (N=66)

DESCRIPTION:

Exterior Attributes:

Element thickness - $\bar{X}$=2.05 sd=.46 n=43

Distance between cords - $\bar{X}$=4.41 sd=.74 n=25

Orientation to rim - The cord orientation to the rim exhibits wide variation. Of the thirty sherd samples analyzed for this attribute, cords that were perpendicular (n=7), oblique (n=13) and parallel (n=1) to the rim were found as well as nearly all possible combinations of two or three directions. The modal class, however, is oblique.

Interior Attributes:

Treatment - Six classes of interior treatment were recorded for this type; corded (n=3), scraped over cord (n=2), smoothed over cord (n=5), scraped (n=14), smoothed over scraped (n=10) and smoothed (n=13). The stages of interior treatment range from the paddled surface alone to complete smoothing of the vessel. The modal class is scraped. There was an obvious attempt to thin the vessel by scraping and finally to finish the interior by smoothing this scraped surface.

Eveness -

Uneven: n=30
Even: n=29

Vessel Wall Thickness: n=66
$\bar{X}$=9.55
sd=1.62

DISTRIBUTION:

Coulbourn Cord occurs at 44 sites in Delaware; 20 or 14% of the collected sites in the Delaware Bay drainage, 11 or 14% of the collected sites in the Atlantic Coast drainage and 13 or 9% of the collected sites in the Chesapeake drainage. No additional dates are known for Coulbourn Cord.

On the Delmarva Peninsula, outside of southern Delaware, only a few sherds of Coulbourn Cord have been located by the authors. In the Middle Atlantic Region, mention is made of Clay Sherd Tempered Plain (Evans 1955:75) in coastal Virginia. This is the only other mention of clay tempered ceramics in the Middle Atlantic which the authors have been able to find.

Coulbourn Net: (cf. Wise 1974)

DEFINITION: Net impressed exterior surfaces (N=67)

DESCRIPTION:

Exterior Attributes: (A sample of fifty-two sherds contains 27% with "open net" impressions while 73% are net-daubed or "net roughened").

Element thickness - (open net only) = $\bar{X}$=1.1 sd=.21 n=14

Knot to knot thickness - (open net only) = $\bar{X}$=8.0 sd=1.72 n=13

Orientation to rim (open net only) - A wide range of variability was recorded in the orientation of open net. The modal class was parallel/perpendicular (n=4) while the remainder are either oblique (n=2) or a combination of both (n=2).

Interior Attributes:

Treatment - Five classes of interior treatment are noted; scraped over net (n=4), smoothed over net (n=11), scraped (n=21), smoothed over scraped (n=14) and smooth (n=14). The modal class is scraped interiors (n=21). The same progression for impressed interiors through scraped interiors to smoothed over scraped to smooth interiors occurred as for Coulbourn Cord.

Eveness -

Uneven: n=45
Even: n=19

Vessel Wall Thickness: n=67
(body sherds only) $\bar{X}$=10.30
sd=1.15

DISTRIBUTION:

Coulbourn Net occurs at 49 sites in Delaware; 28 or 19% of the collected sites in the Delaware Bay drainage, 6 or 8% in the Atlantic Coast drainage and 15 or 10% in the Chesapeake Bay drainage. No additional dates are known for Coulbourn Net.

The distribution outside of southern Delaware is minimal.

MOCKLEY WARE

Mockley Ware has been previously defined and described in the Accokeek Creek Site report (Stephenson 1963). This ware is shell tempered, conoidal and coil constructed. Rims are direct and undecorated while the lips tend to be flattened and impressed. The vessels appear to have been fired in an oxidizing atmosphere though some smudge "clouds" do occur. The ware consists of two types; one net impressed and the other cord marked. At the Wolfe Neck Site, Mockley Ware has been dated to 325 A.D. and 330 A.D. (1620 $\pm$ 65 B.P., UGa-1273(a) and 1625 $\pm$ 160 B.P., UGa-1273(b). The following descriptions are based on the Delaware sample alone, (Plate 2B, 2D).

Mockley Cord:

DEFINITION: Cord impressed exterior surface (N=43)

DESCRIPTION:

Exterior Attributes:

Element thickness - $\bar{X}$=1.87 sd=.56 n=35

Distance between cords - $\bar{X}$=3.40 sd=.67 n=29

Orientation to rim or coil breaks - All possible combinations of orientation are represented including two examples with cord impressions that are perpendicular, oblique and parallel. The modal class is perpendicular (n=6).

Interior Attributes:

Treatment - Four classes of interior treatment are recorded. The progression of interior manufacturing technique is evident from cording (n=1) to scraped (n=14) to smoothed over scraped (n=7) to smoothed (n=21). The goal of this sequence of interior treatments as we interpret it, was to produce a thin-walled, smoothed interior vessel.

Eveness -

Uneven: n=20
Even: n=23

Vessel Wall Thickness: n=43
(body sherds only) $\bar{X}$=9.88
sd=1.46

DISTRIBUTION:

Mockley Cord occurs at 39 sites in Delaware; 15 or 10% of the collected sites in the Delaware Bay drainage, 10 or 13% of the collected sites in the Atlantic Coast drainage and 14 or 10% of the collected sites in the Chesapeake Bay drainage. At the Carey Farm Site (7K-D-3) a date of 200 A.D. ± 90 (I-5817) for feature 1 and at the Hughes-Willis Site (7K-D-21) also from feature 1, a date of 300 A.D. ± 110 (I-6060) were collected for Mockley Cord and Mockley Net (Thomas et. al. n.d.).

Mockley Cord is found throughout the Delmarva Peninsula and in coastal Virginia and Maryland. In Maryland and Virginia, though, Mockley Cord dates are slightly later than in Delaware (Handsman and McNett n.d.:32). No shell tempered cord marked Middle Woodland types are known to occur in the Susquehanna Valley or Upper Delaware Valley. In New Jersey, at the Abbott Farm Site, two cord marked types (Cross 1956:132-135), Thin Interior Cord Marked and Thin Paddled Cord are shell tempered nearly 50% of the time.

Mockley Net:

DEFINITION: Net impressed exterior surfaces (N=56)

DESCRIPTION: The sample obtained for descriptive purposes contains only 5% "open net" and all but one of these sherds is from a single site. The remainder of the sherds are "net-roughened".

Exterior Attributes:

Element thickness - (open net only) = $\bar{X}$=1.0 mm sd=0.0 n=3

Knot to knot distance-(open net only)= $\bar{X}$=12.3 mm sd=2.89 n=3

Orientation to rim - (open net only) - All net elements were parallel/perpendicular to the rim.

Interior Attributes:

Treatment - Four classes of interior treatment occur on Mockley Net. The modal class, as is the case in Mockley Cord, is smooth interiors (n=34). Scraped (n=9), smoothed over scraped (n=11) and corded interiors (n=1) also occur.

Eveness -

Uneven: n=24

Even: n=30

Vessel Wall Thickness: n=56

$\bar{X}$=8.77

sd=1.51

DISTRIBUTION:

Mockley Net occurs at 40 sites in Delaware; 17 or 12% of the collected sites in the Delaware Bay drainage, 7 or 9% of the collected sites in the Atlantic Coast drainage and 16 or 11% of the collected sites in the Chesapeake Bay drainage. Additional dates for Delaware are the same as those of Mockley Cord.

Mockley Net is found throughout the Delmarva Peninsula and coastal Virginia and Maryland. As with Mockley Cord, the dates for Mockley Net are slightly later in Virginia and Maryland. No similar types are known from the Susquehanna River and Upper Delaware River Valleys. Two types which are net impressed and shell tempered are known from the Abbott Farm Site in New Jersey; shell tempered sherds of the type Net Impressed and Abbott Zoned Net Impressed (Cross 1956). Though netting is not present in Abbott Zoned Incised, it is probably also related temporally (Cross 1956).

CONCLUSIONS

The ceramics of the Wolfe Neck midden define a tradition of the mutually occurring exterior surface treatments. This cord and net tradition cuts across the technological differences in temper from the crushed quartz of Wolfe Neck Ware to the shell temper of Mockley Ware. Comparative studies show that the temporal distribution of the cord/net tradition begins by 500 B.C. and continues through approximately 330 A.D. in southern Delaware. Before this period, surfaces on such ceramics as Marcey Creek, Selden Island or Accokeek, are either plain or cord marked though both surface treatments do not generally occur on the same ware. Ceramics in the study area after 330 A.D. continue to be cord marked for a time with increasing percentages of fabric impressed surfaces after 600 A.D. until by 1000 A.D. the exclusively fabric impressed Townsend ceramics appear. This sequence of surface treatments consists of a series of attribute trajectories through time. These trajectories appear to be independent of technological traditions as indicated in both major manufacturing differences and minor changes such as temper. For the period between 500 B.C. and 1000 A.D., a traditionally accepted range for the Middle Woodland Period, two surface treatments co-occur on all recognized wares; cord/net or cord/fabric. In this study we are particularly concerned with the cord/net impressed tradition that appears in the first part of this period.

The reason for the 800 to 1000 year co-distribution of cord and net remains unclear. To approach this problem, it is hypothesized this initial appearance of two surface treatments within the same ware represents a simple functional difference between the types. Perhaps vessels of one surface treatment function predominantly for storage while the other are for cooking and food processing. Prior to 500 B.C., a functional difference may not have been recognized while after 1000 A.D. functional differences in vessels are reflected in attributes other than surface treatment. Tests of the functional difference hypothesis are conducted by utilizing the data presented in the preceding ware/type definitions and descriptions. These data are compared to determine if there exists a consistent and significant difference between the net and cord marked types of all three wares that could be attributed to differences in function. Appropriate statistical tests (Kolmogorov-Smirnov or t-test) are used to measure the significance of measured differences.

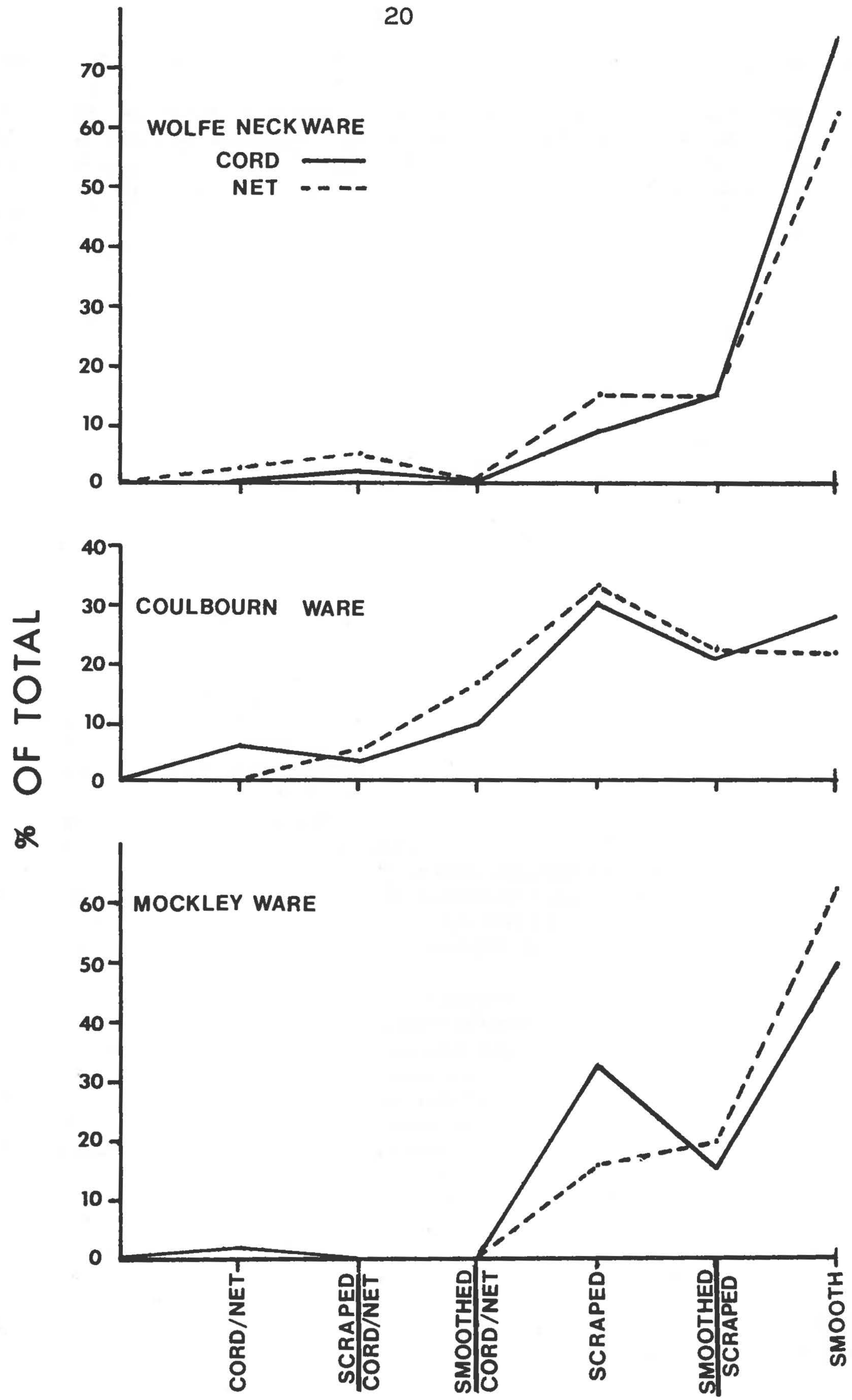

Figure 5: Interior surface treatment

A comparison of interior surface treatments, body sherd (vessel wall) thickness, attributes of the exterior elements (cord width and distance between cords and types of net) and interior eveness between the cord and net types within a ware produced some interesting if not altogether understandable results. The authors reasoned that the best indicator of functional differences should be interior surface treatment. Logically, storage vessels should have the most variance in this attribute; there would be less need to produce a highly refined and smoothed interior for vessels used primarily for storage. Cooking and processing vessels on the other hand should be much smoother on the interior for even heating and ease in cleaning. A test of this hypothesis using the Kolmogorov-Smirnov test for the comparison of cumulative frequency curves indicate differences between the wares on this attribute but not between the types within a ware (Fig. 5). That is, there was no significant difference in interior treatment between the cord marked and net impressed types within each ware. This finding did not support our contention of functional difference, provided interior surface treatment is a measure of this, but did add further support to the validity of the ware definitions. Interior eveness, using the same logic as for interior treatment, is also believed to offer some measure of functional difference. Again, the tests proved insignificant except in the case of Coulbourn Ware. This anomaly may be the result of interior treatment differences between the Coulbourn types. The high percentage of net impressed and scraped interiors produced a greater percentage of uneven surfaces. Vessel wall thickness, however, did indicate a consistent and significant difference between types within the wares in all cases (t-test). If we may assume that the thicker walls represent larger vessels, the Wolfe Neck Net, Coulbourn Net and Mockley Cord types are the largest vessels within each ware. Larger vessels may or may not indicate functional differences. Unfortunately, the authors do not have independent data on vessel size or sufficient contextual data to pursue further the question of ceramic function. These observed differences and similarities do provide some background for future research on this problem.

In addition to the previously discussed attributes, those of exterior cord marked and net impressed surfaces are also checked for statistical significances to complete the comparative descriptions. Student-t tests for cord thickness and distance between cords between wares proves highly insignificant. A trend in net impressed surfaces is, however, noted. There is a steadily increasing percentage of "net-roughened" impressions versus "open net" impressions through time from nearly equivalent percentages in Wolfe Neck Ware to 95% net-roughened in Mockley Ware. The significance of this trend is unclear but it appears to represent stylistic drift and/or spatial differences within the wares.

In the course of the analysis for the ware/type definitions and the comparative analyses for description, it became apparent that there may be spatial differences in the distributions of certain descriptive attributes as was just noted in the case of net impressed surfaces. It was the authors' initial purpose to include all these variations in the overall ware description so as to encompass the total range of variability for each ware. Within this wider range, certain attributes spatially cluster revealing local "micro-style" zones. These "micro-style" zones may represent local cultural groups, and if they can be isolated, would be useful units of study for synchronic problems as subsistence-settlement patterns and inter-group contact. The problems of within ware spatial variability and accompanying interpretations is a subject for further study.

Turning to the distribution of wares and types within Delaware, the ceramics preceding the three wares defined in this paper, namely Marcey Creek, Selden Island, Ware Plain and Dames Quarter are distributed throughout Delaware, but only in small, scattered occurrences (Artusy 1977). As yet, no site has been found in Delaware that is the equivalent of the Ware Site in New Jersey (McCann 1956) or the Marcey Creek Site in Maryland (Manson 1948). This is in marked contrast to the Wolfe Neck, Coulbourn and Mockley Ware which occur at over a 100 of the 366 sites for which we have surface collections at the Island Field Museum and Research Center. Not only is there a distinct increase in the number of sites and intensity of individual site occupation during this period of time, but the sites are located almost exclusively in the southern half of the state. This distribuiion coincides with the northern range of shellfish resources in the Delaware Bay. The later ceramic wares, Hell Island and Townsend, also occur most frequently in southern Delaware within easy reach of the shellfish resources. This obviously has implications for the study of Middle and Late Woodland subsistence and settlement.

A generalized view of the Woodland periods in the Middle Atlantic can be built upon a knowledge of ceramic wares and types which are related both temporally and physically. A more complete picture can be ascertained when adequate phase descriptions which include subsistence and settlement data further subdivide and clarify the relationships which exist between subareas of the Middle Atlantic. For the present, ceramics and their distribution will have to suffice as the building block for understanding the Woodland in Delaware and its external relationships. The Woodland classically has been subdivided into Early Woodland, Middle Woodland and Late Woodland based upon mortuary systems in the Ohio Valley or arbitrarily divided into temporal units of 1000 to 500 B.C., 500 B.C. to 500 A.D. and 500 A.D. to contact. The authors feel that the ceramic assemblages in Delaware reflect a subdivision of the Woodland into again three periods; early, middle and late. The Early Woodland is a time of ceramic experimentation (1000 B.C. to 700 B.C.) which in Delaware only occasionally occurs and is highly scattered. In the Middle Atlantic in general, this period is poorly understood (Gardner 1975).

The Middle Woodland (700 B.C. to 1000 A.D.) is a period of ceramic stabilization and regionalization. Wolfe Neck Ware is similar both physically and temporally to a large number of types found throughout the Middle Atlantic in both piedmont and coastal ecosystems. In most of the Middle Atlantic these crushed stone tempered, net or cord types occur from 700 B.C. to possibly 100 A.D. However, in Delaware, Coulbourn Ware interrupts this continuum at about 400 B.C. and probably lasts until 100 B.C. A similar phenomenon occurs on the Potomac River with Popes Creek, a sand tempered rather than crushed stone ware. Both Popes Creek and Coulbourn develop in localized areas after a crushed quartz or grit tempered tradition. There are also similarities in certain descriptive attributes such as a scraped interior surface treatment. Based on an evaluation of radiocarbon dates and ware distributions, it appears that Coulbourn and Popes Creek are at least partially contemporaneous and represent islands of ceramic development in a broader background of Wolfe Neck and Wolfe Neck-like wares in the Mid-Atlantic. In other words, by approximately 400 B.C. three different, though related wares are co-occurring on the Mid-Atlantic Coastal Plain; Popes Creek on the Potomac and immediately adjacent areas, Coulbourn on the Delaware Bay and Atlantic Coast drainages in southern Delaware and the Wolfe Neck types in the intervening areas. This is admittedly a preliminary picture based on incomplete space/time distribution studies, but one that the authors feel merits further consideration.

Appearing after Coulbourn and Popes Creek in some areas and directly after Wolfe Neck in others are the shell tempered Mockley types. The earliest dates for Mockley Ware, 200 A.D. and 300 A.D. occur within the areal distribution of Coulbourn Ware. While Mockley Ware outside this distribution has generally smooth interiors, a sizeable percent in southern Delaware is scraped on the interior (Fig. 5) as is the case for Coulbourn. Though additional work at several key sites is necessary, it appears that Mockley Ware develops first in the Mid-Atlantic somewhere in the Delaware Bay and Atlantic Coast drainages by 200 A.D. There after shell tempered, cord and net impressed ceramics occur elsewhere on the Coastal Plain of the Middle Atlantic from New York to Virginia.

The latest ware known from the Delaware Middle Woodland is Hell Island (Artusy 1977). It is crushed quartz tempered with cord or fabric impressed exterior surfaces. The single date for Hell Island Ware from Delaware is 645 A.D. (1305 ± 55, UGa-1441). It is related in time and artifact association to the Webb Phase defined from the Island Field Site burial complex. It has a slightly more northern center of distribution than Mockley Ware in Delaware and may be partially contemporaneous. It has a more restricted distribution than Mockley, occurring from Virginia to New Jersey primarily on the Coastal Plain.

The Late Woodland in Delaware (1000 A.D. to contact) is a period of increased localization marked by the Townsend Series ceramics (Blaker 1963). This series is shell tempered and fabric impressed with the first consistently designed rims. It can be sub-divided into two temporal periods based on decorative technique. The incised designs are the earliest ranging intime from 1000 A.D. to 1300 A.D. (Griffith and Artusy 1975). Their area of greatest concentration is in the middle two-thirds of the Delmarva Peninsula and the middle western shore of the Chesapeake. Corded designs range from 1300 A.D. to contact and are found in a slightly more restricted area.

ACKNOWLEDGEMENTS

The authors would like to thank those members of the Sussex Society of Archeology and History who conducted the fieldwork and published the earlier reports on the Wolfe Neck Site. This list includes the late Dr. David Marine, the late Orville H. Peets, the late Henry H. Hutchinson, the late James L. Parsons, Robert R. Bell and S. Bryn. Within this group, the authors would like to single out Dr. David Marine for allowing them to analyze the ceramics from his work at the Wolfe Neck Site.

We are also grateful to Mr. John G. Townsend for allowing us to work on his property not only at the Wolfe Neck Site but throughout Sussex County.

This paper could not have been completed without the assistance of Robert F. Hoffman who illustrated Figures 1-5 and Abbey Feierstein who typed this paper from handwritten scratchings.

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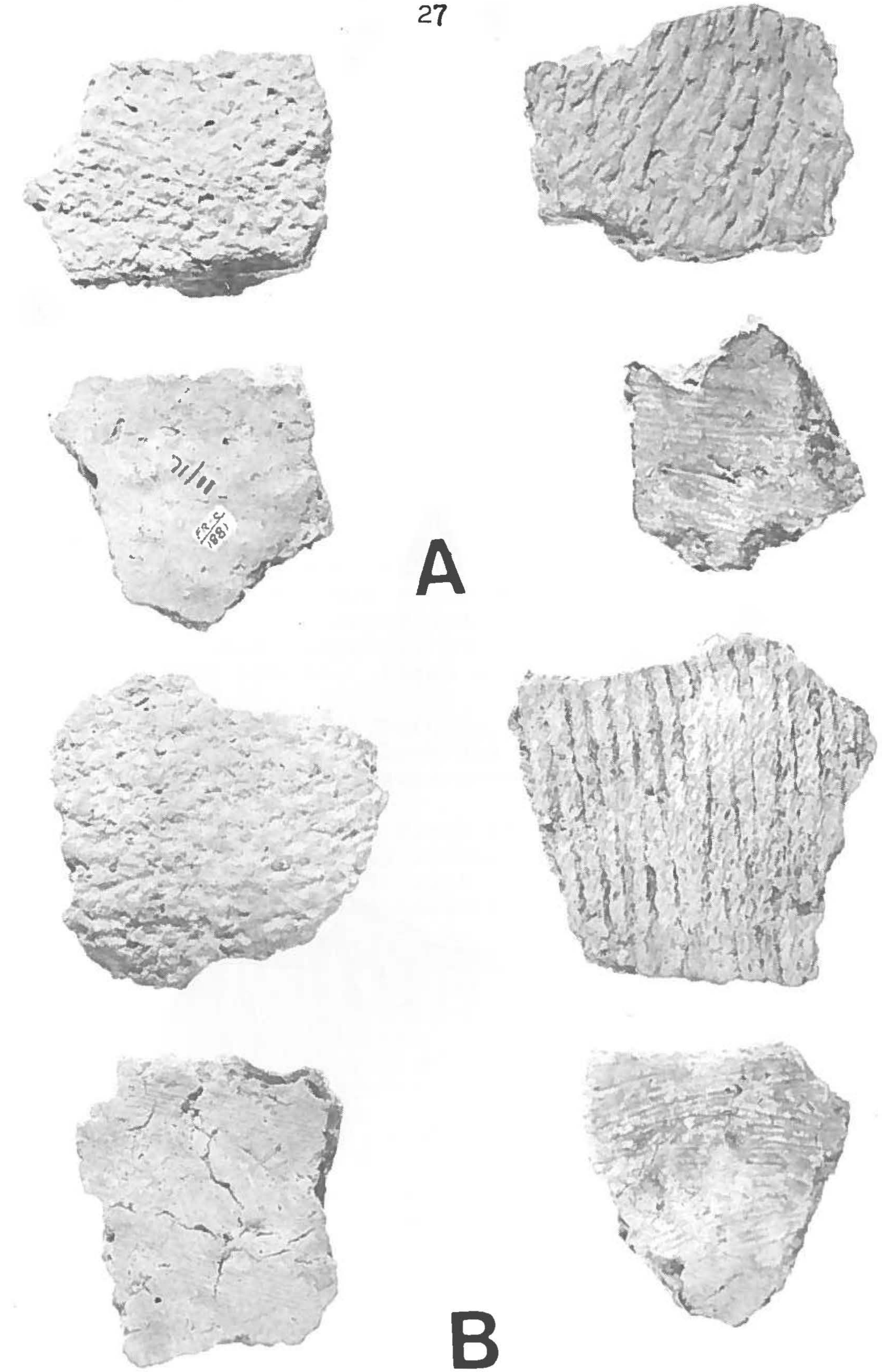

PLATE 1: A - Wolfe Neck Ware
B - Coulbourn Ware

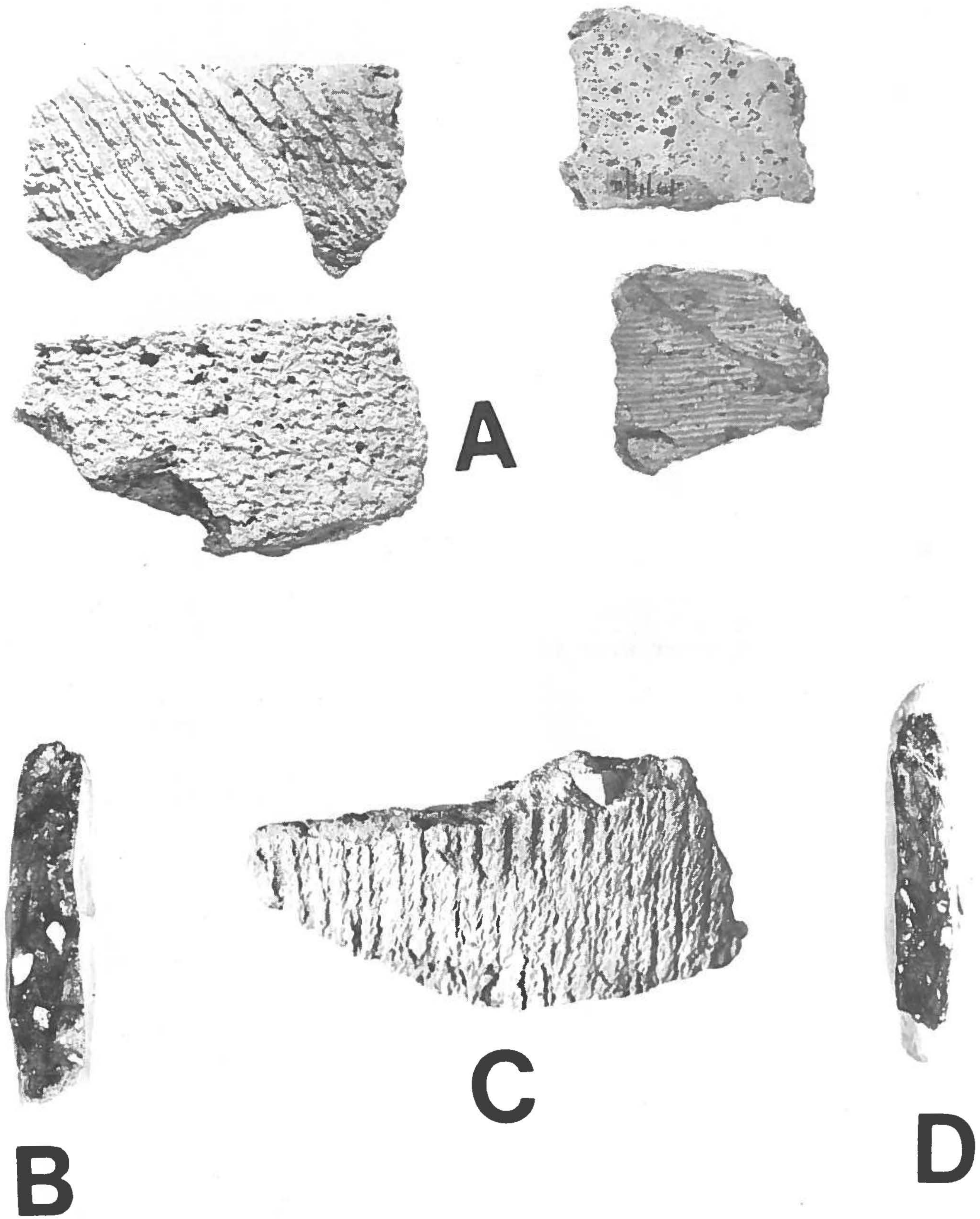

PLATE 2: A- Mockley Ware; B,C&D-cross sectional views of temper B- Wolfe Neck Ware, C-Coulbourn Ware, D-Mockley Ware.

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IN REMEMBRANCE

of

Dr. David Marine

who gave much of his life to

the

Sussex Society of Archeology and History