LATE WOODLAND CULTURAL DYNAMICS IN THE NORTHERN LOWER PENINSULA OF MICHIGAN

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WILLIAM ANTHONY LOVIS, JR.
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Charles E. Cleland

Major professor
Charles E. Cleland

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ABSTRACT

LATE WOODLAND CULTURAL DYNAMICS
IN THE NORTHERN LOWER PENINSULA OF MICHIGAN

By

William Anthony Lovis, Jr.

The partially stratified O'Neill Site (20CX18) Charlevoix County, Michigan, was excavated by the Michigan State University Museum during 1969 and 1971. Examination of the material culture coupled with a radiocarbon chronology indicates an occupation span from ca. A.D. 1000 to A.D. 1700. Ceramic analysis demonstrated use by groups common to both the Straits of Mackinac area to the north and the Traverse Bay area to the south. A sparse chipped stone assemblage belonging to a flake industry is described and interpreted. Warm season occupation of the site, from late spring until early fall, is documented from the faunal remains.

Spatial analysis of the assemblage points toward a number of localized occupation areas. Combined with large amounts of unworked raw material, chert cores, and debitage, the primary role of the O'Neill Site is believed to have been as a chert processing station utilized by small, transient groups.

Ceramics from seven Late Woodland sites are examined within a temporal and spatial framework. Key style attributes are exposed through the use of proximity analysis, and a distance-similarity hypothesis based on decorative attributes is tested and rejected. Testing of diffusion hypotheses leads to a reformulation of the extant interaction model. Implications of the latter are discussed, future research objectives are proposed, and a testable model of ceramic similarity in the study area is generated.

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By

William Anthony Lovis, Jr.

A DISSERTATION

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Although a single name is appended to the title of this manuscript, in actuality it is the product of input from a number of persons and organizations without whose suggestions, help, and guidance it could not have been completed. Funding for the project came from a number of sources. Excavation of the O'Neill Site was partially financed through a National Science Foundation Undergraduate Research Grant (GY-2825), National Science Foundation Research Grants entitled "Prehistoric Cultures of the Grand Traverse Bay Area, Michigan" (GS-1669), and a grant funded by the National Historic Preservation Act through the Michigan Department of Natural Resources (Project No. 26-71-00025), awarded to Charles E. Cleland, Michigan State University. Monies for computer time were made available by the College of Social Science, Department of Anthropology, and Computer Institute for Social Science Research, Michigan State University under a proposal entitled "Cultural Dynamics of the Traverse Corridor." I am indebted to Rollin H. Baker, Director of the Michigan State University Museum, for making space, facilities, and supplies available while the analysis was in progress. Personal support, funding for manuscript preparation, and typing were financed by a Woodrow Wilson Dissertation Fellowship. Without the support of this organization, my finances would have been sorely strained.

A special debt of gratitude is owed my Doctoral Committee: Charles E. Cleland, Chairman, Lawrence H. Robbins, and Joseph Chartkoff. Their guidance of the research and their advice on manuscript drafts was helpful and perceptive, while the diligence with which they managed to meet tight personal deadlines is greatly appreciated. For his constant personal and professional interest Dr. Cleland, who originally proposed the research problem, deserves special mention. James A. Brown, Northwestern University, both participated in many informal discussions of the analytical procedures and perused the manuscript and made many constructive comments despite his heavy schedule. I hope his contributions are evident.

Investigation of the O'Neill Site would not have been possible without the permission of the property owner, John O'Neill. His cooperation in allowing excavations to take place assured that the information from this important site would not be lost. Laboratory handling of the assemblage was aided by a number of persons: Tracy Mengerink worked on the ceramics while at The Museum as part of the Kalamazoo College Career Service Program; Steve Devine and Jean Farr did much of the preliminary flint analysis; and Denise King, MSU Department of Anthropology, analyzed the faunal remains. Aid on much of the statistics and computer programming was furnished by Robert Mainfort, whose help was instrumental in the completion of the analysis. Additionally, the help and encouragement of my friends and colleagues Patrick Martin, Nancy Nowak, Dennie Fitch, and Margaret Rogers must be acknowledged.

I, however, take sole responsibility for any errors of analysis or interpretation that might occur.

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CHAPTER 1

INTRODUCTION

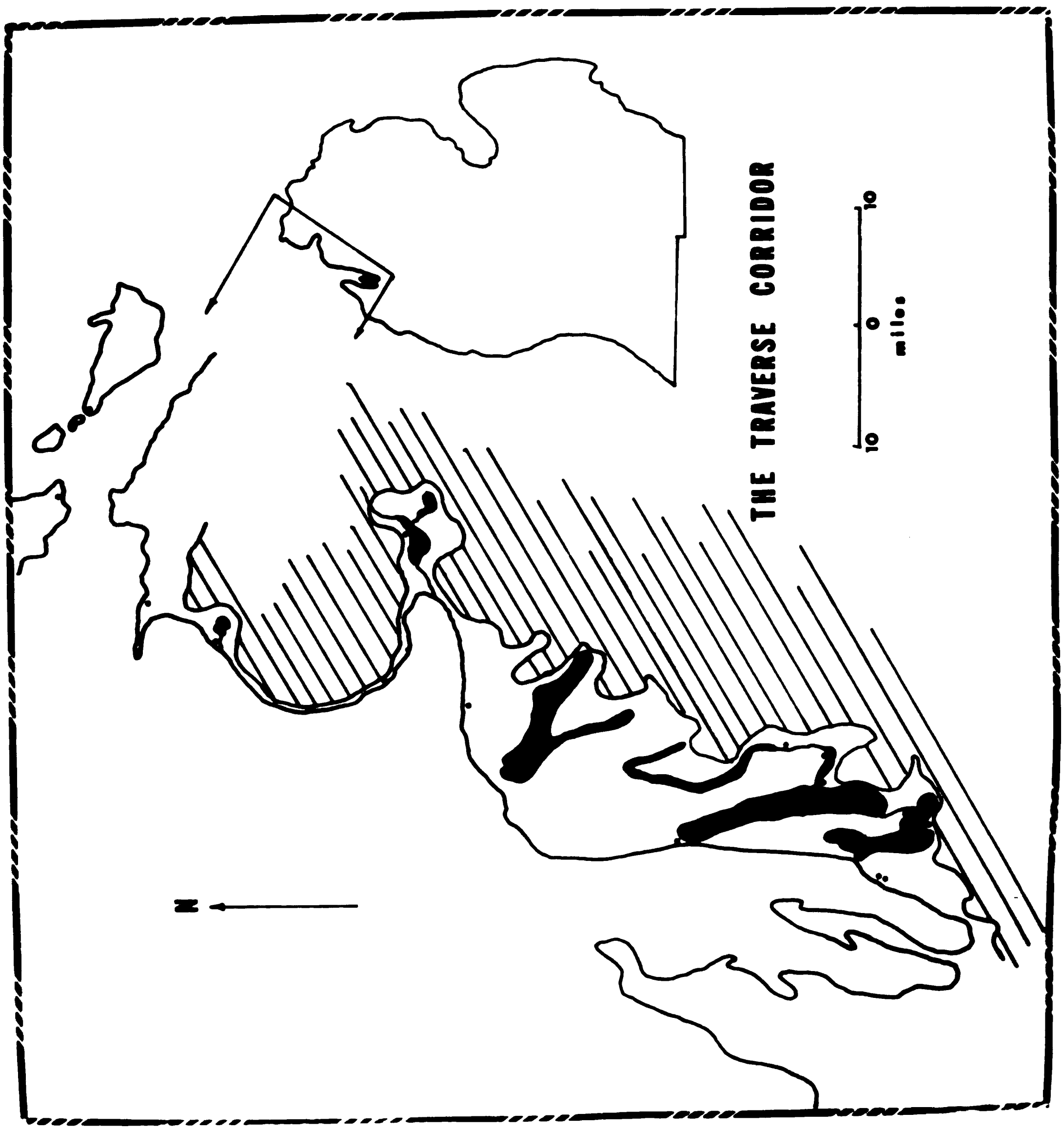
The Corridor Concept

Since 1966, archaeological investigations undertaken by the Michigan State University Museum and the Department of Anthropology have been concentrated on the coastal plain of Lake Michigan between Traverse City and Mackinaw City, Michigan, which has been called The Traverse Corridor. The rationale behind this long-term program has been outlined by Cleland (1967) who describes the Research Universe as a north-south lakeside passage differentiated from surrounding areas by a complex combination of natural factors. To the west, the study area is bounded by Lake Michigan; while to the east a major physiographic transition takes place when the hilly, rocky, terminal Valders moraine is encountered. The morainic system initiates at varying distances from the Lake Michigan shore -- as near as 50 yards and as distant as 12 miles. The area encompassed between Lake Michigan and the morainic interior is a flat, sandy, littoral (Fig. 1).

The coastal plain, as a result of its elevation, the proximity of Lake Michigan, and the modifying air masses which result from the latter, differs radically in both climate and vegetation from the interior. Recent studies of climatic differences in the study area have demonstrated that the littoral enjoys between 120 and 140 frost-free days, while the interior uplands can depend on less than 110 frost-free days (Wagner n.d.). The coastal plain, therefore, is situated within a thermocline representing the effective limits of prehistoric agriculture (Yarnell 1964:128). This difference in climate is reflected in the natural biotic communities as well, since the coastal plain flora represents a narrow extension of the

Figure 1

Map of the Traverse Corridor

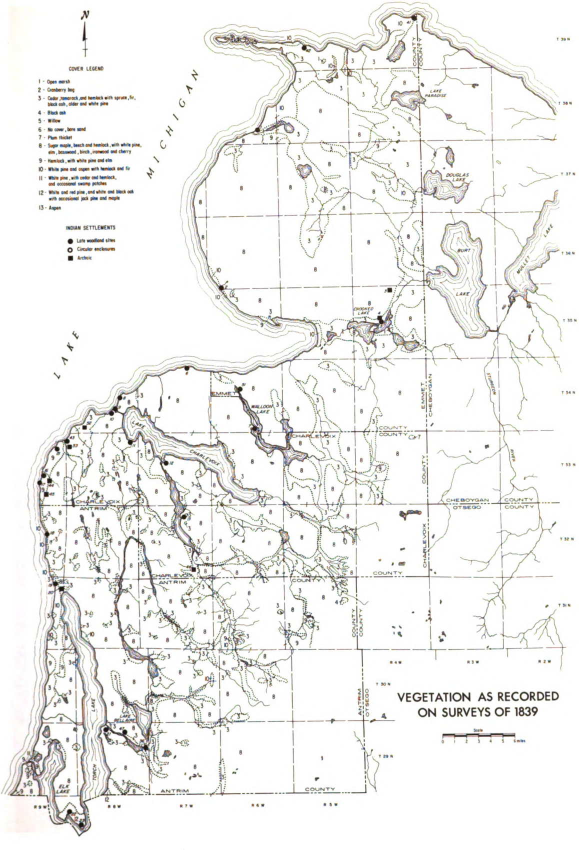

THE TRAVERSE CORRIDOR
10 0 10
miles
N

Canadian-Carolinian transition zone into what is predominantly a Canadian biome. That the latter phenomenon is not merely a contemporary situation has been clarified and substantiated by Isleib's (n.d.) analysis of presettlement forest communities within the study area. Utilizing primary data consisting of original county surveyor's notes, Isleib was able to recognize 13 different vegetational associations within the 100-mile-long coastal plain and adjacent uplands. These various floral associations form a mosaic (Figs. 2-4) but include species common to both the Canadian and Carolinian biomes, creating an ecotonal or edge effect (Odum 1965:278). The numerous micro-environmental interfaces that result from a mosaic of this type seem, preliminarily, to have been optimal locations for prehistoric settlements (N. Nowak, personal communication). Contrasting strongly with the edge effect present on the Lake Michigan shoreline, however, is the predominantly Canadian community found on the Lake Huron coastal plain. Thus, Cleland (1967:2) concludes that "it (the littoral between Traverse City and Mackinaw City) is the only continuous region favorable for settlement linking the northern and southern cultural and natural areas."

Testing the hypothesis that prehistoric settlement patterns were, for the most part, confined to the naturally favorable corridor was accomplished early in the program (1967). Archaeological reconnaissance in the morainic eastern uplands has demonstrated the virtual absence of sites in this region. The few sites that were located are apparently small, short-term campsites dated to the Late Woodland. This sparse occupation contrasts strongly with the numerous (N=36) settlements located in the Corridor, demonstrating aboriginal occupation from the Early Archaic through Historic periods. Therefore, the data gathered to date

Figure 2

Presettlement Vegetation in the Traverse Corridor

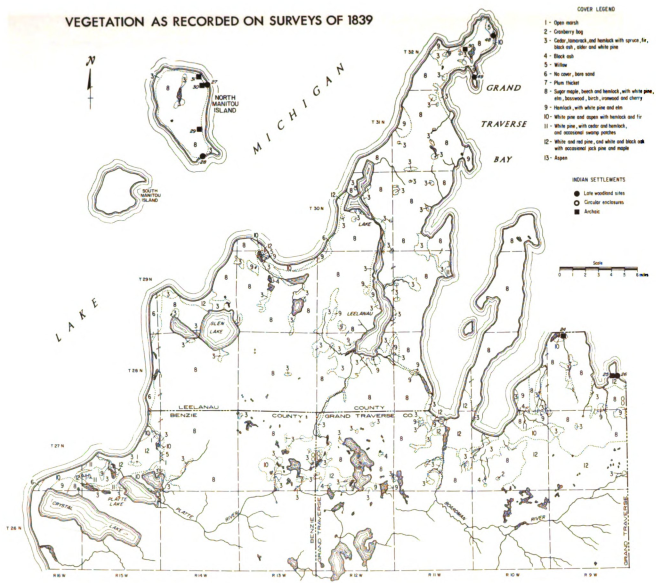


VEGETATION AS RECORDED ON SURVEYS OF 1839

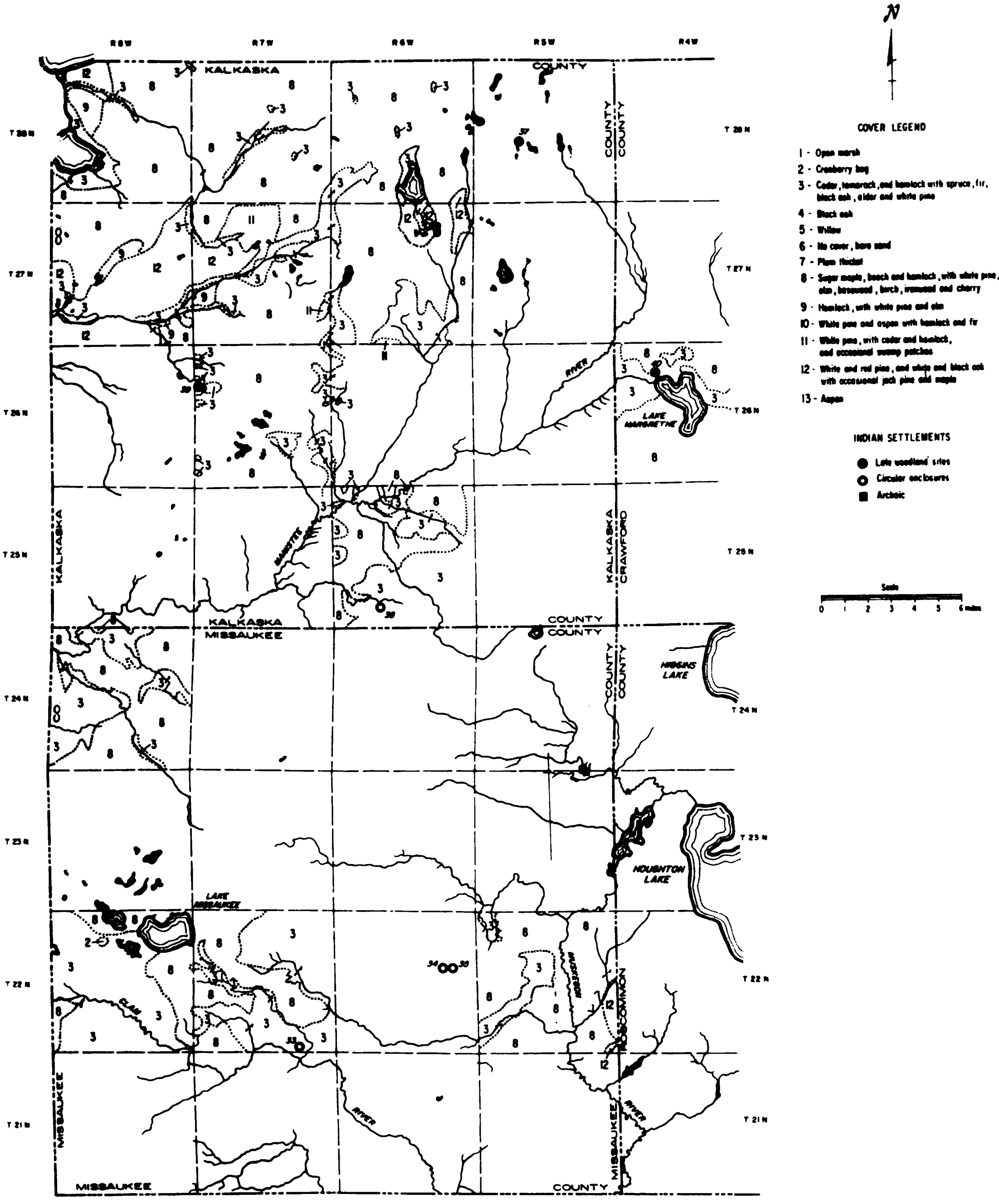
Figure 3

Presettlement Vegetation in the Traverse Corridor

VEGETATION AS RECORDED ON SURVEYS OF 1839



VEGETATION AS RECORDED ON SURVEYS OF 1839



seems to support the contention that prehistoric adaptations were funneled and highly confined to the coastal corridor.

Although the Traverse Corridor has yielded cultural evidence demonstrating aboriginal utilization from ca. 8000 B.C., not until the Late Woodland (A.D. 700–A.D. 1650) did the coastal plain undergo intensive exploitation and occupation. The 29 sites assignable to the Late Woodland period present a quantum increase when contrasted to the four late Middle Woodland settlements in the study area. Because of information derived from these Middle and Late Woodland villages, evidence was generated that the Traverse Corridor acted as a passage for cultural transfer of people or ideas.

Beginning in the late Middle Woodland (ca. A.D. 400), we see a juxtaposition of typically northern archaeological manifestations with southern complexes of the same time period. Populations manufacturing Laurel tradition ceramics penetrate as far south as the Pine River Channel Site in Charlevoix, while two other occupation sites of these typically northern peoples are located north of this point, towards the Straits of Mackinac. Likewise, Havana tradition penetration is documented as far north as the Pine River Channel Site; the only other Havana ceramic-bearing occupation in this area is located south of the town of Charlevoix. No "intermediate" assemblages have yet been recovered.

The nascent north-south bipolarity of the Middle Woodland period, as exhibited through ceramic expression, is a long-lived phenomenon which continues at least through the fifteenth century A.D. The Skegemog Phase (A.D. 900–A.D. 1200) of the south is roughly contemporaneous with the northern Mackinac (A.D. 700–A.D. 1000) and Bois Blanc (A.D. 1000–A.D. 1200). Both Mackinac and Skegemog Phase ceramics maintain a certain impression of similarity characteristic of early Late Woodland Ceramics in Michigan, whereas the pottery of the Bois Blanc Phase represents a noticeable style horizon. Bois Blanc may, indeed, need reappraisal due to its limited distribution (see "Ceramic" discussion). In later periods, we see Traverse Phase peoples (A.D. 1200-A.D. 1450) juxtaposed to populations manufacturing Juntunen ceramics. With the exception of scattered materials from the Wycamp Creek Site and the prehistoric component at Fort Michilimackinac, our knowledge of the material culture of the protohistoric inhabitants is minimal. These data demonstrate that some overlap in the spatial distribution of the northern and southern style traditions does occur -- the extent of this area of mutual use had not yet been investigated.

This general pattern, the penetration of the Corridor from both the northern and southern termini by peoples practicing different ceramic traditions, continues into and through the Late Woodland period. Not only does the filling of a favorable natural vacuum minimize the possibility of spatial isolation of Late Woodland populations, but, furthermore, cultural traditions practicing different adaptive strategies are brought into close proximity. These stratagies have been summarized for the Historic inhabitants, which in turn enabled generalizations pertaining to Late Woodland adaptations to be formulated (Fitting and Cleland 1969). It has been argued that the northern end of the Corridor was inhabited by groups practicing a hunting/fishing/gathering subsistence base, whereas the southern, terminus populations were supplementing a similar strategy with the products of domestic agriculture. Thus, the contrasts documented for natural communities and ceramic style traditions seem to carry over to subsistence practices as well. This model, however, still needs to be rigorously tested.

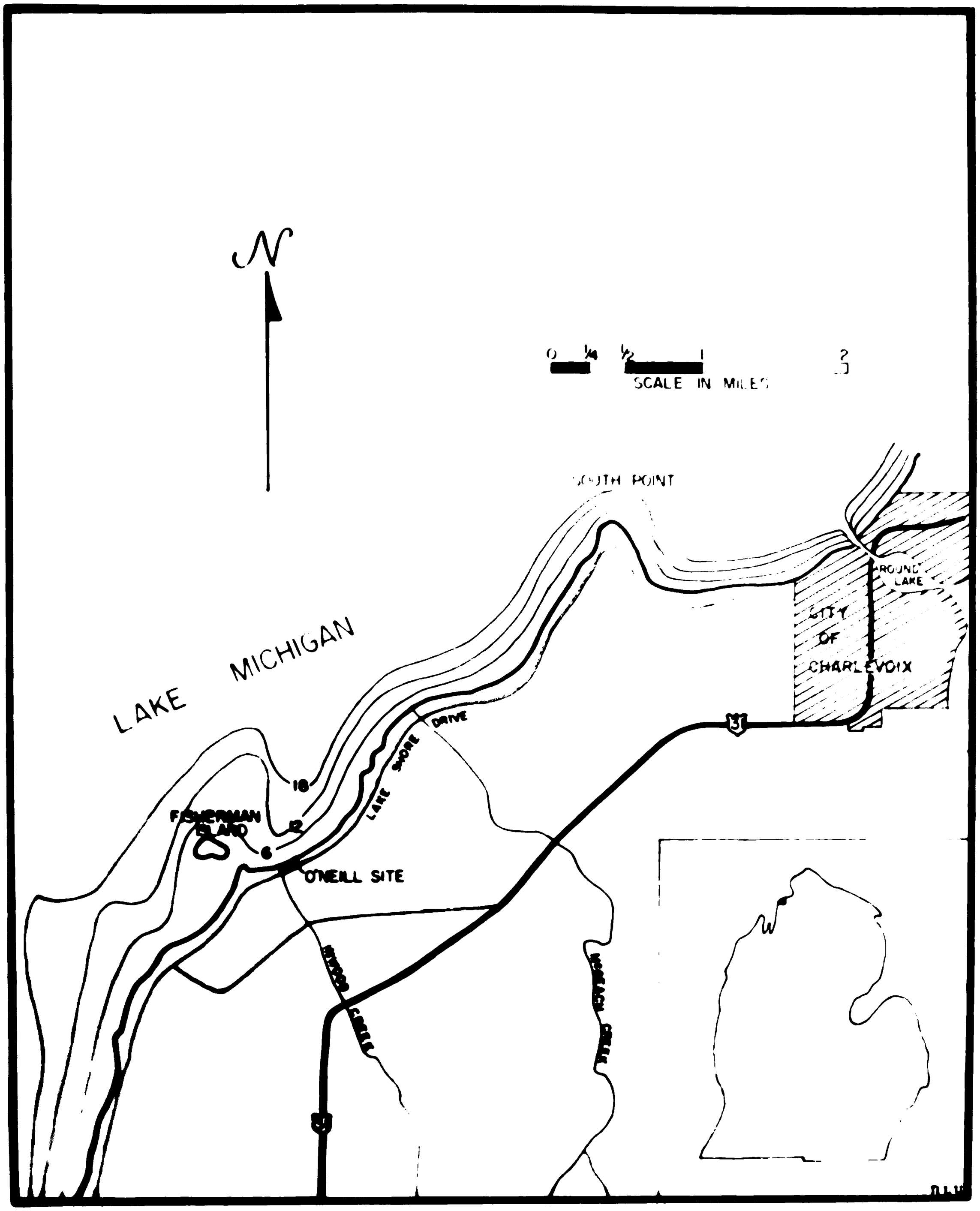
As mentioned previously, one of the primary goals of the Traverse Corridor Project is clarification of temporal and spatial relationships of the two Late Woodland ceramic traditions recognized in the study area -- a problem that had not yet been approached. In order that these relationships be defined, it was necessary to possess proper temporal and spatial control from specific sites in the study area. Few of the Late Woodland sites located could provide the necessary temporal separation -- stratification of occupations is rare, while superposition and mixing of occupations in an undifferentiated soil zone is common. Testing operations performed at the O'Neill Site in 1969 revealed that it was best suited to answer the questions posed. A partially stratified site which thereby provided the necessary temporal separation, the O'Neill Site contained village material from the early Late Woodland through proto-historic periods, thereby providing a complete Late Woodland sequence; furthermore, the site was located in the approximate center of the study area. Its potential for examination of the initial problem not only far exceeded that of other sites considered but was augmented by both excellent faunal preservation in the stratified areas and the presence of house structures. To collect an adequate sample from the site, major excavations were planned for 1971. The results of these excavations are presented in the following sections of this report.

History of Investigations

The O'Neill Site (20CX18) is located in the NE$\frac{1}{4}$ of the SE$\frac{1}{4}$ of Section 7, T 33 N, R 9 W, about 3 miles south of the Pine River in Charlevoix County, Michigan (Figure 5). The site was discovered by field crews from the Michigan State University Museum engaged in a settlement pattern study

Figure 5

Location of the O'Neill Site, Including Offshore Water Depths


LAKE MICHIGAN
SOUTH POINT
ROUND LAKE
CITY OF CHARLEVOIX
SCALE IN MILES
0 1/4 1/2 1 2
LAKE SHORE DRIVE
FISHERMAN ISLAND
18
12
6
O'NEILL SITE
31

of the area between Traverse City and Mackinaw City, Michigan. Under the direction of Dr. Charles E. Cleland, this survey was partially financed by a National Science Foundation Undergraduate Research Participation Grant (GY-2825) and National Science Foundation Research Grants (GS-1026; GS-1669) entitled "Prehistoric Cultures of the Grand Traverse Bay Area, Michigan." The area of the site brought to the attention of the investigators was located on a Nipissing beach with an elevation of 610 feet-612 feet a.s.l. The elevation, coupled with the lack of surface ceramic materials, prompted a preliminary Archaic designation for the site.

During the summer of 1969 Dr. Cleland returned to the O'Neill Site with a crew of six Michigan State University students to initiate test excavations. The first season's field crew consisted of Richard Clute, William Lovis, Jeffrey Tordoff, Donald Weir, and Daniel Wymer. Primary interest at this time was focused on the Archaic occupation. Indications of a Late Woodland occupation were subsequently noticed in a disturbed road cut connecting Lakeview Drive with the beach, at elevations ranging between 580 feet and 595 feet. The decision was made to test excavate the Late Woodland component as a secondary phase of the operations on the Archaic occupation. Due to the success of these initial testing procedures, 1750 square feet of the Woodland component was excavated that season. These investigations revealed a partially stratified Late Woodland village site, containing ceramic materials of the Mackinac and Juntunen Phases (McPherron 1967a) and the protohistoric period.

Following the 1969 operations, the O'Neill Site was nominated to, and eventually placed on, the National Register of Historic Places. During the winter of 1969/70 a Detroit, Michigan, development company revealed plans for a resort subdivision on the site area. The U.S. Park Service

responded to this threat to both the natural and cultural components of the shoreline by recommending that these and adjoining lands be brought under Federal ownership. Plans were proposed for an interpretive reconstruction of the site as a major component of the National Woodland Indian Memorial.

These developments prompted a grant request under the National Historic Preservation Act to pursue excavations during the summer of 1971. This grant was awarded to the principal investigator, Dr. Charles Cleland, through the Michigan Department of Natural Resources (Project No. 26-71-00025). From 21 June until 12 August, a crew of seven students under the direction of the author, excavated 2100 square feet of the site, with a concentration in the stratified areas of the site; an effort to determine the limits of the occupation was also pursued. The second season's crew included P. Fisher, J. Kimball, J. Burdick, C. Nern, N. Nowak, B. Reed, and J. Tordoff. These field workers were occasionally supplemented by visitors; Dr. Cleland was present for most of the field season. A preliminary report on the second season's work was prepared for the Michigan Department of Natural Resources (Lovis and Cleland 1971).

Glacial Geology and Topography

Discussion of the geologic glacial sequence in the Grand Traverse and Mackinac Straits region relating to aboriginal occupation of the area commences with the glacial substage known as the Valders Maximum. At this time the water levels of both Lake Michigan and Lake Huron rose to an elevation of 605 feet a.s.l. forming Early Lake Algonquian (Kelley and Farrand 1967: 14-15). Retreat of the Valders ice mass ca. 11,000 B.P. freed the area, at which time resultant rises in lake level back up to the

605 foot level submerged the coastal regions with waters of glacial Lake Algonquian. The fossil beaches of glacial Lake Algonquian are visible in Charlevoix County both inland from the present Lake Michigan shoreline and on Lake Charlevoix; they generally attain an elevation of about 690 feet a.s.l. as a result of isostatic rebound. Following this Algonquian high-water stage of ca. 9500 B.P., continued retreat of the Valders ice margin freed the Trent Lowland of Georgian Bay. The Michigan basin drained via the Straits of Mackinac into the Huron basin, and then out the sea level drainage at North Bay, eventually reaching the low-water Lake Chippewa stage. During the drop from Lake Algonquian to Lake Chippewa-Stanley, a number of brief, dropping lake stages are recorded by fossil beaches. These "upper group" beaches are not visible in the immediate vicinity of the O'Neill Site, although several beaches of this group occurred at elevations ranging between 540 and 390 feet a.s.l. Finally, Lake Chippewa-Stanley reached its lowest level of 230 feet a.s.l. ca. 9500 B.P.

Throughout the post-Valders sequence the land was rebounding from the removal of the weight of the ice, with rebound taking place along a generally north to south axis. Crustal rebound terminated the drainage of Lake Chippewa-Stanley by raising the level of the North Bay outlet above water level which initiated a renewed rise in water level. The impounded waters rose until the levels of the old outlets (St. Clair River and Chicago) were reached, at which point they stabilized at an elevation of 605 feet a.s.l. Drainage also continued through the North Bay outlet until, once again, rebound lifted it above lake elevation. Lake Nipissing, as this 605 foot stage is called, reached its maximum at about 4200 B.P. In the Charlevoix area this stage is represented by fossil beaches at elevations of ca. 610 to 612 feet a.s.l. Continued drainage through the

southern outlets caused down-cutting of the glacial till in the St. Clair River, dropping the lake level to 595 feet a.s.l., the Algoma stage.

The current topography of the O'Neill Site area suggests that from as early as post-Algonquian upper group times, the Inwood Creek drainage area was a series of rolling and sometimes steep dunes. A similar situation was apparent at the Mt. McSauba Site north of Charlevoix, where steep dunes were the only indication of the Nipissing lake stage (Charles E. Cleland, personal communication). Furthermore, the Archaic Inwood Creek Site (southeast of the O'Neill Site) seems to have been located on a sandy Nipissing stage beach. During modern times and as early as the Nipissing stage, these dunes ran parallel to the beach, occasionally cut by either wind or water eroded gullies formed at right angles to the shoreline. The stratified portions of the O'Neill Site attest to the presence of a similar situation as late as A.D. 1500, while the occupied areas to the east of Inwood Creek corroborate these observations.

Soils and Vegetation

The O'Neill Site is geographically positioned within what Cleland (1966: 5, Fig. 1, p. 6) characterizes as an ecological transition zone between the Carolinian and Canadian biotic provinces (Dice 1943). Despite its position at a microenvironmental interface, however, the transition zone itself retains a distinct identity due to diversity of the overlapping communities it contains. This identity has been described as an ecötonal or edge effect (Odum 1965: 278) and is quite visible in the natural communities within which the O'Neill Site is located.

Soil surveys of Charlevoix County were undertaken during the years 1940 and 1949 under the cooperative auspices of the Agricultural

Experiment Station, Michigan State College of Agriculture and Applied Science, Conservation Institute; the Soil Science Section, United States Department of Agriculture, Division of Soil Survey; and the Bureau of Agricultural Economics. Unfortunately, a report of their survey was never published. A County soil map and key are available for inspection, however, and the information presented here is drawn from these sources (Schneider 1949).

Within 1 mile of the Lake Michigan beach, moving inland, one rapidly crosses three soil zones which run almost parallel to the shoreline. The stabilized dunes on which the O'Neill Site is located are dominated by Eastport and Bridgman sands. These well-drained soils, which generally occur on hilly slopes with a gradient of 15 per cent, presently support a second-growth vegetation of aspen, white birch, oak, jack pine, and some hardwoods (Schneider 1949: 10). As one moves further inland, high-water table soil associations are rapidly encountered, in particular the Carbondale muck-Rifle Peat association and the Detour loam-Munuscong loam association. Both of these soil associations are generally found on slopes of less than 3 per cent. The former presently supports second-growth black spruce, white cedar, ash, elm, balsam fir with tamarack (Schneider 1949: 9), while the latter is predominantly second-growth aspen, black spruce, white cedar, and balsam, although some elm, ash, and hemlock also occur. Moving to higher elevations these soils finally grade into an Emmet loam-Onaway loam-Detour loam association which occurs on hilly areas with less than 7 per cent gradient but which contain occasional, short escarpments. Second-growth forest cover in these areas includes aspen, sugar maple, elm, ash, with some white pine, hemlock, black spruce, cedar, and balsam (Schneider 1949: 3).

The above soil and vegetational associations indicate that the O'Neill Site is located at a modern microenvironmental interface and that the inhabitants had access to a variety of faunal and floral resources. Isleib's analysis of the composition of the presettlement forests in Emmet, Charlevoix, and Antrim Counties (n.d., Map 1) also supports this contention for the primary vegetation. Her data, drawn from the original county surveyor's notes, demonstrate that the O'Neill Site was located at the juncture of three microenvironmental zones. North of Inwood Creek and bordering the shoreline, the plant community was composed of cedar, tamarack, and hemlock with some spruce, fir, black ash, alder, and white pine. To the south of the creek, the coastal flora consisted of hemlock with white pine and elm, while the interior supported a community of sugar maple, beech, and hemlock with minor amounts of white pine, elm, basswood, birch, ironwood, and cherry.

This diversity of floral communities illustrates the variability present in an ecotonal area. The area of the O'Neill Site may be generally described as a mixed forest due to the mosaic effect evident in both the primary and secondary communities. That human habitation occurred in these extant microenvironments cannot be merely fortuitous but must be viewed as a maximization of potential subsistence with respect to edge area diversity.

Fauna

As a result of the transitional nature of the environment on which the O'Neill Site is located, an interesting admixture of mammalian fauna may be observed. These have been described by Burt (1954: 1957), Cleland (1966), and Dice (1925). For the transition zone between the Canadian and

Carolinian biotic provinces Burt (1957: 3) indicates 16 northern species with their southern limits in the ecotone, while 17 southern species have northern ranges in the area. Today, only 28 species are found in the transition zone (c.f. Fitting 1966: 143-144). Conspicuously absent from the modern lists are some larger Canadian mammals such as the elk and moose.

The relative abundance of avian fauna in Charlevoix County may in part be due to its location along a minor tributary of the Mississippi Flyway (Hawkins 1964: 185, 187). Van Tyne (1923) and Wood (1951) list 118 species that occur in modern times in the vicinity. Of these, the number of available game birds has varied through time both in respect to the species utilized by various inhabitants of the site and those which might be included in modern game lists. This will be explored more fully in the faunal analysis. In recent years some migratory aquatic species have wintered in the area. Local informants claim that this phenomenon is due to the increased amounts of open water made available by Coast Guard vessels during winter months.

The availability of aquatic resources is dependent on the interplay of a number of variables. Water temperature, depth, gravel spawning-bed availability, direction and speed of currents, and the availability of both mollusks and plankton are some of the major factors to be considered. In terms of these variables the O'Neill Site and adjacent Lake Michigan shoreline bear a remarkable resemblance to the lacustrine environment described by Brose (1970a: 13-15) for Summer Island.

The shallow Antrim Low Shoretype (Humphrys, et. al. 1958: 1), with its sand and gravel bottom, has a water surface temperature ranging between 15 and 16 degrees centigrade (Ayers, et. al. 1958: 21). Surface currents move slowly in a north northeast direction out of Grand Traverse Bay (Ayers, et. al. 1958: 30). Even these slow currents are probably moderated by the shoal areas surrounding Fisherman's Island (Fig. 5), thus sheltering the bay into which Inwood Creek drains. These factors, coupled with an abundance of small, distinctly northern mollusks that play an important part in the diet of bottom-feeding fish such as sturgeon (Walker, 1896: 96-97), encourage an abundance of those species preferring shallow, protected coastlines with sand and gravel bottoms. It should be noted, however, that rocky, unprotected, but shallow, shores occur both north and south of Inwood Creek.

In summary, the O'Neill Site lies in a rather rich natural area. The ecotonal vegetation provides a variety of microhabitats for terrestrial mammals, while both the aquatic and avian fauna supplement these resources starting in the early spring. Peak resource availability would therefore occur in the late spring and early summer with the return of migratory waterfowl and the beginning of the spring spawn.

Climate

The popularity of the Charlevoix area as a summer resort is the product of many natural factors. Aside from obvious variables such as its proximity to Lake Michigan and its location on the inland lakes, its moderate climate is also an appealing and desirable asset. Data recorded at the Charlevoix weather station (U.S.D.A. Yearbook of Agriculture 1941: 727-728, 914-924) for the years 1899-1938 indicate that radical extremes in temperature occur but generally the climate is rather moderate. For example, the maximum temperature recorded for these years was 99 degrees F., while a minimum of minus 33 degrees F. was recorded. The average January temperature was a not too extreme 21.7 degrees F., rising to a moderate 68.2 degrees F. average during July. Snow cover, however, generally remained for a minimum of 120 days, a product of the 70 inches of snow that falls annually. Average annual precipitation is 28.47 inches.

In striking contrast to the morainic interior, the coastal plain on which Charlevoix is situated enjoys a long growing season of 157 days. Wagner (n.d.) indicates a probability of 100 per cent for a 120 day season, the sufficient minimum for corn agriculture (Yarnell 1964: 136). A primary natural variable responsible for this situation is the wind direction during the growing season, which is predominantly from the north and west, thus dealing a major moderating lake influence on the coastal areas.

Descriptions of Excavations

Survey

With the initiation of excavations at the Archaic component of the O'Neill Site, a point of origin for the superimposed Cartesian grid system was chosen. This center point, designated NO/EO, was located on the northern periphery of the site area, atop a raised knoll free of short vegetation which allowed sightings to take place with a minimum of brush clearance. From the origin a north-south and a east-west transect were laid out utilizing a surveyors' transit, stadia rod, and 100 foot engineer's tape. Ten-by-ten foot excavation units encompassed by the grid were shot in from these transects and designated by the location of their southwest stake in relation to the center of the grid. Thus, a unit whose southwest corner was located 30 feet south of the origin and 20 feet west was labeled unit S30/W20. When investigation of the Late Woodland component was begun, the north-south transect was extended north to the beach, with surveyor's stakes placed at 50-foot intervals, again using the methods stated above. Since the N350 stake fell in the center of the known site area, a second east-west transect was shot from this point with surveyor's stakes located at 10-foot intervals along the line. Once again excavation units were labeled according to their distance and location from the origin. All Late Woodland component excavations, however, were located north of the center reference stake.

The O'Neill Site was mapped with a transit and stadia rod while excavations were in progress, utilizing several stations whose elevations above lake level were recorded during both the 1969 and 1971 field seasons. Their true elevations were then calculated from tables provided by the Water Level Section, United States Lake Survey, for Lake Michigan.

Excavation Strategy and Artifact Recovery

Testing procedures carried out during the 1969 field season at the O'Neill Site were concentrated in two areas of the site, one deeply stratified and the other bearing a number of cultural features as well as portions of a large structure. Preliminary analysis of the recovered materials posed a number of questions which it was hoped could be answered by further excavation. Due to the lack of surface evidence in the form of artifacts or soil features, many of these questions were still of an exploratory nature.

1. What are the limits of the occupation area?
2. What are the intrasite relationships of the cultural strata?
3. Are the cultural strata products of single or multiple occupations?

4. Was more than one structure present at the site; if so, how many more?

5. How did activity areas relate to the structures?

Generally, these problems were investigated through a tripartite strategy. Problem 1 was handled by a systematic testing operation parallel to the shoreline between Lakeshore Drive and the beach and was carried out in a manner that tested both the ridges and gully areas of the site. Supplementary core samples were also performed to extend these test investigations. Clarifications of problems 2 and 3 were accomplished through the placement of a 5-by-60 foot linear block connecting the stratified and unstratified parts of the site as well as through a continuation of block excavation in the deeply stratified zones. The last two questions were approached by continuing investigations in the structure and feature bearing portions of the occupation. All of these operations were hindered by the heavy vegetation present over some parts of the site which at times dictated the placement of excavation units.

Sampling of the site was accomplished with excavation of 5-by-5, 5-by-10, and 10-by-10 foot excavation units, while vertical controls within the units were dependent on both the stratigraphic sequence and the thickness of each stratum. Humus zones were removed in one unit, unless it exceeded 0.3 feet in depth, in which case another level was begun. Arbitrary 0.3-foot levels were utilized in the sandy subsoil below and between occupation zones.

As each vertical provenience unit was closed within a given unit, depths were recorded for all corners. In the case of sloping or uneven occupation floors, depths were recorded for all discontinuities. The base of each level and the top of all occupation zones, were troweled clean, and color positive 35 mm slide photographs were taken. The cleaned and photographed floor was then mapped; all color differences, hearths, pits, and postmolds were plotted on square sheets. In the case of discrete occupation strata, all artifacts on the floor were plotted and photographed in situ.

Cultural features such as hearths and refuse areas were collected as separate provenience units. Half bushel samples of soil, or smaller but proportional-sized samples, were collected from these features and subjected to flotation. Pottery and flint concentrations were plotted and excavated as features, although no float sample was collected. Soil stains suspected of being post molds were cross sectioned to sustain their validity and, when verified, were recorded on the square sheet for that level. Upon reaching sterile layers, the walls of all units were cleaned, troweled, and photographed, after which they were drawn in detail with a line level, plumb bob, and engineer's tape. All excavated soils except for flotation samples were screened through $\frac{1}{4}$-inch hardware cloth, and each unit was terminated when no more cultural materials were gathered.

All excavation was performed according to the above criteria until sterile sands or gravels were encountered. Various units were subsequently excavated to much greater depths as a check on premature termination of the square. Additional data was collected in the form of soil samples and pH tests from widely varied parts of the site. The soil samples are still in the process of being analyzed.

During the 1969 field season, 1750 square feet of the site was excavated by six people in a four week period. In 1971 a crew of eight excavated for eight weeks to remove 2100 square feet of earth. A total of 3850 square feet of site area, therefore, was excavated to an average depth of three feet. Thus, only slightly less than one man hour was expended for the excavation of 3 cubic feet of site area.

Stratigraphy and Dating

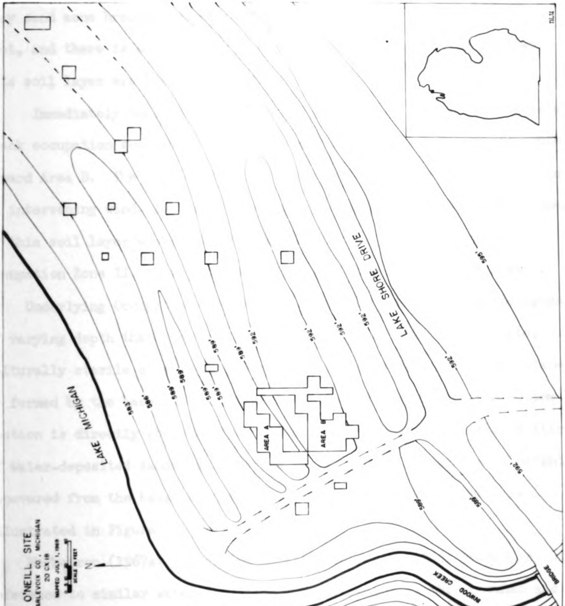
The stratigraphy of the O'Neill Site did not allow surface collection of cultural materials in areas other than disturbed secondary road cuts that penetrated cultural soil strata. Additionally, the shape, depth, and thickness of the various soil zones changed consistently across most of the occupied parts of the site. A single stratified occupation sequence was located within the block excavation labeled Area A (Fig. 6), while the part of the site called Area B had predominantly undifferentiated occupational strata. Test Pit investigations revealed both stratified but unoccupied areas near the lakeshore and undifferentiated occupations for excavations further inland. Radiocarbon dates from Area A and Area B, coupled with the artifactual material, allow us to reconstruct the depositional sequence on the parts of the site most intensively utilized by the Late Woodland inhabitants.

Area A

Due to the stratification of cultural layers revealed in Area A, this part of the O'Neill Site presents us with a more complicated depositional record than excavations on other parts of the site. Overlying parts of Area A are loose, wind-blown sands which have not yet become stabilized and which cover the forest floor with up to 0.5 feet of still active sands. This sand layer did not bear artifactual material. Therefore, this layer was shoveled off until the buried humus zone was exposed. The deep gray humic zone, which was composed of loamy sands ranging between 0.3 feet and 1.0 feet in thickness, graded gently upward from an elevation of 588.5

Figure 6

Map of the O'Neill Site Showing the Location of Excavation Units


O'NEILL SITE
CHARLEVOIX CO., MICHIGAN
20 CX 18
MAPPED JULY 1, 1969
SCALE IN FEET
LAKE MICHIGAN
LAKE SHORE DRIVE
AREA A
AREA B
BRIDGE
583'
586'
589'
592'
595'

feet a.s.l. to 590.5 feet a.s.l. Aboriginal materials and European trade items recovered from this layer have been comparatively dated to the late seventeenth century, although some modern cultural remains also occur. This soil layer was designated Occupation Zone I. The east part of Area A differed slightly in the deposition of this occupation stratum. A light gray sand zone branches downward from the humus zone to a depth of 1.0 feet, and there is an intervening sand stratum that separates the two. This soil layer was labeled Occupation Zone Ib.

Immediately beneath the humus zone on the west part of Area A is a black occupation zone which lenses out and disappears as one moves south toward Area B. The same cultural stratum on the east part of Area A has an intervening wind-blown sand stratum separating it from the humus zone. As this soil layer was followed across the site, it was designated Occupation Zone II. This surface was essentially level across Area A.

Underlying Occupation Zone II is a layer of water-layed white sands of varying depth that contain thin black laminae. This intermediate, culturally sterile stratum is a plano convex in profile; the upper plane is formed by the base of Occupation Zone II, and the bowl-shaped bottom section is directly above another occupation stratum. The interpretation of water-deposited sands is supported by the eroded appearance of ceramics recovered from the basal occupation stratum. The above sequence is illustrated in Figure 7A.

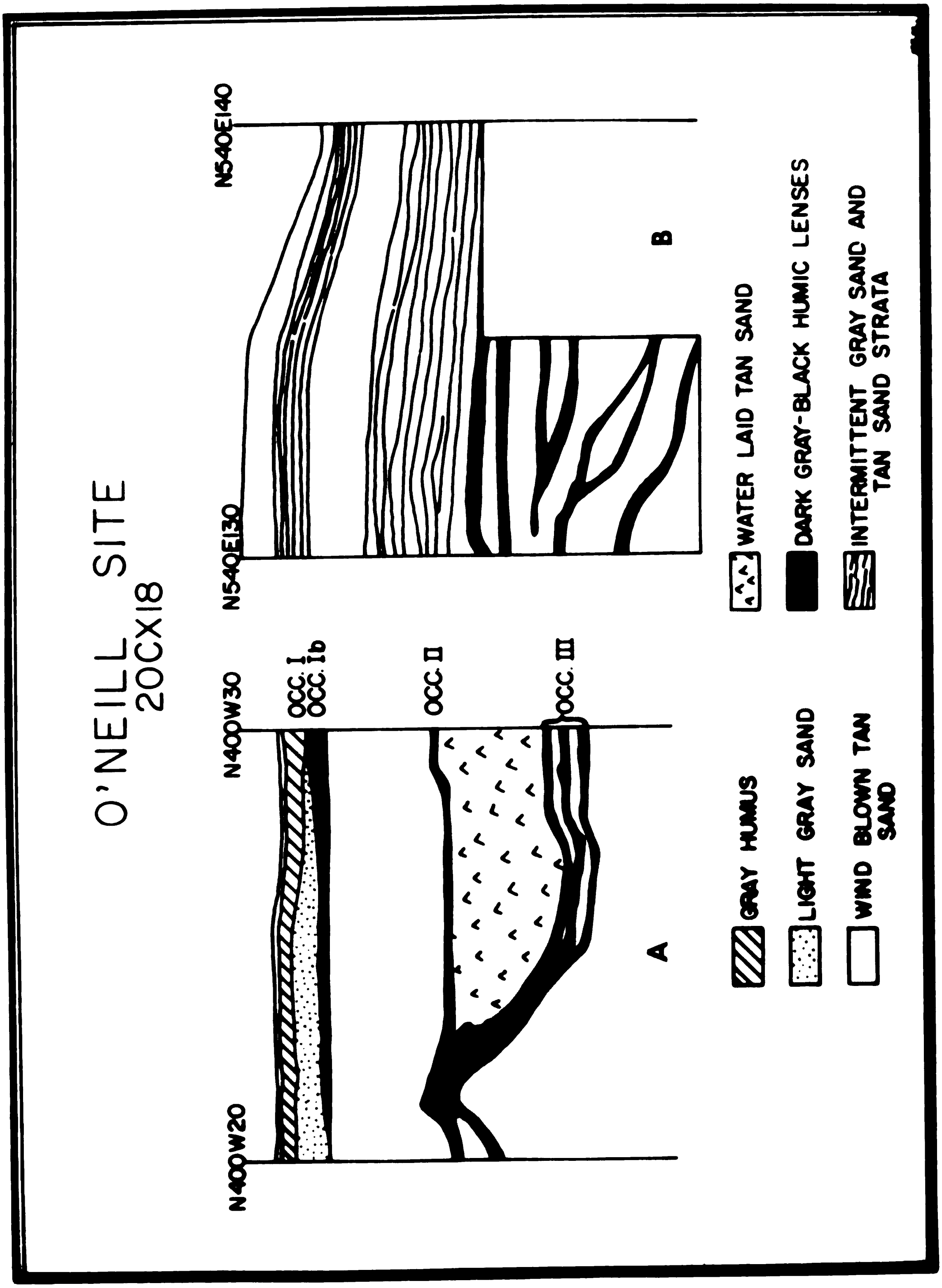
McPherron (1967a: 34, citing Wright) and Mason (1966: 50-52) in reference to similar water-deposited sand phenomena at the Juntunen and Mero Sites attribute this to storm beaches rather than a major rise in lake levels. This is one explanation. A second explanation, which may well be unique to the O'Neill Site, would pertain to current occurrences

Figure 7

Stratigraphic Profiles of the O'Neill Site

A - Stratigraphy of Area A

B - Typical Stratigraphy of Lakeshore Test Pits


O'NEILL SITE
20CX18
N400W20
N400W30
OCC. I
OCC. Ib
OCC. II
OCC. III
A
N540E130
N540E140
B
GRAY HUMUS
LIGHT GRAY SAND
WIND BLOWN TAN SAND
WATER LAID TAN SAND
DARK GRAY-BLACK HUMIC LENSES
INTERMITTENT GRAY SAND AND TAN SAND STRATA

that might possibly have had a prehistoric analog. Throughout both season's excavations at the O'Neill Site, the outlet of Inwood Creek into Lake Michigan was observed to shift almost daily, an occurence dependent on wind direction and wave action. Quite often the outlet is small with a sluggish water flow. In this event, a backwater pond forms, always in the same area, a hollow behind the beach crest. Even when waters are not impounded, the beach is wet and mucky. Thus, little modern utilization of this part of the beach occurs; a situation that is identical to that found in Occupation Zone II. McPherron reports similar occupation-density decreases for those occupational layers overlying the flooded parts of the Juntunen Site.

The basal occupation layer, which ranges between 0.05 feet and 0.30 feet in thickness, reflects intensive use by Late Woodland populations. This zone is actually a series of thin, gray-black sand layers that meet and diverge across the floor. Separation of discrete layers was not possible; the entire layer was designated Occupation Zone III. Two radiocarbon dates were obtained on charred wood from a hearth on this occupation floor; A.D. 1210±100 (M-2406, unpublished) and A.D. 1290±100 (M-2405, unpublished). These are compatible with artifactual material from this layer. A single date of A.D. 1115 (N-1268, unpublished) was received on charred wood from 0.3 feet below Occupation Zone II in the water-deposited sand stratum. Considering its position above Occupation Zone III, it may have been deposited by human or natural agencies or may even have been contaminated by the inundation of this strata. In either case, it is clearly not compatible with the stratigraphic position of Occupation Zone II.

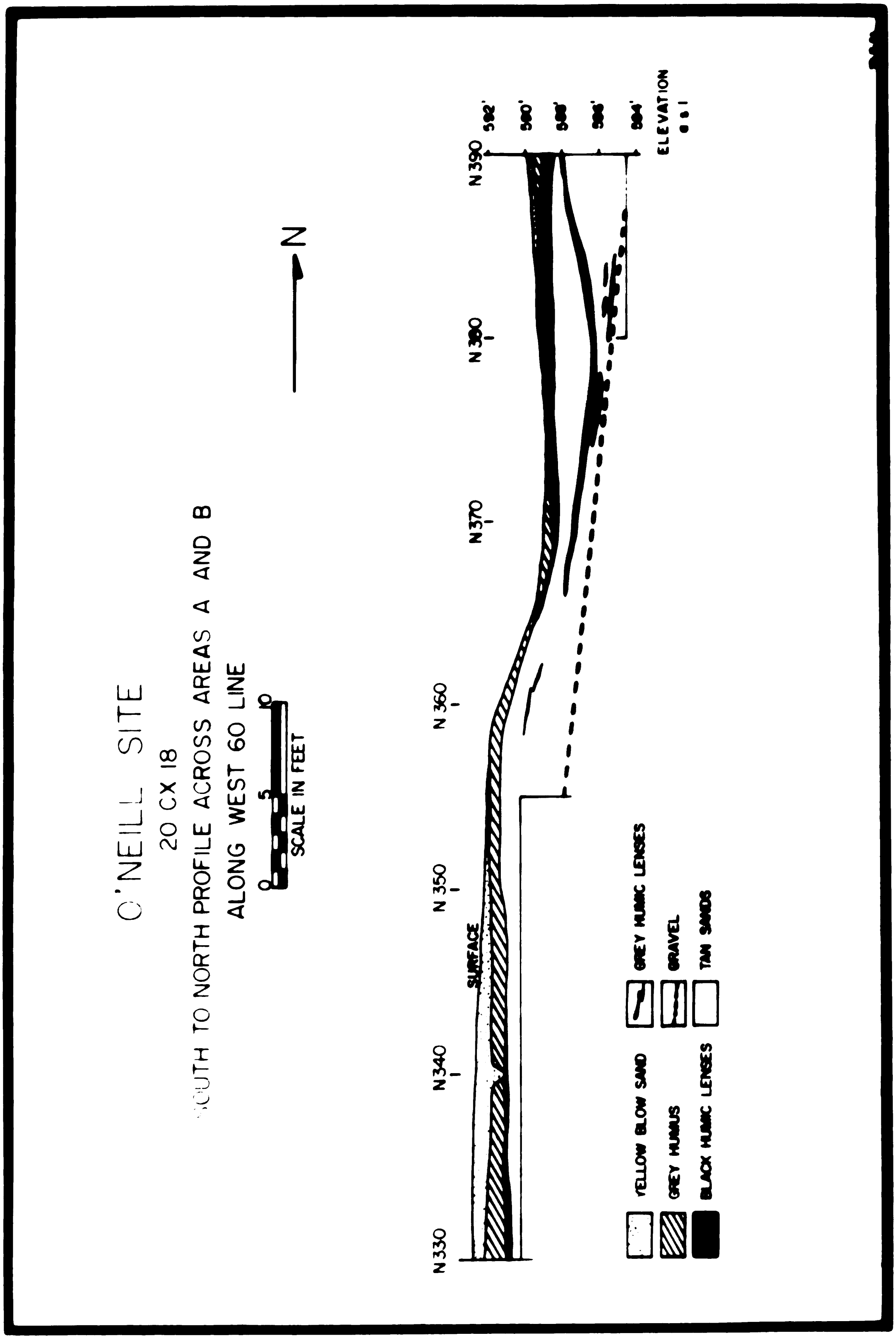
Area B

The stratigraphic sequence of Area B is essentially the same as that reported for the upper layers of Area A. An overlying layer of tan wind-blown sand, a dark gray loamy humus zone, and an underlying occupation strata of black sands rest on a yellow-tan sand subsoil. However, variations do occur. For instance, parts of the north portion of Area B do not have an occupation zone. When viewed in profile, it assumes the shape of a truncated dune crest (Fig. 8). A thin sand stratum occasionally intervenes between the base of the humus and the occupation strata on the western part of Area B. Further variation is evident in the linear profile block. Here, a second, thin gray, undulating stratum was located beneath the occupation zone, and separated by a layer of yellow-tan wind-blown sands. This lower stratum probably represents a stage of light grass cover stabilizing the back beach dunes.

Radiocarbon determinations were obtained on two of the above layers, the occupation zone and, indirectly, the basal sand layer. The latter was obtained on a hearth, Feature 3, which was isolated in the basal sands. This date of A.D. 1000±140 (M-2401, unpublished) indicates that Area B was still in an unstable dune situation until this time. Ceramic materials in the vicinity of Feature 3 corroborate the validity of the Carbon-14 date. This age of the undifferentiated occupation strata in Area B was based on a Carbon-14 date of A.D. 1455±100 (M-2398, unpublished). Stabilization of this zone had probably occurred by this time. Furthermore, this date may well correspond to the intermediate Occupation Zone II in Area A.

Figure 8

Stratigraphic Profile Across Area A and Area B of the O'Neill Site


O'NEILL SITE
20 CX 18
SOUTH TO NORTH PROFILE ACROSS AREAS A AND B
ALONG WEST 60 LINE
0
5
10
SCALE IN FEET
N
N330
N340
N350
N360
N370
N380
N390
SURFACE
592'
590'
588'
586'
584'
ELEVATION
YELLOW BLOW SAND
GREY HUMUS
BLACK HUMIC LENSES
GREY HUMIC LENSES
GRAVEL
TAN SANDS

Test Pits

Two types of stratigraphic variation were recorded for various test pits placed to the east of our block excavations at the O'Neill Site. Most of our investigations encountered a humus, occupation, yellow-tan sand sequence similar to that recorded in Area B. As we moved toward the beach, however, more complex stratigraphy and fewer occupational debris became apparent. A typical profile from these test pits is presented in Figure 7B.

Several differences may be seen between the strata in Area A and the outlying test pits. First, groups of thin gray sand strata separated by tan blow sand are present in the position of the humus zone. No water-laid sand layers were exposed. Major buried humus zones were first recognized at a depth of about 2.0 feet. Explanation of the thin, gray sand strata groups are based on observations of the site during autumn and winter. During the fall, the grass cover on the dune-forest edge becomes covered with leaves, and the grasses die and begin to decompose. Winter snowcover then buries these organic materials. Then sand, blown from the exposed beach, covers the snow. As the spring thaw melts the snow, this sand cover is deposited on top of the dead organic materials from the preceding year, thus sealing the stratum. As time passes, some of these layers merge, as suggested by the increasing thickness of the layers as one excavates deeper. Occasional major deposits of wind-blown sand are attested to by the upper soil layers illustrated in Figure 7B. We could not accurately correlate the deeper humus zones from these beach excavations with either inland test pits or the Area A and Area B excavations. We can, however, state that a complex history of dune migration, stabilization, and the repetition of these two phenomena occurred until the modern forest became established. Further research which may clarify this situation might employ a back hoe to transect the site from Lake Shore Drive to the beach.

Depositional History

The depositional history of the O'Neill Site is a story of dune formation through both wind and water action with the ultimate stabilization of the dunes caused by these natural factors. At about A.D. 1000 those parts of the site called Area B were partially stabilized sand floors, bordered on the lakeward side by deep, grass-covered dunes running parallel to the beach. Occupation of Area B and to some extent Area A during this period of unforested succession is demonstrated by occupational debris on these floors. Sometime prior to A.D. 1200, some further stabilization of the dune gullies exposed in Area A took place. At this time a series of occupations of both Area A and Area B occured. Following the stabilization and utilization of this part of the site, Area A was inundated by either unusually high water stages, possibly caused by storm activities or impounded waters due to the inhibited outflow of Inwood Creek into Lake Michigan. As water-laid sand layers accumulated, this low area of the beach was not used by the prehistoric inhabitants; when reoccupation did begin, it was still very limited. This second series of occupations in Area A was covered by a layer of wind-blown dune sands. By the fifteenth century, however, Area B had stabilized and was reoccupied along with Area A. The dune crest separating these parts of the site was still subject to wind action which prohibited stabilization and the formation of a discrete occupation strata. Continued occupation of the site, combined with deposits of sand and organic materials, covered the earliest humus zone with a modern sand loam.

This process of sand deposition and stabilization still occurs; in Area A at least, the final stages of stabilization took place during the seventeenth century, when the site was visited by Historic Indian groups.

CHAPTER 2

CERAMICS

The 3850 square feet of the O'Neill Site which was excavated over the course of two field seasons yielded 9194 ceramic fragments. These materials were analyzed in the laboratory in a number of different ways. Separation of the sherds into gross categories based on the presence or absence of decoration and whether or not it was a rim fragment was the first step in the process; this group included 777 sherds. These sherds were then sorted and combined until, with reasonable certainty, we had combined all sherds representative of single vessels; the result was a minimal vessel count of 80. The body sherds were treated in a somewhat similar fashion. Initial stages in the processing of these materials were to sort out all those sherds too fragmented or too weather worn to discern surface preparation. This excluding process left a sample of body sherds which could be classified on the basis of the amount and type of surface texturing. All of the resultant subdivisions were counted and weighed, and mean sherd weights by excavation area and Occupation Zone were calculated for both the identifiable and unidentifiable sherds. These data are presented in Table 1. Few body sherds could be linked with rims and decorated sherds due to the rather striking similarities in surface treatment among the different vessels in the sample.

No evidence of coiling was present in the sample studied. Manufacture was probably done by patching or through a paddle and anvil technique. There were no repair holes in any of the sherds, and only five minimal vessels displayed any cooking residue on the interior of the rim. Tempering particles other than crushed granite were not present in this

TABLE 1.
BODY SHERD FREQUENCY, WEIGHT, AND MEAN WEIGHT BY AREA AND OCCUPATION ZONE AT THE O'NEILL SITE

Excavation Area and Occupation Zone		Smooth	Sandy	2-4 Cord	4-6 Cord	6-8 Cord	Fabric	Smoothed	Undet. Imp.	Unident.	Total
Area A Occupation Zone I	Count	1	25	0	0	0	0	117	0	357	500
	Weight	2	110	0	0	0	0	529	0	203	844
	X Weight	1.0	4.1	---	---	---	---	4.5	---	0.6	1.7
Area A Occupation Zone II	Count	0	53	63	0	0	4	259	0	750	1129
	Weight	0	262	209	0	0	24	2124	0	2482	5101
	X Weight	---	4.9	3.3	---	---	6.0	8.2	---	3.3	4.5
Area A Occupation Zone III	Count	1	49	36	0	0	36	388	1	717	1228
	Weight	5	174	188	0	0	175	2029	10	956	3537
	X Weight	5.0	3.6	5.2	---	---	4.9	5.2	10.0	1.3	2.9
Area B	Count	16	122	96	9	1	19	829	5	2521	3618
	Weight	91	521	510	44	9	130	4127	20	3471	8923
	X Weight	5.7	4.3	5.3	4.9	9.0	6.8	5.0	4.0	1.4	2.5
Test Pits	Count	0	57	36	24	47	64	146	1	1567	1942
	Weight	0	60	90	72	98	166	464	5	1162	2117
	X Weight	---	1.1	2.5	3.0	2.1	2.6	3.2	5.0	0.7	1.1
TOTALS	Count	18	306	231	33	48	123	1739	7	5912	8417
	Weight	98	1127	997	116	107	495	9273	35	8274	20522
	X Weight	5.4	3.7	4.3	3.5	2.2	4.0	5.3	5.0	1.4	2.4

sample. Due to the lack of cooking residue it is quite possible that most of the vessels with which we are dealing were used for storage or water containers and not food preparation.

Body Sherds

Assignment of all the 8417 (20,522 gm) body sherds from the O'Neill Site to individual vessels was not accomplished during the ceramic analysis for a number of reasons. Primary among these was the inability to determine surface treatment for 5912 (70.2 per cent) of the body sherds in the sample; these sherds either had been broken into fragments too small to distinguish surface treatment, had had their surfaces eroded through wind or water action, or had exfoliated along lines of cleavage longitudinal to the sherd's axis. Further, those vessels from the O'Neill Site that were restored gave indications that many combined two or three surface techniques; thus, all smooth sherds did not necessarily belong to only one or two vessels. Exceptions to the above treatment included those body sherds recovered from ceramic features; these sherd groups were restored as completely as possible. Our working sample, therefore, included 2505 sherds weighing 12,248 gm which were complete enough to discern types of surface finish.

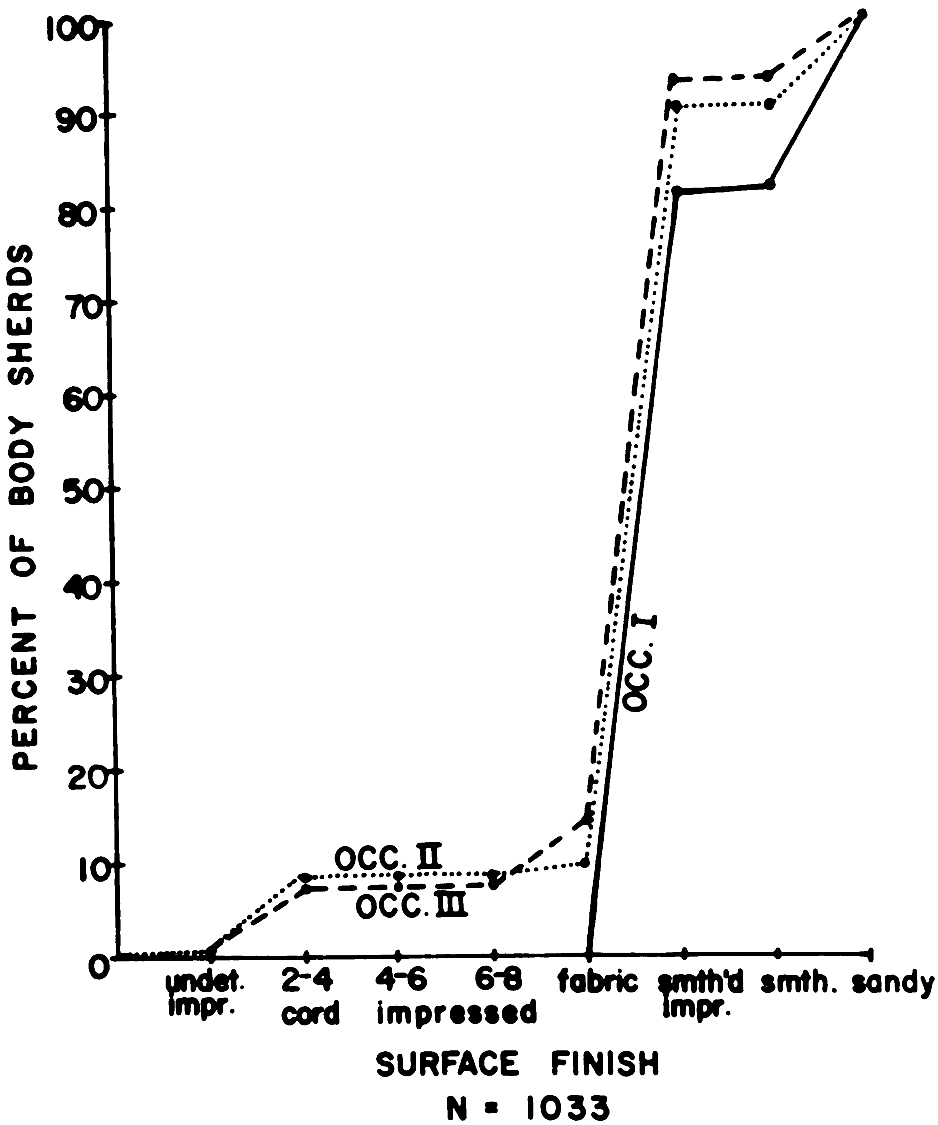
The body sherd sample was then subjected to individual examination and grouped into one of nine categories: (1) undetermined impressed -- including those sherds with either cord or fabric impression but which could not be distinguished between the two (c.f. Quimby, 1961); (2) fabric impressed; (3) smoothed impressed -- those sherds having either cord or fabric surface treatment which was subsequently obliterated by smoothing; (4) smooth; (5) sandy -- including those sherds that were both smooth and had adhering granules of sand; and (6-9) cord impressed. In an attempt to define temporal and spatial differences in the use of cordmarking at the O'Neill Site, this latter category was further subdivided into class intervals of 2.0 cord impressions per centimeter of surface area. The coarsest of these class intervals, 0.1 - 2.0 impressions per centimeter, contained no sherds.

Following the formal division, the body sherd sample was grouped by Area and Occupation Zone, using both the number of sherds and their weight in grams. Since both of these techniques conformed closely when percentages were calculated, it was arbitrarily decided that graphic descriptions would utilize the number of sherds rather than their weight. This not only provided uniformity but omitted unnecessary duplication.

Cumulative frequency graphs were then calculated for the stratified portion of the site; Area A, including the three occupation zones; Area B, the unstratified block excavation; and the grouped Test Pit data. From the graph comparing the Area A occupations (Fig. 9), it is evident that the preferred types of surface finish for both Occupation II and Occupation III are proportionally similar; this includes minor quantities of coarse cord impressing, fabric impressing, and sandy finish, while smoothing is the dominant surface finish technique for both. The rather close alignment of the graphic curves shows little if any difference in the proportional occurrence of the above body sherd surface preparation. A striking difference, however, is noted in the curve representing Occupation I. Neither cordmarking nor fabric impressing are present in the body surface finish inventory, while 82.5 per cent of the sherds were smoothed and the remainder sandy. Restored vessels from the O'Neill Site indicate that the sandy finish sherds are in all likelihood from the

Figure 9

Cumulative Comparison of Body Sherd Frequency in Area A of the O'Neill Site

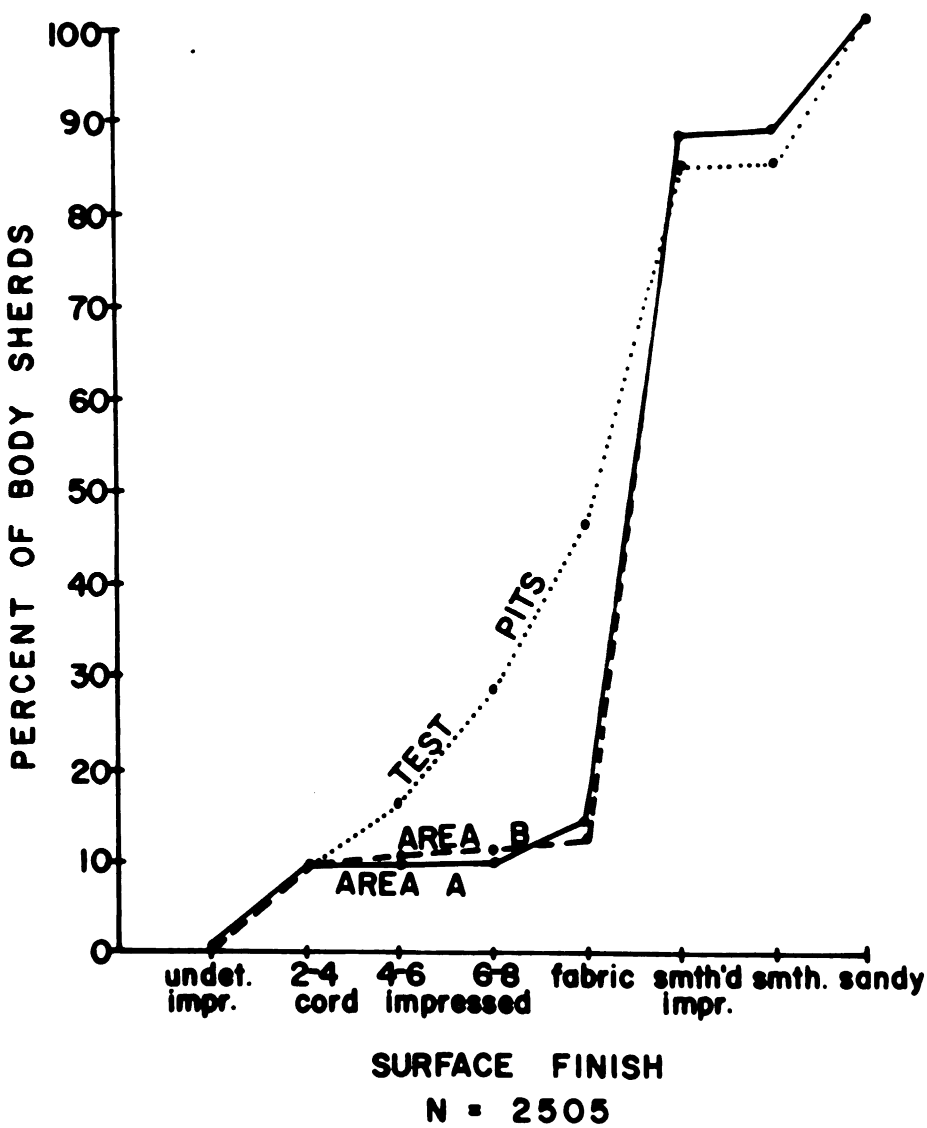

PERCENT OF BODY SHERDS
100
90
80
70
60
50
40
30
20
10
0
OCC. II
OCC. III
OCC. I
undet. impr.
2-4 cord
4-6 impressed
6-8
fabric
smth'd impr.
smth.
sandy
SURFACE FINISH
N = 1033

bottoms of vessels; these are a product of placing still plastic, finished vessels on the sand to dry, thus obliterating any prior treatment of the basal parts of the vessels. This may explain the minimal occurrence of this sherd type throughout all temporal and spatial groups on the site. On the other hand, they may also represent partially eroded smooth sherds, although the uniformity of the finish would tend to negate this inference.

In an attempt to determine either patterned similarities or differences in the distribution of body sherd surface treatment over the area of the O'Neill Site excavations, a second cumulative frequency graph for grouped data from all three areas of the site was calculated (Fig. 10). In this case as well a rather close alignment of two of the curves was noted; those for Area A and Area B, and once again a smoothing of prior cord or fabric impression predominated in the style pool. A divergence, however, was noted for the grouped Test Pit data. The curve indicates that on this part of the site, at least, fine cord impression and fabric treatment were more popular than on other parts of the site. Explanation of this phenomena may take the form of a temporal hypothesis. In Area A we noted that unmodified impressions on body sherds dropped out of the style pool with the most recent occupation, an occupation that was associated with European trade items, while the earlier utilizations of this area had minimal but higher frequencies of unmodified impressed surface treatment. Therefore, those occupations of the site that produce higher frequencies of unmodified impressed body sherds may be earlier in the occupational sequence of the O'Neill Site. This hypothesis, that the use of smoothing increases through time, will be tested in the following portions of the ceramic analysis.

Figure 10

Cumulative Comparison of Body Sherd Frequency at the O'Neill Site


PERCENT OF BODY SHERDS
100
90
80
70
60
50
40
30
20
10
0
TEST PITS
AREA B
AREA A
undet. impr.
2-4 cord
4-6 impressed
6-8
fabric
smth'd impr.
smth.
sandy
SURFACE FINISH
N = 2505

Formal Analysis and Description

The 777 ceramic sherds from the O'Neill Site that were either rimsherds or bore decoration other than the body surface treatment described in the preceding section, when sorted and combined, comprised portions of a minimum of 80 vessels represented by 723 sherds; the remaining 54 decorated fragments could not be linked with either rimsherds or other decorated sherds in the sample. Within the 80 minimal vessels recovered from our excavations, 29 were represented by single sherds or sherds too small to enable us to discern the decorative sequence on the rim. The working sample, therefore, included 51 vessels complete enough that most, if not all, exterior decoration was apparent and which made formal classification feasible.

Three factors controlled the handling of the O'Neill Site ceramic analysis; the rather small size of the sample, the high degree of internal heterogeneity, and our ability to apply prior ware, type, and variety designations to the sample. Initial attempts to derive type-key diagrams to explain positive and negative covariation among and between attribute groups met with little success. Resultant low frequencies for both observed and expected values at those divergent node levels which would define the formal attribute clusters gave little confidence in the utility of this form of analysis for the sample at hand. Thus, little statistical credibility would have ensued from this approach, and it was abandoned. In view of the above, the following formal discussion relies on extant ceramic typologies which could be applied to the ceramic sample with little hesitancy. _Ex post facto_ use of quantitative analysis of formal attributes displayed by the types and varieties resulting from the classification was not performed; this would only have demonstrated that other analysts' formal systems, whether quantitative in orientation or otherwise, were indeed based on observed attribute combinations.

The format of the following discussion will be ordered sequentially from early to late ceramic ware groups within the study area. Attributes such as vessel color and hardness will not be discussed. Although ranges for both oriface diameter (in centimeters) and collar length are mentioned, we are hampered by the small sample size in determining if these attributes behave in a regular fashion. Profiles of the various wares described are found in Figures 13, 15 and 21 and may be referred to as each is encountered in the text. A single, provisional, new ceramic type has been named; hopefully, this type will be useful in other analyses of Late Woodland ceramic samples in the Upper Great Lakes. The category "Unclassifiable" includes those rim fragments which were large enough for most of the decoration to be visible but which do not fit any of the extant descriptive and formal categories, while the "Other" category is reserved for the sample of 29 small rims and fragments which could not be classified because of a lack of visible decoration.

Mackinac Ware

Mackinac Ware from the O'Neill Site was represented by the types Mackinac Undecorated and Mackinac Punctate (McPherron 1967a: 88). The 118 sherds recovered could be grouped into a minimum of seven vessels. Within both the Mackinac ceramic sample and Skegemog Ware sample (to be discussed in the following section), there was a great deal of internal style heterogeneity. To do justice to the ceramic sample an individual description of each vessel should be included; for the sake of brevity, however, this has been avoided. As a whole, the Mackinac Wares from the O'Neill Site did not display the extreme eversion of the rim common to the type site on Bois Blanc Island, nor did the T-shaped or splayed lip profiles occur. Exterior bevels, flat, and rounded lip profiles did occur (Fig. 13). Lip decoration occurred in three cases, all oriented transverse to the axis of the lip. In one instance, the lip decoration was the impression of a sharp-edged tool, while the two remaining were decorated with finely wound, cordwrapped stick impressions. The lip on one vessel was formed by the upper edge of an applique strip applied at right angles to the upper rim; this was subsequently decorated. Surface preparation other than unmodified cord or fabric impression was present on only two rims, both of which were slightly smoothed.

Exterior decoration, in the form of punctates, was present on three vessels. A single example of double-row motif was visible, decorated with closely spaced rectangular punctates (Fig. 11A). Both vessels possessing single row motifs had the impressions placed close to the lip, one with circular punctates oriented at an angle toward the lip (Fig. 12B) and the other with deep, wedge-shaped punctates which raised interior bosses (Fig. 12A). Oriface diameter varied between 8.0 cm and 24.0 cm.

Pottery assignable to the Mackinac Phase has constituted portions of the ceramic samples from a number of Late Woodland sites in the Upper Great Lakes. Other sites in Charlevoix County which yielded similar materials are the Charlevoix City Park Site, Pine River Channel Site, and the Eagle Island Site. Likewise, the Wood Site, the Wycamp Creek Site (Lovis, n.d.a.), and the Ponshewaing Point Sites, located in Emmet County, Michigan, also have varying proportions of Mackinac ceramics in the pottery sample. However, in all of the above cases sharply everted rims with splayed lips occur, whereas these attributes are absent from the sample of these wares at the O'Neill Site. A single site reported by

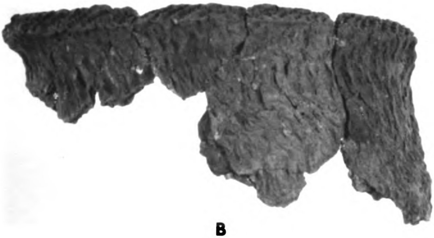
Figure 11

Mackinac Ware From the O'Neill Site

A - Mackinac Punctate

B - Mackinac Undecorated

A



B

Figure 12

Mackinac Ware From the O'Neill Site

A-B -- Mackinac Punctate

C-E - Mackinac Undecorated

A

B

C

D

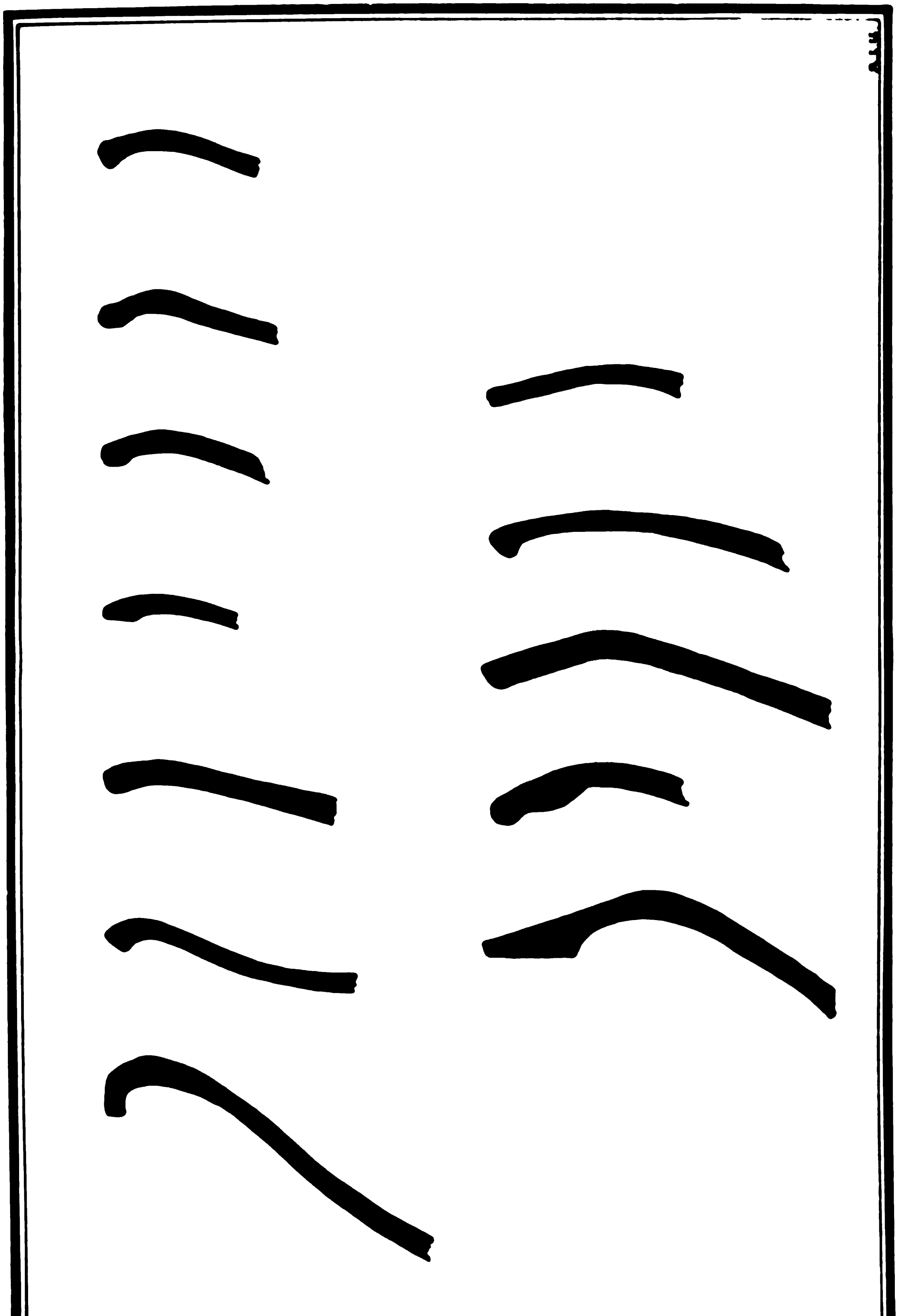
E

Figure 13

Rim Profiles

Upper Row - Mackinac Ware

Lower Row - Skegemog Ware



L. Griffin on Black Lake in Cheboygan County, the Eisen Site (1963: 73-78), seems to be solely a Mackinac Phase occupation site. Scattered materials from Fort Michilimackinac bear close similarities to the Juntunen Site Mackinac Ceramic sample (Lovis and Mainfort, n.d.; Maxwell 1964), while a newly tested site to the west of the stockade proper seems to be early Late Woodland as well (Lyle M. Stone, personal communication). Other than the type site on Bois Blanc Island, the Juntunen Site, Mackinac ceramics have been reported by Janzen (1968: 56) from the Naomikong Point Site, where three types occur. Ranging farther afield, both Wobst (1968: 259-262) and Bigony (1970: 209-210) report Mackinac ceramic materials from the Saginaw River drainage system.

Dating of the Mackinac Phase within the study area is supported by a series of radiocarbon dates from the O'Neill Site, the Juntunen Site, the Pine River Channel Site, and a possibly related date from the Wood Site. A single early phase date of A.D. 1000± 140 (M-2401, unpublished) from Area B at the O'Neill Site may pertain to either the Mackinac or Skegemog occupations of this part of the site. It falls within the range of dates on Skegemog Wares from the Skegemog Point Site of A.D. 900±120 (M-1865; Crane and Griffin 1968), as well as dates on the Juntunen Site Mackinac Phase strata of A.D. 835±75 (M-1142; Crane and Griffin 1961) and A.D. 910±75 (M-1141; Crane and Griffin 1961). A preferred corrected date from the Mackinac Phase site at Pine River Channel is slightly later, A.D. 1110±80 (N-1266, unpublished). Although predominantly Juntunen Phase relationships are seen in the Wood Site ceramic sample, a low frequency of Mackinac Wares and a radiocarbon date of A.D. 1020±120 (M-2057, unpublished) would argue for this date pertaining to the scattered Mackinac component. Thus, a range of ca. A.D. 800 to A.D. 1200 may be argued for the Mackinac ceramics within the study area.

Skegemog Ware

Skegemog Ware is a classificatory name applied to a ceramic group from the type site of Skegemog Point, located in Grand Traverse County, Michigan. Within the stated ware grouping Cleland (n.d.) defined three types; Skegemog Straight Rim, Skegemog Collared, and Skegemog Curled Rim. Two of these types were present in the ceramic sample from the O'Neill Site, the Collared and Straight Rim variants. To avoid duplication, both the ware and type descriptions of the original sample will be omitted. Our discussion of the ware at O'Neill will, however, make use of the descriptions found in Cleland's (n.d.) Skegemog Point Site report and examination of the collections from this site housed at the Michigan State University Museum.

The two Skegemog Collared vessels are represented by 19 rim and neck sherds; both are collared as the name implies. Lip profiles are round and square, respectively (Fig. 13), while both possess a single band of widely spaced, oblique punctates applied with a rough or notched-ended rectangular tool (Fig. 14A, D). One example has a border below the primary band composed of closely spaced impressions thought to be the corner of the tool utilized in applying the punctates. Surface preparation was obliterated by smoothing prior cord or fabric impressions in both cases. Lip decoration consisted of oblique cordwrapped stock and linear plain tool impressions. Rim eversion was moderate, although in one case it appears more extreme due to the thickness and wedge shaped profile of the collar. Diameter of the orifaces was 24 cm and 20 cm.

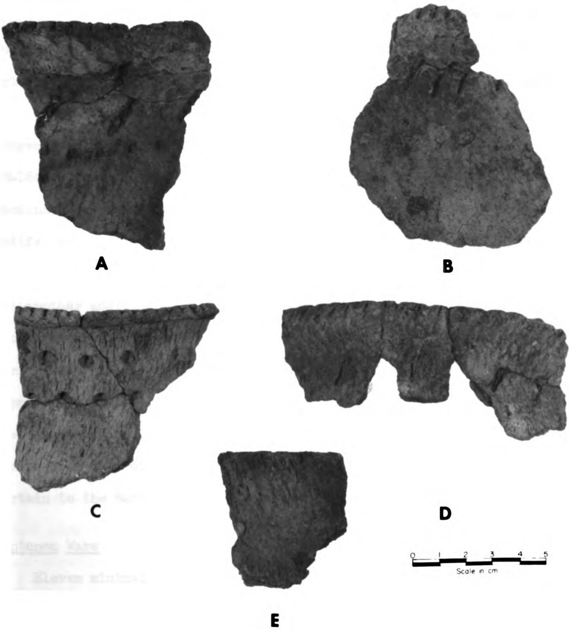
Fourteen rim and neck sherds resulted in a minimum count of three Skegemog Straight Rim vessels (Fig. 14B, C, E). All three display only slight eversion of the rim. No smoothing of the cord impressed surfaces

Figure 14

Skegemog Ware From the O'Neill Site

A, D - Skegemog Collared

B, C, E - Skegemog Straight Rim


A
B
C
D
E
0 1 2 3 4 5
Scale in cm

was accomplished, which in two cases consisted of vertically aligned cordwrapped paddle impressions of 4 per cm, while the remaining vessel was fabric impressed. Lip profiles were either exterior beveled or flat, decorated with cordwrapped stick or paddle impressions. Interior decoration existed on one vessel in the form of vertical cordwrapped stick impressions. Exterior decoration was applied in horizontal bands of punctates, the latter either circular or rectangular with an oblique orientation. One example of a double horizontal band motif was present.

The only date on Skegemog Ware was recovered from the type site at Skegemog Point, which resulted in a preferred date of A.D. 900±120 (M-1865, Crane and Griffin 1968). Similarities between Skegemog Wares and Mackinac Wares, with the exception of collaring and the use of decorative motifs in the former, argue for contemporaneity with both the latter as well as Wayne Ware ceramics and Spring Creek Wayne variants. Thus, they are another addition to a strikingly homogeneous array of early Lake Woodland ceramics from the western Great Lakes. Similarly, their internal variability is also extreme. The above radiocarbon determination would support their coevality with the Mackinac ceramic series discussed in the preceding section. The sample from O'Neill might well be dated by the radiocarbon date of A.D. 1000±140 (M-2401, unpublished) which could also pertain to the Mackinac Wares from the site.

Juntunen Ware

Eleven minimal vessels were assigned to the Juntunen Ware category (McPherron 1967: 111-116). Two of the three types recognized by McPherron were present in the O'Neill Site ceramic sample; Juntunen Linear Punctate and Juntunen Drag and Jab.

Juntunen Linear Punctate was defined by seven vessels composed of 155 sherds. All are characterized by slightly everted rims with flat lip profiles and collaring (Fig. 15). None were castellated. Collars ranged from 2.1 cm to 3.0 cm in height. Surface preparation of the upper rim area prior to decoration was either smooth or a smoothed over paddle impression; the initial use of cord or fabric could not be determined. Primary decoration varied in two manners within the sample. The dominant decorative motif, present on five vessels, was a series of diagonals confined between the lip and the base of the collar (Fig. 16, 17A-B, 18C). In each case this primary band was bordered by a horizontal band of widely spaced punctates. All but one of these diagonal motif vessels was decorated with a round ended tool aligned in closely spaced punctates; the exception was decorated with loosely twined linear cord impression (Fig. 18B). Only one vessel shows secondary decoration in the form of obliques running in the opposite direction to the primary motif (Fig. 17B). Lip decoration varied from vessel to vessel, including linear cord applied transversely, oblique cordwrapped stick, unmodified paddle impressions, and smoothed paddle impression. Interior decoration was present only on the vessel with secondary motif. This decoration was applied in the same manner as on the exterior, but the motif was a vertical zig zag. The remaining two vessels were both decorated in horizontal bands, one with a paddle edge (Fig. 18A), the other with a plain tool impression (Fig. 18D). Lip decoration on both consisted of a transverse linear cord, while the interior decoration on both were composed of vertical impressions, one with cordwrapped stick, the other with plain tool.

Four of the Juntunen Linear Punctate vessels were recovered from datable strata in Area A, Occupation Zone III. The dates bracketing this

Figure 15

Rim Profiles

Juntunen Ware

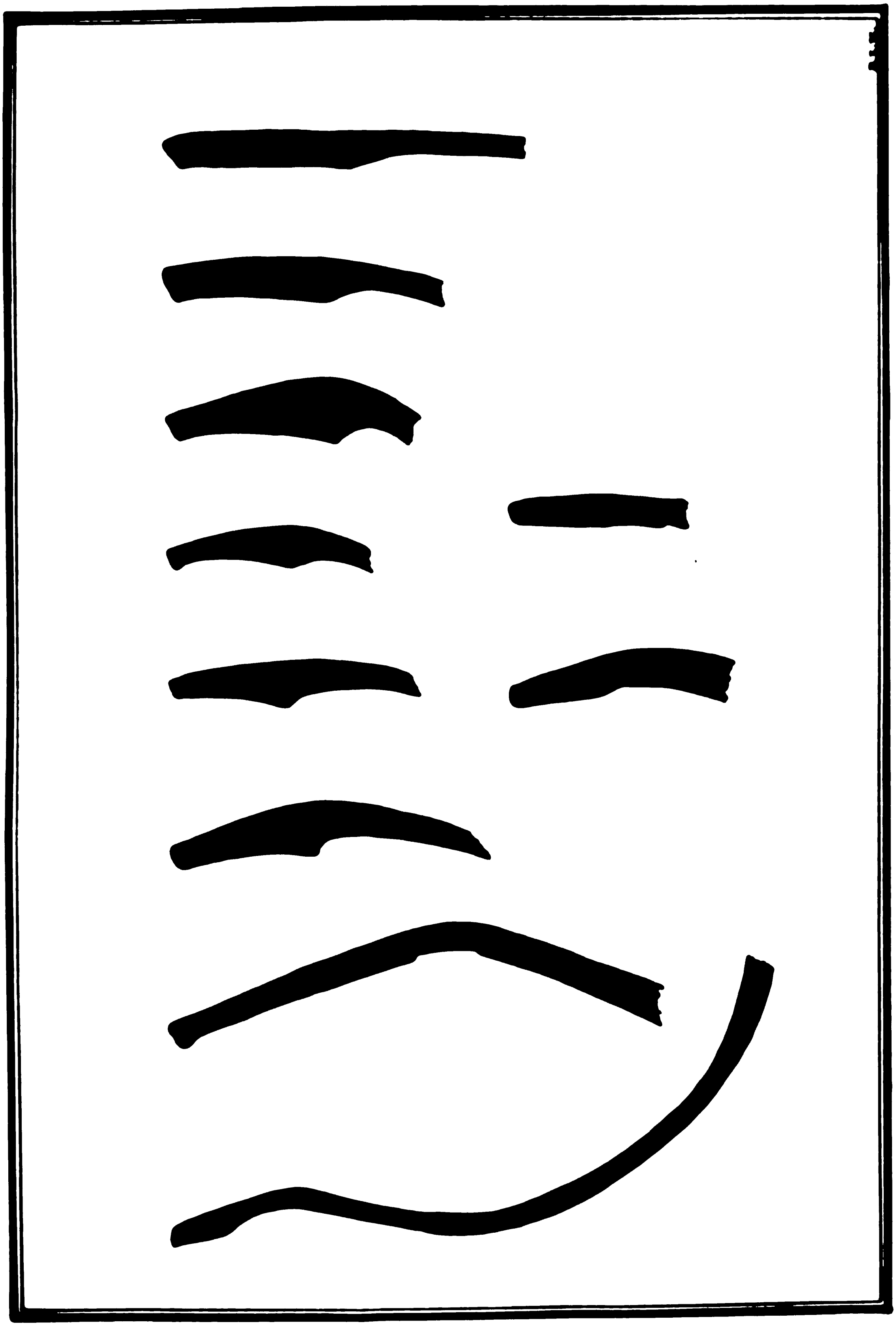


Figure 16

Juntunen Ware From the O'Neill Site

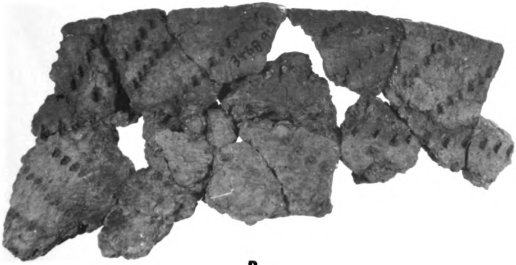
Restored Juntunen Linear Punctate Vessel

Figure 17

Juntunen Ware From the O'Neill Site

A-B - Juntunen Linear Punctate
(Note secondary decoration on B)

A

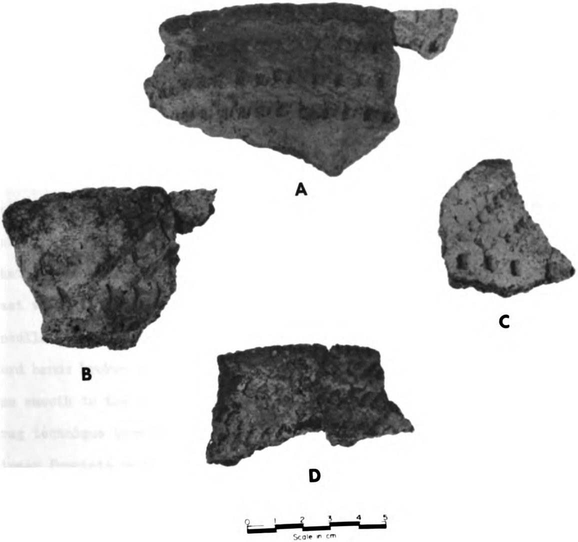


B

Figure 18

Juntunen Ware From the O'Neill Site

A-D - Juntunen Linear Punctate


A
B
C
D
0 1 2 3 4 5
Scale in cm

occupation, A.D. 1210±100 (M-2406, unpublished) and A.D. 1290± (M-2405, unpublished), are compatible with, and inclusive within, the range for these ceramics at the Juntunen Site (McPherron 1967: 112).

The four remaining vessels within the Juntunen Ware classification were of the type Juntunen Drag and Jab. Two were only slightly collared and two were not collared. The square or flat lips on these ceramics were decorated in a variety of techniques: transverse plain tool impression, transverse cordwrapped stick, and paddle impressed. Both vessels decorated in a true drag and jab manner were castellated, with chevron motifs breaking the horizontal bands at the castellation (Fig. 20A). These vessels were also decorated with a plain tool on the lip, although only one had a series of linear plain tool impressions on the interior of the rather straight rim. Also decorated in a stab and drag fashion, uncollared, and castellated, was a vessel that did not have the chevron interrupting motifs (Fig. 20B). Interior decoration was a duplicate of that on the exterior, except for the wider spacing of the punctates. The last vessel in this group was a large, elaborately decorated pot that was uncollared, castellated and decorated with numerous horizontal twisted cord bands broken by chevrons at the castellations (Fig. 19). This vessel was smooth to the shoulder and had a secondary motif executed in stab and drag technique terminating at the shoulder. Mouth diameters for the Linear Punctate vessels ranged between 21.5 cm and 32 cm, while the same measurement for the Stab and Drag sample ranged between 20 cm and 28 cm.

Intersite ceramic relationships are present between a number of sites both within and outside the study area. Dating of these materials, however, is dependent on the O'Neill Site and Juntunen Site radiocarbon sequences. Sites in Charlevoix County which have produced Juntunen Ware

Figure 19

Juntunen Ware From the O'Neill Site

Restored Juntunen Drag and Jab Vessel
(Note secondary decoration on shoulder)

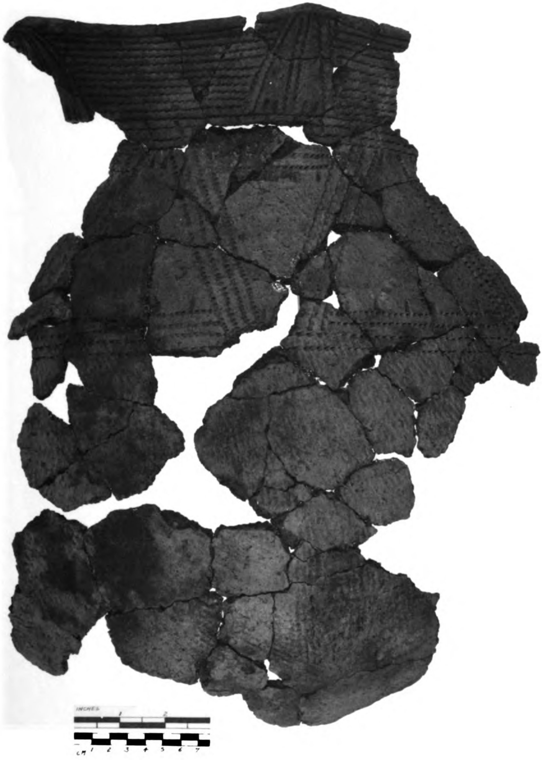
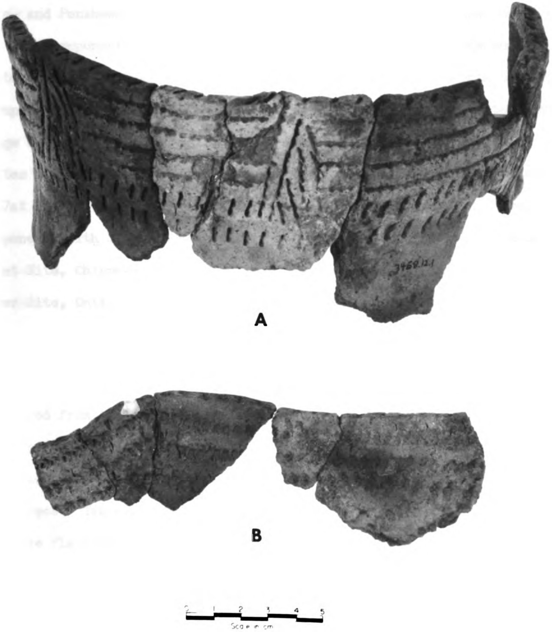

INCHES
1
2
CM 1 2 3 4 5 6 7

Figure 20

Juntunen Ware From the O'Neill Site

A-B - Juntunen Drag and Jab


A
B
0 1 2 3 4 5
Scale in cm

ceramics include the Eagle Island Site on Walloon Lake. Three sites in Emmet County, Michigan, also had small Juntunen Phase components, none radiocarbon dated; the Wood Site, near Seven Mile Point, the Wycamp Creek Site, and Ponshewaing Point Site on Crooked Lake. These occupations are all multicomponent sites. Both Juntunen Linear Punctate sherds and Juntunen Stab and Drag sherds were recovered from the thirteenth century occupation zone of Area A. The former type has been assigned a temporal range between A.D. 1070 and A.D. 1330 at the Juntunen Site, while the latter reaches a peak of popularity at that site ca. A.D. 1300 (McPherron 1967a: 112-115). Outside the study area, two undated Juntunen Phase components with Stab and drag decoration were present at the Naomikong Point Site, Chippewa County, Michigan (Janzen 1968: 56), and the Pic River Site, Ontario (Wright 1966: 62-63; McPherron 1967a: 116).

Traverse Wares

As in the case of the Skegemog Wares, the sample of Traverse Wares recovered from the O'Neill Site excavations are described in reference to a group of ceramics from the Skegemog Point Site, Grand Traverse County, Michigan. This ware category, as defined by Cleland (n.d.), consists of four types: Traverse Scalloped, Traverse Pinched, Traverse Punctate, and Traverse Plain or Undecorated. All of the named types were present in the O'Neill Site ceramic sample. One of the primary discriminating attributes of Traverse Wares is the presence of horizontal bands, or zones, of varying width that are characterized by different surface preparation on the upper rim prior to the application of decoration. Thus, moving sequentially from rim to shoulder, a number of variations are possible: (1) smooth-unpatterned paddle impressions; (2) patterned paddle impressions; (3) smooth-unpatterned paddle impressions; (4) patterned paddle impressions-unpatterned paddle impressions; (5) smooth-smoothed over paddle impressions, and so on. Decoration, whether it be some form of tool or finger impressions, may then be placed (1) at the juncture of different bands of surface preparation, (2) below a patterned band, or (3) on an intermediate band. All but one of the Traverse Ware vessels from the O'Neill Site display the above attribute criteria.

Seventy-six rim and neck sherds were grouped into a minimum of 18 vessels; nine Traverse Punctate, six Traverse Undecorated, and one each of Scalloped, Pinched, and Aberrant. The sample of Traverse Punctate vessels (Fig. 22A) comprised of 47 rim and neck sherds exhibits all of these patterned body surface preparation. All nine vessels were slightly everted, almost straight, with flat or squared lip profiles (Fig. 21). Lip decoration in three cases is transverse linear cord impression, three plain tool impressed, one cordwrapped stick, one cord paddle, and one is obliterated. Smoothing of the lip was performed subsequent to application of this decoration. Exterior decoration was in the form of one or two horizontal bands of punctates, applied to either a smooth area or to the juncture between different zones of surface preparation. Punctate shape varied considerably and included square, rectangular, round, and wedge-shaped tool impressions, as well as deep-looped cord impressions. The latter is not a common form of decoration for this type. Only one vessel had interior decoration: a series of vertical plain tool impressions in a single horizontal band. A slight thickening of the upper rim area was visible on three of the vessels in this type group. Rim diameter ranged from 19 cm to 24 cm.

The six Traverse Undecorated vessels (Fig. 22B-D) from the O'Neill Site were represented by 17 rim and neck sherds. Two of these are too

Figure 21

Rim Profiles

A-J - Traverse Ware

K-L - O'Neill Curvilinear

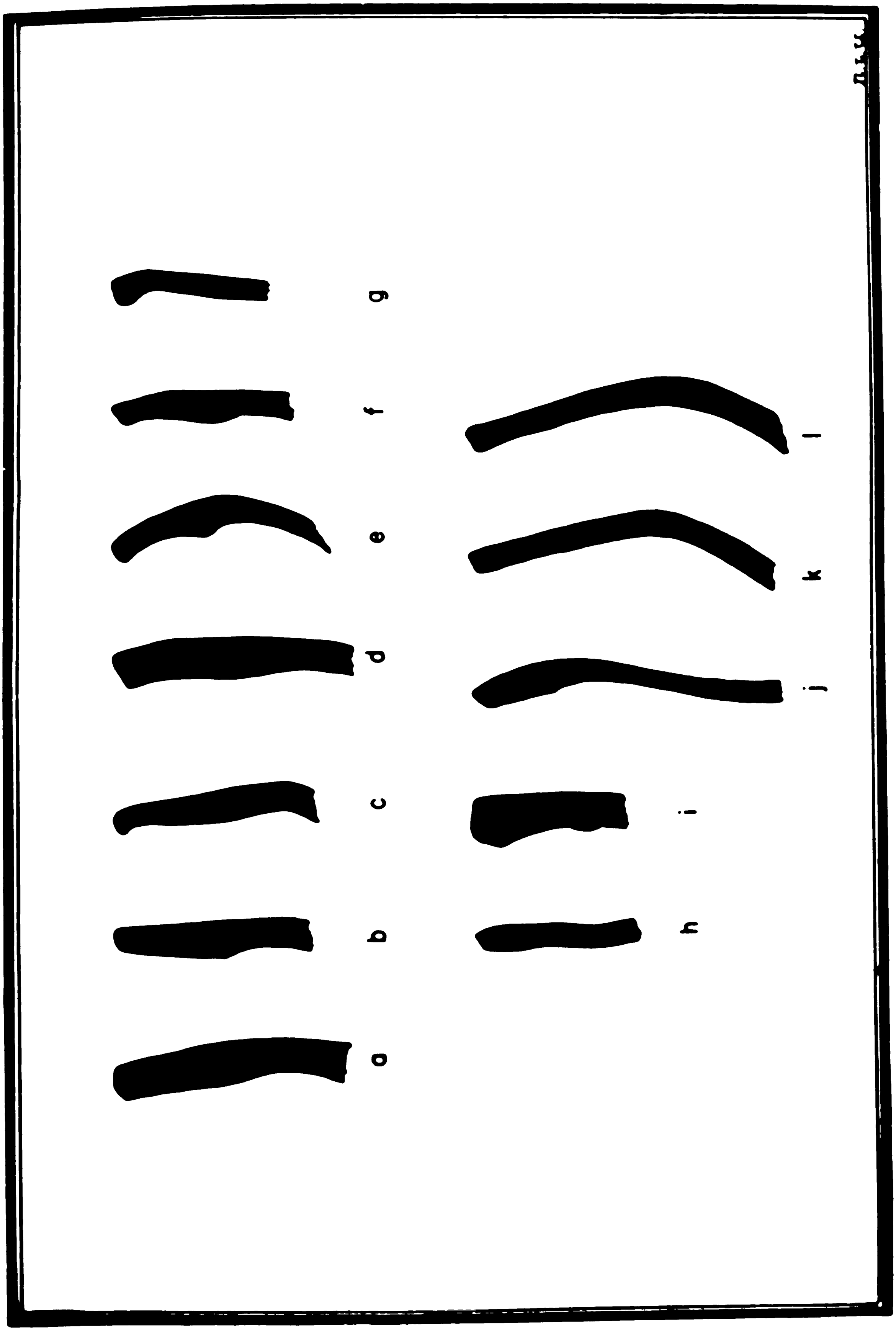

a
b
c
d
e
f
g
h
i
j
k
l

Figure 22

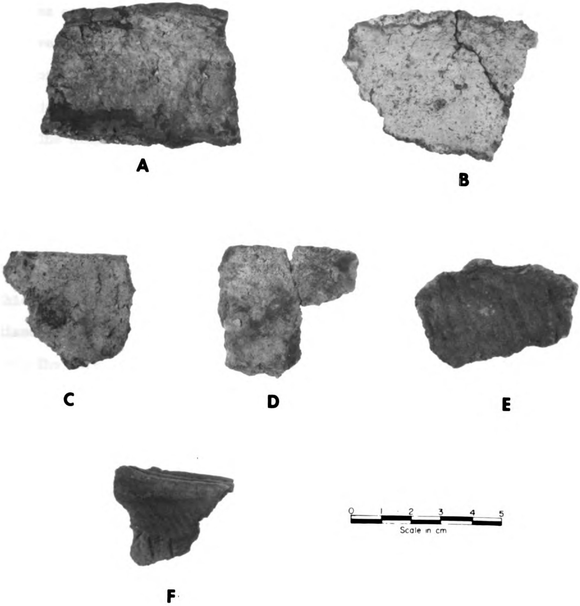
Traverse Ware From the O'Neill Site

A - Traverse Punctate

B-D - Traverse Undecorated

E - Traverse Scalloped

F - Traverse Pinched


A
B
C
D
E
F
0 1 2 3 4 5
Scale in cm

fragmented to discern the presence of differential surface preparation. The remaining five, however, display zonation as either patterned-smooth or patterned-unpatterned. Again, rim profiles are only slightly everted. All but one vessel have flat lip profiles, the exception being round. Three have smooth lips, two are decorated with plain tool impressions, and one has cordwrapped paddle impressions. No interior decoration is present, nor are there punctates, etc. on the exterior. Thickening of the upper rim, or slight collaring, is displayed by three vessels. Rim diameters ranged from 24 cm and 36 cm.

The single Traverse Scalloped rim sherd from the O'Neill Site (Fig. 22E) is too fragmentary to determine a surface preparation sequence; the upper rim is, however, patterned. Deep cordwrapped dowel (1.4 cm in diameter) impressions are the diagnostic criteria for this type. Neither interior decoration nor exterior decoration were visible, nor was any thickening of the upper rim noted. This sherd was too small for oriface diameter calculations.

The three sherds which, when combined, formed a single Traverse Pinched vessel exhibited a smooth-patterned-smooth preparation sequence (Fig. 22F). The square lip, decorated with two bands of longitudinal linear cord, curved upward to a peak or small castellation, although this modification was not completely present. Exterior decoration consisted solely of a single band of vertically oriented finger pinches applied to the smooth surface band of the upper rim; the latter is the primary diagnostic attribute of the type.

One vessel, smoothed throughout, with a square cordwrapped paddle impressed lip, was classified in the Traverse Ware group. This vessel, represented by 11 sherds, does not display surface preparation zonation.

Two bands of shallow toothed tool impressions on the slightly everted rim would perhaps indicate its affinities with Traverse Punctate. Rim diameter of this vessel is 14 cm.

The coevality of Traverse Wares with Bois Blanc Phase and Juntunen Phase ceramics is suggested by radiocarbon dates from three sites in the study area. A date of A.D. 1420±100 (M-2063, unpublished) from the Traverse occupation of the Henderson-Lamb Site may well date the most recent limits of the type. Two dates of A.D. 1210±120 (M-1863; Crane and Griffin 1968) and A.D. 1310±110 (M-1864; Crane and Griffin 1968) on Traverse Wares from the type site at Skegemog Point may well bracket their peak of popularity. These dates coincide well with a single radiocarbon determination from the Wycamp Creek Site of A.D. 1220±110 (M-2059, unpublished), which could relate to either a Bois Blanc component or a Traverse component. Traverse Wares, however, are twice as frequent as the Bois Blanc Wares from this site. Two vessels of this ware category were recovered from the thirteenth-century Occupation Zone III of Area A at the O'Neill Site. This coincides well with the earlier dates on these wares cited above. A date of A.D. 1455±100 (M-2389, unpublished) from O'Neill Site Area B is compatible with the A.D. 1420 date from Henderson-Lamb and is also within the range of Juntunen Wares. Thus a temporal span contemporaneous with the Juntunen ceramic range is not unlikely for these materials; ca. A.D. 1200 to A.D. 1500.

<u>O'Neill Curvilinear</u>

Two vessels represented by 60 sherds are a ceramic style not yet described for the Upper Great Lakes. The use of this type name should be considered provisional due to the small sample size with which we are dealing in this discussion. A conventional type description is presented in Appendix A.

The vessels were not castellated; neither were they collared nor did they possess upper rim thickening elements of any kind. Decoration consisted of three and four bands of horizontal twisted cord impressions which, intermittently and probably based on the diameter of the rim, curved upward and met the rim vertically (Fig. 23A-B). Interior decoration was not present on either vessel, and both lip profiles were flat (Fig. 21K-L). Lips were decorated with either linear punctates or a cordwrapped paddle. Beneath the primary decoration was a single horizontal band of wedge-shaped impressions which acted as a border. Surface preparation on both vessels involved the smoothing of prior paddle impressions. Eversion of the rim is moderate, while diameter of the oriface was 20 cm and 24 cm. Neither vessel could be completely restored; vessel shape is still unknown. Stylistically these two vessels could easily be an outgrowth of the Juntunen Ware series. The use of a row of punctates as a bordering device was recognized for the Juntunen Ware series (McPherron 1967a: 112), although in terms of motif the latter is linear and not curvilinear. Curvilinear motifs may possibly have arisen from the use of wavy linear motifs beneath castellations, a phenomenon that occurs both in the southeastern part of the state (Fitting 1965: 156, Plates XV, XVI), as well as near the Straits of Mackinac. In any case, its use on this type constitutes a break with the geometric motif tradition, while the continued use of horizontal linear motifs demonstrates some continuity as well.

These materials may be provisionally dated on the basis of their stratigraphic position within Area A; one vessel was recovered from Occupation Zone I and the other from Occupation Zone II. The latter was in close association with historical trade items dated to the late

Figure 23

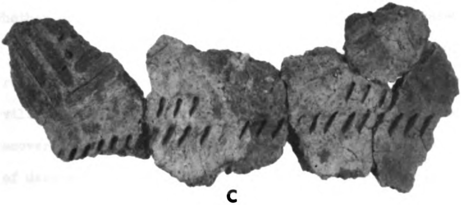
Protohistoric Ceramics From the O'Neill Site

A-B - O'Neill Curvilinear

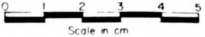
C - Incised, Chevron Motif, Unclassified

A

B



C



seventeenth and early eighteenth centuries, as well as in association with a trailed incised chevron motif vessel to be described later in this section. These vessels, therefore, post date the thirteenth century occupation of Occupation Zone III and continue until European contact. Occupation Zone II of Area A would fall between the early fourteenth century and middle seventeenth century. The A.D. 1455±100 (M-2398, unpublished) date from Area B, cited previously in reference to both Traverse and Juntunen ceramics, would fall within this time period. O'Neill Curvilinear, then, arises near the end of the peak of popularity for Juntunen Stab and Drag and Juntunen Linear Punctate ceramics and continues until contact.

Unclassified

A single vessel from the O'Neill Site, represented by 165 sherds, was decorated with a chevron motif executed by a flat tool in a trailed technique (Fig. 23C). Width of the trailing was 0.3 cm. This design is then bordered by a series of oblique punctates which occasionally become a double row, the upper a group of three, beneath the inverted V part of the motif. The lip area on this vessel is missing; we cannot therefore determine whether or not it was castellated. No collaring is present, and the surface preparation is uniformly smooth. This particular vessel was recovered from Occupation Zone I of Area A in close proximity to a single O'Neill Curvilinear vessel. No ceramics with similar styles of decoration have been recovered from other sites within the study area. Given the wide range of decorative style present during the seventeenth century among aboriginal ceramics, this vessel might well be either the product of trade, movement of people, or an experiment with something new. It is not, as seems to be the case with O'Neill Curvilinear ceramics, an out-growth of recognized precontact ceramics.

One thin, straight rimmed, undecorated vessel was partially restored from 44 rim and body sherds (Fig. 24). Recovered from Occupation Zone II of Area A, this vessel had a thin wedge-shaped lip profile with an interior bevel. The exterior surface treatment consisted of smoothed over paddle impressions, while exterior, interior, and lip decoration were completely absent. Rim diameter is 10 cm and the height is 10.5 cm. This vessel's stratigraphic position would place it either with the Juntunen or Traverse Ware ceramic series, and it has been interpreted as an undecorated utilitarian item, perhaps a bowl. No food residue was present on either the interior or exterior.

Seventeen sherds representative of two rather fragmentary vessels bore similar kinds of decoration when it could be observed in a sequential rim to shoulder manner. One possessed a slight collar and was straight rimmed, while the other was everted and uncollared. Interior decoration in both cases consisted of two rows of shallow lunar impressions probably executed with the edge of a round stick. Lip profiles were flat, and lip decoration was either linear tool impressed or a series of round punctates. Exterior decoration occurred in two bands; an upper motif of one or two rows of rectangular tool impressions. These items might broadly fit a Juntunen Linear Punctate category. The differences observed between these vessels and Juntunen Linear Punctate ceramics from the site argued against this classification. Rim diameters were about 24 cm in both cases; this is an estimate due to the shortness of the restorable rim fragments.

One vessel, partially restored from nine sherds, bore extremely unusual decoration for the Late Woodland ceramics of this area. The rim was peaked and collared. Exterior decoration consisted of four rows of dragged, oblique, toothed tool impressions reminiscent of Middle Woodland

Figure 24

Restored Unclassified Vessel From the O'Neill Site


0 1 2 3 4 5
Scale in cm

Laurel decoration. A similar technique was used to superimpose zig zag diagonal lines across the horizontal bands. A single row of similarly executed decoration was placed on the upper part of the rim interior. The flat lip was smooth, and the rim fragments were too small to calculate diameter.

The remaining 12 sherds in the sample were assigned to two vessels. One was straight rimmed, and the other was extremely everted in profile. Both had flat lips. The everted rim vessel had transversely applied twisted cord lip decoration, and interior decoration consisting of one oblique row of the same impressions. Exterior decoration was smoothed after it was applied; it might possibly have been horizontal bands of the same cord impressions, although we have speculated on the possibility of a patterned fabric impression as well. The straight rimmed vessel has a transversely notched rim, and a single band of round punctates around the upper interior rim. Exterior decoration occurs in three bands; (1) two rows of oblique toothed tool impressions applied in opposite directions to achieve a herringbone effect; (2) a band of three rows of stab drag decoration executed with the same tool; and (3) a band of diagonals below this, again applied in a stab drag fashion with the same tool. Rim diameter of the latter could not be calculated; for the former it is 20 cm.

Others

This category includes rim and decorated sherds that, when combined into a minimal vessel count, were still too small for classificatory purposes. Twenty nine of the 80 vessels recovered from our excavations were placed here.

Discussion

The O'Neill Site ceramic sample is rather typical of Late Woodland pottery industries in the northwestern lower Peninsula of Michigan. Its interest lies in the spatial distribution of related materials within the study area. The prior descriptive discussion of the ceramics was based on two typological systems, each applicable to specific ceramic samples located approximately 120 miles apart and at opposite extremes of the study area. The data support the contention that the O'Neill Site was utilized by peoples practicing both ceramic decorative systems for the duration of its occupational history. For example, those sites with comparable Skegemog Ware and Traverse Ware ceramic samples occur, for the most part, south of the O'Neill Site; these include the Fauver Site, the Henderson-Lamb Site, the Skegemog Point Site, and the Schular Site. One exception to this general rule lies in the presence of Traverse Wares from the Wycamp Creek Site in Emmet County. Likewise, ceramic relationships of the Mackinac Wares and the Juntunen Wares lie to the north, including Pine River Channel, Charlevoix City Park, Eagle Island, Woods, Eisen, Ponshewaing Point, Wycamp Creek, and Juntunen. This framework, as well, has exceptions in the occurrence of Mackinac ceramics in the Saginaw drainage area, although if the discussion is confined to the littoral between Traverse City and Mackinac City the statement holds true. No other sites within the study area show such a marked mixing of ceramics from both northern and southern ceramic traditions.

Conspicuously absent from the northern tradition was the ceramic taxa, Bois Blanc Ware, defined at the Juntunen Site. This ceramic style is a Blackduck related middle Late Woodland ware dated to between A.D. 1000 and A.D. 1200 (McPherron 1967a: 275-278). Only two assemblages within the study area included these ceramics: a small quantity from the Wycamp Creek Site, Emmet County (Lovis, n.d.a.), and what appears to be a major component at the Ponshewaing Point Site, Emmet County. Spatially, this ware is restricted to the northern third of the study area, and its absence or paucity in ceramic samples from other sites in this area may be cause for explanations other than its derivation from the Mackinac Phase. If, indeed, it is an intermediate phase, then little if any occupation of the northern part of the study area can be demonstrated for the period A.D. 1000 to A.D. 1200. On the other hand, we may be dealing with a ceramic style that leaves evidence of a short-lived penetration of the area by a non-indigenous group. Ceramic material evidence illustrates that some kind of contact was made with peoples from the Skegemog Point Site where a single Bois Blanc Braced Rim vessel (McPherron 1967: 105-107) was recovered from the excavations (Cleland, n.d.).

Intrasite distributions of both early and late ceramic ware classes were calculated by grouping sherd counts from excavation units and features from both Area A and Area B. Contour distribution maps of the various wares were then drawn, using contour intervals of 10 per cent, based on the total number of sherds assignable to that ware category. When completed, composite maps of Area A and Area B were drawn for temporally coeval ceramics, such as Skegemog and Mackinac, based on those contour lines delimiting areas which contained a <u>greater than 10 per cent</u> distribution of each ceramic ware sample. Thus, using this arbitrary contour interval, we were able to define the areas of most intense occupation for both northern and southern series ceramics, as well as the early and late subdivisions within each.

Results of the mapping procedures are illustrated in Figures 25-27. When dealing with contemporaneous groups of ceramics, a mutually exclusive pattern of space utilization is apparent. Mackinac and Skegemog Wares, are, for the most part, confined to the unstratified parts of the block excavations (Fig. 25). The encouraging mutually exclusive tendencies of these ceramic distributions were duplicated even when dealing with overall ceramic occurrence; very little spatial mixing of the components is discernible. Unfortunately, these data do little to explain the occupancy of either of the structures or to clarify which component the A.D. 1000±140 (M-2401, unpublished) radiocarbon date pertains. The feature from which the latter was obtained falls between areas of Skegemog and Mackinac ceramic occurrence and could, with equal validity, be placed with either. A low frequency, (less than 10 per cent) of Mackinac Wares was recovered from the vicinity of Structure 2, whereas no early period ceramics came from Structure 1. Structure 2 may, therefore, be part of the Mackinac Phase occupation. It is, at the least, early. The fact that a number of localized ceramic distributions are present might well be due to specialized task activity areas or because the site was used by contemporaneous peoples at slightly different times, both of whom possessed different ceramic assemblages consisting of the northern and southern groups.

In contrast, both Juntunen and Traverse ceramics display distributions which take advantage of the partially stable dune bottoms uncovered in Area A, while in Area B we maintain discrete high frequency areas with a great deal of overlap in the overall distributions (Fig. 26). The overlap occurs around Structure 1, the longhouse. This structure, therefore, is probably late, assignable to either of the above occupations.

Figure 25

Map Indicating Areas with Greater than Ten Percent Distribution of Mackinac and Skegemog Wares

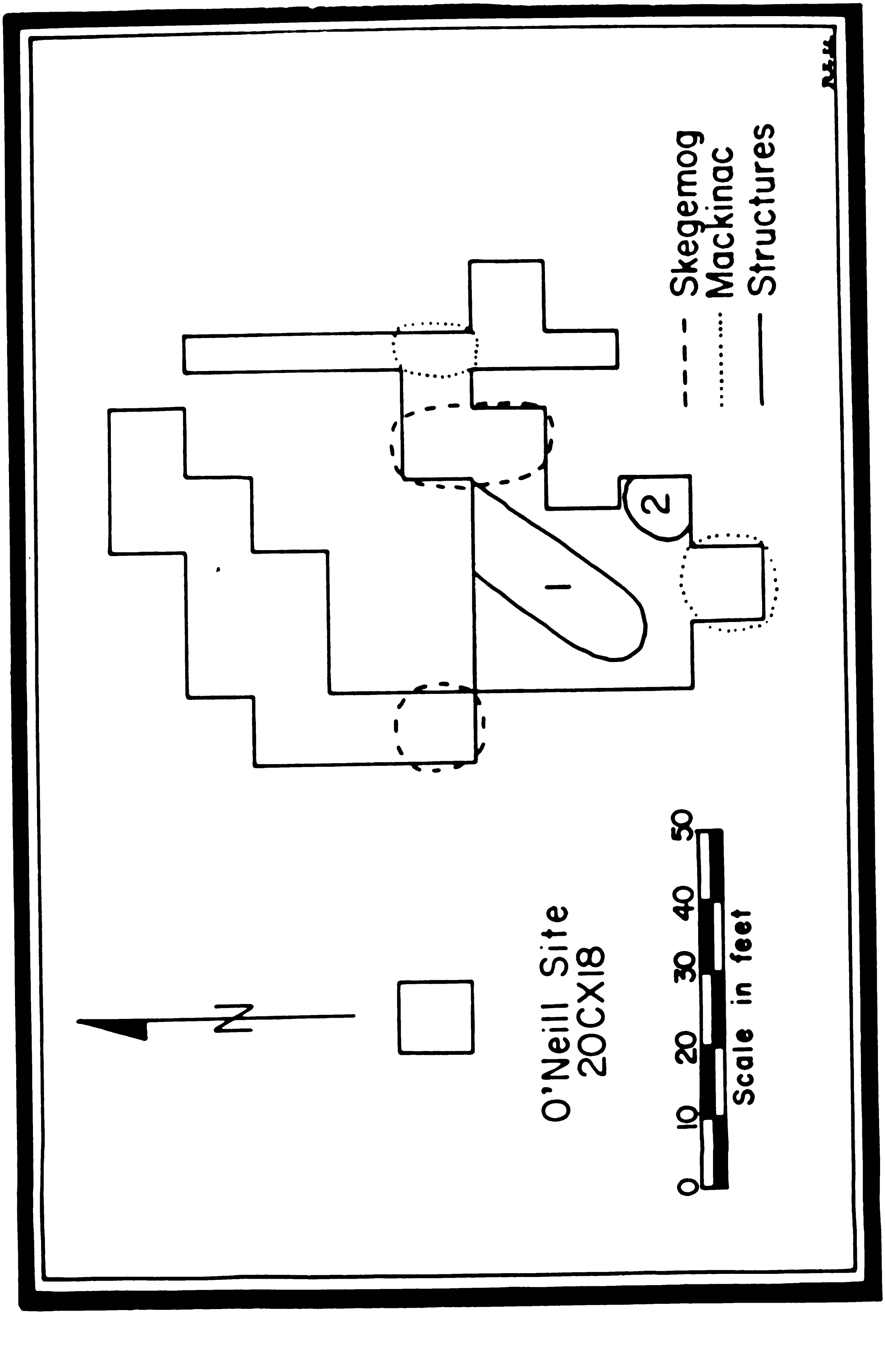
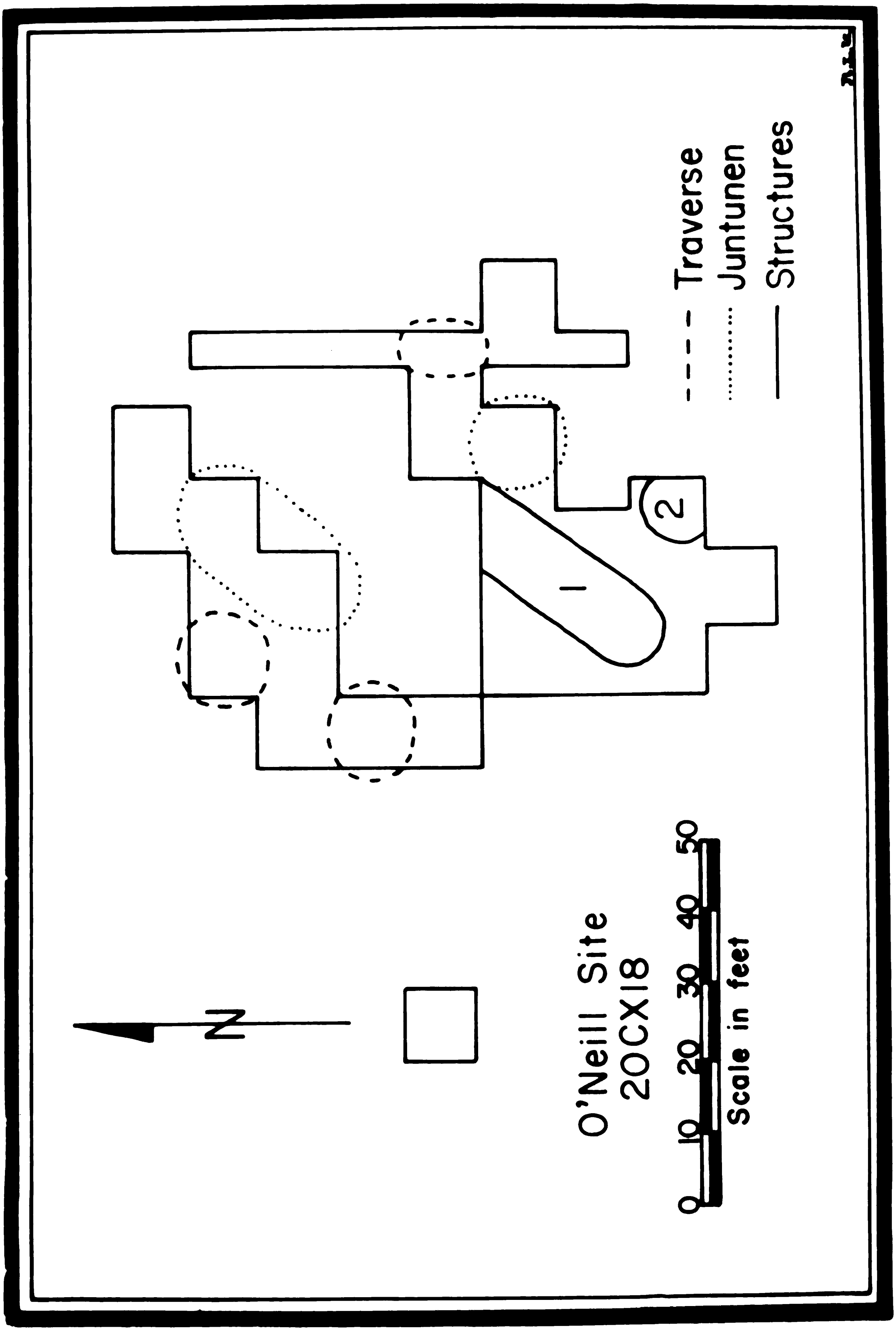

O'Neill Site
20CX18
N
0 10 20 30 40 50
Scale in feet
Skegemog
Mackinac
Structures
1
2

Figure 26

Map Indicating Areas with Greater Than Ten Percent Distribution of Juntunen and Traverse Wares


O'Neill Site
20CX18
0 10 20 30 40 50
Scale in feet
N
Traverse
Juntunen
Structures
1
2

Although the C-14 date of A.D. 1455±100 (M-2398, unpublished) was recovered from the Juntunen occupied part of Area B, the proximity of a localized Traverse component, coupled with similar overall distributions, still leaves doubt to which component this sample dates. It could apply to either, but a case for relationships to the Juntunen Phase is stronger.

Included in the Late Late Woodland and Early Historic distributions were the O'Neill Curvilinear and trailed Chevron motif ceramics. Both (Fig. 27) are localized to Area A and, furthermore, are stratigraphically as well as spatially distinct from the other ceramic groups. These late occupations occur closer to the lake than the earlier ones and also display similar restricted spatial tendencies.

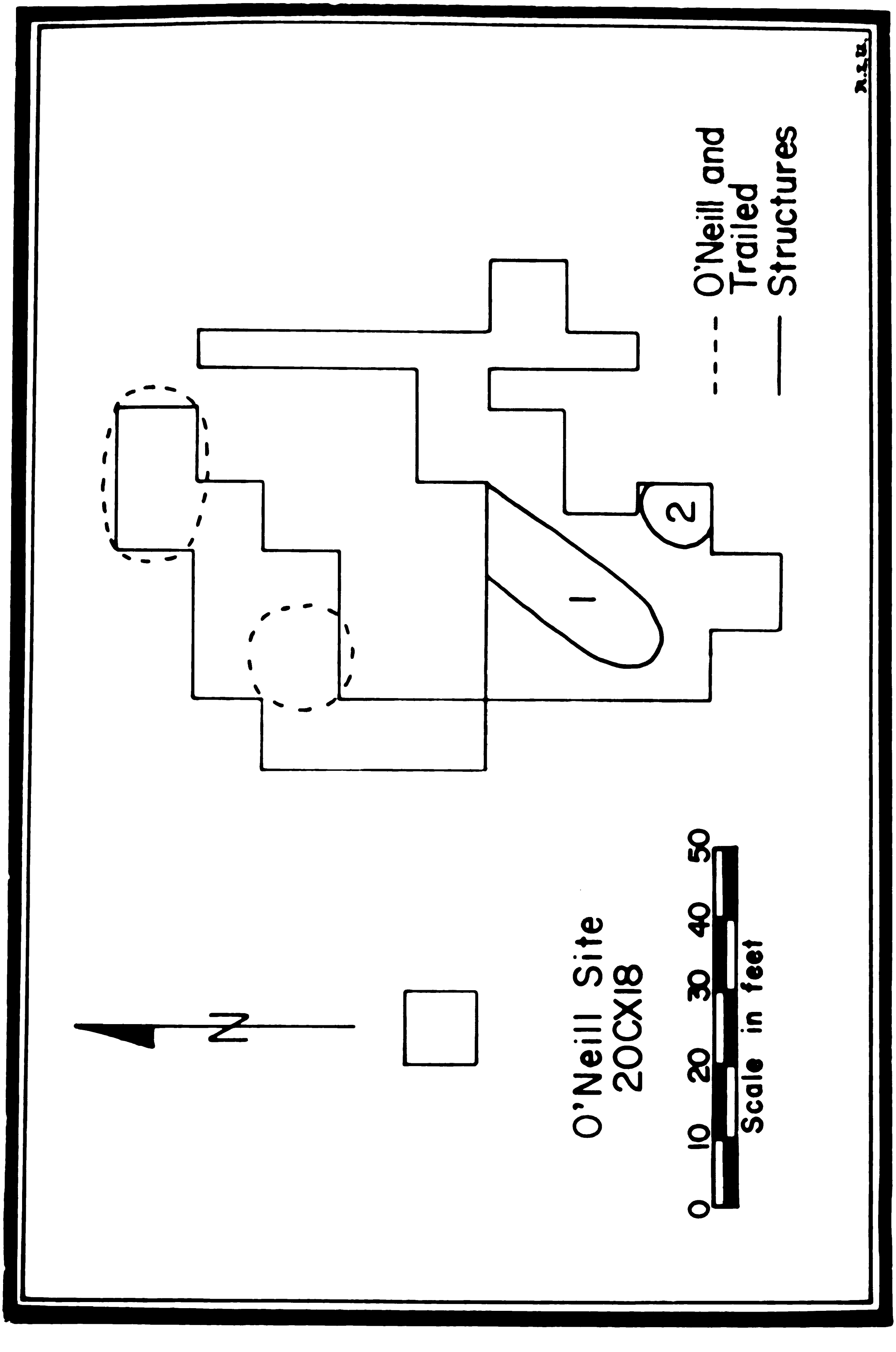
The overall pattern of space utilization through time as reflected in the identifiable ceramic distributions displays a lakeward shift. This phenomenon may well correspond to the patterns of site stabilization described earlier (<u>see</u> "Depositional History"). In general, structures at the site seem to have been constructed in stabilized zones along the beach, while other activities were performed on the more active lakeshore dunes. As the latter became covered with vegetation, more evidence of use arises, until during the final occupation stages the now stabilized lakeward dunes were the only occupied areas of the site.

Techniques similar to those used above would not have been appropriate for viewing the distribution of identifiable ceramics from the Test Pits. Two factors account for this: the large distances between test excavation units and the paucity of ceramic materials recovered from these units. Contour mapping would have given a false impression of spatial patterning; high frequency contours occur in areas where ceramics were present not in areas of high frequency for a large group of ceramics. Thus, the data

Figure 27

Map Indicating Areas with Greater than Ten Percent

Distribution of O'Neill Curvilinear, and Trailed Ceramics


O'Neill Site
20CX18
N
0 10 20 30 40 50
Scale in feet
O'Neill and
Trailed
Structures
1
2

derived would illustrate where ceramics occur, and would not illustrate patterning of occupations. For instance, two Mackinac ware pots and one vessel each of Skegemog and Traverse Wares were recovered from the Test Pits, each from a different excavation unit. Each unit would have been contoured as an area of intense occupation for the respective phase. Although a statement concerning the presence or absence of occupation can be made, one could not be made concerning either intensity or the overall spatial patterning.

In our discussion of the body sherds from the O'Neill Site, the hypothesis that the frequency of smoothing of prior surface preparation increases through time was proposed. The description of classifiable ceramics and their surface preparation tendencies would support this; unsmoothed surfaces do not occur in late period ceramics. Much higher frequencies of unmodified cord and fabric impression from the Test Pits would lead one to suspect, if this is true, more traces of Mackinac and Skegemog occupation than Juntunen and Traverse. Vessel frequencies, however, generate only minimal support in this direction. We are, in this case, probably dealing with fragments of more vessels than we were able to retrieve and identify. Statements pertaining to the relative density of different components in the Test Pit area, based on the body sherd data, would at the least be premature.

Ceramic density for grouped pottery types can be calculated for all the excavated areas of the O'Neill Site, and verifies the preceding discussion about the lack of ceramic debris from the Test Pits. Each of the 80 vessels in the sample, whether classifiable or not, was grouped on the basis of sherd weight into one of the three excavated areas of the site, Area A, Area B, or the Test Pits, depending upon where maximum sherd weight occurred. When divided by the number of square feet excavated in each area, a mean vessel figure was arrived at (Table 2). The density figures for Area A and Area B were quite close, .024 and .025 vessels per square foot respectively. The Test Pits illustrated a density of less than half that of the block excavations, .010 vessels per square foot. Occupation of this part of the site seems to have been much less intense than the other areas, a fact supported by the flint chip and artifact distributions as well.

TABLE 2

CERAMIC VESSEL DENSITY AT THE O'NEILL SITE

Ceramic Category	Area A	Area B	Test Pits	Total
Mackinac	1	4	2	7
Skegemog	1	3	1	5
Juntunen	6	5	0	11
Traverse	8	9	1	18
Unclassified	4	2	1	7
Other	4	19	6	29
Protohistoric	3	0	0	3
TOTAL	27	42	11	80
Square feet of excavated area	1100	1650	1100	3850
Vessels / ft.^{2}	.024	.025	.010	.023

CHAPTER 3

THE CHIPPED STONE INDUSTRY

The two season's excavations performed at the O'Neill Site produced 33,716 pieces of raw material or non-utilized debitage with a total weight of 142,446 gm (313.4 pounds) and an additional 370 chipped stone artifacts. Within the latter category were 181 cores or core fragments, 59 bifacial artifacts, and 125 unifacial artifacts. Description of this chipped stone industry relied primarily on the shape of the working edge (pointed, transverse, or lateral) within the biface and uniface groups. Functional explanations were then proposed for the formal categories when possible. During the transition from formal to functional analysis, microscopic observation was occasionally performed to study wear patterns; for some formal categories use attribution has not been possible.

Raw Material

Within the large sample of flint debris from the O'Neill Site was a large series of 795 rather large, unmodified chert blocks weighing a total of 64,556 gm (Table 3). No subdivisions were discernible within this category, although a series of small pebble cobbles were grouped in other chipped stone categories (cores). The pebbles were probably gathered from the glacial till, while the cores were all gathered from the Norwood (Pi-wan-go-ning) Quarry Site. This chert has been previously designated as Eastport chert (Binford and Papworth 1963: 80) but has been renamed Norwood chert in Cleland's (1973) discussion of the Pi-wan-go-ning Prehistoric District.

Norwood Chert, as it will be called throughout the remainder of this discussion, is tabular in its most common form; the chert is sandwiched

TABLE 3

FLAKE AND RAW MATERIAL FREQUENCY BY AREA AND OCCUPATION ZONE

	Area A (I)		Area A (II)		Area A (III)		Area B		Test Units		TOTAL	
	Count	Weight	Count	Weight	Count	Weight	Count	Weight	Count	Weight	Count	Weight
Raw Material	59	3753	53	5209	43	2632	498	41480	142	11482	795	64556
Blocky Flakes	75	591	256	1159	208	2196	783	12021	69	1307	1391	17274
Primary Flakes	56	1035	442	1791	324	3049	158	5688	16	420	996	11983
0-0.9	32	2	99	3	125	13	1649	121	304	27	2209	166
1-1.9	550	236	472	83	1071	533	10984	4595	3407	1288	16484	6735
2-2.9	341	678	193	204	736	1300	4843	8205	1736	2577	7849	12964
3-3.9	138	952	54	208	297	1426	1649	8615	489	2403	2627	13604
4-4.9	51	665	15	111	88	930	500	5955	165	1679	819	9340
5-5.9	9	219	13	198	21	382	132	3303	16	818	215	4920
Other	1	0	204	200	90	380	37	342	40	0	331	904
TOTAL	1312	8131	1801	9166	3003	12841	21233	90307	6368	22001	33716	142446

between two layers of thin limestone cortex occurring on opposite faces of the block. This tabular form distinguishes it from both Bayport chert, common to the Saginaw drainage (Dustin 1935) and Lambrix chert from Oceana County (Robert Green, personal communication), both of which are nodular forms. Its grey/white/blue, banded coloration is a characteristic unlike that of other chert types in Michigan. The Norwood Quarry Site exposure, the most common source of this material, is located approximately 5.5 miles south of the O'Neill Site along the Lake Michigan shoreline. Other sources of similar, if not the same, chert are also available from the glacial drift around Hayden Point in Lake Charlevoix (Charles Cleland, personal communication). Both sources would have been available for exploitation by the inhabitants of the O'Neill Site, and both could be the ultimate source of the unmodified blocks recovered from the site.

The distinction between these unmodified pieces and modified block cores was based on the observation that all unworked material exhibited smoothed, waterworn cortical edges and flake scar ridges. The latter are a result of the chert eroding from the outcrop and falling on the beach, where they often fracture due to natural causes. Likewise, the drift around Hayden Point extends into the water, and similar conditions could have occurred at this location as well. No platform preparation was present, although battering was frequently visible on the edges of the blocks. These characteristics imply that these pieces of raw material were gathered from the beach below the outcrop at Norwood or from a shoreline situation at Hayden Point, both of which are littered with eroded chert cobbles (Charles Cleland, personal communication) rather than quarried from the outcrop itself.

Cores

This analysis uses the definition of cores, as a formal category, proposed by Binford and Papworth (1963: 83). That is, they are pieces of raw material that have been prepared so that systematic flake removal may be performed. Using these criteria, 181 cores and core fragments from the O'Neill Site were assigned to five major categories based on differences in the technique and pattern of flake removal.

Block cores and block core fragments constituted the largest core category recovered from the O'Neill Site. All 68 block cores were manufactured on Norwood chert. This sample includes 14 block core nucleii, 14 intact but unexpended cores, and 40 broken or fragmentary examples. Both the intact examples and the expended nucleii exhibited cortical faces at two ends; these opposing faces also functioned as the striking platforms for flake detachment (Fig. 28). This phenomenon was noted in the Eastport Site lithic industry as well, in which the block cores' "striking platform frequently was the original cortical surface of a rough tabular nodule" (Binford and Papworth 1963: 97). All but three of the 41 block cores from the O'Neill Site possessed at least one flat cortical surface that had been utilized in this manner.

The two cores which showed evidence that both cortical faces had functioned as platforms illustrated that flakes would have been driven from the opposite side of the tabular block. Although 13 of the cores examined in the sample had flakes driven from non-cortical areas of the block, this was infrequent and probably resulted from a process of core trim. Likewise, four of the block cores assumed a rather regular, polyhedral shape on the worked faces, specifically when lamellar flakes were struck in series (Fig. 29).

Figure 28

Cores From the O'Neill Site

Upper Row - Block Core Nucleii

Lower Row - Block Cores

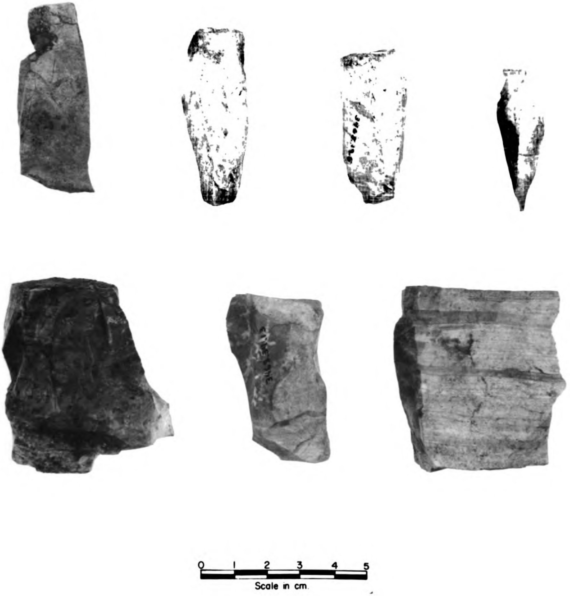
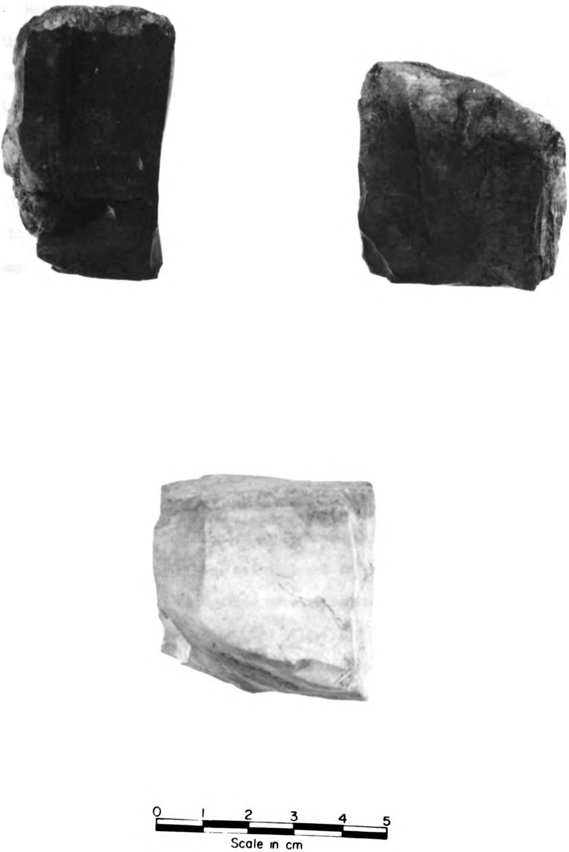

0 1 2 3 4 5
Scale in cm.

Figure 29

Cores From The O'Neill Site

Polyhedral Block Cores


0 1 2 3 4 5
Scale in cm

Metric attributes of the block cores from the O'Neill Site were gathered from the unbroken block cores and the expended nucleii (Table 4). Length measurements were made from cortical face to cortical face. Thickness and width cannot be applied to the block core, since they are essentially cylindrical; therefore, maximum diameter will be used. Both the mean and the range of the length of the two groups corresponds closely, while the measurements of diameter are rather disparate. The lower limits of block core length and diameter were both made on an extremely small example of this type.

TABLE 4

LENGTH AND DIAMETER OF BLOCK CORES FROM THE O'NEILL SITE

	N	X Length	Range	X Diameter	Range
Nucleii	15	5.4 cm	4.0 - 6.1	2.5 cm	1.6 - 3.3
Block Cores	14	5.6 cm	3.5 - 6.7	4.4 cm	6.3 - 3.0

The second most frequent group of cores from the O'Neill Site were those displaying opposed zones of percussion as a result of a bipolar, hammerstone and anvil technique. Binford and Quimby's (1963: 289-296) six-fold classificatory scheme was utilized to group the 48 bipolar cores in the sample. All six categories were recognized in the O'Neill Site specimens; (1) basal area-point, N=4 (Fig. 31); (2) opposing point, N=2 (Fig. 30); basal area-ridge, N=14 (Fig. 30); opposing ridge, N=9 (Fig. 30); (5) ridge-point, N=5 (Fig. 31); and (6) right angle ridge, N=5. Additionally, nine fragments were also present in the sample. All of the latter exhibited areas of resolved flaking and battering that were similar to those present on zones of percussion on the intact specimens. Indeed, five of these cores exhibit a sharply concavo convex edge which is reminiscent of McPherron's "gouged-end" artifacts, whereas only five of

Figure 30

Cores From The O'Neill Site

Upper Row - Opposing Ridge Bipolar Cores

Middle Row - Area/Ridge Bipolar Cores

Bottom Row - Point/Point Bipolar Cores

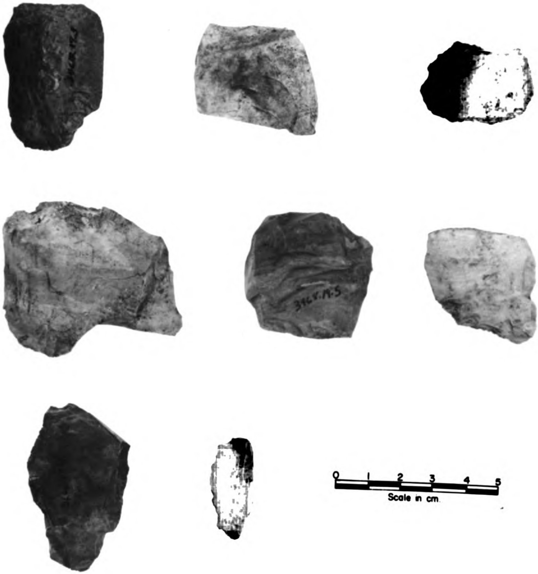

0
1
2
3
4
5
Scale in cm.

Figure 31

Cores From The O'Neill Site

Upper Row - Ridge/Point Bipolar Cores

Lower Row - Area/Point Bipolar Cores


0 1 2 3 4 5
Scale in cm.

the intact bipolar cores in the sample displayed this attribute. There is a possibility that bipolar cores may have been utilized as tools (Binford and Quimby 1963: 288-289), and McPherron speculates that the "gouged end" artifacts may have served as gouges (1967a: 137-142). Brose's (1970a: 104-106) microscopic analysis of wear patterns has not clarified this problem other than to demonstrate that wear striae are present. It is tempting to speculate, however, that five of the nine broken core specimens from the O'Neill Site had a "gouged" end and that the breakage may possibly be the result of heavy use.

Metric attributes of the bipolar cores from the O'Neill Site are presented in Table 5. As a group the area-ridge cores are larger than the other bipolar cores in the sample. This is true of the Summer Island bipolar core sample as well (Brose 1970a: 104), although not true of the materials analyzed by Binford and Quimby (1963). The area-ridge cores from O'Neill may also be favorably compared with some of the rejected block cores from the site, specifically those that were seemingly discarded by a hinge through fracture. This phenomenon produces a ridge that may have functioned as an anvil support for continued knapping of cores which otherwise might have been rejected.

All but two bipolar cores in the O'Neill Site sample were manufactured on Norwood Chert. The exceptions were also the smallest cores in the sample and were a very waxy, high quality material; this characteristic may be the primary selection criteria (Binford and Quimby 1963: 353-354). On the other hand, this type of industry is generally located in areas where primary flint sources are scarce or nonexistent and the occurrence of higher quality cherts is a function of the proportions of these materials in the glacial till. None of the O'Neill Site bipolar

TABLE 5

COMPARATIVE MEASUREMENTS OF BIPOLAR CORES FROM THE O'NEILL SITE

	Core Type					
	Point-Point	Area-Point	Rt. Angle Ridge	Ridge-Point	Opposed Ridge	Area-Ridge
Length						
Mean	4.2 cm	3.7 cm	2.9 cm	3.8 cm	3.6 cm	4.4 cm
Range	3.2 - 5.2	3.1 - 4.4	1.9 - 4.0	1.6 - 5.0	2.0 - 5.4	2.5 - 6.3
Width						
Mean	2.3 cm	2.6 cm	2.6 cm	2.4 cm	2.6 cm	3.3 cm
Range	1.4 - 3.2	1.9 - 4.0	1.9 - 3.3	1.0 - 3.3	1.9 - 3.3	1.6 - 4.8
Thickness						
Mean	1.0 cm	1.7 cm	0.8 cm	1.5 cm	1.3 cm	1.9 cm
Range	0.8 - 1.3	1.1 - 2.7	0.4 - 1.0	0.5 - 2.2	0.7 - 2.0	1.0 - 4.1
N=39	N=2	N=4	N=5	N=5	N=9	N=14

cores showed signs of heat treatment prior to production, although four were surface charred and one had a number of "pot lid" fractures.

One of the less popular core types at the O'Neill Site are plano-convex cores, 24 of which were recovered during the excavations. Characteristically this core type has a flat basal surface, while the opposite face has either a point or a ridge formed from the juncture of several flakes driven from the flat face (Fig. 32A-C). Occasional platform preparation is evident, a characteristic also true of the Schultz Site plano-convex core sample (Fitting 1972: 101). All but one of those recovered from the O'Neill Site are manufactured on Norwood chert. The aberrant specimen is a split beach cobble with a reddish cortex. The chert, however, has banding and coloration that is in all respects comparable with quarried Norwood chert. These cores are plano convex because flakes have been driven from a flat striking surface across the opposite face, in series, around at least part of the circumference of the core. However, initially they were probably fragments of block cores, a longitudinally fractured angular edge which had flakes removed from the planar surface.

Biconvex cores (Fig. 32D) comprised the smallest classifiable core category at the O'Neill Site. The seven artifacts included within this group all shared a number of attributes; they were ovoid in shape; had flakes driven from both faces; the flakes covered at least three fourths of the circumference of the artifact; and little if any further edge modification was present. These cores may possibly have served a chopping or cutting function as well as having functioned as a flake nucleus. Only one of those examined, however, had any visible evidence of use, a short battered edge which may have been the result of repeated attempts to

Figure 32

Cores From The O'Neill Site

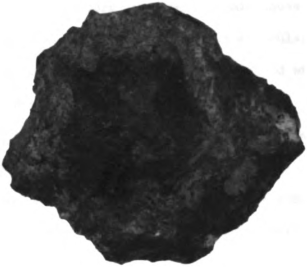
A-C Plano Convex Cores

D Bifacial Core

A

B

C



D

detach a flake. A single example of a biconvex core was manufactured on a mottled gray and brown chert.

The term "amorphous cores" was used by Fitting (1965: 53-55) to describe the core sample from the Riviere au Vase Site. In subsequent reports (1972: 191) Fitting has revised his earlier classificatory names and refers to these same objects as block cores, following Binford and Papworth's (1963: 83) notation for materials from the Eastport Site. Although the term is no longer compatible with the original description, it is still useful and may be applied with a different connotation to 14 cores from the O'Neill Site. The one shared attribute of these artifacts is the irregular pattern of flake detachment which was not true of the other cores in the sample. Flakes appear to have been driven from virtually every available platform, and fracture along frost cracks is occasionally noticed. This core type may include those pieces of raw materials that, while intended to be worked in a regular block core fashion, suffered from irregular natural fracture and which could not be prepared for flake production in a systematic fashion. The large size of some of the specimens indicates that they were discarded shortly after the above qualities became evident.

In addition to the cores described above, 20 fragments could not be classified. These are included in the total core count and distributional study.

Lithic Debitage

Primary Flakes

As noted previously, tabular Norwood Chert generally has two opposing cortical faces between which the chert is sandwiched with the actual thickness dependent on the size of the lens from which it was originally obtained. Thus, some tabular blocks may be as much as 8 inches or as little as 2 inches thick. Primary flakes derived from this type of chert were in most cases struck along a platform that consisted of thin cortex and may or may not have terminated at the opposite cortical layer. The major part of the outer face of these primary flakes, therefore, was not cortex, but exposed chert; few literal "decortication" flakes were present therefore. Since such primary preparation often continued further into the tabular core than just the outer surface, both fresh as well as waterworn outer faces were included within this category which consisted of a total of 996 flakes weighing 11,983 gm (Table 3). Other criterion used in classification were the angular, irregular shape of the flake which did not have the chunky appearance of block flakes (see description) but were generally longer and thinner. Platform preparation could not be discerned due to the soft cortex, which often appeared battered but not prepared. This phenomenon may be attributed to the fact that more force is needed to direct a blow through the soft cortex than is needed on a chert platform. Since extensive discussions of primary or decortication flakes are already present in the literature, the reader is referred to other sources for further clarification (White 1963: 5).

Block Flakes

Representing the second stage of core preparation, this particular flake type, 1391 of which were recovered from the O'Neill Site with a weight of 17,274 grams (Table 3), is rather ambiguous because debitage of this nature may be the result of natural actions, such as freezing and subsequent breakage along natural lines of cleavage, or from intentional preparation through percussion. Likewise, both agencies may be responsible since light percussion will detach frozen portions of the nodule until unfrozen chert is exposed. Since it was determined that much of the raw material was exposed on the shore for enough time for the surfaces to have become worn, the latter assumption is most acceptable; that is, these flakes are the result of intentional percussion designed to expose unfrozen and, therefore, workable chert.

Characteristically these flakes have sharp planar surfaces, with edges approaching right angles. In almost all cases they maintain a rectangular or cubic shape. Striking platforms are not evident in the O'Neill Site sample. A similar absence of striking platforms was characteristic of this flake type at the Summer Island Site (Brose 1970a: 99). These flakes have been described as a by-product of core preparation (White 1963: 13-14; McPherron 1967a: 131) and probably hold a similar position within the flake assemblage from the O'Neill Site.

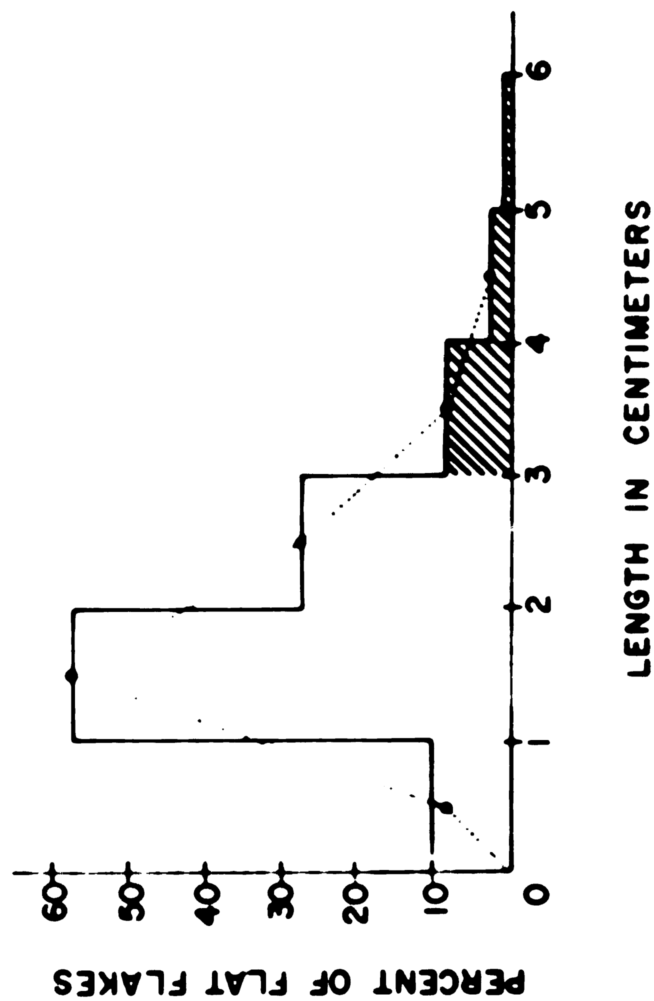
Flat Flakes

The largest class of lithic debitage from the O'Neill Site consisted of 30,523 flat flakes weighing 47,729 gm (Table 3), 33.5 per cent of the weight of the lithic debitage sample or 89.5 per cent of the count. Examination of the striking platform angles on this class of flakes was not accomplished; thus the distinction between core-derived and bifacial-artifact-derived flat flakes was not made for this sample. These flakes are essentially what their name implies, regular flakes that are rather thin, possess striking platforms, have a concave inner face and a convex outer face which has flake scar ridges crossing the face. The O'Neill Site sample demonstrated that flat flakes on the site rarely exceeded 6 cm in length.

The 30,203 flat flakes from the O'Neill Site were further subdivided into class intervals of length: 0.0 cm to 0.9 cm, 1.0 cm to 1.9 cm, etc. The resultant graphic distribution of these flakes based on their class interval frequency is presented in Fig. 33. A distinctly unimodal distribution of these flakes is evident; 54.6 per cent of the flat flakes fall into the class interval 1.0 cm to 1.9 cm. A paucity of flat flakes at both the higher and lower end of the scale can be explained due to sampling error. First, the lower end of the scale may not be a valid estimate of the frequency of flakes from 0.0 cm to 0.1 cm due to the size of the screen with which the sample was collected. This sampling error may be tested when analysis of the microchippage from flotation samples is completed. Many smaller flakes undoubtedly fell through the ¼-inch mesh used for collection. The larger flat flakes in the sample, on the other hand, are more difficult to explain. The distinction between large flat flakes and primary chippage is based on the regularity of the thickness of the flake. The larger flat flakes in the lithic debitage sample are proposed to be the result of continued preparation of the core after (1) the core has been worked into a regular shape and (2) after the desired platform preparation has been achieved. Since 80.6 per cent of the flat flakes fall into the range from 1.0 cm to 2.9 cm, some sort of selection of flake size is obviously being made; whether in relation to tool production, that is the size of preforms being manufactured at the site, in relation to flake tool production and manufacture of flakes driven from a core, or a mechanical matter such as the density of the chert and the kind of tool being used to strike it is unknown.

Figure 33

Percent Frequency of Flat Flakes by Length at the O'Neill Site


PERCENT OF FLAT FLAKES
0
10
20
30
40
50
60
0
1
2
3
4
5
6
LENGTH IN CENTIMETERS
N = 30203

Other

This category includes those flakes which could not be classified due to breakage and/or missing discriminatory attributes. The 331 flakes weighing 904 grams that were classified in this manner were, in almost all cases, flat flakes that were broken and could not be placed within one of the class intervals of length.

Bifaces

Projectile Points

Nineteen chipped flint artifacts from the O'Neill Site were classified as projectile points, a rather low mean density of .50 projectile points per 10 by 10 foot excavation unit. Aside from the remarkably small size of the sample, which prohibited classification on a quantitative basis, there was also a large degree of heterogeneity within the sample. The classification process resulted in two classes, six types, and two varieties of chipped stone projectiles. Description of these artifacts conforms with the notation devised by Binford (1963), although much more general. Metric and formal attributes of types and varieties are presented in Table 6.

Class I Triangular Points

Type 1

N = 2

Both points in this group were characterized by their incurvate blade edges and slightly convex bases (Fig. 34A-B). Their transverse cross section is diamond shaped. Flaking is both bifacial and bilateral, and occurs on both blade edges and base in the form of short conchoidal and lamellar flakes.

TABLE 6

ATTRIBUTES OF PROJECTILE POINTS FROM THE O'NEILL SITE

	Metric Attributes (cm)			Chert Types		Hafting
	Length	Width	Thickness	Norwood	Other	Modification
C I, T 1	4.3	2.4	0.4	x		no
	3.1	1.8	0.4	x		no
C I, T 2	3.1	2.0	0.6	x		no
	2.3	1.5	0.3		x	no
	2.2	1.5	0.4	x		no
	1.5	---	0.4		x	no
C I, T 3	4.3	2.0	0.7	x		no
	3.5	1.8	0.5	x		no
	3.1	1.6	0.3		x	no
	2.7	1.8	0.5	x		no
	2.0	---	0.7	x		no
C I, T 4	2.4	1.3	0.4	x		yes
	2.5	1.7	0.5	x		yes
	2.4	1.0	0.3	x		yes
	2.6	1.2	0.4	x		no
	2.4	1.3	0.3	x		no
	3.0	1.3	0.5	x		no
	2.5	1.6	0.4		x	yes
C II, T 1	3.8	1.3	0.7	x		yes

Figure 34

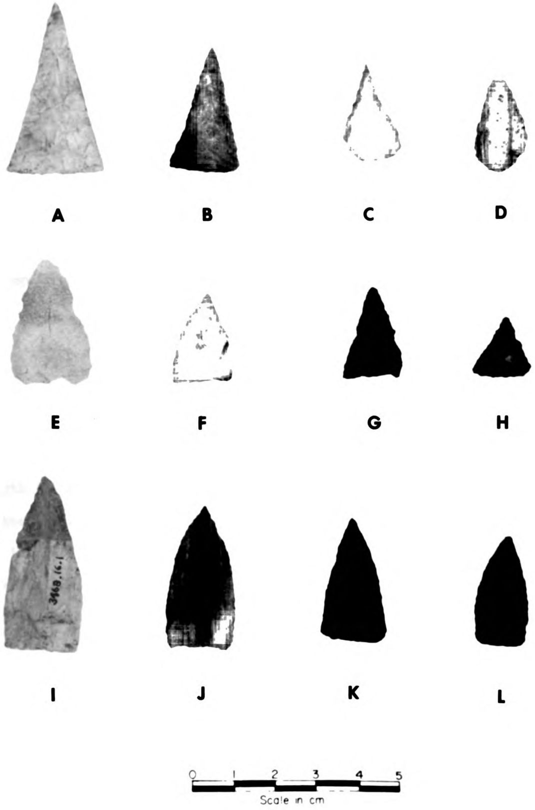
Projectile Points and Gravers From The O'Neill Site

A-B Class I, Type 1 projectile points

C-D Gravers

E-H Class I, Type 2 projectile points

I-L Class I, Type 3 projectile points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Scale in cm

Discussion: These projectiles bear a close resemblance to Scully's (1951: 14) Madison Point. Their local derivation, however, is demonstrated by their manufacture on locally available Norwood chert. No points of this specific morphology have been recovered from a purely Late Woodland context in the Straits of Mackinac area. They have, however, been reported from the prehistoric component at Fort Michilimackinac (Lovis and Mainfort, n.d.), an assemblage that also yielded Lake Winnebago Trailed ceramics. Brose (1970a: 184) also reports them from the Upper Mississippian component at the Summer Island Site. In general, most triangular points from Late Woodland sites are called Madison points.

Type 2

N = 4

The projectiles included within this category are, again, basically triangular, although their shape and workmanship differ from other groups of triangular points in the sample. They are wider in relation to their length (1.5:1), while the primary flaking tends to be composed of larger flakes (Fig. 34E-H). Blade shape is either straight or slightly convex, and the base is either straight or concave. They are flaked both bifacially and bilaterally, while secondary retouch occurs predominantly in irregularly spaced clusters.

Discussion: Similar points have been recovered from a number of both published and unpublished sites in the Upper Great Lakes. Within the area bounded by Traverse City to the south and the Straits of Mackinac to the north, they have been part of the assemblage of six sites, five of which are multicomponent Late Woodland Sites. In Cheboygan County, they were recovered from the Mackinac Phase Eisen Site, dated to between A.D. 700

and A.D. 900 (Griffin 1963: 75). From Emmet County they have been classified as Type 9 at the Wycamp Creek Site (Lovis, n.d.a.) and Type II at Ponshewaing Point (Lovis, n.d.b.); both sites have been comparatively dated to between A.D. 800-A.D. 1300. Unclassified but similar artifacts have also been recovered from both the Antrim Creek Site and Henderson-Lamb Site, Antrim County. At Skegemog Point, Cleland (n.d.) has classified similar points as Class III, Type B, Variety 1. This site was occupied from ca. A.D. 900 - A.D. 1400. Aside from the Eisen Site, therefore, little temporal control can be imposed on this type of projectile.

Type 3

N = 5

Possessing a parallel ovate blade outline, Type 3 projectile points are also characterized by a straight or slightly concave base (Fig. 34I-L). Flaking is both bifacial and bilateral with large expanding, lamellar flakes. Retouch is continuous, unifacial, and unilateral. At least one projectile was manufactured on a thin flake.

Discussion: The only site within the study area with projectiles of a similar style is the Skegemog Point Site (Cleland, n.d.), where they have been classified as Class III, Type C, Variety 1. At the O'Neill Site a projectile point within this category was recovered from Occupation Zone III, dated to the thirteenth century A.D.

Type 4

N = 7

Manufactured on small, generally ridged, flakes, the points in this category exhibit a wide variety of retouch and shaping techniques. All

have a generally triangular shape, yet major variability in the formal outline is still noticeable. These have been termed Juntunen Points by McPherron (1967a: 148-153) from a large sample at the Juntunen Site.

Variety a: unhafted (N=3). This category includes those points with no hafting modification (Fig. 35A-C). The type is comparable to Juntunen Triangular (McPherron 1967a: 152).

Variety b: notched (N=4). Artifacts included in this category are those with either a notched or corner removed (stemmed) haft element (Fig. 35D-H). The type designation is Juntunen Notched (McPherron 1967a: 152).

Discussion: Small, irregularly shaped flake points of this type have been recovered in minimal quantities from a number of Late Woodland sites in the study area. The Juntunen Triangular variety has been part of the lithic assemblage from the Ponshewaing Point and Wycamp Creek Sites in Emmet County, classified as Type 5 at the latter (Lovis, n.d.a.). To the south they have been recovered from the Antrim Creek Site and the Schuler Site (Masters, n.d.) in Antrim County; they form a substantial part of the triangular point category at the Skegemog Point Site in Grand Traverse County, classified as Class III, Type B, Variety 1 (Cleland, n.d.). At the O'Neill Site a single projectile of this type was recovered from a thirteenth-century stratum. Notched points (Variety b), on the other hand, have only been recognized at two sites: Wycamp Creek category Type 1 and an untyped variety from the Ponshewaing Point Site.

Class II - Lanceolate Points

Type 1

N = 1

Figure 35

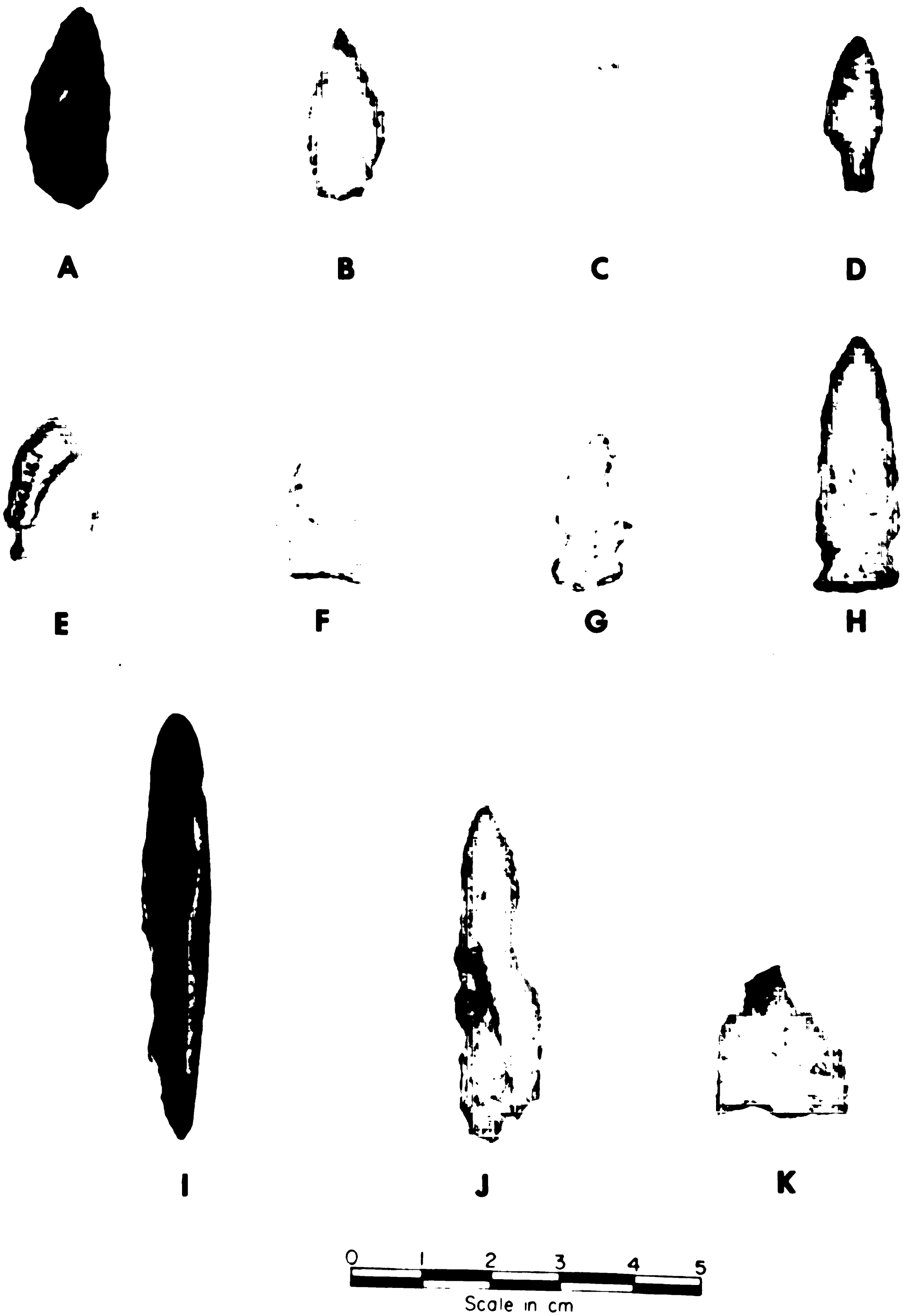
Projectile Points and Drills From The O'Neill Site

A-C Class I, Type 4, Variety a projectile points

D-G Class I, Type 4, Variety b projectile points

H Class II, Type 1 projectile point

I-K Drills and Drill Fragments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0 1 2 3 4 5
Scale in cm

A single narrow, shallow side notched or expanding stemmed point concludes the projectile point sample (Fig. 35H). This projectile is worked bifacially and bilaterally and exhibits marked basal thinning. Both the transverse and longitudinal cross sections are plano convex.

Discussion: At least three other sites in the Straits of Mackinac area have yielded formally similar points. McPherron (1967a: 153-154, Plate 33c) reports a "Dustin point" from mixed provenience at the Juntunen Site. Likewise they have been recovered from the Fauver Site, Antrim County (McGonagle, n.d.) and at the Skegemog Point Site in Grand Traverse County, classified as Class I, Type A, Variety 2 at the latter. All of the above sites are Late Woodland. Ranging farther afield Fitting 1972: 199, 203) notes similar Dustin or Lamoka-like points from Late Middle Woodland and Late Woodland contexts at the Schultz Site in the Saginaw drainage. At the late Middle Woodland Holtz Site in Antrim County, a single Lamoka-like point was also recorded (Lovis 1971: 57-59). Therefore, this type probably arises during the late Middle Woodland and enjoys a limited popularity for an undetermined period of time during the Late Woodland.

Projectile Point Fragments: This classificatory category includes projectile point fragments which could not be defined to the type or variety level. The sample consists of seven bifacially flaked tips. No broken bases were recovered from the O'Neill Site.

Gravers and Drills

The pointed bifaces recovered from the O'Neill Site included gravers and three drills. Subsumed under the graver category are two bifacially and bilaterally chipped artifacts which have convex or round bases curving into straight blade edges.(Fig. 34C-D). The graving tip on one is broken, while the second has a sharp, unifacially chipped graving edge (Fig. 34D). The intact specimen was recovered from a stratum dated to the thirteenth century A.D. and displays marked polish on the ventral face.

All drill and drill fragments from the O'Neill Site represent different formal categories, although all are manufactured through a bifacial technique. A single basal fragment with a maximum width of 2.0 cm and a bit width of 0.7 cm was recovered and is the only hafted drill in the chipped stone sample (Fig. 35K). The second drill is manufactured on an irregular primary flake with a length of 4.9 cm and a width of 1.6 cm (Fig. 35J). The bit, however, accounts for only 1.7 cm of the total length, the remainder of the artifact having only been modified by widely spaced massive chipping. This tool might more fruitfully be called a hand drill, since no haft modification is present. A similar artifact was recovered from the Late Woodland component at the Wycamp Creek Site (Lovis, n.d.a.). Completing the sample is a long, thin (6.2 cm by 1.1 cm) unhafted drill with a triangular transverse cross section (Fig. 35I). Only one of the three faces has been fully shaped, while the remaining two show evidence of minor shaping. Marked grinding and polish as well as wear striations are evident on all three apexes of the triangle.

Ovates

The four bifacial ovates from the O'Neill Site displayed two modes of formal variability in terms of base shape. A single intact member of this group had a rounded or convex base (Fig. 37D), while the remaining three basal fragments had straight, flat bases (Fig. 37A-c). Likewise, differences existed in the amount and location of flaking as well; the blade margins on the round-based artifact were regularly and bifacially retouched, while the remainder had no secondary retouch. The flat-based ovates also displayed prominent striking platforms and bulbs of percussion at the juncture of the base and the blade. These formal differences may have functional implications as well. The true ovate has been described functionally as a knife in numerous contexts. It is argued, however, that the flat based artifacts are blanks manufactured on large block core derived flakes. These were meant to be transported to other locations for eventual completion and use. The fact that they were broken is cause enough for them to have been discarded.

Lanceolates

Among the other large bifaces in the chipped stone assemblage were three long, lanceolate artifacts; one point fragment, one unfinished "blank," and one complete tool (Fig. 36A-C). The completed example is uniformly flaked both bifacially and bilaterally with expanding flakes that terminate in a medial ridge. Retouch occurs both in clusters and regularly, again both bifacially and bilaterally. Neither of the remaining two artifacts had retouched blade edges, and both were uniformly unthinned. The fragment resulted from a hinge fracture, most likely during a thinning process. Both of the latter probably are unfinished artifacts. Neither polish nor microscopic wear was visible on any of these materials. No functional classification was deduced from these data.

Triangular Knives

Seven of the large bifaces in the O'Neill Site chipped stone sample, six basal fragments and one complete, had a triangular shape (Fig. 36D-H). All had retouched blade edges, although the primary flaking within this group varied considerably. Three had unthinned areas on one face of the artifact, an attribute recognized for the group of small, triangular unhafted bifaces as well. One artifact in this group had "pot lip" fractures present on one face, the result of heat action after manufacture and probably after it was discarded. These tools are not to be confused with the "cache points" described by McPherron (1967a: 154-156) from the Juntunen Site nor the Pomranky Points from the Eastport Site, which typically have an ovate blade edge, despite the one triangular specimen in the sample (Binford and Papworth 1963: 95). These bifaces were probably not intended as "blanks." The extent of retouch on the blade edges and the high frequency of small, stepped, multiple hinge fractures would suggest their utilization as a form of knife.

Chopper

A single large biface with a convex working edge, massive flaking, and a cortical surface acting in the same manner as intentional backing has been classified as the functional equivalent of a lunate "chopper." This large (7.2 cm x 5.1 cm x 3.1 cm) artifact (Fig. 38E) shows only meager attempts at secondary retouch. Portions of the blade edge show evidence of heavy battering, and hinge fractures were present on both faces, most often confined to the central portion of the blade.

Small Triangular Knives

Small triangular bifaces other than projectile points were represented by six artifacts in the O'Neill Site assemblage. Two were modified by shallow side notches, while one of the hafted and three of the unhafted implements were broken. The four unhafted artifacts had fully bifacial chipping, and all had thick, unworked areas on one face. These artifacts can be readily equated with the "hump-backed" knives of the upper Ohio

Valley (Munson and Munson 1972: 31-36). Similar tools are included in the assemblage of almost all the Late Woodland sites in the study area, classified as rejected projectile points, or small knives.

The hafted artifacts in this group are manufactured on thick flakes modified laterally by regular bifacial retouch and the addition of shallow side notches. The single intact specimen is asymmetrical with slight basal thinning. A quantity of analagous tools have been recovered from the Ponshewaing Point Site, a Late Woodland site in Emmet County, Michigan (Lovis, n.d.b.). Functionally, they have been termed asymmetrical, bifacial knives (Lovis, n.d.b.).

Miscellaneous

Four irregularly shaped flakes were included within the biface subdivision. All share a bifacially retouched working edge, and none are modified to the point where they are bilaterally symmetrical. Two are manufactured on thick flakes, both of which have unmodified cortical striking platforms at the basal end (Fig. 38A-B). Both have contracting lateral edges, while one has a pointed tip, and the other is broken. Functionally, these artifacts could be classified as either a flake knife or side scraper, although either would be conjectural. A single lamellar flake, bifacially worked along one lateral margin and unifacially retouched along the other was also included (Fig. 38C); the flake is not a true blade. Microscopic examination of both working edges revealed numerous minute hinge fractures overlapping on the dorsal face of the flake. No polish was evident on either edge. This artifact has been interpreted as a side scraper. The final artifact in this group is manufactured on a contracting pointed flake (Fig. 38D). The pointed end has been bifacially modified for a distance of 1.4 cm. This working edge is very highly polished from use; in some cases flake scars have been obliterated from the wear. Since the polish completely encircles the working edge, it is unlikely that it functioned as a graver. More feasible possibilities would be either as an awl or a small drill.

Other than the knives and ovate bifaces described previously, artifacts with lateral working edges were few in the biface sample from the O'Neill Site. The three artifacts in this group were all laterally modified, expanding outward from the base and terminating in a shallow convex arc. Basal characteristics among the three differed; the longest (Fig. 37E) had an unthinned square base with shallow side notches, while one was broken and the last had a thinned, convex base (Fig. 37G). The lateral edges of all three exhibited signs of crushing in the form of minute stepped hinge fractures on both faces. No wear striations were visible, while light polish was evident on the lateral edges of the hafted specimen.

Unclassified

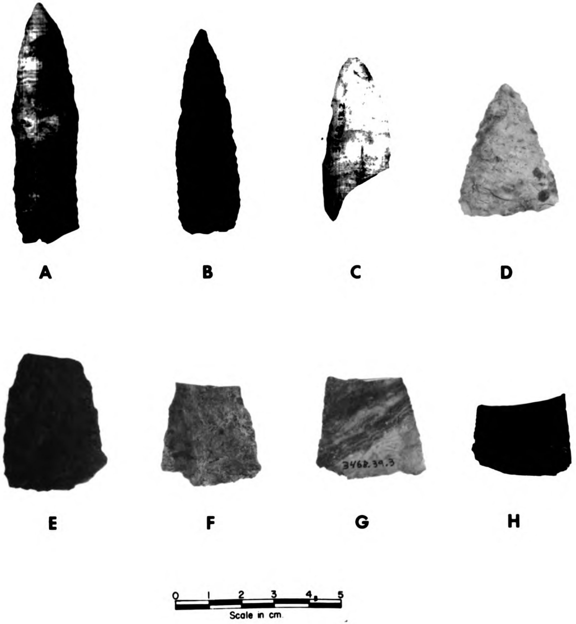
Many of the fragmentary implements recovered from the excavations at the O'Neill Site could be classified on the basis of extant formal attributes, their combination and recombination. Seven fragments in the sample, however, were unclassifiable. Two of these artifacts were tip fragments from large bifaces, both pointed and having an ovate blade edges. These may possibly be associated with the ovate bifaces. The remaining four are large, broken bifaces; none show signs of intentional retouch or work other than the rather massive primary flaking that occurs on all. The last member of this group is a small, irregularly shaped, broken tool with no secondary retouch and with a striking platform visible at the unbroken end.

Figure 36

Lanceolates and Triangular Knives

A-C Lanceolate

D-H Triangular Knives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Scale in cm.

Figure 37

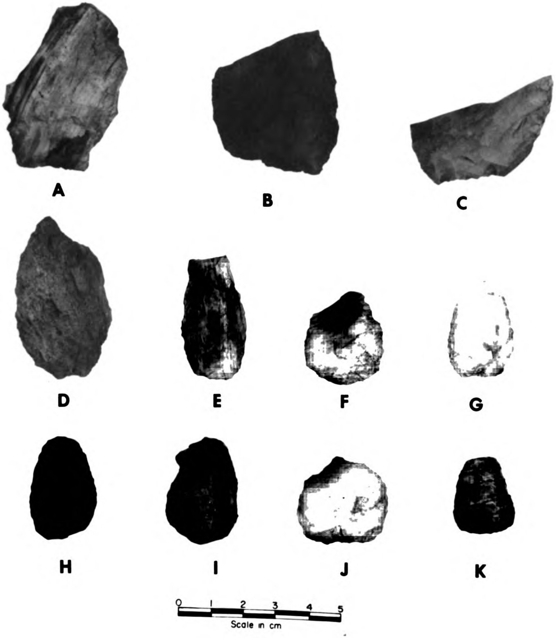
Ovates, End Scrapers and Miscellaneous Bifaces

A-C Flat based ovate "preforms"

D Ovate Knife

E-G Miscellaneous Bifaces

H-K End Scrapers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Scale in cm

Figure 38

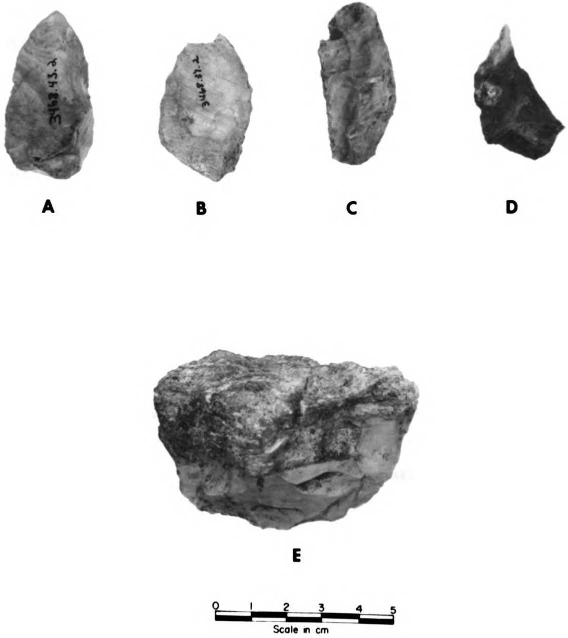
Chopper and Miscellaneous Bifaces

A-B Bifacial Flake Knives

C Side Scraper

D Flake Awl or Drill

E Bifacial Chopper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Scale in cm

Unifaces

End Scrapers

Exclusive of those flake artifacts with thin, unifacial but regular retouch on the working edge were four artifacts with steep unifacial retouch on a rather thick flake that has been modified laterally. These artifacts have traditionally been called "end scrapers." All four (Fig. 37H-K) have convex transverse working edges. Two have working edges which are overhung by the "top" of the flake on which they were manufactured (Fig. 37H-I), while a third (Fig. 37J) has a spur projecting from one side. No polish or sheen was visible on the latter, and this lateral projection most likely served as an aid in hafting the tool, rather than having functioned as a graver. The possibility that the projection originally intended to serve the second function cannot be discounted.

Retouched Flakes

Retouched flakes, as a formal category, is used here to describe a series of unifacial artifacts from the chipped stone assemblage. As a whole, these implements are manufactured on irregularly shaped flakes that have had edge retouch performed in a regular fashion, thus distinguishing them from utilized flakes, which show irregular, unpatterned retouch. Other modifications such as the addition of a haft element, or lateral shaping, are absent. The shape of the working edge also varies considerably. Frequencies of the edge shapes and flake types on which they were manufactured are presented in Table 7. These data demonstrate that convex and straight working edges were the predominant attributes selected for within the sample, while expanding flakes far exceeded other

TABLE 7

FLAKE TYPE AND WORKING EDGE OF RETOUCHED FLAKES

Flake Type	Concave	Convex	Straight	Pointed	Total
Primary	2	5	6	--	13
Block	--	--	1	--	1
Lamellar	2	2	3	--	7
Expanding	9	1	8	3	21
Contracting	--	14	2	1	17
Broken	--	5	4	--	9
TOTAL	13	27	24	4	68

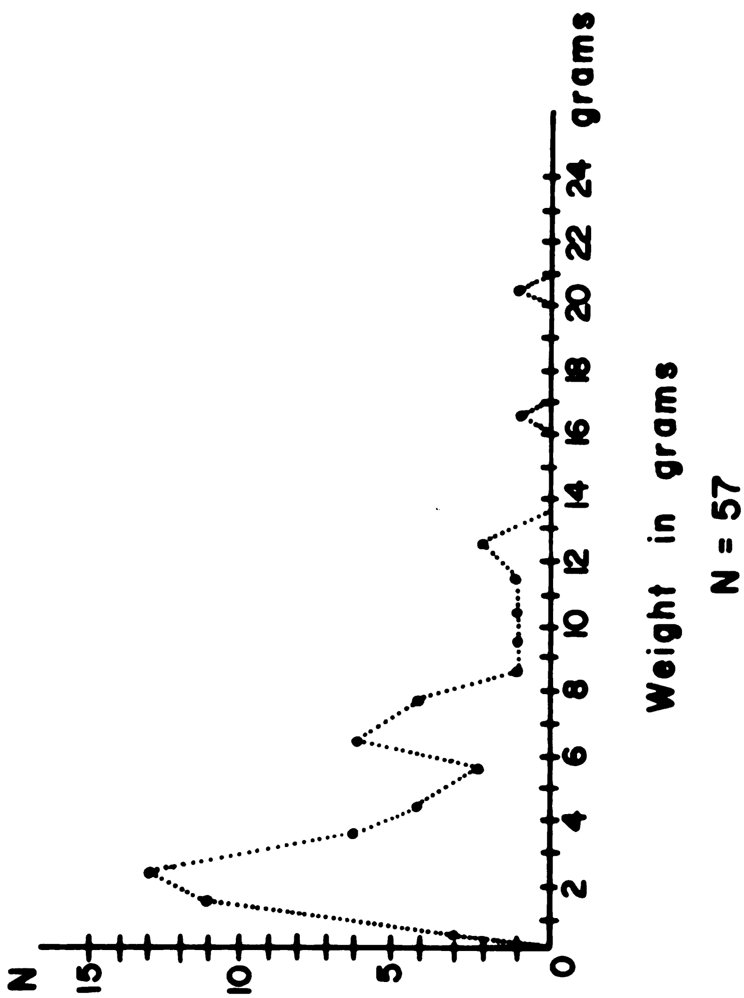
flake types as the base for manufacture. The expanding flakes in the sample had either straight-straight or concave-straight edge combinations, thus accounting for the highest frequencies of concave and straight working edges. Contracting flakes, on the other hand, had either a convex-straight or a convex-convex edge combination. This may account for the high frequency of convex edges among contracting flakes.

All but seven of these flakes possessed a worked edge that was parallel to the longitudinal axis of the flake. Three had points unifacially manufactured at the juncture of the lateral and distal edges of an expanding flake, while one pointed end was worked at the juncture of the lateral edges of a contracting flake. The remaining three had transverse working edges, one on a primary flake and two on lamellar flakes.

The weight distribution of this class of artifacts was calculated from the 57 unbroken flakes in the sample and is presented as a histogram in Fig. 39. The mode falls between 2.1 gm and 3.0 gm, while the mean is only slightly higher, 4.74 gm. These artifacts are reminiscent of the "unplanned" scrapers recovered from the Juntunen Site (McPherron 1967a: 156-158) since the retouched areas fall mainly on unsupported edges of the flakes. Comparable though they might be formally, the weight distribution

Figure 39

Weight Distribution of Retouched Flakes at the O'Neill Site


N
15
10
5
0
2
4
6
8
10
12
14
16
18
20
22
24
grams
Weight in grams
N = 57

varies considerably between the two samples. The mode of the O'Neill Site sample falls between .5 and 1.0 gm higher than the Juntunen sample, while the mean is 2.0 gm higher. This difference is reflected in the size of the cores from the two lithic industries as well. Weight differences such as this can be expected as one moves further away from the source of raw material. Thus, the differences reflected in this comparison are most likely explained by the O'Neill Site's proximity to the Norwood Quarry Site and are probably not to be construed as connoting functional differentiation between the two samples.

Utilized Flakes

In keeping with the distinction between retouched and utilized flakes stated above, 53 flakes were included in the utilized flake category. Sixteen of these (30 per cent) were manufactured on primary or decortication flakes. No utilized blocky flakes were recognized in this sample. A breakdown of types of flat flakes indicated that nine lamellar, eight expanding, and nine contracting flakes were present, while 11 flakes were broken. One of the lamellar flakes was the product of bipolar manufacture. The rather striking even breakdown in types of flat flakes utilized leads to the inference that selection for specific flake shapes was not an important factor.

The weight distribution of these artifacts was calculated for 42 unbroken examples. Close similarities were observed with the retouched flakes analyzed above. Once again the mode fell between 2.1 gm and 3.0 gm, while the mean was 4.64 gm, 0.10 gm less than the retouched flake sample. This similarity would imply similar kinds of selective factors for both artifact groups, the differences lying in the intentional modification of the retouched flake group as well as in a selection for expanding flakes in the latter. On the other hand, it may indicate that if the criteria for formal differentiation of these two flake groups is correct, these criteria cannot be extended to encompass functional distinctions. To define functional differences between the two types of flakes, portions of both samples were subjected to microscopic analysis under both high and low power objectives. This process revealed that (1) the retouch was not "fresh" and therefore was not a product of screen collection or field and laboratory handling; (2) that when wear occurred it was in the form of slightly polished flake scar ridges; (3) that this wear occurred on the worked face of the flake; and (4) no wear striae were visible on members of either class. In light of these observations the two types of flakes may not be functionally differentiated. The distinction, then, must remain formal.

Discussion

An appraisal of the chipped stone industry from the O'Neill Site in relation to its functional specificity or diversity and the types of industrial activity carried out at the site may give insights into the role this series of occupations played in the overall Late Woodland settlement system of the northwestern Lower Peninsula of Michigan. The most striking aspect of the flint artifact inventory from O'Neill is the high frequency and variety of cores compared with the rest of the chipped stone sample; the ratio of cores to other artifacts is 1:1. If we apply this ratio to the types of activity carried out at the site and their relative importance, the implications would be that flint processing was at least as important as the sum of the other tasks that could be performed using chipped stone tools. Additional data should strengthen this generalization. First, over 45 per cent of the weight of the non-utilized flint from the site consisted of tabular raw material unmodified in any manner; this suggests active transportation of large quantities of flint to the site for processing. Corroborative evidence is also recognized in the flake to artifact ratio. If we exclude cores, there is a ratio of 171 flakes per artifact, an impressive fact in itself. The Eastport Site, which was interpreted as a functionally specific quarry site, had a ratio of 95 analyzed flakes per artifact (Binford and Papworth 1963: 120-121). The contrast between similar ratios computed for the Spring Creek Site lithic data (Fitting 1968: 32) of 7:1 and a 26:1 ratio for the Juntunen Site chipped stone industry makes the O'Neill ratio all the more startling. In fact, the only reported occupation which exceeds that of the O'Neill Site occurs in the late Middle Woodland levels of the Schultz Site (Fitting 1972: 218). We must therefore conclude that one of the primary activities performed at the O'Neill Site was the processing of flint materials.

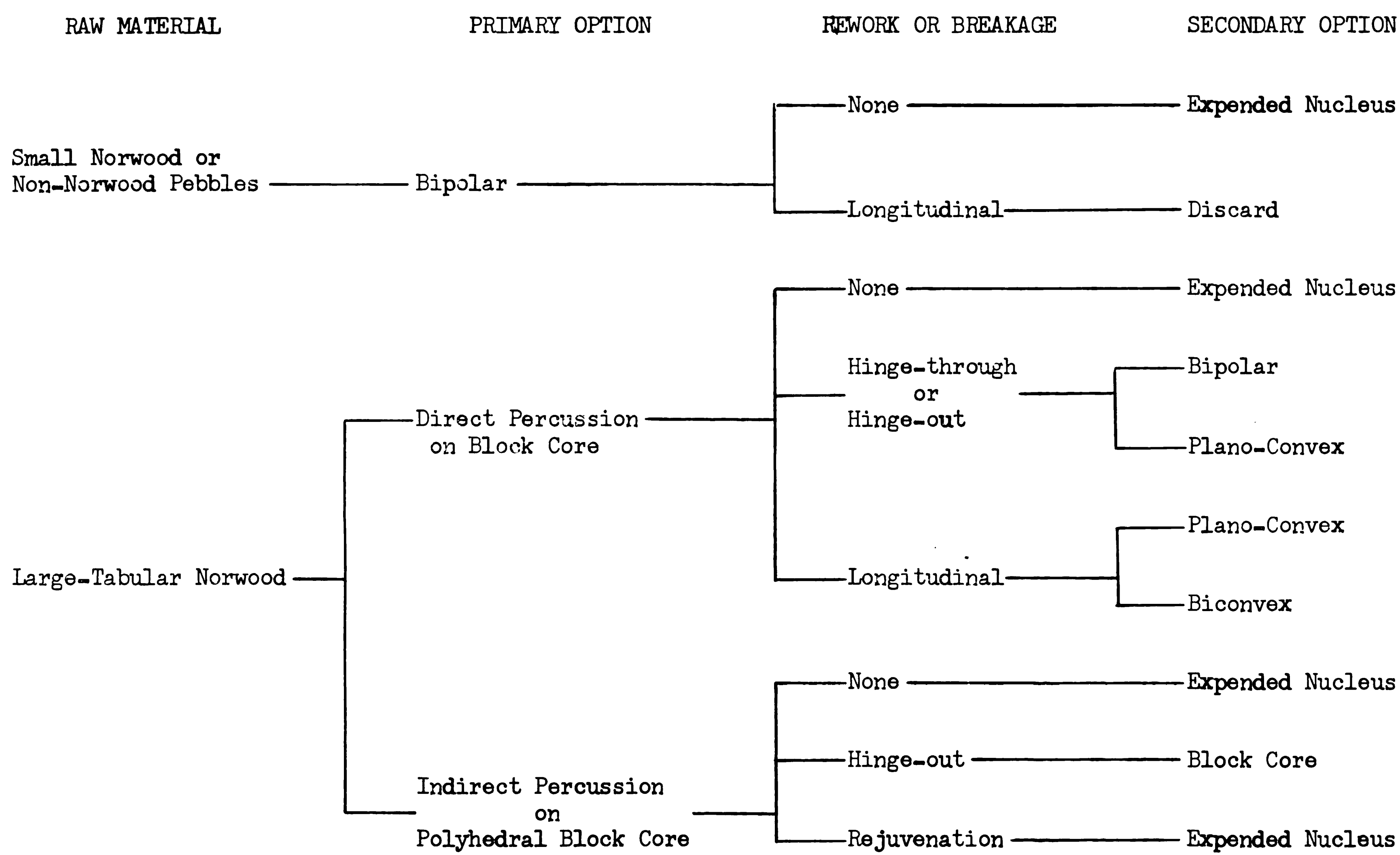
The cores from the site display a wide range of variability both in the type of technology and their size range. Considering the proximity of both Hayden Point and the Norwood Quarry Site, as well as the large amounts of unworked raw material present on the site, an unexpected reluctance to discard broken cores occurs. As noted earlier, some of the bipolar cores in the sample seem to have been broken block cores that were then subjected to bipolar knapping, yet only one flake tool from the site may possibly have been manufactured on a flake from a bipolar core. There is also a possibility that both the biconvex and plano-convex cores from O'Neill are a result of similar behavior. Both groups are composed of smaller cores that may, initially, have been fragmented block cores. Technologically this would not be impossible. Wobst's (1968: 211) discussion of plano-convex cores from the Butterfield Site dealt predominantly with nodular core preparation. The process involved splitting the nodule, removing the cortex, and striking flakes using the flat, split face as a platform. Although some convoluted lenses of tabular chert which are reminiscent of nodular material are present at the Norwood Quarry Site (Cleland 1973), tabular material can also be given similar treatment. The rectangular section of these materials allow working of the flat faces in either a unifacial or bifacial manner and also allow the knapper to remove the top and bottom cortical layers by driving flakes from a striking platform. In the case of the O'Neill Site sample, this process seems to have been utilized to work both smaller pieces of raw material or fragmented cores of other types.

If these conclusions are valid for the sample under discussion, it would follow that a series of options were open to the knapper during the chipping process. Due to the high frequency of block cores and block core fragments in the core sample (38 per cent), it is suggested that this is the initial option and that, in the majority of cases, initial core preparation would follow a block core technique. Small, polyhedral block core nucleii attest to the fact that, when possible, tabular cores are worked down to a very small diameter. Options appear when the tabular or block core breaks. If hinge through occurs, the knapper has the choice of continuing with either a bipolar or plano-convex technique; if longitudinal fracture takes place, plano-convex or biconvex options are available. Thus, there is no need to discard a broken but prepared core; the knapper needs only to choose the best option for the type of breakage that has occurred and can continue removing flakes from the same piece of flint in a different manner.

These options seem to hold true insofar as the dominant core types are utilized. Two cases arise, however, which add to the decision-making process at different levels. The first is the occurrence of tiny bipolar cores manufactured on chert other than Norwood. Here, it seems, the primary option is for the use of the bipolar technique when smaller material is being worked. Thus, chert type dictates the primary option. The second case involves the occurrence of four cores which showed evidence of a blade-like technique of flake production. The latter were found on Norwood chert, and all can be considered block core variants. The difference lies in the mode of flake detachment. Examination of the cortical faces of these cores revealed both scratched, roughened areas and thin, gouged concavities located in the center of the cortex above the negative bulb that remained on the core. The first attribute is consistent with platform surfaces found on prepared blade cores (Crabtree 1968: 457). Furthermore, these gouges would be the expected type of scarification resulting from the use of a punch for indirect percussion in the removal of flakes. One fragment resembles a thin slab removed from the "top" of the core as part of a rejuvenation process. A single expended nucleus verifies the fact that occasionally these polyhedral cores avoided breakage and could be worked down to rather small sizes (Fig. 29). And, finally, a hinged through fragment was reworked as a block core. In spite of the tantalizing suggestion of a blade industry during the Late Woodland, the occurrence of only eight artifacts manufactured on blade-like flakes and four polyhedral cores of 66 block cores in the sample indicate a minimal reliance on this industry. Quite possibly, blades were sometimes made for specific types of activities. In any case, the outlined options seem to be valid for the O'Neill Site chipped stone industry. These options are diagrammed in Figure 40.

Figure 40

Diagram of Options in Core Manufacture


RAW MATERIAL
PRIMARY OPTION
REWORK OR BREAKAGE
SECONDARY OPTION
Small Norwood or Non-Norwood Pebbles
Bipolar
None
Expended Nucleus
Longitudinal
Discard
Large-Tabular Norwood
Direct Percussion on Block Core
None
Expended Nucleus
Hinge-through or Hinge-out
Bipolar
Plano-Convex
Longitudinal
Plano-Convex
Biconvex
Indirect Percussion on Polyhedral Block Core
None
Expended Nucleus
Hinge-out
Block Core
Rejuvenation
Expended Nucleus

The 172 other chipped stone artifacts from the O'Neill Site fall into a wide range of formal classes that functionally overlap. Readily recognizable secondary tools utilized in the manufacture of wood or bone implements compose a small part of the total industry; gravers, drills, and choppers account for only 3 per cent of the tool inventory. Cutting and scraping tools, which may well have served secondary functions, dominate with 75 per cent of the sample; projectile points and fragments account for 15 per cent of the total. The presence of projectile point tips and the large number of cutting and scraping tools should reflect a large amount of both hunting and processing of game animals. These subsistance activities, however, probably were a necessary, but secondary, adjunct to the flint processing activities.

Examination of the O'Neill Site industry to deduce the primary subsistence activity performed at the site was accomplished by comparing the ratio of bifaces to unifaces. A resultant ratio of 1.75 unifacial tools per biface would support the conclusion that the occupation relied for the most part on fishing (Fitting 1969: 367). Two considerations may negate this interpretation. First, Fitting notes that the derived ratios are not applicable to Woodland sites because of the omission of certain tool categories from Taggart's (1967) study from which the ratio was calculated. Secondly, 17 of the bifacial implements, a total of 27 per cent of the bifaces, are manufactured on small flakes that have been shaped by bifacial marginal retouch. This includes projectile points, knives, and scrapers. McPherron (1967a: 149) observed that unifacial Juntunen points occurred in the Juntunen sample. Upon examination many of the Late Woodland chipped stone industries in the Upper Great Lakes seem to be flake industries, and minimal bifacial stone work is necessary. The

O'Neill Site fits this description; laterally modified unifaces sufficed in places where the Saginaw Valley Archaic would have manufactured bifaces.

The above statement is supported by the frequency distribution of flat flakes in class intervals of length. It was observed (Fig. 33) that 54.6 per cent of these flakes were between 1.0 cm and 1.9 cm, and 80.6 per cent fell between 1.0 cm and 2.9 cm. Only 13 artifacts in the sample would not fit on flake blanks in this size range: the lanceolate bifaces, ovate bifaces, large triangular bifaces, preforms, and lunate chopper. Considering the size, quantity, and quality of raw material available, there seems to be a conscious selection for small flakes and small-flake-derived tools.

Spatial and vertical distributions of both debitage and flint artifacts at the O'Neill Site revealed major differences in the density of artifacts and the types of activity carried out on different parts of the site. The lack of temporally diagnostic lithic materials, coupled with a paucity of artifacts from stratified portions of the occupation (Area A), hindered attempts at explaining formal variability in terms of temporal trends. The only flint artifact class that could be analyzed in this manner was cores. Vertical distribution in Area A illustrates a sharp reduction in the frequency of cores during the most recent occupation (I), while the frequencies remained virtually equal throughout Occupations II and III. Despite this sharp reduction, we can still define a selection for plano-convex cores for this latest occupation. Likewise, bipolar cores are more popular during Occupation II; Occupation III reveals less clearly defined preferences with some emphasis on block cores.

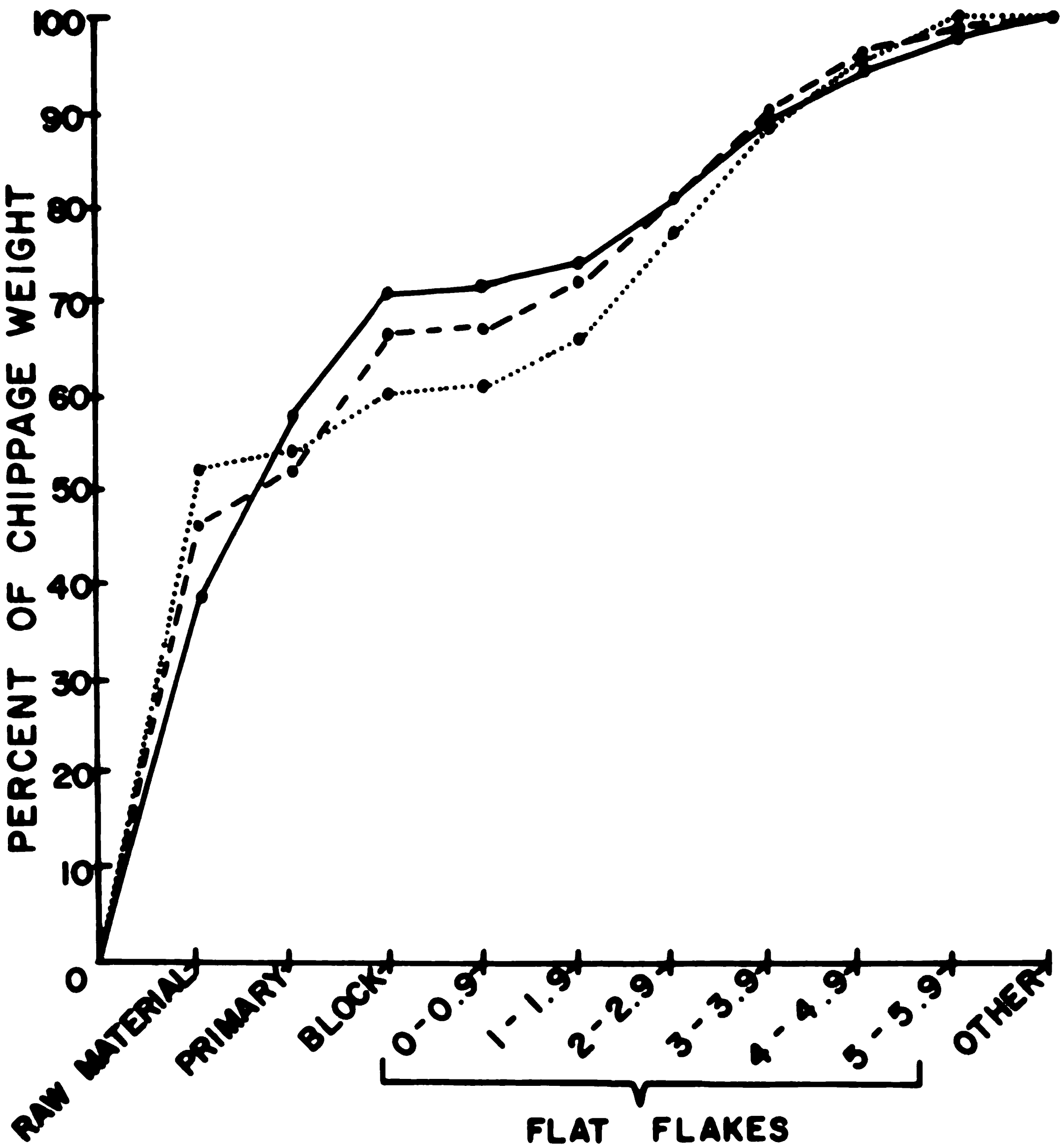
There was considerable differential distribution and density of chert artifacts between excavation areas at the O'Neill Site. Artifact density in Area A was .0210 per cubic foot; for the Test Units it almost doubled to .0417, while Area B jumped to .1117 artifacts per cubic foot. The relationship then can be illustrated as B>Test Units>A and can be said to hold true for tools, cores, and chippage frequency as well as overall density. A similar relationship also pertains to the stratified occupations in Area A, where all of these groups except for cores decrease through time: III>II>I. For cores this would be illustrated as II> III>I.

Area B, if the above relationships are true representations of the amount and kinds of activities carried out on different parts of the site, represents a focus of activities dependent on both primary and secondary chipped stone tools. The stratified parts of the site, on the other hand, seem to have functioned in a different manner for all activities involving chipped stone tools with the exception of core processing. Chipped stone materials from the Test Pits, however, indicate a lack of secondary tools, implying that the manufacture of wood and bone implements was localized to Area B. In addition, the three preform fragments from the site were all recovered from one unit in the Test Pits, N370/E90. This activity may have been localized to certain areas on the fringes of the occupation.

The consistency in the proportion of chippage classes and raw material found on different areas of the site made it impossible to propose statements concerning the types of flint knapping activities performed across the site (Fig. 41). Differential proportions of chippage types recovered from each of the three occupations of Area A, however, led to assumptions pertaining to the stage of manufacture that was emphasized during each (Fig. 42). Throughout Occupation II more core preparation, in the form of block and primary flakes, took place than processes involving

Figure 41

Cumulative Comparison of Flake Type Frequency at the O'Neill Site

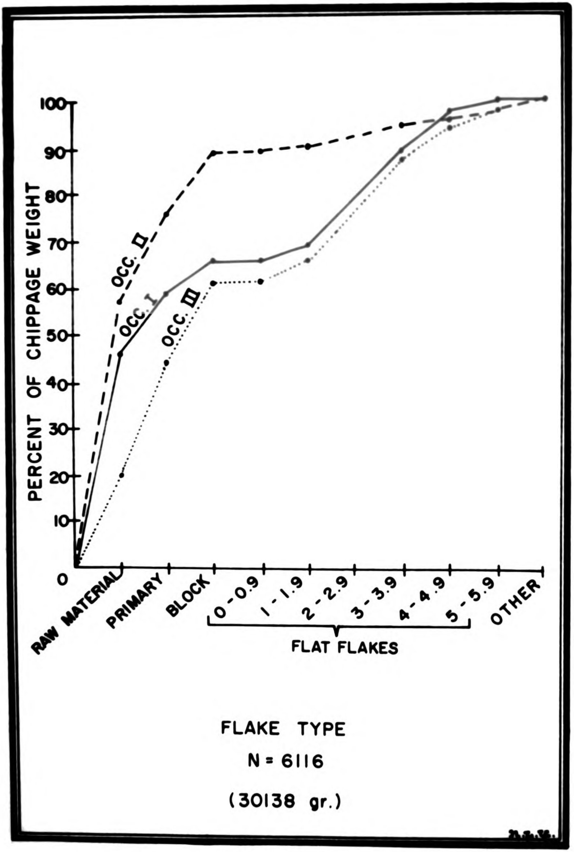


FLAKE TYPE
N = 33716
(142446 gr)

Figure 42

Cumulative Comparison of Flake Type

Frequency in Area A of the O'Neill Site


PERCENT OF CHIPPAGE WEIGHT
100
90
80
70
60
50
40
30
20
10
0
OCC. II
OCC. I
OCC. III
RAW MATERIAL
PRIMARY
BLOCK
0-0.9
1-1.9
2-2.9
3-3.9
4-4.9
5-5.9
OTHER
FLAT FLAKES
FLAKE TYPE
N = 6116
(30138 gr.)

the removal of flat flakes. Although a higher proportion of large flat flakes and a reduction in the amount of raw materials occurs in Occupation III, similar kinds of primary and secondary knapping activities are also present. The most recent occupation displays proportionally less primary chippage than the other occupations of this area, more raw material than Occupation III, and more large flat flakes than Occupation II. During Occupation II, the site probably functioned as a core preparation area for raw materials; during Occupation III, large flake removal from both raw material and prepared cores or artifacts was emphasized. During Occupation I, the primary function was the removal of large flakes from prepared cores or artifacts.

Another factor that would affect flake frequency distributions but which cannot be controlled would be the types of cores that were present. The bipolar core emphasis of Occupation II would account for the lack of flat flakes or at least the lower proportion of this flake type recovered from this occupation. The large block core and amorphous core emphasis of Occupation III could easily increase the amount of larger flakes yielded by this horizon.

CHAPTER 4

PECKED AND GROUND STONE

The two seasons of excavation performed at the O'Neill Site produced 29 pieces of stone altered by either grinding or pecking. This sample includes hammerstones, anvils, grinding stones, abraders, whetstones, netsinkers, gorgets, pendants, knives, and fish scalers.

Pecked Stone

Netsinkers or Linesinkers

Two complete and one fragmentary netsinkers from the O'Neill Site were manufactured on flat, waterworn beach cobbles, each of which was modified by opposed notches presumed to have functioned as line attachments (Fig. 43A-B). In spite of these similarities, however, the size range differed radically; length measurements ranged from 14.6 cm to 10.1 cm, width from 9.0 cm to 5.1 cm, and thickness from 2.5 cm to 1.6 cm. Also, the largest implement was further modified by a third notch at one end. Width between the notches ranged from 0.4 cm to 0.1 cm. The shallowness of the notches indicates that notch depth was not the primary consideration of manufacture; rather the distance the notches extend across the face would be more important. Thus, the thinning rather than the notching of the pebble is the primary criterion of manufacture. On the small sample from the O'Neill Site, notch length (distance across the face) ranged between 1.0 cm and 1.6 cm. No further modification of the line haft, for example pecking or grinding, was noted for any of these artifacts.

Figure 43

Pecked and Ground Stone

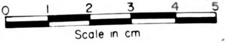
A-B Netsinkers or Linesinkers

C Whetstone

A

B

C



Anvils

Within the ground stone sample from the O'Neill Site, two round, biconvex glacial cobbles were identified as anvils. Both cobbles had the characteristic pecked and battered pitted concavities assumed to be the result of hammer and anvil chert knapping. The larger was utilized on both convex faces; one face had a discernibly deeper (0.3 cm) pit than the opposite (0.1 cm), while the other anvil was modified by pitting on only one face (Fig. 44A). The diameter of the pitted areas ranged between 4.1 cm and 1.3 cm. A secondary function of both items was alternative use as a hammerstone; battered edges were evident on some areas.

Hammerstones

Ten igneous glacial cobbles from the O'Neill Site showed evidence of use as hammerstones. Within this group were two cobbles whose primary function was as anvils, and one which functioned as a grinding implement. Other than these examples, the only modification present were pecked areas around the margins (Fig. 44B-C). No preference could be demonstrated for use of either the side or end of the cobble; one example was even battered on both flat faces. Both size and weight measurements indicated a wide range of variability. In length they ranged from 5.2 cm to 10.3 cm with a mean of 8.1 cm, while their width varied between 4.1 cm and 10.3 cm with a mean of 6.6 cm. Maximum thickness ranged from 3.1 cm to 5.3 cm with a mean of 3.6 cm. In weight, these cobbles ranged between 101 gm for the smallest, and a massive 884 gm for the heaviest -- the upper weight limit is the result of a cobble which functioned primarily as an anvil and only secondarily as a hammer. Mean weight of these artifacts was 327.2 gm. The number of discrete use areas varied between one and three, including both sides and ends. The hammerstone data are summarized in Table 8.

Figure 44

Pecked Stone

A Pitted Anvil

B-C Hammerstones

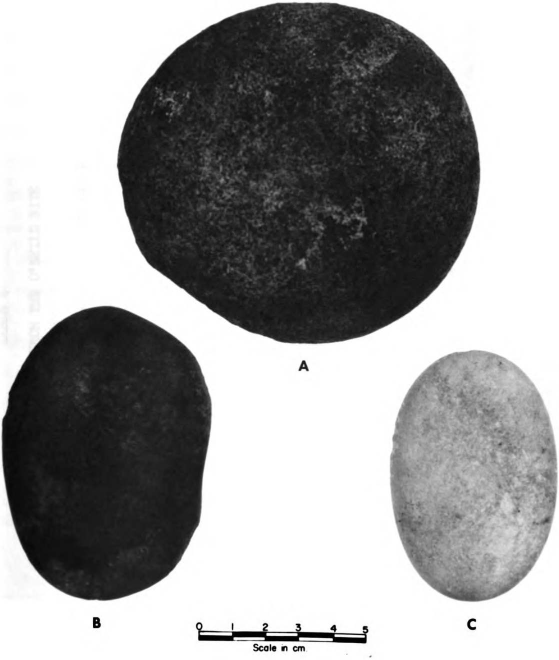

A
B
C
0 1 2 3 4 5
Scale in cm.

TABLE 8

HAMMERSTONES FROM THE O'NEILL SITE

Catalog Number	Shape	Weight	Length	Width	Thickness	Wear Location	Other Function
3468.20.9	Circular	435 gr.	9.2 cm	8.7 cm	4.0 cm	3 areas of circumference	None
3468.28.2	Subrec-tangular	247 gr.	8.8 cm	6.2 cm	2.9 cm	2 sides 1 end	None
3468.11.3	Oval	437 gr.	10.3 cm	7.2 cm	3.6 cm	2 ends	Grindstone
3468.61.2	Subrec-tangular	294 gr.	7.8 cm	6.6 cm	4.1 cm	2 ends 1 side	None
3468.61.2	Oval	105 gr.	5.2 cm	4.1 cm	3.4 cm	1 end	None
3468.28.5	Triang-ular	101 gr.	5.2 cm	4.1 cm	3.1 cm	1 end	None
3468.27.7	Rectangle	391 gr.	9.1 cm	6.6 cm	5.3 cm	1 side	None
3468.17.2	Circular	236 gr.	7.9 cm	7.1 cm	2.2 cm	2 areas on circumference	Anvil
3468.20.1	Circular	884 gr.	10.3 cm	9.8 cm	5.1 cm	3 areas on circumference	Anvil
3468.61.5	Oval	147 gr.	7.5 cm	4.9 cm	2.6 cm	1 side 1 end	None
MEAN		327.2 gr.	8.08 cm	6.58 cm	3.63 cm		

Ground Stone

Grindstones

The O'Neill Site yielded no groundstone material which could be classified as mortars or pestles. On the other hand, certain of the plano-convex cobbles from the site, although waterworn, possess surface sheen on their flat faces. The three cobbles in this group have maximum diameters between 10.3 cm and 6.4 cm, while they are between 3.0 cm and 3.6 cm thick. A fourth example, measuring 7.8 cm x 5.6 cm x 1.3 cm in maximum dimensions, had visible wear striations running parallel to the longitudinal axis. This artifact was manufactured on a waterworn plano-concave beach pebble of irregular shape. The worked area was approximately 1.8 cm x 5.1 cm. Wear striations continued off one end of this pebble, and terminated in deeper gouges 2.7 cm from the opposite end.

Whetstone

A single piece of micaceous schist was also recovered from the O'Neill Site and has been classified as a whetstone (Fig. 43C). The artifact is fragmentary, measuring 4.7 cm wide and 1.3 cm thick. Both lateral margins are heavily polished from use.

Ground Slate and Shale

Throughout the excavations at the O'Neill Site, any material that was not of local origin and which may have been transported to the site, whether worked or unworked, was saved and retained for laboratory analysis. As a result of this recovery, 192 fragments of slate and shale were analyzed. Due to the high frequency of exfoliation, transverse fracture, and surface erosion, it was necessary to restore much of this material as completely as possible; they were then subjected to both visual and microscopic analysis. Twenty-seven of these fragments, four slate and the remainder shale in various states of decomposition, were restored into 12 either whole or fragmentary artifacts that were intentionally modified to some degree.

The 12 artifacts were subsequently subdivided on the basis of presence or absence of ground margins or faces. Seven artifacts within this sample had some formal alteration prior to utilization, while the remaining five had none.

Within the category of modified materials were a gorget blank and a fragmentary pendant. The gorget (Fig. 45A), manufactured on a large piece of partially eroded shale, was quadrilateral, with one end wider than the other. No holes had been drilled, and the corners of the larger end were broken. This ornament measured 13.6 cm in length, 6.4 cm in width at the smaller end, and was extremely uniform in thickness ranging between 1.1 cm and 1.2 cm thick. Both the longitudinal and transverse cross sections were biplano. The pendant, also manufactured on eroding shale, was broken at both ends (Fig. 45B). Its ovoid transverse cross section had a maximum dimension of 2.1 cm and a minimum of 1.1 cm. A single, scratched, decorative line encircled three fourths of the circumference of the artifact, located in the center of the fragment.

A single ground slate "knife" (Fig. 46D) was recovered from Occupation Zone III of Area A. One end of the artifact is broken. The upper blade edge is straight and ground for a distance of 3.6 cm, while the lower blade is curved, ground along 6.2 cm of the edge and terminates in a shallow notch assumed to be a haft. This haft arrangement may have been duplicated at the opposite end, since the thinned area presents a structural weakness; the haft was broken and restored on the portion of

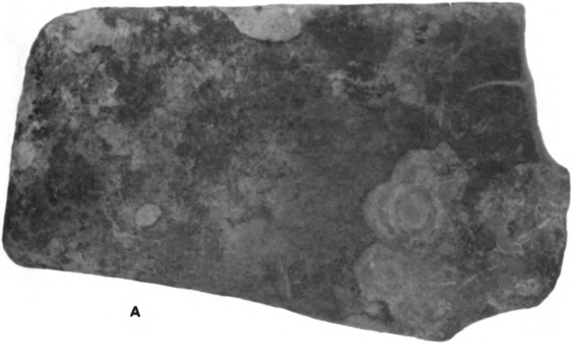
Figure 45

Ground Stone

A Gorget Blank

B Pendant

C Abrader



A

B

C

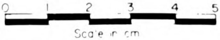
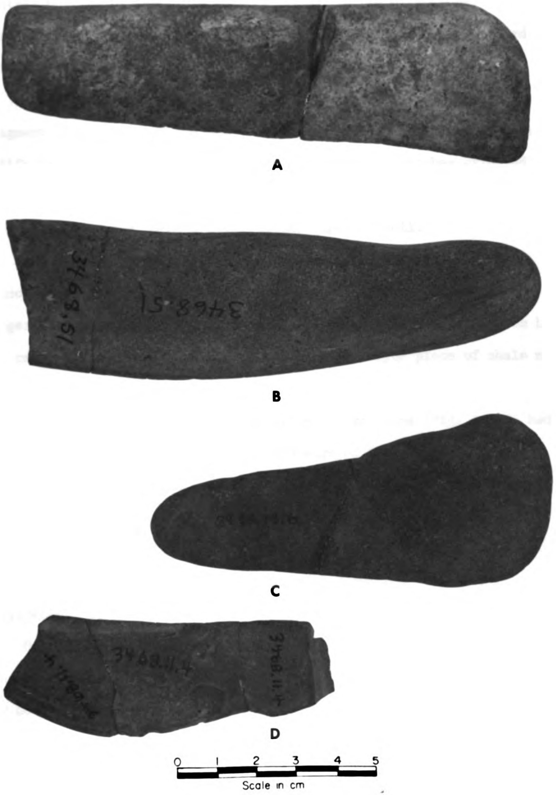


Figure 46

Ground Slate and Shale

A-C Unmodified Shale "Fish Scalers"

D Ground Slate Knife


A
B
C
D
0 1 2 3 4 5
Scale in cm

this artifact that was analyzed. Wear striations were noted along the central portion of the blade edge, oriented in two directions; perpendicular to the working edge, or on a mean of 30 degrees toward the hafted end.

. Abrading tools at the O'Neill Site were represented by one slate fragment (Fig. 45C) and one shale fragment. All intact edges on these artifacts are ground smooth. Both have haphazard scratches oriented parallel to the longitudinal axis, while the larger slate piece has deep, intermittent gouges perpendicular to the edges as well.

The two remaining artifacts in the sample of modified materials cannot be classified functionally. Despite their size disparity, the larger measuring 15.9 cm by 11.5 cm by 1.0 cm and the smaller 7.8 cm by 1.5 cm by 1.2 cm, both have ground edges. The larger piece of shale may possibly represent an initial stage of blank preparation for a gorget.

Those five pieces of shale unmodified by grinding (Fig. 46A-C) had wear striations present on at least one edge of the artifact. These striations did not demonstrate any directional uniformity in relation to the working edge. Two had wear on the ends of the artifact, while the remainder had the striae confined to the long edges. All of these artifacts were elongated and waterworn with tapering, thin edges. Measurements of these implements are summarized in Table 9.

Unmodified but utilized artifacts similar to those described above are not reported from any Woodland sites in the Upper Great Lakes. This may be because they are often broken into small fragments and look much like water-rolled beach cobbles. The shale from which many of these implements were fashioned does not occur locally. It does, however, occur at the Norwood Quarry Site, interbedded with the Traverse limestone and

TABLE 9

UNMODIFIED SHALE FROM THE O'NEILL SITE

Catalog No.	Length	Width	Thickness	Angle of Striae From Working Edge
3468.51	13.8 cm	3.9 cm	0.9 cm	49 degrees 3 degrees
3468.18.1	13.6 cm	4.0 cm	0.9 cm	60 degrees
3468.15.6	10.3 cm	4.4 cm	0.5 cm	74 degrees
3468.18.7	----	3.1 cm	1.3 cm	2 degrees
3468.15.2	----	1.9 cm	0.9 cm	27 degrees
MEAN	12.3 cm	2.7 cm	0.7 cm	

Norwood chert strata, where the raw material for chipped stone tools was gathered (see Chapter 3). It was probably exploited and transported at the same time that chert extraction was practiced. This implies systematic planning on the part of the users. All unmodified material and the "knife," which exhibited similar wear striations, were recovered from Area A; two of these came from Occupation Zone II, while the remaining four were from Occupation Zone III. One of the latter was in direct association with a pile of fish bones and scales, Feature 31. Throughout the occupation of the site Area A was devoid of any architecture, yet was still intensively utilized. These data indicate that the function of the unmodified shale tools was related to the processing of fish and that one function of Area A was food processing.

The dull edges of these artifacts, it was thought, would eliminate a cutting function; this attribute would, in fact, be dysfunctional for that purpose. On the other hand, these implements could be used to scale fish, since this use would not necessitate that the tool be used with a certain edge; both sides and ends would produce effective results. To test this hypothesis a fish from the City Fish Market, Lansing, Michigan, was purchased. An attempt was made to both cut and scale the fish with one of the above tools.

Results of this experiment revealed that (1) these implements were not at all useful for cutting purposes, and (2) that if held at the proper angle one could successfully scale the fish. The correct angle comprised holding the lateral edge of the instrument against the surface to be scaled, canted slightly away from the user. By drawing against the scales and toward the user, scales could be removed -- albeit not very efficiently. Numerous passes with the shale tool to clear an area of scales were often necessary, at which point individual scales still adhering had to be removed by hand. In lieu of an alternative explanation for the use of these items and given the moderate success of the experimentation, these shale implements will be called fish scalers in the remainder of this report. This does not imply that this was their primary or only function, only that fish scaling was one task which could be performed with them.

Discussion

The pecked and ground stone tools from the O'Neill Site can be grouped into three broad functional categories: food extraction and processing (12), tool production and maintenance (13), and personal adornment (2). This sample gives an indication of some activities that occurred at the site. The presence of netsinkers, although in small quantities, would indicate that netfishing was practiced in either the shallow embayment formed by Fisherman Island or in the adjacent Inwood Creek. The extent of this method of fish extraction will be clarified when the faunal analysis is completed. Related to the above is the high frequency of fish-processing tools (six), in relation to plant food processing implements (three). Once again, clarification of this relationship will have to await the floral data. Hammer/anvil flint knapping techniques are usually associated with bipolar flint industries; this is strengthened by the analysis of chipped stone artifacts. A disparity, however, arises in the use of the small abraders. None of the flint tools showed any indication of grinding either on the base or on the haft element. These tools may possibly have been used to manufacture wood or bone implements, some of which are polished. Their use during some phase of plant food processing should also not be discounted.

CHAPTER 5

NATIVE COPPER, PREHISTORIC PIPES, AND WORKED BONE

The sample of bone artifacts, copper artifacts, and prehistoric smoking pipes from the O'Neill Site is both small and rather typical of other Late Woodland sites in the study area; it consists of 5 pieces of copper, 9 pieces of bone, and 11 pipe fragments assignable to two complete pipes. Due to both the small size of the sample and an inability to deduce the function of many of these items, no formal classification was attempted. Instead, a brief description of the individual artifacts follows.

Native Copper

A rather small copper sample was recovered from the prehistoric occupation of the O'Neill Site, consisting of a single rolled tubular bead, a copper "butter" knife, and three pieces of waste. The tubular bead is manufactured from an irregular sheet of copper 0.5 cm thick that had been rolled two full turns, with a total length of 2.7 cm and a diameter of 0.45 cm (Fig. 47A). A striking difference between the scrap sheets (Fig. 47B-D) and the material from which the bead was manufactured is the thickness of the copper. A long, thin sheet (4.3 cm by 1.3 cm) was 0.15 cm thick, while the remaining irregularly shaped sheets both measured 0.2 cm thick. The copper knife, unfortunately, was misplaced shortly after cleaning; no metric attributes are therefore available for this artifact.

Tubular copper beads of the type found at the O'Neill Site have been recovered from a number of predominantly Late Woodland contexts in both Michigan and Ontario. Foremost of these sites are the Dumaw Creek Site, where a total of 96 tubular beads other than hair pipes were recovered

(Quimby 1963a: 194 and 1966a: 39-42; Fischer, n.d.: Table V), and dated to between 1605 and 1620 (Quimby 1966a: 81); and the Juntunen Site in the Straits of Mackinac, a Late Woodland Site with 22 tubular beads in the native copper assemblage (McPherron 1967a: 171). Other sites in the Upper Great Lakes area with similar, yet smaller, bead samples include a single bead from the Ponshewaing Point Site in Emmet County, Michigan (Fischer, n.d.: Table V), and the Pic River Site, Stratum III occupation (Wright 1966: 87); the latter is dated to the tenth century A.D. (Wright 1966: 75), and the former is dated to between A.D. 800 and A.D. 1300 (Charles Cleland, personal communication). The O'Neill Site specimen was recovered from a thirteenth-century stratum.

Both complete and incomplete copper "butter knife" specimens have been recovered from Late Woodland contexts in the Upper Great Lakes (Quimby 1963a); at least one of these artifacts has been associated with an Early Historic assemblage. The majority are tanged; the one exception is from the Ponshewaing Point Site (Fischer, n.d.: Table III), while a probable tanged knife was included in the mid-fifteenth-century assemblage from the Michipicoten Site Stratum III (Wright 1968: 29, 50); a blade fragment was recovered from the Late Woodland Seul Choix Site in Schoolcraft County (Quimby 1963a: 196). Tanged knives, on the other hand, have been found at the Johnson Site on Isle Royale, where two were recovered from a Late Woodland, Iroquoian context (Quimby 1939: 220; 1963: 194-196). A single specimen was recovered from the early eighteenth-century occupation of Stratum I at the Pic River Site, Ontario (Wright 1966: 69-70). Also from Ontario, but dated to the mid fifteenth century, is a single knife from Stratum III at the Michipicoten Site (Wright 1968: 29, 50). From the Straits of Mackinac area, eight tanged "butter knives" were removed from the Late Woodland occupation of the Juntunen Site (McPherron 1967a: 171).

Prehistoric Pipes

One complete sandstone pipe and 10 fragments of a single ceramic pipe were part of the prehistoric assemblage from the O'Neill Site. The former is a truncated, somewhat polyhedral cone, the truncated apex of which is the base (Fig. 47G). Maximum diameter of this pipe is 3.6 cm, while it is 5.4 cm high. A hole for the insertion of a wood or reed stem is centered 2.4 cm from the base with a diameter at the mouth of 1.4 cm. This stem hole is perpendicular to the longitudinal axis of the pipe. The bowl is drilled in a similar manner, with an orifice diameter of 1.6 cm. Both holes are then connected by a thin, gouged passageway, since the drilled holes do not meet on the interior.

Few measurements could be gained from the fragmented ceramic pipe (Fig. 47E, F, H). The bowl is cylindrical and minimally 6.0 cm in height. Decoration consists of three discrete zones: a series of vertical rows of short linear punctations followed by three horizontal trailed zone lines. The latter borders a smooth band which continues onto the stem. The bowl has an exterior diameter of 2.6 cm and an interior diameter of 1.5 cm. The stem of the pipe is at right angles to the bowl, shaped in a rounded D form near the bowl with the flattest part uppermost. It then tapers to a square cross section at the bit. Diameter of the smoke hole is 0.4 cm.

Ceramic pipes with a compatible stem cross section have only been recovered from three other sites in the Upper Great Lakes. A single stem with a flattened upper surface was recovered from the Ponshewaing Point Site, Emmet County. McPherron (1967a: 180-181) notes similar stem cross sections from Juntunen Site pipe fragments assignable to the Mackinac Phase. Both incising and punctation seem to have been present as decorative techniques throughout the occupation of this latter site. A single specimen from the Skegemog Point Site (Cleland, n.d.) also has a partially flattened upper stem surface, although it lacks the D-shaped cross section common to the other examples.

Worked Bone

Two long, pointed objects manufactured from mammal bone have been classified as awls (Fig. 48A-B). Both items have been longitudinally split and then laterally modified to a tapered point. The first was made from a deer metapodial (length 12.5 cm, width 2.1 cm, thickness 1.1 cm), while the other was splintered from a mammal long bone and then modified (length 11.7 cm, width 1.7 cm, thickness 0.8 cm). The worked faces of these piercing implements showed chatter marks, a natural result of the manufacturing process as defined by McPherron (1967a: 176-177) for similar items from the Juntunen Site.

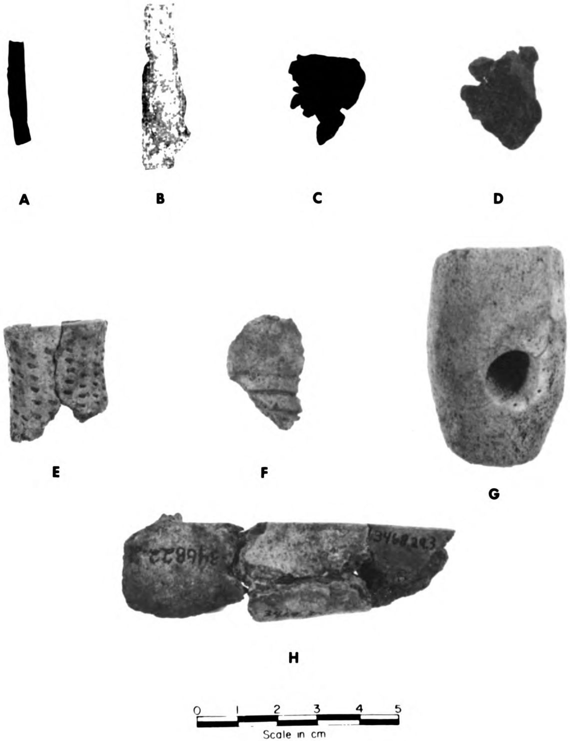
A single, broken bone chisel was recovered from the O'Neill Site (Fig. 48C). The function of this tool has been inferred from the highly polished, pointed working edge and the blunt, squared and exfolitated opposite edge. Produced on a large unidentifiable mammal bone (length 9.1 cm, width 4.2 cm, thickness 1.5 cm) both lateral edges have been modified. Similar tools were recovered from the Late Woodland Juntunen Site (McPherron 1967a: 178).

The remaining six modified bone artifacts cannot be functionally classified with any degree of certainty. Three of these (Fig. 49A-C), one manufactured on a left beaver tibia and the other two on unidentifiable

Figure 47

Native Copper and Prehistoric Pipes

A	Tubular Copper Bead
B-D	Copper Fragments
E-F	Ceramic Pipe Bowl Fragments
G	Sandstone Pipe
H	Ceramic Pipe Stem


A
B
C
D
E
F
G
H
0 1 2 3 4 5
Scale in cm

mammal bone fragments, have beveled edges which may have served some type of scraping function. One bone splinter, (Fig. 49E) was modified laterally, tapering to a sharp point at one end with a shallow notch girdling the other broken end. This artifact, which may have functioned as a pin or awl, was 4.2 cm long, with a maximum diameter of 0.5 cm. A similar artifact to the one just described is broken and has the same type of girdling at one end (Fig. 49D). It is manufactured on a mammal baculum. One cut and polished beaver incisor from the O'Neill Site (length 3.5 cm, width 0.6 cm) might possibly have functioned as a chisel (Fig. 49F). The angle of the working edge, however, does not seem to have the characteristic bevel associated with such tools (D. King, personal communication). The intentional polish on the edge, and the angle of the cut end, may well indicate use as a ceramics stamp, perhaps for the application of punctates or stab and drag decoration.

Figure 48

Worked Bone

A-B Awls

C Chisel

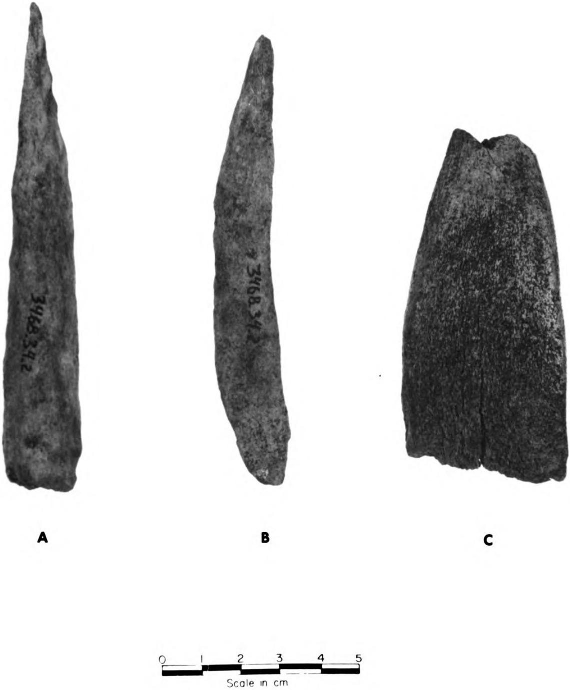

3468.34.2
3468.34.2
A
B
C
0 1 2 3 4 5
Scale in cm

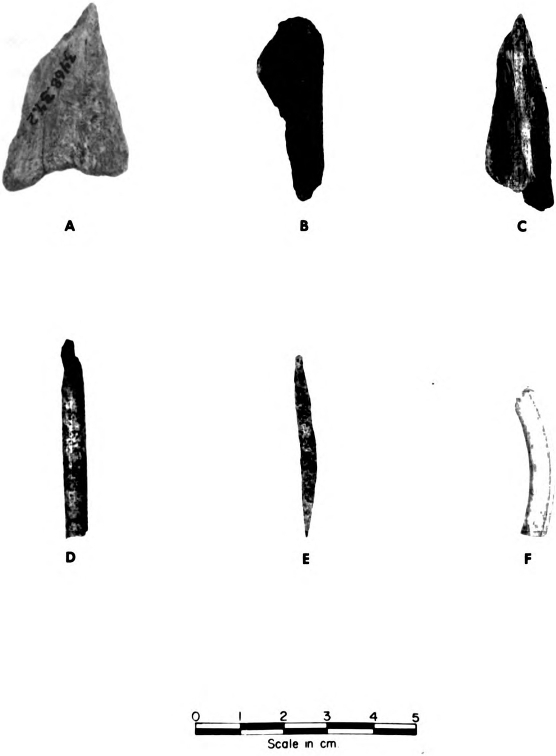
Figure 49

Worked Bone

A-C Unidentifiable Worked Bone

D-E Bone Pins or Awls

F Possible Beaver Incisor Ceramic Stamp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Scale in cm

CHAPTER 6

EURO - AMERICAN ARTIFACTS

Euro-American materials in the O'Neill Site assemblage have been subdivided into two major categories, one of which will receive much more extensive descriptive and comparative attention than the other. The point of divergence in the treatment of the 307 artifacts studied in this section was the ability to apply temporal designations to the materials. When this process was completed two broad groups were left: the first consisted of late nineteenth-century and twentieth-century debris, while the second included either European trade items or artifacts manufactured from such trade materials. The exception to this rule was an aboriginal gunflint (treated in the descriptive section on spalls). European trade items consisted of 14 items, including knives, beads, tinkling cones, earrings, bracelets, and gunflints. Modern cultural materials are listed on the basis of material of manufacture, and their frequency is noted; no further work was done with this part of the Historic sample.

European Trade Items

Brass Artifacts

Among the items of personal adornment from this component of the O'Neill Site was a brass arm band measuring 11 cm by 2.4 cm (Fig. 50C). One edge has been notched at irregular intervals for 6.2 cm of its length with the notches ranging between 1 and 4 mm in depth. All edges have been rounded. Due to the irregular shape of the brass sheet from which this item was manufactured and the non-uniform method of decoration, it is suggested that the bracelet was manufactured from scrap brass and is not a European trade item.

Two conical, sheet-brass tinkling cones were part of the Historic assemblage (Fig. 50D-E). One measured 2 cm long, while the second was 3.1 cm long. Neither had any indication of either hair or leather attachments.

Decorative ornaments of this type have been recovered from Early Historic sites such as Bell (Wittry 1963: 19), Zimmerman (Brown 1961: 60-61), Summer Island III (Brose 1970b: 22), and Lasanen (Cleland 1970a: 27-28); as well as Middle Historic occupations such as Fort Michilimackinac (Stone 1970: 369-374), the Gros Cap Cemetery (Quimby 1963b: 52; Nern and Cleland, n.d.), and the Fletcher Burial Site (Maxwell, personal communication). Their occurrence, therefore, would have little diagnostic value in estimating the temporal position of this occupation.

The fourth brass item was a spiral earring, 1.3 cm in maximum diameter (Fig. 50F). The spiral makes two complete turns, while the brass strip tapers from 2 mm in width at the inner part to 6 mm at the outer part of the spiral.

Iron Artifacts

Two broken iron knife blades were recovered during the 1969 excavations at the O'Neill Site. One is a "french clasp knife" (Fig. 50B). This item has a straight blade back and a cutting edge that curves upward at the heel. The hinge end of the blade has a raised, flattened flange as a lock. Cleaning revealed two lines of letters impressed to the rear of the break and flanked by ace of spades cartouches lying on their sides. The manufacturer's name and other distinguishable letters appeared as follows:

PIERRE DAVID
I-IVS -VNE-

The second blade is from a sheath knife; it is broken near the tip (Fig. 50A). A straight back and curved heel taper gradually into a twisted and hammered tang projecting from the rear of the blade. Neither makers' marks nor hinge holes were present.

Clasp knives of the type found at the O'Neill Site have been recovered from late seventeenth century and early eighteenth century contexts in the eastern and southern parts of the United States. Wittry (1963: 35) reports them from the 1680-1730 Fox occupation of the Bell Site, Wisconsin. In Michigan, compatible comparisons may be made with knives from the 1710-1760 utilization of the Gros Cap Cemetery (Quimby 1963b: 55; Nern and Cleland, n.d.); the Lasanen burials at St. Ignace, dated between 1670 and 1715 (Cleland 1970a: 19-21, 92); Fort Michilimackinac (Maxwell and Binford 1961: 105-106; Stone 1970: 495-499); as well as Fort St. Joseph (Quimby 1938: 27). Perino (1967) reports French clasp knives from Kaskakia, Illinois, while in Texas they have been recovered from the early eighteenth-century occupation at Womack (Harris, et al. 1965: 348-351), and from the Gilbert Site (1750-1775) (Jelks, 1967: 18-24). Because the blade from O'Neill was broken, the shape cannot be determined; thus temporal placement on that basis cannot be attempted. However, Stone's Class I, Group I, Type I, Variety a clasp knives, which have a "standard" blade shape, have been comparatively dated to 1710-1760 (1970: 495-496), while the maximum temporal latitude expressed by these data would encompass the years 1680 to 1775. In addition, the Gros Cap collection includes a specimen that bears the name DAVID on the blade (Nern, personal communication), which may have the effect of narrowing down the temporal possibilities to that of the Gros Cap Site.

Figure 50

European Trade Items

A	Iron Sheath Knife
B	French Clasp Knife
C	Brass Arm Band
D-E	Tinkling Cones
F	Spiral Earring

A

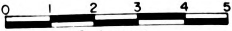
B

C

D

E

F



The sheath knife can be compared to items from three Michigan sites: the Ada Site (Herrick 1958: 7), most likely from the pre-1760 occupation; the Lasanen Site (Cleland 1970a: 20-21); and Stone's Class I, Series A, Category I blades from Fort Michilimackinac (1970: 3). Those from Michilimackinac have been dated to the "first 75 years of the eighteenth century." Both of these blades could therefore be placed safely within the first half of the eighteenth century, particularly if the 1670-1715 range for the Lasanen Site is used rather than Cleland's more accurate, three year estimate based on historic records (Cleland 1970b: 95).

Glass Artifacts

Glass beads are ubiquitous on both European and aboriginally occupied sites of the post-contact period, as well as exhibiting formal characteristics helpful in chronological placement. The small, four-bead sample from the O'Neill Site, despite its size, displays a wide range of formal variability. The bead assemblage consists of two monochromatic, opaque white simple structured beads: one long and ovoid (13 mm by 8 mm; Fig. 51B), and the second barrel shaped (7.5 mm by 8 mm; (Fig. 51A); while the remaining two beads are complex structure polychrome beads. Among the latter was a single Cornaline d'Aleppo bead (Fig. 51C), displaying the three layer construction common to this type; an interior core of translucent green glass, a middle layer of dull red opaque glass, and an outer veneer of clear glass. Lipping is present at both ends of the middle layer, a phenomenon noted by Stone (1971a) for similar beads from the Lasanen Site in St. Ignace. This necklace bead measures 6 mm in length with a diameter of 7.5 mm. Finally, a composite white and blue polychrome bead was recovered. This bead was manufactured on a light blue, glossy glass core, with an outer layer of opaque white glass containing three groups of three dark blue inlays in a spiral pattern (Fig. 51D). This elongated oval bead measures 16 mm by 7.5 mm.

For purposes of temporal assignment only three of the above beads have useful diagnostic value. Cornaline d'Aleppo beads with clear, blue or green glass cores have a broad temporal distribution, thus negating their value as chronological indicators (Stone 1971a: 84-85). Small opaque white beads similar to that from the O'Neill Site have been recovered from the French occupation of Fort Michilimackinac (Stone 1970: 297), where they have been comparatively dated to between A.D. 1710 and A.D. 1750 (Stone 1970: Table 26). The larger, elongated white beads on the other hand have been recovered from the Fox occupation of the Bell Site, Winnebago Co., Wisconsin (Wittry 1963: 30-31); Fort St. Joseph, Michigan (Quimby 1966b: 192-196); Fort Michilimackinac (Stone 1970: 295-296) where they have been classified as Class I, Series A, Type 2, Variety a; as well as from the Fatherland Site (Neitzel 1965: 51 and Pl. 15c; Quimby 1966b: 192-196). These data led Stone (1970: Table 26) to date these beads to the first half of the eighteenth century, during the French occupation of Fort Michilimackinac. These beads have also been recovered from late seventeenth-century contexts other than the Bell Site, in particular the Pen Site (Onondaga Series No. 163) dated to between 1685 and 1696 and the Gros Cap Cemetery Site (Nern and Cleland, n.d.), where they have been classified as Class I, Series A, Type 6, Variety b. This site dates between 1670 and 1705.

Blue and white spiral polychrome beads similar to that from the O'Neill Site have been recovered from a number of sites, yet only those from two of these have the blue glass core present on the O'Neill Bead. Both sites, Bell (Wittry 1963: 31), and Gros Cap (Nern and Cleland, n.d.), are predominantly late seventeenth century sites, although both overlap the first few years of the eighteenth century.

If we apply a purely taxonomic system to these beads from the O'Neill Site, without regard to dating, a useful approach might be that devised by Kidd and Kidd (1970). The two opaque white simple structured beads would fall into their Class II a; the Cornaline D'Aleppo bead would, as a three layered bead, be placed in Class IV a; while the blue spiral polychrome bead with the blue core would fit their Class IV b'; due to both the twist and the compound construction.

Flint Artifacts

Three spalls and one aboriginal gunflint were recovered from this occupation of the O'Neill Site (Fig. 51E-H). All spalls are D-shaped, with a chipped, rounded heel and sharply beveled margins. No chalk is present on the heels of these specimens, yet each shows marked chipping on the bed, perhaps a result of an attempt to manufacture a more regular planar surface. The color variation of these flints ranges from tan, to gray brown, to dark gray. Obvious battering and a deep concavity along the striking edges would support a fire-steel function for the tan specimen. In contrast, however, the dark gray spall shows no evidence of use.

The aboriginally manufactured item was fabricated on a light gray local chert in a generally wedge-shaped form. Shaping of the upper surface was accomplished with two transverse flakes removed parallel to the striking edge, while the remainder of the trimming was composed of short, steep contracting flakes. All edges were lightly retouched with the exception of one broken edge. The latter may have caused this flint to be either discarded from further use or rejected before completion. This interpretation is supported by the location of a battered area on what should technically be described as the heel, while the striking edge is fresh. The battered area may, therefore, be a striking platform ruined in the process of further shaping.

Spall gunflints have been associated with numerous Early and Middle Historic assemblages in the Upper Great Lakes area. The majority of these sites fall into a time range between A.D. 1670 and A.D. 1730, the exception being Stone's Series C, Type 1 spall flints from Fort Michilimackinac, which seem to continue in use throughout the fort's British occupation (1970: 535-539). At St. Ignace, an assemblage from the Marquette Mission Site containing a Series C, Type L, Variety a spall was dated to between A.D. 1670 and A.D. 1720 (Stone 1971b: 25-27). This corresponds well with similar gunflint samples (Murray 1971: 60) from the Lasanen ossuaries, dated between 1670 and 1715 and the 1670 to 1705 occupation of the Gros Cap Cemetery Site (Nern and Cleland, n.d.). To the west, Brose reports a spall from the late seventeenth-century occupation at Summer Island (1970b: 23), while both spalls and aboriginal flints have been identified at the Bell Site in Wisconsin (Wittry 1963: 30), occupied between 1680 and 1730. All of these sites fall into the expected date range calculated for spall gunflints by both Witthoft (1966: 25) and Hamilton (1965: 52-53).

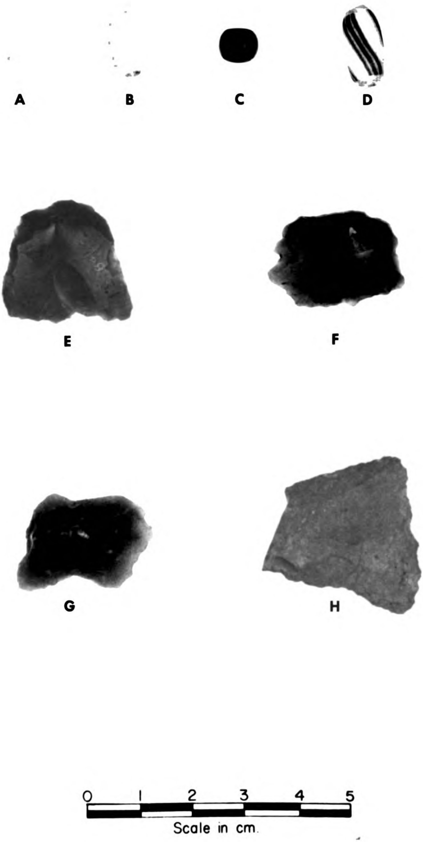
Modern Artifacts

During both the 1969 and 1971 seasons at the O'Neill Site, quantities of modern materials were recovered from the upper levels of the excavation units. Except for one or two artifacts, the majority were recovered from the humus zones, occurring in a thin scatter across almost the entire site area. Except for some kaolin pipe fragments and a single button, these modern debris are predominantly affiliated with twentieth-century occupations of the site. Both the button and the pipe fragments are late

Figure 51

European Trade Items

A	Barrel Shaped White Bead
B	Ovoid White Bead
C	Cornaline d'Aleppo Bead
D	Blue and White Polychrome Bead
E-G	Spall Gunflints
H	Gunflint of Aboriginal Manufacture


A
B
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0 1 2 3 4 5
Scale in cm.

nineteenth century. The quantity of modern materials recovered indicates that the O'Neill Site enjoyed a continuing popularity as a short-term occupation site. The lack of any major or minor structural features, however, argues against any permanent settlement at this location during either the nineteenth or twentieth centuries. Indeed, many of these artifacts are undoubtedly the result of logging operations during the latter half of the nineteenth and early twentieth centuries. The modern assemblage is listed below.

Metal

Bullet and Bullet parts (N=15)

.45 brass jacketed bullet	1
.32 lead bullet	1
.22 lead bullet	1
.22 long rifle casing, marked US	4
.22 long rifle casing, marked U	1
.22 short rifle casing, marked U	1
.22 short rifle casing	1
20 gauge shotgun brass, marked Winchester	2
12 gauge shotgun brass, marked Western Super X	1

Nails (N=26)

Finishing nails	6.5 cm x 0.3 cm	2
	5.1 cm x 0.3 cm	3
Flat head nails	3.2 cm x 0.2 cm	2
	6.0 cm x 0.3 cm	5
	6.5 cm x 0.4 cm	5
	9.5 cm x 0.5 cm	1
	10.5 cm x 0.5 cm	5
	16.0 cm x 0.7 cm	1
Cut nail fragments		2

Staples (N=1)

U-shaped	8.4 cm x 3.2 cm x 0.3 cm	1

Buttons (N=1)

Two piece brass, 5/8" diameter, eagle and shield motif	1

Miscellaneous (N=15)

Chrome plated brass hubcap marked FORD, MADE IN U.S.A., B	1
Cork lined bottle caps, 2.7 cm diameter	2
Tin can lids	4
Circulate token with hexagonal center hole, reads: MADE BY WATLING MFG. CO. CHICAGO, and GOOD FOR 5¢ PACKAGE FRUIT GUM	1
Scrap	5

<u>Glass</u>

Bottle glass (N=229)

Olive green (1 bottle)	87
Light green (1 bottle)	84
Brown	4
Blue/green	9
Dark green	6
Clear, unmarked	34
Clear, marked	1
Clear, marked ONE	2
Clear, marked (Q)UART	1
Clear, marked (AS)CORBIDS US	1

Ceramics (N=6)

Stoneware	1
Fluted kaolin pipe bowl	3
Kaolin pipe stems	2

This list of 293 items of Euro-American manufacture constitutes the entire modern assemblage from the O'Neill Site. Among the readily identifiable items is the military button with the eagle and shield motif. This artifact is identical to the Type C button identified by Brose (1967: 44) from the Custer Road Dump Site, introduced after 1872 as enlisted man's issue. The nature of the modern occupations of the site would seem to be short-term hunting camps, party areas, and picnic sites—a function the site still serves today.

Discussion

Comparative dating of the temporally diagnostic European trade materials from the O'Neill Site supplies us with a wide range of latitude in which to place the Historic occupation of the site. Most would fit in the Middle Historic Period, 1670-1760 (Quimby 1966b). If, however, the presence of a chipped stone aboriginal gunflint and bone tools and ceramics recovered from this component are considered, these data might well point to prior occupations of the O'Neill Site during the early seventeenth century, prior to the time in which ceramics had fallen into disuse among the aboriginal population as a result of their replacement by brass kettles. These data suggest a series of occupations of the site, perhaps both during the whole seventeenth century and during the early part of the eighteenth century.

Two types of variability are displayed in the function of the artifacts recovered in this sample; those items used for personal adornment and those used for food procurement or processing. In both cases there are items manufactured from either local materials or discarded scrap (such as the brass bracelet and gunflint). The presence of gunflints at the site does support the use of firearms, despite the fact that neither musket balls nor stock furniture, were recovered from our excavations. Alternative use as strike-a-lite flints is also demonstrable.

CHAPTER 7

FAUNAL REMAINS

Although all faunal remains from the O'Neill Site have not yet undergone analysis, enough preliminary data are available to posit tentative statements pertaining to the subsistence patterns of the site's occupants. Analysis of these materials was performed by Denise King of the Department of Anthropology, Michigan State University, and major portions of the following discussion were accomplished with data supplied to the author in the form of laboratory data sheets.

A preliminary total of 5041 complete and fragmentary pieces of bone were recovered from the excavations. Preservation of bone varied from one part of the site to the next, with Area A having not only better but more uniform preservation. Although some Test Pits and parts of Area B also had good preservation, for the most part this was erratic, and little useful information would derive from comparative spatial analysis. The analysis, therefore, was confined to Area A, where both the minimum number of individuals and pounds of usable meat per faunal category were calculated. This approach was not performed for either Area B or the Test Pits. Within the total sample recovered from the two seasons' excavations were 606 mammal bones, 4172 fish bones, and 23 bird bones. In addition, 240 bones and bone fragments of reptiles, amphibians and molluscs, etc. were grouped into a miscellaneous category. Over 91 per cent of the bone sample was recovered from Area A.

Mammals

A rather wide variety of mammalian fauna were present in the sample, including at least one domestic dog (*Canis familiarus*). Among the large mammals were bear (Ursus americanus), whitetail deer (Odocoilus virginianus), elk (Cervus canadensis), and moose (Alces alces). Smaller mammals included a possible coyote (Canis latrans), fox (Urocyon, sp.), gray fox (Urocyon cineroargentens, sp.), marten (Martes americanus), mink (Mustelid, sp.), cat (Felid, possibly bobcat, Lynx rufus), muskrat (Ondatra zibethicus), and racoon (Procyon lotor).

As a whole, then, the mammal remains from the O'Neill Site are common to either the transition zone as a whole or are exclusively Canadian (moose, marten). As such, it is characteristic of populations occupying an ecotonal area, with perhaps a slight Canadian emphasis. Few data from the mammalian fauna can be brought to bear when attempting to determine the seasonality of the occupation. Cleland (1966: 163) mentions that the black bear could seldom be found while hibernating, although it was hunted all year. Thus, this food source was most available from early spring until early January. A single partially erupted mandibular molar from a whitetail deer would indicate an age of between one and one and one half years for the animal at death. Ms. King suggests that the animal was killed in the late spring or early summer. The remainder of the species recovered could be exploited to varying degrees throughout the year.

Fish

Fish remains, by far the most frequently recovered faunal material, provide us with a more reliable framework within which to discuss the O'Neill Site's seasonality. The nine species recovered includes sturgeon (Acipenser fulvescens), trout (Salvelinus sp.), White sucker (Catostomus commersomi), redhorse sucker (Moxostoma sp.), walleye pike (Stizostedon vitreum), bass (Micropterus sp.), catfish (Ictalus sp.), channel catfish (Ictalus punctatus), and perch (Percidae).

Except for trout all species listed above are spring spawning fish that prefer shoals, clear streams, or muddy backwater areas. All of these aquatic environments are present in the vicinity of the O'Neill Site today, indicating that the stream and lacustrine environments have changed little if any since the site was occupied. The trout, on the other hand, is a late summer spawner (brook trout) or a fall spawner (lake trout). On the basis of bone size, the majority of the fish bone recovered came from fish that ranged from 30 cm to 40 cm in length. Exceptions include the sturgeon, which was much larger, and some smaller fish such as perch. It would seem that selection for size was a factor in the extraction of this aquatic resource (Denise King, personal communication).

Avian Fauna

Avian fauna were poorly represented in the faunal remains; only six species were recovered. Grouped on the basis of the type of environment within which these birds may be found provides us with two categories: aquatic and deciduous forest. The former displayed more variability, with loon (*Gavia immer* sp.), gull (*Larus* sp.), duck (*Aythya* sp.), and Canada goose (*Branta canadensis*). Only two deciduous forest species, passenger pigeon (*Ectopistes migratorious*) and turkey (*Meleagra gallopavo*), were exploited by the Late Woodland inhabitants. Birds, it seems, were not emphasized in the subsistence activities. An interesting item is the presence of wild turkey about 150 miles north of its present distribution.

Miscellaneous

Other identifiable fauna from the site displays a tendency toward collecting of what may be considered marginal foodstuffs or delicacies, dependent on one's tastes. A frog (Rana sp.) and a turtle (Pseudemys or Chrysemys) may well be part of a summer occupation. With the adjacent Inwood Creek it is not surprising that five species of stream molluscs were identified; Lampsilis (sp.), Lasmigona costata, Ligumia (sp.), Actinonais carinata, and Elliptio dilatatus. E. dilatatus occurs at the northern extreme of its range.

Discussion

Faunal remains from O'Neill were grouped into the four categories mentioned earlier: mammal, bird, fish, and miscellaneous. Due to the negligible amounts of usable meat derived from individuals in the latter category, little mention will be made of these. The minimal reliance on avian fauna, shellfish collecting, and the occasional turtle present in the sample suggest that the O'Neill Site occupants were most likely collecting these supplementary foodstuffs on a haphazard basis and not in an organized, maximizing manner. The abundance of mammal and fish, however, suggest active, and in the case of the latter organized, exploitation of these resources.

Organized exploitation and selection of fish is most visible during Occupation III of Area A, where close to one quarter of the usable meat is derived through fish. There is a noticeable selection for size in the fish sample, with a mean of about 38 cm, and a rather limited number of species present: 19 perch, 44 sucker, and 8 other species. Yellow perch, due to their small size, was most likely taken in nets (Cleland 1966: 174); the occurrence of two netsinkers in Occupation II may well relate to the high frequency (19) of perch. Sucker, on the other hand, are shallow lakeshore and stream spawning fish. Hand-held dip nets, or even clubs and harpoons, were probably used to extract these species. The fish gorges from this stratum could well account for the trout (probably lake trout) and walleye, which occur in minor quantity. This riverine-lacustrine exploitation is also mirrored in the avian fauna from Occupation III; all were aquatic species. Given that all but the trout are spring spawning species, it is not unreasonable to infer a spring occupation for this stratum in spite of the heavy (74.3 per cent) reliance on mammals.

Evidence from the two most recent occupations of Area A may well point to different seasonality for both. All occupation strata in Area A gave comparable pH Readings, ranging from 7.5 (very slightly alkaline) to 8.0 (alkaline); thus variability on the basis of differential preservation is eliminated. Excavated area for each occupation was likewise comparable. Both Occupations II and I go through sharp declines in the proportion of fish used (Table 10), with concommitant decreases in avian faunal exploitation as well. Conversely, mammalian fauna increase by 20 per cent from Occupation III to II, and again by 3.8 per cent from II to I. Birds are absent in Occupation I, while passenger pigeon and wild turkey are introduced during Occupation II, coinciding with the increase in hunting emphasis.

Although this change might possibly reflect a shift in subsistence emphasis toward more mammalian exploitation, more likely the evident changes are a product of seasonality of the occupations. A similar relationship through time was noted for the Schultz Site fauna. Interpretation of this phenomenon states that "the increase in the quantity of big game associated with a drop in small game and fishing is probably closely related to an agricultural way of life" (Cleland 1966: 144). Since the most recent occupation of Area A is Historic, it can be

TABLE 10

POUNDS OF USABLE MEAT PER CATEGORY AT THE O'NEILL SITE

	Mammals		Fish		Bird		Total		Percent of Total
	Pounds	Per cent	Pounds	Per cent	Pounds	Per cent	Pounds	Per cent	
Area A (I)	1640.5	99.5	7.0	0.4	0.0	0.0	1647.5	99.9	43.1
Area A (II)	1546.0	95.7	60.4	3.7	9.0	0.5	1615.4	99.9	42.3
Area A (III)	412.5	74.3	135.4	24.4	6.6	1.1	554.5	99.8	14.5
TOTAL	3599.0	94.2	202.8	5.3	15.6	0.4	3817.4	99.9	99.9

argued that the populations utilizing the O'Neill Site were most likely participating in a settlement-subsistence system of a group that had domestic crops; these crops were supplemented with animals and wild plant foods. That maize or other domestic crops are present in the botanical remains has not yet been determined.

Considering the small faunal sample these changes may, indeed, be attributed to climatic shifts during the protohistoric and Historic Climatic episodes. The climatic fluctuations coincide well with the occurrence of two species, marten and wild turkey, and may well substantiate prior speculations as to the dating of Occupation Zone II. Baerreis and Bryson (1965) have defined three climatic changes from A.D. 1300 through A.D. 1880, of which we are concerned with the first two. From A.D. 1300 - A.D. 1450, the Pacific Climatic Episode in the midwest tends toward cool, dry conditions. The occurrence of the marten, a typically Canadian species, in Occupation Zone III predates this period by about 50 years and postdates the end of the warmer Neo-Atlantic Episode by about the same margin. This occurrence of the marten in this context is perhaps indicative of an earlier beginning to the Pacific Climatic Episode somewhere in the thirteenth century A.D. Following the cool, dry trend of A.D. 1300 - A.D. 1450, is a warmer period with a duration of about 100 years. It has been proposed (<u>see</u> Depositional History, Chapter 1) that Occupation II can be dated to the fifteenth century. This stratum yielded the wild turkey, a bird which at present is restricted to the Carolinian province. If a warm period can be hypothesized on the basis of this occurrence, Occupation II may correspond to the time period just following the Pacific Climatic Episode.

Since both the Ottawa and Chippewa utilized inland areas during the winter, it is doubtful that the two most recent occupations of Area A can be attributed to this season. The fish remains, scant though they are, would point to primarily spring extraction. This minimal presence, however, can only lend little support to such an interpretation. Most likely both Occupation I and Occupation II were used during the summer months as a hunting camp. This conclusion is supported by some of the identified animal remains from Occupation I, where Ms. King notes that few of the abdominal or limb bones from large mammals are present, but that many skull, vertebral, and foot bones are in the sample. Probably, the former are being transported away from the site with only the discarded portions of the animal being left at the butchering site.

CHAPTER 8

FEATURES

During excavations at the O'Neill Site both subsurface soil features (such as hearths and clay caps) and concentrations of artifactual debris were encountered. All hearths and pits were serially numbered in the field. Features of the second category were assigned numbers when they either differed radically in density (such as in the Area B undifferentiated occupation situation) or when they comprised a discrete group on one of the stratified floors in Area A. With the exception of seven hearth features recorded in 1969, all remaining features were collected as separate provenience units. Pit features were collected as separate provenience units. Pit features from the 1971 excavations had proportionally sized flotation samples removed, which in most cases included a half bushel of soil. The flotation analysis is not yet complete; these data, therefore, will not be discussed in the current analysis.

The features from both season's excavations have been compiled in a tabular format, subdivided by site area and occupation zone. Information included in the tables follows.

1. Feature number.
2. Excavation unit number, based on site grid system.
3. Dimensions. The dimensions recorded are N-S by E-W by the depth from the first indication on a square sheet to the bottom of the feature. Parenthetical dimensions include N-S by E-W measurements of all recorded hearth scatter.
4. Shape of the feature.
5. Interpretation.
6. Contents of the feature, including artifacts as well as body sherds, chippage categories, and bone refuse.

Throughout the analysis of pit features it was noticed that all had either ash, fire-cracked rock, or fire-reddened sand in association with the pit proper. These criteria, either separately or as a group, have been used as discriminating attributes in interpretation and categorization of hearths and storage pits (McPherron 1967a: 239-245; Brose 1970a: 152). All but one of the pit features was a shallow basin. No layered soil zones were noted in any of these pits, and no trace of a lining was present either. We must, therefore, assume either that all of the pit features at the O'Neill Site are hearths or that analysis of the flotation materials will supply us with more data on which to further discriminate pit functions. Feature information is presented in Tables 11 through 15, while their locations may be identified in Figures 52 through 55.

Structures

The two structures located at the O'Neill Site occur in Area B; no structural evidence was recovered from any other part of the site. Structure 1 is a series of 35 post molds forming one side and one end of a parallel-sided house with rounded ends (Fig. 55). The post molds ranged from 0.2 feet to 0.35 feet in diameter, arranged in a single, closely spaced row. Oriented in a NE to SW direction, this longhouse parallels the prehistoric dunes uncovered in the Area A excavations. Within the house are three hearths, Features 1, 1b, and 5. Features 1b and 5 are oriented along the central longitudinal axis of the structure, which measures 35 feet long and a possible 15 feet wide. Toward the northeast end of the house are a number of interior post molds; these may represent internal partitions or benches or perhaps parts of other structures. Their haphazard distribution makes it difficult to posit positive

TABLE 11

FEATURES IN AREA A, OCCUPATION ZONE I

Feature Number	Excavation Unit	Dimensions	Shape	Functional Interpretation	Contents
12	N400/W30	2.5' x 2.7' x 0.1'	Oval, shallow basin	Hearth	None (flotation incomplete)
25	N360/W110	1.2' x 1.3'	Circular distribution	Discarded ceramic container	Ceramics - 16 sandy (63 gr) 77 smoothed (374 gr), 265 unidentified (137 gr)
40	N360/W110	1.6' x 1.3' x 0.7'	Rectangular	Stone cairn or possible foundation footing	Unmodified cobbles

Figure 52

Location of Features in Area A, Occupation Zone I

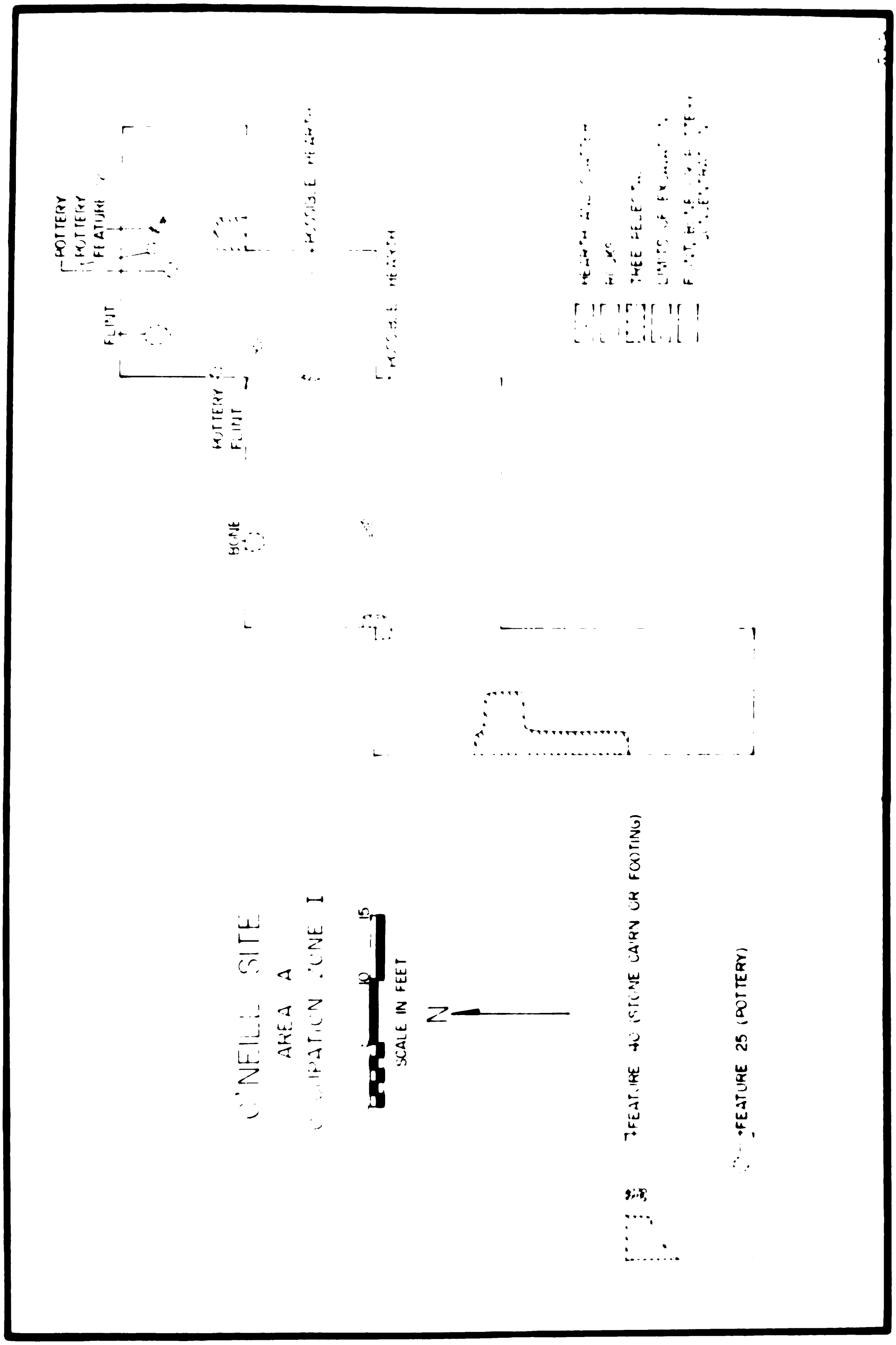

AREA A
SCALE IN FEET
10
15
N
FEATURE 40 (STONE CAIRN OR FOOTING)
FEATURE 25 (POTTERY)
POTTERY
FLINT
BONE
POSSIBLE HEARTH

TABLE 12

FEATURES IN AREA A, OCCUPATION ZONE II

Feature Number	Excavation Unit	Dimensions	Shape	Functional Interpretation	Contents
16	N390/W50	1.8' x 2.1' x 0.2'	Circular, shallow basin	Hearth	None (flotation incomplete)
19	N390/W50	3.0' x 3.2' x 0.1'	Oval, shallow basin	Hearth	None (flotation incomplete)

Figure 53

Location of Features in Area A, Occupation Zone II

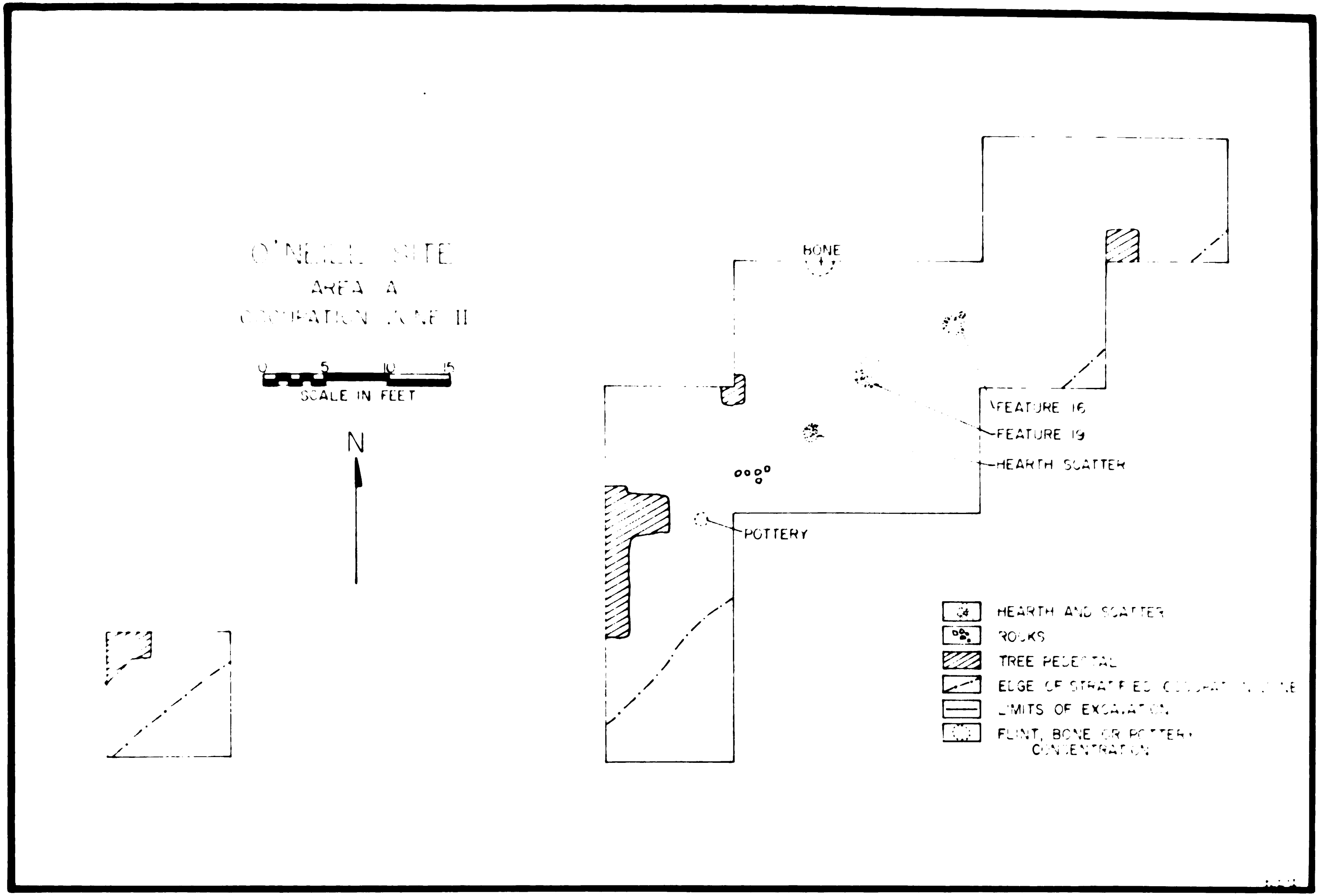

AREA A
0 5 10 15
SCALE IN FEET
N
BONE
FEATURE 16
FEATURE 19
HEARTH SCATTER
POTTERY
HEARTH AND SCATTER
ROCKS

TABLE 13

FEATURES IN AREA A, OCCUPATION ZONE III

Feature Number	Excavation Unit	Dimensions	Shape	Functional Interpretation	Contents
9	N370/W70	5.4' x 4.8' x 0.3'	Oval		Ceramics - 4 sandy (15 gr), smoothed 84 (467 gr), 1 undet. impressed (10 gr), 123 unident. (275 gr). Flint - 1 raw material (15.6 gr), blocky 4 (162 gr), 21 bifacial (83.9 gr), primary 3 (67 gr)
10	N380/W50 N380/W60 N390/W50 N390/W60	3.3' x 4.1' x 0.3' (10.4' x 8.3')	Circular, basin shaped	Hearth	Ceramics Flint - 14 blocky (20 gr) bifacial 27 (4.7 gr), 29 primary (184 gr)
11	N380/W60	3.6' x 3.1' x 0.2'	Oval, shallow basin	Hearth	None (flotation incomplete)
13	N390/W50	1.1' x 1.2' x 0.3'	Irregular oval lens		Red ochre and sand
31	N390/W40	2.2' x 1.1'	Dumb-bell shaped pile	Food processing	Flint - 1 raw material (40 gr) Slate - 2 Fish Clam

TABLE 13 (CONT'D)

FEATURES IN AREA A, OCCUPATION ZONE III

Feature Number	Excavation Unit	Dimensions	Shape	Functional Interpretation	Contents
32	N390/W40	0.7' x 1.0'		Discarded ceramic container	Ceramics - 4 rims 42 body sherds
33	N390/W40	1.5' x 1.2'		Discarded ceramic container	Ceramics - 3 rims 6 decorated 134 cord impressed
34	N390/W40	2.6' x 3.7' x 0.2' (4.0' x 5.6')	Oval, shallow basin	Hearth	1 net sinker (flotation incomplete)
37	N400/W30	1.7' x 1.7' x 0.1' (2.6' x 2.5')	Irregular oval, shallow basin	Hearth	None (flotation incomplete)
38	N400/W30	1.7' x 0.8' x 0.1' (1.7' x 1.6')	Irregular oval, shallow basin	Hearth	None (flotation incomplete)
39	N400/W40	1.5' x 1.6' x 0.2'	Round, shallow basin	Adjunct to: food preparation, ceramic manufacture	Compacted red-orange clay

Figure 54

Location of Features in Area A, Occupation Zone III

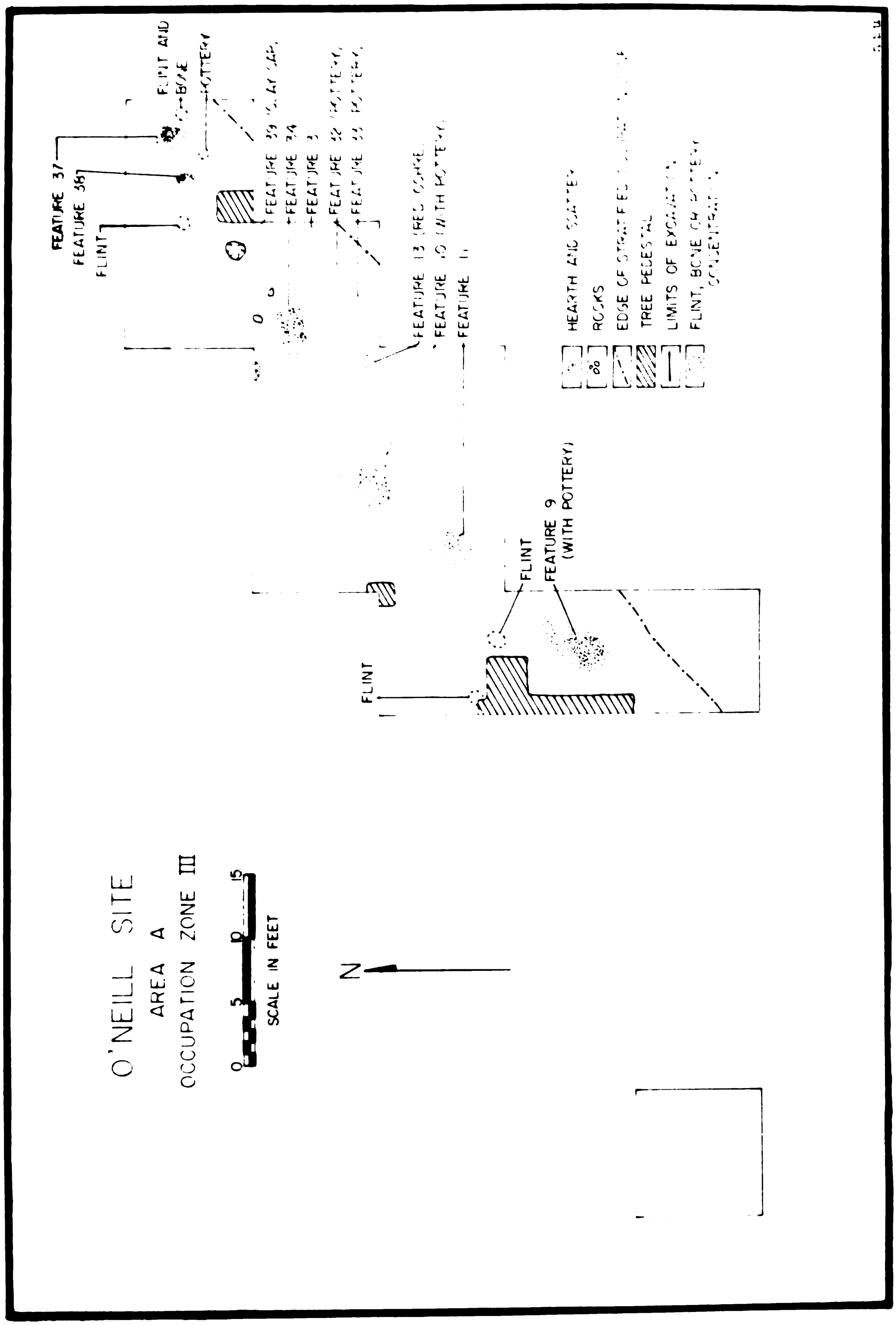

O'NEILL SITE
AREA A
OCCUPATION ZONE III
0 5 10 15
SCALE IN FEET
N
FEATURE 37
FEATURE 38
FLINT
FLINT AND
BONE
POTTERY
FLINT
FLINT
FEATURE 9
(WITH POTTERY)
HEARTH AND SCATTER
ROCKS
TREE PEDESTAL

TABLE 14

FEATURES IN AREA B

Feature Number	Excavation Unit	Dimensions	Shape	Functional Interpretation	Contents
1	N330/W50	3.5' x 4.0' x 0.2'	Circular, basin shaped	Hearth	
1b	N340/W60	1.2' x 1.8' x 0.1'	Oval, shallow basin	Hearth	None (flotation incomplete)
3	N340/W40	4.0' x --' x --	Oval	Hearth	Flint - 2 blocky 105 bifacial
4	N340/W50	1.1' x 0.8' x 0.2'	Round, basin	Adjunct to: food preparation, ceramic manufacture	Compacted, red-orange clay
5	N340/W50	1.6' x 2.0' x -- (2.0' x 2.8')	Oval, shallow basin	Hearth	None (flotation incomplete)
8	N350/W30	3.0' x 2.4' x 0.2' (3.0' x 4.1')	Irregular, basin shaped	Hearth	
14	N350/W40	3.2' x 3.5' x 0.7'	Circular, deep basin	Modern trash pit	Modern
15	N350/W40	--' x 3.4' x --'	Circular distribution		Scattered flecks of red-orange clay

TABLE 14 (CONT'D)

FEATURES IN AREA B

Feature Number	Excavation Unit	Dimensions	Shape	Functional Interpretation	Contents
26	N340/W20	1.6' x --' x 2.1'	Irregular, deep basin	Hearth	Ceramics - 3 sandy (8 gr), 4 corded (27 gr), 15 smoothed (40 gr); 88 unident. (164 gr) Flint - raw material 2 (564 gr), 1 bifacial (2 gr)
27	N360/W20	2.1' x 2.0'	Circular distribution	Discarded ceramic	Flint - 1 bifacial (2 gr) Ceramics - sandy 3 (9 gr), smoothed 19 (109 gr), unidentified 39 (60 gr)
35	N320/W50	1.2' x 1.2' x 0.9' (3.4' x 2.6')	Oval, basin shaped	Hearth	Flint - raw material 2 (66 gr), blocky 1 (5.5 gr), bifacial 44 (4 gr)
36	N330/W40	3.0' x 3.5'	Oval distribution	Flint processing area	Flint - raw material 58 (5036 gr), blocky 23 (289 gr), bifacial 613 (1426 gr), primary 9 (266 gr) Ceramics - unident. 6 (3 gr)

Figure 55

Location of Features in Area B

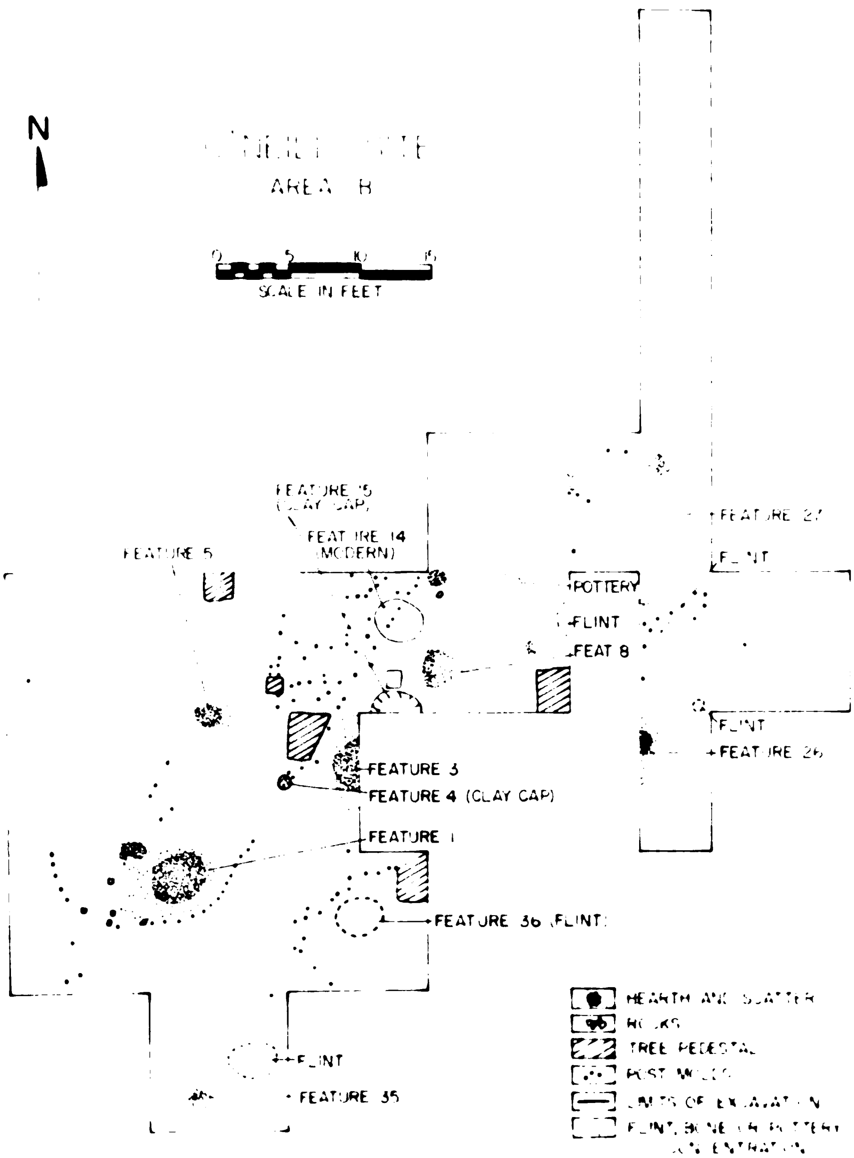

N
AREA B
0 5 10 15
SCALE IN FEET
FEATURE 5
FEATURE 14 (MODERN)
POTTERY
FLINT
FEAT 8
FEATURE 3
FEATURE 4 (CLAY CAP)
FEATURE 1
FEATURE 36 (FLINT)
FLINT
FEATURE 35
FLINT
FEATURE 26
TREE PEDESTAL

TABLE 15

FEATURES IN TEST UNITS

Feature Number	Excavation Unit	Dimensions	Shape	Functional Interpretation	Contents
28	N500/E180	0.8' x 1.1'		Fire-making kit	Flint - Raw material 3 (133 gr), blocky 1 (25 gr), bifacial 1 (28 gr) Iron pyrites (28 gr)
29	N530/E240	0.8' x 0.9' x 0.9'	Circular, deep basin	Hearth	None (flotation incomplete)
30	N490/E190	1.0' x 1.4'	Oval distribution	Discarded ceramic container	Flint - 41 bifacial (33.3 gr) Ceramics - 1 Sandy (2 gr), 7 cordimpressed (10 gr), 41 fabric impressed (95 gr), 14 smoothed (40 gr), 1 undetermined impressed (5 gr), 126 unidentified (91 gr)

statements concerning their function. An entrance is located at the southwest end of the house. It should be noted that the areas of missing posts along the northwest wall of this structure correspond to areas where the occupation zone was truncated by natural action; further, little artifactual material was recovered from this area.

The second structure includes a semi-circular line of post molds in the southeast portion of Area B (Fig. 55). A possible entrance is located on the west side of this partially excavated house. Post mold diameter ranged between 0.25 feet and 0.35 feet. No hearth was found within the exposed area, although a large concentration of flint was included within the post perimeter. If this structure is circular, only half was excavated, and it may indeed be the end of a house similar to Structure 1. Comparative interpretations cannot be made until more is known.

House structures similar to the longhouse at the O'Neill Site have been excavated at the Ponshewaing Point Site, Emmet County, and at the Juntunen Site, Mackinac County. The structure from the Juntunen Site is constructed of a double row of wall posts (McPherron 1967a: 235-239) and is wider than the O'Neill Site example. Although differences may also be found between those from the Ponshewaing Point Site, the similarities are much more striking. Rounded ends, parallel single post walls with compatible post mold diameters, and entranceways located at the ends of the house all bear close similarities to the O'Neill Site Structure 1. The major difference that could be observed is the use of heavy, pit-placed support posts near the ends of the side walls. This variation is relatively insignificant and may bear more directly on the type of saplings or covering used in construction or even the type of ground surface on which it was constructed. The Ponshewaing Point Site is a

Late Woodland site with artifacts dated to between A.D. 800 and A.D. 1300. Since final analysis of this site has not yet been completed, it is not possible to refine our dating of the structure from this village.

CHAPTER 9

SPATIAL ANALYSIS AND CONCLUSIONS

Spatial Analysis

Although the O'Neill Site does not offer ideal opportunities for analysis of intra-site spatial utilization, particularly in view of the multi-component, only partially stratified nature of the site, it does afford greater possibilities in this direction than many other sites in the study area. Descriptions have been forwarded of what seem, after a partial analysis of distribution of artifact classes, a series of localized habitation areas confined to areas away from the location of dwellings. Thus, there is a strong chance that these distributions represent task-specific activity areas. The rest of the analysis will attempt to test the following question: is there a tendency for certain chipped stone artifacts, ceramics, and faunal debris to be distributed in patterns in space? An attempt, therefore, will be made to define relationships between and within groups that may well be functional. To accomplish this, certain classes of artifacts were coded according to their frequency by Area and Occupation Zone. It was necessary to delete one of these classes from each of the analyses because of uncontrollable factors. For instance, using bone frequency as a variable in Area B could have given a skewed picture of the relationships of faunal debris with artifact classes, due to differential preservation. Faunal remains were, therefore, deleted from Area B, but were retained in all three occupation zones from Area A, where the conditions for bone preservation were present.

Measurement

The measure chosen to test associations was Pearson's product-moment correlation coefficient, a measure that defines a linear relationship between two variables. The correlation coefficient, r, ranges between values of +1.0 and -1.0; the former indicates that as one variable frequency increases, the other does as well. Likewise, the negative value would illustrate an inverse relationship; as the frequency of one variable increases, the other decreases accordingly. A value of r approaching, or at, 0.00 indicates no patterned relationship; one that could occur by chance. It should be emphasized that non-linear correlation between two variables can be computed; that is, the relationship is defined by a curve and not a line. This analysis, however, will be limited to the linear case. The intercorrelation matrices were obtained as output from ICMATRIX, a computer program designed for use on the CDC6500 computer at Michigan State University (Paulson, Donaldson, Price, and Carroll 1972) and programmed by the Computer Institute for Social Science Research Stat Systems Group. These matrices are presented in Appendix B.

To maintain some security in the following statements, levels of significance were computed for each of the four intercorrelation matrices. Area B, with 18 d.f. and $r=.5000$, has a $p<.05$ of being due to chance alone. Likewise, the Occupation Zones I, II, and III, with 9 d.f. and $r=.6000$, are significant to .05; they are not due to chance (sampling error) 95 times out of 100. On occasion, correlation coefficients with less significant values will be used to help strengthen specific statements.

Occupation III

Analysis of the spatial relationships within Occupation Zone III of Area A, the most intensive occupation, verifies some of the concluding statements contained in the ceramic analysis. Correlation coefficient values between ceramic types were either close to .0000, an association that could occur by chance alone, or negative, in which case they do not occur simultaneously. This substantiates the concept of the occupation of the O'Neill Site based on the contour distributions obtained from the different ware categories.

Strong positive _r_ values resulted between a variety of artifact groups and in part help refine the interpretation of the subsistence patterns practiced by some of the inhabitants. Distribution of Juntunen ceramics, for instance, correlates highly with both fish bone (_r_=.46529) _and_ mammal bone (_r_=.52824). Subsistence emphasis does not seem to have been an either/or proposition; both terrestrial and aquatic fauna were being prepared or consumed. No strong positive or negative faunal associations were obtained between other ceramic wares; their occurrence with these wares could be due to chance. The strong associations between Traverse wares and bifacial cores (_r_=.96189) and Skegemog wares with the few plano-convex cores from this stratum (_r_=.67802) may well indicate that both of the latter inhabitants utilized the partially stable dune area as a special function locus for flintknapping, whereas the Juntunen populations were employing it primarily for either food preparation or consumption.

Occupation II

Explanation of O'Neill Curvilinear ceramics as a stylistic continuation of Juntunen wares was strengthened by an _r_ value of .6646 between the two in Occupation Zone II. Their similar spatial relationship is perhaps indicative of other ties as well. The possibility exists, of course, that the ceramic remains were deposited at different times, in which case little stylistic seriation should be attempted. Both stylistic and spatial indications, however, point towards major similarities existing between the two. An added factor is high correlation (r=.6708 and r=.99816) between Juntunen ware and O'Neill Curvilinear respectively and bifacial cores. On the other hand, only Juntunen ceramics are distributed in a similar manner to the fish bone in this stratum (r=.6038), a situation present in Occupation Zone III as well. Occupation Zone II is probably a summer occupation, while Occupation Zone III is primarily a spring utilization of the site. In either case, the Juntunen occupants seem to be exploiting aquatic resources and were either preparing and/or consuming them in the northeast part of Area A.

Occupation I

As noted previously, the most recent occupation of the O'Neill Site is most likely the product of a number of short-term camps spanning the late prehistoric and both early and middle historic periods. The historic inhabitants left a thin scatter of trade materials in both Occupation Zone I, Area B and the Test Pits, while the late Late Woodland occupants seem to have had a rather confined occupancy, primarily Area A. O'Neill Curvilinear ceramics and the chevron-incised vessel were both recovered from a single unit. The resultant intercorrelation matrix between artifacts from Area A illustrated high coefficients of correlation between these ceramics and fish debris (r=.5892) and two core types: block cores (r=.6517), and plano-convex (r=.5079) cores. Block cores and mammalian fauna also display this relationship (r=.4083), as does the former with fish (r=.7015). On the other hand, plano-convex cores and mammalian remains rarely occur together (r=.3018). The interpretation of this phenomenon is that block cores have a distribution overlapping that of the area defined by O'Neill Curvilinear ceramics. The resultant coefficients also have some bearing on the possibility that the historic period's occupants are responsible for the mammalian fauna in this occupation zone. The fact that late aboriginal ceramics and plano-convex cores occur together, but plano-convex cores and mammal remains do not, may perhaps indicate dissimilar temporal relationships. This conjecture is partially upheld by the presence of butchering marks, some of which may have been done with a metal blade, on the mammalian remains from Occupation I (D. King, personal communication). If this is true, then it follows that the ceramic bearing occupation may not be a summer encampment but that the historic occupation probably did take place during the summer months.

Area B

Unlike the three occupational strata in Area A of the O'Neill Site, Area B contained few faunal remains and an abundance of chipped stone artifacts. Beyond this, the evidence of dwellings in the unstratified excavations would presuppose some sort of functional differentiation between the two areas. Of the above contrasts, the first cannot be controlled. The differential preservation present in Area B has been noted. Thus, two points of departure are left in the analysis of intra-site functional differentiation.

Within the group of 34 artifact variables on which correlation coefficients were obtained, two did not occur in Area B: CI, T1 projectile points, and bifacial preforms. Given the rather poor control on temporal relationships of chipped stone artifacts from this part of Michigan, the first part of the analysis attempted to define chipped stone artifact associations with datable ceramics. Although some of these associations are probably the result of prehistoric disturbance and scatter, the derived associations may be tested for similar relationships at other sites; hopefully, then, these results may be viewed as future testable hypotheses. Due to a high correlation between Juntunen ware and Skegemog ware (r=.8210), temporal dichotomies will be difficult to define for artifacts associated with these types.

Although a similar situation obtained between Juntunen ware and O'Neill Curvilinear in Occupation Zone II, the contexts differed enough that the problem of superposition warranted alternative treatment. First, Occupation Zone II was virtually devoid of chipped stone artifacts, making it difficult to derive temporal associations, whereas Area B provided more opportunity in this direction. Second, the temporal disparity between Skegemog ware and Juntunen wares is great enough that ignoring their superposition would have given a distorted view of the associated chipped stone materials, while O'Neill Curvilinear is probably coeval with Juntunen Wares at its inception. Furthermore, both wares were highly associated with bifacial cores, the only differences in association was the Juntunen Ware and fish bone correlation. However, both Juntunen wares and Skegemog wares covaried highly with the same chipped stone materials in Area B: a total of four artifact group.

Mackinac wares illustrate similar distributions with small triangular unhafted knives (r=.6296), small triangular hafted knives (r=.7293), awls (r=.9677), and with both retouched and utilized flakes (r=.4107, r=.6393 respectively.) Traverse wares do not correlate highly with any of the artifact types tested; all associations both positive and negative are within the realm of chance. One artifact class which covaried highly with either Skegemog wares or Juntunen wares was end scrapers, which are distributed in a similar manner to Skegemog wares (r=.4887). Additionally, a high r (.4378) was obtained between Juntunen ceramics and CI, T2 projectile points. Beyond these relationships, little temporal definition of chipped stone artifacts was possible.

Due to the large number of high r values obtained between artifact classes, these data have been treated in a more general manner than above. For instance, grouped projectile points and unifaces covary highly (r=. .5894), suggesting a functional association between the two. Within the projectile point and uniface categories there was also a great deal of high internal correlation. These artifacts behave similarly both within and between groups, and are distributed primarily in the vicinity of Feature 1. These materials are very probably associated with butchering activities. All core categories correlated with each other to at least r=.2200, perhaps an indication of specific core preparation areas or areas commonly used to discard cores. Low significance levels, however, tend to diminish the credibility of these hypothesis.

"Constellations" of variables (Freeman and Brown 1964; Brose 1970c), in this case tool types, which could be defined from the intercorrelation matrix, could be defined by two overlapping groups. Both constellations were also recovered in the vicinity of Feature 1. The first consists of eight chipped stone artifacts, CI, T2 projectiles, CI, T4 projectiles, fragmented projectiles, gravers, drills, ovate bifaces, retouched flakes, and utilized flakes. Utilized flakes link this group and small triangular hafted knives, small triangular unhafted knives, and awls. The first cluster, functionally, could well have been a wood or bone working tool combination if it were not for the presence of projectile points. It is possible that at times projectiles were used in butchering activities. Both gravers and drills are assumed to have functioned in such manners. The second constellation, with an awl, could have served for hide preparation. The high intercorrelation with artifact types not included in the first cluster and of unknown function other than perhaps as cutting implements would argue for a functionally specific group of tools. It is, of course, possible that projectile points were included in the first constellation, along with both utilized and retouched flakes, due to their high frequencies in the Feature 1 area; Feature 1 seemed to serve as a locus for a number of activities. It is due to this point, as well as its position within the longhouse (near the NE-SW wall), that it is proposed that Feature 1 is not contemporaneous with the structure but might possibly predate it. The lack of both early and late Late Woodland ceramics in the vicinity of both structures, with the attendant difficulties in dating these habitation features, would suggest maintenance activities that take place away from dwellings. If this is the case, the maintenance activities performed adjacent to Feature 1 would not relate to the longhouse but more likely would be a focus of activity on the lakeward side of the earlier, circular structure.

Discussion

Patterns of intrasite spatial utilization that emerge from the intercorrelation matrices, as well as from the discussion of both chipped stone and ceramic distributions, are in many ways unclear. Ceramic distributions within both Area A and Area B point to localized areas of high sherd frequency, suggesting short term, small group use of the O'Neill Site at different periods of time. These data also demonstrate a lakeward shift through time. During the late Late Woodland Juntunen and Traverse occupations, the small dwelling was placed in back of the partially stabilized dunes in Area A (Occupation Zone III). In the case of food processing, at least part of the activities connected with this process were performed in the lakeshore dunes. Similar activities may have been practiced by Traverse and Skegemog occupants as well, although the data only support an association with core processing activities. The association of early Late Woodland ceramics in what may well be a functionally specific situation in the dune area could reflect a similar back-beach dwelling/lakeshore processing dichotomy as was generated for the later occupants. This argument would be strengthened if Feature 1 and the varied activities which seem to be associated with it do, indeed, date from this earlier occupation sequence.

As a result of the multiple occupation of Area B by both early and late Late Woodland populations, practicing both northern and southern ceramic decorative traditions, it is difficult to isolate activity areas that can be definitely assigned to a single occupation. The presence of both early and late structures on this part of the site, both constructed in different manners, is a good indication of use as a dwelling area. Isolation of the use of these houses by northern Juntunen/Mackinac or southern Traverse/Skegemog groups is not possible; the ceramic distributions could argue for either. The local settlement pattern seems to be one in which most activities other than specific household tasks are accomplished around the peripheries of whatever structures are present. During Mackinac and Skegemog, or Mackinac/Skegemog, occupations (ca. A.D. 1000-A.D. 1200), the features that can be assigned with some certainty to this time period occur north and west of the circular structure: Features 1, 3, 35, the flint concentrations adjacent to Feature 35, and the early core preparation locus in Occupation Zone III. Somewhat tenuous, but compatible with the ceramic distributions, would be assignment of Features 26 and 27, to the northeast, to this time span. If Feature 1, in front of the entrance to the early structure, was indeed the center for a multiplicity of activities, it could well have served as a communal center, while individual activities such as flint knapping took place on the peripheries of the campsite.

Similar patterns are displayed by the Traverse and Juntunen occupations. The major noticeable change is the extended length of the dwelling, with two definitely associated hearths, sterile of artifacts, along the center (Features 1b and 5). This is most likely a multi-family dwelling, perhaps of two or more families. Although the increase in house size through time is probably illustrative of changing social structure as well, the data are too limited to draw forceful conclusions. Due to small sample size, it is impossible to test the seeming increase in homogeneity of ceramic style through time at the O'Neill Site. Spatial organization of the occupation closely parallels that of the earlier occupations. That few ceramics were found in the longhouse is again compatible with peripheral activity areas. It has been argued that at least the people making Traverse ceramics used the lakeshore area as a core preparation and knapping area (Occupation Zone II). The later Juntunen Phase populations carried out either food processing or consumption activities in the grassy lakeshore hollows (Occupation Zones II and III), in the vicinity of Features 10, 31 - 34, 36 - 39. Feature 39, a clay concentration, could relate to food processing, but more likely attests to ceramic manufacture. High Juntunen Ware frequencies and a radiocarbon date of A.D. 1455 from Feature 8, adjacent to the longhouse, indicate contemporaneity with the house, and once again illustrate what seem to be activity areas located near, but not in, the dwellings.

No structures can be assigned to the most recent occupations of the O'Neill Site. The only possible part of a structure is the stone cairn or footing, Feature 40. If it is, indeed, a house footing then it is not part of the aboriginal occupation, although a stone cairn could occur with either European or aboriginal occupations. The single gunflint from this stratum of N360/W110, along with some eroded smooth ceramics, would date this area to the late eighteenth century, when both European or indigenous peoples could have used the site. The possible hearths in Occupation Zone I of Area A are within an area that yielded historic trade goods. A gunflint (spall type), two tinkling cones, and a white bead were recovered from this vicinity. The nearby bone concentration would support a late date, especially since it contained bone fragments with possible iron tool butchering marks. This information would suggest a late sevenenteenth to early eighteenth century butchering area. The stone cairn or footing, Feature 40, may well be coeval with this occupation. Trade material distributions from Area B and Area A demonstrate that if this is a single short-term site, it was not highly localized. It may be a multiple occupation.

Both O'Neill Curvilinear and Chevron Incised ceramics were recovered adjacent to Feature 12, a hearth. There is a flint concentration, with plano-convex cores, in close proximity to both the ceramics and the hearth. Three bone awls were recovered from nearby N390/W40, and there was a high correlation between fish bone and ceramics in this occupation zone. The utilization of space is therefore localized. Food processing, flint knapping, and possibly sewing or other household tasks were performed near a hearth area. Although later in time, this locus of materials is reminiscent of the limited distributions of all ceramic types at the O'Neill Site, attributable to short term, small group occupations.

In summary then, the spatial patterning of settlement throughout the O'Neill Site's use reflects separate dwelling and maintenance activity areas. The latter are most often located around structures, and there is a distinct possibility of a communal hearth area during the early occupations. Ceramic distributions reflect confined occupation areas attributed to short term camps by small groups. Most commonly, the specific activity areas deal with food preparation and flint knapping; while butchering activities, hide preparation, and the working of wood and bone took place in the same area, at least during the early occupations.

Conclusion and Summary

Synthesis of the varied types of information set forth in the preceding sections allows a rather complete portrayal of the occupational sequence and functional specificity of the O'Neill Site. Primary among the varied activities which took place within the excavated areas was flint knapping. High core:artifact and artifact:flake ratios demonstrate that the manufacture of chipped stone tools, or at least the preforms for future finishing, was of primary concern. Large amounts of raw material derived from the Pi-wan-go-ning Quarry Site at Norwood or from Hayden Point on Lake Charlevoix would suggest extraction from one of these primary sources. As a whole, the chipped stone industry is a flake tool industry, many of the artifacts having been produced on flakes less than 3 cm in length. Given the specialized activity which occurred at O'Neill, it seems to have been one of a series of sites in the vicinity of the quarries which functioned in such a manner. Other sites of similar function would include the Eastport Site, as well as Whiskey Creek, and the Neff's A.H. Map Site.

Preparation of cores and the production of flakes involved a series of options based on the size of the raw material and the types of fracture which occurred. Thus, the aboriginal flint worker, no doubt well versed in the production of chipped stone implements, could make specific decisions based on a variety of criteria. Since the indistry is a flake tool industry, the options did not involve the discarding of smaller prepared, but fractured, cores. There is, further, some evidence of the use of indirect percussion for blade-like flake detachment.

Extraction of raw material and the preparation of chipped stone implements was not, as might be expected, performed at the expense of maintenance activities necessary to the survival of the group. Faunal remains were abundant on certain parts of the O'Neill Site, indicating that some of these maintenance activities were taking place at O'Neill in conjunction with quarry activity and flint preparation. The data are most complete for the earliest occupation of Area A in terms of subsistence practices. Juntunen populations were exploiting fish from both the adjacent Inwood Creek and Fisherman's Island embayment, most likely during the late spring, using nets, gorges, and probably clubs. Later occupations seem to be oriented toward the extraction of mammals from the surrounding forests, most likely during the summer months. A possible exception to this is the O'Neill Curvilinear locus of Occupation Zone I, which may have taken place during the spring, depending on fish as the major food source.

The settlement pattern derived from the spatial analysis points toward localized occupation areas due to short stays by small groups. Populations utilizing the site came from both the Straits of Mackinac vicinity to the north and the Traverse Bay area to the south. Individual activity areas were defined in areas away from the dwellings, most often in the direction of the lake or stream. There is some possibility of a communal activity area near a hearth during either the Mackinac or Skegemog occupations. Among the isolated activity areas postulated are butchering, wood or bone working, knapping areas, and food preparation or consumption areas. There is also some support for the presence of confined areas for ceramic manufacture and hide preparation. Dwellings were probably utilized for household specific tasks; no data are present to define these tasks. Thus, both group maintenance and subsistence activities took place while flint extraction was being practiced. Although some copper was present at the O'Neill Site, there is little support for the actual production of copper tools at the village.

O'Neill occupies a unique position within the overall Late Woodland settlement system in that despite what seems to be a functionally specific (primarily extraction and processing of chert) orientation for the different occupations, it is not seasonally specific. There are faunal data to support late spring, summer, and fall occupations; floral data, when completed, may give us a better idea of the overall subsistence pattern and seasonality. This non-seasonal quality would suggest chert extraction as at least a warm season task, practiced when the need arose. Both spring and fall were probably times of critical need for chert, supplementing an expended tool inventory following the winter and stockpiling of either actual finished implements or blanks in preparation for winter. Although the presence of summer occupations does not necessarily argue for concomitant chert extraction, neither does it argue against it.

Certain evidence, specifically that of house size and ceramics, give some indication that both the group size, and possibly the organization, of the inhabitants changed through time. McPherron (1967a: 298; 1967b: 105) proposes a shift from virilocal toward uxorilocal systems of post-marital residence at the Juntunen Site based on the increasing homogeneity of ceramic styles through time. This interpretation corresponds well with the late phase "longhouse" recovered during the Juntunen excavations. A similar shift in post-marital residence may be postulated by the increasing house size at the O'Neill Site where the ceramics at the site also seem to undergo changes toward increasing homogeneity; this cannot be demonstrated with the limited ceramic sample, however. On the other hand, multi-family oval houses have been documented from Lake Forest Middle Woodland sites as well (Brose, 1970a: 44; Wright and Anderson 1963: 11-15). The presence of a two-fire "longhouse" at the O'Neill Site does not necessarily demonstrate matrilocality as the preferred form of post-marital residence but could equally be illustrative of an extended patrilocal family.

Throughout the documented occupational history of the O'Neill Site, there tends to be a characteristic stability through time, in a general sense. Group size tends to remain small, settlement patterns are strikingly similar, and chert exploitation is a common link. The only documented changes in artifact frequencies are a change in the frequency of core types through time, and an increasing stylistic preference for smoothing of ceramic body surfaces prior to decoration. The latter, of course, changes with other style variables in the ceramic assemblage.

In summary, one highly variable part of the settlement system practiced by Late Woodland peoples in the Straits of Mackinac area has been defined. Small groups occupied the site at different points in the warm season, practicing maintenance and subsistence activities in conjunction with chert extraction -- the primary objective.

CHAPTER 10

LATE WOODLAND CULTURAL DYNAMICS

Ceramic analysis in archaeology is being increasingly employed as an avenue whereby generalizations pertaining to integrating social mechanisms of prehistoric "cultures" may be formulated. Often these studies make use of ethnographic analogy to generate a problem or to support the concluding remarks, thereby fitting the archaeological data to generalizations about the historic inhabitants. Virtually all of these studies, furthermore, use statistical techniques for the definition of highly intercorrelated groups of style attributes which may then be viewed as types in the sense of Spauldings (1953) definition. The degree of randomness or non-randomness, association, and so on in the behavior of these attributes and types provides the basis for statements about human behavioral patterns.

These studies may be partitioned in a number of ways depending upon the problems which each investigator was attempting to solve. At the site-specific level of analysis, both time trend and space trend analyses have been employed. For example, Deetz (1965), Hill (1966), and McPherron (1967a; 1967b) were able to formulate statements concerning changing social organizational responses of a single archaeological community through time, whereas the differential intra-site spatial distribution of statistical ceramic types at Carter Ranch Pueblo prompted Freeman and Brown (1964) and Longacre (1964) to posit statements as to community organization at a theoretically synchronous point in time.

Multi-site analyses have taken a variety of directions, from examination of decorative motifs in relation to the temporal formation of the Iroquois Confederacy (Whallon 1968; Engelbrecht 1972) to more complex studies of community interactions through time in the same general area

(Tuck 1971). This problem of spatial partitioning of ceramic assemblages into micro-style zones was in part suggested by Struever (1965: 220-221) for a Lower Illinois Valley Middle Woodland example. Further testing of the hypothesis (Loy 1968) demonstrated that, indeed, regional differences based on ceramic decoration at the same time level can be defined.

One of the more useful aspects of such approaches to archaeological inference is the ability to formulate testable models from the results of a single analysis (see Engelbrechts' 1972 test of Whallon's 1968 model). The model itself is capable of and subject to revision such that new data may be accommodated by alternative explanation. Importantly, the patterned behavior for which the models account does not necessarily imply that the social organizational analogies are correct -- the patterns may be present where more than one social explanation is feasible. Thus, the probability of deriving correct and exact explanations of the data may be limited, but the parameters of the operating system become increasingly well defined. As definition of the parameters becomes more precise, explicit hypotheses pertaining to behavior within the parameters may be generated and tested -- a process of constantly narrowing the scope of the problem.

This analysis is problem oriented in that specific hypotheses have been generated and will be tested. Explanation of the results will, hopefully, allow the investigator to propose a problem hierarchy and to define a model from the results by which problems of process may be researched and tested.

The Hypotheses

Reports on individual Late Woodland village sites located within the Traverse Corridor research area have, for the most part, employed two ceramic taxonomies: that devised for the Juntunen Site, Mackinac County, Michigan (McPherron 1967a), and one derived from analysis of the Skegemog Point Site Grand Traverse County, Michigan (Cleland, n.d.). In general, these classificatory systems were applicable to most of the site samples under inspection due to rather basic similarities in most of the materials. However, distinct differences between site samples at the same level were evident as well. These differences took the form of (1) varying frequencies of specific attributes of style at different sites in the study area and (2) the deletion or addition of style variables from diagnostic type clusters at different sites in the study area. Both attribute behavioral differences seem to be valid for specific time levels as well.

The intuitive explanation of these observed differences is that despite the fact that certain attributes within the style pool are shared -- can and are being used at all sites of a given style zone -- there are also specific attributes that are the prerogative of inhabitants of different areas within this spatial continuum. Moreover, these observed style differences are consistent in that they occur at different time levels as well. Within a systemic framework the variations may be viewed as differences in behavioral constraints within the ceramic decorative system at different sites in the study area. The first working hypothesis, then, is that <u>regional micro-style zones can be defined in the study area</u>.

As an adjunct to the observations by which the micro-style hypothesis was formulated, other facts became evident which relate directly to the two major ceramic style traditions discussed in Chapter 2. Primary among these was the observation that (1) specific site ceramic samples display different frequencies of typically northern and/or typically southern ceramic styles and (2) the distribution of these differences varies temporally as well as spatially. Cleland (1967: 3-4) has proposed that climatic fluctuation may well be responsible for this observed differential distribution through time. The second hypothesis, therefore, is that directional trends of specific style attributes are present in the study area and can be defined. Demonstration or rejection of this hypothesis could well provide the basis for hypotheses pertaining to the movement of people or style influences through time in the study area.

Theory

The stated hypotheses deal with information contained within a discrete prehistoric cultural system. In order that the parts of the overall system with which we are concerned not be confused, it seems efficaceous to isolate those parts of the systemic hierarchy relevant to the problem. This process should allow both definition of those factors critical to the problem and a limitation of the number of ways these factors may be treated within a problem-solving framework. Much information contained herein is derived from the tenets of general systems theory in archaeology (Clarke 1968) and the systematics of defined systems in prehistory (Dunnell 1971). This approach, in combination with an explanation of the constraints placed on the problem-solving capabilities of the data utilized, should provide a general framework of the problem, methods, and techniques which follow.

Within the systemic milieu we may recognize that the type of artifact called "ceramics" exists as part of the material culture subsystem. The system and its constituent parts are dynamic and continuous, engaging in varying states of transformation which are successive but which do not necessarily take place at the same rate. The kinds and rate of transformation of the system and its component parts are constrained by regulators which are internal to the system. Thus, the regulator may be seen as constraining variety and maintaining the limits of different parameters within the system. However, subassemblies of the system may operate independently of other subassemblies; only required input and produced output are relevant to overall system behavior. Likewise, functionally equivalent subassemblies allow within-subsystem change and selection without synchronous changes in all parts of the system (Simon 1973: 16-17).

Among the internal and external factors which act on the trajectory of a subsystem is the kind of information contained within that system. Transmission of information may take either a direct or looped path. This information may or may not initiate transformation of the continuous material culture subsystem and, specifically, the artifact type ceramics contained therein. The problem under consideration imposes limits on the kinds of subsystemic information with which one must be concerned. Binford (1965) recognizes that material remains have three dimensions: technical, morphological, and decorative. The latter dimension will be explored. Information pertaining to decoration of ceramics imposes constraints on the state of the ceramic decorative system. These imposed constraints may be viewed as regularity in the behavior of that system. This point will be discussed shortly.

Ceramics exist in time and space. The hypothesis generated earlier deals specifically with the intra-temporal aspects of confined space. Therefore the concern is with a recognizeable period of time in space: the phase (Willey and Phillips 1958: 22). Due to limits in the present ability to discriminate finely defined temporal units in the study area, the temporal dimension has been reduced to two units within the Late Woodland: an early period, to (A.D. 800-A.D. 1200); and a late period, t_1 (A.D. 1200-A.D. 1600). Discrete within phase groups of material culture are assemblages -- time segments of shorter duration than the phase but within the spatial extent of the latter. The ceramic sample from each phase may therefore be viewed in a number of ways: at the level of the site-specific sample, at the level of the sum of the ceramics from all assemblages within the phase, or at the level of occupations within the site-specific sample. The last assumes temporal distortion of the assemblage sample; the assemblage as a whole is not the product of a single occupation but rather is the collective result of numerous occupations within the time segment encompassed by the assemblage. Since the artifact sample for this problem is drawn at the assemblage level and then extended across the spatial limits of the study area and since the site-specific assemblages are the product of multiple occupation, we can assume that temporal, spatial, and sampling distortion is present. These factors cannot be controlled due to methodological restrictions. However, since the same systemic parts of a series of subsystems within the whole are being examined, we can assume that the systemic parts undergoing analysis are at similar levels within the system.

Given the constraints on the ceramic decorative system from which we departed earlier, certain assumptions concerning the behavior of the phase and assemblage samples can be made: primarily, that the affinities within phase or assemblage samples are greater than those between phase or assemblage samples. These constraints may be viewed as a modal distribution of specific variables within the systemic subdivisions called phase and assemblage sample. If we then: "imagine an n-dimensional model to express n-attribute scales then attribute clusters of individual artifacts can be located in this multidimensional hyperspace--with relative distance measuring the degree of correlation; the clusters of attributes representing the correlated and covarying galaxies of attributes will express the overall dispersion and patterning of attribute complexes within the sample (Clarke 1968: 159)" of artifact types. The resultant clusters of correlated and covarying galaxies of attributes are the key attributes (Clarke 1968: 75) or relevant attributes of the ceramic decorative system. These occur at different points in space, the site assemblage sample, within a span of time. They are therefore related in a non-random fashion within the system.

The classificatory subgroups or types (Krieger 1944) upon which our recognition of phase regularity within the Traverse Corridor is based derive from extant classifications which have defined ceramic decorative systems behaving in a polythetic fashion (McPherron 1967; Cleland, n.d.). That is, the attributes of style which define types within the artifact type ceramics are based on criterion which are shared by a large number of individuals within the type group. However, no single attribute of style is either a sufficient or necessary criterion for an individual to gain membership in the group (Sokal and Sneath 1963: 13-15). Thus, we can visualize both patterning in terms of shared attributes of style and variability in non-shared attributes between members of the polythetically behaving group.

The hypothesis posed, then, deals with the differences in behavioral constraints located in the ceramic decorative system at different points in the study area (the site). Thus, the patterning of <u>key</u> attributes at the site level will be investigated at a number of sites. These key attributes will be termed the <u>site style pool</u>. If the hypothesis is correct, site style pools will not be the same for all sites within the phase, but rather the key attributes of each site should contain different attributes. Certain of them may be shared by two, three, or more sites in the phase sample, but never by all. In this case, then, constraints on the ceramic decorative system at each site in the study area will differ. Women manufacturing ceramics at different sites in the study area possess different preferences in the use of certain attributes of style within a larger pool. Testing of this hypothesis may be called a space series analysis.

Space series analysis attempts to define diffusion processes of single or multiple characteristics over a discrete geographic area. These processes of diffusion are dependent on information transfer through a spatially structured network, such that information transmittal of a given characteristic may pass through various levels of spatial organization, i.e. local, regional, international (Hagerstrand 1968: 370-371). Once the structure has been defined it is or should be possible to generate predictive models of flow and/or diffusion for the area under consideration.

Basic to the development of diffusion models is the proposition that the characteristic being studied, whether it be human migration, information transfer, or railway networks, are defined by spatial distributions known as <u>fields</u>. These theoretically continuous distributions (within the field) have their highest density near their center with fall off toward the edges (Hagerstrand 1968: 368). Thus, one is able to conceptualize between mean field and the absolute field limits of a specific phenomenon (Haggett 1965: 40-41). Field shape may vary due to either natural or humanly imposed factors, such as rivers (ease of transportation), mountains (barriers), or political boundaries (Haggett 1965: 43-47). One difficult factor to control has been suggested by Hagerstrand (1968: 382-383) who argues that human resistance to change "leads to slower development over time, but also to a spatial concentration." Thus, diffusion models which explain the distribution of a phenomenon can be exceedingly complex and cannot be attempted until the ramifying data has been organized.

When dealing with abstract concepts such as the innovation of an idea and its subsequent application in a material form (e.g. ceramic decorative techniques, motifs), one may visualize a succession of spatial diffusions in a growing network hierarchy such that the innovation is spread in a wave-like manner out from one or more innovating centers. Concomitantly, modal shifts of the phenomenon are recognizable (c.f. discussion of Hagerstrand (1952) in Haggett (1965: 57-58) and discussion of Gould (1960) in Haggett and Chorley (1969: 271)). Essentially, diffusion waves may be viewed as successively decreasing frequencies of a phenomenon as one moves away from the innovating center or centers.

Among the earliest anthropological approximations of such diffusion models was that developed by Clark Wissler (1923) in his attempts to deal with the spatial distribution of ethnological traits. The core-area concept states that there is a point (area or field) in the distribution of a "culture" where all of that culture's diagnostic features occur simultaneously. These features are differentially distributed about the center. As Clarke (1968: 248) points out in reference to Wissler, however, the "mean, mode, and median region for one artifact-type is rarely the nucleus for another." He also states that spatial patterning of individual artifact types is irregular and may be shared by other cultural assemblages. However, Clarke recognizes (1968: 248) that distributions fall-off towards the boundaries of the dispersion area.

This recognizable overlap of artifact (extension to attribute level involves the same process) distributions and diffusion was elaborated upon by others (Kroeber 1940; Taylor 1948) but most succinctly stated by Ford (1954: 64-68) in his discussion of Gamma-gamma house types. Ford makes three points which are critical to the application of spatial diffusion models with specific reference to types: (1) barriers may or may not be present, (2) the effects of barriers are variable and indeed may be less than expected, and (3) the archaeologist's concept of such distributions is based on the completeness of the spatial sample at a given time level.

Synthesizing the archaeological and geographical models presented, both disciplines refer to mean spatial distributions of a given phenomenon over time. These mean distributions may be considered areas of high popularity or innovation; in the archaeological context this distinction is often impossible to define. Decreasing frequency may be viewed as the lessening of popularity or the route of diffusion from an innovative center. Information transfer takes place through a network which may or may not be hierarchical and may or may not be constrained by intervening boundaries. Adequate sampling is a requisite for any model to be sustained.

Method

Theoretical underpinnings such as those in the foregoing discussion must, of necessity, be divorced from both method and technique. Technique refers to the actual manipulations of data (Dunnell 1971: 36), whereas method is a subsystem of a larger theory. This subsystem is directed in such a manner that it moves toward the solution of specific kinds of problems (Dunnell 1971: 34). In keeping with this relationship, the method utilized was based on Clarke's previously cited theoretical notions that attribute clusters of individual artifacts are located in multidimensional space, that relative distance is the measure of correlation, and that the spatial groups derived are illustrative of the variability and patterning of attribute association.

Among the different methods available to the archaeologist which are designed to expose these patterns, the process of multidimensional scaling, a form of proximity analysis (Cowgill 1968: 373-374), most closely parallels the above theoretical statement. Multidimensional scaling can be accomplished in a variety of ways. In the current problem, for instance, the data are non-metric, necessitating an approach that is also non-metric; were the data metric, a different approach would have been warranted. In spite of these differences in procedure which are dependent on the form in which the data is presented, Shephard (1972a: 1) recognized that multidimensional scaling regardless of technique has two purposes: the exposure of hidden patterns or structure in a given data matrix and the representation of that structure as a geometric model.

A description of multidimensional scaling in particular reference to the use of non-metric data has been provided by Kruskal (1964: 1-27). Essentially, multidimensional scaling attempts to place _n_ points in such a relationship that the mathematical interpoint distances somehow reflect the experimental relationships of _n_ objects. The relationships, or interpoint distances, may be based on measures of similarity, dissimilarity, intercorrelation, or other tests of proximity or distance. Proximity data possess the quality of each entry being represented by the degree to which the point representing its row value falls in respect to the point representing its column value in a common space (Shephard 1972b: 31-32). Thus, proximity data assumes the form of an n x n matrix (Shephard 1972b: 24). What is being sought, then, is a monotonic or unvarying relationship between experimental distance or similarity measures and the configuration of n points; the two must correspond. The extent to which such a relationship can be accepted as a solution is based on the degree to which the monotonic condition is approached -- a question of goodness of fit.

The geometric model being discussed is the description of an array of highly intercorrelated points (based on the measure of proximity) in a model which may assume, two, three, or more planes. To optimize the procedure it is desirable to search for the model with fewest dimensions and best fit. The rationale is straightforward -- the fewer the number of parameters estimated and imposed on a given set of data, the larger the subset on which each is based (Shephard 1972a: 2). Practical applications of multidimensional scaling have evolved a specific assumption upon which an investigator may decide the minimum number of dimensions for which to search in a given data set; the number of observations must be three times greater than the maximum number of dimensions in the search (Kruskal and Carmone 1969: 43). These limitations reduce the possibility of extracting more dimensions than could be meaningful.

Within each dimensional array extracted by multidimensional scaling all variables utilized in the n by n input matrix are assigned a loading which is indicative of a single variable's strength of relationship with other variables in that dimension. Both positive and negative values of the configuration loading can and do occur; negative values generally illustrate maximum distance from the center of one point cluster where they may be positive in other dimensions. The higher the configuration loading, the greater the intercorrelation between that point (variable) and the dimension of which it is a part. Given the problem at hand, it did not seem desirable to rank variables within each of the extracted dimensions. Instead, variables with high positive configuration loadings (greater than .700) were extracted from each dimension. This procedure provides a group of variables from each dimension which, for the most part, are mutually exclusive of highly loaded variables extracted from other dimensions in the search. Thus, in lieu of a rank-order those variables which are most highly intercorrelated about the center of their respective clustered point arrays may be defined.

The measure of statistical goodness of fit is termed stress. Descriptions of stress define it as a positive, dimensionless number that can be expressed as a percentage (Kruskal 1964: 3). Stress, then, is a value that ranges between 0.000 and +1.000. So that a best-fit configuration of _n_-points in _n_ dimensions be attained, a starting configuration of _n_ points (each corresponding to a particular variable) is generated. Each _n_ point is then moved slightly in relation to its mathematical distance from other points, after stress is calculated, so that stress is decreased. This movement of points, or the process of iteration (Shephard 1972b: 34), is repeated for a given number of iterations (in this case 50), until a stopping criterion is reached.

For example, let us assume a similarity matrix of phi-coefficients (fuller explanation of phi is contained in the technique section). These coefficients are viewed as an expression of between-variable mathematical distance. A starting configuration of points corresponding to the number of variables (n) is generated; this starting configuration may well be random. Similar expressions of mathematical distance may then be calculated between all points in the starting configuration. To obtain a measure of distance between the generated point configuration and the data point configuration, a least squares regression is performed between the two and arranged in an n x n matrix. Computation of the arithmetic mean of the generated point configuration is now in order.

Stress may now be conveniently calculated as a standard deviation. Subtracting inter-variable distance from the regression function, squaring the difference, and summing from 1-n obtains the numerator of the expression. To obtain the denominator one computes the difference between inter-variable distance and the arithmetic mean, squaring the differences, and summing the squares. Stress is the square root of this expression.

It should be emphasized here that the initial dimensions *per se* cannot be interpreted as either a rank-order or a cluster (Shephard 1972a: 10). Use as a clustering method can only be achieved after the initial axes are adjusted by either clustering or rotation of the extracted dimensions (Shephard 1972a: 10; 1972b: 39-44; *see* Shephard, Romney and Nerlove [1972 Vol. II] for applications as a clustering tool). Probably the most important aspect of multi-dimensional scaling is that it helps an investigator to better understand the hidden patterns in a body of data. Decisions can then be more easily made as to how the data can be supplemented by observation or experimentation. Hopefully, better theoretical models can then be derived for the data (Shephard 1972a: 3).

Technique

The Attribute List

The primary, and in many ways most critical, stage of analysis was experimentation with, and reformulation of, the coding list for ceramic decorative attributes. Even with modification of extant attribute codes (McPherron 1967a: 303-306; Cleland, n.d.), experience with the decorative systems at work in the Traverse Corridor indicated that modification was necessary. This modification took two directions, the first of which was to collapse or delete variable sets or individual variables based on the ability to discriminate fine-level differences. For example, after the vessel has been completed and fired it is difficult to distinguish folded collars from applique collars except in cases where the applied strip has exfoliated from the sherd. Additionally, experience with these materials dictated that some attribute sets would have to be expanded and refined. Admittedly, the initial attribute discrimination rests on a subjective base; more objective criteria could have been employed had not the sample covered such a wide range of variability. Ideally, an initial list such as that devised by Hurley and Wagner (1972) would have provided a more complete base from which to delete attributes. Unfortunately the extant computer routines could not possibly have handled such a large group of variables.

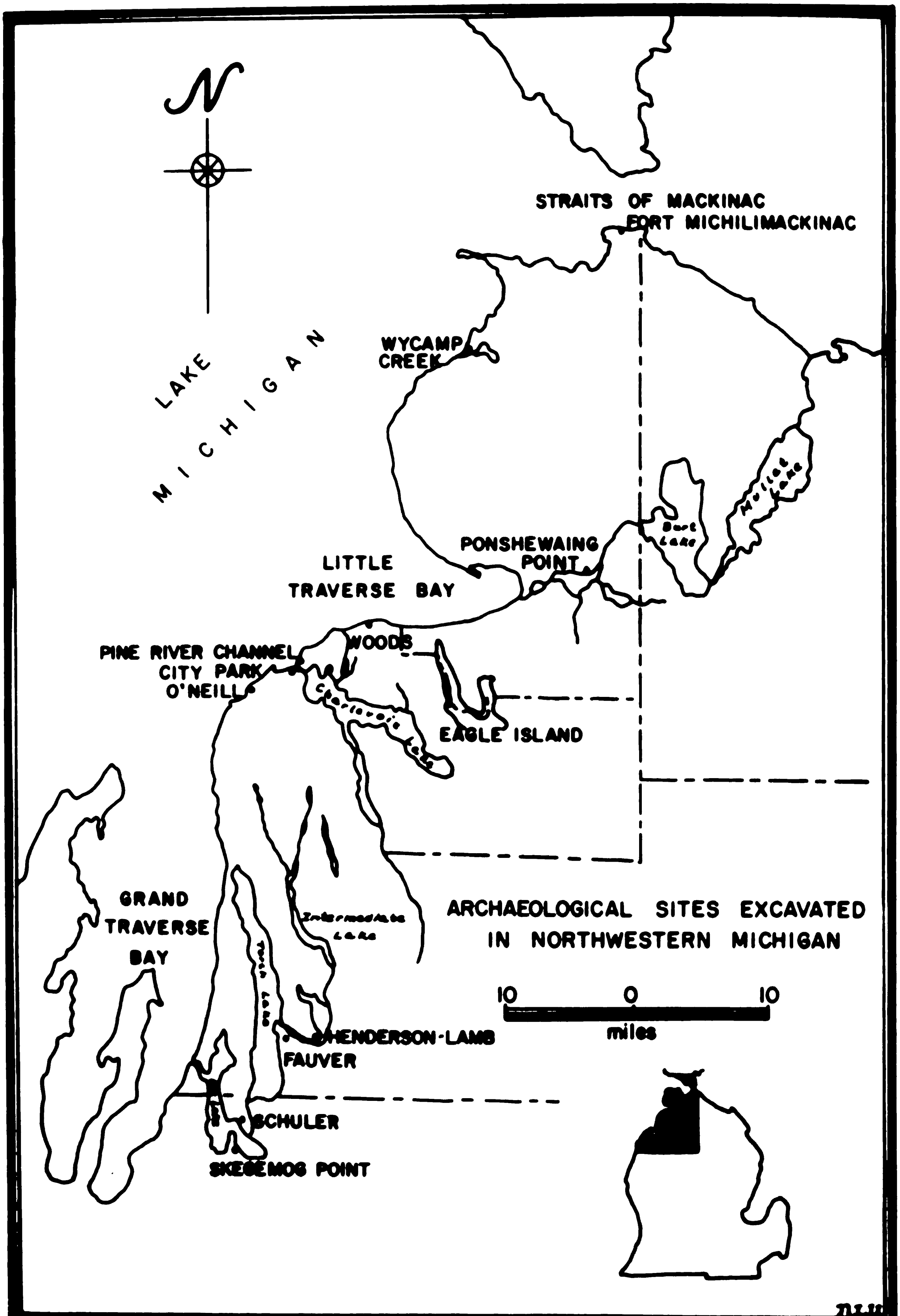
The list of style variables which evolved during the experimental procedures may be broken into a series of categories which differ in the types of information to which they pertain: particularly, those attributes pertaining to shapes of different parts of the vessel, kinds of tools used for decoration of specific areas of the vessel, the manner in which the tools were applied, and the motif elements which they formed. (The final attribute coding form consisted of 81 variables; these are presented in Appendix C.) The latter category did not rely on several common designs, composed of different elements, but rather individual elements. Thus, two or three individual elements could have been coded as present; these formed a design motif. The only application technique which contained subdivisions was punctate which can occur in a number of contexts (McPherron 1967a: 305). Since exterior decoration occurs in horizontal bands, sometimes multiple but most often single, the number of bands of different decoration (tool and technique of application, one of these, or one with a different motif element) was also included.

Although the resultant list was not particularly designed to set up "types" so much as it was formulated to perceive key attributes within site style pools, some of the resultant attribute clusters can and do fit extant type descriptions that vary in both time and space. Thus, there is reason to believe that the attributes used for this list can be used to discriminate statistical types based on pairs or groups of covarying attributes (Spaulding 1953: 305).

Ceramic samples from seven sites in the Traverse Corridor were coded on IBM punch cards, using two cards per vessel, each vessel identified as to site and observation number by a ten-character alphanumeric acronym. The sites coded included Wycamp Creek, Ponshewaing Point, Wood, Eagle Island, O'Neill, Fauver, and Skegemog Point. The location of these sites within the study area may be seen in Figure 56. Each site ceramic sample was subdivided into an early phase (A.D. 800-A.D. 1200) and a late phase (A.D. 1200-A.D. 1600). The early and late phase samples from each site were analyzed as independent groups.

Figure 56

Map Showing Location of Sites Used in the Analysis


STRAITS OF MACKINAC
FORT MICHILIMACKINAC
LAKE MICHIGAN
WYCAMP CREEK
PONSHEWAING POINT
LITTLE TRAVERSE BAY
WOODS
PINE RIVER CHANNEL
CITY PARK
O'NEILL
EAGLE ISLAND
GRAND TRAVERSE BAY
ARCHAEOLOGICAL SITES EXCAVATED IN NORTHWESTERN MICHIGAN
10 0 10
miles
HENDERSON-LAMB
FAUVER
SCHULER
SKEGEMOG POINT

The Measure of Relationship

Input to multidimensional scaling, as mentioned in the preceding section on method, is in the form of a matrix of measures of similarity, dissimilarity, etc. All ceramic style variables were coded in a binary or dichotomous fashion, necessitating the use of a measure of relationship where both variables x and y are dichotomous. The measure chosen was the phi (ϕ) coefficient. Calculation of phi with raw data is performed in a contingency table such as Table 16 (reproduced from Glass and Stanley 1970: 161, Fig. 9-2), where each variable has values of 0 (absent) or 1 (present). Letter a equals the number of times x is absent when y is

TABLE 16

TWO BY TWO CONTINGENCY
TABLE FOR THE CALCULATION OF PHI

		Variable x		Totals
		0	1	
Variable y	1	a	b	a+b
	0	c	d	c+d
Totals		a+c	b+d	n

present; b, the number of times both x and y are present at the same time, etc. To calculate phi with the above data, the following equation is used (Glass and Stanley 1970) 161:

$$\phi = \frac{bc-ad}{\sqrt{(a+c)(b+d)(a+b)(c+d)}}$$

To obtain the value of phi in an n x n matrix Program PHICOE was used (Mainfort, n.d.). This routine calculates phi for all pairs of variables according to the above equation and produces punch card output. The punched output was necessary for the following stages of analysis, Phi coefficient matrices were computed through PHICOE for early phase and late phase ceramic groups from each test site in the study area. The phi statistic is useful in this instance due to the fact that probability statements are not necessary. It is a measure of relationship which, if the proportional frequency of the dichotomous variable states remains constant, will maintain the same value despite differences in sample size. Coefficient values vary between +1.0 and -1.0, although this is of no immediate concern. In this case the measure is one of the proportional similarity in the two states of paired variables and is used as a distance measure of similarity.

Multidimensional Scaling -- Extraction of the Key Attributes

Output resulting from Program PHICOE consists of an n x n matrix (number of variables by number of variables) punched in IBM punch cards. This punch-card deck, not the raw data cards, are used as input for the multidimensional scaling analysis. The computer program utilized to perform multidimensional scaling was M-D-SCAL (Version 5M; Kruskal and Carmone 1969), a routine implemented as part of the Computer Institute for Social Science Research tape library for use on the CDC 6500 computer at Michigan State University. This program has the ability to scale attributes from two through six dimensions and to calculate stress for each.

Each of the phi-matrix decks, for early and late phase ceramic groups in each site sample, were input into M-D-SCAL and searched through dimensions two to four. The dimension that produced least stress was then chosen as that from which to extract the key variables. Although each dimension produces some variables that have high loadings and these within-dimension high loading clusters may be significant as type-clusters (as was indeed the case with some, they were not viewed as such. Instead, highly loaded variables from each dimension (the one with lowest STRESS) were grouped to form the site style pool. These are the attributes that behave in a non-random fashion, having the closest mathematical distance in n- dimensional space.

Upon completion of this process for early and late phase groups within each site sample, a simple process of comparison and elimination was used to extract those variables within each of the two temporal phases which were common to all sites. The results of this process left those attributes which were spatially significant: the preference of women at specific sites within the study area and those which did not behave in a random fashion.

The Spatial Measure-Trend Surface Analysis

In order that the predicted distributions or "flow" of the discrete variables defined in the preceding section may be more easily visualized, the simplest form of trend-surface analysis was employed to map the data across the study area. Output from such an approach may be viewed as a model illustrating a series of stepped frequencies in space by which testable general hypotheses may be generated relating to the occurrence of specific variables. The applications of trend-surface analysis of various levels of complexity applied to different spatial problems have been described and summarized by Chorley and Haggett (1968: 195-217), while specific archaeological applications have been discussed by Clarke (1968: 480-490).

The procedure involves the fitting of a three dimensional surface to geographical data initiating with the location of data points on a gridded area according to the Cartesian coordinate system. In the current analysis the data points are archaeological sites within the Traverse Corridor. The variables are then located at specific data points according to their frequency of occurrence. Following both the location of data points, using Cartesian coordinates, and the plotting of variable frequencies, a plane or surface is fitted to the data frequencies at their respective locations. This plane is generated through the use of polynomial functions of varying degree e.g. linear, $Z=a+bu+cv$; quadratic, $Z=a+bu+cv+du^2+euv+fv^2$, etc., so that the sum of the squared deviations from the mean is at a minimum. Thus, Z, the variable, is calculated by inserting the locational coordinates, u and v, into the equation. Subtract one from the other, and square the difference. The sum of all squared differences must be at a minimum. When the latter criterion has been met, a best-fit surface has been achieved.

A number of factors bear directly on our handling of the trend surface. First, each data point contributes frequency data not only to the immediate area but to the entire mapped area (Chorley and Haggett 1968: 196-197). The data points were few, thus the amount of confidence placed in the fitted surface is restricted. Lastly, they were scattered in some cases and clustered in others. The results, therefore, can be misleading due to the lack of even data point distribution, since the surface is determined by the clusters and may well deviate in areas of sparse distribution (Muehrcke 1972: 34). It should be recognized, however, when appraising the sum of the squared deviations from the mean as a measure of confidence in the "fit" of the surface, that this statistic is calculated at data points. It cannot be calculated where data points do not exist because, in effect, the surface is floating above a non-existent data point at an interpolated altitude. Thus, the confidence value is based only on the input frequencies at specific points.

Trend surface maps of the key style variables were generated by POLYFIT, a trend surface analysis program for multivariate data. This routine fits algebraic polynomials from first (linear) through fifth (quintic) degree to geographical data. Up to four variables may be utilized for a single job. The program supplies confidence values for the fit of each of the polynomials (per cent sum of squares explained by regression) and maps if desired (Wittick 1971: 10).

Results of the Analysis

Successive States of the Intra-Site Style Pool

Presentation of the results of the multidimensional scaling portions of this study will be performed on a site by site basis. Those style variables extracted by program M-D-Scal (Version 5-M) and which compose the early and late phase site style pools, are presented in a tabular fashion as part of the discussion of each site in the sample. Both sample size and stress values are given treatment as well. Organization of the following section is sequentially ordered on a north to south basis; those sites located closest to the Straits of Mackinac precede those in the Traverse Bay area. Among the seven sites for which the analysis was performed, only the Fauver Site sample did not possess enough early phase vessels for treatment; the discussion of Fauver, therefore, only makes reference to late phase results. In all cases the machine code variable number is used to designate style attributes; these numbers may be referenced in Appendix C.

Within each site discussion certain style variables within both early phase and late phase site style pools are shared, or held in common, between the two successive temporal states of the ceramic decorative system. The trajectory of these successive states, however, is explicated by those variables which are <u>not</u> held in common between t_0 and t_1 and which constitute changes in the use of non-randomly behaving variables through time at a specific site. Within the spatial dimension, which will be given more thorough examination in following sections, It should be noted that certain site samples within each phase use variables in a non-random fashion independently of other sites within the same temporal state of the system. These data are also presented in tabular form.

<u>Wycamp Creek Site</u>. The Wycamp Creek Site (Lovis, n.d.a.) is a multi-component Middle Woodland and Late Woodland village site in Emmet County, Michigan. Late Woodland ceramics from this site illustrate aboriginal occupation from ca. A.D. 700 through the Early Historic periods, the latter represented by <u>affinis</u> Ontario Iroquois rimsherds. Some evidence of Oneota occupation is present in the form of a strap handle and sharply everted rim sherd in the University of Michigan collections, obtained in 1927 by Emerson F. Greenman. Two radiocarbon dates pertaining to the Late Woodland occupation were obtained on charred wood remains from this component: 730± 110 B.P. (M-2059 unpublished), with a normalized age of A.D. 1220± 110; and 240± 100 (M-2060 unpublished), or A.D. 1650± 100. Both of these dates are compatible with ceramic and non-ceramic artifacts recovered from the site, although they favor the recent end of the occupation sequence.

A sample of 46 minimal vessels from the entire ceramic sample recovered during the 1967 excavations were complete enough for coding of attributes presented in Appendix C. Rather equitable distribution between early and late phase vessels resulted. Twenty-three fall into early phase, and 20 fall into the late phase. Results of the multi-dimensional scaling, in the form of those variables extracted as behaving in a non-random fashion, and stress values for early phase and late phase samples, are presented in Table 17.

TABLE 17

KEY STYLE VARIABLES - WYCAMP CREEK SITE

Late Phase (Four dimensions)	STRESS = .396
Variable Numbers	4, 7, 11, 12, 14, 17, 20, 27, 33, 44, 47, 54, 57, 60, 64, 65, 69, 71, 74, 75, 76, 80
Early Phase (Four dimensions)	STRESS = .460
Variable Numbers	3, 7, 14, 19, 20, 25, 28, 36, 41, 44, 46, 48, 53, 55, 56, 63, 65, 68, 71, 72, 78, 81
Shared Variables	7, 14, 20, 44, 57, 65, 71
Late Phase Variables Held Independently of Other Sites	44, 65, 71
Early Phase Variables Held Independently of Other Sites	71

Ponshewaing Point Site. Located on Crooked Lake, Emmet County, Michigan, the Ponshewaing Point Site is an extensive Late Woodland village site situated on a sandy point projecting into the lake. Comparative dating of artifact materials recovered by Michigan State University field crews in 1967 and 1970 demonstrate Late Woodland utilization from ca. A.D. 800 through ca. A.D. 1300. This village also provides some of the few data on house construction within the Corridor. Two radiocarbon dates were received on charcoal from the excavations: 1600± 130 B.P. (M-2399 unpublished), calendrical age A.D. 350± 130; and 1760± 130 B.P. (M-2064 unpublished), or A.D. 190. Both samples are clearly too early to date the occupation.

A large ceramic sample from this site resulted in 122 minimal vessels complete enough for coding, 76 early phase and 46 late phase. As noted in the O'Neill Site ceramic discussion, the Ponshewaing Point Site possessed a large group of Bois Ware vessels, the only site in the Traverse Corridor with a high frequency of this ware. These vessels were included in the early phase sample and were discriminated from other early phase wares in the sample by the multidimensional scaling routine. Results of the analysis are presented in Table 18.

TABLE 18

KEY STYLE VARIABLES - PONSHEWAING POINT SITE

Late Phase (Four dimensions)	STRESS = .493
Variable Numbers	1, 3, 7, 9, 11, 13, 14, 15, 18, 23, 25, 27, 30, 32, 33, 36, 40, 46, 47, 52, 56, 59, 61, 68, 77
Early Phase (Four dimensions)	STRESS = .562
Variable Numbers	1, 7, 11, 12, 13, 18, 27, 30, 33, 36, 38, 39, 41, 43, 47, 61, 63, 72, 81
Shared Variables	1, 7, 11, 13, 27, 30, 33, 36, 47, 61
Late Phase Variables Held Independently of Other Sites	9, 36, 63
Early Phase Variables Held Independently of Other Sites	39

Eagle Island Site. With the exception of spatial extent, the Eagle Island Site compares quite favorably in other respects to the preceding Ponshewaing Point Site. This site is situated on what was formerly an island but which has since been transformed into a peninsula, on Walloon Lake, Charlevoix County, Michigan. Brief excavations were conducted by Michigan State University field parties in 1969. Material remains yielded by these investigations have been comparatively dated to between ca. A.D. 800-A.D. 1300, coeval with Ponshewaing Point. Radiocarbon dates of 2270± 140 (M-2400 unpublished), and 2140± 140 (M-2404 unpublished) were received on charred hearth materials. The resultant calendrical ages of 320±

140 B.C. and 190± 140 B.C., respectively, deviate markedly from the expected age of this occupation site.

Total sample size of coded rim fragments included 33 minimal vessels. Of these, 22 were late phase and 11 early phase. Early phase materials, despite small sample size, were subjected to a search for two to four dimensions since sample size was close to the 12 observations suggested. This paid off in the low stress value obtained on this sample. Results are presented in Table 19.

TABLE 19

KEY STYLE VARIABLES - EAGLE ISLAND SITE

Late Phase (Four dimensions)	STRESS = .453
Variable Numbers	4, 7, 10, 23, 25, 37, 47, 53, 57, 60, 63, 66, 69, 72, 76, 79
Early Phase (Four dimensions)	STRESS = .305
Variable Numbers	1, 4, 7, 9, 10, 16, 18, 20, 22, 25, 26, 30, 38, 42, 43, 44, 47, 48, 59, 60, 64, 65, 66, 78
Shared Variables	4, 7, 10, 25, 47, 60, 66
Late Phase Variables Held Independently of Other Sites	none
Early Phase Variables Held Independently of Other Sites	16, 22

Wood Site. Situated on a gravel beach at Nine Mile Point, Charlevoix County, Michigan, the Wood Site was located and tested by MSU Museum field parties in 1967. This multicomponent Late Woodland site seems, preliminarily, to have functioned as a fishing station along the Lake Michigan shore. Ceramic comparisons indicate a temporal span for the site ranging between A.D. 800 and A.D. 1500. This tentative dating of the occupation was confirmed by dates of 320± 100 (M-2058 unpublished); A.D. 1510, and 990± 120 (M-2057 unpublished); A.D. 1020 obtained on charred wood in association with ceramics and hearth areas. The earlier date, A.D. 1020, is supposed to date Juntunen Ware ceramics but is too early. It may well pertain to early Late Woodland occupations at the site.

Forty-four minimal vessels from the ceramic sample were complete enough for coding. Of these, 19 were early phase and 25 late phase. Results of the multidimensional scaling are presented in Table 20.

TABLE 20

KEY STYLE VARIABLES - WOOD SITE

Late Phase (Four dimensions)	STRESS = .475
Variable Numbers	4, 7, 11, 14, 17, 18, 32, 33, 35, 37, 40, 42, 43, 52, 54, 59, 62, 67, 69, 73, 74, 75, 77, 78
Early Phase (Four dimensions)	STRESS = .433
Variable Numbers	1, 2, 11, 12, 17, 18, 20, 27, 33, 37, 42, 54, 56, 60, 61, 62, 65, 66. 68, 72, 75, 77
Shared Variables	11, 17, 18, 33, 37, 42, 54, 62, 75, 77
Late Phase Variables Held Independently of Other Sites	62, 67
Early Phase Variables Held Independently of Other Sites	37, 62

O'Neill Site. The O'Neill Site has received ample treatment in the preceding sections of this study; the reader is referred to the summary and conclusions of the site report for a synopsis of the analysis. A total of 45 minimal classifiable vessels from this occupation site were coded on punch cards, 32 late phase and 13 early phase. Key attributes extracted from each group by the multidimensional scaling are presented in Table 21.

TABLE 21

KEY STYLE VARIABLES - O'NEILL SITE

Late Phase (Four dimensions) STRESS = .529 Variable Numbers	1, 2, 4, 6, 8, 10, 13, 15, 25, 26, 30, 32, 35, 48, 49, 51, 52, 56, 61, 64, 76, 81
Early Phase (Four dimensions) STRESS = .347 Variable Numbers	1, 4, 15, 17, 19, 26, 28, 30, 35, 43, 44, 46, 47, 48, 57, 61, 64, 72, 81
Shared Variables	1, 4, 15, 26, 30, 32, 35, 48, 61, 64, 81
Late Phase Variables Held Independently of Other Sites	2, 6, 48, 49, 51
Early Phase Variables Held Independently of Other Sites	35

Fauver Site. The Fauver Site is primarily a late phase site with too few ceramics to argue for any intensive utilization prior to A.D. 1200. This site is located on the banks of Clam Lake, a part of the Grass River drainage emptying into Torch Lake. Location and investigation of this small Late Woodland village was accomplished in 1966 by joint Michigan State University and Western Michigan University field parties. A single radiocarbon date was obtained on a charcoal laden hearth, resulting in a radiocarbon age of 340± 100 (M-1866 Crane and Griffin 1968), A.D. 1495. This date is compatible with other late phase sites from this part of the study area; particularly the Skegemog Point Site. A sample of 25 minimal vessels were coded and subjected to phi-coefficient transformation and multidimensional scaling. The results are presented in Table 22.

TABLE 22

KEY STYLE VARIABLES - FAUVER SITE

Late Phase (Four dimensions) STRESS = .503	
Variable Numbers	3, 8, 10, 11, 14, 17, 20, 28, 35, 42, 43, 46, 53, 60, 61, 63, 66, 73, 79, 80
Late Phase Variables Held Independently of Other Sites	
	None

Skegemog Point Site. An extensive, intensively occupied Late Woodland village site, the Skegemog Point Site was located in 1965 and excavated in 1965 and 1966 by a joint Michigan State University and Western Michigan University field crew. This site provides ceramic control for the southern terminis of the study area (Cleland, n.d.). A brief discussion of this sequence is presented in the O'Neill Site Ceramic section. Three radiocarbon determinations date the sequence; 1100± 120 (M-1865, Crane and Griffin 1968): A.D. 900, 630± 110 (M-1864, Crane and Griffin 1968): A.D. 1310, and 865± 120 (M-1863, Crane and Griffin 1968): A.D. 1210. Additionally, a large ceramic sample was recovered from the two seasons' excavations. These ceramics have been temporally subdivided into two major phases corresponding to the analytic t_0, t_1 divisions used herein: the Skegemog Phase (ca. A.D. 700-A.D. 1200) and the Traverse Phase (ca. A.D. 1200-A.D. 1500).

One-hundred-eighty-three minimal vessels from this site were complete enough to be coded and assigned a temporal position, 89 early phase and 94 late phase. Results of the multidimensional scaling are presented in Table 23.

TABLE 23

KEY STYLE VARIABLES - SKEGEMOG POINT SITE

Late Phase (Four dimensions)	STRESS = .396
Variable Numbers	1, 3, 7, 11, 12, 14, 15, 17, 21, 26, 28, 32, 41, 46, 53, 57, 59, 60, 61, 63, 64, 65, 69, 70, 72, 81
Early Phase (Four dimensions)	STRESS = .407
Variable Numbers	2, 3, 5, 6, 7, 14, 17, 18, 20, 24, 25, 26, 28, 32, 34, 41, 43, 46, 52, 55, 57, 63, 66, 73, 76, 77, 79
Shared Variables	3, 7, 14, 17, 26, 28, 32, 41, 46, 57, 63
Late Phase Variables Held Independently of Other Sites	41, 70
Early Phase Variables Held Independently of Other Sites	24, 34, 52, 70, 76, 79

Discussion. Two approaches to the preceding descriptive section are necessary and warrant further discussion: the utility of multidimensional scaling as an information extracting device and a review of the derived information.

One of the more disconcerting factors about the results obtained from M-D-Scal was the uniformly high level of Stress which resulted for almost every sample tested. Program M-D-Scal reaches a stopping criterion when lowest level of Stress has been achieved, whether or not the maximum number of iterations have been processed. In no case did the number of iterations exceed 25, despite the fact that a maximum of 50 were specified. Attempts to reduce Stress through multiple runs on the same data set, with maximum dimension search, failed with the Skegemog Point Site data. In fact, the increased number of dimensions did little other than to rearrange highly loaded variables from low dimension searches. It would seem, then, that the same variables are being extracted, but that their behavior in relation to other variables was defined differently dependent on the number of dimensions extracted.

Throughout this part of the analysis attempts were made to apply ware and type names to the extracted dimensions on the basis of the variables included in each. Success was achieved in some cases but not in others. The Skegemog Point Site, Ponshewaing Point Site, and the O'Neill Site data in particular provided interesting results. The extracted dimensions for these sites tended to mix classificatory levels; ware names were able to be applied to certain dimensions and type names to others. These observations adequately bear out Shephards (1972a: 10) contention that individual interpretation of the initial axes is not possible without further adjustment, through either clustering, or rotation. This continuation would be an interesting application of multi-dimensional scaling to formal analytic problems. In the case of the current problem such discrimination was not necessary, since the extracted variables were grouped to compose the site style pool.

With the data utilized in this analysis two criterion were used in extracting the best-fit dimension: Stress, or fit, and the amount of meaning one could derive from the dimensions. In almost all cases four dimensions were optimal from both vantage points. A question that arose when extracting highly loaded variables (greater than .700) was whether or not the M-D-Scal routine was searching for the same number of variables in each data set and arranging them in the four dimensions. This did not prove to be the case, although a range of from 16-27 variables were extracted; there is no mechanical limit set by the program.

What kinds of information derived from the use of this technique. The grouped variables from all dimensions, those with high loadings, composed the site style pool. In all cases except the Fauver Site sample, which lacks early phase materials, variables were shared between phase site style pools. Shared variables were not limited to any single subset of style attributes, but encompassed all possible subsets presented in Appendix C. It would seem, therefore, that either the ability to discriminate ceramic styles temporally is not rigorous enough or that there is real intra-phase continuity at the site-specific level.

An important bit of information extracted from the site style pools is that certain style variables behave in a non-random fashion at one site only. Only the Eagle Island early phase sample and the single late phase sample from the Fauver Site did not hold at least one variable independently of all other sites. This information, in part, confirms the formulation of a micro-style hypothesis for the study area. It is possible that the inhabitants of specific sites held one attribute of style as their preference only; this, however, would be extending the micro-style zone concept to almost improbable limits.

Inter-Site Similarities

Early Phase Relationships. Analysis of within-phase spatial relationships was accomplished with the information extracted by the multi-dimensional scaling program. These data consist, as noted in the preceding section, of groups of style variables. Each style variable has the identical analytic weight of all other extracted variables; no single style variable is treated as being more or less important than any of its neighbors. Furthermore, the collapsing of dimensions, or intercorrelated variable clusters, removed any links that were present between a single variable and any other variables in the study. Each style variable, then, has and will be treated as an independent variable characterized by its non-random behavior within a phase grouping of a site sample. The presence of any variable at this stage of the analysis argues for its extraction on the basis of non-random behavior at an earlier stage.

Examination of between-site relationships was initially based on the presence of specific variables at two or more sites within the study area. Sites were listed in columnar form beneath the variables which linked them, grouped on the basis of subdivisions within the ceramic attribute list in Appendix C, i.e. Lip Area-Directional Elements, Technique of Application, Type of Tool. Individual linkage diagrams were then constructed for the intersite relationships. The linkage diagrams were utilized as a filtering mechanism, whereby those attribute categories which contributed least to the demonstration or rejection of the micro-style hypothesis were dropped. For instance, the Rim Shape category was not selected as possessing non-randomly behaving variables for two of the six sites in the early phase sample, and was dropped. This criticism was true of other style variable categories as well. Those variable categories which contributed most, however, were Lip Area-Directional Elements, Type of Tool; Upper Rim Exterior - Number of Bands (Same Technique and Tool), Number of Bands (Different Technique and Tool), Directional Elements, Continuity of Directional Elements, and Type of Tool.

Each variable set will now be viewed as independent units with specific emphasis on their spatial distribution. The first of these sets to undergo inspection were sites linked through Lip Area, Direction of Application (if present), and the absence of lip decoration. These data are presented in Table 24. With reference to the site location map (Fig. 56), it is evident that variables 17 and 18 are common to those sites at the southern and middle portions of the Corridor, whereas

TABLE 24

LIP AREA, DIRECTION OF APPLICATION IN EARLY PHASE SITES

Site	Variable			
	17 (absent)	18 (longitudinal)	19 (transverse)	20 (Oblique)
O'Neill	x		x	
Wycamp			x	x
E. Island	x	x		x
Skegemog	x	x		x
Wood		x		x
Ponshewaing		x		

variables 19 and 20 are common to northern and middle Corridor sites. Thus, there is an overlapping or common area in the central parts of the study area, a phenomenon that could be expected if juxtaposed ceramic traditions are present at the northern and southern termini but whose populations are using the Corridor on a mutual basis.

This pattern, however, does not hold for the variables subsumed under Lip Area, Type of Tool, which relationships are presented in Table 25. In this case, variable 26 links a southern site with two middle Corridor sites, and variable 27 links two middle Corridor sites. However, both variables 25 and 28 link a northern, middle, and southern Corridor site, illustrating, if anything, a single style zone. Furthermore, the sites linked by this group of variables differ from the preceding directional element links.

TABLE 25

LIP AREA, TYPE OF TOOL IN EARLY PHASE SITES

Site	Variable			
	25 (c/w stick)	26 (cord imp.)	27 (c/w paddle)	28 (plain tool)
Wycamp	x			x
Ponshewaing			x	
Wood			x	
E. Island	x	x		
O'Neill		x		x
Skegemog	x	x		

Those attribute categories contributing to the overall design motif were grouped for the third early phase linkage examination, including variables numbered 33 through 48. Once again, examination of the groups of sites linked by the different variables resulted in different patterned relationships (Table 26). Four of these variables link two sites each: 33, 36, 38, and 42. Only variable 42 links a northern site with a central Corridor site, the remainder interacting between middle sites exclusively. Variable 47, in keeping with the paired-site middle Corridor relationships joins three central sites. A closer duplication of the first, rather clean relationships displayed by lip decoration direction, is manifested by variables 43, 44, and 48. The first links Skegemog Point, the most southern site in the study area, with three middle Corridor sites. Likewise, 44 and 48 link the most northern site, Wycamp Creek, with two middle Corridor sites, O'Neill and Eagle Island. These three variables give a rather close approximation of a mutual use, central Corridor region. However, once again Wycamp Creek and Skegemog Point share variables, 41 and 46, negating these earlier patterns.

TABLE 26

MOTIF VARIABLES IN EARLY PHASE SITES

Site	Variable 35 (one)	36 (>three)	38 (two)	41 (horizontal)	42 (oblique r/l)	43 (oblique rt.)	44 (oblique left)	46 (continuous)	47 (linear, close)	48 (linear, wide)
Wycamp		x		x			x	x		x
Ponshewaing	x	x	x	x		x			x	
Wood	x				x				x	
E. Island			x		x	x	x		x	x
O'Neill						x	x	x		x
Skegemog				x		x		x		

The last early phase relationships in the linked-variable analysis were those defined by the type of tool used in exterior decoration. These data are presented in Table 27. Three variables behave in a fashion

TABLE 27

EXTERIOR DECORATION, TOOL TYPE IN EARLY PHASE SITES

Site	Variable					
	61 (linear cd.)	63 (c/w stick)	64 (rect.)	65 (cun.)	66 (triang.)	68 (paddle edge)
Wycamp		x		x		x
Ponshewaing	x	x				
Wood	x			x	x	
E. Island			x	x	x	
O'Neill	x		x			x
Skegemog		x			x	

similar to Lip Directional elements. South/middle sites are linked through variable 66, while northern/middle study area sites are related through variables 68 and 65. As in the motif elements, middle Corridor links exist independently of northern and southern sites, specifically in variables 64 and 67. Thus, in three of four cases variables are present which suggest style attributes common to the central part of the Corridor <u>only</u>. Likewise, Skegemog Point and Wycamp Creek are also linked through variable 63.

Synthesis of the varied data presented above was accomplished by grouping variables that occurred in northern/central, southern/central, central, and northern/southern contexts. The results of this collation (Table 28) indicate that, although the same sites do not share the same variables from each of the above sets, pools of style attributes are present for the northern, central, and southern Corridor areas.

TABLE 28

SPATIAL BEHAVIOR OF STYLE VARIABLES

Corridor Distribution	Variable Numbers
northern/central	19, 36, 44, 48, 65, 68
central	27, 30, 33, 38, 42, 47, 61, 64
southern/central	17, 18, 26, 43, 66
northern/central/southern	20, 25, 28, 41, 46, 63

A major criticism of the resultant attribute pools is that they may well be an artifact of the manner in which the sites were ordered spatially, i.e. southern, central, northern. Implicit in this ordering is the notion that the closest stylistic affinities lie between sites that have the closest spatial proximity. In order that this proposition be tested and that spatial models not be built on preconceived ideas as to the spatial organization of style in the study area, measures of between-site style affinity were calculated. This test took the form of phi-coefficients calculated in the Q-mode (Thomas 1971: 206-207), comparing the dichotomous occurrence of non-randomly behaving style variables between early phase site style pools. The phi-matrix, then, would be of the dimensions six by six, corresponding to the number of site style pools in the early phase sample. Results of this treatment are presented in Table 29. It is evident from the low positive and negative results that the statistical distance between all sites in the sample is low, the highest value of ϕ obtained being +.20, and the third highest positive coefficient linking the Skegemog Point Site and the Wycamp Creek Site. These sites are the two most distant sites in the sample. The phi measure of relationship, therefore, indicates that the style affinity proposition

TABLE 29

PHI-COEFFICIENT MATRIX IN Q-MODE FOR EARLY PHASE SITES

	Wycamp	Ponshewaing	E. Island	Wood	O'Neill	Skegemog
Wycamp	1.0000					
Ponshewaing	-.0383	1.0000				
E. Island	-.1082	.0338	1.0000			
Wood	-.2956	.2014	-.0854	1.0000		
O'Neill	.1949	-.0171	.0547	-.1340	1.0000	
Skegemog	.1382	-.1893	-.1298	-.1715	-.1715	1.0000

is incorrect for early phase sites in the study area. Although certain style variables behave in a non-random, patterned fashion at the site-specific level, current evidence points toward independent spatial behavior of these same style variables in the Corridor as a whole. The resultant lack of patterned style behavior in space, however, has in this case been treated on a presence/absence basis as opposed to a differential spatial frequency approach. Among the factors which could easily affect the outcome of such an analysis is sampling error which is poorly controlled. Likewise, an inability to more finely discriminate the temporal duration of ceramic styles would interject confusing information into the system which could well obliterate patterned behavior. Concomitant with the latter is the ability to define the spatial extent of attributes of style. The current analysis could well have included sites, in the linkage analysis, which do not interact in a patterned fashion with other sites which do behave together regularly. Any or all of the above may have obscured this regularized behavior in the *Q*-mode analysis, if indeed regularized spatial style behavior existed. McPherron (1967a: 299) suggests that style attributes may cline through time and space which would make it extremely difficult to isolate spatial behavior at a given time level.

Late Phase Relationships. As in the case of the early phase style linkages, late phase style variable relationships in space were initially examined through the deletion of non-diagnostic variable sets and the construction of spatial linkage diagrams on the basis of the presence of the same non-randomly behaving variable at two or more sites in the study area. Although the results of this treatment were essentially compatible with those from the early phase analysis in that no spatial patterning was displayed by the style variables, the information will be presented in the following discussion for the seven sites utilized. Three attribute sets were examined during this phase of analysis.

Diagrams constructed for Lip Area, Type of Tool for the late phase sites illustrated rather clean partitioning of the study area; these data are presented in Table 30. Those variables confined to southern study area are numbered 28, while variable 26 links a southern and middle Corridor site. Four sites in the central part of the study area are linked by variable number 25, suggesting a single style zone for the central part of the Traverse Corridor. Clear cut partitioning of the central and northern sections is illustrated by the behavior of variable 27 which links a northern and central site. Thus, for this variable set a clean tripartite spatial partitioning of attribute behavior is evident, a situation noted for early phase behavior of the same variable set as well.

TABLE 30

LIP AREA, TYPE OF TOOL IN LATE PHASE SITES

	25 (c/w stick)	26 (cd. imp.)	27 (c/w paddle)	28 (plain tool)
Wycamp			x	
Ponshewaing	x		x	
Wood	x			
E. Island	x			
O'Neill	x	x		
Fauver				x
Skegemog		x		x

The clean spatial behavior of the above set is rapidly complicated by the results of linkage comparisons for decorative motifs of exterior decoration presented in Table 31. For the most part the resultant

TABLE 31

MOTIF VARIABLES IN LATE PHASE SITES

	32 (absent)	33 (one)	35 (three)	37 (one)	42 (oblique r/l)	43 (oblique rt.)	46 (continuous)	47 (linear, close)
Wycamp		x						x
Ponshewaing	x	x					x	x
Wood	x	x	x	x	x	x		
E. Island				x				x
O'Neill	x		x					
Fauver			x		x	x	x	
Skegemog	x						x	

linkages indicate a style zone encompassing both the southern and middle portions of the study area and a possible northern style zone. Only one variable, 37, is located at sites in the central Corridor only. Northern linked variables include numbers 33 and 47, while the remaining five variables numbered 32, 35, 42, 43, and 46 distribute themselves spatially across both southern and central areas. In this case, then, a conflict with the preceding lip area decoration is obvious.

The last style variable set examined by the linkage procedure was Exterior Decoration, Type of Tool, consisting of five style variables occurring at two or more sites. Spatial behavior of these attributes is presented in Table 32 and differs from the preceding two variable sets. Variable 64, for instance, links a northern and a middle study area site, while variables 66 and 63 are spatially distributed across the southern and central parts of the Corridor. However, both variables 61 and 69 behave in a manner which encompasses the entire region under consideration. There is, therefore, either an inability to define spatial partitioning with this variable set or the variables behave non-randomly in both style traditions, northern and southern.

TABLE 32

EXTERIOR DECORATION, TOOL TYPE IN LATE PHASE SITES

	61 (linear cord)	63 (c/w stick)	64 (rect.)	66 (triang.)	69 (fingernail)
Wycamp			x		x
Ponshewaing	x				
Wood					x
E. Island		x		x	x
O'Neill	x		x		
Fauver	x	x		x	
Skegemog					x

Due to an inability to define spatial patterning of style attributes in the study area by using a linkage analysis, recourse to phi in the _Q_-mode was once again made. These results are presented in Table 33 and were calculated in reference to a spatial proximity/style proximity proposition. Among the 21 measures of relationship calculated, the highest positive value of ϕ was obtained between Fauver and Skegemog Point, both sites being in close spatial proximity. However, this relationship collapses when other close proximity site style interactions are included. In fact, negative measures of relationship obtained between many of these sites, e.g. Wycamp Creek/Ponshewaing Point (ϕ = -.1377), Wood/Eagle Island (ϕ = -.0960), O'Neill/Wood (ϕ = -.2476), etc. Once again, then, this proposition must be rejected since it is not supported by the data. This rejection could well be attributed to the same factors discussed for the early phase rejection.

Distance and Similarity. The preceding discussion and statements pertaining to a seeming inability to define spatial site clusters based on phi-coefficient associations was tested further through the use of the correlation coefficient (_r_). Multiple correlations were calculated between intersite similarity (ϕ) and actual geographic distance for all pairs of sites at both analytic time levels. The resultant late phase value (r = .1128) and an early phase value (r = .0041) support the proposition that at present no spatial style zone patterning dependent on distance can be defined in the study area.

The Trend-Surface Analysis

Since the preceding portions of this analysis cast some degree of doubt on the presence of micro-style zones as well as on present abilities

TABLE 33

PHI-COEFFICIENT MATRIX IN Q-MODE FOR LATE PHASE SITES

	Wycamp	Ponshewaing	E. Island	Wood	O'Neill	Fauver	Skegemog
Wycamp	1.0000						
Ponshewaing	-.1377	1.0000					
E. Island	.1444	-.1703	1.0000				
Wood	.1224	.0985	-.0960	1.0000			
O'Neill	-.2951	.0155	-.0647	-.2476	1.0000		
Fauver	-.0295	-.1170	.0639	.0202	-.1504	1.0000	
Skegemog	.0771	.0521	.0923	-.1378	-.0913	.1845	1.0000

to explicate formal and temporal ceramic relationships with extant data, a revision of the second hypothesis was deemed necessary. The interactions between sites, based on non-randomly behaving style variables, illustrated that on the basis of just presence or absence, no spatial style patterning could be isolated. Possible factors relating to this phenomena were discussed. Among the arguments which defeated the proposition of stylistic partitioning within the Corridor were the presence of certain variables at sites both at the northern and southern termini of the study area, five early phase variables and four late phase variables.

Given that the early stages of analysis were confined to dichotomous relationships which took no account of frequency distributions within the study area, it is evident that this manner of treatment could easily obscure the relative popularity of non-randomly behaving variables at each site or at groups of sites. This particular criticism is most easily leveled at those variables which illustrated no spatial patterning, the nine variables noted above. The revision of the second hypothesis, then, pertained to clarification of the spatial frequency "flow" of these variables which is a descriptive problem.

The measure utilized for these data constituted proportional frequency occurrence of these nine variables at the seven sites in the study area. Each site was a single data point, and each variable was trend-surface mapped separately. Trend surfaces were calculated using polynomials of the first through third degrees, due to the small number of data points. This last problem poses some problems in interpreting the results, as does the unequal distribution of these points within the mapped area. In all cases, the second degree surface provided the best fit; that is, the fitted surface was closest to the actual data values when the second degree polynomial was calculated than when the first or third degree polynomials were used. In all cases, the fit was perfect and 100 per cent of the variation was explained; the fitted surface was projected through all data points. However, in all cases the *F*-ratio was close to 0 as a result of the small number of data points. In a purely quantitative sense, then, little statistical confidence can be placed in the fitted surface due to a lack of intensively sampled sites, but the contours generated by the trend-surface are illustrative of the relative "height" of the data at various places within the Corridor.

Compilation of the resultant surfaces was not accomplished on the basis of subtle innuendos in the contours because of the small site sample under consideration; any statements about minor frequency changes in the Corridor would be mere speculation. However, the surfaces obtained do correspond on a general level, and two major patterns can be discerned among the nine maps which resulted from the plotting of variables 25, 63, 69, 20, 28, 41, 17, and 61. These general patterns can be viewed with more confidence than would individual statements on the behavior of each variable tested. The fact that both patterns occur in the early phase and late phase samples and that no other incompatible patterns emerged from the analysis suggests not only uniformity of spatial behavior based on frequency but temporal continuity as well. These general patterns are presented in Figures 57 and 58, which also define the outlines of the mapped area.

Viewing the width of the mapped arrows as proportionally comparable, the patterns presented and the direction of "flow" based on frequency, provides us with information that argues for a reappraisal of the Traverse Corridor Concept. Pattern A, for instance, illustrates decreasing

Figure 57

Map Illustrating Pattern A Diffusion in the Traverse Corridor

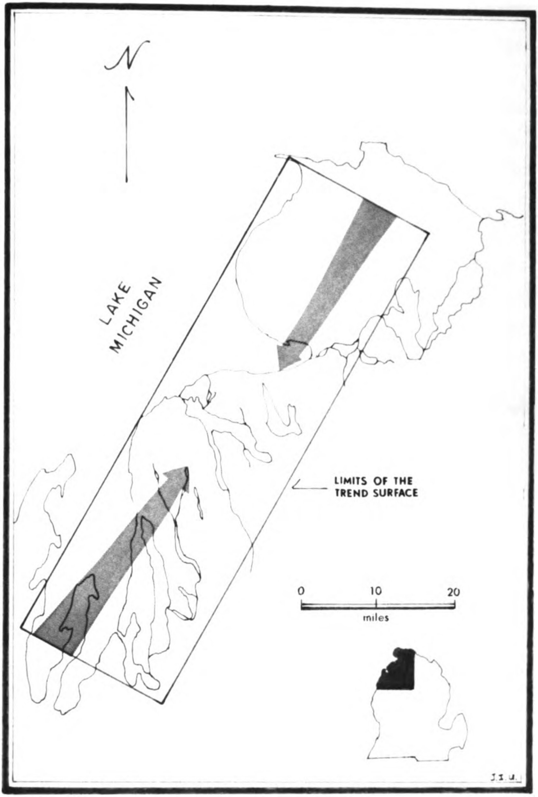
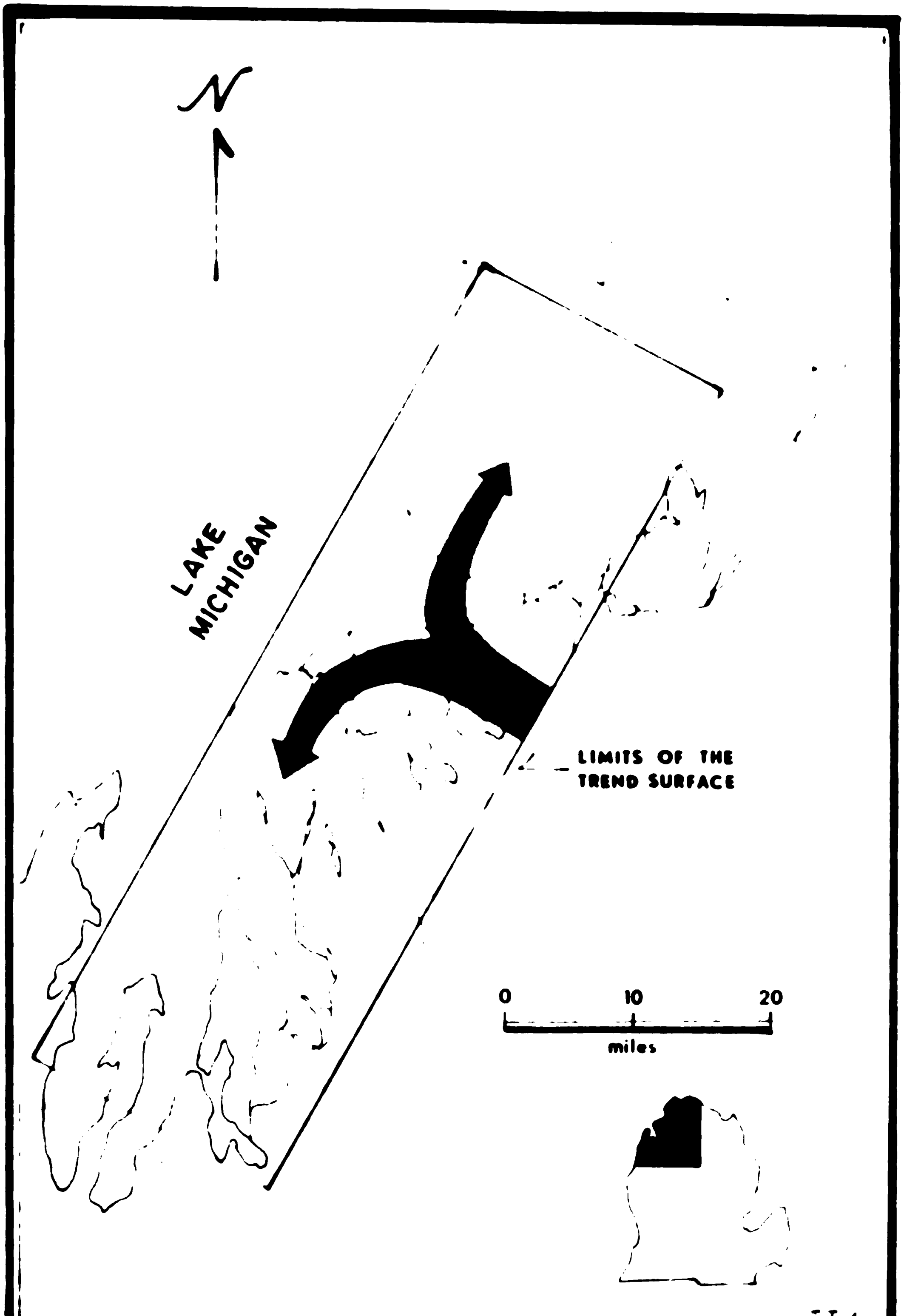

N
LAKE
MICHIGAN
LIMITS OF THE
TREND SURFACE
0
10
20
miles
J.I.U.

Figure 58

Map Illustrating Pattern B Diffusion in the Traverse Corridor


N
LAKE MICHIGAN
LIMITS OF THE TREND SURFACE
0
10
20
miles
J.T.A.

frequency as one moves from either the northern or southern termini toward the central parts of the study area. If this is examined merely on the basis of decreasing frequency and the direction of decreasing frequency, support for a northern and southern penetration of the Corridor is generated. However, it should be noted that the proportional frequency of the southern trend is relatively greater than the comparable northern trend; this relationship holds true for early phase variables 25 (c/w stick $<$ 0.5 cm), and 63 (c/w stick), and late phase variable 69 (fingernail). The behavior of these three variables supports the contention that they are shared by the southern and northern Corridor style traditions and should be eliminated as a discriminating variable between the two or more carefully defined.

Pattern B, on the other hand, was "unexpected" in terms of the Traverse Corridor hypothesis (Cleland 1967) (Fig. 58). This pattern of flow was shared by early phase variables 20 (oblique), 28 (plain tool), and 41 (horizontal), and late phase variables 17 (decoration absent) and 61 (linear cord). The implications of the second set of frequency relationships are that the highest frequency areas occur in the east central parts of the study area, near the southern end of the Inland Lake chain and the interior of Little Traverse Bay. From this point, which is most likely attributable to high frequencies of these variables at Ponshewaing Point and Eagle Island (possibly the Wood Site as well), frequencies decrease toward both the north and the south, but more rapidly toward the south. These data led toward a reformulation of the Corridor hypothesis.

It is argued here that a potential source for population input, and concomitantly material culture remains, is omitted by the current hypothesis which fixes its attention primarily on the coastal region. In part, Pattern A supports both northern and southern intrusion along the littoral with the tested style variables. However, Pattern B, if high frequency can be considered a source, suggests input from inland areas for certain variables. The most likely source for this east-west input is the Inland Lakes, which assume a continuous northeast to southwest direction, connecting Lake Huron near Cheboygan with the interior of Little Traverse Bay. Those bodies of water pertinent to the inland route include the Black River, Mullett Lake, Burt Lake, and Crooked Lake. Archaeological investigation of this route is, however, nonexistent; its prehistoric importance is unknown. A single Mackinac Phase site has been recorded by L. Griffin (1963) on Black Lake, southeast of the inland route. It is proposed that this interior lake chain is an additional source of input to the Traverse Corridor but does not exclude either the northern or southern littoral routes.

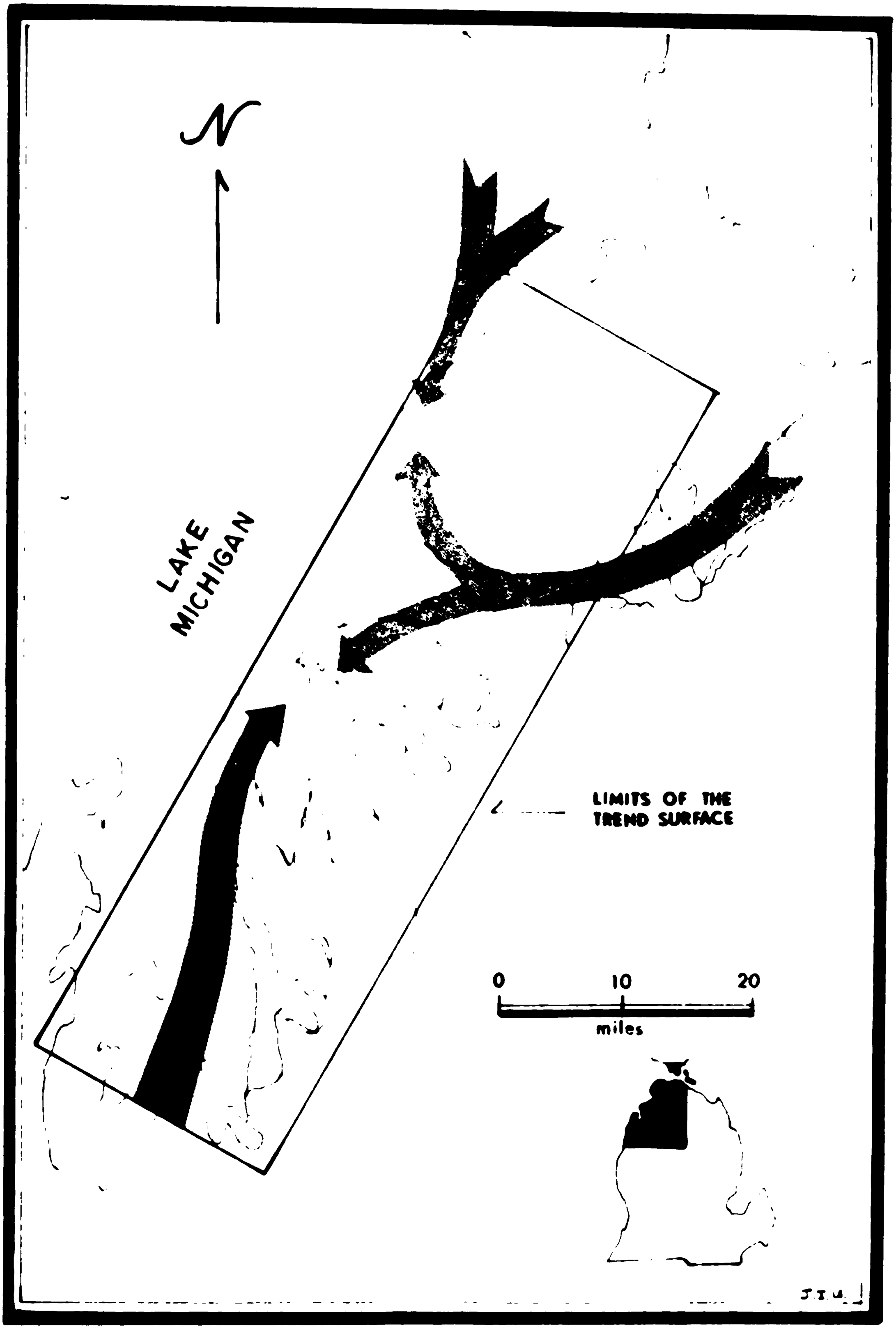
The plausability of such an argument is accentuated by other data pertinent to the natural environment and may indeed indicate that the inland lakes possess more satisfactory natural factors for prehistoric settlement than does the coastal plain at the northern entrance to the Corridor. First, the littoral between Little Traverse Bay and the Straits of Mackinac is virtually nonexistent (Fig. 1); the morainic system terminates almost at the shore of Lake Michigan in the form of steep lakeside bluffs. Secondly, the current archaeological site density information indicates that site settlement may well be dependent upon a mosaic vegetation pattern as well as dissection by numerous lakes and streams (Fig. 56). The last two natural variables are not present in the northern third of the Traverse Corridor. In direct contrast, however, the

Inland Lakes provide the necessary riverine/lacustrine environments. Furthermore, Isleib's (n.d.) data on Crooked Lake, the southernmost of the lake chain, illustrates a vegetation mosaic comparable to that south of Lake Charlevoix. Presettlement forest data on the vegetation patterns of areas adjacent to the other lakes in the chain have not yet been compiled. In support of the above is the low site density between Little Traverse Bay and the Straits of Mackinac. Surveys by Michigan State University, in conjunction with earlier survey reports (Greeman 1927), have located a total of seven sites along this stretch of coastline.

In view of the data derived through trend-surface analysis and the preceding discussion, the following Corridor model revision is forwarded which greatly increases the complexity of any future investigations. The revised model includes the inland lakes as a potential source of population movement into the study area. From Little Traverse Bay, it is likely that movement both to the north and the south occurred. At the same time, penetration of the Corridor is taking place from both the northern and southern entrances as well. The central portion of the Corridor is therefore subject to occupation by peoples from three directions rather than two as previously hypothesized. The resultant complexity of ceramic style elements is then further confused by the fact that no archaeological investigations of the north-eastern lower Peninsula have taken place. There are, therefore, no collections extant with which to compare Corridor material. A diagram of the revised Traverse Corridor model is presented in Fig. 59.

Figure 59

Map Illustrating Revised Traverse Corridor Diffusion Model


N
LAKE MICHIGAN
LIMITS OF THE TREND SURFACE
0
10
20
miles
J.T.U.

Summary and Conclusions

This study was presented in three stages, each stage having an explicit goal which it attempted to attain. Likewise, the information gained from each step of the analysis was necessary for the investigation to continue on to further analytic steps; thus, the procedure followed was hierarchically ordered. The discussion which follows will be organized in a similar manner in that each of the analytic steps will be summarized and evaluated with respect to its position within the research design.

The primary stage of the analysis, extraction of the non-randomly behaving variables at the intra-site level and the intra-phase levels, was rather fruitful from the perspective of types of information derived and the technique utilized. The results of the multi-dimensional scaling gave clear indications that, at the site level, certain attributes of style were behaving in a regular fashion in relation to other style variables. Continuity between phases at specific sites is illustrated by the fact that attributes are shared between time levels. Further, the site style pools at each site are unique in that each contains non-randomly behaving variables within the pool in such combination that no two sites possess the same combinations. Certain sites possess attributes within the pool which are shared by no other sites in the study area. Thus, phase samples within each site possess a style pool different than those at all other sites and which may be considered that group of attribute combinations which are the preference of potters at that site only.

Moving from the site-specific level to the inter-site similarities comprised the next step of the analysis which was designed to test the micro-style hypothesis. Data derived from the definition of site style pools were utilized in an attempt to isolate regularized spatial patterns of attribute behavior. The premise upon which this part of the study revolved was that two or more sites would be linked by regularized non-random behavior of a series of style variables. Frequency of the non-randomly behaving variables was not taken into account -- only their presence on a dichotomous scale. Originally, sets of attributes from early and late phases were mapped according to their presence at more than one site in the study area. The network which resulted from this treatment illustrated that each set of style variables behaved independently in the spatial dimension. Some semblance of spatial patterning within the Traverse Corridor seemed to occur, but it was determined that this partitioning could well be a product of the manner in which the sites were grouped, e.g. north, central, south. In addition, this technique severely limited the ability to view the spatial behavior of style variables from different sets in the attribute list.

In order that the latter be tested and that simplification of the network analysis take place, a measure of similarity was utilized to test the proposition that spatial proximity varies directly with stylistic proximity. Results of the Q-mode analysis for both the early and late phases indicated that the proposition was incorrect -- sites closest in space were not, for the most part, closest in style. Qualification of this statement is necessary because Skegemog Point and the Fauver Site reacted in a manner that suggested the proposition was true.

How, then, can this apparent lack of patterned spatial behavior be explained? It is, of course, possible that there is no patterned spatial behavior of style attributes within the study area. It is equally possible that there are deficiencies in the data available at present, and it is true that all possible techniques for extracting information from the data have not yet been exhausted. Among those deficiencies which bore directly on the handling of this study was sample size. Sample size at the site level limited the number of sites usable according to this criterion to seven; those sites not meeting the size criteria were eliminated. Only two of these seven sites possessed large numbers of ceramics; these were Skegemog Point and Ponshewaing Point. When site samples were reduced to phase samples based on (1) the ability to accurately place them temporally and (2) their ability, based on size, to provide the information necessary, sample size in some instances became marginal.

The temporal problem, as well as the directly related formal problem of classification, was a nemesis equal to that of the sample. Had the sites been seriated according to the present ceramic classification systems, the temporal span of the phase would have been reduced, thus cleansing much of the temporal distortion from the data. However, the number of sites within the phase would have been reduced, thus leaving an insufficient sample of data points for the mapping procedures. Likewise, the vessel sample within each phase grouping would have been reduced to the point where they would have been completely inadequate for the purpose -- the site style pools within the phase could not have been defined.

A serious question which should be asked of the data is whether or not seriation is feasible. Whether McPherron's three phase Mackinac-Bois Blanc-Juntunen, Cleland's two phase Skegemog-Traverse, or the bipartite division in this report is used, more than one ceramic style is present within each phase. The most pressing inadequacies of all three systems are that the temporal relationships between types and varieties within the phase are unknown. Clarification of these relationships on the basis of current radiocarbon chronologies is not feasible -- there are too few reliable dates, and many of these dates do not pertain to specific ceramic categories. Until these deficiencies are eliminated, ceramic analysis in the study area will of necessity be inhibited.

Even given clarification of all the data deficiencies discussed above, from sample size to seriation, the possibility still exists that patterned relationships will elude analytic grasp. McPherron (1967a: 299) has suggested that style variables in the Straits of Mackinac area may readily cline through space and time. The implications of such a process being operative are that the archaeologists, with the techniques at their disposal, will not be able to define such a complex three-dimensional system. Style attributes varying through space and time, perhaps discontinuously, perhaps independently of other variables, do not lend themselves to traditional analysis. The current classifications and temporal divisions, if this is the case, may be as definite as such a system will allow the researcher to achieve.

At the termination of the inter-site level of analysis it was noted that certain variables behaved independently in space; they occurred at both the northern and southern termini of the study area. These variables could well be shared by both ceramic decorative systems and would, therefore, not have much diagnostic value for spatial analysis. In terms of priority, then, clarification of their spatial distribution assumed more importance than the testing of other variables which, if they occur at the southern entrance to the Corridor, do not occur at the northern entrance. Trend-surface analysis utilizing proportional frequency was then used to clarify the distribution of these nine variables.

The results of this mapping technique indicated that, indeed, certain of these variables are shared. More importantly, however, the resultant patterns hinted that in some cases a heavy east-central distribution prevailed, with diminishing frequencies as one moves north or south. Interpretation of this phenomenon took on the form of a revision of the Traverse Corridor hypothesis by addition of the Inland Lakes route as an additional input path to the study area. Given our present knowledge of the area from which the inland lakes derive, it is more than likely that populations using this approach to the study area are manufacturing northern tradition ceramics similar to those from the Juntunen Site. This revision accounts for the consistent style overlap in the central parts of the study area.

One major criticism of the mapping techniques utilized in the final steps of the analysis is that the number of sites used as data points is small. The larger the sample size, the greater the quantitative credence lent to the outcome. As explained earlier, the plane fitted to the data points was, in all cases, exactly the "height" of the data point values, whereas the F-ratio was low due to the lack of numerous data points. Thus, only the general trend could be used. Were there a large enough site sample, the resultant maps could have assumed greater predictive qualities. This problem of inadequate sampling proved to be critical at all levels of the analysis.

An appraisal of the foregoing analysis is in some ways a difficult proposition. Although negative or inconclusive results were obtained for portions of the analysis, definition of the specific problems which hindered the investigation make the study as a whole warranted from the perspective of future research objectives. The latter is particularly true in reference to some of the a priori assumptions pertaining to data samples and working hypothesis. The techniques through which the data were handled definitely have utility in the solution of archaeological problems, if restraint is used in their interpretation with marginal data. Perhaps an adequate summary of this study is that it was far too ambitious given the present state of knowledge of archaeological manifestations in the study area.

It seems profitable here to outline problems which may give direction to future research.

The most consistent problem in this study dealt with sample size at the site-specific level, and the spatial distribution of adequately sampled sites. To overcome the prohibitive effects of these inadequacies, an organized program designed to supplement recognizable gaps in the data should be implemented. This goal is in no way contradictory to the extant Traverse Corridor program but will instead provide ample direction for ongoing research.

Dealing first with site distribution and site sample size, two major directions may be taken: (1) filling in gaps in the Traverse Corridor where few or no sites have been located and/or excavated and (2) exploring the Inland Lakes through archaeological survey. Within the Traverse Corridor, two expanses of coastline need more intensive investigation: the lakeshore and bluffs between Little Traverse Bay and Waugoshance Point and the lakeshore between the town of Eastport, Antrim County, and Traverse City, along the east coast of Grand Traverse Bay. Additional sites from these two areas would help overcome the undesirable data point cluster in the central portion of the Traverse Corridor, thus enabling trend-surface analysis to be employed as a predictive agent. Since the majority of the investigations performed to date have taken place within the Corridor, it would seem that the above would be of highest priority in the research design. Of secondary importance at this point is exploration of the Inland Lake chain -- Crooked Lake, Burt Lake, Mullett Lake, and the Black River drainage to Cheboygan. This secondary position does not, however, negate the value exploratory work in this area would have on interpretation of Traverse Corridor materials.

As part of the present program within the study area, further excavation of located but only partially test excavated sites should take place. In particular, the following sites should be subjected to organized sampling operations in order to increase sample sizes to the point where analysis will have a credible basis: the Schuler Site, the Henderson-Lamb Site, the Charlevoix City Park Site, the Neff's A.H. Map Site, the Whiskey Creek Site, and the Eastport Site. Unless adequate systematic testing and sampling operations are performed on these sites, they will have virtually no value for any kind of regional synthesis.

In reference to ceramics alone, the greatest amount of difficulty was attributable to an inability to order individual vessels in the tight temporal dimension. Since this is closely allied with the formal systems used for classification, they will be treated in an integrated fashion. Foremost of the necessary projects which should be initiated is a complete formal analysis of all ceramics from the study area. The fitting of marginal vessels into extant type systems is not adequate and can only lead to increased confusion. Whether or not this results in a complete revamping of extant typologies, or merely refining them, is of no concern; a more comprehensive system must be generated. In conjunction with reappraisal of the ceramic typologies, every effort should be made to accurately seriate resultant categories. Ceramic types that, at best, can only be assigned a temporal span within a four century limit are of little value. Radiocarbon samples should be selected for their ability to date specific ceramics. The latter in combination with traditional methods of seriation should provide us with more accurate temporal controls than now exist. If this is accomplished, a majority of the temporal confusion can be readily eliminated.

Although the analysis contained in this section was fraught with problems, for the most part confined to sample size, enough information has been derived that the formulation of a testable model from extant data is now feasible. To date, ceramic studies have demonstrated that (1) the ceramic systems present in the study area are polythetic; (2) despite their polytheticity, non-randomly behaving variables are present within the system; (3) there is a strong possibility that the study area was subject to population input from a minimum of three directions; (4) this input contains time depth through the early and late Late Woodland periods; and (5) there does not seem to be any organized spatial structure to community interaction based on ceramic styles. It is possible, of course, that future work will revise some of these statements. At present, however, the problem is how to account for these data in a testable model.

Population input or style diffusion into the study area from at least three directions has been demonstrated by the limited study of diffusion of style variables based on their frequency distributions. Movement into the Traverse Corridor may well have taken place by populations that were not practicing a full-year subsistence cycle in the study area or that were exploiting the area as a marginal resource area during periods of need. If no permanent populations were resident in the area, it would be highly unlikely that organized spatial patterns of ceramic materials could be defined. In fact, the almost complete randomness of the patterning suggested by the Q-mode similarity matrix could be expected in such a situation. This lack of patterning could easily affect the behavior of decorative attributes within the ceramic decorative system as well -- the point is that no easily definable monothetic systems are present due to the transient nature and perhaps variable group size and differing spatial origins of the peoples utilizing the area. Thus polytheticity of ceramic systems, if this is the case, could be expected. There are ceramic decorative attributes which behave in a patterned fashion, however, suggesting that perhaps the areas from which the populations are deriving have well defined and possibly monothetic systems.

Testing of the above model, although the techniques have not yet been fully explored, would involve a two-dimensional graphic transect across the study area and surrounding areas. If one were to investigate more than one time level, a three-dimensional model could be constructed. The basic proposition to be tested is one of increasing homogeneity (monotheticity) of ceramic styles as one moves away from the study area to the north, south, or east. In order that this be accomplished a measure of homogeneity must be employed (James Brown, personal communication). At some point along the scaling of this statistic, there should be a threshold at which a transition from polytheticity to monotheticity takes place. This threshold could well be in the form of a probability statement as to the degree of style clustering in a specific sample.

Given a proper measure, it should be feasible to plot a clinal curve for different time levels across a defined spatial continuum. The origin of the spatial axis of this graphic representation could represent the center of the study area and could be extended to whatever limits correspond to the most distant site in the sample. At some point along the spatial continuum the clinal curve representing degree of style patterning should both reach the probability threshold and pass through it.

This basic stochastic model could easily be rendered more complex by the addition of two further quantifiable dimensions - those of directionality (in quadrants about a polar axis, for example), in the form of polar coordinates, and in the inclusion of a number of time levels as opposed to a theoretically synchronous time span. Thus, vectoral clines through time and space representative of patterned behavior in the ceramic decorative system could be generated.

Such a stochastic model would aid in the testing of the inductive model presented earlier in this section. It could define directional characteristics supplementary to the diffusion model, as well as test the proposition that the study area was utilized by populations peripheral to but not resident in it. Additionally, the generalization pertaining to increasing homogeneity through space as one moves away from the study area could be tested. The model is also capable of revision if new data change the initial statements or if these generalizations are tested and rejected.

APPENDIX A

O'NEILL CURVILINEAR TYPE DESCRIPTION

APPENDIX A

O'NEILL CURVILINEAR TYPE DESCRIPTION

<u>O'Neill Curvilinear</u> (provisional type name)

Sample size: Two vessels from the O'Neill Site, Charlevoix County Michigan.

Temper: Grit.

Texture: Crumbly, little laminar spalling.

Color: Reddish - brown.

Surface finish: Cord or fabric wrapped paddle impressions which are subsequently smoothed.

Decoration: Three or four horizontal, parallel bands of twisted cord impressions which intermittently curve upward and meet the lip vertically.

Form: Rim is uncastellated and uncollared, and slightly everted. Lips are square on both vessels. Vessel shape is probably similar to Juntunen Ware.

Geographic range: Northwestern lower peninsula of Michigan.

Chronological range: Late Late Woodland through early Historic; ca. A.D. 1400 to A.D. 1650.

Other references in literature: none.

Relationships: This type may be considered an outgrowth of Juntunen Linear Punctate and Juntunen Stab and Drag (McPherron, 1967a: 111-116), although post-dating both of these types.

APPENDIX B

O'NEILL SITE CORRELATION MATRICES

TABLE 1

MACHINE CODE VARIABLE NUMBERS FOR ARTIFACTS IN AREA A, OCCUPATION ZONES I, II, AND III CORRELATION MATRICES

1 -- Block Cores

2 -- Amorphous Cores

3 -- Bifacial Cores

4 -- Planoconvex Cores

5 -- Bipolar Cores

6 -- Total Cores

7 -- Mackinac Ceramics

8 -- Traverse Ceramics

9 -- Juntunen Ceramics

10 -- Skegemog Ceramics

11 -- O'Neill and Trailed Ceramics

12 -- Mammal Bone

13 -- Fish Bone

14 -- Ground Shale

SIMPLE CORRELATIONS

VAR NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1.00000													
2	0.00000	1.00000												
3	0.00000	0.00000	1.00000											
4	.26993	0.00000	0.00000	1.00000										
5	-.22222	0.00000	0.00000	-.07910	1.00000									
6	-.03753	0.00000	0.00000	.82379	-.11913	1.00000								
7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000							
8	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000						
9	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000					
10	-.14957	0.00000	0.00000	-.16979	-.14907	-.12177	0.00000	0.00000	0.00000	1.00000				
11	.65173	0.00000	0.00000	.50792	-.05170	-.02390	0.00000	0.00000	0.00000	-.11500	1.00000			
12	.40936	0.00000	0.00000	-.30183	-.17660	-.21929	0.00000	0.00000	0.00000	-.20339	.21712	1.00000		
13	.70157	0.00000	0.00000	.18667	.44854	-.20629	0.00000	0.00000	0.00000	-.29318	.58926	.14814	1.00000	
14	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000

Table 2. Correlation Matrix; Area A, Occupation Zone I

VAR NO.	1	2	3	4	5	6	7	8	9	10	11
1	1.00000										
2	.65653	1.00000									
3	.11744	.67082	1.00000								
4	-.06565	.38889	.67082	1.00000							
5	-.17375	-.19365	-.12990	-.07531	1.00000						
6	.39755	.50451	.40623	.30277	.70356	1.00000					
7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000				
8	.06258	-.03661	.13755	-.03661	-.22689	-.14633	0.00000	1.00000			
9	-.06565	.38889	.67082	.38889	-.19365	.10092	0.00000	-.03661	1.00000		
10	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000	
11	.10543	.66460	.99816	.66460	-.07072	.44913	0.00000	.12577	.66460	0.00000	1.00000
12	-.13514	-.12453	.00539	.66200	-.05632	-.01459	0.00000	.20110	-.05383	0.00000	-.00436
13	-.29100	-.21875	-.13127	.05032	-.14819	-.30851	0.00000	-.13336	.60383	0.00000	-.14107
14	.11744	-.14907	-.10000	-.14907	-.12990	-.13540	0.00000	.78538	-.14907	0.00000	-.10651

VAR NO.	12	13	14
12	1.00000		
13	.22064	1.00000	
14	.34923	-.04876	1.00000

Table 3. Correlation Matrix; Area A, Occupation Zone II

SIMPLE CORRELATIONS

VAR NO.	1	2	3	4	5	6	7	8	9	10	11
1	1.00000										
2	-.31305	1.00000									
3	-.17500	-.17899	1.00000								
4	-.26087	.46667	-.14907	1.00000							
5	-.24478	.66725	-.13998	.17376	1.00000						
6	.47101	.53341	-.12566	.32781	.57611	1.00000					
7	.46579	.71245	-.14556	.25038	.09501	.52186	1.00000				
8	.00540	-.27615	.03189	-.13845	-.17593	-.03223	.04000	1.00000			
9	.35835	.10734	-.20195	-.28009	.41434	.33259	-.29568	-.25518	1.00000		
10	-.17500	-.17383	-.10000	.67082	-.13999	-.12566	-.14555	-.12542	-.18789	1.00000	
11	-.17500	-.17883	1.00000	-.14907	-.13398	-.12516	-.14556	.96139	-.20185	-.10000	1.00000
12	.23445	.31370	.06229	-.16321	.79112	.47259	.06018	.10226	.52324	-.22334	.06029
13	.40558	-.18396	-.25104	-.15081	-.03479	.18221	-.00802	-.25839	.46523	-.25930	-.25104
14	.77008	.16036	-.23905	.13363	-.02786	.06333	.60490	-.12154	.09332	-.23905	-.23905
	1	2	3	4	5	6	7	8	9	10	11

	12	13	14
12	1.00000		
13	-.36581	1.00000	
14	-.17348	.24344	1.00000
	12	13	14

Table 4. Correlation Matrix; Area A, Occupation Zone III

TABLE 5

MACHINE CODE VARIABLE NUMBERS FOR ARTIFACTS IN AREA B CORRELATION MATRIX

1 -- CI, T1 Projectile Points
2 -- CI, T2 Projectile Points
3 -- CI, T3 Projectile Points
4 -- CI, T4 Projectile Points
5 -- CII, T1 Projectile Points
6 -- Fragmented Projectile Points
7 -- Total Projectile Points
8 -- Gravers
9 -- Drills
10 -- Lanceolates
11 -- Small Triangular Unhafted
12 -- Small Triangular Hafted
13 -- Large Triangular Knives
14 -- Ovate Bifaces
15 -- Preforms
16 -- Snub Bifaces
17 -- Lunate
18 -- Side Scrapers
19 -- Awl
20 -- Total Bifaces
21 -- Retouched Flakes
22 -- Utilized Flakes
23 -- Grouped Flakes
24 -- End Scrapers
25 -- Block Cores
26 -- Amorphous Cores
27 -- Bifacial Cores
28 -- Plano Convex Cores
29 -- Bipolar Cores
30 -- Total Cores
31 -- Mackinac Ceramics
32 -- Traverse Ceramics
33 -- Juntunen Ceramics
34 -- Skegemog Ceramics

SIMPLE CORRELATIONS

VAR NO.	1	2	3	4	5	6	7	8	9	10	11
1	1.00000										
2	0.00000	1.00000									
3	0.00000	[illegible]	1.00000								
4	0.00000	.42479	.60909	1.00000							
5	0.00000	-.08949	1.00000	.60909	1.00000						
6	0.00000	.34103	.52119	.84976	.52119	1.00000					
7	0.00000	[illegible]	.63702	.94898	.63702	.90636	1.00000				
8	0.00000	[illegible]	-.05263	.60909	-.05263	.52119	.58085	1.00000			
9	0.00000	[illegible]	-.07215	.67123	-.07215	.71445	.65597	.88332	1.00000		
10	0.00000	[illegible]	-.07647	.13412	-.07647	.20832	.08439	-.07647	.24460	1.00000	
11	0.00000	[illegible]	-.09637	[illegible]	-.09637	[illegible]	-.14181	-.09637	-.13211	-.14003	1.00000
12	0.00000	[illegible]	-.07647	[illegible]	-.07647	.06384	-.08439	-.07647	-.10483	-.11111	.79349
13	0.00000	[illegible]	-.09637	-.13682	-.09637	-.20244	-.14181	-.09637	-.13211	-.14003	.21569
14	0.00000	[illegible]	-.05263	.60909	-.05263	.52119	.58085	1.00000	.88332	-.07647	-.09637
15	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
16	0.00000	[illegible]	-.07647	.35441	-.07647	.20832	.33758	.58825	.59403	-.11111	.32673
17	0.00000	[illegible]	-.05263	-.10749	-.05263	-.11076	0.00000	-.05263	-.07215	-.07647	[illegible]
18	0.00000	[illegible]	-.05263	-.10749	-.05263	-.11056	0.00000	-.05263	-.07215	-.07647	-.09637
19	0.00000	[illegible]	-.05263	-.10749	-.05263	.20532	0.00000	-.05263	-.07215	-.07647	[illegible]
20	0.00000	[illegible]	.40058	.81807	.40058	.85547	.88416	.72104	.76876	.11641	.14670
21	0.00000	.62711	.33245	.70828	.33245	.79117	.76039	.75230	.67323	-.12155	[illegible]
22	0.00000	[illegible]	.12806	.41134	.12806	.58703	.50684	.56365	.43840	-.13474	[illegible]
23	0.00000	.74449	.32287	.47759	.32287	.64306	.58440	.41307	.37504	-.13051	[illegible]
24	0.00000	[illegible]	-.05263	-.10749	-.05263	-.11056	-.11517	-.05263	-.07215	-.07647	-.09637
25	0.00000	[illegible]	-.18732	.14477	-.18732	-.05558	0.00000	-.03122	.02453	-.04536	[illegible]
26	0.00000	[illegible]	-.14031	-.15009	-.14031	.05616	0.00000	-.14031	-.00916	.08737	-.01223
27	0.00000	[illegible]	-.09637	-.13682	-.09637	-.20244	-.14181	-.09637	-.13211	-.14003	.21569
28	0.00000	.13348	-.14031	.13103	-.14031	.05616	.04448	.26057	.17402	-.05925	-.01223
29	0.00000	.37451	-.02738	.01320	-.02738	.00822	.12037	.19167	.11260	-.19892	-.05014
30	0.00000	[illegible]	-.12424	.13331	-.12424	.01864	.09712	.13459	.11354	-.14091	[illegible]
31	0.00000	[illegible]	-.08216	-.10565	-.08216	.19724	-.01511	-.08216	-.07092	[illegible]	[illegible]
32	0.00000	.03151	.06563	.05791	.06569	.09418	.10203	.06559	.06782	-.08131	.12029
33	0.00000	.43779	-.01847	-.03772	-.01847	-.05677	.07381	.04143	.00205	-.10461	-.09475
34	0.00000	.26037	-.07792	-.15912	-.07792	-.16367	-.07035	-.07792	-.10681	-.11321	-.14267

VAR NO.	12	13
12	1.00000	
13	.32673	1.00000

Table 6. Correlation Matrix; Area B

14	-.07647	-.09537	1.00000								
15	0.00000	0.00000	0.00000	1.00000							
16	.44444	.32673	.68825	0.00000	1.00000						
17	-.07647	.54612	-.05263	0.00000	-.07647	1.00000					
18	-.07647	-.09637	-.05263	0.00000	-.07647	-.05263	1.00000				
19	.58825	-.09637	-.05263	0.00000	-.07647	-.05263	-.05263	1.00000			
20	.28291	.09780	.72104	0.00000	.54023	.03012	0.00000	.15023	1.00000		
21	.25245	-.19318	.75290	0.00000	.48619	-.01931	-.01931	.43115	.85709	1.00000	
22	.57926	-.15504	.56965	0.00000	.57134	-.13689	.03974	.65737	.73941	.87844	1.00000
23	.57493	-.07038	.41997	0.00000	.36330	-.06554	.03156	.71128	.72057	.89013	.94976
24	-.07647	-.09637	-.05263	0.00000	-.07647	-.05263	-.05263	-.05263	-.16023	.04505	.03974
25	.36904	.03811	-.04122	0.00000	.06904	.12488	.28098	-.03122	.03564	.02672	-.02881
26	.34737	.23245	-.14031	0.00000	-.20386	.65146	.26057	.26057	.09153	.09558	.10595
27	.37673	.21559	-.09637	0.00000	.32673	-.09637	.54612	-.09637	0.00000	-.15318	.07077
28	.04737	-.13458	.26057	0.00000	.08737	.06013	-.14031	.26057	.13730	.29163	.20686
29	.03078	-.11649	.19167	0.00000	.19842	-.13691	.62977	-.02738	.15005	.17074	.10598
30	.17034	-.10632	.13459	0.00000	.15735	.04283	.44520	.08283	.16548	.17595	.18937
31	.83016	-.11114	-.08216	0.00000	.04643	-.08216	.00313	.96770	.13455	.41076	.69397
32	.23605	.13119	.06569	0.00000	.27220	-.12895	.21157	.01723	.15296	.17878	.17086
33	-.05084	-.17233	.04143	0.00000	.03119	-.03343	.97382	-.07837	.08390	.04693	.09603
34	-.11721	-.14267	-.07792	0.00000	-.11321	-.07792	.84291	-.07792	-.09704	-.00260	.04695
	12	13	14	15	16	17	18	19	20	21	22

23	1.00000										
24	.08011	1.00000									
25	.01372	-.08122	1.00000								
26	.10507	.26057	.27346	1.00000							
27	-.07112	-.09637	.32394	.23245	1.00000						
28	.21356	-.14031	.51125	.23664	.23245	1.00000					
29	.14776	-.02738	.45477	.30241	.81932	.53182	1.00000				
30	.17478	-.02071	.72468	.47710	.68881	.71368	.87797	1.00000			
31	.72151	.06913	.09341	.28510	.04458	.23294	.03900	.16971	1.00000		
32	.19452	-.12835	.27710	-.06579	.23349	.07320	.28227	.10003	.08567	1.00000	
33	.36309	-.07837	.30437	.28913	.65471	-.02452	.75072	.55830	-.01325	.23256	1.00000
34	.05979	.43875	.23739	.39576	.46261	-.15376	.57355	.41371	.00737	.11362	.82109
	23	24	25	26	27	28	29	30	31	32	33

34	1.00000
	34

Table 6. (cont.)

APPENDIX C

CERAMIC ATTRIBUTE LIST

CERAMIC ATTRIBUTE LIST

Vessel Shape

<u>Lip Profile</u>

1) Flat

2) Wedge

3) Outside Bevel

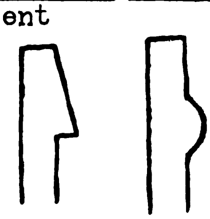
4) Splayed

5) Rolled

6) Round

<u>Rim Thickening Elements</u>

7) Present



8) Absent

<u>Lip Form</u>

9) Flat

10) Castelated

11) Peaked

12) Modified (10 and 11)
<u>Rim Shape</u>
13) Straight
14) Moderate Eversion
15) Extreme Eversion

Lip Area
16) Decoration Present
17) Decoration Absent
<u>Directional Elements</u>
18) Longitudinal
19) Transverse
20) Oblique
<u>Technique of Application</u>
21) Punctate
22) Stab and Drag
23) Impressed
<u>Type of Tool</u>
24) Cordwrapped Stick (greater than 0.5 cm diameter)
25) Cordwrapped Stick (less than 0.5 cm diameter)
26) Cord impressed
27) Cordwrapped Paddle
28) Plain Tool
29) Finger Pinching
30) Other

Upper Rim - Exterior
31) Decoration Present
32) Decoration Absent
<u>Number of Bands, Same Technique and Tool</u>
33) one
34) two
35) three
36) more than three

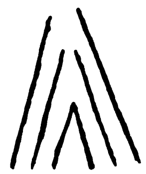
Upper Rim - Exterior

<u>Number of Bands, Different Technique and Tool</u>
37) one
38) two
39) more than two

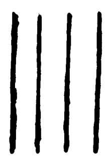
<u>Directional Elements</u>
40) vertical
41) horizontal
42) oblique (right or left)
43) oblique, right
44) oblique, left
45) zigzag

<u>Continuity of Directional Elements</u>
46) continuous
47) linear, closely spaced
48) linear, widely spaced

<u>Interrupting Elements</u>
49) Chevron



50) Vertical



51) Curvilinear

<u>Technique of Application</u>
Punctates:
52) Only decorative element
53) Part of overall motif
54) Superimposed
55) Used as border

Other Techniques
56) Stab and Drag
57) Impressed
58) Trailed

<u>Tool end characteristics</u>
59) Rough end
60) Smooth end

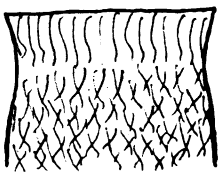
<u>Type of Tool</u>
61) Linear Cord
62) Linear Cordwrapped Cord

63) Cordwrapped Stick
64) Rectilinear Tool
65) Curvilinear Tool
66) Triangular or Wedge shaped Tool
67) Cord knot or loop
68) Paddle edge or end
69) Fingernail
70) Finger Pinched
71) Other

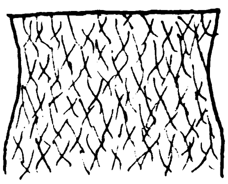
Interior Decoration
72) Interior Decoration Present
73) Interior Decoration Absent

Lower Rim - Exterior
74) Secondary Decoration Present
75) Secondary Decoration Absent

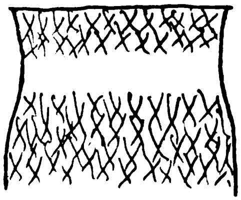
Body Surface Preparation
76) Differential Preparation (Zoning)



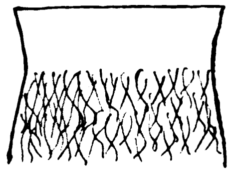
77) Roughened, unpatterned (no special preparation)



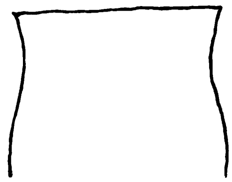
78) Roughened, Smoothed, Roughened



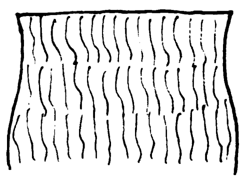
79) Smoothed, Roughened



80) Smooth or Smoothed



81) Roughened, patterned



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