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Ohio Hopewell settlement patterns: An application of the Vacant Center Model to Middle Woodland Period intracommunity settlement variability in the upper Licking River Valley

Pacheco, Paul Joe, Ph.D.
The Ohio State University, 1993
OHIO HOPEWELL SETTLEMENT PATTERNS: AN APPLICATION OF THE VACANT CENTER MODEL TO MIDDLE WOODLAND PERIOD INTRACOMMUNITY SETTLEMENT VARIABILITY IN THE UPPER LICKING RIVER VALLEY

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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*****

The Ohio State University
1993

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To my family and friends
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CHAPTER I
INTRODUCTION

The Prufer Model of Ohio Hopewell Settlement Patterns

Olaf Prufer's research in the central Scioto Valley during the 1960's was the first to integrate study of the Ohio Hopewell earthworks and burial mounds with the domestic settlements of the people who built the monuments. Prior to his research, little empirical evidence existed for where Hopewellian populations lived:

One of the most surprising aspects of Ohio Hopewell in the past has been the curious fact that notwithstanding intensive research and fieldwork for well over a century, few if any Hopewellian village sites have been reported in the literature.... There is plenty of evidence in the published reports that the older investigators not only wondered at the lack of settlement sites, but they also attempted to find them, albeit without success [Prufer 1965:125].

Since the completion of Prufer's research, detailed studies of Ohio Hopewell settlement patterns have failed to materialize:

This distinct separation of the corporate-ceremonial and domestic spheres of Hopewellian life is clearly evident in the archaeological record, and is accordingly reflected in the remarkable imbalance in our knowledge, even today, regarding corporate centers vs. farming settlements. Nowhere is this imbalance more striking than in the south-central Ohio "heartland" of Hopewell, where only a single possible Middle Woodland habitation structure (Fischer 1971) has ever been excavated, and where the location, size, and degree of organizational complexity of Hopewell settlements remains largely undocumented [Smith 1987a:17].

Fischer's work on the excavated structure at Twin Mounds - West Habitation Area remains unpublished, and only recently has the first complete-systematic excavation of an Ohio Hopewell domestic settlement (the Murphy site) been published (Dancey 1991).

Prufer (1965:126-127) argued in his conclusions to the McGraw site report that this failure stemmed from several false assumptions about Ohio Hopewell populations including: the belief that settlements would be located immediately adjacent to the great earthworks; the belief that villages would be large due to the large populations implied by the immensity of the earthworks; and the belief that these populations were largely non-agrarian. As a result of surface surveys and excavations along the middle Scioto River and Paint Creek, Prufer (1965:126) concluded that past researchers had searched in the wrong places for the wrong kind of evidence.

Prufer's excavations at the McGraw site produced evidence for a small settlement located on a low rise of the Scioto River bottoms, approximately 1.6 kilometers from the nearest earthwork. No evidence of pit features or postmolds was discovered, precluding a picture of the total site plan. However, abundant artifactual evidence linked McGraw to the local Hopewell mounds and earthworks. The majority of the excavation was considered to be in a midden deposit because of the rich organic content of the soil, representing a refuse dump. A limited quantity of carbonized maize was recovered from the midden, which Prufer (1965:125) interpreted as evidence for farming. The various lines of recovered evidence from the McGraw excavation suggested to Prufer an answer to the mystery of Ohio Hopewell domestic
settlements. Such settlements existed away from the great earthworks, were small in size, low in archaeological visibility, and located on prime agricultural land (Prufer 1965:127).

One of Prufer's (1965:12) two primary working hypotheses was the agricultural basis of Ohio Hopewell. He argued that a stable agricultural economy was necessary to support the building of the large earthworks and burial mounds. The theory that Ohio Hopewell mound-builders were sedentary agriculturalists was not new, having had its roots in the beginning of American archaeology:

That the mound-builders, although perhaps in a less degree, were also stationary and agricultural, clearly appears from a variety of facts and circumstances...[Squier and Davis 1848:302].

The theory that Ohio Hopewell populations were hunter-gatherers stemmed from cautionary statements issued by Caldwell (1958:30) based on his concept of primary forest efficiency. Recent research lends support to both Caldwell's and Prufer's positions. Ohio Hopewell populations were both intensive collectors and farmers. But, instead of corn, a diverse variety of native domesticates were grown in small swidden gardens (Ford 1979a; Wymer 1987a; Smith 1987a; 1989; 1992). Bone collagen studies, in particular, have shown that corn was not important to Hopewellian subsistence (Van der Merwe et al. 1978; Bender et al. 1981). Likewise, samples of most extant examples of proposed Hopewellian corn have been proven to be modern based on application of the AMS radiocarbon dating technique (Smith 1992).

Prufer's research program led him to speculations concerning the general Ohio Hopewell settlement pattern, with the McGraw site as the
example of a domestic residence. In his first major publication on the problem he argued:

It seems to me that based upon present knowledge, this situation allows for only one interpretation. I suggest that it reflects a settlement pattern similar to the classic Mesoamerican situation of the vacant ceremonial centers - shifting village type. In other words, what we are facing here seem to be elaborate ceremonial centers based upon a mortuary cult and surrounded by very small dependent villages of little permanence [Prufer 1964a:71].

Prufer (1965:127) thereafter conducted his research with the additional working hypothesis that the general Ohio Hopewell settlement pattern was of the Vacant Ceremonial Center-Dispersed Agricultural Hamlet pattern, similar to what was then a popular theory for Mayan and Olmec settlement patterns. Following the McGraw excavation, Prufer's statement concerning the Ohio Hopewell settlement pattern became more refined and direct:

The general settlement pattern during the Hopewellian period in Ohio seems to have been characterized by a system of semi-permanent shifting agricultural farmsteads or hamlets, clustered around a series of ceremonial centers and burial grounds with which a number of such settlements identified themselves [Prufer 1965:137].

These statements constitute both an explanation for Prufer's problem and a general model for Ohio Hopewell settlement patterns. Following Dancey and Pacheco (1992), I will build on Prufer's idea and formalize the Vacant Center Model as an explanatory framework for Ohio Hopewell community organization. I have referred to the model as the "Hamlet Hypothesis" (Pacheco 1988) and Dancey (1991) has called it the "Prufer Model"; these terms are considered interchangeable.
Plan of Dissertation

Chapter II explores aspects of the Vacant Center Model, including a formalized version of the model. Research problems are defined and discussed at the conclusion of this chapter. Chapter III creates an explanatory framework for understanding Ohio Hopewell community organization by examining implications of the Vacant Center Model. The chapter begins with definitions of concepts and terms such as archaeological community and dispersed settlement pattern. The relationship between dispersion and community organization is then explored through discussion of Caldwell's concept of nuclear and non-nuclear cultures. The creation of vacant ceremonial centers by dispersed populations is discussed in the context of the conditions under which such centers may occur and through description of archaeological and ethnographical examples of societies with similar settlement systems. An explanation for the development of Ohio Hopewell dispersed communities is presented through examination of the Hopewell niche, followed by a lengthy discussion of the case for sedentism. Following these topics, the implications of the Ohio Hopewell settlement pattern for the archaeological record are presented. These implications are followed by a series of deductions or working hypotheses, formulated with the goal of establishing a research design to gather data sufficient to test and apply the model.

Chapter IV outlines the research design and the strategy developed for this study based on the set of working hypotheses presented in Chapter III. The survey area is defined and the local regional cultural and environmental setting of the study are
presented. Following these issues of context is an outline of the basic methodology of the survey and analytical methods. Chapter V presents the data collected during the study, beginning with presentation of assemblage composition. The data are analysed for settlement size, surface structure, assemblage variability, and spatial distribution, through a consideration of artifact density and diversity. The chapter ends with an evaluation of the confounding effect of contemporaneity and duration on the study. Conclusions are presented in Chapter VI.
CHAPTER II
EXPLORING THE VACANT CENTER MODEL

Terminology for Ohio Hopewell Domestic Units: Hamlets and Households

Prufer (1964a; 1964b; 1965; 1967) used a variety of terms to refer to the McGraw archaeological cluster. Village, farmstead, household, and hamlet were terms he used interchangeably. Yet, each of these terms have different connotations. In a number of other papers (Pacheco 1988; 1990; 1991; 1992a; Dancey 1991; Dancey and Pacheco 1992) we have chosen hamlet over the other terms; and hamlet is used here in the same context.

Hamlet is a flexible term with an appropriate scale for small dispersed sedentary habitations. Webster's New World Dictionary defines hamlet as "a very small village." The term does not specify or imply population density, economic orientation, or social organization. Hamlet has been used regularly as a contrast to nucleated settlements such as a village or town (Bullard 1962; Fuller 1981; 1986; Wilhusen and Varien 1990). Hamlet is also often defined as a lower order settlement type in hierarchical settlement systems (Willey 1956; Harn 1978; Muller 1978; Smith 1978).

The terms village and farmstead have connotation problems that make them poor choices. Village refers to a settlement with population aggregates often in the hundreds or even thousands.
Indistinct boundaries prevent clarification of phrases like small village or large hamlet, however, a village is traditionally a larger settlement type than a hamlet. The term farmstead implies the farm buildings and land of a single farming family. Likewise, it implies either a frontier or rural connotation; none of which applies well to Hopewellian garden-level farming communities.

Smith (1992) prefers the term Hopewellian households. Household implies a single family unit living together in a house associated with secondary buildings or areas such as kitchens and open yards. Bullard (1962:139) and Smith (1992) suggest that household units are basic independent building blocks of sedentary settlement systems. I accept this idea as a basic assumption. However, Smith documents Hopewellian domestic units in other regions, especially Illinois, to often consist of more than one household. Yet, these household groups lack hierarchical integration and none of the known Illinois examples would qualify as nucleated villages. Therefore, hamlet will be the term used here to specify Ohio Hopewell domestic units. In the context of Ohio Hopewell, hamlets are domestic settlements made-up of one to at most a few household units. Interacting clusters of hamlets in local regions form dispersed sedentary communities.

The most potential confusion with the choice of the term hamlet comes from areas where it has been used in the context of hierarchical settlement systems. The term has been used to indicate a settlement with a certain small population size, number of structures, or area of settlement. For example, Sanders et al. (1979:56) define hamlets in the Mesoamerican Highlands based upon the presence or absence of
ceremonial-civic-elite architecture, size, and a population of less than 100 individuals. Mississippian archaeologists generally define hamlets as settlements consisting of 10 to 20 structures, ranging in size from 1.5 to 6 ha (Smith 1978:500; Harn 1978:250). Muller (1978:280) suggests smaller concentrations from the lower Ohio Valley, with hamlets consisting of 8 to 15 structures.

Aspects of the Vacant Center Model

Following Prufer, Ohio Hopewell settlement patterns are composed of two basic types of settlements: ceremonial centers and associated hamlets. Prufer discussed only one other type of Hopewell settlement in his publications. These were the low density scatters of artifacts that had been observed within and around several of the large ceremonial centers. Prufer (1964a:70; 1965:126) viewed such scatters as extremely skimpy and in no sense commensurate with the dimensions of the earthworks. These sites can be lumped under a general category of specialized camps, which represent periodic encampments at ceremonial centers by some segment of the population for the purpose of constructing mounds, conducting ceremonies, producing craft items, and socializing.

Prufer specifically called such sites temporary encampments (1964a:71), squatters tenancies (1964b:58), specialized loci (1967:289), and specialized workshops (1982:466). "Specialized loci" was used to describe the Russell Brown Upper Terrace site, a 0.4 ha area near the Harness Earthworks at which bladelet manufacturing was being performed. "Specialized workshops" described the several structures excavated at Seip by Baby and Langois (1979).
Therefore, Prufer’s "vacant" centers are not to be interpreted solely as empty monuments to the dead. Vacant centers are not expected to be devoid of evidence for all but mortuary related activities. To the contrary, Ohio Hopewell earthwork/mound concentrations functioned as multipurpose centers, where a wide variety of social activities and interactions took place, including many otherwise typical domestic activities (Greber 1979a). The juxtaposition of domestic and corporate spheres of Hopewelian societies (i.e. Smith 1992) is a useful dichotomy, but can sometimes obscure understanding of Hopewell centers. People attending corporate events at centers must continue normal processes of life, a byproduct of which is domestic refuse. What makes the centers vacant is that they are not primary loci for habitation, especially substantial aggregated or nucleated villages, towns, or cities. Rather they are vacant by virtue of supporting dispersed communities, whose members periodically gather at the centers to reaffirm their social identity, but who do not live together for the balance of the calendar year. The term empty or vacant refers only to the time when the center is not in use, not the lack of permanent structures or features within the center:

... a grouping of public buildings housing common facilities, such as shrines, meeting places, markets, and law courts, which is used seasonally or at prescribed intervals by the population of a considerable surrounding area. Between the occasions when a ceremonial center is used it is either closed and empty or houses only a small permanent or caretaker personnel [Rowe 1967:296].
Baby and Langois (1979:18) confused this issue following their documentation and interpretation of the structures they excavated within the Seip Earthworks, proclaiming "one thing is certain: Seip at least was not a 'vacant ceremonial center' (sensu Prufer 1964a:71)".

Yet, prior to this statement they argue that the structures should be considered neither family dwellings nor charnel houses for preparation of the dead. Rather, these structures appear to have been permanent workshop facilities based on the lack of domestic debris, cooking features, quantities of exotic materials, and high frequencies of heavily utilized Hopewellian bladelets. As such, they would represent maintained facilities periodically utilized by some segment of the population for craft production. Brown (1982) has reported excavation of a similar structure at Mound City, identified stratigraphically beneath the Mound 10 charnel house. As shown by Brown's explicit acceptance of the vacant center interpretation for Mound City, the mere presence of permanent facilities within the Seip Great Circle is not an invalidation of the model. It is the lack of aggregated permanent residences at Seip and Mound City that qualifies them as the Hopewellian vacant centers of the model.

Other types of Ohio Hopewell settlements or activity locales can be inferred from Prufer's publications. One such obvious activity loci is the area used to plant crops. Presumably fertile terrace and floodplain soils located between hamlets were favored for gardens. Generally small hamlet populations limit the size of garden plots. Activities relating to tree clearance, and crop tending/harvesting would occur in gardens.
Likewise, a wide variety of other short-term activity locales can be envisioned, such as: upland rockshelter usage for nut collecting or hunting; stream side shell fish collecting; chert quarrying at chert outcrops; and many other types of resource extraction areas. Lack of explicit definition of these types of settlements by Prufer is probably due to the rather obvious status they maintain in relation to sedentary hamlets, and not something that was overlooked. Rejection of the model should not rest upon the identification of a variety of activity locales, but rather upon whether or not communities of dispersed hamlets surround vacant ceremonial centers (Pacheco 1988:94).

Prufer (1965:127) adhered to the double tradition concept to explain cultural aspects of the Vacant Center Model. The essence of this concept is now a well accepted component of Hopewellian studies and was introduced by Joseph Caldwell (1958) in his famous treatise Trend and Tradition in the Prehistory of the Eastern United States. In this work, he outlined a series of supra-regional traditions in the Eastern Woodlands. Caldwell (1964:138) later coined the term Hopewell Interaction Sphere to encompass the differential acceptance of a Hopewellian civic-ceremonial-mortuary system in each of these distinct regional traditions. Individuals and/or groups of individuals from widespread regions are assumed to have interacted between communities to the extent that certain types of exotic raw materials and craft artifacts can be found in societies having distinct secular-domestic traditions.
Ohio Hopewell has quantitatively and qualitatively more expression of the ideological system than all other regional traditions combined, making it not only a source for the rich paraphenalia that characterizes Hopewell, but a drain towards which such artifacts and the raw materials for making them flowed (Seeman 1979). Likewise, Ohio Hopewell ceremonial centers are often characterized by complex geometric valley or hilltop earthworks as well as burial mounds. Earthworks are rare outside of the Ohio region.

The term Hopewell, therefore, is not to be understood as a far-reaching, uniform culture. Rather, it is an archaeological horizon representing an ideological system which is expressed in distinct regional cultural traditions in primarily the corporate, as opposed to the domestic, sphere (Smith 1992). Therefore, the term Hopewellian refers to any aspect of a regional cultural tradition that characterizes the archaeological horizon. I use the term Ohio Hopewell to broadly encompass all local Middle Woodland period communities within the major south-flowing Ohio drainage systems that participated in the Hopewellian ideological system, as well as a few other isolated communities on the periphery of this core area (Figure 1). To that extent I am interested in explaining broad similarities in settlement patterning and community organization that cross-cut Ohio Hopewell household and community boundaries. Variability is expected at each scale of settlement patterning because individual households, communities, and groups of interacting communities possess unique histories of population fluctuations and movements. Least common denominators can be a productive source of archaeological knowledge.
Figure 1. Estimated distribution of Ohio Hopewell communities (adapted from Dancey and Pacheco 1992)
Evidence is now accumulating that settlement systems from the Great and Little Miami, the Licking-upper Muskingum, and the Scioto River drainages potentially possess enough time depth and secular-domestic differences to be considered separate traditions or co-traditions (Hawkins-Bennett 1986; Pacheco 1988; Greber and Ruhl 1989; Dancey 1991; Greber 1991). Prufer (1964a) included all of the Ohio core area within the Scioto Tradition-Hopewell Phase, based upon limited data from outside the Scioto Valley. Regardless, Prufer's term Scioto Tradition-Hopewell Phase is equivalent to the term Ohio Hopewell used here. The Middle Woodland (ca. late 2nd century B.C. to late 5th century A.D.) is both the cultural stage and temporal period during which Ohio Hopewell existed and flourished (Stoltman 1978).

Prufer (1964a) argued at great length that, for the most part, the Ohio Hopewell Phase developed from the Ohio Adena Phase of the Scioto Tradition. He contrasted the Scioto Tradition with the Havana Tradition in the Illinois River Valley - where the development of typical Hopewellian traits was chronologically earlier. Prufer suggested that Havana Hopewell people not only interacted with contemporaneous Adena people in Ohio, but also contributed immigrants who brought key aspects of the Hopewell cult with them. Two key facts suggested to Prufer (1964a:49-60; 1965:133) a complex development or "Hopewellianization" process: (1) the chronological overlap of Late Adena in the hinterlands of Ohio with Hopewell in the main river valleys; and (2) the distinct head types of uncremated Adena and Hopewell people excavated from mounds. Likewise, Prufer argued that while most Ohio Hopewell cultural traits had Adena
antecedents, some traits, such as classic Hopewell ceramics, clearly could not be derived from Adena. He suggested:

One way of solving this dilemma is to assume that the classic Hopewell pottery complex, together with other Hopewell traits not of Adena derivation, was introduced into Ohio from Illinois not merely by diffusion, but in conjunction with a population movement of long-headed Hopewellians [Prufer 1964a:58].

The transition between Adena and Hopewell was, therefore, not a simple transformation or elaboration of Adena derived traits which progressed evenly or linearly across the middle Ohio Valley. Apparently, some local regional Adena populations never completely accepted participation in the Hopewell Interaction Sphere. Ritchie and Dragoo (1960) and Dragoo (1963; 1964), argued that many of these Adena people were displaced eastward as Hopewell spread through the Ohio Valley. Adena groups in the Hocking Valley may never have actively participated in Hopewellian networks (Murphy 1989; Greber 1991). Nearby groups in the central Muskingum Valley, on the other hand, appear to have joined into the "interaction sphere" at a later time than groups in the Licking Valley (Carskadden and Morton 1992).

Prufer (1965:130) suggested that most Ohio Hopewell domestic settlements were inhabited by people of Adena stock. These people were isolated from the Illinois derived people (the source of the double tradition) who became the ceremonial and craft specialists or bearers of the "cult". These cultists were a "privileged minority" or elite who dominated the local Adena derived farmers (Prufer 1964b:61). He believed elite were buried in the great mounds to the exclusion of their Adena contemporaries (Prufer 1965:133).
By extension, two additional settlement types can be extrapolated from Prufer's adherence to the double tradition concept: elite residences and commoner burial grounds. Elite residences might be identifiable by spatial proximity to ceremonial centers or differences in quantities or qualities of Hopewelian artifacts and raw materials. Commoner burial grounds might be identifiable as non-mound burials possibly in domestic contexts lacking Hopewelian paraphernalia. Prufer (1964a:74) speculated that hinterland Late Adena mounds might contain Ohio Hopewell commoners, which follows logically from the double tradition concept. If true, then two types of mound burial existed, those at centers for elite and those in hinterlands for commoners. Little archaeological evidence exists to support these conjectural settlement types, although Middle Woodland/Hopewell non-mound burials have been identified in at least five different locations (Fischer 1971; Lee and Vickery 1972; Brose 1976; Brown 1982; Blosser 1989). One possible elite residence has been excavated near Ft. Ancient (Connolly 1991).

Modern biological evidence is not in favor of a migration of Illinoian Hopewell to Ohio (Buikstra 1979). Prufer relied for his conclusions about distinctive cranial morphology on Snow's analyses of extant Adena and Hopewell skeletal populations (Webb and Snow 1945; Snow 1957). Osteologists now believe that Snow's comparison of culturally deformed Adena crania with undeformed Hopewell crania seriously biased his population comparisons (Buikstra 1979:223). More recent analyses, such as Reichs' (1984) multivariate analysis of biological distance between contemporaneous Middle Woodland samples
from Illinois and Ohio, demonstrate that the two areas show as much biological divergence as samples from Illinois separated by 800 years. Reichs argues in favor of local biologically distinct populations, who participated in the Hopewell Interaction Sphere. Using cranial metric and discrete trait variation, Sciulli and Maheney (1986) have demonstrated the local biological continuity between the skeletal population from the Hopewell Earthworks and a series of eight Terminal Late Archaic skeletal populations from Ohio. Their study also included three Early Woodland/Adena skeletal populations which showed a general similarity to the Late Archaic and Hopewell samples.

A dichotomy between elites and commoners may have existed in local Ohio Hopewell populations, but the differences do not stem from ascribed institutionalized differences based on the double tradition concept and its migration of Illinoian ceremonial cultists. An elite/commoner dichotomy may have had little or no expression in the domestic sphere or in the organization of communities if individual social ranks were based on achieved status distinctions (Braun 1979; 1986). Individuals could have risen to positions of group leadership based on their achievements rather than birth rights. Smith (1992) describes known Hopwellian domestic units as "redundantly egalitarian", seeing no evidence for social ranking in any domestic settlements. In Ohio Hopewell, particular communities and/or segments of communities may have been afforded differential status. These social distinctions may be expressed by spatially discrete burial areas within mounds or by differential access to certain artifacts or raw materials (Greber 1976; 1979a; 1979b).
The relatively abundant exotic raw material and diagnostic Hopewellian artifacts recovered from the McGraw midden also calls to issue the proposed relationship between Ohio Hopewell elite and commoners. Prufer implies that the elite controlled ceremonial crafts and exchange networks, but then argues that the McGraw population must have included elite craftspersons who were producing grave goods for the Hopewellian cult (Prufer 1964b:60). Either domination by the elite was willingly accepted by local commoners, or some elite craftspersons lived with the common folk. Thus, the question becomes: is there archaeological evidence of an Ohio Hopewell elite and their residences, regardless of their origin or basis for status distinction?

Another aspect of the abundant Hopewellian material in the McGraw midden is related to the identification problem. Prufer (1965:60) argued that McGraw is "clearly identified as belonging to the Hopewell complex not only by the few Hopewell potsherds, but also by other characteristic Hopewell artifacts". Domestic sites could not be identified as belonging to the Ohio Hopewell complex if they completely retained only Adena traits. One solution to this dilemma is that most of the craftspersons could not have been elite and were instead commoners who had reasonable and unrestrained access to the necessary non-local raw materials to create ceremonial and symbolic artifacts, some of which eventually were used in mortuary activities.

In summary, the Vacant Center Model, as originally developed by Prufer, consists minimally of a series of periodically used ceremonial centers surrounded by dependent hamlets. Directly in and around the
centers can be found the locations of specialized camps, representing the remains of periodic short-term activities at the centers. Logistical activity locales for resource extraction, including garden plots, existed between and around hamlets, and in peripheral areas. Two conjectural settlement types, inferred from the double tradition concept, are elite residences and commoner burial grounds. Elite residences might be located near ceremonial centers because of elite control over access to burial in mounds located at centers. Commoner burials might have also existed in hinterland mounds or as casual interments at domestic sites. However, both elite residences and commoner burial grounds rely on an ascribed elite/commoner dichotomy.

A Formal Model of Ohio Hopewell Community Organization

The Vacant Center Model strongly implies that any given Ohio Hopewell ceremonial center and its surrounding hamlets form a community. These communities represent the basic cultural and evolutionary units which competed and interacted as participants in the Hopewelian phenomenon in Ohio. Each community had a unique historical background and was of different size and complexity. Local environmental carrying capacity also produced variability between communities. Local material culture may reflect historical differences between communities, but all Ohio Hopewell communities are assumed to have had a shared world view. Despite differences, communities are assumed to be structurally and functionally analogous, providing the appropriate societal scale for understanding Ohio Hopewell social organization (Dancey and Pacheco 1992).
A generalized diagram of a single hypothetical Ohio Hopewell community is provided in Figure 2 to illustrate the basic organizational principles embodied by the Vacant Center Model (Dancey and Pacheco 1992). The lower portion of the figure shows a series of functionally similar communities extending along a river system. The diagram is based in part on Prufer's (1967:275) presentation of survey data from the central Scioto Valley. He noted the sharp territoriality of the settlement pattern, shown in the diagram as dark boundaries between communities (Prufer 1964a:73). In our model, we refer to territoriality in the human-sense of symbolically and geographically-defined spatial relationships between functionally similar groups of individuals. Our use of the term territoriality is fundamentally distinct from non-human territorial behavior (Colinvaux 1973; Dyson-Hudson and Smith 1978).

The distribution of the various settlement types illustrated on Figure 2 were placed in hypothetical arrangements with ceremonial centers of earthworks and/or mound groups representing the central place in each community (literally, but not necessarily geographically). For comparative purposes each community can be broken down into center, core, and periphery spatial arrangements. Specialized camps are shown exclusively in the vicinity of the ceremonial centers, but may have been located in other parts of a territory, especially around raw material source zones.

Hamlets are dispersed within territories based on ecological and economic reasons (to be discussed later in this chapter). Hamlets are shown as equidistant or regularly dispersed, representing
Contiguous Communities Along a River

Figure 2. Generalized model of Ohio Hopewell community organization (from Dancey and Pacheco 1992)
longer-lived communities. Hamlets spaced in dispersed clusters as a result of budding off or "cloning" might be expected to occur in shorter-lived or emerging communities (Green and Perlman 1985:4). Distance between hamlets is shown increasing towards the peripheries.

Territory margins are open towards the peripheral uplands where hunting and other activities would have taken place. Short-term activity areas like gardens or hunting stations, were not placed on the diagram to reduce clutter. Conjectural settlement types, like elite residences or commoner burial grounds, are also not included in the diagram, but could be added if necessary.

Since a synchronic model of Ohio Hopewell community organization statically portrays historical data, Figures 1 and 2 fail to express dynamic aspects of the archaeological record. Spatial relationships and organizational patterns are expressed as an end product of perhaps long histories of occupation. For example, not shown in Figure 2 are: hamlet use and abandonment; periodic movements between the hamlets and centers; and accumulation of short-term specialized camps. The archaeological pattern of observed hamlets is composed of residences that were not necessarily contemporaneous with each other and which were each occupied for variable durations (Figure 3). Likewise, in Figure 1, the origin and demise of specific communities or polities are not shown. For archaeologists, these problems boil down to aspects of contemporaneity and duration. Although these are unavoidable with any synchronic analysis, one goal of my research is to draw conclusions having analytical value, regardless of these issues.
Figure 3. Model of hamlet history (from Dancey and Pacheco 1992)
The Problem Defined

Prufer concluded the McGraw site report with a challenge that for all intents and purposes has not been accepted:

The excavations carried out at the McGraw Site constitute only a beginning of what will undoubtedly be a period of long and arduous research into the cultural manifestations of the Woodland period in Ohio. As yet, our knowledge is woefully limited, condemning many of our conclusions to the lowly status of speculations [Prufer 1965:137].

The long, arduous period of Woodland research in Ohio did not happen. Ohio Hopewell settlement pattern studies, since 1967, have been especially limited. Research designed specifically to test the Vacant Center Model has never been carried out. The lack of substantive regional settlement data makes it difficult to assess critically the validity of the model. Ohio Hopewell research since 1967 has either ignored the Vacant Center Model completely, or viewed the model as a given. Most sites or places are intuitively evaluated as to which type of settlement has been observed. Despite lack of explicit testing of the Vacant Center Model, it has often been accepted as "the model" of Ohio Hopewell settlement systems (Seeman 1979; Lynott and Monk 1985; Braun 1986; Yerkes 1988; Smith 1992).

Prufer himself dropped from the scene of Hopewellian research by the late 1960's, reporting on the results of the Scioto Survey in 1967, and his comprehensive ceramics analysis in 1968. In the Scioto Survey Report, Prufer states that searches along the productive bottom lands and terraces of the river produced abundant Hopewellian surface materials from small sites. Diagnostic artifacts were documented from these sites, but data on site structure or assemblage
composition were generally not reported. Clusters of such sites were reportedly observed in the vicinity of the Harness, High Banks, Hopeton, East Bank, and Mound City Earthworks (Prufer 1967:316). The same pattern was also reported by survey crews in the Paint Creek Valley in 1964, however very few locations were actually documented near any of these ceremonial centers that might be interpreted as Hopewell domestic units. Likewise, Shane (1971:145) observed 21 small "refuse areas" during a survey west of the High Banks Earthworks, that contained Hopewellian artifacts and local Middle Woodland ceramics. The spatial structure, assemblage composition, and distribution of these locations has never been published.

Assuming for the purpose of this study that Ohio Hopewell earthwork/mound centers qualify as vacant ceremonial centers, what remains to be shown is that these centers are in fact surrounded by dispersed hamlets. Research at centers has been relatively more common than at possible domestic settlements. Specifically, research at Seip (Greber 1979a; 1983), Mound City (Brown 1982; Lynott and Monk 1985); Ft. Ancient (Essenpreis and Connolly 1989; Connolly 1991; 1992); Hopewell (Seeman 1981); Hopeton (Brose 1976); and Stubbs Mill (Genheimer 1984; 1992) in general support the assumption that the earthwork/mound centers are vacant ceremonial centers lacking substantial aggregated populations. Clearly, the most significant problem for understanding Ohio Hopewell settlement patterns relates to the distribution and organization of the domestic settlements. As James Griffin (1979:279) once argued "significant differences in the social and political structure of Ohio Hopewell ... have been
recognized for 150 years by archaeologists, but delineation of the structure has not been satisfactorily accomplished because of the absence of important data from village sites...."

Focusing on the domestic aspects of the Ohio Hopewell settlement pattern, the following questions define a set of research problems:

1) What is the variability in sizes of Ohio Hopewell settlements?
2) What is the variability in material assemblage patterns between hamlets, specialized camps, and logistical or short-term activity areas?
3) What are the structural properties of artifact clusters that represent these different varieties of settlements?
4) What is the spatial distribution of particular clusters of settlements and how do these patterns relate to the locations of earthwork/mound centers?

The purpose of my dissertation research is to address these problems. This goal will be accomplished by developing a series of deductions from the model predicting the organization of Ohio Hopewell communities. From these working hypotheses a research design is generated and a survey is conducted within the boundaries of a former Ohio Hopewell community. Data are analysed according to the interpretative framework that has been established. Thus, the research represents both an application of the Vacant Center Model, and an independent test of the model. As a result of the research carried out for this dissertation, a case is made that the Vacant Center Model provides a legitimate foundation for the understanding of Ohio Hopewell settlement patterns and community organization.
Chapter III
AN EXPLANATORY FRAMEWORK FOR OHIO HOPEWELL COMMUNITY ORGANIZATION

Archaeological Communities and Other Concepts

Definition of the terms community and community pattern is required to conceptualize the model of Ohio Hopewell settlement patterns being developed. Community is defined anthropologically as, "the largest grouping of persons in any particular culture whose normal activities bind them into a self-conscious, corporate unit, which is economically self-sufficient and politically independent" (Beardsley et al. 1956:133). A community pattern then follows as, "the organization of economic, sociopolitical, and ceremonial interrelationships within a community" (Beardsley et al. 1956:134). Since both of these definitions are based on ethnographic behavior, they require an archaeological expression.

The archaeological expression of a community and the community pattern requires the recognition of observable units that can be recovered from the archaeological record. The above definition deals with interacting individuals who can be ethnographically observed, however, the individual tends to be archaeologically obscured. For archaeology, the minimal observable component of communities are the remains of groups of interacting individuals, usually related, termed a domestic unit (Fuller 1981:9). Such units consist of spatially
discrete living spaces such as structures, cooking areas, and refuse disposal areas. The minimum size of the population, the number of structures, and the number of refuse disposal areas that make up the domestic units of any given archaeological community vary based on historical precedent. Ideally the domestic unit is composed of a singular household with one structure and one set of living facilities, however, this need not be the case. Operationally the domestic unit can be defined as "a contiguous contemporaneous deposit of domestic artifacts which cannot be spatially subdivided into redundant functional units" (Fuller 1981:20). The community, being comprised of interacting domestic units operationally can be defined as "a cohesive stylistic aggregate of artifacts which can be spatially sub-divided into redundant functional units and unique structures of features" (Fuller 1981:22).

Fuller uses the term redundant to mean repetitive pattern based on the equivalency of one functional unit or area to the next. This does not mean that units or areas are identical, only that they are part of a repetitive pattern. His specific context for use of the term is the "spatial arrangements of contemporaneous functions, denoting the multiple occurrence of the same activity area or functional feature from within a single site" (Fuller 1981:18). These might be equivalent singular occurrences of similar areas or features repeated from site to site. Nonetheless, it should be noted that the term redundant is used here in a manner different from standard dictionary definitions.
Communities tend to occur in restricted environmental spaces such as regions or sub-regions, stemming from the relationships of the interacting, usually kin related, domestic units that comprise the community. Therefore, domestic units in a region can be identified as a community by virtue of their proximity to each other and the occurrence of stylistically similar artifacts (Fuller 1981:9). The community pattern is expressed in the archaeological record by the arrangement of the content of the community across the local regional landscape at a specified point in time. Expression of corporate identity occurs not only through stylistic similarity among certain artifact classes, but also through the creation of public architecture or corporate space. In Ohio Hopewell communities, corporate space is clearly demarcated by earthwork and mound centers, representing a basic separation of the sacred and mundane (Kus 1986; Smith 1992).

Researchers in general have not explicitly defined the concept of a Hopewellian community. Smith (1992) refers to Hopewellian communities of self-sufficient farmers with undefined boundaries. Greber (1979a:36) defined an earthwork society as "the total number of individuals who interact with each other at regular, cyclic, or predictable time intervals, and who consider either the buildings or the site of the earthwork itself as one major focus of their activities." Greber's definition ties together the more general anthropological definition of community with the Hopewellian corporate expression of earthwork building as the focal point of interaction.

The term community has been applied in a confusing manner by Hopewellian researchers in the American Bottom. For example, the
excavation of the Holding site was referred to as exposure of the
community plan (Fortier et al. 1989:1). Yet, in the discussion of the
site, Holding is referred to as a horticultural hamlet which
participated and interacted with a larger population of Hopewellians
on the American Bottom. Holding is considered but one component of
the American Bottom Hopewell community during the Holding Phase –
circa 50 B.C. to A.D. 150 (Fortier et al. 1989:568). The community
plan is equivalent to the site plan only if the entire community
lives together.

Archaeological communities can have arrangements that vary
between having the entire community in one location and having the
community spread or dispersed throughout the local region (Fuller
1981; 1986; Railey 1991). A centralized or aggregated community
pattern is referred to as a nucleated pattern, while a community
pattern composed of a network of spatially separate domestic units is
referred to as a dispersed pattern. Following Fuller's distinctions,
the archaeological definitions can be operationalized as:

A nucleated community is a contiguous domestic
deposit of artifacts which can be spatially sub-
divided into contemporaneous redundant domestic
units. A dispersed community is a group of
spatially separate but stylistically similar
domestic units, each of which cannot be sub-divided
into redundant functional units [Fuller 1981:25].

Mobility patterns associated with the community land use cycle
affect the distribution and identification of components of the
community, but do not affect the status of a set of interacting
domestic units as a community. Mobility patterns range between
completely sedentary and completely nomadic. Sedentism is used here
to mean a living style in which at least some members of the domestic unit reside in the same place year-round (Rafferty 1985). Sedentary communities can vary in the length of time they spend at a given location. Kent (1992:636) has distinguished several kinds of sedentism, including "short-term sedentism" (from 6-10 months up to a approximately a generation in one location) and "hypersedentism" (potentially centuries in one location). As mentioned earlier, Prufer (1964a; 1965) referred to McGraw-like hamlets as "semi-permanent" and "shifting", but later clarified these phrases as referring to settlements that were occupied for about a generation, shifting locations as garden patches were abandoned. Prufer clearly refers to a pattern of short-term sedentism, not seasonal mobility. Some locations in the Ohio Hopewell settlement pattern, such as specialized camps associated with structural remains inside earthwork centers, may be considered permanent locations because they are used repeatedly, periodically, or year after year. However, unless such locations are occupied year-round, they are not sedentary habitations. Thus a given location can have permanent facilities, but is not necessarily a sedentary residence (Connolly 1991:5).

Dispersion and Community Organization

Residential dispersion is an efficient response to most environments because communities comprised of dispersed domestic units have effectively larger catchment areas than nucleated communities (Railey 1991). Seasonal residential dispersion occurs in many mobile forager or collector hunter-gatherer societies, while
sedentary residential dispersion is a common pattern for intensive collecting and/or farming societies. The explicit archaeological and ethnological literature on the organization and development of such societies is limited, although a few brief descriptions of archaeological and ethnographic examples of societies with dispersed communities and vacant ceremonial centers will be considered.

For heuristic purposes we can recognize two types of cultural situations in which sedentary residential dispersion might occur. These situations can be best understood by use of Caldwell's (1958:72-75) distinction between nuclear and non-nuclear societies. Nuclear societies can be characterized as vertically integrated with hierarchically organized settlement systems while non-nuclear societies are horizontally integrated with non-hierarchically organized settlement systems.

Nuclear societies depend on social surpluses generated by food producing; or borrowing Braidwood's term, "village efficiency". Dispersed domestic units can be identified in these societies as part of hierarchically organized settlement systems where the dispersed or rural settlements often contain the bulk of a population, but they do not contain the entire community. Hierarchically organized settlement systems have multiple levels of functionally distinct settlement types that include nucleated population centers (i.e. villages, towns, cities) which are economic and political centers (Blanton et al. 1981:175-176). Archaeological examples of such population centers tend to contain public architecture that has ceremonial/religious significance for the community (Sanders et al. 1979).
Mississippian societies (ca. 800 A.D.- 1500 A.D.), which were located on floodplains of the major river systems of the midcontinent, provide an archaeological example of community patterns that had sedentary dispersed farmsteads as the lowest level of the settlement hierarchy. Smith (1978:491) argued, "Many, if not all, Mississippian populations could be generally characterized as having a settlement system consisting of dispersed farmsteads surrounding a local-center..." The local-centers in general functioned as civic-ceremonial centers and contained mounds and plazas. These represent nucleated villages which were occupied on a permanent sedentary basis by hundreds of individuals. Administration of local-centers was accomplished through ranked simple-chiefdom level political structures. The bulk of the populations, however, were located in small sedentary farmsteads dispersed within the supporting region of the centers. A well documented local-center system is the Kincaid system from the Black Bottom (Muller 1978).

In a few locations, such as Cahokia on the American Bottom, regional centers developed which could be characterized as complex-chiefdoms or state level societies (Fowler 1978). Cahokia sprawled over an area of almost 13 square kilometers at its peak development (ca. 1150 A.D.), containing over 100 earthen mounds dominated by the imposing Monks Mound. Over 800 hectares of residential buildings suggest a population in the range of 30,000 individuals. On the American Bottom there were at least three hierarchical levels of functionally distinct settlements below Cahokia, with numerous dispersed sedentary farmsteads between population aggregates.
In contrast, a non-nuclear society might be horizontally complex, but that complexity is not based on vertical integration and hierarchical organization. Horizontal complexity might be measured by the number of functionally equivalent social units, which is positively related to population size (Blanton et al. 1981). An evolutionary relationship between non-nuclear and nuclear societies does not necessarily exist. The two types of social organizations probably represent separate trajectories of human cultural variability. This disjunction fundamentally denies the inapplicability to Ohio Hopewell of models of cultural evolution that seek transformations from tribal societies into chiefdom and state level societies. Ohio Hopewell populations have tribal-like attributes, such as territorial lineage-based descent groups, but it is critical to recognize that non-nuclear Hopewell societies were not evolving into hierarchically organized chiefdoms or states.

Potential confusion with the Caldwell dichotomy may occur because of the complex relationship that exists between dispersion and aggregation or nucleation (pertaining to population arrangement, not to Caldwell's nuclear culture type). The source of confusion stems from all nucleated or aggregated communities not representing nuclear societies. As long as the whole community occupies only one settlement type (i.e. a village), nucleation can occur without settlement hierarchy. Over time, dispersed communities can become nucleated communities by either fusion or growth (Fuller 1981; 1986). Fusion is usually a response to community requirements for mutual-defense, and might be expected to occur in regions where communities
are aggressively competing with each other. In reverse, nucleated communities can become dispersed communities through fission. Often dispersal is triggered by intragroup conflict, which is dampened by allowing disputants to "vote with their feet" (Railey 1991). Wilhusen and Varien (1990) argue that based on their cross-cultural analyses of pre-state societies, communities can move between states of dispersion and aggregation with greater social ease than might be expected.

Caldwell (1958) implied that the main difference between the two types of societies is based on the organizational requirements of food producing. Food production systems based on mono-crop field agriculture or irrigation require organized labor between domestic units. On the other hand, garden-base food production systems only require domestic unit labor. As indicated previously, Caldwell (1958) maintained that Hopewellians were temperate woodland hunter-gatherers, allowing him to contrast the socio-economic organization of non-nuclear Hopewellian societies as examples of "primary forest efficiency" with nuclear Mesopotamian and Mesoamerican societies as examples of "primary village efficiency". Since Hopewellian societies did actively produce food, this contrast might be considered inapplicable. However, Hopewellian societies can still be considered examples of non-nuclear culture types because the food production system, based on a diverse complex of native plants, represents a logical extension of primary forest efficiency (Streuver 1964; 1968). The link to Caldwell's non-nuclear type for Hopewellian societies is maintained by food production organized within domestic units.
Caldwell (1958:74) also suggested that the development of hierarchical Mississippian settlement systems was the result of the expansion and capture of the non-nuclear Eastern Woodland societies by nuclear societies from Mesoamerica, not the collapse or failure of Eastern Woodland societies. For Caldwell (1958:30-31), Ohio Hopewell represented the cultural climax of the non-nuclear type. The apparent complexity of Hopewellian societies as viewed from the perspective of their sometimes massive ceremonial centers and exotic paraphernalia, must therefore be understood from the perspective of the interaction of horizontally integrated dispersed communities. Comparison between archaeological examples of Hopewellian settlement systems and ethnographically known vertically or hierarchically integrated settlement systems is untenable assuming these arguments.

The Use of Vacant Ceremonial Centers by Dispersed Communities

Conditions

For dispersed communities, public monuments such as isolated or vacant ceremonial centers, serve the social function of providing a mechanism for group integration, social cohesion, and group identity. Railey (1991:58-59) identifies four conditions under which we might expect to find archaeological indicators of isolated ceremonial centers in dispersed settlement systems. These are: 1) a sedentary subsistence economy; 2) population growth; 3) territorially based descent groups; and 4) a need for access to restricted critical resources that are "owned" by adjacent or distant territorially based descent groups.
The conditions advanced by Railey are readily inferred to be applicable to Ohio Hopewell dispersed communities. A sedentary subsistence economy is assumed by the model for McGraw-like hamlets, based on diverse gardens of native horticultural products. Additionally, further discussion of subsistence patterns and the case for sedentism follows later in this chapter. Population growth, on the other hand, is the most difficult of the conditions to demonstrate in the archaeological record because of the basic problems relating to population estimation from archaeological data and the generally poor record of regional scale data in Ohio necessary to show population changes. Likewise, despite potentially high relative population density within core areas of Ohio Hopewell communities, relative population density at the regional scale may have remained low overall (Greber 1979a). The population growth condition is also not clearly a necessary or sufficient cause of the creation of vacant ceremonial centers by dispersed communities, and needs further evaluation as a condition.

Territorially based descent groups, however, appear to be an essential condition behind the use and creation of vacant ceremonial centers. In Ohio, the earthwork/mound centers demarcate territorially based descent groups (Prufer 1964a). It can be inferred that these territorial Ohio Hopewell dispersed communities represent descent groups because of their general practice of mound burial. The creation of formal cemeteries, of which mounds are one possible type, links a population to the land through the history of their lineages (Brose 1979:7). Mounds in particular are a highly visible symbol of
the claim by a group that the land belonged to the group's ancestors and that the land therefore rightfully belongs to the group who built the mounds (Charles and Buikstra 1983).

The fourth condition relates the need to have access to critical resources owned by adjacent or distant territorially based descent groups. This condition also appears to be essential to the local development of vacant centers, providing a motive for the maintenance of intra and intercommunity integration and interaction. Access to exactly the same resources by all groups would decrease the need to create social ties extending beyond groups needs as breeding populations (i.e. large enough for mate selection). The Hopewell Interaction Sphere, in general, demonstrates that communities required access to resources beyond the limits of their own territories. Brose (1979) has also suggested that periodic shortfalls in local regional carrying capacity are highly likely. Such shortfalls require access to the food resources of distant groups with surpluses, providing a strong incentive for the maintenance of exchange relationships that could be formalized at earthwork/mound centers. The real and hypothetical distribution of functionally similar, contiguous, Ohio Hopewell communities shown in Figures 1 and 2, suggests establishment of intercommunity interactions which could be characterized as peer-polity interactions (Renfrew 1986). Peer-polity interactions could address local and regional issues concerning access to resources. In certain regions, such as the central Scioto and Licking Valleys, peer-polities may have been formalized at complex centers like the Hopewell and Newark Earthworks.
Cultural Examples

An alternative approach to understanding the relationship between dispersed communities and vacant ceremonial centers is to examine the archaeological and ethnographic record for societies which used and created such centers. The classic archaeological examples of dispersed communities and vacant centers come from the New World, although in the Old World Late Neolithic societies in temperate Europe and China might constitute comparable examples. Chapman (1981), in particular, suggested a link between predominantly dispersed farmers and spatially isolated European Megalithic tombs, and the disappearance of such structures during periods of aggregated fortified villages. Cultural situations involving Native American populations provide the best comparisons for Ohio Hopewell so these will be the focus of the following descriptions. The best known archaeological cases of vacant ceremonial centers come from Mesoamerica. The concept of vacant ceremonial centers surrounded by dispersed hamlets was popularized by professors and cohorts of Prufer's at Harvard in the late 1950's and early 1960's such as Gordon Willey, William Bullard, and Michael Coe.

Willey (1956:107-114) discussed the implications of settlement pattern studies that had focused on regional Lowland Mayan communities rather than just temple complexes. Including his own work in the Belize Valley, Willey concluded that although ceremonial centers were obvious nuclei of population, most Mayans (ca. 300 B.C. - A.D. 900) lived in a pattern of scattered rural dwellings rather than in urban concentrations. Mayan domestic units maintained complex gardens and
practiced slash and burn techniques which required a large amount of land per unit, leading to scattered populations (Dumond 1961). In Willey's (1956:110) idealized diagram of possible Mayan settlement types, Type B has "the ceremonial center without dwellings and houses of the sustaining population are scattered singly over a wide surrounding area." The diagram is in essence the same as that offered here in Figure 2 as a model for Ohio Hopewell communities. Willey was justifiably cautious in his final conclusions, arguing for more extensive field surveys and excavations.

Bullard (1962), also working in the Belize Valley, offered the strongest support for a Mayan vacant ceremonial center-dispersed agricultural settlement pattern:

The survey work in the Peten has shown that the major ceremonial centers of the Classic Period were not "cities" in the sense of compact nucleus of settlement. Instead, residential structures were dispersed in rather loose aggregates throughout the sustaining area. The locations of these aggregates were determined primarily by topographical factors. Well-drained sites in the vicinity of a source of water were preferred, and nearness to good milpa land was also a factor. The important thing is that domestic settlement was not significantly greater in the immediate vicinity of the major ceremonial centers than it was in the more distant parts of the sustaining area [Bullard 1962:139].

Bullard further suggested that the majority of ceremonial centers supported areas of approximately 1000 square kilometers, with populations of less that 10,000 individuals. He also proposed that Mayan communities were much more equalitarian than most researchers would assume.
Mayan settlement patterns remain a topic for debate. Many hold the view that complex centers like Tikal are undeniably cities with hierarchically organized social systems (Blanton et al. 1981:196). Others cling to the position that despite cultural achievements, the Mayans obtained a unique advanced civilization without cities (Wenke 1990:502-505). An alternative view is that there are examples of both nuclear and non-nuclear Mayan cultures. Nuclear Mayan cultures may have developed as a response to the rise of nuclear societies in other parts of Mesoamerica such as the central and southern Highlands.

Dillehay's (1990; 1992) ethnographic study of the Mapuche, provides an extant example of a dispersed Native American society based on communities composed of sedentary, territorially based, descent groups. These people dwell in the temperate valleys flowing west into the Pacific Ocean from the southern Andes. The Mapuche gather at isolated ceremonial centers that include dance plazas and burial mounds for the observation of scheduled festivals and religious events such as the four day nguillitan ceremony. Afterwards the members of respective Mapuche communities disperse into food producing household units.

Mapuche monuments are permanent ceremonial fields and earthen mounds where public activities are spatially located and anchored, and where kinship and other lineage relations are historically and continuously formed. As viable social places, these monuments do not just emerge temporarily out of a local group, go out of use, collapse, and, after their abandonment, become part of past lineage history. They contribute to local history in a specific spatial and temporal context through the perpetual and intergenerational creation and utility of particular geographical and ceremonial locations [Dillehay 1990:226].
The Mapuche have a total population of some 200,000 individuals, organized into lineage based dispersed communities with populations ranging between 200 and 3000 members. Groups of three to four contiguous communities, ranging in size between 2000 and 10,000 people, are organized into trokinche units. These units interact with each other at isolated ceremonal fields (Dillehay 1992:382). Trokinches are organized through a web of agnatic and cognatic wife exchanging lineages, but lack a centralized control mechanism. The creation of alliances from these marriages is the main organizational structure of trokinche units. As such, Mapuche communities constitute hetarchical peer groups, "in which anything goes in terms of social and economic transactions between different lineage levels" (Dillehay 1992:387). Such relationships are similar to Renfrew's (1986) concept of comparable peer-polities, providing a good comparison to dispersed Ohio Hopewell communities. "Individual lineages and trokinche units are uniform in religious rules, household and community patterns, and political relations" (Dillehay 1992:386). Conditions similar to those identified by Railey are present in Mapuche society and can be extended back about 400 years into Proto-Mapuche. The marriage alliances, in particular, lead to mechanisms for dampening social conflict. Alliances also provide a mechanism for access to the resources of allied communities (Dillehay 1990).

The use of ceremonial fields by the Mapuche demonstrates the dynamic relationship between dispersed communities and their use of vacant ceremonial centers as a mechanism for social integration. As Dillehay explains:
Participation in group activities at (ceremonial fields) leads to reinforcement of pan-Mapuche social, economic, and religious institutions (e.g. alliances, public ceremony, and ancestral worship). This, in turn, results in the emergence and persistence of lineage-specific historical and social contexts at the same time that it contributes to an uninterrupted development of Mapuche architectural ideology that is etched across the landscape in the form of fields and mounds. The material and spatial continuity of this architecture and of the ceremonial activity associated with it are vital to the social and cultural persistence of lineages because it contributes to the integration and continuity of these institutions [Dillehay 1990:227].

Brief mention should be made of the Chachi, a Native American people whose social organization is based on dispersed communities and vacant centers. The Chachi population of about 3000 individuals occupy the Cayapas-Santiago River Basins region of coastal Ecuador (DeBoer and Blitz 1991). Chachi settlement and subsistence patterns are based on dispersed, sedentary, single households which have a farming and fishing economy.

Four Chachi ceremonial centers serve a territorial subdivision equivalent to dispersed communities. Punta Venado, the largest center, has a series of large guest houses arranged in a U-shape surrounding a plaza that contains a church, several religious icons, and a cemetery. Large-scale aggregations at the centers are scheduled twice yearly around the Christmas and Easter holidays (the Chachi blend Catholicism and native religion). Unscheduled gatherings occur for marriages, rites of passage, and mortuary ceremonies. Chachi engage in religious observances, feasting, heavy drinking, and dancing at gatherings. A hereditary governor and a temporarily
activated police-force confront and adjudicate complaints and intra- 
group conflicts that have erupted during the year. Chachi vacant 
centers serve multiple purposes, acting as "calendar, court, church, 
and necropolis all wrapped up in one" (DeBoer and Blitz 1991:62). 
The centers reassert Chachi identity, integrating the dispersed 
population with visible symbols on the landscape.

The Niche of Dispersed Ohio Hopewell Domestic Units

During the past thirty years a great deal of research has 
focused on the subject of Woodland period subsistence patterns (see 
for example Streuver 1964; 1968; Asch et al. 1979; Ford 1979b; Smith 
1989). Specific analysis of Ohio Hopewell botanical data has been 
presented by Ford (1979a) and Wymer (1987a; 1987b; 1992a; 1992b). 
These data are complex and no attempt will be made here to 
comprehensively repeat their findings. Instead, a brief review of 
the findings and implications of the data will be presented in order 
to outline the generalized nature of the niche of Ohio Hopewell 
domestic units, and to identify aspects of the niche that favored 
communities of dispersed sedentary hamlets.

Middle Woodland/Hopewellian populations from throughout the 
Eastern Woodlands were classic generalists who utilized a wide 
variety of resources. Subsistence data from many distant regions with 
distinct environments are overall quite similar, indicating a broad 
pattern of human influenced and created ecosystems (Wymer 1987a). 
Middle Woodland subsistence patterns, including the use of a native 
plant horticultural complex, can be characterized as diffuse rather
than focal (Cleland 1976:70-71) or as an example of "primary forest efficiency" (Caldwell 1958:31). Wymer (1992a) has calculated a broad niche-width for her samples of botanical material from several Ohio Hopewell domestic contexts, including relatively equal contributions from many varieties of collected and cultivated plant species.

Nuts from hickory and hazelnut trees were of primary importance, followed by black walnut, butternut, and acorns (Wymer 1987a:209). Elderberry, blackberry, sumac, hackberry, and grapes were collected (Wymer 1987a:210). Several types of tubers and bulbs were also utilized such as: groundnut, cattail, arrowroot, and wild onions (Kozarek 1987:12). Maygrass, goosefoot, erect knotweed, sumpweed, sunflower, and possibly little barley were the primary cultivated seed species (Wymer 1987a:210; Wymer 1992b). A subspecies of squash with edible flesh and seeds, including acorn squashes, crook necks, and fordhooks were also cultivated (Smith 1989:1567).

Nut and acorn bearing tree species were an important human resource in the Eastern Woodlands. Nut and acorn trees of different species prefer divergent habitats, producing a diverse patchy distribution of these resources. Patchiness is magnified further by inconsistent nut yields from year to year which are dependent on a variety of factors including water, temperature, and disease (Ford 1979a:236; Reidhead 1981:182-192). Nonetheless, net combined yearly yields within a catchment area of 10 square miles (25.8 square km) of deciduous woodland have been calculated at between 250,000 and 1,000,000 bushels of harvestable mast. Even 25% of this amount is a massive potential resource (Munson et al. 1971:414-415).
Potentially dense patches of berries, tubers, and greens would be seasonally available within the same catchments of deciduous woodland (Kozarek 1987:12-13). For many such species, patch location in mature deciduous forests is dependent on openings in the canopy, which occur by natural processes or from human land disturbance. Nuts, acorns and other plant species provide diverse nutritional requirements. Nuts and acorns provide mostly fats and proteins and some carbohydrates, while berries and greens provide essential vitamins and fibers (Reidhead 1981).

The seed species, along with squash, are known as the Eastern Agricultural Complex or EAC (Streuver and Vickery 1973). Streuver (1964) argued that these plant species thrived on naturally disturbed surfaces, such as flood deposits or mudflats, which may have led inexorably to their domestication. While subsequent research has shown that mudflats probably were not important to the domestication process (Munson 1984:379-385), morphological changes in seed or achene size and thickness of seed coating indicative of strong selective pressures have been identified for goosefoot, sumpweed, and sunflower (Fritz and Smith 1988; Smith 1989). Maygrass, goosefoot, knotweed, sumpweed, and little barley are found in archaeological contexts outside their present ranges, suggesting human intervention in the propagation of these plants that represents domestication (Cowan 1978; O'Brien 1987; Wymer 1987a:59; Smith 1989).

Small swidden gardens would have been the best planting strategy for these domesticates (Ford 1979a; 1981; Cowan 1985; Wymer 1987a; Smith 1989). The harvestable yields of cultivated plants from this
complex are greater than expected given the generally small size of the seeds (except for sunflower). Smith (1989:1569) argues, based on estimates from commercial and non-commercial stands of these and related plants, that yields of 500-1000 kilograms of edible material per hectare were possible. He notes that these figures overlap with yields for Mississippian corn and Neolithic wheat crops.

Approximately 27 liters of goosefoot seeds, estimated at nine million seeds, were recovered at Ash Cave in Ohio. An accelerator radiocarbon date directly on some of these seeds produced a date of A.D. 230 ± 100, attesting to the extensive utilization of EAC plants by Ohio Middle Woodland populations (Smith 1985). The stability and predictability of these resources was high because the plants are easily grown and garden location and size can be controlled. The plant complex provided carbohydrates in the spring and summer, and carbohydrates, fats and oils during the fall (Smith 1989:1569).

Forest clearance, and human land disturbance in general, influenced the availability of collectible plant and animal species. Berries and particularly hazelnuts are most abundant in secondary growth situations, leading Wymer (1987a:207) to hypothesize that these species were collected in abandoned gardens. Asch and Asch (1985:353) suggest controlled fires as a possible mechanism for encouraging hazelnut growth, reduction of competition for selected nut trees, and garden patch clearance. Open edges with nuts and berries are also a favorite foraging place for forest mammals such as deer and raccoon, further suggesting to Wymer (1987a:207) that human gardening improved the local resource base, or increased the productivity of collectible
fauna and flora. Along similar lines, Crites (1987) has argued that Middle Woodland human and plant interactions represents a coevolutionary process of mutualism. This process results in improvements in fitness for both humans and plants by increasing plant growing space, affording a mechanism for propagation, and by providing humans with predictable resources (Rindos 1984).

Faunal remains are not well known for Ohio Hopewell domestic contexts, although they were recovered in abundance at the McGraw site (Parmalee 1965), the Jennison Guard or Whitacre site (Whitacre and Whitacre 1986; Kozarek 1987) located near the mouth of the Great Miami River, and the Fairchance site (Hemmings 1977) located on the upper Ohio River floodplain. Modern political boundaries place Jennison Guard in Indiana, and Fairchance in West Virginia, although both are within 2 miles of the Ohio border, and represent Ohio Hopewell domestic units. Faunal remains are better known for domestic contexts in other Hopewellian regions such as the Illinois River Valley (Munson et al. 1971; Styles 1981; Styles et al. 1985).

White-tailed deer were the principal game species and protein source during the Middle Woodland period, and probably most other prehistoric eras as well (Ford 1979a:235; 1979b). Of the identifiable faunal remains deer comprised 75% of the McGraw sample (Parmalee 1965:115), 70% of the Jennison Guard sample (Whitacre and Whitacre 1986:25), and 85% of the Fairchance sample (Hemmings 1977:52). At the late Middle Woodland Scovill site, in the Illinois River Valley, deer contributed an estimated 92% of all available animal meat (Munson et al. 1971:425).
Deer densities in an undisturbed Eastern Woodlands temperate deciduous forest biome, have been estimated at between 10 and 85 individuals per 2.59 square kilometers, with an average of 15.4 deer per square kilometer (Shelford 1963:26-28). Starna and Relethford (1985:826-828) suggest caution in the overextension of density figures such as Shelford's. They argue that many non-human factors influence the year to year availability of white-tailed deer and that deer should not be considered a stable unchanging resource. Nonetheless, during prehistoric times there were considerable numbers of deer in Ohio, possibly equal to or greater than modern herd sizes (Shriver 1987). Deer herds can sustain predation rates nearing 50% without appreciable decline in numbers through preferential hunting selection of males and spontaneous twinning. Likewise, white-tailed deer have a high turn-over ratio every four years (Shelford 1963:26; Shriver 1987:29).

Single hunter stalking techniques, including tree stands, produce the highest success rate for white-tailed deer hunters (Reidhead 1981:129). Group drives actually decrease the overall ratio of labor to meat by more than half (Reidhead 1981:128). Prufer and Shane (1967:46-47) noted that the deer faunal elements from Late Woodland deposits at Chesser Cave, a rockshelter in Athens County, are almost certainly the result of individual hunters versus group hunting. The principle reason for this pattern of hunting success may be a combination of: a lack of significant herding behavior; regular use of trails; and restricted home foraging ranges. The mean estimated home range varies between 1.6 and 3.2 kilometers from a central
point (Hoekstra 1972:188-192). Therefore, white-tailed deer may be considered a fairly evenly dispersed, but mobile resource, best exploited by skilled individual hunters.

An average of three dozen mammalian, avian, reptilian, and amphibian species, were identified at the three Ohio Middle Woodland sites. These included several meat and fur bearing species such as: elk, black bear, mountain lion, wolf, fox, beaver, raccoon, oppossum, groundhog, cottontail rabbit, gray squirrel, turkey, passenger pigeon, waterfowl, bobwhite, turtles, many types of fish, and fresh-water molluscs. Each individual species varies in availability, and most were taken individually. Certain species such as molluscs, fish, passerines, and waterfowl were seasonally available in dense concentrations (Limp and Reidhead 1979; Reidhead 1981).

As a response to availability and predictability of food resources, group dispersion is favored by organisms when resources are evenly dispersed, stable, and homogeneous (Horn 1968). A similar response has been shown applicable to human hunter-gatherer populations (Harpending and Davis 1977; Wilmsen 1973). Patchy resources favor group aggregation, with mobile clumped resources are most successfully exploited by mobile aggregated foragers (MacArthur and Pianka 1966).

As outlined above, the niche of Ohio Hopewell domestic units can be considered stable with generalized exploitation of relatively predictable, but patchy resources. When considered from the standpoint of catchment scale aggregates of resources, such as the approximately 10 square kilometer area humans typically exploit around
a base settlement (Roper 1979), the patchiness of individual resources is evened out, approximating the quality of a dispersed homogeneous resource base. Paradoxically, at the catchment scale, the Hopewelian pattern of generalized use of diverse species, each of which have patchy distributions, when combined with stable dispersed gardens, produces a net or aggregated even distribution of predictable resources (Figure 4). Therefore, within local regions or communities, dispersed Ohio Hopewell domestic units should show broad similarity among catchments. Kozarek's (1987) analysis of adjacent catchments near Jennison Guard matched this pattern.

Exchange between local domestic units serves the function of dampening shortfalls in single resources within catchments (Brose 1979; Railey 1991). Such shortfalls would be the focus of community level interactions, with the community resource base conceptualized as the aggregated catchment resources of the combined domestic units. In general, burial mound and earthwork construction suggests that community resource bases were treated as subject to corporate ownership. These territoriality behaviors, including aggressive defense, is expected to increase as the stability and predictability of resources increases (Horn 1968; Weins 1976:97; Dyson-Hudson and Smith 1978). The rigid territoriality of individual Ohio Hopewell communities depicted in Figure 2 is at least partially explained by these ecological relationships. Likewise, the link between dispersion, territoriality, and use of vacant centers by lineage-based descent groups, can also be interpreted as an ecological relationship between people, environment, and resource spatial distributions.
Figure 4. Hypothetical pattern of resources in an Ohio Hopewell catchment region
The Ohio Hopewell Settlement Pattern and Sedentism

Introduction

As described above, the niche favors dispersion by sedentary Ohio Hopewell domestic units. Exploitation of a wide variety of forest resources, available within short distances of each other, favors a decrease in residential mobility (Caldwell 1958). Maintaining a pattern of residential mobility within small catchment areas produces no tangible rewards. Likewise, essentially equivalent resources in adjacent catchments decrease the need for residential mobility (Kozarek 1987). Any necessary resources not immediately available to domestic units can be procured with a strategy of logistical mobility involving mobile work parties which bring resources back to the sedentary residences. In contrast, a strategy of residential mobility moves residences to the locations of seasonally available resources (Binford 1980; 1982). Kozarek (1987) argues that the Hopewellian household(s) at the Jennison Guard site used logistical mobility to obtain some varieties of chert. Other chert resources may have been obtained by exchange, indicating how multiple level exchange networks may also decreases the need for residential mobility. O'Brien (1987:187-188) proposed a similar argument for the development of sedentism in dispersed Havana Hopewell populations in the lower Illinois River Valley, based on localized production of garden resources and intensive collection of seasonally abundant local resources.

Biannual residential mobility, in the form of paired cold and warm season residences, has been proposed as a settlement system model
for Hopewelian populations in the American Bottom of the Mississippi River Valley (Smith 1987a; Fortier et al. 1989). The limited number of excavated sites in this region are interpreted as either cold season single households (i.e. Truck #7 - Fortier 1985) or warm season farming hamlets composed of multiple households (i.e. Holding - Fortier et al. 1989), supported by networks of satellite logistical camps (i.e. Mund - Fortier et al. 1983). Seasonality interpretations at these excavated settlements were primarily inductive interpretations of duration and function.

Each of the theorized cold and warm season residences may alternatively be interpreted as dispersed sedentary singular or multiple household units. The structural properties of the Illinois settlement data, based on criteria discussed below, can also be interpreted as supporting this alternate model. Variability in regional settlement patterns clearly existed, however, Hopewelian communities in the lower Illinois Valley and the American Bottom are best characterized as dispersed rather than nucleated (Smith 1992). Dispersed communities in the lower Illinois Valley were definitely associated with mound centers of many different scales (Streuver 1964; 1968; Asch 1976; Asch et al. 1979). Similar mound centers may have existed in the American Bottom (Fortier et al. 1989:8). Illinois Hopewell centers as a whole were not as structurally complex as vacant earthwork/mound centers in Ohio, but may have had similar functions (Streuver and Houart 1972).

It is important to recognize that regional mobility patterns and settlement patterns will vary depending upon community social
organization and the resource distribution of the particular region. All Hopewellian regional traditions are not expected to have identical settlement systems, nonetheless, "seasonal rather than permanent hamlets should not be considered evidence for rejection of the model to the extent that seasonal movements maintain the hamlet residence pattern" (Pacheco 1988:96). The network of paired-dispersed domestic units consisting of eight-month-long warm season camps, and four-month-long cold season camps, is the equivalent of a sedentary settlement system. As Church (1992:23) argues, the models converge at this point.

Sedentism in Ohio Hopewell Populations

The once popular notion that Ohio Hopewell settlement systems involved a strategy of seasonal residential mobility is waning. Kozarek's (1987; 1992) cogent analysis of evidence for sedentism at the Jennison Guard site, shifts the burden of proof back onto arguments for seasonal residential mobility. The location of known Ohio Hopewell domestic units are all within a days walk of earthwork/mound centers, begging the question of why such groups would move during the year and to where? Periodic movement to earthwork/mound centers by all or some segment of the population is assumed by arguments like Kozarek's to not represent residential mobility, or a discontinuance of use of the dispersed sedentary hamlet residences. Rather, periodic use of the ceremonial centers for short periods is an expected part of the settlement system that does not negate the sedentism of the dispersed domestic units.
Of recent arguments for seasonal mobility by the residents of excavated Ohio Hopewell domestic settlements, the most compelling has been presented by Yerkes (1988; 1990; Lepper and Yerkes 1993) based on his microwear analysis of lithic tools (primarily utilized debitage and bladelets) from the Licking Valley Murphy and Li.79 #1 sites. In order to explore the sedentism issue, a critique of Yerkes' various arguments will be presented. In general I will not challenge the methodology for obtaining functional results by microwear analysis, although such an avenue of argumentation has been presented by others (i.e. Odell and Odell-Vereecken 1980). While accepting the basic results of the microwear studies, I will defend the position that the interpretation of seasonal residential mobility as a result of these analyses is incorrect.

Initially I contend that microwear analysis says relatively little, if anything, about the seasonality or duration of a human occupation (Dancey 1991:68). To the contrary, at best, microwear analysis indicates the kinds of activities performed by the edges of lithic tools which were positively identified as having a wear polish. There is no experimental or theoretical basis beyond Yerkes' assertions in this and other of his works (i.e. Yerkes 1987) that interpretation of a sites' seasonality can be derived from consultation of the results of a microwear analysis. The logical position would take microwear evidence for a limited number of activities to represent seasonality based on a short-term or specialized occupation relating to use or procurement of a certain resource. Microwear evidence of multiple activities would then be
interpreted as resulting from a base camp or generalized domestic occupation. Instead of this position, Yerkes interprets the evidence for generalized multiple activities at both Murphy and Li.79 #1, as resulting from seasonal domestic base camps of short duration.

The artifact assemblages from Murphy and Li.79 #1 are broadly similar, including types of exotic raw materials. However, the proportion of exotic materials is significantly greater at Li.79 #1 than at Murphy (Pacheco 1988; Dancey 1991; Lepper and Yerkes 1993). Murphy is located on a glacial terrace beside a small stream, approximately 1.5 kilometers from the Newark Earthworks in Raccoon Creek Valley (Dancey 1991). Weakly developed traces of microwear, generalized expedient tool use representing multiple activities, lack of significant evidence for hafting and retooling curated and formal tools, feature contents, settlement plan, and archaeobotanical materials were cited as evidence that the Murphy site was used over a long period of time intermittently and seasonally by a small Hopewelian group, perhaps as a warm season growing camp (Yerkes 1988:232; 1990:174).

Li.79 #1 consists of two spatially separated, but not necessarily related, loci of excavated prehistoric features within 150 meters of the Newark Earthworks (Lepper 1988; Pacheco 1988). Examined tools edges from the Li.79 #1 tool assemblage exhibited similar weakly developed microwear traces and a generalized expedient pattern of tool use representing multiple activities, resulting from repeated short-term domestic occupations related to the use of the Newark Earthworks by a small Hopewelian social group (Lepper and Yerkes 1993:23).
sites were interpreted as functionally equivalent, representing brief
domestic occupations by small groups of residentially mobile
Hopewellians (Lepper and Yerkes 1993:23–24).

Yerkes' seasonality interpretation appears to be based on several
independent arguments, only two of which stem from the microwear
analysis. These are: 1) the weakly developed microwear polishes
resulting from expedient or short usage of the examined utilized
edges and the related overall low frequency of curated/heavily
utilized tools; 2) the lack of significant microwear evidence for
tool hafting; 3) the settlement layout or structural pattern of the
sites including a lack of "deep" storage pits, "substantial"
structures, and "dense" concentrations of features; 4) a long spread
in the radiocarbon dates; and 5) the results of the archaeobotanical
analysis (only for Murphy).

I contend that the main source for Yerkes' interpretations are
inferences concerning settlement layouts or structural patterns, and
not microwear analysis. As with his microwear analysis, no
theoretical basis for determining seasonality based on site structure
has been provided. Rather, intuitive evaluation of settlement layout
based on such properties as depth of pits and posts, and number of
features, are used to judge sedentism. In the following discussion,
my goal is to address the first three arguments outlined above.
Yerkes' arguments concerning radiocarbon dates and archaeobotany from
the Murphy site have been addressed by Dancey (1991). The subsistence
issue was addressed previously in this chapter and has also been
To address these issues, a theoretical basis for understanding the structural properties of a sedentary versus seasonal settlement system will be presented, and then compared to the archaeological records of Murphy and Li.79 #1. As a result of these comparisons it will be argued that Murphy represents the location of a dispersed sedentary domestic unit, while Li.79 #1 is more difficult to interpret because of the limited exposure of the settlement layout. Li.79 #1 represents either the temporary encampment of a domestic unit utilizing the earthwork/mound center, as suggested by Lepper and Yerkes (1993), or it represents a dispersed sedentary domestic unit, similar to Murphy, but closer to the center. Yerkes' microwear analysis only establishes the general domestic context of these settlements, it does not determine their seasonality.

Expediency/Curation and Ohio Hopewell Chert Technology

The assumption that a high frequency of curated tools represents sedentism and a high frequency of expedient tools represents mobility is questionable (Bamforth 1986:38-39; Pacheco 1988:96). Raw material availability and characteristics of the regional settlement pattern directly affect curation and expediency (Bamforth 1986:40). In the case of Murphy and Li.79 #1, a high quality lithic resource (Vanport chert) is located within the Licking region at Flint Ridge. Vanport chert was abundantly available to the Middle Woodland population of the Licking Valley, and exotic cherts were available through exchange networks or logistical procurement. Hopewell curation in this region should not have been based on mobility considerations.
Formalized bifacial-core reduction strategies have been correlated to mobility, while expedient flake tools are characteristic of sedentary populations (Parry and Kelly 1987). For example, some of the most extensively curated tool kits were used by Paleoindians, generally considered to represent highly mobile foraging populations (Cleland 1976). Ellis (1992) documents an extreme example of residential mobility and curation for the Paleoindians of southern Ontario. He documented group exploitation of territories hundreds of kilometers across, with chert resources available only in certain areas of the seasonal mobility pattern. Several of the base camps and field stations located a long distance from main chert sources contained almost nodebitage, but had numerous bases of bifacially chipped fluted points plus heavily used scrapers. All of the artifact assemblages were tools, many of which were highly curated (such as the fluted points and the scrapers). These were abandoned only after being broken or totally exhausted.

The occurrence of a biface industry in both the Murpy and Li. 79#1 assemblages, must by the curation criteria represent the creation of curated (and often hafted) tools. The suggestion that curated, heavily used bifacial tools are rare or missing is only in comparison to the ratio of bifaces against the entire lithic assemblages. That the majority of bifaces are rejects of the production process helps explain the supposed lack of curated bifaces. In a sedentary context, we might expect finished bifaces to be completely reworked until broken into small pieces, or to be carried away from the site to be used in logistical activities (Dancey 1992a).
Presence of debitage representing production and maintenance may be a more useful signature for separating the use and production of bifaces in sedentary versus residentially mobile contexts. The labor invested in bifaces suggests bifaces are always curated tools, regardless of mobility strategy.

The artifact assemblages from Murphy and Li.79 #1 have relatively abundant debitage as compared to the ratio of recognizable tools, although Murphy has a much greater mass of debitage. The main tools in these assemblages include: retouched or unretouched debitage chosen from stockpiles created by core reduction for bladelet or biface production, bladelets, bifaces (including an occasional hafted projectile point), and rare unifacial items such as formal end scrapers. Overall there is superficial similarity between the lithic assemblages (Pacheco 1988).

Yerkes examined bifaces (including projectile points) and cores for microwear as available in the two assemblages, but concentrated his analyses on the bladelets and debitage; two categories that are inherently expedient in nature (i.e. Hopewell did not make most of these items for extended use lives). Such tools are characterized by thin angled edges that wear out quickly. The tool user, upon dulling a bladelet or utilized debitage edge, is presented with the option of retouching the used edge or selecting or making a replacement. The later choice, at least for most expedient work situations, would be the more efficient of the two. Retouched bladelets and utilized debitage are probably made for specific tasks, rather than examples of resharpening. Observation of weakly developed edge wear among the
categories of utilized bladelets and debitage is hardly surprising. Even if involved in specialized production, we might expect weakly developed edge wear on bladelets due to constraints of morphology. Disposable razors are probably a better analogy for bladelets than chipped stone biface technology (Grubb 1984).

Microwear analysis of bladelets is especially important because these artifacts are the best candidate for an Ohio Hopewell "index fossil" that currently exists. Bladelets have been recovered from a wide variety of Ohio Hopewell social contexts. Chronologically this technology is restricted to the Middle Woodland period in Ohio (Robertson 1986:35). Lithic technology for producing bladelets is separate from Middle Woodland technology for producing bifaces (Dancey 1990). The origin of bladelet technology in Ohio Hopewell is commonly associated with the production of crafts, like the sculpted animal pipes and mica cutouts (i.e. Mills 1916:390; Baby and Langois 1979; Parry 1992). This long-standing assumption was part of Yerkes' research design for the Murphy and Li.79 #1 microwear analyses. While it is unlikely that bladelets were not used in craft production, evidence (including Yerkes' studies) is now accumulating to support the position that Ohio Hopewell bladelets had multiple uses (Greber et al. 1981; Genheimer 1984; Yerkes 1988; 1990). Social context is probably the single greatest determinant of specific bladelet use, suggesting that site function cannot be determined directly from the observation of bladelets or bladelet use in an assemblage (Pacheco and Pickard 1992). To that end, Yerkes' studies are a productive investigation of the Ohio Hopewell bladelet use.
Parry (1992) has emphasized that blade-core reduction strategies do not conform to the mobility patterns suggested for populations with bifacial-core reduction strategies. Eight out of ten New World blade-core technologies are in cultures with low degrees of residential mobility or complete sedentism. Likewise, following the initial Parry and Kelly (1987) arguments, the presence of expedient flake tools is a signature of sedentism, not mobility. For the Murphy site, the pool of available expedient edges was enormous. Extrapolation of the frequency of used debitage and bladelets (18%) observed by Yerkes (1990) over the entire assemblage, which is conservatively estimated at 0.75 million items of debitage, suggests thousands of expedient tools were available. The number of possible expedient tools and the variety of tasks for which they could be used probably explains the weak development of microwear. Replacements were always at hand. It is not as clear because of excavation techniques, that as many items of debitage were available to choose from at Li.79 #1. Instead, there seems to be a relatively high frequency of bladelets, over half of which were made out of exotic cherts (Lepper and Yerkes 1993:21). Yet, the overall use rate (14%) observed for the Li. 79#1 assemblage is comparable to Murphy, covering the same basic tasks (Lepper and Yerkes 1993). Minimally, the evidence for bladelet production and multiple expedient uses of bladelets and debitage at both Murphy and Li.79 #1 supports the interpretation that both of these localities are locations of generalized domestic activities. However, it does not indicate the seasonality or duration of these activities.
Hafting

The second argument, about hafting and seasonality, is similar to the issue of expediency and seasonality. Consequently, most arguments are equally applicable. The recognition of an inherent relationship between using hafted, curated tools and residential patterns has not been established. Many completely sedentary populations in the Australian New Guinea Highlands, for example, utilize no hafted stone tools in their lithic tool kits (White 1969), while many residentially mobile foraging groups, such as Paleoindians or Archaic foragers in the Eastern Woodlands had a wide variety of hafted tool forms (see Jennings 1974). Utilized debitage rarely has evidence for hafting and the same is true for Hopewelian bladelets. These appear to have been generally hand-held rather than hafted tools, involving short fine movements (Greber et al. 1981). Notching is also a rare attribute of bladelets. Only one example of a hafted bladelet has been described in the literature for Ohio Hopewell, and this specimen was "glued" or fixed into a shaft rather than being bound (Pacheco and Pickard 1992).

Settlement Structure and Residential Patterns

Many archaeologists have noted the distinct contrast between the archaeological record produced by sedentary settlement systems and that produced by residentially mobile settlement systems (i.e. Binford 1980; 1982; Rafferty 1985; Kent 1992). Dispersed sedentary residences display evidence for regular and systematic maintenance of occupation space, while seasonal settlements exhibit low degrees of
maintenance. The long-term outcome of systematic maintenance of the occupation space is an archaeological record with clearly defined zones or clusters of features, structures, refuse deposits, and open spaces (Dancey 1991:66; 1992a; Smith 1992). Areas used for domestic activities will be cleared of debris "predicated on the intended future use of that area" (Kozarek 1987:127). Cross-culturally, maintained refuse deposits such as dumps or middens, are an indicator of sedentism (Kent 1992). In archaeological contexts, sedentary refuse deposits are characterized by high density clusters of artifactual debris with crisp spatial boundaries (Kozarek 1987; Dancey 1991). Obnoxious or smelly organic refuse should be deposited down wind or well away from house areas, and may or may not be associated with non-organic refuse (i.e. Fischer 1971).

There are predictable relationships between refuse disposal, artifact discard, intensity of occupation, and duration as formation processes (Schiffer 1972:162; 1987). Kozarek (1987:127-130) and Kent (1992:641) cite ethnographic data such as Murray's (1980) cross-cultural study which documents that mobile hunter-gatherers are the most likely populations to discard items where used and to not regularly clear activity areas. The lack of refuse removal in seasonally occupied settlements is due to the lack of intended or anticipated use of that particular space. Short-term seasonal settlements display spatial patterns of artifact discard and refuse disposal that reflect expedient decisions about the potential danger of debris, creating toss, drop, and displacement zones, or simply thin sheet deposits of debris (Kozarek 1987:128). Seasonally reoccupied
locations may contain tool or raw material stockpiles for future activities, however, activity areas and disposal areas tend to become blurred as the site is reoccupied year after year (Kozarek 1987:131). Likewise, old features may become overlapped and intruded into as new features are created upon the most recent occupation of the location (Dancey 1992a).

In general, therefore, archaeological locations will consist of debris representing the combined outcome of past refuse disposal decisions. Scattered debris represents short-term activities where the need to clear and maintain areas from potentially hazardous materials are minimal. Sharply defined refuse deposits result from the anticipated prolonged occupation of a settlement through the behavior of clearing and maintaining well defined spaces of potentially hazardous materials (Kent 1992). Therefore, seasonal settlements in general, and logistical or short-term activity areas in particular, should display a lack of well defined refuse deposits, providing a recognizable structural contrast between hamlets and other types of Ohio Hopewell settlements.

Following these criteria, the structural characteristics of Murphy and Li.79 #1 can be examined. As with the issues of tool expediency and hafting, I would contend that there is no inherent relationship between mobility patterns and the depth of pit features, the size of postmolds, or the number of features at a settlement. Rather than sedentism determining these aspects of settlement structure, a wide set of other determinants are likely to be involved, including: cultural variability; duration of occupation; settlement
function; ease of digging local soils; and systematic maintenance of activity areas within the settlement. Likewise, anticipated sedentism has an affect on settlement structure (Kent 1992). Dancey (1992a) argues that sedentary settlements which are occupied for a shorter relative duration (for whatever reason) have distinctive structural remains when compared to long-term sedentary settlements. Sedentary settlements which are occupied for only a relatively short time will have clearly defined structures, fewer features, and less developed refuse deposits. In contrast, long-term sedentary settlements will tend to have blurred structural patterns due to rebuilding and structure maintenance, greater number of features, and well developed refuse deposits. Such distinctive records may result in different interpretations for what are in principle equivalent dispersed sedentary domestic units.

Structural Remains of Murphy

Dancey's (1991) excavation of the Murphy site is the first published complete Middle Woodland settlement layout in Ohio. Mechanical removal of the plowzone in an area of 0.6 ha allowed for complete sampling of preserved feature remnants. Systematic surface collections were performed prior to excavation. Unknown numbers of cultural features may have been located totally within the plowzone and were destroyed. Preserved subsurface feature remnants and surface and subsurface artifact concentrations indicate a settlement plan consisting of spatially defined activity zones, including areas for food processing, one or more structures, refuse disposal, and an open
yard (Figure 5). The Murphy settlement layout is consistent with expectations of a sedentary settlement (Dancey 1991:67).

Specific descriptions of structural remains at Murphy support the interpretation that these represent the remains of a dispersed sedentary Ohio Hopewell domestic unit, which was occupied for possibly several consecutive generations (Dancey 1991:51). Of the 43 cultural features there was only one instance of feature was overlapped by another feature. Features ranged in size up to 0.8 meters deep and 1.6 meters across. Feature contents were variable, but several contained large samples of ceramics, archaeobotanical remains, and fire-cracked rock indicative of cooking functions. All features excavated at Murphy have a high probability of being Middle Woodland in origin (Dancey 1991:47-49). One flat-bottomed deep cylindrical pit fits the classic description a Woodland storage pit (Dancey 1991:43). The area of postmolds characterized as the structure zone contained minimal refuse, suggesting systematic refuse clearing. Postmolds were observed to have three distinct size classes, some of which could certainly be considered substantial. The deepest postmold 70 cm deep and 15 cm across. No clear house pattern was delineated, though many shallower postmolds (i.e. less than 0.3 m deep) may have been destroyed in the plowzone. Connect-the-dots postmold patterns are intellectually satisfying, but the lack of such patterns does not negate the presence of structures at a settlement. As noted above, long duration of occupation and subsequent rebuilding in general tend to obscure postmold patterns (Dancey 1992a). The clustering of postmolds in a specific zone within
Figure 5. Settlement layout from Murphy site, Licking County, Ohio
the settlement space is critical to this interpretation. A dense cluster of chert debris was located northeast of the other domestic activity zones, along a slight slope edge. This cluster has a crisp spatial pattern which was defined during both surface and subsurface investigations, despite a long history of agricultural disturbance. The pattern can be described as a "bull's eye". These surface patterns delineate systematically created refuse deposits, at least for chert debris (Fuller 1981; Pacheco 1988; Dancey 1991; 1992a). Unfortunately, organic animal refuse was not preserved at Murphy, and organic plant refuse was only preserved in remnant features, so it is not known to what degree chert debris was associated with organic refuse. The area southwest of the postmolds (see Figure 5) contained only one feature and had a low density scatter of debris. Yerkes' (1990) identified use-wear traces on several tools from this area, suggesting that it may represent an open yard where work activities were carried out on a day to day basis.

Structural Remains of Li.79 #1

The investigation of Li.79 #1 by Hale (1980) represented a disjointed reconnaissance and salvage effort prompted by the extension of Route 79 through Newark/Heath, Ohio. No systematic surface data were collected, and excavations consisted of discontinuous, mechanically stripped blocks focusing on hand excavation of exposed feature remnants. The spaces between features were almost entirely ignored, and it is not clear if there was a formal refuse deposit in the settlement space. Exposures at Li.79 #1 consisted of three
excavation blocks north of an unnamed alley, and four excavation blocks 15 meters to the south, on the other side of this alley. Approximately half of the total area (0.65 ha) encompassing all of these excavation units was investigated, but the number of unexposed features is difficult to assess because of the generally scattered nature of the settlement layout. A total of 23 features, 13 of which were postmolds, were examined by Hale (1980).

Two of the three excavation blocks north of the alley contained one pit feature each. The single pit in the farthest north unit (Feature 1), was a shallow hour-glass shaped pit lined with pebbles and containing intentional layers of mica sheets. A radiocarbon date of A.D. 310 ± 90 has recently been obtained on charcoal from this feature (Lepper and Yerkes 1993:12). The other block contained a shallow basin-shaped pit (Feature 4), which contained no diagnostic materials.

The largest excavation block north of the alley contained 11 postmolds and 6 pits (Figure 6). The postmolds forming a rough sub-rectangular arc (Hale's House, cf. Lepper and Yerkes 1993) were associated with a hearth (Feature 9) and a prepared clay floor, both of which were devoid of artifacts except for one flake on the floor. This hearth may have been intruded into by a shallow postmold which Hale (1980:45) felt may be associated with a semi-circular arc of postmolds overlapping the other structure. Feature 8 is a shallow pit or hearth possibly associated with this semi-circular arc of posts, but also containing no artifacts. A large irregular pit (Feature 3) is situated southeast of the sub-rectangular arc of posts. The
Figure 6. Settlement layout from L.i.79#1 site, excavation block containing "Hale's house" (adapted from Pacheco 1988), Licking County, Ohio
feature may represent a Middle Woodland refuse/storage pit. This interpretation is based on the presence in the feature fill of diagnostic mica, ceramics (including 4 sand-tempered, simple-stamped sherds) and bladelets (including 1 Knife River and 17 Wyandotte chert specimens), and lack of evidence for use as a cooking feature (Lepper and Yerkes 1993). The base of an Archaic projectile point was also recovered in this pit (Hale 1980). Feature 3 intrudes into the prepared floor of "Hale's House", suggesting it was dug after use of the sub-rectangular structure, possibly truncating additional postmolds that would have completed a rectangular single-post structure (Lepper and Yerkes 1993:11). Furthermore, a postmold was identified intruding into Feature 3, suggesting an additional post-refuse pit occupation, possibly of historic origin (Hale 1980) or possibly related to the semi-circular arc. North of the sub-rectangular arc, was a circular basin-shaped pit (Feature 2) which Hale (1980:46) felt was a Middle Woodland storage facility. It contained mica, bladelets, and a corner-notched projectile point. A single postmold is located near this feature. None of the postmolds contained diagnostic artifacts except for mica in the post intruding into Feature 3. Directly adjacent to Feature 3, was a deep circular pit (Feature 10), devoid of artifactual remains, but containing charcoal radiocarbon dated to 720±70 B.C. (Lepper 1988:127). Reddened clay and abundant charcoal suggested to Hale (1980:47) that this was a cooking feature. Another shallow pit (Feature 11) is located west of Feature 10, but it also contained no diagnostic artifacts.
No features were identified in two of four excavation blocks south of the alley. The other two blocks contained two features each. The block on the east, directly south of both possible arcs of postmolds, had two pit features in it (Features 15 and 16), both of which had mica, cordmarked ceramics, and bladelets. Charcoal from Feature 15 was radiocarbon dated to 105 +60 A.D. (Lepper 1988:127), confirming Middle Woodland origin of these two features. The excavation block to the southwest contained two shallow pits or posts, both of which lacked cultural material. These two features had been preserved under a historic house foundation.

Thus the occupation area of Li.79 #1 is quite confused, lacks clarity, and has much overlap of features. It is not clear, for instance, if sub-rectangular arc of postmolds represents a truncated rectangular structure or an open wind-break, or even what time period it was built. Because of the intrusion into the floor of the sub-rectangular structure by a Middle Woodland refuse pit, this structure pre-dates at least one Middle Woodland occupation. Most likely the semi-rectangular structure relates to a Late Archaic-Early Woodland camp associated, based on proximity, with Feature 10, and possibly associated with Features 4 and 11. The possible semi-circular arc of postmolds may be younger than at least one Middle Woodland occupation (if the postmold intruding into Feature 3 is part of the arc) or may be unassignable to time period. It is also not clear to what extent the features south of the alley are connected to those north of the alley. If the radiocarbon date can be extended to other features it is at least probable that most Hopewellian features date to a single
second century A.D. occupation, characterized by scattered features, and perhaps a structure. Feature 1, located 15 meters north of "Hale's House" along the terrace edge, is Middle Woodland in origin, but may be totally unrelated to the other Hopewellian features altogether, based on the mica layers and the younger radiocarbon date.

Discussion

Comparison of the two settlement layouts at this level of detail reveals little similarity between Murphy and Li.79 #1. A shorter relative duration could account for fewer features at Li.79 #1, but unlike Murphy, Li.79 #1 lacks a clear delineation of space. While there was little feature overlap at Murphy, there was considerable overlap at Li.79 #1, representing stratigraphic evidence for as many as four separate occupations. The features at Li. 79#1 are scattered, rather than clustered, and one of these may have been ceremonial (Feature 1). There is also no clear refuse deposit, although one may have been missed (which seems highly unlikely since refuse deposits are indicated by high density concentrations of artifacts). Feature 3, however, may represent systematic refuse disposal, but at a smaller scale than the Murphy refuse deposit.

While direct comparisons of the assemblages are difficult, it is clear that Li. 79#1 has a higher frequency of artifacts made out of non-local material than Murphy. However, the specific kinds of exotic materials are present at Murphy in lower frequencies. The records from these sites are not as similar as Yerkes' has suggested. Although domestic activities seem to have been performed at both
settlements, the context of this domestic activity appears to be different. It should also be recognized that so much of Li. 79#1 was destroyed or uninvestigated that it cannot be ruled out that complimentary zones of feature types or activity areas did exist within the settlement space. Therefore, it is also possible that Li. 79 #1 represents a dispersed sedentary domestic unit similar to Murphy, only much closer to the center.

Conclusion

The weight of evidence and argumentation favors interpretation of Ohio Hopewell dispersed domestic units as sedentary settlements. Consideration of the Ohio Hopewell niche indicates a subsistence pattern based on intensive localized procurement strategies, including farming, that does not conform to exploitation patterns used by residually mobile groups. Furthermore, the location of apparently vacant ceremonial centers in relationship to probable domestic settlements supports interpretation of these clusters of settlements and centers as the remains of dispersed sedentary communities. A pattern of residential mobility during the Middle Woodland also fails to conform to territorial boundaries marked by mounds and earthworks. Many arguments suggest that Yerkes' use of microwear analysis as an interpretive tool for identifying seasonality and duration at Ohio Hopewell settlements was inappropriate. Finally, consideration of structural patterns for sedentary versus seasonal settlements suggests that settlements such as Murphy are sedentary domestic units rather than seasonal encampments.
Archaeological Properties of the Ohio Hopewell Settlement Pattern

A settlement pattern composed of dispersed sedentary Ohio Hopewell hamlets can be expected to produce redundant archaeological traces, since each hamlet represents the maintained space of similar domestic units. The actual arrangement and number of structures, features, and refuse areas at each hamlet are not expected to be identical since individual histories are different; however, the pattern is generalizable.

Smith's (1987a; 1992) synthesis of available domestic data from Hopewellian traditions in Illinois, Tennessee, and other areas suggests a repetitive pattern of dispersed sedentary household units farming Eastern Agricultural Complex crops in gardens across the Eastern Woodlands. Based on these data, Smith presents a model of the kinds of archaeological remains that might be excavated from a Hopewellian household unit. His model fits the structural arrangement of the Murphy site. Likewise, in general it can be extrapolated as a general model of the settlement layout of Ohio Hopewell hamlets.

Major components of Hopewellian household units are: 1) structures large enough for 5-13 people with internal hearths and possibly storage pits; 2) external zones or clusters of pit features such as earth ovens, storage pits, hearths, and shallow basins; 3) scattered postmolds representing wind breaks, meat racks or other types of small pole constructions; and 4) refuse dumps often found accumulating on slopes such as gullies or terrace edges. If a given domestic unit is composed of more than one contemporaneous household
unit there may be evidence for additional structures and possibly other components of the settlement model, although feature zones and refuse dumps may be shared.

Beside Murphy, currently documented probable Ohio Hopewell/Middle Woodland domestic settlements with sufficient excavated evidence of settlement layout to critically address these criteria include: the Jennison Guard site (Kozarek 1987; 1992); the Twin Mounds Western Habitation area (Fischer 1971; Hawkins-Bennet 1986); the DECCO site (Phagan 1977; Dancey 1992a); the Marsh Run and Ford sites (Aument 1992); the Wade site (Church 1989; 1992); the Grimes site (Brose 1982); the Dow #2 site (Pacheco 1988; Pacheco and Dancey 1989); the Murphy III site (Pacheco 1991); and the Cox site cluster (Morton and Carskadden 1987; Carskadden and Morton 1992). In general, the settlement layouts for these settlements conform to the expected pattern of dispersed sedentary domestic units; these are all examples of Ohio Hopewell hamlets.

Logistical or short-term activity areas that support these dispersed sedentary domestic units are expected by the model to be located in the community space between residences. The archaeological properties of these activity areas can be expected to vary according to the specific activity performed, the range of which is not currently well explored. As Binford (1982:371) notes, in societies with minimal residential mobility (i.e. when territories are fixed and group movement is limited) the archaeological trace of the settlement system should be characterized by greater intersite variability among special purpose localities. Garden plots, for instance, should lack
evidence of structures, pit features, and refuse disposal. Scattered
discarded artifacts representing land clearing and plant processing
should be present. Tool retouch in such areas may have occurred, but
primary production would likely be concentrated at hamlets. Hunting
camps may contain structural remains of hearths, drying racks, and
other small pole constructions, but no substantial structures, zones
of cooking and storage features, or evidence for systematic refuse
disposal like dumps. Tool assemblages from hunting camps should
emphasize the hunt (i.e. hafted bifaces), and meat/hide processing
activities (i.e. scrapers). One possible example of a logistical
Middle Woodland hunting camp is Jonah's Run site (Brose and White
1979). Several Middle Woodland rockshelter occupations, such as:
Stanhope (Grunwald 1980); Rais-Swartz (Shane 1971); and Knight Hollow
(Felumlee 1984) are also good possibilities for logistical hunting
camps.

Specialized camps of many varieties, including those for the
production of Hopewellian paraphenelia out of exotic raw materials,
may contain structures and features, but these will not have the same
characteristics as in domestic contexts. Cooking features and storage
pits will probably be lacking as was shown for the Seip and Mound City
workshop structures (Baby and Langois 1979; Brown 1982). These
workshops areas are permanent locations, but nobody lives at them on a
sedentary basis. Assemblage composition is expected to provide the
means of separating specialized camps/workshops from domestic
locations. Such assemblages should be characterized by high
quantities and qualities of exotic materials representing production
of Hopewellian artifacts, probably involving use of Ohio Hopewell bladelets (Prufer 1967; Baby and Langois 1979; Parry 1992; Smith 1992). Short-term specialized camps are expected to have similar specialized assemblages, but debris patterning should be scattered and of relatively low density. The Russell Brown Middle Terrace #2 and Russell Brown Upper Terrace sites (Prufer 1967), and possibly the Stubbs Mill Blade site (Genheimer 1984) are documented locations that appear to conform to such patterns.

Refuse deposits within defined areas of ceremonial centers may be due to periodic site maintenance of places like dance plazas or feasting areas. Such behavior would follow from the desire to keep the ceremonial center free of accumulating refuse, in anticipation of future activities. In Ohio Hopewell contexts, many earthwork complexes have interior or exterior ditches that may have functioned as refuse disposal areas following ritual cleaning. Evidence for such cleanings may be documented at Mound City (Brown 1982), Seip (Baby and Langois 1979), and Fort Ancient (Connolly 1991). Ethnographic records show that members of dispersed Mapuche communities coordinate ritually cleanings of spaces within ceremonial centers, both before and after ceremonies, to remove any socially identifiable objects that might be affected by evil forces (Dillehay 1992:394). A practical consideration is to protect dancers and performers feet from being cut by sharp objects. At one of the active Mapuche ceremonial centers, refuse from ritual cleaning is discarded in a pit connected to the main burial mound by a causeway flanked by the "arms" of the ceremonial field (Dillehay 1992:406).
Working Hypotheses for Analysis of Ohio Hopewell Settlement Patterns

Introduction

The most significant problem for recovering Ohio Hopewell settlement data concerning the archaeological properties outlined in the previous section is the heavy reliance by archaeologists on excavation as the primary data recovery technique to solve archaeological problems. Excavation is both costly and time consuming, and rarely capable of producing data on a large enough spatial scale to address community patterns. The main problem with excavation techniques stems from over-emphasis on site oriented archaeology (Dunnell and Dancey 1983). The solution to this logistical and analytical problem is the use of "siteless survey" and complete systematic surface collection, a theoretical and methodological approach which produces larger samples for less cost with greater spatial coverage (Dancey 1973; 1974; 1981). Siteless survey also provides the community scale spatial data necessary to address the Ohio Hopewell settlement pattern problem. The archaeological record is defined as a continuous distribution of artifacts across the landscape with variable densities (Dunnell and Dancey 1983). Thus, artifact distributions become the focus for analysis, replacing the site as the analytical focal point. Artifact distributional variability is sampled across the landscape rather than within the confines of a specific trench or block. Most excavations produce data equivalent to point samples which have doubtful extrapolation value, whereas complete surface collections sample all areas of artifact clusters evenly (Lewarch and O'Brien 1981a).
Severe site formation processes have affected the majority of the Ohio Middle Woodland archaeological record, including secondary deposition from cultural and natural processes. Because most Ohio Hopewell hamlets are on well drained soils suitable for gardening, modern agricultural plowing is the most likely cultural process to have significantly influenced the patterns of refuse disposal. Degree of plowzone distortion is variable and must be incorporated into research designs and analysis, however, in general plowing does not seem to destroy sharp contrasts in artifact densities (Fuller 1981; Pacheco 1990). Refuse deposits already represent secondary deposition prior to plow disturbance.

The plowzone matrix can be treated as a continuous distribution of cultural materials with properties of artifact density per unit volume and surface area. The plowzone matrix represents soil which has been churned by the plow, possibly mixing together once separable cultural remains from multiple non-contemporaneous episodes of past human activities or occupations. Plowzone assemblages minimally represent conflated views of all human activities in a particular matrix space; with similar activities assumed to produce consistent or uniform assemblages. Plowzone artifact assemblages can be estimated by sampling the matrix volume or the exposed surface.

Working Hypotheses

To address the Ohio Hopewell settlement pattern problem as laid out in Chapter I, I have formulated working hypotheses to generate a research design in order to collect Ohio Hopewell intracommunity
settlement data using systematic surface survey techniques. The working hypotheses were deduced from several independent sources including: extension of Prufer's Vacant Center Model; Fuller's research on village nucleation processes; and generalizations about the structural properties of the Ohio Hopewell settlement pattern. In addition, the site plan and assemblage composition of the Murphy site influenced the hypotheses (Dancey 1991). Some of the working hypotheses, initially referred to as "Correlates of the Hamlet Hypothesis", were presented prior to the fieldwork as a research proposal (Pacheco 1988:92-94).

The working hypotheses concerning expectations about the archaeological properties of Ohio Hopewell hamlets can be restated as:

1) Hamlets will be small in size, with a unimodal size distribution.
2) Hamlets will have functionally redundant assemblages, representing the general day to day activities of the domestic unit.
3) Hamlets will be structurally redundant, consisting of a repetitive pattern of maintained activity zones. Refuse dumps are characterized by sharply defined (uninodal) high density clusters of debris.
4) Hamlets will be spatially dispersed, but clustered around earthwork or burial mound complexes.

To these I would add the following working hypotheses concerning the expected archaeological properties of Ohio Hopewell logistical or short-term activity areas:

1) Logistical or short-term activity areas will be smaller than hamlets.
2) Logistical or short-term activity areas will have functionally diverse assemblages related specifically to the activity being performed.

3) Logistical or short-term activity areas will be structurally diverse relative to the activity being performed. In general settlement layout will consist of scattered debris patterns rather than high density maintained refuse deposits.

4) Logistical and short-term activity areas will be located between hamlets and in peripheral uplands away from hamlets relative to the location of the resource being procured.

Additionally, the following working hypotheses concern the expected archaeological properties of Ohio Hopewell specialized camps:

1) Specialized camps will have variable sizes relative to the size of the group participating in the activity and the location of the camp, thus, some specialized camps will be relatively large when compared to hamlets, and some may be much smaller.

2) Specialized camps may have functionally distinct assemblages related to the production of Hopewelian paraphernalia, including a high frequency of blade-core industry usage and debris, however, temporary encampments at ceremonial centers by dispersed domestic units are specialized camps with assemblages similar to hamlets, with evidence for multiple general domestic activities.

3) Specialized camps will have variable structural characteristics relative to the permanence of the camp within the settlement system. Some camps may represent maintained workshops, while
3) continued ....

others represent temporary encampments of visiting domestic units. There should be little evidence for structural rebuilding, but feature overlap should be common, representing separate occupations of the camp. Debris patterns should in general be scattered and light, because most camps are short-term. Formal refuse deposits may be expected to occur at non-habitation locations or structures permanently maintained in the settlement system for repetitive workshop functions.

4) Specialized camps will be located primarily within or near earthwork and mound centers, although these may occasionally be established at source areas of raw materials used in craft-workshop activities.

Discussion

Further discussion beyond that presented elsewhere is required to clarify the intent and meaning of these working hypotheses, especially in relation to the role that they play in the interpretive framework of this study. Post-research refinement of working hypotheses is acceptable only to the extent that the major purpose is clarification of intent, and not to replace the hypotheses with terminology that accommodates exceptions to the pattern. The four initial hypotheses as stated were testable by the results of the analysis of the data generated and collected by the research design. Similarly, excavations can be considered an independent test of the working hypotheses. Observation of settlement pattern data contrary to the
properties of dispersed sedentary hamlets and their associated settlement types falsifies the hypotheses.

For example, a settlement pattern of nucleated villages, such as those present in the early Late Woodland of central Ohio, would possess archaeological properties that are the obverse of a hamlet pattern (Pacheco 1988; Dancey 1992b). The archaeological properties of the early Late Woodland Water Plant site in Franklin County provides a striking example of a settlement type which would falsify the hypotheses if discovered in Hopewell context (Dancey 1988; 1992b). Water Plant is a nucleated village encompassing 3.5 ha, and is surrounded by an earthen fortification. Evidence suggested approximately one dozen domestic units within the spatially defined village that were structurally and functionally redundant.

The working hypotheses also need to be operationalized for use with systematic surface collected data. Small size is based on the measurement of the spread of artifacts on the surface using artifact density to define clustering and spatial association. Functional redundancy is measured by examining the variability in artifact assemblages from defined clustered and non-clustered areas. Artifacts from different time periods can be partitioned out of the analysis, however, remaining assemblages are conflations of all refuse producing activities from the period of interest, plus possibly residuals from other components. Structural redundancy of the settlement layout is measured by comparison of the patterned arrangement of artifact distributions. Refuse deposits, as previously argued, should contain high densities of artifacts and have
crisp spatial parameters. Hamlet clustering around earthwork/mound centers is measured from community level data and inferred locations of hamlet residences.

Identification of activity areas and specialized camps is predicated on a clear contrast with hamlet residences. Short-term activity areas would presumably be smaller on average than hamlets because they represent activities performed by some segment of a single domestic unit, however, some types of specialized camps may be much larger than hamlets because they represent areas where large numbers of people from multiple domestic units congregated. Logistical or short-term activity areas should have little evidence of discrete, maintained spatial zones because of the lack of expected future use of that particular space. Artifact assemblages should vary at these locations depending on the types of activities involved, but surface artifact density should be slight with a scattered distributional pattern. Evidence for primary lithic production should be lacking whereas evidence for tool maintenance or tool resharpening might be common. The spatial distribution of short term activity areas has also be specified in contrast to the dispersed hamlet pattern. Short-term activity areas will be located between hamlets (ie. garden plots) or away from hamlets in peripheral uplands (ie. hunting camps), whereas specialized camps will be in the core areas within or near ceremonial centers.

The redundancy standard for size, structural, and functional patterns, is aimed solely at pattern recognition. There is no implication that redundancy means lack of variation. Hypothetically,
one hamlet may be spatially larger than another hamlet, having been occupied for a longer period of time, and possessing a larger potentially more diverse assemblage (Dancey 1992a). Each hypothetical settlement would still be identifiable as a hamlet because of overall small size, evidence for maintained space such as feature zones or refuse deposits, and assemblages which represent the generalized daily activities of economically independent dispersed domestic units. Hence, the repetitiveness of the pattern can be said to be redundant, not the exactness of each hamlet to another. Variability is expected because the life history and duration of each settlement are unique.
CHAPTER IV
RESEARCH STRATEGY - METHODOLOGY

Selection of Study Area

Having been intermittently involved with the Murphy excavations (or Murphy I as it will be referred to hereafter), as a volunteer (1983-1985), I became associated with the Licking County Archaeology and Landmarks Society (LCALS). Upon narrowing my research interests to Ohio Hopewell settlement patterns, the opportunity presented itself to utilize the resources of LCALS. Expansion of the Murphy Project to include systematic surveys on the approximate 81 ha property owned by the Murphy's, was the logical location for systematically testing and applying the implications of the Vacant Center Model as outlined in Chapter III. As shown in Figure 7, Murphy I is situated within the core area of a Ohio Hopewell earthwork/mound complex, with the local Granville-Raccoon Creek center to the west, and the Newark Earthworks to the east. Hence, the analytical requirement that the survey take place within the boundaries of a former Hopewell community can be safely assumed.

Survey of the Murphy Property to recover distributional information on Hopewell settlement variability was not a complete adventure into the unknown. Several other locations were known to contain Hopewell diagnostics. These had been identified by Margaret
Figure 7. Six miles of the Newark Valley (Squier and Davis 1848), star shows approximate location of Murphy site.

Figure 8. Topographic location of Murphy Property study area, Licking County, Ohio (adapted from Dancey 1991)
Figure 9. Map of study area, showing legal information
MacMinn, a former OSU graduate student, who had conducted limited surveys in 1984-1985 as part of a dissertation project. One of these localities identified by MacMinn is listed under the name SubStanley (33Li233). For consistency, Murphy IV is used herein.

The study area was defined as a 1000 by 500 meter strip, corresponding approximately to the orientation of the Universal Transverse Mercator (U.T.M.) system (Figures 8 and 9). This 50 ha strip includes known Murphy localities. Topography of the study area is dominated by a uniform glacial terrace deposit. Terrace soils have been subjected to post-depositional plowing and intense collector activity, since the mid-1800's (Moorehead 1892). Part of the study area was excluded because of steep, vegetated slopes. A smaller segment of the study area extends onto the Racoon Creek floodplain. Only a single artifact was observed on the floodplain, suggesting it was either not utilized during prehistory, or evidence is buried.

Research Setting

Cultural Context

As noted previously, the Licking Valley can be considered one of three main sub-regions within the core area of Ohio Hopewell. During the Middle Woodland period local communities in this region participated and shared in the Hopewellian world view. These populations constructed earthwork/mound centers in a manner similar to their counterparts in the central Scioto Valley. The Newark Earthworks (Figure 10), in particular, are unrivaled in size and complexity, within the Eastern Woodlands (Lepper 1988).
Figure 10. Map of Newark Earthworks (Squier and Davis 1848), Licking County, Ohio
The Newark Earthworks are located at the geographic center of the Licking Valley, where the three major forks of the Licking River join to flow 47 kilometers east before emptying into the Muskingum River at Zanesville (Figure 11). The complexity of the architectural design of the earthworks and mounds, accomplished at such a grand scale, defies the logic of the Vacant Center Model, straining the applicability of the concept. It is hard to imagine an earthwork complex like Newark as a vacant place, even though the final configuration of the earthwork plan is almost certainly the result of incremental growth (Byers 1987), spanning some 500 years or more. Literal interpretation of the connotation of the word vacant in the model evokes images of "vacant" earthwork/mound centers as infrequently visited holy places, devoid of much evidence for anything but spiritual activities. The Newark Earthworks were certainly more than this, representing the focal point of intense, well organized human labor, and a myriad of social interactions beyond ceremonialism.

My primary argument relies on the position that within the spatial boundaries of the earthwork complex, the property of vacantness refers only to lack of permanent occupancy, not lack of evidence for a diverse variety of corporate activities. According to the model, Newark is not a population center in the manner of a nucleated town or city. The population is not distributed as a high density urban clump within the limits of the earthworks, surrounded by a scattered rural population. Rather, Newark is more of a population magnet, itself designated space devoid of immediate occupants, but surrounded by dispersed domestic units similar to Murphy I. The
Figure 11. Distribution of known Ohio Hopewell settlements, earthworks, and Woodland period mounds from upper Licking River Valley (adapted from Pacheco 1988)
The key difference between the two residential patterns is the distance or spacing between domestic units. In a nucleated or urban environment, the spacing between domestic units can be very small, while known dispersed Ohio Hopewell domestic units, maintained a distance of at least 100 meters between settlements. These units may have been drawn towards the center, appearing clustered at the regional or local scale (Pacheco 1988:93), yet the entire society is actually rural and scattered.

The Newark Earthworks qualifies as a vacant center to the extent that it integrated the dispersed members of Licking Valley Hopewell communities through centralization of the the interactions that defined and perpetuated the social group. Thus, Newark's primary importance to the Licking Hopewell is as a visible symbol on the landscape which bound together the dispersed population, not the place where most Licking Valley folks lived. Ultimately, our lack of comprehensive excavations or surveys within the boundaries of the Newark Earthwork precludes a complete picture of the settlement variability associated with the complex (Lepper 1988). However, based on available data from the Newark earthwork/mound center, there does not appear to be sufficient evidence for rejecting the application of the Vacant Center Model as a unifying theory for the understanding of Hopewell settlement patterns in the region.

The Licking Valley Hopewell were distributed centripetally away from Newark along the three forks of the valley and along the main trunk (see Figure 11). There were close to two dozen smaller earthworks and upwards of 225 mounds in the Licking Valley distributed
in a variety of topographic locations (Pacheco 1992b). At least three of these other local earthwork centers in the Licking Valley have a high probability of having been constructed during the Middle Woodland period. These are the Granville Circle on Raccoon Creek, the Larimore Circle on the upper North Fork, and the Hazlett Earthworks on Flint Ridge (Pacheco 1992b). Many of Licking Valley Earthworks and mounds, however, are Early Woodland in origin. The practice of mound and earthwork building in the Licking Valley extending through these periods represents evidence for a stable, evolving, settlement system. There is a high density of mounds and earthworks clustered in the Licking Valley when examined at the statewide scale (see Mills' 1914:XI). Within the Licking Valley moundbuilding tradition the ultimate meaning of the terms Adena and Hopewell can only be understood as aspects of a cultural continuum (Pacheco 1992b). Moundbuilding began in the region as early as the seventh century B.C., with a burst of activity in the second century B.C., near the transition from Adena to Hopewell in the region (Pacheco 1991; 1992b). To what extent the Early Woodland settlement pattern in the Licking Valley (or other regions of Ohio that did or did not participate in Hopewellian traditions) conforms to the expectations of the Vacant Center Model is an open question.

It may be conjectured that Newark functioned at multiple scales: as an inter-regional transaction center (Streuver and Houart 1972; Bernhardt 1976); as a regional polity center (Dancey and Pacheco 1992); and as a local community center. The Early Woodland components of Newark probably include the numerous small circles
associated with the larger earthworks (Fischer 1974). The Fairgrounds Circle is probably the initial Hopewell construction at Newark. This large geometric circular encloses the Eagle Mound, an effigy-like conjoined mound, which was excavated in 1928 (Shetrone 1930:265). A large post structure, devoid of numerous burials, was discovered beneath the mound. This structure is analogous to the Great Houses beneath large mounds in the Scioto Valley (Lepper 1988; Pacheco 1988:Figure 3). Greber (1979; 1983) argues that Great Houses functioned at the societal level as integrative structures where important meetings and ceremonies were conducted. The location within the Fairgrounds Circle of the only known Great House in the region suggests an integrative function above the community level.

At some point, the function of Newark Earthworks shifted or expanded to the role of regional polity center and/or inter-regional transaction center. Evidence for clustering of domestic units directly within the supporting region of Newark (see Figure 11), as opposed to only around the smaller local centers, supports this conclusion. The centralized location of the Newark Earthworks and its initial operation as a local community center may have suppressed the development of other local community centers in the Licking Valley. All of the other potential Hopewellian centers in the Licking Valley are at least ten times smaller than the Newark Earthworks. Newark, therefore, represents a classic example of a primate center (Johnson 1977). Primate centers minimize the size of other centers in their region by suppressing competition and providing boundary maintenance for the settlement system (Johnson 1980:173).
Environmental Context

The regional and specific environmental context of the Licking Valley and the Murphy Property study area, respectively, have been described in detail by Seeman (1987) Wymer (1987a) and Dancey (1991). Wymer's descriptions focus on the Murphy locality and include an environmental reconstruction of the local floral community extending from the Raccoon Valley floor northeast into the uplands (Wymer 1987a:80). Her analysis suggests that a diverse number of microenvironments were available within a short distance of the study area. A brief summary of the regional and specific context is provided in this section to establish survey conditions and environmental factors that affected the study, and to define the environmental parameters of the kind of habitats chosen by dispersed Ohio Hopewell domestic units in the Licking Valley.

The valley floors of the main forks of the Licking River are choked with glacial outwash sand and gravel deposits. During the Pleistocene the topography and drainage systems of the region were dramatically altered. The maximum advances of the last two Pleistocene glaciations, the Illinoian and Wisconsinan, halted on or near the Licking Valley, placing the regional topography under diverse and intense geomorphological processes (Forsyth 1966). Prior to the Illinoian glaciation, the Licking Valley system was occupied by west and north flowing tributaries of the Teays River system, which emptied into the St. Lawrence Seaway. At some places, the valley floors are up to 65 meters higher than the Illinoian age Deep-Stage Newark River (Stout et al. 1943).
Late Illinoian and Wisconsinan ice blocks lead to a reversal of the regional drainage system and the creation of the east and south flowing Licking-Muskingum River system that empties into the Ohio River (Bork and Malcuit 1985). Consequently, modern Licking Valley streams, including Raccoon Creek, are underfit to their valleys possessing relatively narrow floodplains incised into the glacial outwash terraces. Raccoon Creek, which drains the study area, is 6-10 meters below the terrace surface upon which the survey was conducted (Dancey 1991:40). This terrace is a Wisconsinan age deposit referred to as the Vanatta Terrace and it can be traced east towards Newark, north along North Fork, and south along South Fork (Forsyth 1966).

The valley walls are composed of eroded sandstones, shales, and conglomerates of the Cuyahoga Formation. Steep slopes, rising 50-60 meters above the valley bottom, define the valley walls of Raccoon Creek, which is about 1 kilometer wide at this point (Dancey 1991:40). Numerous springs are located along the valley margin in permeable sandstones and shales, and these supported small streams that cut laterally across the terrace, before emptying over the terrace edge into Raccoon Creek (Frolking and Lepper 1989). One of these small streams flowed across the study area during prehistory (see Figure 9), prior to the modern containment efforts placing it underground (Wymer 1987a:81-85). The paleostream had a low gradient and was characterized by sluggish marshy places.

Based on the unsystematically collected sample of known Hopewell settlements in the region (see Figure 10), terrace surfaces like those
in the study area were preferred locations for Hopewell habitations in the Licking Valley (Wymer 1987a:80-81). The parent material for the terrace surface is primarily glacial outwash in origin, but includes some erosional material from the uplands. The ridge systems above the study area are covered with a veneer or mantle of Wisconsinan age ground moraine deposits, composed of unsorted tills (Forsyth 1966). The soil association is known as Ockley silt loam, a friable, well-drained soil, suited to crops and moderately acidic (Parkinson et al. 1987; Dancey 1991:41).

All areas of the study area but the slopes have been farmed during the modern era for at least a century. Consequently, there is a distinct plowzone, averaging a fairly uniform 30 centimeters in depth. The terrace surface is mostly flat, sloping to the southeast at a gradient of less than 1% (Dancey 1991:40). The northern margin of the terrace is between 3-4 meters than the southern margin along the terrace edge. Prior to modern clear cutting, the terrace supported an white oak-hickory forest, with an elm-ash-maple association near the stream and marshes. A mixed mesophytic forest association occupied the valley-edge slopes (Wymer 1987a:80).

Field Methods

Selection of Collection Units

Choosing the size of collection units to be used during a survey is based on multiple considerations. Pin-point, three-dimensional locations for surface assemblages provide a wide range of analytical options for studying intra and inter-assemblage variability, but come
at a high cost of time and effort per-unit area examined, that may result in sacrificing coverage (Jermann 1981). The primary considerations governing the choice of obtaining this type of precision are: the density of artifacts in the area of interest; available energy for the field work; the intensity of post-depositional formation processes that have affected the surfaces to be surveyed; and most importantly the analytical questions being explored.

For the purposes of the survey, the most important requirement was obtaining relatively complete coverage of all accessible portions of the study area, including a representative sample of the archaeological record pertaining to the Middle Woodland occupation of the Raccoon Valley. For this reason, the object of interest was not to collect a sample of specific sites within the study area, but the block of land itself and the distribution of artifacts on the surface of the land (Dunnell and Dancey 1983). Whether or not artifacts are distributed into what traditionally are called sites is informative, but not critical to success or failure, since low density dispersed artifacts can be attached meaning through the working hypothesis equally as well as clustered areas. I conceptualize the research strategy as attempting to take a slice of space from within the boundary of the local Middle Woodland community (visualize a transect through the core area of Figure 2). How that space was utilized, whether for households units, isolated activities, or not at all, is the knowledge desired.
Prior to the survey, I had important information about the Murphy study area, some of which has been alluded to in other discussions. MacMinn had documented at least four other dense artifact concentrations on the property that had Middle Woodland artifacts in the surface collections. I suspected that prehistoric artifacts, especially lithics, were scattered across the terrace surface, but I did not know at what density. Therefore, the possibility existed that I would encounter large numbers of lithic artifacts on the survey. Since the gently sloping terrace surface had been subjected to intense modern agricultural activities, precise locational information in this situation would document the cumulative movements of the artifacts over time from their context of deposition. Hence, precise locations have little likelihood of recording useful contextual information.

Experimental and empirical studies of the lateral movement of artifacts by modern agricultural plowing techniques have found an average distance of between 1 and 2 meters cumulative per item (Roper 1976:373-374; Lewarch and O'Brien 1981b; Odell and Cowan 1987:468). The latter study was a formal experiment, and at the time the experiment was terminated, the mean distance was continuing to rise. However, projection of Odell and Cowan's data suggests stabilization of the average lateral movement per artifact at definitely less than 3 meters. They argue that size of the artifact did not affect the distance moved (Odell and Cowan 1987:474), although others have postulated that size is positively correlated to lateral displacement (Lewarch and O'Brien 1981b). There is a distinct "size effect" for
vertical movement within archaeological deposits, with larger items rising to the top of deposits at faster rates than smaller items (Baker 1978), but this effect may decrease with repeated tillage (Odell and Cowan 1987:464).

Collector activity is an independent factor impacting the representation of large items in surface assemblages, since collectors disproportionately remove large objects in excess of their frequency (Odell and Cowan 1987:464). Surface collecting following fresh plowing can be expected to dampen collector biases, since new objects are brought to the surface each time an archaeological deposit is plowed. However, because the collector activity represents sampling without replacement, there is no solution or avoidance of biased collections in heavily collected areas. The best that can be done is to note regional collection patterns and preferences. In our area of Ohio, ground stone, projectile points, and other recognizable chipped stone tools are preferred collectibles, based on my own experiences with large local surface collections. Hopewell bladelet cores are coveted objects, but rarely are bladelets collected unless they are complete specimens.

Taking into account the various issues discussed, unit size for the survey was set at 4x4 meters. This provides 31,250 possible units within the study area. Units are designated by approximated U.T.M. coordinates for the southwest corner of the unit, providing each and every unit with a unique easterly and northerly identification. It was felt that 2x2 meter units, which provide four times the precision of 4x4 meter units, would lead to spurious
aggregation patterns due to lateral displacement. Units 3x3 meters in size are difficult to manipulate, hence the choice of 4x4 meter units. An approximation of the U.T.M. grid was extended onto the ground by establishment of the corner of the 500 meter block (373000 east; 4435500 north) at the stone monument near the intersection of Jones Road and Granville Road (see Figure 9). All objects are provenienced to the southwest corner of the nearest 4x4 meter unit. The trade-off between loss of spatial information and relative ease in collection of 4x4 meter units was considered reasonable. The resolution of surface concentrations is preserved by the larger units, but inferences about specific places cannot extend beyond general locations of broad activities. Precise functional inferences are unavailable (and unnecessary to address the research problem).

Field Survey

The survey was conducted during the spring months of 1989 and 1990, following fresh plowing of the terrace surface in early April of both years. The farmer did not practice the no-till farming soil conservation technique - to the benefit of my research. Surface collections began in April both years, continuing through June. Both years had ample rain that both aided and impeded the survey work by improving artifact visibility and washing out field days. Odell and Cowan (1987:465) have noted that spring is the best overall season for surface collecting, as intuitively most archaeologists would agree. Surface visibility decreased in the later part of each field season associated with crop growth (corn in 1989 & soy beans in 1990).
During the 1989 field season, labor was provided for the survey by volunteers from LCALS, the Department of Anthropology at Ohio State University, and one student from the Dennison University summer apprenticeship program. During the 1990 field season, labor was provided again by volunteers from LCALS and OSU, and also by students from the Bloomsburg University summer field school, directed by Dr. Dee Anne Wymer.

For the purposes of the survey, surveyors were directed to collect all observed artifacts. Artifact was situationally defined as any human modified chert material readily visible to the human eye. Practically, this ad-hoc field definition results in the recovery of chert artifacts $\geq 5$ square millimeters (about 1/4" diameter), equivalent to typical screening techniques. The definition also prohibits surveyors from crawling around with their noses on the ground, promoting a walk and bend-over technique which increased collection efficiency and coverage.

The surface visibility of an artifact is influenced by various factors such as color, light, surface cover, and size (Schiffer 1972). Most of these factors tend to balance out across individual surveyors, but size of the artifacts observed and collected by individual surveyors can be variable, introducing biases into assemblage composition. This sort of individual bias is difficult to control, although one possibility is conducting all systematic surveys with the same people (Genheimer 1984 used this approach). The flip-side of this solution, is that placing severe constraints on labor can limit coverage. My solution to this problem, was never to turn down
volunteer help, and to compose crews with a mix of inexperienced and experienced people. Rarely did the same individual collect adjacent units, helping to spread out potential biases and providing a consistency test by comparing adjacent units collected by different surveyors.

Only in one instance was a consistent bias by a crew member noted, and that was against the smallest class of artifacts, during the Murphy VI surface collection. Otherwise, I will maintain that a high degree of consistency was achieved during the survey. High density units are adjacent to each other, and spatial parameters for uninodeal patterns are crisply defined (presented in detail in Chapter V). Probably this is because the task of surface collecting modified cherts, against a uniform plow surface within a defined space, is not difficult to learn. Human modified cherts have angular and textural qualities not present in unmodified terrace gravels. Consequently, modified cherts, especially colorful Vanport chert, or dark blue Upper Mercer cherts, are easy to identify in the field. Pebble cherts, Columbus-Delaware chert, and to a limited degree Wyandotte chert, because of earth-tone coloring, were not as readily identifiable in the field. Sincere, but inexperienced volunteers, can achieve similar collection results to experienced surveyors within a few minutes of learning how to surface collect. One rule which improves the learning process is to have surveyors collect anything that is questionable or marginal, allowing lab sorting and cleaning to make final decisions.
Artifacts were collected with one of three techniques based on the density of artifacts in an area as defined by preliminary walkover reconnaissance surveys in April of both years. Dense clusters of material were collected using grid-blocks of 4x4 meter units, established by 50 meter cloth tapes oriented along the approximated U.T.M. grid base. The intention of the survey was to completely collect, or "vaccum" units in a systematic fashion. Typical gridded collection blocks were 40x40 meters in size, composed of 100 units. Metal pin flags were used to establish unit corners. A total of 14 blocks comprising an area of 16,518 square meters were collected with this technique, accounting for 12,849 artifacts (see Figure 12). All the areas collected with the block technique (but Block 10 from Cluster 1) are within the boundaries of the named clusters; Murphy III/IV/V/VI. Two of the collection blocks were excluded from the study. Block 3, when mapped, lies west of the western margin of the study area. Artifacts collected from this unit were included with the assemblage variability study, but the block was not used for surface distribution maps. Block 8 was rejected because of problems involved with setting-up the grid-block on the ground. The area within this block is located on the south margin of Murphy IV, near the paleostream. Density of recovered artifacts was low, so little information was lost. Collection units were labeled consecutively with a prefix identifying the collection strategy. For example, unit designation B1U22 equals Block 1, Unit 22.

A 520 square meter block from the center of the highest density concentration of artifacts at Murphy I was included in the study,
Figure 12. Map showing collection areas
providing an additional 3772 artifacts. This area had been systematically surface collected using a grid composed of 2x2 meter units by Cowan and associates during the initial survey of Murphy I in 1981 (Cowan et al. 1981). The collection strategy employed by the Cowan group is the equivalent of the strategy I employed, justifying inclusion of this collection in the study, and allowing comparison to the Murphy I assemblage. Surface distribution maps were not made of this collection because it is within the Murphy I "bulls-eye" (see Dancey 1991: Figures 22 & 23).

Transects spaced at arms length between surveyors were walked over the remainder of the accessible portions of the terrace surface within the study area. Metal pin flags were placed at the location of any observed artifact (cf. Dancey 1974). After a sufficiently large area had been surveyed and flagged, moderately dense artifact clusters were identified. Clusters were collected by centrally staking an iron rod within the concentration of flagged artifacts. The location of each artifact or group of artifacts (within 4x4 meter areas) was measured with a 50 meter cloth-tape and compass. Coverage was improved by systematic searches of areas between pin-flagged artifacts. Ten clusters (Cluster 1-10) were collected in this manner, covering approximately 10,932 square meters, and accounting for 561 artifacts (see Figure 12). Cluster 9 was partially rejected in the laboratory because of difficulty in re-establishing the original cluster datum used during the fieldwork. Portions of Cluster 9, including the densest concentrations of artifacts, were subsumed into Murphy VI, based on spatial proximity.
All remaining flagged artifacts, in the Intercluster Space, representing what would typically be called isolated artifacts, were collected with triangulated compass readings to places on the master grid. Areas around these isolated artifacts were searched to approximate 4x4 meter units. Approximately 265,000 additional square meters were examined and collected in this manner, accounting for 196 artifacts. About 30 ha were systematically examined and collected with one of these three survey-collection techniques, covering over half of the defined transect.

Based on the areas collected by each technique during the survey, we can metaphorically characterize the archaeological record within the study area as a vast mostly featureless plain, punctuated by occasional dispersed peaks (some very tall). The archaeological record of this particular transect is especially composed of high density clusters of artifacts that traditionally match the definition of sites, despite the study being oriented to collection of spatial data representing any number of possible distribution patterns. Yet, the inapplicability of the site concept to the data collection strategy is evident as smaller and smaller spatially discrete clusters of artifacts are considered. If the definition of site is strictly applied, then literally hundreds of small discrete sites were identified during the survey. Sites are not physical entities of the archaeological record, they are arbitrary constructs of the archaeologist dividing up distributions of clustered artifacts in spatially defined areas.
Analytical Methods

Defining Assemblages and Clusters

The process of defining assemblages for analysis is a creative one, as opposed to a process of discovery (Madsen 1992:4). The archaeological record in the plowzone is a dynamic product of overlapping, repetitive, and independent, depositional events upon former land surfaces that have become jumbled together by the plow. Multicomponent locations may complicate the situation further by mixing in variation attributable to events separated by possibly long periods of time and radically different land-use strategies (Binford 1983). Thus, surface exposures from plowzone contexts are difficult to translate into single events, making almost all assemblages a sample of the sum total of events that occurred on a location.

Plowzone surface survey can be considered a hopeless cause. In actuality surface collection has proven itself in a variety of research designs, especially regional land-use studies (Lewarch and O'Brien 1981a:313-315; Schlanger and Orcutt 1986). As long as recurrent patterning in surface collections can be attributed to a specific cultural system, rather than to formation processes, surface data has potential to solve archaeological problems (Dancey 1973; 1974; Lewarch and O'Brien 1981a; Dunnell and Dancey 1983). For instance, complete overlap in sequential occupations are rarely isomorphic. In these situations, surface collection is a proven technique for sorting out the multiple occupations (Redman and Watson 1970).
Delineating spatial artifact clusters is also a creative process, although clusters may be said to have a firmer empirical basis. For example, if the total number of artifacts collected during a regional survey is depicted at the level of individual collection units, clusters tend to be self-evident nodes or peaks against the general background of low density or empty intercluster space. By possessing this attribute, artifact clusters can be described as a discoverable phenomena. Only as you decrease scale and increase resolution does the creative process enter into the equation. In other words, the forming of cluster boundaries requires human input that is not self-evident.

The basic archaeological approach to definition of surface assemblages and clusters is the rule of spatial proximity (Madsen 1992). The assumption underlying this rule is that objects discovered near each other potentially derived from the same event or set of events. Plowzone surface assemblages are created from those artifacts clustered together in space. Creativity enters the process through partioning of samples to isolate artifacts from the period of interest, defining areal boundaries, and identifying the associated assemblage. Acceptance of the fact that assemblages created in this manner probably stem from the remains of palimpsests of separate, displaced, depositional events, places limits on the types of conclusions that can be drawn from plowzone surface data. Microfunctional reconstructions are probably not possible with plowzone surface data, while identification of refuse areas should be possible, since these are produced by repeated systematic disposal.
Assemblages and clusters were created from the surface collected data based on four rules: spatial proximity of positive 4x4 meter collection units; obtaining statistically valid sample sizes wherever possible; identification of Hopewell/Middle Woodland diagnostics; and partitioning of the samples based on chert types (discussed in the next section). The effect of the first rule was to treat each of the areas collected with contiguous grid-blocks as clusters with boundaries established at the margins of collection blocks or where artifact density reached zero for two or more consecutive units. These clusters are named Murphy I, III, IV, V, and VI.

A diverse variety of shapes and sizes could have been defined as smaller, less dense clusters. As a starting point, I began with each of the ten circular-type collection patterns. Of these, only Cluster 4 and 7 were defined as they had been collected in the field. Clusters 1, 2, and 3 are located in an area characterized by a discontinuous low density scatter of artifacts. Many clusters consisting of two or three contiguous positive units could be identified in this area, but sample sizes would be too low to be statistically valid. Traditionally, however, small clusters like these would be defined as sites during cultural resource projects. Cluster 1 and 2 possessed central zones where several contiguous units contained recovered artifacts. Slight adjustments to include nearby non-contiguous units defined boundaries for both of these clusters. Cluster 3 contained few positive contiguous units, and was therefore partially subsumed into the adjacent Cluster 1, with the remainder treated included in Itnercluster Space.
No doubt other analysts might create different, equally valid, cluster boundaries and thereby somewhat different assemblages. However, it is unlikely that the proportional representations of artifact classes for any assemblages created from collections in this broad area would have a significant impact on the results and interpretations of the study. One reason for this assertion stems from the possibility that the 4 ha area encompassing Murphy IV, Clusters 1-3, and a many of the isolated artifacts, was utilized as a specialized camp by members of the local Hopewell community.

Cluster 5 and 8 (collected in separate years) were found to be generally in the same area, upon plotting the surface data. These were combined into a cluster identified as Cluster 5/8 to improve the sample size of the combined assemblage. Cluster 5/8 is a low density scatter, but stands out when compared to the surrounding areas at the scale of the 500 meter U.T.M. block within which it is located (see Figure 12). The areas collected as Cluster 6 and Cluster 10 were dropped from the analysis because of lack of diagnostic Hopewell/Middle Woodland artifacts, leading to a net loss of 63 artifacts.

All other localities identified during the survey contained Hopewell bladelets. A number of bladelets were also recovered in Intercluster Space, which is independent evidence for the permanency of the Middle Woodland local community settlement system in the lower Raccoon Valley. This discovery also suggests that the primary goal of the survey, to obtain a transect from within the boundaries of an Ohio Hopewell community, was successfully achieved.
The only other remaining area collected with the circular collection pattern was labeled Cluster 9, located in the approximately 100 meter space between Murphy VI and Murphy V. As previously noted, trouble with re-establishing the datum for this cluster lead to the rejection of this particular collection. However, much of the collection was salvaged by incorporating units adjacent to Murphy VI into that cluster. One non-Middle Woodland projectile point was plotted into this area as an isolate.

The final issue to consider in this discussion of the creation of the assemblages and clusters, is the extent to which the surface samples are valid estimates of the proportional representation of artifact classes in the plowzone. Some potential biases have already been alluded to which can affect population estimates. These included: collectors removing selected classes of artifacts such as diagnostics; visibility characteristics of the surface in relationship to the aspects of artifact size and color; the "size effect" which can lead to the overrepresentation of larger artifacts; and variations between the abilities of individual surveyors to completely recover all artifacts from a surface exposure. Each of these type biases can cause misrepresentations of particular artifact classes.

The proportion of the plowzone artifact population represented on the surface has been estimated to stabilize after repeated tillage at around 5% (Lewarch and O'Brien 1981b:45; Odell and Cowan 1987:460). Even complete coverage with skilled field workers can at best only hope to approach collection of all exposed artifacts. Realistically,
therefore, field samples will represent less than 5% of total plowzone artifact populations. Likewise, because complete collection strategies represent sampling without replacement, subsequent collections will not necessarily replicate the first complete collection of an artifact cluster (see Ammerman and Feldman 1978).

Sample size of the recovered assemblage also has a major impact on the estimation of surface artifact populations (Jones et al. 1983). Valid estimation of the population parameters can only be attempted if the total sample size is large enough. Unfortunately, estimation of the parameters are not considered statistically valid until sample sizes approach 100 objects, however, 400 or more is considered a more appropriate sample size (Cowgill 1989). Therefore, a quandry exists for the accurate estimation of plowzone artifact populations for which the 5% exposed surface sample is less than 100 objects. Sample size requirements bias archaeological analyses and interpretations towards larger clusters with larger assemblages. In this study, after the adjustments of cluster boundaries, only Cluster 5/8 and Cluster 7 had sample sizes of less than 100 artifacts, implying that all other artifact populations, but these two, are composed of greater than 2000 artifacts.

Partitioning the Unit Chert Samples

Macroscopic examination and use of comparative samples identified the following types of lithic raw material - cherts - from collected units in the study area. The 17,378 recovered artifacts were broken down into the following raw material categories for analysis:
1) Vanport chert (Ohio Flint Ridge) - the local chert source, quarried from beds in southeast Licking County, occurs in a wide range of colors (Kozarek 1987:9). Vanport chert was the raw material source for 81.2% of all recovered artifacts. The vast majority of this total could be described as chalcedony white in color, with yellow and red also common.

2) Wyandotte chert (Indiana Hornstone) - an exotic chert that came to the study area from south-central Indiana in nodular form, based on the presence of a chalky tan cortex on large flakes in the collection. Wyandotte chert was a raw material source for 11.1% of all recovered artifacts. This chert is homogeneous in texture and fine-grained. Examples of the chert recovered during the survey were uniform in color, which could be described as a distinctive combination of bluish gray and brown, with small blue crystalline inclusions (Seeman 1975).

3) Other chert - the remaining 7.6% of the chert sample was placed in this inclusive category. The vast majority of cherts in this group were from the Upper Mercer chert quarries located in Coshocton County, or less frequently, Zaleski chert from Perry and Vinton Counties. Both of these chert types are predominantly dark in color, with a majority of Upper Mercer chert having a vitreous texture and a distinctive blue color with white crystalline inclusions (Kozarek 1987:15). Lighter varieties of Upper Mercer chert do occur in the Coshocton area, but these are distinctive colors of light gray with a uniform creamy textural quality. None of this type of raw material was collected. Other
chert also included unknown chert and Columbus/Delaware chert from the Scioto drainage (each about 1% of the total sample). Columbus/Delaware are bedded or nodular cherts with earth tone colors, especially light tan. Fine specimens of Delaware chert are macroscopically similar to the Wyandotte chert collected during the survey, but without the blue crystalline inclusions (Luedtke 1992).

A straight-forward approach was taken to partitioning the artifact samples in an attempt to reduce the bias introduced by artifacts from multiple time periods. A primary consideration was the proportion of chert types used to make diagnostic artifacts. None of the recovered 805 diagnostic Hopewell bladelets or the 29 bladelet cores were made out cherts from the Other chert category; all were made out of either Vanport or Wyandotte chert. The association of large quantities of Vanport chert, with what I interpret to be Middle Woodland refuse deposits, suggests that a high proportion of the Vanport chert in the assemblages is Middle Woodland in origin. A high frequency of heat-treating for Vanport bladelets and cores and associated debitage further supports this conclusion. Likewise, the Wyandotte chert has a high probability of being attributable solely to the Middle Woodland period. This conclusion was based on the co-occurrence of Wyandotte and Vanport within clusters and on the recovery of evidence for the intensive use of Wyandotte chert in the local blade-core industry. Bladelets represented 12.2% of all Wyandotte chert artifacts, as opposed to 4% of all recovered Vanport chert artifacts.
During other periods in prehistory there was a marked preference for Upper Mercer/Zaleski cherts. To a lesser degree, there may have been a preference also for Columbus/Delaware cherts, which are commonly found as pebbles in glacially derived gravel deposits. This pattern is suspected to hold for the Paleoindian and Archaic periods and again during the Late Woodland and Late Prehistoric periods. Vanport chert usage increases during the Late Archaic period of the region, associated with the Gilbert Phase (Morton and Carskadden 1975). No Gilbert Phase diagnostics were recovered.

For the study area, the trend in preference for raw material is shown by reference to the types of raw materials used in the manufacturing of projectile points recovered during the survey (Table 1). Over half (61%) of the 33 projectile points recovered were made of either Upper Mercer/Zaleski or Columbus/Delaware cherts (Figure 13). Murphy IV contained 45% of all points, followed by 21% in Intercluster Space (Table 2). Projectile points were typed using the cluster concept (Justice 1987). The four Middle Woodland points types were exclusively made out of either Vanport or Wyandotte cherts.

The preference for Upper Mercer/Zaleski and Columbus/Delaware cherts during non-Middle Woodland time periods is magnified further by the low frequency of the Other cherts category in the samples (while comprising less than 8% of all chert, it was used in 61% of the recovered projectile points, all of which are non-Middle Woodland.) Thus, it is unlikely that artifacts in the Other cherts category are Middle Woodland in origin. To remove this bias, only Vanport and Wyandotte chert artifacts were treated as Middle Woodland.
Table 1. Proportions of chert types for projectile points collected during the survey

<table>
<thead>
<tr>
<th>Period</th>
<th>Van Port</th>
<th>Wyandotte</th>
<th>Upper Mercer</th>
<th>Columbus-Delaware</th>
<th>TOTAL</th>
</tr>
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<tr>
<td>Early Archaic</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Middle Archaic</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<td>4</td>
<td>0</td>
<td>7</td>
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<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Late Woodland</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Late Prehistoric</td>
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<td>1</td>
<td>3</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
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<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
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<tr>
<td>SUBTOTAL</td>
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<td>1</td>
<td>17</td>
<td>3</td>
<td>29</td>
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<tr>
<td>Middle Woodland</td>
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<td>0</td>
<td>4</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>11</td>
<td>2</td>
<td>17</td>
<td>3</td>
<td>33</td>
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</table>

Other Periods  
N=29

Middle Woodland  
N=4

Chert Types
- Van Port
- Wyandotte
- Upper Mercer
- Columbus-Delaware

Figure 13. Pie-chart showing proportion of chert types for projectile points recovered during survey, Murphy Property, study area
Table 2: Projectile point identifications and provenience

<table>
<thead>
<tr>
<th>Justice Type</th>
<th>Time Period</th>
<th>Chert Type</th>
<th>Cluster</th>
<th>Unit</th>
<th>East</th>
<th>North</th>
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<tr>
<td>Brewerton Side Notch</td>
<td>Late Archaic</td>
<td>Upper Mercer</td>
<td>Murphy IV</td>
<td>B1U22</td>
<td>008</td>
<td>304</td>
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<td>Trimble Side Notch</td>
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<td>Upper Mercer</td>
<td>Murphy IV</td>
<td>B1U61</td>
<td>024</td>
<td>300</td>
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<td>Brewerton Corner Notch</td>
<td>Late Archaic</td>
<td>Upper Mercer</td>
<td>Murphy IV</td>
<td>B3-general surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thebes</td>
<td>Early Archaic</td>
<td>Columbus</td>
<td>Murphy IV</td>
<td>B4-general surface</td>
<td></td>
<td></td>
</tr>
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<td>Snyders</td>
<td>Middle Woodland</td>
<td>Vanport</td>
<td>Murphy IV</td>
<td>B4U23</td>
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<td></td>
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<td>Murphy IV</td>
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<td>264</td>
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<td>Murphy IV</td>
<td>B7U1</td>
<td>084</td>
<td>296</td>
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<td>Levanna</td>
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<td>Upper Mercer</td>
<td>Murphy IV</td>
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<td>Wyandotte</td>
<td>Murphy IV</td>
<td>B7U31</td>
<td>096</td>
<td>296</td>
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<td>Upper Mercer</td>
<td>Murphy IV</td>
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<td>Vanport</td>
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<td>288</td>
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<td>St. Alban's</td>
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<td>Upper Mercer</td>
<td>Murphy IV</td>
<td>B7-general surface</td>
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<tr>
<td>Racoon Notch</td>
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<td>Columbus</td>
<td>Murphy I</td>
<td>Cowan collection</td>
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<tr>
<td>Kirk Stemmed</td>
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<td>Madison Triangle</td>
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<td>Steuben Expanding Stem</td>
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<td>Isolated</td>
<td>I069</td>
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<td>620</td>
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</table>

Note: Coordinates approximated to U.T.M. block 373000 East, 4435000 North.
Artifact Classes

The possibility of biases in the artifact samples suggested adoption of a conservative approach to artifact classification. As previously noted, Ohio Hopewell lithic technology included independent industries for the manufacturing of bifaces and bladelets. Based on his analysis of the Murphy I lithic assemblage, Dancey (1990) argues that hand-sized, tabular chunks of Vanport chert are used as the starting point for both industries. After that the industries diverge, with the bifacial industry systematically removing flakes to produce an implement, and the blade-core industry preparing a platform for the removal of parallel-sided flakes that are themselves implements. "The contrast between the industries is therefore a contrast between positive and negative flake removal strategies" (Pacheco and Pickard 1992:13).

The artifact classes used in this study represent products and byproducts of the dual Hopewell lithic industries (Figure 14). These classes are intended to be mutually exclusive chipped stone debris classes. The typology was created following a taxonomic branching scheme where each branch represents independent dimensions of chipped stone debris variability. Classes are not intended to represent functional classes, but may coincide with traditional functional types. Functional classifications might also be constructed for these data, but except for bladelets, formal tool samples are small within assemblages. For this study, emphasis is placed on investigation of distributional patterns of Hopewell debris rather than reconstruction of specific functional activities.
Figure 14. Taxonomy of chert debris classification
A total of sixteen classes were defined (see Figure 14). The first dimension represents the basic division of chipped stone debris variability into the categories of flakes, cores, and bifaces. Each of these categories is then divided independently based on meaningful variability within the category. Flakes were split into bladelets and non-bladelets ordebitage. Cores were split into amorphous flake cores and bladelet cores. Bifaces were split into classes representing successfully or unsuccessfully thinned bifaces. Additional variability within these classes was then defined for all but cores. Debitage was broken into utilized and not utilized classes. Non-utilized debitage was further broken down into size classes; small, medium, and large. For the largest size class, a further distinction was made between the presence or absence of cortex material. Classes were defined for bladelets which possessed either single or multiple arrises. Within these classes of bladelets, distinctions were made representing fragmentation of the blade. These classes are complete, proximal, or medial/distal. Finally the class thinned bifaces was divided into bifaces which were broken or complete. Further discussion is included below for the criterion and rationale used to make specific classifications and the potential meaning of the various classes or groups of related classes.

As defined by the classification scheme, all artifacts from collected units were placed into one of the sixteen chipped stone classes. Artifacts were independently identified to one of three chert categories; Vanport, Wyandotte, and Other cherts. In combination these two dimensions produce a total of 48 possible
classifications. However, since Other cherts were not utilized for the Hopewell blade-core industry, only 41 classes had possible members. The raw data for each collected unit were recorded using this two dimensional format on a 16x3 table. Raw data was compiled using a spreadsheet format (Pacheco 1993).

There are 32 possible artifact classes considered to be Middle Woodland in origin, based on the dimensions of chert type and artifact class. Differential usage of local Vanport chert versus non-local Wyandotte chert was explored in various analyses. Chert types were combined on other occasions, reducing the number of artifact classes to 16. Sample size disparities between defined assemblages suggested collapsing the typology into a set of fewer classes. This procedure was accomplished by eliminating dimensions of variability in the branching diagram (see Figure 14). The only inconsistency was the inclusion of Class 5 - amorphous cores with the collapsed class of large debitage. This was done because of small sample sizes for both large debitage and amorphous cores, and because both classes represent large byproducts of chipped stone manufacturing processes. The collapsed classification scheme has nine classes, but for the quantitative analyses only eight classes were used. In this instance, Classes 1 and 2 are combined to create a category of small to medium debitage to contrast with the category of large debitage. This procedure was undertaken to dampen potential surveyor bias introduced by size of the artifact. The combination of these two categories decreases the effect of possible assemblages where less small debitage was collected than might be expected.
Classes 1-4 (Small, Medium, and Large Debitage): These classes represent size grades within the general category of debitage. As used here, debitage includes all traditional byproducts of lithic industries: whole or broken flakes, and debris or general shatter. Only debitage that is unmodified or shows no sign of use was included in these classes. The size measurements were based on any single measurement being larger than the defined square area. Debitage placed in Class 1 was less than or equal to 10 square millimeters in size, while debitage placed in Class 2 was greater than 10 square millimeters, but less than or equal to 30 square millimeters. Debitage placed in Class 3 had at least one measurement greater than 30 square millimeters in size. The manufacturing process for bifacial implements has a known trajectory in the production of sizes of debitage, with average size declining throughout the process (Patterson 1990). Relative proportions of the defined size classes are intended to provide some sense of the manufacturing-resharpening process for a particular assemblage. Class 3, large debitage, includes primary flakes and rare examples of large shatter, without evidence of cortex. Class 4 includes large debitage that exhibits evidence of the weathered exterior surface of the chert cortex. Hence, artifacts of this class potentially are from early phases of the production sequence.

Class 5 (Amorphous cores): This class represents blocky pieces of chert from which a limited number of random flakes scars have been removed. These items are usually hand-sized or larger, representing primarily unprocessed or initially processed blocks of chert.
Class 6 (Utilized debitage): This class included any piece of debitage that showed evidence of retouch, or edge damage, attributable to human modification or use. These artifacts typically reflect expedient use of the byproducts of a manufacturing process. As such, they are unintentionally shaped tools fortuitously possessing useful shapes and edges. Use-wear or retouch was identified macroscopically with a low power light source and was defined as patterned microflaking along an edge. Microflaking was created either from use of an unmodified but suitable edge, or retouch to an edge to make it more suitable for use. This study required a minimum of three contiguous flake scars on an artifact's edge to be identified as use-wear or retouch (cf. Connolly 1991:29). Care was taken to identify and omit flake scars resulting from extraneous processes such as geological percussion and plowing. Class 6 potentially includes debitage with more than one used edge falling in any size class, although there does seem to be a size threshold below which debitage is rarely utilized. The class also includes a few examples of what are typically considered formal tool types made on fortuitously shaped flakes. These included three unifacially retouched end-scrapers, a side scraper, and a graver.

Class 7-9 (Bifaces): The classes in this group are examples of the completed and unfinished (rejected) products of the bifacial industry. Bifaces exhibit systematic, invasive flake removal from two sides of a core or large flake resulting from an attempt to produce an artifact with a distinct ovoid shape. Class 7 includes examples of bifaces which failed at some stage during the manufacturing process. Early
stage bifaces potentially can be confused with amorphous cores, as noted above, when failure occurs shortly after the first few removed flakes. The criterion used to place an item in this category was the presence of an attribute indicative of breakage during the manufacturing process, such as, protrusions and snap fractures. Farther along in the process, when a biface reaches a shape often called a blank, there is evidence of non-random flake removal and general ovoid shaping.

Because biface rejects are not exceptionally attractive to collectors, the potential exists with this class to identify areas of primary manufacture of bifacial implements. Successfully completed or thinned bifaces are included in Classes 8 and 9. Such specimens have thinned cross-sections, finished edges, oval to triangular shapes, and no evidence for irregularities in the chert raw material. Class 8 includes thinned bifaces that are broken, and Class 9 includes completely thinned bifaces.

Projectile points are thinned hafted bifaces that would be placed in either Class 8 or 9 relative to condition. Points were so rare that it was deemed unproductive to separate them as a class, although all thinned bifacial implements do not end up as hafted projectiles. The rarity of Middle Woodland projectile points in the collections reflects one of two situations: 1) the observed frequencies are a legitimate expression of the representation of this type of item in Middle Woodland settlements of the kinds observed in the study area, or; 2) the frequencies are a biased representation of projectile points because of intense collector pressure on major artifact
clusters within the study tract, focusing specifically on hafted bifaces. Either way, the low frequency of Middle Woodland points limits their usefulness in the analysis.

**Classes 10-15 (Hopewell bladelets):** This group of classes measures the intended product of the bladelet industry. Bladelets are the intended product of a distinct Hopewell blade-core industry in which small blades are systematically removed in sequence from prepared cores. Bladelets are parallel sided flakes, exhibiting a length to width ratio greater than 2:1. Bladelets have prismatic cross-sections and one or more a medial ridge, or arris, on the exterior surface that runs the length of the blade parallel to the edges. The proximal end of bladelets exhibit a small bulb of percussion which is the section of the prepared platform that was struck to form the bladelet. The longitudinal axis often exhibits moderate curvature, particularly at the distal end which often ends in a feathered termination, but can also end as a hinge fracture (Pi-Sunyer 1965:60-63; Greber et al. 1981; Connolly 1991:26). Classic bladelets as defined by Pi-Sunyer (1965) have trapezoidal cross-sections produced by two arrises. Multiple arrises are created by the removal of successive bladelets from a core, and represent the ultimate goal of the industry, since these specimens are typically thin and narrow with parallel edges. Therefore, bladelets with single arrises may indicate early or unsuccessful stages of the bladelet manufacturing process.

Small fragmentary mid-sections were judged to be bladelets based on overall morphology, despite lack of the 2:1 length-width ratio. These small fragments are a possible source of confusion for the
classification scheme. However, fragments possessing thin cross-sections and one or more arrises parallel to the edges usually were classified as bladelets (either Class 11 or Class 14). Class 10 includes complete bladelets with a single arris or triangular cross-section and Class 13 includes complete bladelets with multiple arrises. Because bladelets can also be considered special types of flakes, they can be described by attribute states of flakes such as complete, proximal, or fragmentary (mid-section or distal end). Sullivan and Rosen (1985) have suggested that these attributes can be useful categories for analysis of flakes, and this potential is reflected by breaking down single arris and multiple arris bladelets further into Classes 11 and 12 and Classes 14 and 15 respectively.

Class 16 (Bladelet core): This class includes prepared cores from which one or more bladelets (parallel sided flakes) were removed. Bladelet cores from Ohio Hopewell contexts exhibit a wide range in morphology (Greber et al. 1981), although all are recognized by the striking platform which is created to remove the bladelets. In this class are included a few examples of artifacts that have been called core rejuvenation flakes in other analyses. These are fragments of bladelet cores removed to create a new platform. These were placed into Class 16 as a minimum representative of a bladelet core as long as the artifact retained evidence for either the prepared platform or parallel sided flake scars. Bladelet cores made out of Vanport chert were frequently heat-treated, producing glossy textures and bright colors, making them attractive items to collectors.
Graphical and Statistical Methods

Assemblage totals are presented as counts for the defined classes on tables representing combined and separated chert types. All statistics used in the study were generated from these tables. Cells within these tables are summations for particular classes of all individual units within defined clusters. Intercluster Space is treated as a cluster for purposes of comparison.

The rationale of combining the two assumed Middle Woodland chert types is explored by addressing the issue of population parameters based on combined chert types, and then graphical and statistical comparison of the differential frequencies of artifact classes for each chert type. This goal is accomplished by creation of a histogram out of the total combined assemblages, contrasting the chert types. Differences between the class frequencies based on chert types were analysed with a Z-test for proportions provided by Fleiss (1983).

The use of two archaeological measurement concepts, density and diversity, were required to operationalize the working hypotheses. These concepts form the basis for testing the implications of the Vacant Center Model for patterns of settlement size, surface structure, assemblage variability, and spatial distribution of the three main types of settlements: hamlets, satellite logistical or short-term activity areas, and specialized camps. As formulated, the four correlates of the model are not directly measureable, but instead must be approximated. Density and diversity measurements on the defined clusters and assemblages fulfill these needs.
Density refers to the ratio of the number of things to a given area (Kintigh 1988). In this case it refers to the number of artifacts in the area of a defined cluster. Density can be calculated or displayed at the scale of individual classes within individual units or at any appropriate level of clustering up to the scale of the assemblage divided by the area of the cluster. This last figure measures the absolute density of a cluster.

The density concept is intrinsically linked to the creation of the clusters, since areas without artifacts are usually omitted when measuring cluster size. Cluster boundaries are defined by decline in density (Fuller 1981; 1986). When density reaches zero, the boundaries of clusters are clearly demarcated, harkening back to the argument that clusters are discoverable phenomena. Density is the concept which introduces the creative process into the delineation of clusters and assemblages, because at some level, choices must be made to include or exclude particular units or areas within defined boundaries. The size estimate used in this study is a measurement of the spread of artifacts within defined cluster, and the assemblages created from this definition have density relative to size.

Density is also, therefore, intrinsically related to settlement structure and settlement spacing or dispersion. In the case of dispersion, the issue is the linear distance between one cluster and another. To make this measurement cluster boundaries and density must be known. Measurement entails decisions about where to measure from, and to what. In this study, the southwest corner of a collection block or a designated datum on the southwest edge of a
cluster was used for linear measurements. Settlement structure was explored with a graphical mapping technique which displays shaded values for unit density. This procedure is the analytical equivalent of surface density contour maps (i.e. Genheimer 1984; 1992; Connolly 1991; 1992).

Maps were created by Map II, an Apple-Macintosh program for manipulation and display of grid-data. Maps were made of combined and separated chert types to establish concordance in spatial patterning. Cowgill (1989) has demonstrated the important effect of disposal context on the interpretation of density and diversity, and one possible solution to this problem is the graphical comparison of the distribution of various artifact class densities within clusters. Maps were made of bladelets to explore the spatial relationship between reliable diagnostic classes and other artifact classes.

"Diversity ... refers to the numerical structure of classes in some collection of artifacts, their number, and relative abundances" (Rhode 1988:708). Thus, diversity analysis measures differences between artifact assemblages; two separate aspects of which are richness and evenness. Richness is a measure of the number of classes in an assemblage. Sample size is known to be positively correlated with richness (Jones et al. 1983). As sample size increases, the potential to observe rare classes increases. Thus, small samples may lack representation of classes simply because the sample size was insufficient to identify classes which are less common. Without taking into account the effect of sample size on the richness of an assemblage, direct interpretation of variability between small and
large assemblages can be misleading. In the present study, sample sizes of the various defined assemblages are extremely variable. Richness was explored with a linear regression technique to account for possible effects of sample size on the number of classes in an assemblage (Jones et al. 1983). A goal of this analysis was to define the classification scheme minimizing the effect of sample size on richness.

Evenness measures the proportional representation of each class in an assemblage. Evenness can be graphically displayed through use of histograms of artifact class frequencies. In this study, histograms were created for the collapsed classification scheme, contrasting the two chert types. Attaching a numerical value to evenness is possible, and several formulas exist. However, any single measure of evenness is greatly influenced by sample size (Bobrowsky and Ball 1989). Other statistics, called heterogeneity measures, combine evenness and richness into a single value, but are also dependent on sample size. In general, all currently available statistical procedures for reducing evenness or heterogeneity to single values are biased by disparities in sample sizes (Bobrowsky and Ball 1989). Since this study is composed of assemblages with extremely divergent sample sizes, a single value calculation for evenness or heterogeneity was not made. Instead, the graphical display of evenness is explored visually to suggest differences in the assemblages.

One potential solution to the analytical problems encountered with exploring evenness was the use of the multivariate statistical technique of correspondence analysis (Greenacre 1984). Correspondence
analysis has been used to explore variability in class frequencies. An example of the application of the technique was to study antelope census data for widely separated African game reserves (Greenacre and Vrba 1984). The data structure in the antelope census study is analogous to the structure of the data in this study; composed of classes and assemblages with divergent sample sizes. The technique of correspondence analysis displays the rows and columns of a data matrix simultaneously, allowing for the investigation of underlying structure in the data. Principal axes of variation are defined, which are analogous to principle components. A number of different correspondence analyses were run with the various classification schemes to explore the stability of the data structure in multidimensional space.

In all correspondence analyses using raw counts, divergent sample sizes severely influenced the results. Greenacre and Vrba (1984) had encountered a similar situation, leading them to try various transforms to minimize or standardize the differences in sample sizes. One procedure they suggest is to equalize the weight of each sample, in essence treating each sample as the same size. An assumption of this transformation is that individual assemblage sample sizes are representative of underlying artifact populations. Since only Cluster 5/8 and Cluster 7 had less than 100 objects, the assumption is considered reasonable. These clusters were grouped to eliminate the small samples. The use of the equal weightings transformation provided the most interpretable results, representing a multivariate comparison of the evenness histograms.
CHAPTER V
RESEARCH RESULTS

Introduction

In this chapter, the results of the various analyses outlined in Chapter IV are presented. The results are broken into four main sections including analyses of assemblage composition, artifact density, artifact diversity, and contemporaneity/duration. After partitioning the artifact unit samples, 15,991 artifacts were available from ten Middle Woodland surface clusters, plus Intercluster Space. These artifacts were counted and classified according to the classification scheme.

The results focus on the research problems outlined in Chapter II. Briefly, these included a need for information on the size, organization, and location of Ohio Hopewell/Middle Woodland domestic settlements. Working hypotheses were developed in Chapter III to address these problems based on extension of the Vacant Center Model. The model establishes a community organization pattern for Ohio Hopewell communities, identifying three main types of domestic settlements: hamlets, logistical or short-term activity areas, and specialized camps. Each of these main types of settlements has predictable aspects of settlement size, surface structure, functional variability, and settlement dispersion. A research design utilizing
complete systematic surface collections was established to recover information on these aspects of settlement variability within a defined study area that is assumed to represent space within the boundaries of a former Ohio Hopewell community. The defined study area is a 50 ha transect located in the Licking Valley on the Murphy property. This property contains the Murphy I site, an extensively researched Ohio Hopewell domestic location that has been argued to represent a hamlet type settlement based on criterion like those established in the working hypotheses. The surface survey recovered abundant evidence related to the Middle Woodland occupation of the study area. Surface artifacts were concentrated into five large clusters, five smaller clusters, and a vast area of Intercluster Space. As a result of this research it will be argued that the model fits the distribution of Middle Woodland artifact clusters in the study area. Five hamlets, several possible logistical or short-term activity areas, and a specialized camp are identified. Finally evidence for the contemporaneity and duration of these various settlements is presented. Based on these interpretations it is concluded that the Vacant Center Model is a productive organizational framework for understanding Ohio Hopewell domestic settlement patterns.

**Assemblage Composition**

Assemblage artifact counts from the ten Middle Woodland clusters and Intercluster Space are presented in Tables 3-6. These tables show raw counts for the 16-class taxonomy established in Chapter IV, except
Table 3. Total assemblage artifact counts

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Table 4. Total assemblage artifact counts, Wyandotte chert only

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Table 6. Total assemblage artifact counts, Other chert only – minus bladelet classes 10-16

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<td>TOTAL</td>
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<td>542</td>
<td>16</td>
<td>9</td>
<td>7</td>
<td>74</td>
<td>11</td>
<td>5</td>
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that Table 6 only lists counts through Class 9 due to the lack of blade-core industry using Other cherts. Of the 41 possible classes, only one class had no members in the sum totals for all assemblages. This is Wyandotte/Class 8-thinned broken bifaces. Within assemblages, many classes have zero values using the complete classification scheme, supporting use of the collapsed classification for statistical analyses to minimize sample size problems.

Table 3 shows the distribution of classes in relation to the artifact clusters defined in Chapter IV. Tables 4-6 break these artifacts down by chert types. Figure 15 shows a histogram of the collapsed classification of the combined total assemblages in Table 3. The resulting frequency distribution shown in this figure represents the sum of all assemblages and has been suggested as an estimate for the underlying population distributions of artifact classes (Kintigh 1984). Potential differences in frequency distributions of artifact classes, plus significant sample size differences between Vanport and Wyandotte chert, limit the validity of using Figure 28 as a population estimate. However, this distribution is used in the calculation of Z-scores as estimated population values (Fleiss 1983).

The dual lithic industries of Ohio Hopewell are embedded in Figure 15. If each was separated we would see a bifacial trajectory beginning with a high proportion of small debitage, dropping steadily through medium debitage, large debitage, biface rejects, and thinned bifaces. The bladelet trajectory would be characterized by high frequencies of single arris bladelets descending through multiple arris bladelets, and bladelet cores.
Figure 12. Class frequencies distribution for total combined lithics class

N = 15991
Analysis of the artifact class frequency distribution for Vanport versus Wyandotte chert addresses the issue of combination of chert types in the assemblages. Figure 16 presents a histogram that uses the sum total of assemblages for Table 4 and 5, respectively, based on the collapsed classification. To the extent that Figure 15 represents an estimate of the population parameters for the combined chert types, Figure 16 can be interpreted as representing estimates of the population parameters for the artifact class frequency distributions of the separated chert types. Sample sizes, though unequal, are large enough for both chert types to support this interpretation as valid.

Visual inspection of Figure 16 suggests different class frequency distributions for the two chert types. Differences appear concentrated in the classes of medium debitage, utilized debitage, and both single and multiple arris bladelets. The most outstanding, and potentially informative visual difference, is the reverse frequencies of single and multiple arris bladelets. Wyandotte has a higher proportion of multiple arris bladelets relative to single arris bladelets, while the ratio is reversed for Vanport bladelets. The reversal of ratios of single to multiple arris bladelets for the two chert types is probably indicative of a higher success rate in sequential removal of bladelets from Wyandotte blade cores, as compared to Vanport blade cores. The high quality, homogeneous, Wyandotte chert that was obtained by the local members of the Middle Woodland community may have been valued as a source for making bladelets because of this higher success rate. Wyandotte may also have
Figure 16. Class frequency distribution for combined assemblages, separated by chert types
been valued because the edges produced with this chert source were superior to Vanport chert that had not been heat-treated. Another potential answer to the observed differences is the mixing of disposal contexts to form the summed assemblages. Hopewell refuse deposits within domestic units may be expected to contain higher frequencies of triangular bladelets, representing manufacturing failures or earlier less desirable stages of bladelet removal (Dancey 1990; 1991). Short-term or specialized Hopewell activity areas, on the other hand, are more apt to be loci of bladelet use. These contexts are explored during the discussion of surface distributions of artifacts.

Statistical comparison of these proportions is based on a Z-test for unequal sample sizes proposed by Fleiss (1983). These scores and associated significance levels are listed in Table 7. Significant differences in proportions were noted for several classes. Significant differences were notably obtained for medium debitage and multiple arris bladelets. Significant differences for classes that are collectibles, such as bladelet cores and thinned are difficult to interpret, and likewise are based on low sample sizes. In general, differences in the two chert types may be isolated as resulting from differential use of the Wyandotte chert in the Hopewell blade-core industry.

Despite the somewhat different utilization patterns for these two chert types by members of the local Middle Woodland population, the combined assemblages also make logical sense. The combined chert types represent the residual of the sum of events at any particular locale, lending meaning to approaching the lithic assemblages as
Table 7: Statistical tests comparing proportional differences in artifact class frequencies by chert types, for collapsed classification scheme

<table>
<thead>
<tr>
<th>Class</th>
<th>Value of Z</th>
<th>Significance Level</th>
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<tr>
<td>Small debitage</td>
<td>0.56</td>
<td>.55&lt;p&lt;.6</td>
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<tr>
<td>Medium debitage</td>
<td>6.09</td>
<td>p&lt;.0001</td>
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<tr>
<td>Large debitage</td>
<td>0.66</td>
<td>.5&lt;p&lt;.55</td>
</tr>
<tr>
<td>Utilized debitage</td>
<td>1.55</td>
<td>.11&lt;p&lt;.13</td>
</tr>
<tr>
<td>Biface reject</td>
<td>-2.07</td>
<td>.04&lt;p&lt;.05</td>
</tr>
<tr>
<td>Thinned biface</td>
<td>-2.69</td>
<td>.007&lt;p&lt;.009</td>
</tr>
<tr>
<td>Single arris bladelet</td>
<td>0.77</td>
<td>.42&lt;p&lt;.48</td>
</tr>
<tr>
<td>Multiple arris bladelet</td>
<td>3.37</td>
<td>.0007&lt;p&lt;.001</td>
</tr>
<tr>
<td>Bladelet core</td>
<td>4.3</td>
<td>p&lt;.0001</td>
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units. As shown in Table 4, Wyandotte is concentrated in the Murphy IV and V assemblages, hence separation only highlights these assemblages, which will be shown to have different patterns of disposal and utilization for Wyandotte chert. Nevertheless, differences in chert types between clusters are examined where appropriate.

Artifact Density

Introduction

Artifact density was calculated based on division of the size of the partitioned assemblages by the size of the defined cluster. The results of estimation of cluster boundaries, assemblage size, and artifact density are presented in Table 8. This table provides an estimate of absolute artifact density within defined areas of cluster space. There are two groups of cluster sizes and artifact densities in addition to Intercluster Space, but there is a fairly direct linear relationship between surface assemblage size and cluster size (Spearman's rank order correlation coefficient = 0.78). On average the larger assemblages are from clusters with larger areas than the smaller assemblages. The most conspicuous outlier in the group is Murphy IV, which is the largest cluster identified, but has the lowest estimated artifact density of any of the large clusters at 0.29 artifacts per square meter. In contrast, Murphy I and III are one-half to two-thirds smaller in area, but six times as dense. As will be shown in various discussions, Murphy IV, with a high frequency of Wyandotte bladelets, is a consistent outlier.
Table 8. Assemblage size, estimated surface area, and density

<table>
<thead>
<tr>
<th>Cluster Identification</th>
<th>M. Woodland Surface Lithics Collected</th>
<th>Estimated Surface Area of Lithics Scatter (sq meters)</th>
<th>Estimated % of Surface Area Sample</th>
<th>Estimated Assemblage Size (% total lithics)</th>
<th>Estimated Density (#/sq m)</th>
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<td>17000</td>
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*A 520 sq. m area was collected from the densest concentration at Murphy I; the estimate reflects known areas of lower density within Mi cluster (Cowan et al. 1981)*
Settlement Size

A generalization about absolute artifact densities is provided by comparing the two groups of assemblages. Not counting Intercluster Space, the five smallest assemblages have estimated surface densities of less than 0.15 artifacts per square meter with an average cluster size equalling 0.14 ha, while the five largest assemblages have estimated surface densities of greater than 0.25 artifacts per square meter with an average cluster size of 0.45 ha. The overall average estimated size of the ten Middle Woodland clusters defined by the survey is 2930 square meters or 0.29 ha. This figure is almost twice as small as the figure calculated for 21 other Middle Woodland sites with size data from the Licking Valley (Pacheco 1988:94-95). The reason for this discrepancy is probably the more precise methods of size estimation utilized in this study. Nonetheless, taking into account possible expansion of surface scatters by plowing (Odell and Cowan 1987), the general trend for Middle Woodland clusters in the Licking Valley is towards small size, and the data collected in this study support the direction of that trend.

Surface Structure

Unit level artifact densities are best illustrated through the analysis of surface structure of the artifact clusters. In this section a detailed examination of the surface distribution of artifacts is presented on a cluster by cluster basis. Distribution maps are made for combined and separated chert types, bladelets, and in one instance utilized debitage.
Murphy I: The surface distribution of artifacts at Murphy I has already been discussed, but will be examined in more detail here in relationship to artifact density. Taking into account the known areas of lower density within the Murphy I cluster, an estimate of the absolute artifact density is 3.86 artifacts per square meter - highest in the study area (see Table 8). A uninodeal or "bull's-eye" pattern characterizes the distribution, with the highest density occurring along the gentle slope on the northeast margin of the site (Dancey 1991:65). The surface collection from Murphy I used in this study covers 520 square meters (Cowan et al. 1981). The 3772 artifacts collected in this block has an average density of 7.25 artifacts per square meter. Cowan's group changed collection strategies after the complete collection of this block to a tools only sample. Debri densities were estimated for each unit, but debitage was no longer collected. The highest estimated densities for individual units observed during the Cowan survey peaked at 15 to 25 artifacts per square meter. The area of the highest concentration was crisply defined by a three to ten fold decline in density along the boundaries of the "bulls-eye". Cowan's complete collection is from the east side of the high density concentration, which Dancey (1991:65) argued represents the type of surface structure formed by a formal refuse dump. A total of 107 single arris bladelets, 66 multiple arris bladelets and 7 bladelet cores were recovered in the complete collection. These blade-core industry materials represent Middle Woodland diagnostics deposited in the context of domestic refuse disposal.
Murphy III: The settlement layout of Murphy III is interpreted to be generally similar to Murphy I. The surface distribution of Murphy III lithics can be characterized as a unimodal concentration that hugs the slope on the southeastern margin of the cluster. A map of the individual unit densities shows this pattern in greater detail (Figure 17). The area of the complete surface collection covered 1600 square meters. Since there were only eight total Wyandotte chert artifacts collected at Murphy III, these were included in Figure 17. Five out of the eight Wyandotte artifacts were bladelets. Two of the bladelets are located in the densest part of the cluster, the other three are on the west and south margins.

Estimated absolute artifact density within the Murphy III cluster is 3.58 artifacts per square meter, including areas of known lower density. Peak artifact density ranged between 7 and 21.65 artifacts per square meter. Artifact density drops off rapidly in adjacent units to the peak concentration, providing crisp spatial parameters and supporting the conclusion that the surface structural patterns at Murphy III also documents a formal refuse dump. A small outlier of high density occurs along the western margin of the cluster. This area may represent a discontinuous extension of the main concentration or perhaps a localized area of Middle Woodland activity since this area also corresponds to an outlier peak of bladelets (Figure 18). The surface distribution of bladelets can be described as isomorphic with other artifacts. The majority of Murphy III bladelets were recovered from the main concentration, suggesting parallel disposal context to the debitage. The ratio of single arris bladelets to
Figure 17. Surface distribution of all lithics, Murphy III cluster, by 4x4 meter units, southwest corner of map = 373160 east; 4435880 north.
Figure 18. Surface distribution for all bladelets, Murphy III cluster, by 4x4 meter units
multiple arris bladelets (142 to 112) may indicate bladelet manufacturing as the source for the bladelets. Six bladelet cores were also recovered in the peak concentration.

**Murphy V:** The surface structural pattern of the Murphy V artifact cluster roughly parallels Murphy I and III, although estimated absolute artifact densities are almost six times lower on average at 0.66 artifacts per square meter. The main concentration in this cluster is located along the south central margin, running up to the edge of the terrace, which defines the south edge of Murphy V. The survey covered 2100 square meters, but did not extend onto the slope of the terrace, which steeply drops approximately 6 meters onto the Raccoon Creek floodplain. Murphy V stands out as the cluster with the highest relative frequency of Wyandotte chert (80.3% of all recovered chert).

The Murphy V surface distributional patterns for Wyandotte chert are shown Figure 19. The main concentration is not as crisply defined as in Murphy I or III, especially on the southeastern edge of the cluster, yet the distribution is best described as uninodal in structure. The northern edges of the main concentration have the crispest boundaries, with corresponding drops in densities for adjacent units. The peak density in the main concentration of Wyandotte chert has an average of 2.6 artifacts per square meter.

Vanport chert is scattered in low densities across the cluster, directly overlapping the distribution of Wyandotte chert. Such overlapping spatial distributions probably stem from a systemic relationship in the depositional patterns of the two chert types. The
Figure 19. Surface distribution of Wyandotte artifacts, Murphy V cluster, by 4x4 meter units, datum shown = 373224 east; 4435112 north
Figure 20. Surface distribution of Vanport artifacts, Murphy V cluster, by 4x4 meter units
Figure 21. Surface distribution of all bladelets, Murphy V cluster, by 4x4 meter units
highest densities of Vanport occur on the northern fringe of the Wyandotte concentration (Figure 20), but the peak density of Vanport was moderate at 0.625 artifacts per square meter.

Bladelets are almost exclusively distributed in the area of the uninodal concentration, with none recovered from the northern half of the Murphy V collection blocks (Figure 21). Two bladelet cores were recovered from the eastern fringe of the cluster, adjacent to units with multiple bladelets. Blade-core industry materials were apparently disposed of in the refuse dump with other lithic debris. Corresponding to the lower absolute artifact surface density, only 45 bladelets were recovered from the Murphy V cluster, 41 of which were made out of Wyandotte chert.

Murphy VI: The structural pattern of the surface lithic distribution for Murphy VI is distinctly uninodal, like Murphy I, III, and V. Also, like Murphy I and III, the Murphy VI assemblage is dominated by a high frequency of Vanport chert (94.5%). Vanport chert artifacts were distributed on the surface of Murphy VI as shown in Figure 22. The spatial boundaries of the uninodal concentration of Vanport chert are crisply defined, supporting an interpretation of this area as a formal refuse deposit. Peak artifact density was recorded at 4.375 artifacts per square meters. Artifact density averaged above 2 artifacts per square meter within the possible refuse area. Absolute density for the Murphy VI cluster was estimated at 0.88 artifacts per square meter over a 3100 square meter area. Absolute density for Murphy VI is about four times lower than Murphy I or III, however, inclusion of over 1000 plus square meters of lower density
Figure 22. Surface distribution of Vanport artifacts, Murphy VI cluster, by 4x4 meter units, datum shown = 373132 east; 4435180 north.
Figure 23. Surface distribution of Wyandotte artifacts, Murphy VI cluster, by 4x4 meter units
Figure 24. Surface distribution of all bladelets, Murphy VI cluster, by 4x4 meter units.
space on the west-southwest side of the cluster may have doubled the
differences in density for these otherwise structurally similar
Middle Woodland clusters.

In contrast to Vanport chert, Wyandotte chert has a patchy
surface distribution pattern, although the highest concentration
corresponds to the peak distribution of Vanport chert artifacts
(Figure 23). Several contiguous units along the west margin of
Murphy VI have Wyandotte artifacts, also corresponding to a
moderately dense outlier Vanport chert concentration. This area
includes bladelets in addition to the Wyandotte chert, indicating a
Middle Woodland origin. Potentially this location is some type of
activity area related either to the Murphy VI occupation, or to the
nearby Murphy IV occupation (it being no more than 50 meters across
the paleostream to the nearest edge of Murphy IV). Another likely
explanation is that recent plowing has truncated a feature, since the
features may be expected in this lower density area in complimentary
distribution to the refuse dump.

Bladelets have a similar patchy distribution, but the bulk of
these also correspond spatially to the uninodal Vanport concentration
(Figure 24), supporting the interpretation that the observed
structural pattern at Murphy VI is attributable to a Middle Woodland
occupation. Bladelets were also distributed in low densities along
the northwest to southwest margin of Murphy VI, parallel to the
terrace edge. The collection includes 40 single arris bladelets, and
29 multiple arris bladelets. The frequency of Wyandotte bladelets was
24.6% of the total, which is five times higher than the frequency of
Wyandotte as a chert type in the assemblage. Four bladelet cores were recovered, two from the uninodal concentration, and two from the west central portion of the cluster.

**Murphy IV:** The surface distribution pattern for Murphy IV, stands in direct contrast to Murphy I, III, V, and VI. Murphy IV is the largest cluster identified in the study area at 9000 square meters (0.9 ha). Absolute artifact density is lowest of any of the large clusters, estimated at 0.29 artifacts per square meter. The Murphy IV locality has significant evidence of multiple occupations, minimally extending from the Early Archaic through the Middle Woodland period. The location of the cluster on the terrace edge near the point where the paleostream emptied over the terrace doubtlessly attributed to the favored reuse of the Murphy IV locality throughout prehistory. Diagnostic evidence for the multiple occupations is provided by the recovery of fifteen out of the thirty-three projectile points from the Murphy IV cluster (see Table 2).

Only two of the fifteen projectile points are Middle Woodland types. Ten of the fifteen projectile points attributable to other occupations were made out of either Upper Mercer (90%) or Columbus cherts (10%). As shown by data in Tables 3-6, Murphy IV has the highest frequency of Other cherts for any cluster (21.9%). A distinct cluster of Upper Mercer was identified along the northwest margin of Murphy IV, representing a spatially distinct non-Middle Woodland occupation (not mapped). Three Late Archaic projectile point types were recovered in this area.
While prehistoric occupations which favored the use of Other cherts were partitioned out of the assemblage to eliminate one source of bias, the Murphy IV assemblage of Vanport is also at least partially attributable to a non-Middle Woodland occupation. Evidence for this occupation is provided by the three Late Archaic projectile points made out of Vanport chert. These points are all morphologically similar examples of the Late Archaic variety Matanzas Side Notch (locally called fishspear). These points were recovered in the northeast quadrant of Murphy IV, from within an area of approximately 1000 square meters. Potentially the spatial proximity of these points documents the lack of spatial overlap between the main Vanport Late Archaic component at Murphy IV, and the Vanport distribution attributable to the Middle Woodland occupation.

**South Block-Murphy IV & Clusters 1 and 2:** The surface distributions for Murphy IV were graphed at a scale that includes an area (called the South Block during the survey) of over 4 ha, which encompasses not only Murphy IV, but Cluster 1, Cluster 2, and a large portion of the Intercluster Space with recovered artifacts. Maps were constructed at this larger scale to provide a broader comparison for the cluster, and because Middle Woodland activities in the South Block potentially do not correspond to defined cluster boundaries.

The surface distribution of all chert is shown in the South Block is shown in Figure 25. Vanport chert represents approximately 65% of the total recovered artifacts, with Wyandotte and Other chert providing roughly equal portions of the remaining 35%. The Vanport chert distribution in the South Block is complex, with both nodal and
Figure 25. Surface distribution of all lithics, South Block, by 4x4 meter units, southwest corner of map = 373000 east; 4435260 north
Figure 26. Surface distribution of Vanport artifacts, South Block, by 4x4 meter units
Figure 27. Surface distribution of Wyandotte artifacts, South Block, by 4x4 meter units
Figure 28. Surface distribution of Wyandotte bladelets, South Block, by 4x4 meter units
Figure 29. Surface distribution of Vanport bladelets, South Block, by 4x4 meter units
Figure 30. Surface distribution of all utilized debitage, South Block, by 4x4 meter units
dispersed qualities (Figure 26). The Murphy IV cluster has a fairly uniform low density distribution of Vanport chert. There is one distinct high density node in the south central portion of the cluster paralleling the terrace edge, and up to five lower density nodes, although spatial proximity suggests two of these may be associated with the highest density area. The moderately dense node along the northeast margin of the cluster is located in the area associated with the Vanport chert Late Archaic points, and the slight node along the northwest margin of the cluster is located in the area where the Upper Mercer chert cluster was noted. Within the highest density node, density peaked at 2.3 artifacts per square meter. The overall crisp spatial boundaries of the concentration suggest that this area of the cluster represents a formal refuse deposit. A Middle Woodland origin for the deposit is suggested by the corresponding association of bladelets (discussed below). Thus, at Murphy IV, the Vanport chert distribution provides evidence for both a probable Middle Woodland refuse deposit, and a general low density scatter at least partially attributable to non-Middle Woodland occupations.

The Wyandotte chert surface distribution in the South Block is generally concordant with the Vanport chert distribution, but is considerably more patchy and scattered (Figure 27). Wyandotte chert artifacts comprised about 18% of the total sample in the South Block, approximately 25% of which were bladelets (Figure 28). The main concentration of Wyandotte chert is to the west of the potential Murphy IV Vanport lithic refuse deposit. There is only slight overlap in these concentrations. Non-overlapping distributions potentially
stem from a lack of contemporaneity between the Vanport refuse deposit and the depositional events responsible for the disposal of the Wyandotte chert. Wyandotte bladelets are distributed in a scattered pattern over the entire South Block, including Cluster 2 and the Intercluster area south, north, and west of Cluster 1. A majority of Wyandotte bladelets are located in the southwest quadrant of Murphy IV, including a few within the high density Vanport node. There are only a couple of small concentrations of bladelets within the cluster, with the highest density concentration located on the northern margin of the Vanport chert nodal concentration.

The overall scattered distribution of Wyandotte bladelets suggests these items were deposited primarily by drop or toss discard pattern as opposed to systematic disposal (the kind of disposal pattern expected from short-term activities). Hence within the South Block, Wyandotte chert and at least one concentrated area of Vanport chert in the Murphy IV cluster, probably represent different disposal patterns. The high frequency of scattered Wyandotte bladelets in the South Block, points to an activity which relied heavily on bladelets. Following this activity bladelets were casually discarded as opposed to being cleared and deposited in a formal refuse zone like those observed in the other large clusters.

Vanport bladelets somewhat mirror the patchy scattered distribution of Wyandotte bladelets, but are not as widely distributed (Figure 29). A majority of Vanport bladelets are isomorphically distributed with the uninodal concentration of Vanport chert in the southwest quadrant of Murphy IV. A distinct low density node of
Vanport bladelets also was identified within Cluster 2. The distribution of Vanport bladelets probably represents two independent disposal contexts. Some were disposed of formally within the Middle Woodland refuse deposit, and others were discarded casually in a similar pattern to the bulk of the Wyandotte bladelets. The distribution of utilized debitage in the South Block is most similar to the scattered distribution of Wyandotte bladelets (Figure 30). Again there is a slight peak associated with the Middle Woodland refuse deposit, but otherwise the distribution is scattered. Whatever widespread activities resulted in the scattered deposition of bladelets, also appears to have included use of utilized debitage. These were not in the areas of formal refuse deposits, suggesting selective carrying of potentially usable debitage to loci of use and disposal.

To summarize, the Middle Woodland distribution of Vanport and Wyandotte artifacts in the South Block is likely attributable to at least two unrelated disposal contexts. Vanport has a distinct uninodal concentration in the Murphy IV cluster, which is associated with Vanport bladelets and utilized debitage. A limited quantity of Wyandotte chert including bladelets is also associated with this uninodal concentration, otherwise the distribution of Wyandotte chert artifacts like bladelets and utilized debitage are widely scattered and with few distinct concentrations. This pattern of discard is associated with short-term activities or occupations, potentially indicating that limited overlap in the distributions of Wyandotte and the Middle Woodland Vanport refuse deposit was fortuitous.
Cluster 1 and 2: The distributional patterns of Cluster 1 and 2 were shown through the group of figures for the South Block. Both of these clusters have fairly distinct low density concentrations. Cluster 1 is primarily composed of Vanport chert, while Cluster 2 has a higher frequency of Wyandotte chert, including several bladelets (see Tables 3-6). It is likely that the area including Cluster 1 and the dispersed intercluster artifacts surrounding Cluster 1 are part of broader activity area which featured use of Wyandotte bladelets, utilized debitage, and informal disposal patterns. Cluster 2 potentially has integrity as a cluster, but absolute artifact densities are low (estimated at 0.07 artifacts per square meter—although density approaches 0.7 artifacts per square meter within the peak concentration of Cluster 2).

Cluster 4: There is a distinct cluster of artifacts in a concentration within Cluster 4 (Figure 46). The main concentration included five bladelets (80% Vanport chert). Density peaked at 0.8 artifacts per square meter in the densest concentration of Cluster 4, however the area of the concentration is relatively small, at about 500 square meters. Remaining artifacts included in the cluster are spread in low numbers around the main concentration. Like Cluster 2, the distributional pattern of artifacts for Cluster 4 is more distinct. This type of low density concentration may have resulted from a set of concentrated short-term activities. Short-term duration is suggested by the relative density within these concentrations being much lower than the concentrations interpreted as formal refuse deposits in Murphy I, III, IV, V, and VI clusters.
Figure 31. Surface distribution of all lithics, Cluster 4, by 4x4 meter units, southwest corner of map = 373092 east; 4435488 north
Cluster 5/8: The artifact distribution for the combined Cluster 5/8 shows a distinct lack of clustering, in contrast to Cluster 4 (Figure 32). Three bladelets were recovered in this cluster, two made out of Wyandotte chert. The distributions within these combined clusters suggest primarily casual discard from possibly unrelated short-term activities as the depositional process.

Cluster 7: The distributional pattern of Cluster 7 shows similarities to both the more concentrated pattern of Cluster 4 and the dispersed pattern of Cluster 5/8 (Figure 33). One area has a concentration of artifacts, but other artifacts are scattered about. Wyandotte chert comprised 26% of the total artifacts, two of which are bladelets. Cluster 7 is the only cluster without any cherts from the Other chert category. The Wyandotte and Vanport chert artifacts overlap in distribution within the cluster, but the scattered pattern is probably indicative of a short-term, single event, activity within the area.

Settlement Dispersion

Artifact density is also related to the issue of spatial dispersion of clusters since it is necessary to define what the distances between two points represents. The approximated locations of clusters relative to the study area, and local region are shown on Figure 34. Large clusters except for Murphy V are located along the paleostream course. Murphy V is located along the terrace margin, near Raccoon Creek. All of the smaller clusters but Cluster 7, and to a lesser extent Cluster 5/8, are located inland from the paleostream on the terrace surface. Measuring from the southwest corner of the
Figure 32. Surface distribution of all lithics, Cluster 5/8, by 4x4 meter units, southwest corner of map = 373072; 4435656 north.
Figure 33. Surface distribution of all lithics, Cluster 7, by 4x4 meter units, southwest corner of map = 373180 east; 4435780 north
Figure 34. Relative distribution of Ohio Hopewell lithic clusters, Murphy Property study area (adapted from Dancey 1991)
clusters provided approximated U.T.M. coordinates for the clusters (Table 9). Murphy IV was measured from the southwest corner of the potential Middle Woodland refuse deposit.

From the U.T.M. coordinates can be calculated distances between clusters. The smaller clusters position relative to the larger clusters is that of a complimentary distribution. These smaller clusters are dispersed in the spaces between the larger clusters. No smaller clusters abutt or are located in close spatial proximity to any larger cluster.

Dispersion of the larger clusters, was calculated using a standard geometrical distance formula (Table 10). The table shows a general pattern of dispersion, with the three large clusters located along the terrace edge. However, even these clusters are at least 100 + meters apart, indicating dispersion between large clusters. The average distance is 480.4 meters. Thus, the spatial patterning can be described as representing a local grouping of dispersed Middle Woodland clusters. There was no evidence for multinodal Middle Woodland clusters in close spatial proximity to each other observed anywhere within the study area (ie. a village was not observed).

**Diversity Results: Assemblage Variability**

**Introduction**

Diversity analysis addresses issues of functional variability between assemblages. Functional variability in spatially separated assemblages implies creation by different activities or events. However, examination of this variability does not imply that direct
Table 9: Locational data for clusters

<table>
<thead>
<tr>
<th>Cluster Name</th>
<th>U.T.M. Easting</th>
<th>U.T.M. Northing</th>
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<tbody>
<tr>
<td>Murphy I</td>
<td>0373,420</td>
<td>4,435,580</td>
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<td>Murphy III</td>
<td>0373,160</td>
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<td>4,435,116</td>
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<td>Murphy VI</td>
<td>0373,120</td>
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<td>Cluster 2</td>
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<td>4,435,380</td>
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<tr>
<td>Cluster 4</td>
<td>0373,096</td>
<td>4,435,508</td>
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<tr>
<td>Cluster 5/8</td>
<td>0373,072</td>
<td>4,435,656</td>
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<tr>
<td>Cluster 7</td>
<td>0373,180</td>
<td>4,435,780</td>
</tr>
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</table>

Table 10: Distance matrix - large cluster dispersion in meters

<table>
<thead>
<tr>
<th></th>
<th>Murphy I</th>
<th>Murphy III</th>
<th>Murphy IV</th>
<th>Murphy V</th>
<th>Murphy VI</th>
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<tr>
<td>Murphy I</td>
<td>0</td>
<td>416</td>
<td>496</td>
<td>510</td>
<td>496</td>
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<tr>
<td>Murphy III</td>
<td>0</td>
<td>0</td>
<td>670</td>
<td>1037</td>
<td>737</td>
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<tr>
<td>Murphy IV</td>
<td>0</td>
<td>0</td>
<td>221</td>
<td>110</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>111</td>
<td>0</td>
</tr>
<tr>
<td>Murphy VI</td>
<td>0</td>
<td>0</td>
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</table>
reconstruction of past events must be the goal. Functional variability can be expressed in numerous ways, including analysis of the defined chipped stone debris classification.

For this study, I have assumed that diversity in the defined classes will be indicative of different types of settlements. The observed patterns of diversity are interpreted through application of the working hypotheses in combination with the analysis of density, which provided data for issues of settlement size, surface structure, and spatial dispersion. Specific activity reconstructions are not attempted. The ultimate goal for the study is differentiation of types of places outlined by the model. Unfortunately, the differentiation of places with diversity analysis is linked intrinsically to artifact density by the sample size requirements necessary to produce valid estimates of differences and similarities between assemblages. Potentially there might be no meaningful diversity comparisons between certain small and large assemblages. Such issues are linked to the aspect of diversity referred to as richness - the number of classes in an assemblage (irregardless of what the classes represent).

Richness

Richness was examined for combinations of the classification scheme and chert type dimensions in order to explore the analytical contexts under which class richness has been influenced by sample size. Simple linear regression coefficients, using log-log transforms as suggested by Jones et al. (1983), were calculated for
models representing various combinations of the two dimensions (Table 11). Examination of the correlation coefficients for the calculated relationships shows that class richness is moderately to strongly related to sample size for all the combinations of data analysed. In general, the greater the number of classes in a given model, the stronger the positive correlation coefficient. This was especially true after removing an outlier, Cluster 1, from the data, reducing sample size from 11 to 10 cases. Correlation coefficients for these combinations ranged between 0.82 and 0.95.

Models involving the collapsed classification in general showed less of a sample size effect on richness, except for Wyandotte which showed a strong correlation between sample size and richness $R=0.81$. For these models, the correlation coefficients prior to removal of the outlier ranged between 0.47 and 0.65. There was also less improvement following the removal of the outlier with these models. The relationship between class richness and sample size is weakest in the models with a collapsed classification and separated or combined chert types (0.67 and 0.48 respectively after removal of the outlier). The weaker relationship is probably directly related to the reduction in the number of classes. Nonetheless, these data structures were preferred for graphical and statistical analyses because they minimize variation attributable solely to sample size, placing emphasis on comparison of evenness to identify significant interassemblage variability. A scatterplot of class richness is provided in Figure 35 showing differences between the collapsed classification scheme when the chert types are separated or combined.
Table II: Regression coefficients for examination of assemblage richness

<table>
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<th>Model*</th>
<th>N</th>
<th>P</th>
<th>Regression Equation</th>
<th>R</th>
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<tbody>
<tr>
<td>Complete/Separated 11 32</td>
<td>Log Y = 0.874 + 0.142 Log X</td>
<td>.743</td>
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<tr>
<td>Complete/Separated 10 32</td>
<td>Log Y = 0.951 + 0.121 Log X</td>
<td>.820</td>
<td></td>
<td></td>
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<tr>
<td>Collapsed/Separated 11 18</td>
<td>Log Y = 1.029 + 0.079 Log X</td>
<td>.653</td>
<td></td>
<td></td>
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<tr>
<td>Collapsed/Separated 10 18</td>
<td>Log Y = 0.969 + 0.066 Log X</td>
<td>.670</td>
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<tr>
<td>Complete/Combined 11 16</td>
<td>Log Y = 0.718 + 0.136 Log X</td>
<td>.660</td>
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<tr>
<td>Complete/Combined 10 16</td>
<td>Log Y = 0.840 + 0.104 Log X</td>
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<tr>
<td>Collapsed/Combined 11 9</td>
<td>Log Y = 0.763 + 0.054 Log X</td>
<td>.470</td>
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<tr>
<td>Collapsed/Combined 10 9</td>
<td>Log Y = 0.833 + 0.034 Log X</td>
<td>.480</td>
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<tr>
<td>Complete/Vanport 11 16</td>
<td>Log Y = 0.633 + 0.144 Log X</td>
<td>.555</td>
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<tr>
<td>Complete/Vanport 10 16</td>
<td>Log Y = 0.529 + 0.198 Log X</td>
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<tr>
<td>Collapsed/Vanport 11 9</td>
<td>Log Y = 0.620 + 0.098 Log X</td>
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<tr>
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<tr>
<td>Complete/Wyandotte 11 16</td>
<td>Log Y = 0.541 + 0.198 Log X</td>
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<td>Collapsed/Wyandotte 11 9</td>
<td>Log Y = 0.593 + 0.120 Log X</td>
<td>.806</td>
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</tbody>
</table>

* Model refers to various combinations of classification scheme and chert types.

Figure 35. Scatterplot of assemblage richness, circles = complete-combined model; asterisks = collapsed-combined model.
Evenness

The graphical comparisons of assemblage evenness explored in this analysis emphasize the potential differences between the utilization of Vanport and Wyandotte chert in the assemblages. Direct interpretation of these evenness profiles is cautioned by the stronger sample size effect on richness for the separated, as opposed to combined, chert types. As shown on Table 11, Wyandotte chert especially has a significant sample size relationship with richness.

Visual examination of the evenness profiles provides an intuitive perspective of assemblage variability. The two largest and densest assemblages, Murphy I and III, have very similar profiles (Figures 36 and 37). Class frequencies exhibited in these profiles document the dual Middle Woodland reduction sequences. There is abundant debitage from primary production of bifaces and bladelet cores. Biface rejects and thinned bifaces document the complete stages of the biface manufacturing process for the assemblage. Likewise there are single arris bladelets and cores representing the bladelet manufacturing process. Multiple arris bladelets, the assumed products of the industry, are also present. Utilized debitage is present which shows within cluster expedient use and discard of fortuitously shaped flakes or debri. Both assemblages have small quantities of Wyandotte chert, especially bladelets and utilized flakes, but these were not shown on the profiles due to the small sample sizes. Overall, taking into account other information about Murphy I and III, the assemblage profiles can be interpreted as documenting a wide range of domestic production, maintenance, and use activities. In other words, the
Figure 36. Lithics Class frequency distribution for Burin I

- Small Debitage
- Medium Deb.
- Large Deb.
- Utilized Deb.
- Biface Reject
- Biface Thinned
- Blade Single Arris
- Blade, Multiple Arris
- Bladelet Core

N=3478
Figure 37. Lithic Class frequency distribution for Murphy III
shapes of these profiles correspond to the definition of assemblage variability expected for Ohio Hopewell hamlets in this study.

The profiles of two other assemblages are similar to Murphy I and III. These assemblages are from Murphy V and VI, both of which were also shown to be similar in size, surface structure, and spatial dispersion to Murphy I and III. The similarity of the Murphy V profile was surprising given the high frequency of Wyandotte chert in the assemblage (Figure 38). I had argued elsewhere (Pacheco 1990; 1991) that Murphy V may have been a staging area for producing the Wyandotte bladelets that are scattered across the South Block. Instead, Wyandotte appears to have been used at Murphy V in a manner similar to the use of Vanport at Murphy I, III, and VI.

While the shape of the Murphy VI assemblage profile is similar overall to Murphy I, III, and V, it also displays more of a contrast between the Wyandotte and Vanport chert types (Figure 39). These differences could stem from non-contemporaneous events. As noted in the examination of the Murphy VI surface structure, a portion of the Wyandotte is marginal to the uninodeal Vanport concentration interpreted as a Middle Woodland refuse deposit. Some overlap was noted in the dump area, confounding a simple explanation of the different class frequencies within the assemblage. As with Murphy V, both chert types may have been incorporated in the domestic context. But while the Wyandotte at Murphy V was utilized like the Vanport in the Murphy I, III, and VI assemblages, the Wyandotte in the Murphy VI assemblage appears to have been channeled primarily into the bladelet industry. Wyandotte also was a preferred source for flake tools.
Figure 38. Class frequency distribution for Murphy A
Figure 39. Class frequency distribution for Murphy VI

Lithics Class

- Blade
- Bladelet
- Blade Multiple Arris
- Blade Single Arris
- Blade Thinned
- Blade Reject
- Utilized Deb.
- Large Deb.
- Medium Deb.
- Small Debitage

Wyandotte N=128
Van Pelt N=2204
The profile for the Murphy IV assemblage supports interpretation of this place as fundamentally different from the other large assemblages (Figure 40). The most striking aspect of the profile is the contrast between the separated Vanport and Wyandotte chert class frequency distributions. The high frequency of multiple arris Wyandotte bladelets suggests activities emphasizing use and some manufacturing of exotic chert bladelets. The Vanport profile, on the other hand, is similar in shape to the profiles of the other large assemblages. Because of density relationships, the profile of Vanport primarily measures the class frequency distribution of the uninodal surface concentration of Vanport chert artifacts located on the southwest margin of the cluster. Thus, assemblage variability at Murphy IV may be explained as resulting from the overlap of two sets of non-contemporaneous activities or events. Vanport chert has frequencies and a depositional pattern placing it with the other possible household clusters, while the Wyandotte frequency distribution and scattered depositional pattern probably were created by a different type of activity.

The analysis of surface structure suggested the possibility that the Wyandotte chert assemblage from Murphy IV was part of a much larger distributional pattern of this chert type, which was deposited as a discontinuous thin scatter across the terrace. According to this view, the activity producing the scatter did not involve formal refuse clearing and redeposition into dumps. Profiles of the other clusters in this area are similar enough in profile shape to the Murphy IV-Wyandotte components to provide additional support for this
Figure 40. Class frequency distribution for Murphy IV.

Lithics Class

Blade
Bladelet Core
Blade Single Arts
Blade Multiple Arts
Biface Thinned
Biface Reject
Utilized Deb.
Large Deb.
Medium Deb.
Small Debitage

Percentage

Wyandotte N=528
Van Pelt N=1953
conclusion. Interpretation of Cluster 1 is hampered because its assemblage is not as rich as would be expected for an assemblage of this sample size, as shown by its consistent status as an outlier in the regression analyses (Figure 41). However, the Wyandotte classes, especially bladelets, present are similar to those in the Murphy IV assemblage. If we can assume that the class frequency distribution for Cluster 1 is a legitimate representation of the actual frequency of classes within the assemblage, then the Vanport profile for the cluster could be contrasted with profiles for the larger assemblages as an example of the outcome of different activity patterns.

The profiles of the other smaller clusters and Intercluster Space all have different shapes. Potentially these differences are related to smaller sample sizes, especially for the chert type profiles. The variation in profile shapes for these smaller clusters includes a few notable features. Cluster 2 (Figure 42) and Intercluster Space (Figure 43), for example, have profiles of Wyandotte chert which exhibit similarities to the Murphy IV-Wyandotte profile, especially in regards to frequencies of multiple arris bladelets. The Vanport profile within Cluster 2 has similarities to the presumed household profile shape (recall the moderately dense node on the surface of Cluster 2), suggesting potentially that like Murphy IV, the Vanport and Wyandotte chert artifacts in these assemblages stem from non-contemporaneous events of a different nature. Intercluster Space includes a high frequency of thinned bifaces, suggesting use and discard of broken or lost bifaces in the spaces in between domestic units. At least one of these thinned bifaces is an example of a
Figure 41. Class frequency distribution for Cluster 1

Lithics Class

Blade, Multiple Arris
Blade, Single Arris
Blade, Thinned
Blade, Rejected
Utilized Deb.
Large Deb.
Medium Deb.
Small Debitage

Wyandotte N=11
Vanport N=127
Figure 4.2. Class frequency distribution for Cluster 2

Lithics Class

- Bladelet Core
- Blade. Multiple Arris
- Blade Single Arris
- Bilace Thinned
- Bilace Reject
- Utilized Deb.
- Large Deb.
- Medium Deb.
- Small Debitage

Percentage

Wyanadotte N=27

Van Port N=85
Figure 43. Class frequency distribution for Intercultural Space

Lithics Class

<table>
<thead>
<tr>
<th>Classification</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Debitage</td>
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</tr>
<tr>
<td>Medium Deb.</td>
<td></td>
</tr>
<tr>
<td>Large Deb.</td>
<td></td>
</tr>
<tr>
<td>Utilized Deb.</td>
<td></td>
</tr>
<tr>
<td>Biface Reject</td>
<td></td>
</tr>
<tr>
<td>Biface Thinned</td>
<td></td>
</tr>
<tr>
<td>Blade Single Arris</td>
<td></td>
</tr>
<tr>
<td>Blade, Multiple Arris</td>
<td></td>
</tr>
<tr>
<td>Bladelet Core</td>
<td></td>
</tr>
</tbody>
</table>
Middle Woodland Synder's projectile point made of Vanport chert. The tip and base of this point exhibit snap fractures.

Cluster 4 has a high proportion of utilized debitage from both chert types, multiple arris Wyandotte bladelets, and a very low frequency of small debitage (Figure 44). As noted, the surface structure of Cluster 4 has a moderate density cluster with crisp spatial boundaries. However, the fundamentally different profile between the Cluster 4 assemblage and the household profiles, suggests a spatially concentrated Middle Woodland activity area between domestic units.

The other small clusters have somewhat unique profile shapes. Cluster 5/8 has a unique profile for Wynadotte chert, emphasizing finished products of both trajectories (bifaces and bladelets), utilized debitage, and low frequencies of small to medium debitage (Figure 45). Cluster 7 has a unique profile for both chert types (Figure 46), including a high frequency of Wyandotte biface rejects (2 out of 42 recovered artifacts). Both Cluster 7 and Cluster 5/8 have small sample sizes containing less than 100 artifacts. The potential for misrepresentations among class frequencies is high. Nonetheless, the scattered nature of these clusters located in the community space between potential domestic units, suggests an interpretation that they represent short-term localized activity areas. In other words, while the sample size problem may precludes statistical demonstration of significant differences between smaller and larger assemblages, the distinct contrast in density properties, size, location, and surface structure strongly suggests that the
Figure 4. Class frequency distribution for Cluster 4.

Lithic Class

- Bladelet Core
- Multiple Arris Blade
- Single Arris Blade
- Bilate Thinned
- Bilate Rejected
- Utilized Deb.
- Large Deb.
- Medium Deb.
- Small Debitage

**Wyandotte N=7**

**Vanport N=101**
Figure 45. Class frequency distribution for Cluster 5/8

Lithic Class

- Small Debitage
- Medium Deb.
- Large Deb.
- Utilized Deb.
- Biface Reject
- Biface Thinned
- Blade. Single Arris
- Blade. Multiple Arris
- Bladelet Core

Percentage

Van Port N=62
Wyandotte N=10
Figure 45. Class frequency distribution for Cluster 7

Lithic Class

- Small Debitage
- Medium Deb.
- Large Deb.
- Utilized Deb.
- Biface Reject
- Biface Thinned
- Single Arris Blade
- Multiple Arris Blade
- Bladelet Core

Percentage

Van Port N=31
Wyandotte N=11
smaller clusters represent activity areas distinct from the household activities and refuse areas. The potential for functional variation in the small clusters is documented by the class profiles, despite possible biases.

Correspondence Analysis

A number of correspondence analyses were performed on various combinations of the data in an attempt to determine the stability of the data set in a multidimensional space. Analyses performed with the raw or untransformed data proved to be seriously affected by the mass of the small and medium debitage classes and the five large assemblages. Sample size differences determined the variability patterns which were detected. The Murphy IV assemblage consistently had a large affect on the models. In models where the chert types were combined, Murphy IV contrasts with all other clusters, while in models with the chert types separated, the Vanport component for Murphy IV clusters internally with the other four large assemblages, and the Wyandotte component contrasts with this group. Likewise, both Cluster 5/8 and Cluster 7 occur in widely scattered locations on the graphs, probably because of the small sample sizes.

The preliminary analyses provided strong evidence that the raw data structure was not stable. Sample size differences, and probable mixing of non-contemporaneous components within assemblages, prevented meaningful interpretation of the graphical displays. Therefore, different transformations were calculated for the data structure to try and stabilize the variability pattern and also
provide a more interpretable result. The transformation which Greenacre and Vrba (1984) used on the antelope census data divided assemblage size by area to produce a density figure, in effect standardizing the observation unit. This transformation, unfortunately, makes little intuitive sense in this context, because the important assemblage differences are not necessarily measured by the density of an artifact type within a unit area. Likewise, the lack of a completely linear relationship between assemblage size and settlement size, compounded the problems of interpreting the results.

Greenacre and Vrba (1984) also suggested equalization of the weights of the samples, treating all assemblages as if they were the same size. For the assemblage data of this study, equal weighting provided the most consistent results. The transform has the added value of providing a statistical comparison of the eveness profiles, using the standardized class frequency distributions as the data matrix. Enhancing the interpretive value of the model is the graphical comparison of the variation pattern provided by correspondence analysis. The most successful correspondence analyses, which is presented here, used a collapsed classification with eight classes (small and medium debitage were combined into a single class) instead of nine. scheme. which will be presented here was a Combined-Reduced Model further reduced to eight classes by combination of the small and medium debitage classes. Murphy IV was split into the two chert type assemblages and Cluster 5/8 and 7 were combined.

The results of the correspondence analysis for the equal weighting model of choice are presented in Table 12. The first three
Table 12: Results of Correspondence Analysis

A. The first three eigenvalues:

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>Percentage</th>
<th>Cumulative Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 0.11846691</td>
<td>68.08%</td>
<td>68.08%</td>
</tr>
<tr>
<td>2. 0.03605876</td>
<td>20.72%</td>
<td>88.80%</td>
</tr>
<tr>
<td>3. 0.00984742</td>
<td>5.66%</td>
<td>94.46%</td>
</tr>
</tbody>
</table>

B. Coordinates of the columns:

<table>
<thead>
<tr>
<th>Class</th>
<th>Grouping</th>
<th>Mass</th>
<th>Distance</th>
<th>First Axis</th>
<th>Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>First Axis</td>
</tr>
<tr>
<td>Class 1/2</td>
<td>Sm. &amp; Med. Debitage</td>
<td>0.768</td>
<td>0.03</td>
<td>0.18</td>
<td>-0.01</td>
</tr>
<tr>
<td>Class 3</td>
<td>Large Debitage</td>
<td>0.024</td>
<td>0.70</td>
<td>-0.59</td>
<td>-0.15</td>
</tr>
<tr>
<td>Class 4</td>
<td>Utilized Debitage</td>
<td>0.096</td>
<td>0.31</td>
<td>-0.46</td>
<td>-0.24</td>
</tr>
<tr>
<td>Class 5</td>
<td>Biface Reject</td>
<td>0.011</td>
<td>1.18</td>
<td>-0.08</td>
<td>-0.95</td>
</tr>
<tr>
<td>Class 6</td>
<td>Thinned Biface</td>
<td>0.011</td>
<td>1.62</td>
<td>-1.05</td>
<td>-0.60</td>
</tr>
<tr>
<td>Class 7</td>
<td>Single Arris Blade</td>
<td>0.037</td>
<td>0.25</td>
<td>-0.39</td>
<td>0.19</td>
</tr>
<tr>
<td>Class 8</td>
<td>Multiple Arris Blade</td>
<td>0.069</td>
<td>1.21</td>
<td>-0.99</td>
<td>0.47</td>
</tr>
<tr>
<td>Class 9</td>
<td>Bladelet Core</td>
<td>0.004</td>
<td>1.00</td>
<td>-0.39</td>
<td>-0.20</td>
</tr>
</tbody>
</table>

C. Absolute contributions and squared correlations of the columns:

<table>
<thead>
<tr>
<th>Class</th>
<th>Absolute Contributions</th>
<th>Squared Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Axis</td>
<td>Second Axis</td>
</tr>
<tr>
<td>Class 1/2</td>
<td>20.1</td>
<td>1.3</td>
</tr>
<tr>
<td>Class 3</td>
<td>7.2</td>
<td>17.9</td>
</tr>
<tr>
<td>Class 4</td>
<td>17.0</td>
<td>14.7</td>
</tr>
<tr>
<td>Class 5</td>
<td>0.1</td>
<td>27.9</td>
</tr>
<tr>
<td>Class 6</td>
<td>9.9</td>
<td>3.0</td>
</tr>
<tr>
<td>Class 7</td>
<td>4.8</td>
<td>3.9</td>
</tr>
<tr>
<td>Class 8</td>
<td>40.4</td>
<td>20.8</td>
</tr>
<tr>
<td>Class 9</td>
<td>0.5</td>
<td>0.4</td>
</tr>
</tbody>
</table>

D. Coordinates of the rows:

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Mass</th>
<th>Distance</th>
<th>First Axis</th>
<th>Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>First Axis</td>
<td>Second Axis</td>
</tr>
<tr>
<td>Murphy I</td>
<td>0.091</td>
<td>0.09</td>
<td>0.29</td>
<td>0.10</td>
</tr>
<tr>
<td>Murphy III</td>
<td>0.091</td>
<td>0.13</td>
<td>0.33</td>
<td>0.10</td>
</tr>
<tr>
<td>Murphy IVA-VP</td>
<td>0.091</td>
<td>0.09</td>
<td>0.28</td>
<td>0.03</td>
</tr>
<tr>
<td>Murphy IVB-Wy</td>
<td>0.091</td>
<td>0.33</td>
<td>-0.39</td>
<td>0.38</td>
</tr>
<tr>
<td>Murphy V</td>
<td>0.091</td>
<td>0.10</td>
<td>0.30</td>
<td>0.05</td>
</tr>
<tr>
<td>Murphy VI</td>
<td>0.091</td>
<td>0.09</td>
<td>0.29</td>
<td>-0.01</td>
</tr>
<tr>
<td>Cluster 1</td>
<td>0.091</td>
<td>0.07</td>
<td>0.11</td>
<td>0.05</td>
</tr>
<tr>
<td>Cluster 2</td>
<td>0.091</td>
<td>0.12</td>
<td>-0.30</td>
<td>-0.03</td>
</tr>
<tr>
<td>Cluster 4</td>
<td>0.091</td>
<td>0.14</td>
<td>-0.01</td>
<td>-0.35</td>
</tr>
<tr>
<td>Cluster 5/7/8</td>
<td>0.091</td>
<td>0.13</td>
<td>-0.14</td>
<td>-0.32</td>
</tr>
<tr>
<td>Intercluster</td>
<td>0.091</td>
<td>0.62</td>
<td>-0.76</td>
<td>0.00</td>
</tr>
</tbody>
</table>

E. Absolute contributions and squared correlations of the rows:

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Absolute Contributions</th>
<th>Squared Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Axis</td>
<td>Second Axis</td>
</tr>
<tr>
<td>Murphy I</td>
<td>6.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Murphy III</td>
<td>8.3</td>
<td>2.8</td>
</tr>
<tr>
<td>Murphy IVA</td>
<td>6.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Murphy IVB</td>
<td>11.9</td>
<td>36.4</td>
</tr>
<tr>
<td>Murphy V</td>
<td>7.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Murphy VI</td>
<td>6.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Cluster 1</td>
<td>1.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Cluster 2</td>
<td>6.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Cluster 4</td>
<td>0.0</td>
<td>31.3</td>
</tr>
<tr>
<td>Cluster 5/7/8</td>
<td>1.5</td>
<td>25.3</td>
</tr>
<tr>
<td>Intercluster</td>
<td>44.5</td>
<td>0.0</td>
</tr>
</tbody>
</table>
eigenvalues are provided by the program. The first eigenvalue accounts for 68.08% of the total variation and the second eigenvalue accounts for another 20.72% of the variation for a cumulative 88.08%. The third eigenvalue adds another 5.6% of explained variation, increasing the cumulative total to 94.46%. A plot of the model in three dimensional space is provided in Figure 47.

The three dimensional graphical display of the correspondence analysis results illustrates the similarity in assemblage composition between Murphy I, III, V, VI, and Murphy IV-Vanport. These assemblages are contrasted with the remaining assemblages, and are farthest removed from Intercluster Space, Murphy IV-Wyandotte and Cluster 2. Cluster 4 and the Cluster 5/7/8 combination are midway between the large assemblages and Murphy IV-Wyandotte. Cluster 1 is close to the large assemblages, but because of low richness, it has a weak correlation with all of the first three principal axes of variation.

The loadings and correlations of each class and assemblage with the principal axes of variation define similarities and differences in the data structure. The small and medium debitage class is associated with the large assemblages, all of which have high correlation with the first axis. Directly opposed on the first axis are thinned bifaces and multiple arris bladelets, and the assemblages from the South Block. The first axis appears to contrast domestic production with specialized use. Utilized debitage and single arris bladelets also are positively correlated with the first axis and support this interpretation. Both classes of bladelets loaded positive
Figure 47. Three-dimensional display of Correspondence Analysis results. Circles = assemblages, squares = artifact classes. The display was rotated 80 degrees, and tilted 80 degrees.
on the second axis, as did the South Block assemblages. These were contrasted with large debitage, biface rejects, utilized debitage, and the other small clusters. The second axis shows a contrast between specialized use of bladelets in the South Block and the use of large edge or expedient tools in smaller assemblages and clusters. To summarize, the first axis contrasts sedentary domestic units and short-term specialized use. The domestic assemblages are signified by clear association with the byproducts of primary production, including Murphy IV-Vanport. The first axis contrasts the domestic units with the other assemblages from the South Block, including Murphy IV-Wyandotte. Artifact classes included in the contrast are bladelets and bifaces, or products of the reduction sequences. The second axis is interpreted as a contrast between types of short-term activity localities. These were defined by the assemblages in the South Block and an association with bladelets. The contrast was between the south block assemblages and the other small clusters. Artifact classes associated with these assemblages included utilized debitage, large debitage, and biface rejects.

The correspondence analysis results present a consistent pattern of variation with that exhibited by the other analyses. The large assemblages stood out as dense clusters with uninodal concentrations. These assemblages were spatially dispersed from each other and possessed similar assemblages, including abundant debitage. The South Block assemblages were characterized by the scattered distribution of Wyandotte chert artifacts, especially multiple arris bladelets and utilized debitage. Finally, the smaller clusters
located in the space between the large clusters were similar to each other in structure and size, and possessed divergent assemblages emphasizing use over production.

Confounding Issues: Contemporaneity and Duration

Introduction

Evidence for contemporaneity and duration in the collected data are examined in this final section of the analysis. These issues of contemporaneity and duration have an undetermined, but important, confounding effect on the conclusions of this study. The observed Middle Woodland settlement variability represents a conflation of multiple activities and events that took place over an extended period of time, possibly as much as 400 years. Aspects of the analysis, such as investigation of settlement dispersion, assume the contemporaneity of the phenomena being measured. This assumption is undoubtedly invalid. Likewise, the length of time that each deposit took to accumulate is critical to interpretation of density and assemblage variability, because assemblages can record short-term single events or multiple events. In general, the longer a settlement is occupied, the greater the density of disposable trash.

One important issue mitigates or minimizes the effects of contemporaneity and duration on the conclusions. This issue is the apparent stability of the local Ohio Hopewell community which occupied the study area during the Middle Woodland period. Analysis of settlement variability indicated redundant patterning in the archaeological record of the observed household and activity areas.
Although the various settlements investigated in the study area are probably not all contemporaneous and were of different durations, they remain comparable because the community pattern and household organization remained stable throughout the Ohio Hopewell occupation.

Contemporaneity

A possible solution to the contemporaneity issue relies on the presence of the Wyandotte chert artifacts in the assemblage. As shown in Table 13 and Figure 48, the total weight of the recovered Wyandotte chert sample is ten times less than the weight of the local Vanport. Approximately 2 kilograms were recovered during the survey, and if we can rely on the assumption that this figure is somewhat less than 5% of the total Wyandotte population within the plowzone, then the total weight of Wyandotte chert in the study area is between 40 to 50 kilograms. This amount is no more than one or two canoe loads full in terms of transportability and exchange (Brose 1990). If we consider the acquisition of the Wyandotte to be an event, rather than a process of long term acquisition, then the presence and types of Wyandotte chert artifacts in assemblages can serve as time markers. The homogeneity of the Wyandotte chert used in the study area supports the single acquisition theory. An absolute date for this event can be extended through the radiocarbon date for Murphy I Feature #100A. A Wyandotte biface and bladelet were recovered from this feature, which has a date of 190± 60 A.D. (Dancey 1991).

This assumption, and other inferences presented during the study, implies contemporaneity for at least some of the Middle Woodland
Table 13. Chert raw material weight totals

<table>
<thead>
<tr>
<th></th>
<th>Van Port</th>
<th>Wyandotte</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murphy I</td>
<td>4535.9</td>
<td>18.2</td>
</tr>
<tr>
<td>Murphy III</td>
<td>6137.2</td>
<td>7.3</td>
</tr>
<tr>
<td>Murphy IV</td>
<td>2831.6</td>
<td>681.1</td>
</tr>
<tr>
<td>Murphy V</td>
<td>646.6</td>
<td>691.3</td>
</tr>
<tr>
<td>Murphy VI</td>
<td>4432.7</td>
<td>125.4</td>
</tr>
<tr>
<td>Cluster 1</td>
<td>211</td>
<td>19.8</td>
</tr>
<tr>
<td>Cluster 2</td>
<td>209.5</td>
<td>63.4</td>
</tr>
<tr>
<td>InterCluster Space</td>
<td>366.3</td>
<td>311.6</td>
</tr>
<tr>
<td>TOTAL (in gms.):</td>
<td>19370.8</td>
<td>1918.1</td>
</tr>
</tbody>
</table>

Figure 48. Frequency distribution of chert weights by cluster
clusters in the study area. Murphy V and IV-Wyandotte (and the rest of the Wyandotte chert in the South Block) have a high probability of contemporaneity. Murphy IV-Vanport presumably would predate the Wyandotte event, based on the partially overlapping surface distribution. Murphy I is likely contemporaneous with Murphy V and the Wyandotte event, based on the radiocarbon date and evidence for greater access to Wyandotte than either Murphy III or VI. For example, four Wyandotte bladelet cores were recovered during the excavations and surface collections at Murphy I. Murphy VI, as noted, has a light scatter of Wyandotte chert on its west margin that may be related to nearby Murphy IV-Wyandotte, although like Murphy III, there are bladelets in the central refuse deposit. Murphy VI and III probably post-date the Wyandotte event, with Wyandotte presence in these assemblages a result of recycling of bladelets discovered while living in the study area. Ceramic evidence from the Murphy III features support a late Middle Woodland position, overlapping the end of the Murphy I occupation (Pacheco 1991). Of the smaller clusters, Cluster 1, 4, 5/8, and 7 all contained Wyandotte artifacts, including bladelets. These short-term activity areas are, therefore, either contemporaneous with or post-date the Wyandotte event. Partial overlap of Vanport and Wyandotte in Cluster 2 suggests that this cluster, like Murphy IV-Vanport, may pre-date the Wyandotte event. All of these proposed relationships require explicit testing beyond the hints of evidence found in this study. Seriation and chert analysis are two possible independent tests of this hypothetical reconstruction.
The Murphy V assemblage is puzzling because of the typical household characteristics of the settlement. Wyandotte was not used at Murphy V in any special manner, duplicating use of local Vanport in the other household clusters. I would speculate that the Murphy V household is the member of the local community that acquired the Wyandotte, either through exchange or as a result of an expedition to southern Indiana. Everywhere else in the study area Wyandotte was channeled into the blade-core industry, but at Murphy V it is used as every day material. In conclusion, the presence of the Wyandotte chert in the collected samples indicates a high probability that at least some of the settlements involved contemporaneous events within an Ohio Hopewell community.

Duration

One possible solution to the duration issue is provided by the relationship between absolute artifact density and duration. As people stay in one place for a longer time we can expect the accumulation of more trash. Since the pattern of hamlets in the study area have redundant traces, and similar sizes, the intervening variable of differences in the number of people involved is less likely to affect the density/duration relationship. Based on this assumption, a plot of artifact assemblage size versus area of surface scatter is shown in Figure 49. Duration of the various Middle Woodland localities in the study area is interpreted by position of the assemblage on this graph. By this reasoning, Murphy I and III represent long-term dispersed Ohio Hopewell hamlets.
Figure 49. Scatterplot of relative cluster duration based on density

KEY:
A LONG TERM HAMLETS
B SHORT TERM HAMLETS
C ACTIVITY LOCALES
MIVA = MURPHY IV VAN PORT
MIVB = MURPHY IV WANDOTTE
* ESTIMATED POINT

SURFACE AREA OF SCATTER - SQUARE METERS
CHAPTER VI
SUMMARY AND CONCLUSIONS

"We must never lose the simple and unvarnished joy of discovering a past that has disappeared from view."

Steven J. Gould

Ohio Hopewell settlement patterns have long suffered from underexposure to archaeological research. When Prufer began his central Scioto research program thirty years ago there were only two possible candidates for Hopewell domestic settlements known in the literature, and neither of these was well documented. As a result of Prufer's research, especially at the McGraw site, he proposed the Vacant Center Model to characterize the Ohio Hopewell settlement pattern. Prufer argued that Hopewell earthwork/mound complexes were isolated ceremonial centers which were surrounded by small rural farming settlements. According to the model, Hopewell centers were the focal point of group interaction, but not the place that the group called home. Yet, despite Prufer's work, substantive support for his theory has not appeared in the literature. The first completely excavated Ohio Hopewell domestic settlement (the Murphy site) was not reported until 1991. What little evidence exists (mostly in gray literature) supports the Vacant Center Model. But, there has never been an explicit test of the model or its implications for
understanding the Middle Woodland period archaeological record. As noted by Smith (quoted at the beginning of Chapter 1), despite archaeologists' fascination with the mounds and earthworks for at least 150 years, we still do not know much about the sizes, distributions, or organizational complexity of Ohio Hopewell domestic settlements.

The present study was undertaken to address these issues. To accomplish this goal the Vacant Center Model was formalized as an organizational framework for understanding Ohio Hopewell community settlement patterns. Issues were considered that distinguish the Vacant Center pattern, and which may have led to its origin. Primary among these issues may be characteristics of the Ohio Hopewell niche and the ecological adjustments of dispersed sedentary Ohio Hopewell domestic units to the temperate woodland environment.

Working hypotheses were generated from the model, which predicted the state of the archaeological record for the three main types of settlements expected by the model: hamlets, logistical or short-term activity areas, and specialized camps. For each settlement type, predictions were made concerning settlement size, structural patterns, assemblage variability, and distributional characteristics. Because these hypotheses are statements about the archaeological record, they can be falsified by archaeological data. Thus, the research design is not only an application of the model, but a test of its applicability to explain Ohio Hopewell settlement variability.

An understanding of Ohio Hopewell settlement patterns requires a community scale analysis. Traditional excavation methods have
failed to solve the mystery of Ohio Hopewell settlement patterns precisely because excavation cannot provide data on a scale large enough to reconstruct community organization. For this study, the methodological approach of siteless survey was combined with systematic complete surface collections, because surface survey provides broader spatial coverage and larger samples for less cost. Siteless survey reorients focus of analysis from sites to distributions of artifacts across the landscape — a perfect match for acquiring information at the community level.

The study was conducted on a 50 ha tract, the majority of which is a glacial outwash terrace, in the upper Licking River Valley of central Ohio. This property contained the previously excavated Murphy site, and is situated between Hopewellian earthwork and mound centers at Granville and Newark. Hence, the analytical requirement that the survey obtain data from within an Ohio Hopewell community is a safe assumption. The survey was conducted in the spring months of 1989 and 1990 using volunteer labor coordinated through the Licking County Archaeology and Landmarks Society. Surface collections were conducted with one of three methods based on the density of artifacts identified in a particular sector. The majority of artifacts were collected with a grid-block method in which surveyors systematically collected all visible surface artifacts from defined units. Unit size was established at 4x4 meters to minimize bias introduced by lateral displacement from modern agricultural plowing. A total of approximately 30 ha were completely collected during the survey, producing over 17,000 artifacts from approximately 1200 surface units.
Analytical methods were chosen that operationally measure the settlement variables specified in the working hypotheses: size, structure, assemblage variability, and spatial distribution. Initially, artifact assemblages were partitioned by chert types based on the exclusive use of local Vanport and exotic Wyandotte chert in the local Ohio Hopewell blade-core industry. Blade-core industry artifacts were abundantly recovered during the survey, testifying to an intensive use of study area during the Middle Woodland period. Additionally, Other cherts, such as Upper Mercer and Columbus cherts, were used for the majority of non-Middle Woodland projectile points recovered during the survey. After partitioning the chert samples, clusters and assemblages were defined based on criterion of spatial proximity of positive units, presence of diagnostic artifacts within clusters, and statistically valid sample sizes wherever possible. A classification scheme was devised to emphasize variability in chert production debris, rather than a strictly functional typology. The classes represent products and byproducts of the independent Ohio Hopewell biface and blade-core industries. Although the survey methodology was geared towards any distributional pattern of surface artifacts, in the study area, there was a predominant occurrence of artifacts within well defined spatial clusters.

Investigation of settlement size, surface structure, assemblage variability, and settlement dispersion was accomplished with use of the concepts of artifact density and diversity. Density refers to the number of artifacts in a specified area and was used to investigate settlement size, surface structure, and settlement dispersion.
Diversity analysis was used to investigate assemblage variability. The analysis focused on the five large, dense clusters, five smaller, less dense clusters, and intercluster areas which contained Hopewell diagnostics. These clusters were analysed to determine the degree to which they conformed to expectations of the working hypotheses. Comparison with Murphy I provided a solid foundation against which to make comparisons to determine if other clusters were similar examples of Hopewell hamlets, activity areas, or even perhaps components of an aggregated Hopewell village settlement, which would falsify the model.

Based on the results of the analysis of density and diversity, the five high density concentrations of artifacts with crisp spatial boundaries (Murphy I, III, IV-Vanport, V, VI) are interpreted as systematic refuse deposits, which mark the location of dispersed sedentary single household hamlets. The working hypotheses concerning uniform small size, redundant surface structures, redundant assemblage variability, and dispersed spacing of Hopewell hamlets fits the pattern of settlement variation exhibited by these localities. There was no evidence for a village in the study area, indicating an inability to outright reject the model. I would propose, therefore, that the study area contains the remains of five Hopewell hamlets and no examples of the types of domestic settlements that could falsify the model. These Murphy settlements conform in all respects to the expected patterns of dispersed agricultural hamlets. Together these hamlets within the Murphy study area represent part of a dispersed community which presumably participated in the social events taking place at the "vacant" centers of the Licking Valley.
The remaining clusters within the study area which contained Middle Woodland period artifacts are interpreted as representing examples of these other types of settlements. Clusters 1, 2, 4, 5/8, and 7 can be characterized as smaller, less dense clusters, with generally scattered surface structures, assemblage variability assumed to stem from functional differences, and locations between the household clusters. This pattern of settlement variability conforms to the expected pattern of short-term logistical activity areas, which were arranged as work stations to Ohio Hopewell household clusters. The presence in Intercluster Space of diagnostic Hopewell artifacts such as bladelets, document limited activities in the spaces between the hamlets, involving casual discard of used, broken, or lost tools.

The area of the South Block (approximately 4 ha total) included Clusters 1, 2, Murphy IV, and a bulk of the artifacts provenienced to Intercluster Space. These clusters stand out because of the scattered distribution of Hopewell bladelets and utilized debitage made from non-local Wyandotte chert. The primarily non-overlapping surface distribution of Wyandotte chert artifacts and the uninodal concentration of Vanport chert in the Murphy IV assemblage suggested the probable lack of contemporaneity in the depositional events of these Middle Woodland artifacts. (This may also be true for Cluster 2 and at least a portion of the Wyandotte component in the Murphy VI cluster). The similarities in surface structure and assemblage variability for Clusters 1, 2, Murphy IV-Wyandotte, and Intercluster Space is interpreted as resulting from a single short-term event emphasizing the specialized use of non-local bladelets. The pattern
of variability exhibited for the Wyandotte and some of the Vanport chert artifacts in the South Block conforms to the expected pattern produced by a specialized camp. Therefore, the South Block can be considered an example of a specialized camp. It is located 700 meters east of the local Granville Earthwork Complex, and is presumably associated with that center.

Putting together all the information learned during this study, it is proposed that the Middle Woodland remains within the study area represent several generations of an evolving family's utilization of the valley floor. This includes evidence for five household areas, short-term activity areas between households, and a specialized camp in which exotic bladelets were used. A time series diagram of this evolutionary process is shown in Figure 50. This diagram incorporates all available evidence discussed during the analysis, but is also at another level a testable hypothesis. Comparison of the diagram to the hypothetical models of Ohio Hopewell community organization presented in Figures 2 and 3 demonstrates a close match to the pattern observed in the study area. Based on the results of this study in the Licking Valley, the Vacant Center Model can be considered a valid characterization for the local Ohio Hopewell community settlement pattern.

Broad acceptance of the Vacant Center Model for all Ohio Hopewell communities, will ultimately, I believe, lead to a shift from site oriented research to studies of local communities and regional systems. Ohio Hopewell communities are fundamentally linked to the vacant center–dispersed hamlet dichotomy. The spectacular aspects of
Figure 50. Reconstruction of Ohio Hopewell community pattern from study area

Legend
- Black: Occupied/Utilized
- Gray: Archaeological
- M: Murphy
- C: Cluster
Hopewell societies stem from the social relationships created by interacting dispersed households at vacant centers. If the communities were not dispersed, the earthwork/mound centers would cease to function in the same manner. Thus, stability in community organization should be considered a standard feature of Ohio Hopewell settlement systems. Change is not expected within the pattern, but only as the pattern evolves and then ultimately disappears from the record. From this argument, I would expect major disjunctions in settlement patterns prior to and after Ohio Hopewell, but not during the use of the vacant centers - these existed for and by the efforts of dispersed communities. The various dispersed Ohio Hopewell communities which used the vacant centers, however, have their own individual histories of success and failure. These communities and the dispersed households that form them are the social units on which evolutionary processes are acting. Thus, community scale analysis provides the focus for which an evolutionary approach to Ohio Hopewell settlement archaeology can be based. The Hopewell were mysterious people only because the lives of the people who built the earthworks and mounds were not grounded. The Vacant Center Model provides these people with communities and homes, placing the moundbuilding activities into a social framework that unites the domestic and corporate spheres of Hopewell life. If in the future, the model should receive continued application and testing, then I will consider this research effort to be a success.
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