An Analysis of the Lithic Assemblage from the Armintrout-Blackman Site (20AE812), Allegan County, Michigan

Arthur L. DeJardins
Western Michigan University

Follow this and additional works at: https://scholarworks.wmich.edu/masters_theses
Part of the Anthropology Commons

Recommended Citation
https://scholarworks.wmich.edu/masters_theses/3936

This Masters Thesis-Open Access is brought to you for free and open access by the Graduate College at ScholarWorks at WMU. It has been accepted for inclusion in Master's Theses by an authorized administrator of ScholarWorks at WMU. For more information, please contact maira.bundza@wmich.edu.
AN ANALYSIS OF THE LITHIC ASSEMBLAGE FROM
THE ARMINTROUT-BLACKMAN SITE (20AE812),
ALLEGAN COUNTY, MICHIGAN

by

Arthur L. DesJardins

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Anthropology

Western Michigan University
Kalamazoo, Michigan
April 2001
ACKNOWLEDGMENTS

I would like to extend many thanks to my committee members, Dr. William Cremin, Dr. Elizabeth Garland and Dr. Janet Brashier for their patience, thoughtful guidance and constructive comments during the course of this study. Special thanks goes to Dr. Garland for her contributions to the excavation and interpretation of this site, and the realization of its importance for understanding Middle Woodland period occupations in Western Michigan.

I also would also like to thank the faculty of the Anthropology Department for their interest in students and willingness to engage in conversation outside of classroom environments. I have always viewed this as an important part of my education experience in the graduate program here at Western and believe that it will continue well into the future.

Appreciation need also be given to the members of the Kalamazoo Valley Chapter, Michigan Archaeological Society. The availability of this lithic collection for study was only made possible through their devotion to archaeology and personal time spent in conducting a thorough excavation of the Armintrout-Blackman site. Specifically, I appreciate the dedication of Mr. George Spero, the principal director of site excavations that took place over several years. On a number of occasions Mr. Spero and I have engaged in various conversations on field archaeology, interpretation, and certain aspects of lithic analysis and typology. These conversations were very instructive to my own efforts during the course of this study and have come to value him as a good friend during my archaeological experiences that have extended beyond the university environment.
Acknowledgments—continued

Additional thanks go to Dr. Michael Hambacher, Daniel Goatley and numerous other individuals who have shared their personal comments and experiences with me in the area of lithic technology and material analysis.

Finally, I would like to thank my family and friends for all their patience and support they have given me while engaged in the rigors of academic coursework and completion of the degree requirements.

Arthur L. DesJardins
AN ANALYSIS OF THE LITHIC ASSEMBLAGE FROM
THE ARMINTROUT-BLACKMAN SITE (20AE812),
ALLEGAN COUNTY, MICHIGAN

Arthur L. DesJardins, M. A.
Western Michigan University, 2001

Middle Woodland period Hopewell manifestations in western Michigan were
mainly concentrated in the St. Joseph, Grand and Muskegon River Valleys. By
contrast, the Kalamazoo River valley is lacking in a significant Hopewell expression,
suggesting this area was peripheral to Hopewell developments elsewhere in western
Michigan. The Armintrout-Blackman site (20AE812) is a Middle Woodland period
campment in the middle segment of the Kalamazoo River valley and has yielded
artifacts bearing Hopewell stylistic attributes. More specifically, this thoroughly
evacuated site exhibits spatial separation of temporally sensitive ceramic components,
reflecting early Havana-Hopewell through late Middle Woodland occupations. This
project examines such a situation further through a formal analysis of the lithic
assemblage. It is felt that this study will augment ceramic interpretations and
contribute to a better understanding of Middle Woodland occupations within the
Kalamazoo River valley.
# TABLE OF CONTENTS

ACKNOWLEDGMENTS ........................................................................................................... ii

LIST OF TABLES .................................................................................................................. vi

LIST OF FIGURES .................................................................................................................. v

CHAPTER

I. INTRODUCTION .................................................................................................................. 1

   Historical Background ........................................................................................................ 1

   Problem Orientation .......................................................................................................... 5

   Focus of This Study ........................................................................................................... 7

II. THE ARMINTROUT-BLACKMAN SITE ........................................................................... 9

   Environmental Setting ...................................................................................................... 9

   History of Investigations ................................................................................................ 12

   Recovery Summary .......................................................................................................... 16

      Ceramics ...................................................................................................................... 18

      Features ...................................................................................................................... 20

      Faunal Remains .......................................................................................................... 22

III. METHODOLOGY ............................................................................................................. 26

   Lithic Raw Materials ...................................................................................................... 27

   Local Raw Materials .................................................................................................... 29

   Exotic Raw Materials .................................................................................................... 34

   Heat Alteration of Raw Materials ................................................................................ 37

   Debitage Classification .................................................................................................... 40

   Use-Wear Assessments .................................................................................................... 42
Table of Contents—continued

CHAPTER

IV. LITHIC ASSEMBLAGE DESCRIPTION .......................................... 44

   Projectile Points ............................................................. 45

   Stemmed Points ............................................................... 45

   Large Corner Notched Points ............................................ 51

   Broken Large Corner Notched Points ................................... 53

   Medium Corner Notched Points ........................................... 53

   Expanding Stem Points ..................................................... 57

   Small Notched Points ....................................................... 60

   Miscellaneous Expanding Stem Points .................................. 61

   Late Woodland Triangular Points ....................................... 62

   Archaic and Unclassified Points ......................................... 62

   Staged Bifaces and Fragments ........................................... 64

   Stage 1/2 Bifaces ............................................................. 64

   Stage 3/4 Bifaces ............................................................. 64

   Broken Staged Bifaces ....................................................... 66

   Miscellaneous Bifacial Items .............................................. 66

   Projectile Point Blades .................................................... 67

   Projectile Point Bases ...................................................... 67

   Bifacial Tips ................................................................. 67

   Cores, Core Fragments and Bipolar Lithics ............................. 70

   Cores and Core Fragments .................................................. 70
Table of Contents—continued

CHAPTER

Bipolar Lithics ................................................................. 71
Chipped Stone Tools ........................................................... 73
Hafted Tools and Drills/Reamers ........................................ 73
Retouched Unifacial Scrapers ............................................. 74
Flake Tools ......................................................................... 75
Non-Chert Tools .................................................................. 76
Non-Chipped Lithics .......................................................... 77
Lithic Debitage ..................................................................... 78
Burlington Chert ................................................................. 80
Wyandotte/Cobden Chert ..................................................... 81
Flint Ridge Chert ............................................................... 82
Local Raw Materials .......................................................... 82

V. INTERPRETATIONS AND CONCLUSIONS.......................... 85

Typological Discussion of Middle Woodland Points ............ 86
Overview of Lithic Raw Material and Artifact Distributions .... 91

APPENDICES

A. Projectile Point Recording Schema .................................. 94
B. Lithic Artifact Illustrations ............................................... 99
C. Projectile Point Metrical Data and Raw Material Type by Sector ...... 135
D. Distribution of Selected Artifacts and Exotic Raw Materials by Sector ................................................................. 145
E. Lithic Raw Material Distributions by Artifact Class ............. 159
Table of Contents—continued

BIBLIOGRAPHY ........................................................................................................ 167
LIST OF TABLES

1. Faunal Assemblage Composition ................................................................. 23
2. Corner Notched Points Average Width-to-Thickness Ratios ...................... 56
3. Distribution and Raw Material Type for Stage 2/3 Bifaces ....................... 66
4. Distribution of Projectile Point Bases ......................................................... 68
5. Distribution of Bifacial Tips ...................................................................... 69
6. Distribution of Raw Material Types by Sector ......................................... 79
7. Local Raw Material Distributions .............................................................. 83
LIST OF FIGURES

1. Selected Sites With Middle Woodland Components................................. 3
2. Armintrout-Blackman Site Environs .......................................................... 11
3. Excavation Units...................................................................................... 14
4. Lithic Debitage Densities per Square Meter ........................................... 17
5. Ceramic Distributions.............................................................................. 19
6. Distribution of Deer/Large Mammal, Turtle and Sturgeon Remains .......... 25
7. Location of Fully Analyzed Units............................................................. 46
8. Primary Stage Debitage Percentages by Count........................................ 47
9. Primary Stage Debitage Percentages by Weight....................................... 48
10. Distribution of Stemmed and Corner Notched Points ............................ 52
11. Distribution of Expanding Stem and Small Notched Points................... 58
CHAPTER I

INTRODUCTION

Historical Background

Definition of the Middle Woodland period (ca. 50 B.C. – A.D. 500) in lower Michigan is traditionally rooted in the presence of Hopewell socio-cultural elements. Such elements are uniquely visible in the form of burial mound groups, pan-regional exchange of exotic items and elaboration of material culture. Participation in pan-regional exchange of exotic items also reflects a sophisticated degree of social organization. Within the eastern Woodlands this phenomenon is commonly referred to as the “Hopewellian Interaction Sphere”, viewed as operating through areas of regionally distinct Hopewell cultural traditions (Caldwell 1964). And, as demonstrated through many years of archaeological research, lower Michigan Hopewellian expressions have affinities to Illinois Valley Havana Hopewell (for discussion see Kingsley 1999).

Some of the most interesting Hopewell style artifacts have come from burial mound contexts. Examples include copper axes, worked conch shell from the Gulf of Mexico, sheet mica and copper or silver sheathed pan pipes. These have generally been interpreted as items of prestige, acquired by individuals who held positions of social importance. Lithic artifacts made on non-local raw materials and highly decorated ceramic vessels are also quite common. The latter are also found in habitation sites, yet the finest examples were included in mortuary contexts.

Most of the known burial mounds have long disappeared due to early excavation, agriculture and modern development. However, their former presence serves to
delineate distinct areas of Hopewellian activity in lower Michigan (see Figure 1). The Saginaw valley perhaps stands as an exception; large mound groups are not known for this area and much of what is known of the Middle Woodland period for this area can be attributed to archaeological investigations at the Schultz site, an intensively occupied village site with stratified deposits (Fitting 1972:1-41). These investigations have resulted in a wealth of data on settlement and subsistence practices throughout the Middle Woodland period. The Schultz site has since become an important resource for understanding Middle Woodland occupations throughout the Saginaw valley, as well as relationships to Hopewellian developments elsewhere in lower Michigan (Brashler et al 1994:8-12; Fitting 1972b:267-271).

Hopewellian expressions in western lower Michigan were primarily concentrated in the St. Joseph, Grand and Muskegon River valleys. The Walter and Sumnerville mound groups in Cass County, along with additional mound groups further upriver in St. Joseph County represent the St. Joseph. With the possible exception of the Moccasin Bluff site (see Bettarel and Smith 1973:107-110), intensively occupied villages sites remain elusive in this river valley.

The Grand River valley is represented by the large Norton and Converse mound groups in the Grand Rapids area and further down river at the Spoonville Mounds site. A more recent discovery, the Prison Farm site, shows considerable promise as a major Middle Woodland village site within this river valley (Brashler et al 1998). The Muskegon River valley includes several minor mound groups and the small Toft Lake and Jancarich village sites (Prahl 1991).

By contrast, the Kalamazoo River valley is decidedly lacking a significant Hopewellian expression. Mound groups are rare or nonexistent (see Kingsley 1981:148), suggesting this area was peripheral to Hopewellian developments within
Figure 1: Selected Sites With Middle Woodland Components. 1) Goodall Mounds and related sites; 2) Moccasin Bluff; 3) Eidson and Wymer East and West Knolls; 4) Summerville and Walters Mounds; 5) Strobel; 6) Marantette Mounds; 7) Mushroom; 8) Armintrout-Blackman; 9) Spoonville Mounds; 10) Zemaitis; 11) Norton and Converse Mounds; 12) Prison Farm; 13) Brooks, Carrigan, Gratten and Schumaker Mounds, Jancarich and Toft Lake Villages; 14) Schultz.
lower Michigan. Yet this does not mean the Kalamazoo is devoid of such influences; artifacts bearing Hopewell stylistic attributes are found in small quantities at a number of locations within this river valley (Garland and DesJardins 1999; Mangold and Garland 1979; Spero et al 1991). However, the problematic aspect is that they occur at small habitation or logistical campsite locations generally lacking datable contexts, making assessments of Middle Woodland occupations in this area difficult at best. Thus, investigations have understandably focused on identifying sites with the potential for favorable feature contexts and associated diagnostic artifacts of chronological value (i.e., typologically distinctive ceramics and lithic artifacts).

Middle Woodland research in western lower Michigan has proceeded mainly in three directions: (1) analysis and refinement of regional ceramic typologies (Flanders 1965; Kingsley 1990; Mangold 1981; Quimby 1941a); (2) studies related to environmental assessments, subsistence and settlement patterning (Kingsley 1981; Prahl 1966); and (3) ideas on the introduction of Hopewell influences into lower Michigan (Brashier 1995:8-9; Brown 1964; Garland and DesJardins 1995:30-32; Quimby 1941b). Establishment of a cultural chronology, with the goal of understanding both the timing and mechanisms involved in the development of Hopewelian manifestations in lower Michigan, is one important aspect common amongst these studies. And, as summarized by Kingsley (1999:148-152), competing themes have been offered revolving around ideas of migration and/or diffusion of Hopewell traits into the area and acculturation of indigenous populations. While these issues are beyond the scope of this study, they are nonetheless important considerations for anyone engaging in Middle Woodland research, at any level of specificity.
Problem Orientation

From a review of Middle Woodland research in Michigan (Brashler et al 1994), four factors surface as problem areas for evaluating this period in Michigan: (1) the number of known habitation sites is small, with none exhibiting occupational intensities typical of larger village sites in the Illinois River valley; (2) most of the known sites are probably seasonally occupied and lack favorable feature contexts; (3) there is a general lack of good subsistence information; and (4) many sites are multi-component, and some may actually represent aceramic Middle Woodland occupations. Interpretation of aceramic components is often hindered by continuities in notched projectile point forms throughout the Woodland period and absence of a well defined regional typology (Garland, Clark and Parker 1990:422-425).

These problems are especially important for understanding Middle Woodland period occupations in the Kalamazoo River valley. Despite the efforts of numerous archaeological surveys, there are only two relatively large sites that exhibit a significant degree of Hopewellian influence: Armintrout-Blackman (Spero et al 1991) and Mushroom (Mangold and Garland 1979). The Armintrout-Blackman site is located on the north bank of the Kalamazoo River a short distance upriver from the City of Allegan in Trowbridge Township. The Mushroom site is also located on the north bank of the river above modern Lake Allegan, an impoundment of the Kalamazoo River downstream from Allegan. Both are characterized as seasonally occupied habitation sites.

Distinctive corner notched points and nonlocal lithic raw materials – items present in documented Middle Woodland contexts elsewhere in the Midwest – have been found during archaeological surveys at many sites lacking ceramic associations or datable features (Campbell 1986:55-58 and 72-74; Clark 1981). However, as
diagnostic indicators, lithic artifacts have not provided the degree of temporal sensi­ivity necessary for understanding internal cultural dynamics within the Middle Woodland period. At present, the analysis of ceramic assemblages represents the most influential interpretive framework, only augmented by an externally derived projectile point typology.

The authors of the aforementioned review (Brashler et al 1994) specified a need for regional assessments of point typologies and lithic raw material sourcing in future research endeavors. However, as Clark points out:

"Typology is not an end in itself, but one with which one makes an initial as­sessment of temporal relationships . . . An exhaustive analysis of whole site assemblages, including in addition to diagnostic items, non-diagnostic tools and debitage, will provide a more complete picture of lithic raw material dis­tributions in the Kalamazoo Basin and may permit an evaluation of the sys­tematic interrelationships of sites . . . “ (1981:49).

The problem mainly resides in the fact that lithic artifacts, themselves, are part of a much larger process characterized as a subtractive technology. In other words, this process involves selection of suitable raw material for the manufacturing of a wide variety of implements, which are then subject to further reduction throughout their use-life. The principle variables involved are not only technological and functional, but also include stylistic considerations related to cultural practice and social identity. This imposes certain difficulties in the study of lithics, but it is herein proposed that meaningful assessments can be made on items such as projectile points when evalu­ated on an assemblage-wide basis.

This study seeks to examine such issues through an analysis of the lithic as­semblage from the Armintrout-Blackman site. This site exhibits spatial separation of chronologically sensitive ceramic components, in the form of Havana-related and later Hopewellian wares. Such a situation is uncommon in lower Michigan, where components tend to overlap or are mixed within plow zone contexts. The ability to
isolate and analyze discreet aspects of this site assemblage is important for evaluating internal cultural dynamics. In this regard, the findings presented in this study should make an important contribution to understanding Middle Woodland occupations in the Kalamazoo valley and beyond. It also should provide comparison with data from the stratified Schultz site in the Saginaw valley and from the Prison Farm site in the Grand River valley.

Focus of This Study

Previous lithic studies in western lower Michigan display considerable variation in forms of analysis. Examples include tool class descriptions, functional interpretations and technological assessments (Campbell 1984:28-62; Clark 1990a:8-41; Sorenson 1978), statistical and distributional analyses (Murphy 1986; Quattrin 1988:21-48; Stout 1984), and lithic raw material utilization in temporal and cultural contexts (Campbell 1986; Goatley 1993). Understandably, each has its own goals and contributions to offer, but data and findings are not wholly comparable with one another. This study seeks to present data and findings that demonstrate as much comparability to prior research as possible, for several important reasons.

First, this study represents the only formal analysis of a large, predominately Middle Woodland lithic assemblage from the Kalamazoo River valley. In particular, this site exhibits little evidence for earlier or later occupations. A small number of Late Woodland triangular points were recovered but definitive Late Woodland ceramics are poorly represented, suggesting short duration or transitory use of the site during this time period. The assemblage is large because Armintrout-Blackman also represents the most thoroughly excavated Middle Woodland habitation site in the Kalamazoo River valley.

Secondly, during the course of this analysis, comparisons will be made to the
study of the Schultz site lithics (Fitting 1972:191-224). Fitting's study was the first to be conducted on a large Middle Woodland assemblage in Michigan. However, no adequate comparison to other substantial Middle Woodland sites was possible. Since 1972 much more data has become available. However, Fitting's study continues to be an important reference for Middle Woodland lithic industries in Michigan. The present study consists of three primary components: (1) an assessment of projectile point forms (e.g., metrical attributes, morphology, use-wear patterns, raw materials), with the goal of providing meaningful data for future development of a regional point typology; (2) a comparative analysis of all tool classes, including morphology and use-wear patterns; and (3) an examination of debitage for patterns of raw material utilization, with an emphasis on the presence of raw materials from distant source areas.
CHAPTER II

THE ARMINTROUT-BLACKMAN SITE

Environmental Setting

The Armintrout-Blackman site is located in an area where the Kalamazoo River has been downgrading through a series of north-south trending glacial end moraines (see Farrand 1982). Surface geology consists of glacial outwash sand and gravel and postglacial alluvium. The same applies for the areas between the end moraines, which are also the location of primary tributaries in the Kalamazoo drainage basin. The river valley in this area is roughly demarcated by a contour elevation of 213 meters ASL (700 feet). Presently, the river is operating at levels less than 195 meters ASL (640 feet), being influenced by dam construction and seasonal fluctuations.

The site is located just west of Trowbridge Dam, at a point where the river has incised a deep, narrow channel through the coarse tills of an end moraine. A third generation area resident states that prior to dam construction the river was shallow here and may have consisted of shallow riffles.

Approximately one mile west of the site the river turns northward and the valley margins become much broader. The river also begins to meander noticeably with some active braiding of the main channel, most likely reflecting a change in downstream gradient. The topographic map for the area reveals that extensive meandering and/or channel braiding has occurred here over time, as evidenced by the presence of remnant oxbows and river margin wetlands. Directly north of the site
there is a rather sizable oxbow presently consisting of waterlogged marsh habitat (Figure 2). The author has investigated this location and found it to be well populated with frogs and turtles, as well as frequent visitations by white-tailed deer, raccoon and other mammals.

The surrounding environs are within a narrow presettlement vegetation zone (ca. 2-3 miles wide) of Beech-Maple Forest that broadens to the north and south (Brewer 1980). Oak-Pine Forest lies to the west and Oak-Hickory Forest predominates to the east. The latter two extend to within a short distance of the site area as narrow river margin zones. Given this, it is safe to say the site environs probably consisted of a mixture of all three forest communities at one time or another, being sensitive to broad scale climatic changes. The most notable changes likely occurred along the river margin, lending itself as an attractive locale for both riverine and nearby upland resources. In particular, the presence of riffles and wetland habitats would have been ideal locations for riparian species (e.g., fish, turtles, beaver, etc.).

The Armintrout-Blackman site itself is situated on the uppermost terrace north of the river at an elevation of 205 meters ASL (672 feet)(Figure 2). This landform generally descends from east to west. It appears to be a large river point bar structure of unknown geological age, quite possibly associated with the remnant oxbow to the north. Soils within the immediate site area are Chelsea fine loamy sand (Knapp 1987:Map Sheet 98), becoming noticeably coarser to the east and west.

A steep bluff that drops some 5-6 meters to a narrow intermediate terrace formation bounds the south edge of the site. Along the south edge of this terrace there is a deeply incised gully that is typically wet in the early spring. Near the river it has been truncated by a more recent levee or channel bar formation. The origin of this gully is unknown and currently under review – it could represent a former channel
Figure 2: Armintrout-Blackman Site Environs.
chute or remnant meander loop. In the final analysis, it might prove interesting to
determine if it was occasionally inundated, particularly during the time of the prehis-
toric occupations of the Armintrout-Blackman site.

History of Investigations

The late Paul Armintrout, who leased the property for a tree nursery, first
brought the site to the attention of the Michigan Archaeological Society. Between
1985 and 1989 members of the Kalamazoo Valley Chapter of the Michigan Ar-
chaeological Society, under the direction of George Spero, conducted survey and
excavations at this location. The 1989 field season was augmented by support from
the Western Michigan University archeological field school, under the direction of
Dr. Elizabeth Garland. A report on the site was published in The Michigan Archae-
ologist (Spero et al 1991).

Fieldwork began again in 1994, conducted by members of the Kalamazoo
Valley Chapter, under Dr. Garland’s direction. This work entailed mechanical strip-
ning of plow-zone near a service road along the north side of earlier excavations.
This area had previously been planted with nursery trees and accessible only for
limited excavation. Shovel skimming of remaining portions of plowzone followed the
mechanical stripping operation. Margins of the former excavation units were relo-
cated and a grid of additional units was then placed in areas of interest. All other
work consisted of surface collection of cultural materials in marginal areas outside the
grid.

The 1994 field season resulted in additional feature definition and recovery of
ceramics that were different from what had previously been found. Further excava-
tions were conducted from 1995 into the 1997 field season. The 1995-97 fieldwork
was oriented toward identifying site boundaries and additional artifact recovery. The latter led to recognition of spatially separated ceramic components across this site. Additionally, the edge of the plow zone was clearly defined for the first time within a few units along the bluff edge. Unfortunately it appears that plowing was done close to the bluff edge and cultural material recovery began to taper off in the unplowed margin.

Since 1995 investigations have also been conducted on the lower terrace formation directly below the main site area, under the general direction of the writer. This work is still in progress and no definitive interpretations can be offered at this time. However, several preliminary observations are offered here: (1) cultural material recovery is light as compared to the main site on the upper terrace, possibly reflecting limited or short term use of the lower terrace; and (2) although no formal analysis has been conducted on the ceramics, a majority are suggestive of late Middle Woodland and early Late Woodland placement.

There is one aspect of the lower terrace investigations that is deserving of mention here. During the 1985-89 fieldwork, investigators noted the presence of a ditch-like feature in the general area of site datum running downward over the bluff edge (Spero et al 1991:214 and 247). Excavations in this location resulted in deeper cultural material recovery, along with profile definition of a ditch feature consisting of dark humus soils. At that time, this was considered to represent either an erosional cut or former spring – possibly flowing at the time of the prehistoric occupations.

Beginning in 1995 the latter interpretation was further considered through excavation of two narrow trenches at the bluff edge (see Figure 3). Trench 3 was within the area of the ditch feature and Trench 2 was placed nearby to examine the actual bluff profile. Trench 3 revealed the presence of a ditch profile consisting of well
Figure 3. Excavation Units.
decayed and humified gray loam soils. A similar profile was also observed during the 1998 excavation of Unit 101 nearby.

Additional evidence comes from excavations on the lower terrace. Immediately below the ditch feature the bluff slope is less sharp and forms an area of elevated relief as it enters the lower terrace. A few deep test units and another narrow trench were placed in this location. Much of this work was accomplished by students from the 1999 Western Michigan University archaeological field school, under the direction of Dr. William Cremin. All excavations revealed the presence of a buried organic soil horizon that topographically correlates with the modern surface in the surrounding areas. The soil matrix overlying this buried horizon consisted of thin laminar structures of well sorted fine sand particles and silt lenses, suggesting low energy deposition (seasonal?) as opposed to more rapid surface run-off from above (i.e., field drainage or heavy rainfall erosion from exposed surfaces). Water flotation samples were also collected from the buried soil horizon and were found to be devoid of preserved organic matter or cultural materials. Additionally, recovery within the soil matrix above this buried soil horizon was very sparse, consisting only of occasional pieces of light chippage or small fragments of fire-cracked rock. Significant recovery did not begin until within the first 10 centimeters below the buried horizon.

Recently the writer has examined the field records from the former excavations within the ditch feature area on the bluff top. Within the deepest levels, east-west running plow scars disappeared in the area of the ditch feature. This suggests skipping of the plowshare as it passed over a narrow depressed area, meaning that the ditch probably existed prior to modern agricultural activity. The ditch has slowly been infilled with continual plowing of the area.

All of this has given greater strength to the idea that a spring existed here in
Middle Woodland times (see Spero et al 1991:247). The writer feels that although absent today, a spring probably existed when the area was fully vegetated with mature trees and undergrowth. Large root mass and groundcover would have acted to retain ground water closer to the surface. Once the land had been cleared for agriculture, exposed soils became drier and drained water much more readily. If a spring was flowing here during the prehistoric occupations, it might have represented one important consideration in site selection.

Recovery Summary

The Armintrout-Blackman site is small and concentrated and the upper terrace has been fully excavated, encompassing an area of not more than 650 square meters. A small quantity of cultural material has been observed in the surrounding fields. However, controlled surface collection and placement of a few test units in these areas resulted in minimal recovery, with debris densities that dramatically fade within 20 meters of the site area. High densities of fire-cracked rock and lithic debitage roughly demarcate the site boundaries. Figure 4 shows lithic debitage densities per square meter, along with the analytical sectors chosen for this study. These sectors were selected in the attempt to evaluate intra-site differences based on the primary ceramic components and lithic debitage density distributions.

As can be seen there are three principle areas of high lithic debitage densities. There is an overlap between the center and east sectors, which is believed to represent activity occurring on either side of the former spring, followed by recent plow movement of cultural material. Fire-cracked rock totaling 9,903 pieces weighing 1,021.5 kilograms was generally encountered in all excavation units, with the highest densities correlating well with lithic debitage densities. And, as will be seen below, the
Armintrout-Blackman Site (20AE812)

Note: Circles Represent High Debitage Density Areas

- - - = Site Datum

- - - = Bluff Edge Contour

- - - = Mechanical Stripped Margin

= Ditch Feature

West Sector

Center Sector

East Sector

Figure 4. Lithic Debitage Densities per Square Meter.
same general observation applies to other aspects of the lithic assemblage. There follows a summary of the ceramic assemblage, features and faunal recovery.

Ceramics

Ceramic distributions at the Armintrout-Blackman site are summarized in Figure 5. The map is based on information in the published report (Spero et al 1995) and on unpublished data acquired between 1994 and 1997 when the west portion of the site was excavated (Elizabeth Garland, personal communication). There are two major Middle Woodland components on the site. Component Number 1, represented by some 40 vessels, is a Hopewellian occupation considered to be Late Middle Woodland with primary distribution on the east half of the site. Ceramics are relatively thin, plain surfaced, and characterized by plain rocker stamped decoration. Combed, brushed and incised surface treatments, often zoned, also occur. The most intensive Hopewellian occupation is located in the hachured part of Component 1 on the map, with an attenuated distribution toward the west and to the southeast represented by a relatively small number of sherds.

The second major component (Number 2) is a Havana-related occupation (or occupations) that is represented by ca. 15 vessels confined to the western part of the site. Ceramics are thicker than in the Hopewellian component; rim decoration includes cord-wrapped stick stamping, noding and punctation. Two areas of concentration are noted within this Havana distribution which is believed to temporally precede the Hopewellian. Age estimates for the major components are A.D. 1-200 for the Havana related material and perhaps A.D. 200-500 for the Hopewellian. Spatial overlap between these two components is minimal.

Additional ceramics include two or three vessels with interior-exterior cord
Figure 5. Ceramic Distributions. Data compiled by Elizabeth Garland (used by permission).
marking (Number 3), and one Sister Creeks vessel (Number 4) that is also interior-exterior cord-marked. These ceramics are typologically late Early Woodland or early Middle Woodland in Michigan, perhaps ca. the first or second century B.C., or Caldwell phase in the Central Illinois Valley (Cantwell 1980).

Several vessels representing Hacklander Ware comprise a minor component in the central part of the site (Number 5). The presence of Hacklander Ware in Michigan is enigmatic, in terms of its distribution, typological and cultural relationships and the ability to adequately bracket is occurrence within an interpretive suite of radiocarbon dates (Kingsley 1989; Brashier and Garland 1993). Cord-marked body sherds that are probably Late Woodland also occur in small numbers, but typological and spatial definition of this material is at present unclear.

Features

Soil stains and artifact concentrations observed during excavation were given feature designations for further evaluation (Figure 5). A few were subsequently determined to be natural disturbances, such as decayed tree stumps, or indeterminate stains of probable historic origin. Artifact concentrations, consisting mainly of ceramics or fire-cracked rock, were interpreted as isolated occurrences and generally lacked a definable feature morphology. Twelve features are characterized as subplow zone feature remnants ranging from shallow ashy lenses to deeper pits with a discernable profile. Feature boundary definition was often difficult to define; preservation of organic remains was poor and leaching of feature fill into the surrounding sterile soils was also typical. Regrettably, no datable contexts with valid cultural associations were found.

Two features, Features 6 and 7, were encountered immediately south of the
plowed area in the southwest portion of the site. Feature 6 is a small, oval shallow basin hearth located on the field margin, such that the north portion is partially incorporated in the plowzone. This feature consisted of a charcoal flecked fill (or fuel zone) lacking cultural associations. Organic remains were sparse and limited to several nutshell fragments. Feature 7 is a concentration of nine rocks in undisturbed (unplowed) context near the bluff edge. There was no charcoal in association or definable feature morphology. Four items were determined to be either fire-cracked rock or unmodified cobbles with no discernable use-wear patterns. The remaining five items consist of a core fragment, a groundstone implement, a hammerstone and two sandstone fragments that may have been utilized. An in-situ cache of materials as part of an activity area was considered by the excavators.

One of the more difficult problems encountered during the early investigation of this site was the inability to obtain adequate samples, with cultural associations, for radiocarbon analysis. This may in part be due to agricultural practices and other related historical disturbances. For instance, as previously reported (Spero et al 1991:218), a sample from a feature on the east side of the site was submitted for radiocarbon analysis, with a resulting date of A.D. 1310 +/- 50. Later it was determined that the sample was contaminated with partially carbonized pine of recent origin. Another date of A.D. 1050 +/- 50 was also obtained for Feature 10, a small storage pit on the west side of the site. However, the inclusive Middle Woodland ceramics in Feature 10 are believed to be earlier than this date (personal communication, Elizabeth Garland). Examination of wood charcoal from excavation also revealed the presence of occasional specimens of partially carbonized pine and, most likely attributable to recent wildfires and/or land clearing activity. One additional factor relates to the nature of agricultural activity; it is felt that land clearing and
exposure of surfaces has probably contributed to poor preservation of organic remains and accelerated leaching of feature fill into the surrounding soil matrix, especially in acid soils typical of the general area (Spero et al 1995:218-219).

Faunal Remains

The Armintrout-Blackman faunal assemblage is small but nonetheless informative. Dr. Terrance Martin of the Illinois State Museum kindly provided identifications. The assemblage comprises 392 elements totaling 105 grams in weight. Some uncarbonized elements are of recent origin, including short tail shrew, eastern cotton-tail, muskrat, crow, an unidentified medium sized bird and an unidentified bivalve. Table 1 lists all species identified that were probably associated with the prehistoric occupation, and provides percentages for all specimens that were listed as calcined in Martin’s data summary.

Most of the faunal remains are small and fragmentary, but Martin was able to make a number of identifications of individual elements. White-tailed deer is represented by teeth, tarsal, carpal and phalanx elements. The last three are all from the lower leg. A similar observation was noted in the Schultz site analysis, which Luxenberg (1972:93-98) interpreted as removal of only the head and leg portions from the carcass at distant kill sites, quite possibly during the cold weather season. A similar interpretation might be offered for the Armintrout-Blackman site.

Most of the faunal remains are small and fragmentary, but Martin was able to make a number of identifications of individual elements. White-tailed deer is represented by teeth, tarsal, carpal and phalanx elements. The last three are all from the lower leg. A similar observation was noted in the Schultz site analysis, which Luxenberg (1972:93-98) interpreted as removal of only the head and leg portions from the
Table 1
Faunal Assemblage Composition

<table>
<thead>
<tr>
<th>Species</th>
<th>NISP</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>White-tailed Deer <em>Odocoileus virginianus</em></td>
<td>9</td>
<td>2.3%</td>
</tr>
<tr>
<td>Unidentified Large Mammal</td>
<td>108</td>
<td>28.2%</td>
</tr>
<tr>
<td>Medium Mammal</td>
<td>132</td>
<td>34.5%</td>
</tr>
<tr>
<td>Beaver <em>Castor Canadensis</em></td>
<td>1</td>
<td>0.3%</td>
</tr>
<tr>
<td>Pond Turtle ssp. <em>Emydidae</em></td>
<td>40</td>
<td>10.4%</td>
</tr>
<tr>
<td>Lake Sturgeon <em>Acipenser fulvescens</em></td>
<td>28</td>
<td>7.3%</td>
</tr>
<tr>
<td>Unidentified Vertabratata</td>
<td>55</td>
<td>14.4%</td>
</tr>
</tbody>
</table>

NISP = Number of identified specimens

carcass at distant kill sites, quite possibly during the cold weather season. A similar interpretation might be offered for the Armintrout-Blackman site.

Turtle remains consist of carapace and plastron fragments. Turtle shell has also been found at other Middle Woodland sites in Michigan, and given the small amount of available meat in turtles emphasis may have been placed on the acquisition of shells for bowls and fabrication of various ornamental items (Luxenberg 1972:100-101; Murphy 1986:7-8). Dermal plate fragments represent sturgeon. Other sizable elements, such as pectoral spines, were not identified. Although this could be a factor of preservation, the writer believes it could relate to modes of procurement and processing. During spring spawning, sturgeon would most easily have been taken from
shallow waters and areas of rapids. Occupation at sites near these locations on the river could then be considered logistical in nature, with an emphasis on primary processing and preparation of meat. With the anticipation of a surplus beyond immediate consumption, preparation most likely entailed meat curing (e.g., drying, smoking, etc.) for storage or transport elsewhere.

The distribution of identified species across the site is most interesting. All species occur in both the east and center sectors (Figure 6). They are observed to be dispersed throughout the east sector, but more concentrated in the areas of high debitage densities in the center sector. By contrast, the west sector has produced only white-tailed deer elements, large mammal and medium to large mammal remains, and two small specimens of turtle and one of sturgeon. The last two occur near the east edge of this sector and may represent plow drag from the center sector. Additionally, all faunal remains from this area of the site are associated with locations of high debitage densities. This, in itself, could reflect cold weather occupation of this area of the site, characterized by more concentrated areas of activity and refuse disposal, perhaps reflecting existence of semi-permanent shelters in areas outside of these concentrations, for which we have no direct evidence.
Figure 6. Distribution of Deer/Large Mammal, Turtle and Sturgeon Remains.
CHAPTER III

METHODOLOGY

As seen in the previous chapter the ceramic assemblage demonstrates spatial boundaries of temporally sensitive site occupations. The distribution of faunal remains also suggests the possibility for defining these occupations with respect to seasonality. Both have provided the basis for establishing the principle criteria of this lithic study. The former leads to questions of intra-site comparisons for typologically diagnostic artifacts (e.g., projectile points) and lithic raw material utilization. The latter is addressed through identification of other artifact types and their spatial distributions with respect to possible activity areas. Assessment of wear patterns and use-related attrition of certain artifact types is also examined. It also formed one of main components of the projectile point analysis, since it is believed that the groundwork for establishment of a regional typology should also include use-related characterizations, particularly as these relate to issues of style, function and form.

The lithic analysis began with a scan of all debitage for the presence of raw materials of exotic origin (i.e., those from nonlocal or distant source areas). Distinctive items (e.g., utilized debitage, biface tips and fragments, etc.) that were missed during initial cleaning and cataloging of the assemblage were also removed at this point. Identification of raw material types was not conducted on a piece by piece basis. Rather, all specimens of potential exotic derivation were sorted out and further evaluated as a group once the scanning procedure was completed. This proved beneficial for assessing distributions of material types across the site, the range of varia-
ficial for assessing distributions of material types across the site, the range of variation in exotic materials and their similarities to locally available till materials.

A schema of debitage classification was used to evaluate the ways that exotic materials were being utilized at this site. The categories selected, to be described in detail below, relate to the stages of reduction in the working of stone material, and are patterned after other southwest Michigan lithic studies (Campbell 1984:34-38: Clark 1990a:8-41). There is a general notion that exotic material utilization entailed some form of processing at source locations prior to the material having entered distribution and exchange networks. Thus, the presence of such materials at distant sites should relate to the final stages of lithic reduction (i.e., tool manufacturing from preforms, resharpening and other maintenance activities, etc.).

Following this all lithic artifacts were analyzed by class. Pertinent data such as raw material, measurements, morphological characteristics, use-wear assessments and internal variation within each artifact class was recorded. The sections that follow discuss lithic raw material types, heat-treatment of raw materials, debitage classification and some specifics on the use-wear evaluations made in this study.

Lithic Raw Materials

Within the Midwest there are natural surface outcroppings of sedimentary formations containing cherts that display a wide range of macroscopic characteristics (e.g., color, texture, luster, etc.). These outcroppings are important because they represent point sources for tracing the origin of raw materials found on prehistoric sites. Archaeologists have developed typological classifications for many of these
cherts based on their macroscopic qualities and source locations. This presents a
problem in western lower Michigan, as natural chert producing outcroppings are
nonexistent. Locally available raw materials in this area consist of a wide variety of
till cherts that have been glacially transported from geological formations elsewhere.
Consequently, archaeological studies have focused on distinguishing differences
between the vast array of local till cherts and those of exotic origin.

The identification of exotic raw materials is essential because it has the poten­
tial for yielding insights into patterns of social interaction, trade and exchange mecha­
nisms and the ways that people moved about the landscape. This is typically ap­
proached by evaluating the range of represented exotic materials, their relative fre­
quencies of occurrence, and direction to respective source areas. The last is also
useful for identifying potential corridors for the acquisition and distribution of raw
material resources in a broader socio-cultural context.

The descriptions provided here are for the raw material types evaluated in this
study. Reference to published descriptions of local till chert types are also included.
Comparative type sets at the Department of Anthropology, Western Michigan Univers­
ity and those from the writer’s personal collection were used for the identifications.
Lighting was also considered important to assessing properties of color, texture and
luster. Light sources used included a combination of incandescent, fluorescent and
direct sunlight. Additionally, identifications were often achieved through 10-30x
magnification to examine microscopic characteristics unique to certain chert types
(e.g., granular structure, fossil inclusions, etc.).
Local Raw Materials

Local till cherts typically dominate lithic assemblages in western lower Michigan. The nature of these materials has long been the subject of interest in archaeological studies, ranging from typological descriptions of unique types (Campbell 1986:11-26; Clark 1990a:30-41; Goatley 1992) to chemical characterization studies (DesJardins 1993; Gibeson 1977; Luedtke 1976). However, what these studies have demonstrated is that the geographic distribution, range of variation and interrelationships of various available till cherts is complex and poorly understood. It is felt that meaningful assessment requires systematic collection on a regional scale, balanced with patterns of actual prehistoric utilization in archaeological contexts. Given this, all local till cherts discussed below are limited to those commonly presented in earlier studies of lithic assemblages in western lower Michigan.

**Lambrix Chert**

Lambrix chert was first described and studied by Luedtke (1976:248-255). Luedtke’s samples were obtained from a prehistoric quarry in glacial tills in Oceana County. Quarrying was evident in the form of deep pits surrounded by lithic debris and hammerstones used to process the raw material. Lambrix chert is highly variable, mainly characterized by a somewhat homogenous to irregularly mottled blue-gray color with occasional streaks or zones of pale brown. Texture is generally medium with occasional abrupt zones of differential granular composition. Some samples are densely compacted with bold quartz lenses. Most samples consist of a chert matrix sandwiched between a thick sandy brown cortex. Others may only be fragments with irregular surfaces and little remaining cortex due to glacial transport.
Based on Luedtke’s description a tabular or bedded geological deposition is suggested. From assessments of glacial transport mechanisms and the relative size and distribution of samples, Luedtke suggested a nearby lower Michigan geological source – possibly near the interface of the Marshall Sandstone and Coldwater Shale formations. However, this has not been verified.

**Deer Lick Creek Chert**

Both Campbell (1988) and Goatley (1993:27-30) have provided detailed descriptions of the source areas and physical characteristics for this chert type. The principle source location is along the Lake Michigan shoreline in proximity to the mouth of Deer Lick Creek near South Haven in Van Buren County. Additional collections have been made along the lakeshore in portions of Allegan and Berrien Counties as well. The writer has also collected samples from beach areas at the Deer Lick Creek locality. The creek itself is characterized by shallow running waters, and no chert samples were found during a walk along its course. It is felt that samples collected from beach areas are derived from offshore deposits and/or erosion of glacial till along the shoreline.

In general, Deer Lick Creek is a fine to medium quality nodular chert, with coloration ranging from light gray to dark gray and dark bluish gray. It is typically fairly homogenous, but mottling in the form of blotchy light gray and white colors also occurs. Exterior surfaces consist of a well weathered, thin orangish tan to dark reddish brown rind. This is the result of oxidation in wave action environments. Geological associations for this material are unknown at present, but it could be related to Lambrix chert based on some visual overlap between the two and Luedtke’s discussion of glacial transport mechanisms (Campbell 1988:106-107).
Purple Chert

The presence of this material as a unique mottled lavender till chert was first noted by Luedtke (1976:294). It was later fully described and named Purple chert by Clark (1981:18 and 1990a:30-32). Both authors noted the high occurrence of this material throughout southern lower Michigan, and Clark (1990a:30-32) further observed that it is particularly prevalent within Cass County tills. Campbell (1988) and the writer collected additional samples from Allegan, Calhoun, Kalamazoo, and Kent counties. Color ranges from light gray with weak red mottling to a dark grayish purple. It is generally medium textured with occasional whitish quartz inclusions. The exterior typically consists of a heavily weathered patina over glacially fractured surfaces. The writer has noted that as one proceeds northward, collected samples exhibit a dusky appearance that visually overlaps with samples of Lambrix chert. Campbell (1988) and Luedtke (1976:294), in their discussion of similar observations, opt for this material being a variant of Lambrix chert.

Gray-White

This category probably represents one of the most highly variable and poorly understood classes of local till cherts. Color ranges from homogenous white to mottled zones of pale light gray and very pale tan gray. Texture is generally medium but does range from coarse to fine in a some specimens. A variety of fossil inclusions have been observed, with tiny clear quartz inclusions common in some of the more homogenous specimens. Samples are typically found as small cobbles or irregularly shaped pieces with heavily weathered patina over glacially fractured surfaces. These till cherts are visually similar to materials from known geological associations throughout northern Michigan and Ontario, and were probably glacially transported
from those areas.

Evaluation of this group is important because many researchers have noted in some specimens visual similarities to Burlington chert from the Illinois River valley (for discussion see Goatley 1992:11-12 and 1993:33). There are a few specimens of Gray-White material exhibiting a white homogenous coloration and fine texture. Accurate identification is problematic when dealing with small specimens of prehistoric chippage.

Unidentified

All materials not identified as exotic or assignable to the above categories are included here. This group consists primarily of glacial till cherts with a wide range of variation. Understandably, misidentifications, with respect to exotic cherts, often occur. It is for this reason that materials of potential exotic origin were sorted out for further evaluation during analysis of the debitage in this study.

Non-Chert Raw Materials

Specimens of debitage and artifacts made on a variety of non-chert materials are often identified in minor quantities in western lower Michigan lithic assemblages. This applies to the Armintrout-Blackman assemblage, with examples that include a variety of slates, fine grain cemented quartzite and medium to coarse textured granites. All of these materials occur naturally within the glacial till of the surrounding site environs. The slate specimens display considerable variation, ranging from dark graywaches or argillites to green pyritiferous slate (as described by Bell and Wright 1985). This most likely reflects various states of deposition and metamorphism within the geological formations from which these materials are derived. Most of the
Armintrout-Blackman specimens are probably green pyritiferous slate.

**Discussion of Lambrix and Deer Lick Creek Cherts**

Shortly after their introduction into the archaeological literature it was plausible to consider that utilization of each of these cherts entailed procurement from their respective source areas. Since then archaeological researchers have sought to better understand their degree of similarity and distribution in western lower Michigan. Because of the inability to make adequate visual distinctions between the two they can now be considered as one class of local till material. For example, during recent archaeological fieldwork at the Spoonville Mounds in the Grand River Valley (Branstner et al 1999:136-137) the investigators did recognize the presence of each, but cautioned that they needed to be discussed together because of their visual similarities.

In this study distinctions between Lambrix and Deer Lick Creek cherts were similarly not attempted; the writer has collected numerous samples from the environs of the Armintrout-Blackman site which exhibit characteristics of both Lambrix and Deer Lick Creek cherts. They are also essentially identical to what was encountered in the actual site assemblage. One sample, a large cobble weighing nearly 3 kilograms and approximating 15 centimeters in diameter, was found during excavation of Trench 2 at the site. There was also a considerable quantity of this material represented in the primary stages of processing, consisting of sizable pieces of cortex and angular or blocky shatter. It seems plausible that much of the Lambrix/Deer Lick Creek-like material in the assemblage was obtained from nearby sources. Likely locations would be streambeds and/or eroded surfaces on steep slopes.
Exotic Raw Materials

Several exotic cherts from source areas throughout the Midwest were identified during this analysis. They represent materials that have also been identified at a number of lower Michigan sites. Along with the comparative type collections, several references on lithic raw materials in the Midwest were consulted. Four studies (DeRegnaucourt and Georgiady 1998; Luedtke 1976 and 1992; Meyers 1970) are primary sources because they provide detailed material descriptions, source areas and geological associations, and published references. Luedtke’s 1992 study provides an informative discussion of the physical properties of chert in general, its origins and formation processes. DeRegnaucourt and Georgiady include excellent color plates of chert types described in their study.

Bayport

Bayport chert is derived from the Bayport Limestone Formation that outcrops in several locations in the Saginaw Bay area of Michigan. It occurs as medium to large chert nodules in the limestone matrix of the formation. Tabular or bedded varieties, which are associated with different portions or members of the Bayport Formation, also occur. Color ranges from light gray to very dark gray, with concentric banding typical of the nodular forms. Cortex is chalky white to pale light gray in color and generally exhibits sharp contrast with the interior chert matrix. Texture is medium to coarse with a low degree of luster. The chert matrix is often speckled and may contain bluish chalcedony structures in the center of the nodule. Ozker (1982:84-85) described a light grayish beige variant of Bayport that is more homogenous and lacks concentric banding. Specimens of this variant occur in the Armintrout-Blackman assemblage.
Bayport was one of the most important and frequently exploited Michigan area cherts for much of prehistory. It is in lithic assemblages throughout Michigan and is especially common in Saginaw Valley sites.

**Norwood**

Norwood is another Michigan chert accessible in exposed outcrops and as redeposited fragments along the Lake Michigan shoreline in Charlevoix County in northwestern lower Michigan. The matrix consists of banded or layered laminar structures of varying colors. Geologic uplift in portions of the formation has resulted in warping or cross-bedding in some specimens. Color ranges from pale cream and tan to very dark gray and dark grayish brown, with the medium gray hues being most typical. Samples collected from beach areas are often bleached to the pale side of the color range and have a water-worn patina. Texture is medium with a dull luster.

**Burlington**

Burlington chert is found in outcroppings in many locations within the Lower Illinois River valley. It also occurs as talus slope detritus and large redeposited stream cobbles, with the later perhaps representing the most reliable and exploitable source (Meyers 1970:34). This material typically ranges from homogenous white to light gray, with varying degrees of subtle mottling and differential zones of granular structure. It is also highly variable in terms of fossil composition. Texture is generally fine to medium with higher degrees of luster occurring in the better quality specimens. Cortex in outcrop specimens consists of moderately dense to porous limestone, and interior fracture planes are often visible as pale to light tan or orange color.
There are other outcrop locations in Illinois with materials that share similarities to Burlington, such as Avon and Utica in the northern Illinois River valley. However, Burlington was the most heavily exploited and distributed raw material, especially during the Middle Woodland period (for discussion see Cantwell 1987). Burlington also visually overlaps some of the better quality local Gray-White till cherts, making accurate identifications for small chippage problematic.

**Wyandotte/Cobden**

These two cherts are derived from two different source areas but have been combined in this study because of their visual similarities. Wyandotte (formerly called Indiana Hornstone) is a homogenous fine to medium textured blue gray chert with a considerable amount of luster. Concentric banding of varying color also occurs. Wyandotte is found in surface and cave outcrops at various locations in extreme southern Indiana. Cobden (often referred to as Cobden-Dongola) shares the same general characteristics as Wyandotte. It is found in locations in Union County, Illinois. Both of these cherts share visual similarities with some of the higher quality local Blue-Gray till cherts. Thus caution is needed when making identification of these materials in Michigan lithic assemblages, especially on samples of small chippage.

**Flint Ridge**

Flint Ridge occurs as thick tabular lenses in outcrop locations throughout central Ohio, primarily in Licking and Muskingum Counties. It is perhaps one of the most highly variable Midwest cherts in terms of visual characteristics. This material is characterized as a medium to fine textured chert with near chalcedony-like and
highly translucent qualities in some specimens. The range of color is variable, consisting of pale whites, light to dark grays, tan and pale browns, yellowish brown and light grays with a light reddish cast. Texture is generally medium to very fine, with inclusions in the form of tiny quartz particles and microfossils.

Luedtke has defined Flint Ridge as one of the most important cherts in this area of the Midwest (1976:234). It has commonly been identified in many sites throughout Ohio, Indiana and southern lower Michigan. However, this material exhibits a considerable range of variation, making it difficult to consistently distinguish Flint Ridge from specimens of local till cherts with similar characteristics.

**Upper Mercer/Zaleski**

These two cherts are included in the same category because of the visual similarities they share. Both are from outcrop locations in central Ohio. The difference is that each is derived from a different portion of the Pennsylvanian-aged geological formation with which they are associated. Color ranges from dark gray to black, with mottling in the form of patchy light grays and pale white. A light bluish or faint pale brown cast is also observed in some samples. Texture is generally medium to fine with high luster characterizing the better quality specimens. Inclusions are rare to absent.

**Heat Alteration of Raw Materials**

The heat treatment of select raw materials has a long history in North American lithic industries. As described by Crabtree (1972) and Rick (1978), the process entailed burying raw materials in sand and slowly bringing them to a high temperature with the aid of fire, followed by a slow period of cooling. This acts to anneal inherent
structural weaknesses in the material and makes the chert more plastic in terms of workability. The intended result is that it improves the flaking properties: thinner and longer flakes can be driven from the treated core.

In the Middle Woodland period the heat treatment of exotic materials was quite common, with Burlington chert being the most widely selected type. The change in physical properties in heat-treated Burlington typically results in a color shift ranging from slightly darker pink to red hues in the higher quality homogenous white specimens. There is also a marked increase in luster as well. The pink or red coloration and high degree of luster are often used to signify the presence of Burlington in lithic assemblages throughout the Midwest.

Evidence of heat-treatment of local till cherts is not well documented and apparently was not a common practice. However, preliminary examination of the Armintrout-Blackman lithics suggests that it does exist in some of the artifacts and debitage. To further examine this possibility the writer heat-treated several samples of exotic and local till cherts for comparative purposes. The exotic samples included Bayport, Norwood, Burlington, Flint Ridge and Cobden chert from southern Illinois. Local tills cherts consisted of Gray-White, Deer Lick Creek, and Lambrix/Deer Lick Creek specimens from the Armintrout-Blackman site locality.

Three techniques were employed in this experiment: (1) heat-treatment outdoors as described above; (2) burying samples in a pan of sand for controlled time/temperature treatment in an oven; and (3) burying samples in a thin layer of sand outdoors and rapidly bringing them to a high temperature through use of a hot fire. The last was intended to simulate rapid alteration that might occur through wild fires or incidental inclusion in firepits (Parenthetically it should be noted that tossing a handful of chert specimens into an open fire is to be avoided, as this usually results in
the rapid release of spalls that fly about like hot missiles.

Less than satisfactory results were obtained from the first technique. It proved difficult to control the time/temperature curve and transfer of heat, particularly in well-drained dry sandy soils. The most notable changes occurred in the oven treated samples, with the effects on Burlington and Bayport being consistent with those reported by Rick (1978) and Ozker (1976), respectively. Both Cobden and Norwood exhibited a slight change to darker hues with a pinkish tinge, but with no real increase in luster. The Flint Ridge samples took on a higher degree of luster and reddish hue, but were much more brittle than untreated specimens. The local Gray-White samples also turned pinkish red with only a slight increase in luster. The color of both Deer Lick Creek and Lambrix/Deer Lick Creek materials darkened somewhat with a slight waxy appearance. In particular, some of the more mottled varieties of the Lambrix/Deer Lick Creek group came to resemble some samples of local Purple chert. The most noticeable change resulted in a reddening of cortex material.

Intentional rapid heating resulted in a general roasted or burned appearance. Bayport turned very dark gray to black. The local blue gray till samples also became much darker with greater color definition within mottled areas. Any build-up of reddish coloration in exterior surfaces reverted to a very dark expression of the original color. Most importantly, there were visible signs of damage in the form of heat crazing and fracturing, consistent with what had been observed by Rick (1978:20-21) in his study. This latter experiment proved useful for evaluating differences between intentional heat-treatment and non-intentional thermal alteration of specimens in the Armintrout-Blackman assemblage. From this it has become evident that some amount of heat-treatment of local till materials did take place, but its use may have been restricted to enhancing the flaking characteristics of certain cobbles (of varying
size and quality) in the manufacturing of bifaces. Much more research is needed in this area.

Debitage Classification

The following categories are partially derived from a prior review of southern lower Michigan lithic analyses (Clark 1990:8-30; Goatley 1992:62-76; Murphy 1986; Sorensen 1978:16-31), along with two additional Midwest studies (Overstreet 1992:44-48; Williams 1989:319-343). Six basic categories were used in this study and consist of the following:

1. Primary Processing. This category represents the initial stages of raw material reduction, for production of cores or preparation of surfaces for flake blank removal. Primary stage flakes usually have retained at least 50% or more of the original exterior surface. They are typically thick and vary in size according to the specific techniques employed and relative cobble size. Cobble splits were also considered as a distinctive primary stage item. Cobble splits are relatively large and thick, with a prominent bulb and radiating cone of percussion on their ventral surface. These are the result of heavy percussion to create a platform surface for further reduction. It also provides the means of testing raw material for internal fractures and other flaws.

2. Shatter. Shatter is characterized by blocky or angular pieces that lack a striking platform. They are incidental by-products of the reduction process, with most occurring within the primary stage. Shatter ranges in size from large blocky pieces to small angular shatter or spalls. It is felt that large shatter is mainly primary stage debitage while small shatter is probably produced throughout the reduction continuum.

3. Secondary stage. Secondary stage represents core reduction and removal of flake blanks for bifacial production. It also entails removal of smaller flakes for
immediate use with little further modification. Secondary flakes generally have less than 50% of the exterior surface. Dorsal surfaces exhibit increasing amounts of prior flake scars with prominent intervening ridges. The strategies employed consist of both free hand percussion and bipolar techniques and were probably used interchangeably.

4. Trimming flakes. Trimming flakes (described as edging flakes by Overstreet 1992:45) are broad and short with prominent striking platforms and bulbs of percussion. Striking platforms are typically flat, not ground, and form a 90-degree angle with the long axis of the flake. Size varies, but all are generally small. Trimming flakes are the result of edge preparation of striking platforms on cores and bifaces. They also probably occur throughout the reduction continuum.

5. Flat Chippage. These specimens are attributable to the various stages of bifacial reduction, from manufacturing of task specific tools to maintenance activities such as resharpening. Flat flakes are typically small and thin. Also included here are lamellar flakes, which are not considered a true product of blade production in this assemblage. Dorsal surfaces are highly complex with intervening ridges of prior flake scars not as pronounced as secondary stage debitage. Striking platforms are small, faceted or ground and typically form an angle of less than 70-degrees to the long axis. Lipping on the ventral margin of the striking platform is also common. The principle techniques used include pressure flaking and/or free hand percussion with a small hammerstone, or billet made on antler or wood.

6. Flake Debris. All items in this category represent broken flake debris with missing striking platforms and exhibit characteristics assignable to a number of the categories above. It is also used as the unidentified category so as to avoid lumping broken specimens into the shatter category.
Use-Wear Assessments

Use-wear studies have evolved into a highly specialized form of analysis that employs a variety of techniques to evaluate patterns of use and infer function for chipped stone artifacts. Examples include microscopic examination at varying degrees of magnification, high-powered electron scanning microscopy, experimentation and replication, and knowledge of the working of stone. All of these require a considerable amount of expertise, experience and time expenditure to fully analyze an assemblage of any size. Therefore, the procedures used in this study needed to be limited in scope, with the goal of gaining reasonable assessments of the use-wear patterns exhibited on items examined. This phase of the analysis had two primary components: (1) assessment of all projectile points for indications of use-wear, forms of breakage or damage, and evidence of resharpening along blade margins; and (2) inspection of all other tools for the presence and nature of wear patterns exhibited in each. The first component is valuable for examining issues of typology, especially as it relates to style and form. Specifics on the types of wear and breakage observed on projectile points are discussed in Chapter Four. The latter component permits limited characterization of wear type and preliminary assessment of tool function.

A standard binocular stereoscope with indirect illumination was used to examine each piece. Magnification ranged from 10-30x to upwards of 80x in some instances. As a way of standardizing the procedure, examination and recording of data were limited to 30 minutes for each item studied. This helped to curtail the impulse to “read too deeply” into the nature of exhibited wear patterns. A number of use-wear studies (Odell 1985 and 1996; Odell and Odell-Vereecken 1980; Sheets 1973; Tringham et al 1974) were consulted during the analysis, and two studies (Odell and Cowan 1986; Towner and Warburton 1990) addressing the effects of
projectile point breakage and impact damage also proved important to this analysis.

Also important to this analysis were experimentally reproduced comparative type sets by McMullen (1996) and those of the writer. The latter consist of a variety of specimens (e.g., bifaces, scrapers, utilized flakes) produced for specific tasks such as cutting and sawing fresh wood, scraping fresh wood and deer antler, cutting fresh meat and sinew, butchering, splitting wood, and slicing through grass and weedy annuals. All were used for at least 500 to 1,000 strokes; in most cases this represents the low end of specimen use resulting in visually recognizable wear patterns. For example, a lamellar flake tool used for slicing weeds required over 1,000 strokes before any characteristic “nibbling” of the outer margins became readily visible. Alternately, as the rate of wear increased on bifaces used to saw through fresh wood, increasing application of force was also required. This generally resulted in accelerated destruction of the blade margins. The solution was to stop and re-sharpen the blade!

Other specimens in the writer’s collection include experimentally produced bifaces and projectile points not subjected to use-wear. These have proven useful in assessing differences between actual use-wear and wear attributable to biface manufacture (i.e., edge abrasion prior to flake removal).
CHAPTER IV

LITHIC ASSEMBLAGE DESCRIPTION

This chapter presents descriptions of lithic artifact types by classes, and a summary of debitage recovery and raw material utilization. The principal artifact classes consist of projectile points, staged bifaces and fragments, miscellaneous bifacial items, cores and bipolar lithics, chipped stone tools, non-chipped stone tools and lithic debitage. An overview of raw material utilization is then presented in the closing section of this chapter. In the interest of readability, some aspects of the data presentation are included in the appendices. Appendix A shows the locations at which projectile point measurements were taken, the types of notching and stem development observed and examples of use-related projectile point damage. Illustrations of all projectile points and selected examples of other artifact types are shown in Appendix B (Figures 15-32). Appendix C consists of projectile point metrical data and raw material types. Distributions for some of the artifact types are provided in Appendix D (Figures 33-45). Appendix E lists lithic raw material distributions and percentages by artifact class. Further interpretations of the lithic assemblage at large and typological assessment of Middle Woodland projectile points are presented in Chapter 5.

Throughout the course of this study several significant intra-site comparisons emerged, the most important being the distribution of projectile point types and exotic raw materials. There is also a general correlation of most artifact types with the high debitage density contours, suggesting the presence of discreet lithic activity locations. To further evaluate these observations, a sample of 29 units from across the site was
arbitrarily selected for a more thorough analysis (Figure 7). This entailed sorting all
debitage into representative stages of reduction, as defined in Chapter 3. Additionally, all primary stage debitage was recorded during the scan for exotic raw materials. The results of both demonstrate that most of the primary stage debitage occurs in units outside the high debitage density areas. Percentages of primary stage debitage by count and weight are shown for each unit in Figures 8 and 9, respectively.

By contrast, debitage within the high density contours mainly consists of secondary to late stage small chippage. It would appear that high debitage density areas were the locations for bifacial reduction, tool production and maintenance, and other activities involving chipped stone implements. In the final analysis, this observation should make an important contribution to understanding the nature of occupations at this site, when considered along with other components of the larger site assemblage (e.g., ceramics, faunal interpretations, etc.).

Projectile Points

A total of 92 excavated projectile points were first sorted according to degree of similarity, haft morphology and relative size. Pertinent data, such as metrical measurements and raw material type, were then recorded. The specific type of notching technique and stem development was recorded during the microscopic examination that followed. The groupings of points presented below are a result of the final review of all data. They are presented in chronological sequence from earliest to most recent. All illustrations are in Appendix B.

Stemmed Points (N=6; Figure 16A-I)

These points are quite variable in overall morphology and in need of detailed
Figure 7. Location of Fully Analyzed Units.
Figure 8. Primary Stage Debitage Percentages by Count.
Figure 9. Primary Stage Debitage Percentages by Weight.
discussion here. Typological and chronological assessments are also offered because they are important to interpreting the earliest Havana-related occupations at this site. Two of these points (Figure 16A,C) correlate well with Dickson contracting stem and Adena-like forms (Justice 1987:184-198). Lateral margins of the stems and bases are moderately ground in both Armintrout-Blackman points. One (Figure 16A) is made on high quality heat-altered Wyandotte/Cobden chert. It has slightly squared shoulders that are somewhat reduced from either reworking or refinement of blade margins during manufacture. Distinctions between the two were difficult to make because of the very fine-grained nature of the raw material and lack of discernable wear on blade surfaces. A portion of the base is also missing.

The second (Figure 16B) is made on Bayport chert and also has reduced blade margins and a broken shoulder. Blade surfaces exhibit use-wear in the form of smoothed over flake ridges and polish or filling of surface pores. Less worn reworking flake scars occur within the distal aspect and along portions of the blade margins. These two points resemble a contracting stem point from the Mushroom site (Figure 16G), which has intact shoulders that lack reworking and may be considered to represent a Dickson contracting stem point. A similar contracting stem point made on Wyandotte chert was recovered at the Schultz site (Ozker 1982:96-97).

Two others (Figure 16B, D) are straight stemmed forms with slightly squared bases. One is made on pale homogenous Bayport chert and the other is on local till chert. Both have heavily ground bases and stem margins. They are most similar to Kramer points at the Schultz site (Ozker 1982:Figure 37), where they occur primarily in the Early Woodland levels with declining frequencies in the early Middle Woodland levels. Some amount of reworking is evident and is consistent with Ozker’s (1982:92) discussion of reworking on the Schultz site Kramer points.
The last two (Figure 16E-F) are fairly large and thick points. The first has shallow primary conchoidal flake scars followed by pressure flaked development of a straight stem. The base is broken and stem margins are moderately ground. Moderate to heavy use-wear along the blade margins suggests use on medium to hard materials (e.g., wood, bone, etc.). Extensive reworking is also evident. The second (Figure 16F) is an exceptionally well-made point on high quality Wyandotte/Cobden chert. It also displays shallow primary conchoidal flake scars followed by development of a straight stem. Base and stem margins are moderately ground and discernable use-wear along the blade margins is absent. This point has been compared to two similar ones from the Goodall Mounds area Ernest B. Young Collection (Mangold 1998). Both exhibit similar modes of stem preparation and are also made on high quality Wyandotte/Cobden chert. Outlines of these points, obtained by permission (William Mangold, personal communication), are shown in Figure 16 (H-I).

Typological comparisons for the latter two Armintrout-Blackman stemmed points were at first difficult, but one possibility is considered here. Montet-White (1968:174 and 178-181) discussed the possible development of diagonal or corner notching occurring on lanceolate forms prior to the introduction of broad-bladed Middle Woodland Snyders forms. The lanceolate stemmed forms are also considered by Montet-White to be Early Havana, with some continuity into the following Early Hopewell phase. It is believed that the Armintrout-Blackman examples, along with the two points from the Ernest B. Young Collection, could be included in this same context. A temporal placement representing overlap of contracting stem points with the introduction of the Snyders corner notched points at ca. 150 B.C. – A.D. 1 is suggested (see Garland and DesJardins 1995:30-31; Munson 1986:292-293).

Additionally, Figure 16F co-occurs with one of the Havana-related interior-
exterior cordmarked ceramic concentrations in unit WP in the east sector, thereby lending support to this suggestion. It is further felt that the other stemmed points probably have similar temporal relationships -- unless one considers minor use of the site during the Early Woodland period without associated Marion ceramics. And, as discussed by Ozker (1982:100-102), the observed variability of all these points could actually relate to different modes of hafting and/or functionally specific forms (e.g., spears, darts, hafted knives).

Large Corner Notched Points (N=5; Figure 17A-E).

Large Corner Notched points are narrow bladed forms that have lengths greater than 45 mm and display bold haft element characteristics. All are from the west sector and south portion of the center sector (Figure 10). One is made on Bayport chert and the rest are on local till cherts. One (Figure 17E) is slightly narrower and thinner, but shares the same haft area characteristics. All have primary conchoidal flake scars on both sides of each notch area. Blade outlines vary from excursive to triangular with biplano to biconvex profiles. They resemble Norton points, which are a morphological correlate of the Snyders cluster (Justice 1987:201-204). In particular, morphological attributes of the haft element are proportionally identical to corner notched points from the Norton Mounds (Griffin et al 1970:Plates 123, 146 and 170). Similar comparisons were also made to corner notched points at the Prison Farm Site (Brashier et al 1998:Figures 4A-B and 5).

Reworking is evident in most, resulting in a near bi-triangular cross section in those with triangular outlines. Discontinuous use-wear patterns are evident along the blade margins, consisting of abrupt hinge terminated flake scars and abraded/pitted high points. Polish and filling of surface pores is absent. The type of use-wear
Armintrout-Blackman Site (20AE812)

West Sector

Center Sector

East Sector

S = Stemmed Point
L = Large Corner Notched Point
B = Broken Large Corner Notched Point
M = Medium Corner notched Point

Figure 10. Distribution of Stemmed and Corner Notched Points.
observed is similar to contemporary specimens used in sawing or cutting medium to hard materials, such as wood and bone, with some reworking to maintain a sharp cutting edge. Comparisons were also made to a series of large expanding stem points, with similar use-wear characteristics, at the Schultz site (Fitting 1972:202-203). Fitting suggested that these points represented hafted knives.

Four Large Corner Notched points from the Mushroom site (Figure 17F-I) are included in this discussion because they are similar to the Armintrout-Blackman Large Corner Notched points. Three are made on Bayport chert and the fourth is on heat-altered local till chert. All four also have primary conchoidal flake scars on both sides of each notch. Two (Figure 17F,H) have broken blade tips with heavy use-wear and reworking of the intact blade margins. One (Figure 17I) is a relatively complete narrow ovate form, with no discernable use-wear or evidence of resharpening. It very closely resembles corner notched points from Norton Mound C (Griffin et al 1970:Plate 146).

Broken Large Corner Notched Points (N=4; Figure 18A-D).

Four broken corner notched points are considered to represent large corner notched forms because the intact blade margins suggest lengths greater than 45 mm. All also have primary conchoidal flake scars on both sides of each intact notch area. All are from the west and center sectors. One is made on heat-altered Bayport chert and the rest are on local till cherts. Two (Figure 18A-B) exhibit heavy-duty breakage suggestive of prying or twisting actions. Breakage on the remaining two is probably attributable to impact damage.
Medium Corner Notched Points (N=24; Figure 19A-X).

On the basis of visual comparison to typological references, these points vary considerably between small affinis Snyders types and examples of other notched points, such as Chesser Notched (Justice 1987). However, upon close examination, all exhibit a corner notch technique characteristic of the Snyders cluster (as described by Justice 1987:201-204). In particular, they are most similar to the affinis Snyders and Manker corner notched types. Most of these points are located in the west sector of the site (Figure 10).

Five of these points (Figure 19A-E) are relatively complete and may represent their original form and size. One (Figure 19E) is missing the distal aspect of its blade, but the remaining portion exhibits no significant amount of reworking. One is made on Norwood chert and the rest are on local till cherts. All have biconvex crosssections and longitudinal profiles. Haft area dimensions are smaller than the large corner notched points and exhibit an alternating corner notching technique, consisting of a primary conchoidal flake scar and pressure flaked retouched on the opposing side of each notch area. Use-wear is not readily distinguishable from what could be attributed to edge abrasion during.

Eight points (Figure 19F-M) are short broad forms with triangular blade outlines. Three are made on Bayport chert, one on Burlington chert, one on Norwood chert, and the rest are on local till cherts. Most have primary conchoidal flake scars on both sides of each notch area. Three (Figure 19F-H) have haft area measurements in the range of the Large Corner Notched points. Varying degrees of use-wear in the blade area consist of smoothed flake ridges and polish. Moderate use-wear along the blade margins varies between polished domed high points to micro-step fractures and abraded/pitted edges. Less worn reworking flake scars typically emanate toward the
center of the point, and have cut through the shoulder areas on most. One (Figure 19L) has a shallow hinge terminated flake scar attributable to impact damage, with invasive reworking flake scars along the distal blade margins. Another (Figure 19M) has reworked notch areas, probably reflecting an attempt to increase notch depths due to attrition of blade margins and shoulder areas. These eight points are similar to some of the expanding stem points at the Schultz site (Fitting 1972: Figure 62 bottom row); the Mushroom site (Stout 1984: Figure 8F-G), Jancarich Village (Prahl 1991: Figure 21 top row) and the Prison Farm site (Brashler et al 1998:152-155).

Five points (Figure 19N-R) are damaged but have remnant portions of primary conchoidal flake scars in notch areas. One is made on Burlington chert, one on Flint Ridge chert and the rest are on local till cherts. Three (Figure 19N-P) exhibit deep impact force resulting in damage further downward in the blade area. The first two have tip damage and shearing of the blade areas. The third has heavy tip breakage, followed by transverse shear or burination along one blade margin and complete shattering of the point blade. Another (Figure 19R) has a partially sheared base with worn surfaces, indicating continued use after the damage occurred.

The remaining six points (Figure 19S-X) exhibit varying degrees of heavy use and reworking. One is made on Bayport chert and the rest are on local till cherts. Flake scar ridges on blade surfaces are typically heavily worn and highly polished. Multiple episodes of reworking is evident in most through a series of invasive flake scars with varying degrees of wear. Reworking has also cut through considerable portions of the shoulder and upper notch areas. Use-wear along blade margins consists of polished and domed high points, suggesting use on soft to medium materials. It is believed this reflects their use as small hafted knives with intermittent re-sharpening of blade edges, possibly related to butchering activities. It also suggests
curation, in that these points have been recycled as other tool forms once they have been reduced to blunt forms that are inefficient as penetrating projectile tips. From replication studies, Odell and Cowan (1986:205-206) observed that short points with broad tip angles tended to bounce off targets.

The Prison Farm expanding stem points were described as extensively re-worked forms with near bi-triangular outlines and reduction of haft area characteristics (Brashier et al 1998:152-155). A thick crosssection was also noted, with an average width-to-thickness ratio of 3.12. By way of comparison, width to thickness ratios for all the Armintrout-Blackman corner notched points is listed in Table 2.

Table 2
Corner Notched Points Average Width-to-Thickness Ratios

<table>
<thead>
<tr>
<th>Type</th>
<th>N</th>
<th>Figure No.</th>
<th>Average W/T Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Corner Notched</td>
<td>5</td>
<td>17A-E</td>
<td>2.78</td>
</tr>
<tr>
<td>Broken Large Corner Notched</td>
<td>2</td>
<td>18A-B</td>
<td>2.48</td>
</tr>
<tr>
<td>Mushroom Corner Notched</td>
<td>4</td>
<td>17F-I</td>
<td>3.20</td>
</tr>
<tr>
<td>Medium Corner Notched</td>
<td>5</td>
<td>19A-E</td>
<td>3.28</td>
</tr>
<tr>
<td>Medium Corner Notched</td>
<td>17</td>
<td>19F-X</td>
<td>2.83</td>
</tr>
<tr>
<td>Totals</td>
<td>33</td>
<td>----</td>
<td>2.93</td>
</tr>
</tbody>
</table>

W/T = Width-to-Thickness

Haft area measurements for all the Medium Corner Notched points vary con-
siderably, but at least one pattern is deserving of mention here. There appears to be a relationship between thickness and relative breadth of the haft area. Specifically, the thicker points have wider necks and primary conchoidal flake scars on both sides of each notch. This relationship appears further supported by increasing stem lengths and base widths; however, these two measures are not always reliable because they are influenced by use-wear and some amount of marginal refinement following placement of notches, evident in a number of the Armintrout-Blackman points. Thus, a few could have originally been close in size and form to the Large Corner Notched points, but have subsequently been broken and reworked into short forms. This also suggests the existence of different sized points – ranging from large spear points to smaller dart points – with similar stylistic attributes and methods of stem development.

**Expanding Stem Points** (N=26; Figure 20A-Z).

Expanding Stem points are characterized by a modified notching technique defined as the placement of a shallow primary notch followed by lateral retouch development of stem areas. The primary notches vary between a diagonal or corner placement to broad shallow side notched expressions. This group of points displays the greatest variation in haft area morphology and overall size. Most are located in the east sector and continue in decreasing numbers into the north portion of the west sector (Figure 11). Initially there appeared to be two types represented: (1) Manker stemmed and Ansell related forms (Montet-White 1968:73-79); and (2) flared base forms related to Lowe Flared Base and Steuben Expanded Stemmed types (Justice 1987:208-214). However, they all share one or more characteristics of all these types. Additionally, varying degrees of blade attrition have cut through the shoulders in a
Figure 11. Distribution of Expanding Stem and Small Notched Points.
few; it is felt that the shoulders and upper notch areas are important to making typological distinctions. The most meaningful observation made is that some are smaller and narrower, with reduced haft area dimensions – which, in the final analysis, could have temporal significance as well.

Three points (Figure 20A-C) may represent intermediate forms between the early Middle Woodland corner notched points and later Middle Woodland expanding stem points, because of their resemblance to Gibson Notched and Manker Stemmed types (Montet-White 1968:73-79). One is made on Norwood chert and the other two are on local till cherts.

Twelve points (Figure 20D-O) are medium sized forms that have characteristics of both Steuben Expanded Stemmed and Lowe Flared Base types. All exhibit varying degrees of reworking. Two are made on an unidentified white chert similar to Burlington, and the rest are on local till materials. The local materials range from good quality chert to cherty cortex and cortex. There is a tendency toward placement of cortex at the base for those with a mixed chert/cortex matrix. Bases are sub-convex to straight with minimal grinding of the stem areas. Points with cortex bases do appear ground, but this may be the result of “scrubbing” as a means of shaping the haft area. Those that are made on higher quality cherts tend to have flatter bases and straighter flared stem margins. Generally all have biconvex crossections and longitudinal profiles. A few display asymmetrical profiles and unmodified areas on one side of the blade surface, suggesting that they were produced directly from flake blanks as opposed to preforms. Both Deregnaucourt (1991:239) and Justice (1987:208-213) described this as a characteristic attribute for some of the Lowe cluster points. Use-wear along blade margins is typically light, consisting of moderate doming of high points. Polish and wear on blade surfaces are generally absent. One (Figure 20L)
exhibits impact damage in the blade, along with partial shearing of the base. Three (Figure 20I, J, N) have broken tips from either impact or use in prying actions.

These twelve points (Figure 20D-O) resemble some of the small expanding stem points at the Schultz site (Fitting 1972: Figure 62 rows 3-5); a small number at the Zemaitis site (Murphy 1986: Plate 6, 7 and 10); the Hacklander site (Sorensen 1978: Plate 6); and to Steuben points at the Steuben site in Illinois (Morse 1963: Figure 1). Asymmetrical blades and evidence of resharpening was also noted for the Hacklander and Zemaitis points. Based on these comparisons, it is felt that the Armintrout-Blackman points probably represent medium sized dart points with some use as hafted knives.

Eleven points (Figure 20P-V) are small and narrow forms in varying stages of reworking and breakage. Three (Figure 20P-R) exhibit straight stems and out-flaring basal ears. Grinding along the base and stem margins is absent. One is made on an unidentified fine-grained dark blue-gray chert, and the other two are on local till cherts. The remaining eight points are made on local till materials, with cortex represented in nearly half. One (Figure 20T) exhibits impact damage in the form of a sheared base. All of these eleven points resemble the narrow expanding stem points at the Schultz site (Fitting 1972: Figure 63A); two of the expanding stem points at the Mushroom site (Stout 1984: Figure 8:L, O); the Dustin/Lamoka points at the Zemaitis site (Murphy 1986: Plate 10); and some of the expanding stem points at the Hacklander site (Sorensen 1978: Plate 4). Fitting (1972:199-203) discussed the similarity of the Schultz site points to Archaic Dustin/Lamoka points, but noted that they are restricted to the late Middle Woodland and Late Woodland levels at Schultz.
Small Notched Points (N=6; Figure 21A-F).

This small group of points has small notches that are diagonally oriented, but lack prominent conchoidal flake scar characteristics. All are made on local till materials. Three are in the center sector and the rest are located throughout the east sector. They appear to have been made on either small preforms, or directly from flake blanks. One (Figure 21E) exhibits a large heat-spall that has removed most of the blade surface on one side. Another (Figure 21F), made on cortex, has breakage along an internal fracture plane at the base, giving the impression of a deliberate bifurcate modification. These points resemble some of the smallest expanding stem points at the Schultz site (Fitting 1972: Figure 62 top two rows). Similar points also occur at the Zemaitis site (Murphy 1986); the Hacklander site (Sorensen 1978); and the Mushroom site (Stout 1984: Figure 8:1-J). These points are believed to represent types that are found in late Middle Woodland to early Late Woodland contexts throughout lower Michigan.

Miscellaneous Expanding Stem Points (N=5; Figure 22A-E).

This group represents points that are unique and do not fit into the any of the above categories. Two (Figure 22A,C), made on local till cherts, are very heavily reworked forms that are visually similar to Ansell types. However, they have remnant primary conchoidal flake scars on both notch areas, suggesting that they might have originally been corner notched points. Both have heavy wear patterns along the blade margins, interrupted by intermittent reworking. The first point is from the west sector and the other is from the center sector. A third (Figure 22B), made on a coarse textured unidentified white chert, exhibits rough flaked surfaces and weak notches. It is located in the east sector and appears to be an unfinished point with minimal stem
development.

The last two (Figure 22D-E) are unifacial in form. The first, located in the west sector, is made on a thick broad flake of Bayport chert. Blade margins are unmodified and one edge consists of a thick, truncated or broken surface. Primary conchoidal flake scars are found in both notch areas. The base is broken but does exhibit some amount of refinement. Use-wear consists of moderately domed high points and smoothed flake ridges within the first 3 mm. of the dorsal blade surface. It is suggested that this form was primarily used as a knife. The second is from the east sector and is made on Norwood chert. It has impact damage in the form of tip breakage and longitudinal shearing through the cross-section, which has also removed much of the haft area. A remnant conchoidal flake scar is evident in one notch area, suggesting a corner notched point form.

Late Woodland Triangular Points (N=8; Figure 23A-H).

These points were recovered from excavation units in an area confined to the southwest portion of the site. All display considerable variation in overall size, shape and degree of blade refinement. For the most part, they display characteristics of both the Madison and Levanna types (Justice 1987) and are typical of Late Woodland triangular points found at many sites throughout lower Michigan.

Archaic and Unclassified Points (N=6; Figure 24A-F).

Two Archaic points (Figure 24A-B) are from Units 11 and 59, respectively. The first is made on heat-altered Burlington chert. Blade margins are slightly serrated and the base is moderately ground. This point correlates well with the Kirk corner notched types (Justice 1987:71-72), with an Early-to-Middle Archaic placement. The
second is made on an unidentified local till chert and exhibits a heavily reworked blade. It is side notched with a bold thick base that is heavily ground. This point is an Early-to-Middle Archaic Thebes point (Justice 1987:54).

The last four points (Figure 24C-F) are unclassified. One (Figure 24C), made on local till chert, is a thin lanceolate form with a very irregular base. Notches are small and placed on the sides with a slight diagonal orientation. The base is ground and blade margins are somewhat reduced through reworking. This point is similar to the Oronoko side notched points at the Eidson and Wymer East Knoll sites in Berrien County, Michigan (Clark 1990b:71-72). These points have radiocarbon dates ranging between 550 B.C. +/- 70 to A.D. 10 +/- 70. It is felt that the Armintrout-Blackman specimen might also represent a side notched lanceolate point which occurs throughout the Early Woodland and into the early Middle Woodland period.

The last three points (Figure 24D-F) are thin forms with broad triangular blade outlines. One is made on Norwood chert and the others are on Lambrix/Deer Lick Creek cherts. The stems are narrow and slightly expanding with rounded basal ears. Bases are straight with a weak bifurcation resulting from bifacial thinning. A similar point occurs at the Mushroom site (Stout 1984: Figure 7B). Comparisons can also be made to nine points from the lower Kalamazoo River valley settlement pattern survey which were described as Kanawha or Fox Valley types (Campbell 1986:38-39). Justice (1987:95-97) has discussed these types and assigns them to an Early-to-Middle Archaic temporal placement. Alternately, Ritzenthaler (1967:32) described Fox Valley Truncated Barb points, with very similar characteristics to the Kanawha type, as occurring in Late Woodland contexts. However, as noted by Justice (1987:96), radiocarbon dates are not available for the Fox Valley Truncated Barb points. It is for this reason that the Armintrout-Blackman points remain unclassified.
until more is learned of the distribution and chronological associations for these point types.

Staged Bifaces and Fragments

A total of 44 complete unnotched bifaces and 154 biface fragments were recovered from the excavation. A three-stage approach to classification was used during the analysis, reflecting different stages of preform development and refinement (as described by Clark 1990a:21; and Johnson 1993). However, separation of all bifaces into distinct stages was not always possible since they are in a continuous state of reduction. Thus, they are presented here as either stage 1/2 or stage 3/4 bifaces. Distributions across the site are shown in Figure 36.

Stage 1/2 Bifaces (N=25; Figure 25A-H).

All stage 1/2 bifaces exhibit considerable variation in overall size, thickness and degree of refinement. Some are very thick with respect to width and could just as well be considered bifacial cores. It is believed that many represent rejects in the attempt to thin the biface while maintaining sufficient width. None shows any discernable indications of use-wear. All are made on local till cherts with heat alteration evident in five specimens.

Stage 2/3 Bifaces (N=19; Figure 26A-O).

The stage 2/3 bifaces are subdivided into four basic forms according to size and shape. Metrical data and raw material types for all these forms are shown in Table 3. None exhibits any discernable indications of use-wear. Three narrow lanceolate forms (Figure 26C-E) may represent preforms for stemmed points. All co-occur with one of the interior-exterior cordmarked ceramic concentrations the east
Table 3
Distribution and Raw Material Type for Stage 2/3 Bifaces

<table>
<thead>
<tr>
<th>Sector</th>
<th>Unit</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Broad Ovate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>14</td>
<td>70.2</td>
<td>46.5</td>
<td>10.4</td>
<td>Unidentified</td>
</tr>
<tr>
<td>East</td>
<td>23</td>
<td>63.6</td>
<td>47.5</td>
<td>13.7</td>
<td>Unidentified</td>
</tr>
<tr>
<td><strong>Narrow Ovate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>58</td>
<td>56.4</td>
<td>28.3</td>
<td>11.2</td>
<td>Lambriz/Deer Lick Creek</td>
</tr>
<tr>
<td>West</td>
<td>WF</td>
<td>50.2</td>
<td>26.0</td>
<td>11.1</td>
<td>Bayport</td>
</tr>
<tr>
<td>West</td>
<td>54</td>
<td>56.5</td>
<td>26.3</td>
<td>10.2</td>
<td>Lambriz/Deer Lick Creek</td>
</tr>
<tr>
<td>Center</td>
<td>19</td>
<td>62.4</td>
<td>35.4</td>
<td>6.9</td>
<td>Purple</td>
</tr>
<tr>
<td><strong>Small Ovate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>FF</td>
<td>40.6</td>
<td>22.5</td>
<td>11.1</td>
<td>Cortex</td>
</tr>
<tr>
<td>West</td>
<td>14</td>
<td>36.6</td>
<td>24.1</td>
<td>8.5</td>
<td>Lambriz/Deer Lick Creek</td>
</tr>
<tr>
<td>Center</td>
<td>WV</td>
<td>42.3</td>
<td>25.2</td>
<td>6.8</td>
<td>Lambriz/Deer Lick Creek</td>
</tr>
<tr>
<td>East</td>
<td>75</td>
<td>44.2</td>
<td>26.3</td>
<td>5.1</td>
<td>Purple</td>
</tr>
<tr>
<td>East</td>
<td>WO</td>
<td>48.3</td>
<td>24.8</td>
<td>6.3</td>
<td>Burlington</td>
</tr>
<tr>
<td>East</td>
<td>JJ</td>
<td>36.1</td>
<td>25.3</td>
<td>9.1</td>
<td>Lambriz/Deer Lick Creek</td>
</tr>
<tr>
<td>East</td>
<td>V</td>
<td>39.2</td>
<td>22.7</td>
<td>10.4</td>
<td>Cortex</td>
</tr>
<tr>
<td>East</td>
<td>WU</td>
<td>42.2</td>
<td>23.0</td>
<td>7.9</td>
<td>Unidentified</td>
</tr>
<tr>
<td>East</td>
<td>23</td>
<td>39.2</td>
<td>19.7</td>
<td>10.0</td>
<td>Gray-White</td>
</tr>
<tr>
<td>East</td>
<td>E</td>
<td>38.5</td>
<td>25.7</td>
<td>10.1</td>
<td>Lambriz/Deer Lick Creek</td>
</tr>
</tbody>
</table>

L = Length  W = Width  T = Thickness
sector. Two broad ovate forms (Figure 26A-B) are rough flaked without well-refined margins. They represent somewhat smaller expressions of the broad-bladed Snyders preforms described by Montet-White (1968:38-42). Four medium sized narrow ovate forms (Figure 26F-I) are from the west and center sectors. The remaining 10 are small ovate forms (Figure 26J-O). Six of these are from the east sector.

**Broken Staged Bifaces (N=44; Figure 27A-I).**

These items are from bifaces broken during various stages of reduction, from small fragments to near complete specimens. A majority are located within the high debitage density areas (Figure 36). One (Figure 27A), from Unit 96, is made on good quality Wyandotte/Cobden chert that is similar to the large Wyandotte/Cobden stemmed point described above. Another is made on Norwood chert, and all of the rest are on local material. Morphology of the more complete specimens suggests a size range of preforms from broad-bladed ovate forms to more narrow ovate forms. All of the broad-bladed forms are from the east and center sectors. The narrow ovate forms are more widely distributed throughout all three sectors.

**Miscellaneous Bifacial Items**

A total of 110 miscellaneous bifacial items consisting of projectile point blades and bases, bifacial tips and indeterminate fragments were identified in the assemblage. Point blades and bifacial tips are mainly associated with the high debitage density areas in all three sectors (Figure 37). In contrast, point bases and miscellaneous bifacial fragments generally appear to have been discarded widely over the site area. Indeterminate fragments (N=32) are small miscellaneous portions of either shattered projectile points or finished preforms. Two from the East sector are made
on Bayport chert and all the rest are on local till cherts.

**Projectile Point Blades (N=7).**

All point blades have simple snap breakage just below the shoulder and with no indications of impact damage. Breakage associated with bending or prying actions is suggested. All are extensively reworked. Remnant portions of notches are present, but not enough information is available for typological assessment. Two from the west sector are made on Bayport chert and one in the east sector is made on Burlington chert (Figure 37). Another exhibits some attempt at placement of new notches just above the broken proximal aspect.

**Projectile Point Bases (N=20).**

With the exception of two Bayport specimens from the west sector and one on Burlington chert from the center sector, all bases are made on local till cherts. Distributions across the site are provided in Table 4. Most are broken across the neck area, with a smaller number exhibiting compound breakage through the long axis of the point. The latter are the most informative in that they exhibit at least one intact notch area and represent corner notched forms. The rest are characterized as short proximal ends of the base that cannot be accurately typed because they lack the haft area. However, by way of general impression, they appear to correlate with the distribution of projectile point types across the site.

**Bifacial Tips (N=49).**

Three distinct tip forms are present in the assemblage: (1) small point tips averaging between 5-15 mm in length; (2) large point tips that are much thicker and
### Table 4

Distribution of Projectile Point Bases

<table>
<thead>
<tr>
<th>Unit</th>
<th>Type</th>
<th>BW</th>
<th>NW</th>
<th>SL</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West Sector</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Corner Notched</td>
<td>22.9</td>
<td>17.3</td>
<td>15.2</td>
<td>Bayport</td>
</tr>
<tr>
<td>51</td>
<td>Corner Notched</td>
<td>22.6</td>
<td>13.8</td>
<td>---</td>
<td>LX/DL</td>
</tr>
<tr>
<td>S</td>
<td>Corner Notched</td>
<td>21.2</td>
<td>15.9</td>
<td>---</td>
<td>Unidentified</td>
</tr>
<tr>
<td>6</td>
<td>Corner Notched</td>
<td>---</td>
<td>---</td>
<td>16.3</td>
<td>Bayport</td>
</tr>
<tr>
<td>S</td>
<td>Corner Notched/Expanding Stem</td>
<td>18.5</td>
<td>14.5</td>
<td>13.0</td>
<td>Cortex</td>
</tr>
<tr>
<td>12</td>
<td>Corner Notched/Expanding Stem</td>
<td>14.9</td>
<td>11.1</td>
<td>---</td>
<td>LX/DL</td>
</tr>
<tr>
<td></td>
<td>Center Sector</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Corner Notched</td>
<td>---</td>
<td>---</td>
<td>14.6</td>
<td>Purple</td>
</tr>
<tr>
<td>WB</td>
<td>Corner Notched/Expanding Stem</td>
<td>19.4</td>
<td>---</td>
<td>---</td>
<td>LX/DL</td>
</tr>
<tr>
<td>CC</td>
<td>Corner Notched/Expanding Stem</td>
<td>20.0</td>
<td>---</td>
<td>---</td>
<td>LX/DL</td>
</tr>
<tr>
<td>MM</td>
<td>Corner Notched/Expanding Stem</td>
<td>20.2</td>
<td>15.3</td>
<td>---</td>
<td>Unidentified</td>
</tr>
<tr>
<td>WG</td>
<td>Corner Notched/Expanding Stem</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Unidentified</td>
</tr>
<tr>
<td></td>
<td>East Sector</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS</td>
<td>Corner Notched</td>
<td>---</td>
<td>17.2</td>
<td>12.0</td>
<td>LX/DL</td>
</tr>
<tr>
<td>WR</td>
<td>Corner Notched</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Unidentified</td>
</tr>
<tr>
<td>WQ</td>
<td>Expanding Stem</td>
<td>24.3</td>
<td>12.1</td>
<td>---</td>
<td>Gray-White</td>
</tr>
<tr>
<td>A</td>
<td>Expanding Stem</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Gray-White</td>
</tr>
<tr>
<td>100</td>
<td>Corner Notched/Expanding Stem</td>
<td>18.0</td>
<td>14.1</td>
<td>---</td>
<td>Cortex</td>
</tr>
<tr>
<td>23</td>
<td>Expanding Stem</td>
<td>21.5</td>
<td>12.1</td>
<td>---</td>
<td>Unidentified</td>
</tr>
<tr>
<td>E</td>
<td>Indeterminate</td>
<td>---</td>
<td>17.8</td>
<td>---</td>
<td>Unidentified</td>
</tr>
<tr>
<td>II</td>
<td>Indeterminate</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Unidentified</td>
</tr>
<tr>
<td>K</td>
<td>Indeterminate</td>
<td>17.5</td>
<td></td>
<td>---</td>
<td>Unidentified</td>
</tr>
</tbody>
</table>

BW = Base Width    NW = Neck Width    SL = Stem Length    
LX/DL = Lambrix/Deer Lick Creek Chert
range between 18–40 mm in length; and (3) thick tips that generally exhibit rough flaking patterns representative of the reduction continuum of biface manufacture. Table 5 and Figure 37 show the distribution of each across the site. As shown in Table 5, tips are most numerous in the west sector, with small tips obtaining their highest frequencies of occurrence there. Exotic raw materials in the west sector consist of two tips on Bayport chert and one on Burlington chert. The center sector tips are all on local till cherts, and the east sector is restricted to one large point tip on Bayport chert. The smallest tips exhibit no impact damage and appear to have been snapped or rolled off the point blade by a prying action – possibly related to butchering or other activities incorporating the use of projectile points as hafted tools. Most of the large point tips have similar breakage characteristics, with a smaller number being attributable to some form of heavy force breakage or shattering of the point blade. Two of the large point tips also have impact damage in the form of broken distal aspects and presence of shallow hinge terminated flake scars.

Table 5
Distribution of Bifacial Tips

<table>
<thead>
<tr>
<th>Sector</th>
<th>Small Point Tip</th>
<th>Large Point Tip</th>
<th>Preform Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>9  52.9%</td>
<td>6  75.0%</td>
<td>5  22.7%</td>
</tr>
<tr>
<td>Center</td>
<td>6  35.3%</td>
<td>1  12.5%</td>
<td>4  18.2%</td>
</tr>
<tr>
<td>East</td>
<td>2  11.8%</td>
<td>1  12.5%</td>
<td>13 59.1%</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>8</td>
<td>22</td>
</tr>
</tbody>
</table>
A total of 123 of these items are included together in this grouping because the assemblage evidences utilization of both free hand percussion and bipolar techniques. Also, both techniques were probably used interchangeably during individual episodes of lithic reduction. A degree of conservatism characterized identification of bipolar lithics because these are sometimes difficult to distinguish from the by-products of core reduction using free hand percussion (Jeske and Lurie 1993). A few more probably remain within the debitage, but what has been identified is nonetheless representative.

Cores and Core Fragments (N=42; Figure 28A-F)

A total of six cores and 36 core fragments were identified in the assemblage. All are made on local raw materials, dominated by the presence of Lambrix/Deer Lick Creek cherts. Core fragments are generally associated with the high debitage density areas in the west and center sectors, but not so in the east sector (Figure 38). The largest number of specimens and greatest range of core fragment size occurs within the west sector. The number of cores initially appeared surprisingly small for this assemblage. However, a similar situation was observed at the Spoonville site (Higgins 1982:2-3); the Mushroom site (Stout 1984:38); and the Zemaitis site (Murphy 1986:82). As with the Armintrout-Blackman assemblage, large numbers of indeterminate core fragments were also recovered at these same sites.

The Armintrout-Blackman cores would be difficult to distinguish from large blocky shatter were it not for the presence of prior flake removal scars. This is partly due to the nature of local glacial till cherts, which are found in a variety of shapes and sizes that do not lend themselves well to reduction strategies employed on cherts from
quarry sources. Based on personal experience in working local till cherts, any attempt to remove all cortex and reduce the chert matrix into a core usually results in an unusable pile of blocky debris. An alternative strategy entails breaking open the cobble to expose a clean surface for platform preparation and removal of sizable flake blanks for further bifacial reduction. Both free hand percussion and bipolar techniques are employed, depending on the shape of the cobble and presence of internal flaws attributable to glacial transport. This often results in significant amounts of large shatter and core-like fragments, but is considered an effective way of producing sizable bifaces from till chert sources.

Of the six cores recovered from excavation, three are block cores with amorphous flaking patterns (Figure 28A-C). One is from the west sector, and the rest are from the east sector. The remaining three cores are bipolar, and all are from the east sector. One (Figure 28E) is a small remnant sheared off a much larger bipolar core. It also shows indications of use as a tool in the form of extensive battering at opposing ends. Its function remains unclear, but use on medium to hard materials is suggested by the degree of battering observed.

**Bipolar Lithics (N=81; Figure 29A-O)**

A total of 81 bipolar specimens, commonly referred to as pieces esquillees, were identified in the assemblage. More than one-half are concentrated in and near the high debitage density area in the east sector (Figure 39). The rest are mainly from the center sector, with a small number found more widely dispersed in the east. All are essentially by-products of bipolar reduction, but at least 45 evidence probable use-wear patterns. The remaining 36 items are either splintered remnants from actual use or incidental by-products of bipolar reduction.
Identification of actual use was not easy to make considering the various forms of damage created on individual specimens during the bipolar reduction process (Lothrop and Gramly 1982:6-8). The nature of pieces esquillees in prehistoric lithic industries has received considerable attention in the archaeological (for a review see LeBlanc 1992). At least two types exist in the Armintrout-Blackman assemblage and are simply herein referred to as Types A and B. Interpretation of actual function is not offered, as this requires a considerable amount of microscopic examination and replication study.

Type A examples (N=23; Figure 29A-I) are thick linear specimens, varying between 25-45 mm in length, 18-25 mm in width, and 6-8 mm in thickness. The opposing ends exhibit battered and crushed surfaces, with occasional splintering and columnar step fractures occurring on one end. Their actual function is unknown, but one possibility can be suggested. During stone working experiments by the writer, selection of a stout piece of debitage for use as an intermediate bipolar punch has resulted in damage and wear patterns similar to those of the Type A Armintrout-Blackman specimens.

Type B specimens (N=22; Figure 29H-O) are smaller and thinner, averaging 20-30 mm length, 18-25 mm in width and 6-8 mm in thickness. Evidence for actual use remains tenuous, but is characterized by small feather-terminated (“fish scale”) flake scars, some step fracturing, and micro crushing on two opposing sides. These are often referred to as wood or bone splitting wedges in the archaeological literature. However, they may simply represent bipolar flakes used for any number of tasks, since many evidence wear patterns similar to experimental specimens used by the writer for cutting or scraping operations on a variety of materials.
Chipped Stone Tools

A total of 102 chipped stone tools are further classified as hafted tools, retouched unifacial scrapers, flake tools and non-chert tools. Hafted tools consist of both projectile points recycled into tool forms and drills or reamers. The non-chert category comprises a wide variety of implements made on slate, quartzite and granites.

Hafted Tools and Drills/Reamers (N=19; Figure 30A-L)

With the exception of two corner notched specimens on Bayport from the west sector, all items in this category are made on local till cherts. Three are end scrapers (Figure 30A-B) made on broken or heavily reworked corner notched point forms. Two are from the west sector and the third is from the center sector. Three other broken or reworked corner notched forms (Figure 30C-E) are classified as drills or reamers. The first two have broken tips with no discernable wear along the blade margins. The third has wear within the first 5-10 mm of the tip, consisting of heavily worn and polished surfaces. One of the shoulders is more noticeably reworked and worn smooth. Montet-White (1968:88) has referred to these as winged drills, suggesting that the shoulders could have served as convenient handles. Six additional drills/reamers (Figure 30H-M) are in varying states of wear and breakage. One (Figure 30H) is a T-base drill from Trench 2. Another (Figure 30I), from the west sector, is an exhausted point with reworking of the notch areas. The remaining four are expanding stem forms from the east sector. The remaining seven items in this group are broken drill tips and midsections. Where discernable, use-wear is mainly confined to the first 10 mm of the tip.
Retouched Unifacial Scrapers (N=54; Figure 29A-L)

All of the retouched unifacial scrapers are made on thick secondary stage flakes, with indications of a few being produced through bipolar techniques. Margins on most have unifacial flaking followed by light retouching of the working edge. However, much of the latter could also reflect resharpening as the tool was being used. Three basic types recognized in the assemblage consist of 30 steep retouched (Figure 31A-F), 20 sloping retouched (Figure 31G-J) and four thumbnail scrapers (Figure 31K-L). The last are actually small counterparts of the steep retouched scrapers, with similar use-wear patterns, and occur only in the west sector. Similar typological distinctions were made by Fitting (1972:204-208) at the Schultz site. Half of all unifacial scrapers are associated with the high debitage density areas in the west sector (Figure 40), with two made on Bayport chert and two on Burlington chert. All other unifacial scrapers are made on local till materials.

The steep retouched scrapers vary between 6-10 mm in thickness and have edge angles of 40-85 degrees in their work areas. Use-wear typically consists of heavily worn edges, abraded and pitted high points and with multiple small step fractures within the first 2-3 mm of the working edge. Occasional small feather edge terminated (“fish scale”) flake scars were observed on the unmodified ventral surface in a number of specimens. This type of use-wear is similar to experimental specimens used by the writer for scraping wood and antler. Cantwell (1980:63) observed similar wear patterns on a group of Havana scrapers from the Dickson Camp and Pond sites in the central Illinois River valley and suggested they were used primarily in woodworking.

Sloping retouched scrapers range from 3-6 mm thick and have much shallower angles along the working edge. Use-wear generally consists of domed high
points, smoothed and polished surfaces and a minor amount of step fracturing within
the first 1-3 mm of the working edge. This type of wear is similar to what has been
suggested for hide working and soft woodworking (Cantwell 1980:63).

Flake Tools (N=26; Figure 32A-O)

Eleven specimens are large lamellar flakes with varying types of use-wear. Three in the west sector are made on Bayport chert and one in the center sector is on Norwood chert (Figure 41). All the rest are specimens on high quality local till cherts. Four (Figure 32A-D) have a denticulate retouched margin with smoothed edges and readily discernable polish. They are considered to be knives used on soft materials. The first (Figure 32A), made on Bayport chert, is a true outrepasse flake, defined as having traveled across the surface of a biface and retaining a portion of the opposite margin. This item measures 54 mm in length, 29 mm in width and 8 mm in thickness -- giving a good indication of the size of Bayport chert forms that were brought to this site for further reduction. The remaining seven lamellar flake tools (Figure 32E-I) lack denticulate retouched margins and have wear patterns suggestive of both scraping and cutting actions on soft to medium hard materials.

Eight more specimens represent thick and large pieces of debitage. With the exception of one on Bayport chert (Figure 32M) in the west sector and another on a thick tabular flake blank of Burlington chert (Figure 32J) in the center sector, all are made on local till cherts of varying quality. The Burlington specimen indicates that this material was transported from the Illinois Valley in partially processed form. All have a minor amount of retouch with rather abusive use-wear, suggesting use as a knife and/or scraper. The remaining seven items in this group are small utilized flakes that lack retouching and appear to have been used for a variety of tasks.
Non-Chert Tools (N=10; Figures 33 and 34)

Six slate tools show considerable variation in terms of edge modification and degree of use-wear. Three (Figure 33A-C) have bifacial flaked margins with wear patterns in the form of smoothed high points and subtle expressions of a dark polish along the working edge that dissipate inward. One is from the east sector and the other two are from the west sector. A similar slate tool was observed in the Middle Woodland assemblage from the Strobel site in the St. Joseph River valley (Garland and DesJardins 1995:25).

The other three slate tools have undergone more heavy-duty use. One (Figure 33D), from the east sector, exhibits wear patterns along a denticulate retouched margin suggestive of use as a knife. Another (Figure 33E) has a unifacially flaked indentation with heavily abraded and pitted edges. It is considered to be a woodworking implement, possibly for scraping small poles or weapon shafts. The third (Figure 33F) exhibits heavy battering along opposing bifacially flaked margins and may have served as a wedge.

The remaining four non-chert items represent heavy-duty tools that are considered to represent woodworking tools. One (Figure 34A) is made on a fine-grained quartzite and is from the west sector. Initially it was thought to be a bipolar core, but close inspection revealed the presence of heavily abraded edges and multiple step fracturing similar to the steep unifacial scrapers. The other three are made on granite and are from all three sectors. They have unifacially flaked working margins with wear patterns similar to the fine-grained quartzite specimen. Similar specimens were observed at the Zemaitis site (Murphy 1986:84-86). Murphy considered the Zemaitis site specimens to represent early stage woodworking implements, and the writer has used such implements for scraping wood in the replication of spear shafts.
Non-Chipped Lithics

The non-chipped items comprise an interesting group of 10 stone working implements and 3 groundstone artifacts. The stone working tools represent a wide variety of specialized types related to different techniques of lithic reduction. A total of eight hammerstones were identified in the assemblage, varying from large specimens with heavily pitted/battered surfaces to smaller stones with moderate pitting. It is felt that the large hammerstones were used primarily for early stage reduction of raw material cobbles. These have well smoothed, slightly stained surfaces with moderately pitted areas concentrated at their ends. They are very similar to small handheld hammerstones in the writer's stone working toolkit, which are used for free hand flat flaking of bifaces and are stained by skin oils from repeated use.

Five additional stone working implements are considered to be bipolar anvils and/or hammers. One is a large flat anvil with heavily pitted areas in the middle of one surface. The other four are round with one flat surface exhibiting heavy pitting and probably represent hand held bipolar hammers. The writer has also used similar implements as hammers for striking hand held intermediate punches (e.g., stone, bone, antler, wood) during indirect percussion; the flat surface of the hammer provides for controlled impact and does not glance off the punch.

The four groundstone items consist of round and slightly flattened stones with evidence of use on at least one side. Two are from the east sector and the other two are from the west sector. Wear patterns are light and consist of smoothed surfaces with expressions of a light dark polish. Individual grains on the surface are intact and evidence only minor abrasion. Striations are generally lacking or difficult to discern. Three have also been used as hammerstones, as evidenced by heavily pitted areas along the sides. They could represent manos, but metates, their counterparts as
grinding stones, were not identified in the assemblage. There is one other possibility. Adams (1998) has conducted use-wear analyses on both manos and other grinding stones that were used for hide processing (e.g., application of dye solutions, raising hide nap, etc.) and identified differences in wear patterns between the two. Manos exhibited greater degrees of abrasion and smoothing of the granular surface under magnification while those used in hide processing exhibited less abrasion and polish on individual grain surfaces. Similar patterns of light wear on groundstone items were observed for a small number of specimens at the Zemaitis site (Murphy 1986:96). Murphy suggested that they could represent milling stones, implements used in ceramic production, or hide processing tools. Additional microscopic analysis of the Armintrout-Blackman specimens may shed further light on this matter.

Lithic Debitage

A total of 27,177 pieces of lithic debitage weighing 27,519.7 from excavation were evaluated in this study. Of this number all but 175 represent chert debitage. Non-chert debitage includes 138 pieces of slate, 30 pieces of fine-grained quartzite and seven pieces of granite that exhibit flake characteristics. Approximately 50% of all lithic debitage is from the east sector where it is concentrated in units in the southern half of this sector. The remainder is equally divided between the center and west sectors. Table 6 lists the distribution by sector of debitage by counts and raw material types. Figures 40-45 in Appendix D show distributions across the site for exotic raw materials.

The percentages of exotic raw materials are not especially high in this assemblage, but some significant patterns are nonetheless observed. Bayport chert is concentrated in the west sector and in units in the northern portion of the east sector.
Table 6

Distribution of Lithic Raw Material Types by Sector

<table>
<thead>
<tr>
<th>Sector</th>
<th>N</th>
<th>Local Till</th>
<th>Bay</th>
<th>Nor</th>
<th>Burl</th>
<th>W/C</th>
<th>Flint Ridge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lithic Debitage Only</td>
<td>West</td>
<td>7,149</td>
<td>6,896</td>
<td>112</td>
<td>25</td>
<td>95</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Center</td>
<td>7,203</td>
<td>7,161</td>
<td>7</td>
<td>2</td>
<td>22</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>East</td>
<td>12,650</td>
<td>12,306</td>
<td>40</td>
<td>18</td>
<td>117</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lithic Debitage and Artifacts Combined</td>
<td>West</td>
<td>7,355</td>
<td>7,072</td>
<td>132</td>
<td>27</td>
<td>102</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Center</td>
<td>7,297</td>
<td>7,254</td>
<td>8</td>
<td>2</td>
<td>22</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>East</td>
<td>12,801</td>
<td>12,446</td>
<td>43</td>
<td>20</td>
<td>122</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assemblage Totals</td>
<td></td>
<td>27,453</td>
<td>26,772</td>
<td>183</td>
<td>49</td>
<td>246</td>
<td>31</td>
</tr>
<tr>
<td>Bay = Bayport</td>
<td>Nor = Norwood</td>
<td>Burl = Burlington</td>
<td>W/C = Wyandotte/Cobden</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Norwood chert shows a similar distribution. Burlington chert is much more evenly distributed across the site, with minor concentrations in the west sector and two areas in the east sector. By contrast, both Wyandotte/Cobden chert and Flint Ridge chert
are restricted to the east sector; a small number of Flint Ridge-like specimens in the northwest portion of the west sector are probably local till cherts. Upper Mercer chert is represented by only five or six specimens and is not considered a factor in this study.

Identifications of Bayport chert were by the far the easiest to obtain for all exotic materials represented by debitage. It occurs in late stage debitage from small chippage to lamellar flakes. The presence of Bayport chert in the form of large lamellar flake knives, thick retouched knife/scrapers, unifacially retouched scrapers, and bipolar specimens suggests that this material reached the site as large bifaces (either notched or unnotched) or as partially finished bifacial cores.

Norwood Chert identifications were also made with a high degree of confidence. This material is well represented in small chippage reflecting final stage tool production and maintenance. A wide range of colors and textures for Norwood was observed and some pieces evidence remnants of bleached weathered surfaces, suggesting procurement from beach areas associated with natural outcroppings along the lake shoreline. Identifications of other exotic raw materials were more difficult and require further discussion below.

Burlington Chert

Burlington chert specimens required a considerable amount of time to identify and a number of the identifications remain problematic. Although most are in the form of small chippage and lamellar flakes, there is some evidence to suggest that Burlington chert arrived at the site in semi-processed form, as some specimens were identified in secondary stage debitage. In particular, a large, thick flake tool described above (Figure 32J) is suggestive of the presence of some small tabular slabs or flake
blanks. Identified specimens also display a wide range of textures and fossil inclusions, including nearly all of what is exhibited in the comparative type set materials available to the writer. Heat alteration occurs in approximately 25% of all specimens, with no apparent differences in distributions across the site.

A high frequency of unidentified white cherts was observed to co-occur with the distribution of Burlington chert specimens. Precise distinctions between Burlington and local Gray-White till cherts could not be obtained, and these materials are included in the unidentified category. Approximately 10% are also heat altered. A few exhibit portions of a weathered exterior cobble surface but are homogenous and lack the degree of variation in color, texture, and luster observed in the local Gray-White till cherts. Clark (1990c:333) also noted problems with Burlington identification during examination of debitage from the Eidson site in Berrien county, Michigan. Two scenarios might be considered here: (1) some quantity of Burlington chert was arriving at a few sites in western lower Michigan in partially processed form, either as small tabular slabs from quarry locations or redeposited cobbles from rivers or streams; and/or (2) the role of white cherts may have held social importance, entailing procurement of both exotic materials and local high quality white till cherts. More research is clearly needed to permit meaningful interpretation of this situation.

**Wyandotte/Cobden Chert**

It is probable that a few additional specimens of Wyandotte/Cobden chert remain unidentified. These are in the form of small flat chippage and broken flake debris, similar in appearance to high quality Lambrix/Deer Lick Creek chert specimens in the assemblage. Wyandotte/Cobden chert that has been identified consists of small to medium sized flat chippage and lamellar flakes of notable size. Concentric
banding of colors is evident in a few, and all specimens are generally fine textured.

Flint Ridge Chert

Given the low frequency of occurrence in the assemblage, the identification of Flint Ridge chert in debitage is problematic. Most specimens exhibit qualities characteristic of Flint Ridge chert, but some were clearly derived from small cobbles, suggesting utilization of chalcedony-like materials occurring in local till. However, it is felt that some Flint Ridge did reach the site in the form of finished tools, with debitage then being produced during tool maintenance activities.

Local Raw Materials

Local raw materials in both the lithic debitage and artifact assemblage are dominated by Lambrix/Deer Lick Creek cherts, followed by Gray-White and unidentified local till chert. Purple chert comprises a minor expression in the assemblage. Table 7 lists counts and percentages for local materials from fully analyzed units and primary stage debitage for all units. Lambrix/Deer Lick Creek cherts also represent the largest specimens of primary stage debitage. The importance of this local till chert for the production of bifaces and other sizable implements is underscored by the observation that many of the primary stage items (e.g., cobble splits, core fragments, large shatter, etc.) suggest cobbles in the size range of small muskmelons. Additionally, some of the high quality Lambrix/Deer Lick Creek lamellar flake tools were clearly detached from large bifacial cores. Evidence of heat alteration was also observed in a number of Lambrix/Deer Lick Creek debitage specimens and artifacts in the assemblage.

By contrast, Gray-White chert primary stage items are typically much smaller
Table 7
Local Raw Material Distributions

<table>
<thead>
<tr>
<th>Sector</th>
<th>N</th>
<th>LX/DL</th>
<th>Purple</th>
<th>G-W</th>
<th>Cortex</th>
<th>U.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully Analyzed Units</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>2,446</td>
<td>1,160</td>
<td>62</td>
<td>416</td>
<td>150</td>
<td>658</td>
</tr>
<tr>
<td></td>
<td></td>
<td>47.5%</td>
<td>2.5%</td>
<td>17.0%</td>
<td>6.1%</td>
<td>26.9%</td>
</tr>
<tr>
<td>Center</td>
<td>1,352</td>
<td>630</td>
<td>10</td>
<td>74</td>
<td>290</td>
<td>348</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70.7%</td>
<td>0.7%</td>
<td>5.5%</td>
<td>21.4%</td>
<td>25.7%</td>
</tr>
<tr>
<td>East</td>
<td>2,347</td>
<td>844</td>
<td>31</td>
<td>377</td>
<td>447</td>
<td>648</td>
</tr>
<tr>
<td></td>
<td></td>
<td>64.0%</td>
<td>1.1%</td>
<td>19.4%</td>
<td>18.2%</td>
<td>13.6%</td>
</tr>
<tr>
<td>Primary Stage Debitage (All Units)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>697</td>
<td>386</td>
<td>14</td>
<td>95</td>
<td>113</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55.4%</td>
<td>20.2%</td>
<td>13.6%</td>
<td>16.2%</td>
<td>12.8%</td>
</tr>
<tr>
<td>Center</td>
<td>490</td>
<td>248</td>
<td>19</td>
<td>54</td>
<td>122</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50.4%</td>
<td>3.9%</td>
<td>11.1%</td>
<td>25.0%</td>
<td>9.6%</td>
</tr>
<tr>
<td>East</td>
<td>512</td>
<td>230</td>
<td>8</td>
<td>101</td>
<td>132</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>44.9%</td>
<td>1.6%</td>
<td>19.7%</td>
<td>8.0%</td>
<td>8.0%</td>
</tr>
</tbody>
</table>

LX/DL = Lambrix/Deer Lick Creek  G-W = Gray-White

in size, with less associated blocky shatter. It is represented in only 10% of the projectile points, being mainly restricted to the expanding stem group, but has a much higher occurrence in bipolar lithics and unifacial scrapers. Utilization of this material probably entailed reduction strategies emphasizing removal of usable flake blanks from small to medium sized cobbles.

Purple chert generally occurs in low percentages in all artifact classes. It is poorly represented in primary stage debitage but occurs more frequently in secondary
stage debitage and bipolar lithics. Furthermore, much of the debitage and bipolar pieces consist of specimens produced from small cobbles of medium quality and homogenous color. By contrast, the large lamellar flakes and bifacial artifacts made on this material are more characteristic of the mottled lavender Purple chert from till locations to the south in St. Joseph and Cass counties. The writer has made similar observations when examining other western lower Michigan lithic assemblages. The possibility that good quality Purple chert enters local exchange networks has been considered by the writer, but cannot be addressed further until more is known about the geographic distribution of this material and its utilization in particular lithic industries.
CHAPTER V

INTERPRETATIONS AND CONCLUSIONS

The data presented in this study demonstrates considerable interpretive value for understanding the nature of occupations at Armintrout-Blackman site. In particular, the use of low power microscopic examination has led to a more precise definition of points characteristic of early Middle Woodland corner notched forms and those related to late Middle Woodland expanding stem types, such as Lowe Flared Base, Steuben Expanded Stemmed and Chesser Notched. From this one can then examine their spatial distributions with respect to the observed ceramic components and draw reasonable conclusions about temporal relationships. Lithic raw material utilization and spatial distributions are also important for they can contribute to understanding patterns of interaction occurring throughout the Middle Woodland period in this part of western lower Michigan.

The delineation of lithic activity areas appears evident through the relationship between various artifact types to locations of high lithic debitage densities. It is felt that this may have potential for furthering interpretations of site chronology and also examining issues of seasonality when brought to bear upon the distribution of faunal remains. The findings offered here first begin with a typological discussion of the Middle Woodland projectile points, followed by summary observations on raw material utilization and intra-site comparisons derived from the lithic assemblage.

Typological Discussion of Middle Woodland Projectile Points

Montet-White (1968:172-181) has discussed the development of Illinois Val-
ley Middle Woodland point forms in a chronological context, from early Havana Middle Woodland to late Hopewellian or terminal Middle Woodland. The most widely recognized are the large ovate Snyders corner notched, the smaller ovate Manker corner notched and stemmed types, and the narrow ovate Norton corner notched. Montet-White considered the Snyders type to represent an early Havana Middle Woodland point form that is most common from ca. 200 B.C. to A.D. 50. The Manker types are a smaller broad ovate (utilitarian) variant of the Snyders type and are typically found only at habitation sites. They occur throughout the Hopewell Middle Woodland period, with a tendency towards reduction in relative size over time. The Norton type is considered to be a slightly later expression of the Snyders type. During the middle to late Hopewell phases ovate points decline in frequency with increasing numbers of sub-triangular points, such as the Gibson, Ansell and Steuben types. These three become the dominant types, with a marked reduction in size, in the terminal Middle Woodland period.

In western lower Michigan large ovate Snyders points are occasionally identified in archaeological contexts and in private collections. However, from a review of available literature, it is apparent that their distribution and frequency of occurrence is poorly understood, for several reasons. First, classic examples of large ovate Snyders points are not well documented for mortuary or habitation site contexts in western lower Michigan. The best examples of corner notched points from archaeological contexts are Norton points from the Norton Mounds (Griffin et al 1970:Plates 123, 146 and 170), bracketed by radiocarbon dates of 1960 +/- 120 B.P.:10 B.C. for Mound C and 1850 +/- 100 B.P.: A.D. 100 for Mound H (Brashier and Holman 1996:200), yielding multiple intercept calibrated ages of A.D. 31, A.D. 38, and A.D. 53 and a single intercept calibrated age of A.D. 133, respectively (Stuiver and Reimer
1993). Good examples of Norton points were also reported for the Prison Farm site (Brashler et al 1998).

Secondly, a majority of corner notched points exhibit varying degrees of reworking, making distinctions between Snyders, Manker and Norton types difficult to obtain. As a consequence such points have typically been assigned to the broad category of the Snyders cluster (as described by Justice 1987), which essentially covers the entire range of variation for Middle Woodland period notched points. Understandably, this approach represents the only realistic way of assessing assemblages with small numbers of points represented. However, the drawback is that issues of regional variation cannot be adequately addressed, especially when they might involve stylistic attributes related to social identity and cultural practice, similar to what is suggested in the expression of regional ceramic styles. The same can be said for the various expanding stem forms that come to dominate the latter portion of the Middle Woodland period in Michigan; at present the only comparative analogs for these points are regionally defined types and stylistic traditions from areas outside of Michigan.

Turning now to the Armintrout-Blackman points, it is believed that we can begin to address some of these issues. As detailed in Chapter 4, this study has resulted in the definition of two basic point styles: corner notched points and expanding stem types produced by a modified notching technique. The distinction appears to be much sharper than initially anticipated, with few examples that could be deemed transitional forms, and this is further supported by their degree of spatial separation. By virtue of the site’s location between the major western Michigan Hopewellian expressions, comparisons to the north and south is considered a plausible way of making typological assessments.
To begin, the corner notched points are suggestive of a narrow ovate form, and definitive expressions of the broad ovate Snyders type cannot be demonstrated. The best comparisons are made with similar points at the Schultz and Prison Farm sites and the Norton points from the Norton Mounds, although the latter do represent especially well made specimens for inclusion in burial contexts. The presence of Norwood and Bayport chert in a number of Armintrout-Blackman specimens also indicates greater interaction with the north. A similar argument could also be made for the Mushroom site corner notched points evaluated in this study.

By contrast, less than satisfactory results were obtained when making comparisons to corner notched points from the south, with the best available published data coming from the US-31 Berrien County Freeway Project (Garland ed. 1990) and the Moccasin Bluff site report (Betteral and Smith 1973). The writer has compared the Armintrout-Blackman specimens to the US-31 project corner notched points. Generally speaking, the US-31 specimens were observed to comprise a highly variable population, ranging from narrow ovate types to broader ovate forms that resemble the Snyders/Manker points that are prevalent in the Illinois Valley archaeological literature. A similar case appears to obtain for the Moccasin Bluff corner notched points as well. The best comparisons were made to the US-31 Norton points (Garland ed. 1990:Plate 41), but these were observed to be thinner with slightly smaller haft area measurements than the Armintrout-Blackman specimens.

As discussed in Chapter 4, the Armintrout-Blackman corner notched points do exhibit variation in haft area measurements. But in consideration of site size, occupational intensity and distribution of points with respect to the ceramic components, such variation cannot be simply explained as change over time. Some of the observed variation is undoubtedly due to differences in raw material and mechanics of
the notching process. Alternatively, and accepting that overall blade length is not always a reliable discriminator because of reworking, it is believed that an argument can be made for the co-occurrence of two basic forms – large hafted knives or spear points and smaller points representing dart tips. The most important discriminating variables are thickness at or slightly above the shoulder area and width of the haft area, which could very well relate to differences in shaft size.

The expanding stem points exhibit considerable internal variation and pose far greater difficulties in terms of typological assessment. The same also appears evident in the site assemblages with which these points were compared. It is believed that this may also be a reflection of changes occurring during the later Hopewellian phases (e.g., socio-cultural relations, changes in subsistence practices, etc.). And, as discussed by Justice (1987:208-214), such variation is also part of a broad scale pattern of changes in haft morphology represented by Chesser Notched in the eastern Great Lakes, Lowe Flared Base centered in the lower Ohio River valley, and Steuben Expanded Stemmed types found primarily in the Illinois River valley. Other Illinois Valley types include Manker Stemmed, Ansell, Marshall Barbed and Gibson Notched (Montet-White 1968:73-81).

The most important aspect of the changes occurring in expanding stem point types is a shift from modified corner notching to laterally notched expanded stem forms. Any one of the above named point types should then exhibit internal variation in hafting technology on a temporal scale. For instance, Steuben Expanded Stem points have an age range of A.D. 100 to A.D. 500-800 (Justice 1987:208-211). Justice described this point type as corner notched with lateral retouching of the stem margins, which then changes into an expanding stem form with Lowe Flared Base characteristics during the late Illinois Valley Middle Woodland sequence. Based on
visual comparisons some of the Manker Stemmed and Marshall Barbed types (Montet-White 1968:Figures 29 and 32; Morse 1963:Plate 7, Figure 2) are similar to some Steuben types (Justice 1987:Figure 45A), in that they are diagonally notched and exhibit shoulder barbs. Other examples of Steuben Expanded Stemmed points (Justice 1987:Figure 45B-C; Montet-White 1968:Figure 33) are more related to Ansell Constricted (Montet-White 1968:Figure 32) and Lowe Flared Base types (DeRegnaucourt 1991:Plate 46; Justice 1987:Figure 45H-K).

Thus, there appears to be a trend from modified corner notched expanding stem forms to those with squared or rounded shoulders, flared stems and straighter bases, along with a general reduction in size in the late Middle Woodland (Montet-White 1968:180-181 and Figure 65). As evidenced in the site assemblages referred to in this study, the same applies to much of western lower Michigan as well. At present the best temporally sensitive data comes from the Schultz site (Fitting 1972:212-215), where small expanding stem and narrow expanding stem points were observed to occur in greatest frequency in the late Middle Woodland levels. However, Fitting did not attempt to differentiate between reworked corner notched points and later Middle Woodland expanding stem types, reflecting a lack of good comparative data at that time and issues of projectile point typology that are now being raised in current Middle Woodland period research (for discussion see Brashler et al 1994).

The distinctions between corner notched (including reworked corner notched) and expanding stem points made in this study for the Armintrout-Blackman points, especially with respect to their spatial distributions (Figures 10 and 11), demonstrates the need for evaluation of Middle Woodland projectile point typologies in Michigan. Based on the above discussion of regional later Middle Woodland expanding stem types, the Armintrout-Blackman expanding stem points are believed to be more
related to the Steuben Expanded Stemmed types. Examples of modified corner notched forms with shoulder barbs, which can be considered early within the developmental sequence of later Middle Woodland expanding stem points, are lacking at Armintrout-Blackman. There are also a few examples of small, narrow expanding stem forms considered to be late or terminal Middle Woodland. What is needed is problem oriented comparative study of these points that includes data from a number of sites with good cultural and chronological associations. Thus, the most meaningful contribution this study can offer is adequate description of the points represented in the assemblage along with comparisons to other well-recognized site assemblages.

Overview of Lithic Raw Material and Artifact Distributions

Some significant observations can be made when exotic raw material and lithic artifact distributions were examined together, with temporal indications as well. As evidenced by the ceramic assemblage and discussion of the stemmed projectile points, the earliest occupations are considered to be terminal Early Woodland or early Middle Woodland. The best expression is in the northern portion of the east sector, in the area of the interior-exterior cord-marked ceramic concentrations. Lithic raw materials represented in the stemmed points and co-occurring lanceolate preforms include Bayport, Wyandotte/Cobden, Burlington and Norwood chert. Additionally, all of the identified Wyandotte/Cobden chert debitage and most of the east sector Norwood and Bayport debitage is also from these locations. Since Wyandotte/Cobden chert is restricted to two stemmed points, it is felt that the Wyandotte/Cobden debitage is probably related to the earliest Middle Woodland occupations. Some of the Norwood, Bayport and Burlington chert debitage can also be included as well.
The following Middle Woodland occupations are best represented in the west sector by the Havana-related ceramics and a great majority of the corner notched projectile points. The west sector also exhibits the highest correlation of lithic artifacts to areas of high debitage densities. It is believed that these are discrete activity areas; the concentration of lithic artifacts, along with the predominance of white-tailed deer in the faunal remains (Figure 6), could indicate cold weather occupation for this area of the site. The principle elements of the lithic inventory consist of hafted bifaces, unifacial scrapers, a variety of flake tools and bipolar lithics. Many of the hafted bifaces evidence cutting and/or sawing use-wear patterns. Additionally, the high occurrence of point tips in this sector evidencing breakage from prying or twisting actions is noteworthy. This is interpreted as reflecting their use in the butchering of large game and/or fabrication of implements from wood and bone.

The center and east sectors exhibit greater complexity in terms of artifact distributions. It is suggested that these sectors were most likely utilized throughout the history of site occupation, particularly areas associated with the spring. A majority of the broken broad ovate staged bifaces, probably associated with production of large bifaces, was observed to occur on either side of the ditch. A number of corner notched points are from the high debitage density area of the center sector and into the northern portion of the east sector. Additionally, the high quantities of lithic debitage in the southern portion of the east sector might also reflect repeated use of this location over time.

As previously noted, distributions for many of the lithic artifacts in the east sector are more widely dispersed than in the west sector. There is also a significant decrease in quantities of unifacial scrapers, lamellar flake tools and bipolar lithics. One explanation for this situation may be derived from the composition of faunal
remains; the presence of white-tailed deer, sturgeon and turtle (Figure 6) suggests multi-seasonal occupations, with warm weather activities being more dispersed across the site area. Thus, one could expect that the suite of activities might also entail different lithic activities and production of specialized tools. Furthermore, the reduction in haft area measurements for the late Middle Woodland points should also correlate with smaller shaft size, with less requirements for heavy duty woodworking tools. It is hoped that the intra-site analysis presented in this study of typology, tool function and lithic raw materials has made a contribution toward fuller understanding of the Middle Woodland period in western lower Michigan.
Appendix A

Projectile Point Recording Schema
Figure 12. Location of Projectile Point Measurements.

ML = Maximum Length  
MW = Maximum Length  
NW = Neck Width  
SL = Stem Length  
BW = Base Width
Primary Conchoidal Flake Scars on Both Sides of Each Notch
Occurs Mainly on Large Corner Notched Points

Alternate Corner Notching
Primary Conchoidal Flake Scar on One Side
With Pressure Flake Modification on the Other Side

Figure 13. Corner Notched Point Stem Development.
Figure 14. Expanding Stem Point Forms.

Note: Dashed Outline Indicates Influence of Blade Attrition
Figure 15. Examples of Use Related Projectile Point Damage.

- Distal Impact Damage With Shallow Hinge Terminated Flake Scar and Resharpened Blade Margins on Specimen to the Right
- Mesial Damage to Shoulder Barbs and Basal Ears
- Extensive Blade Attrition and Basal Damage with Reworking of Notch Areas in Specimen to the Right
- Heavy Impact Damage with Broken Tip, Shearing or Burination Along Blade Margin and Snapped Base
Appendix B
Artifact Illustrations
Figure 16. Stemmed Points.
Figure 16 – Continued.

Mushroom Site (20AE88)
Figure 16 – Continued.

Stemmed Points from the Ernest B. Young Collection
Figure 17. Large Corner Notched Points.
Figure 17 – Continued.
Figure 17 – Continued.
Figure 18. Broken Large Corner Notched Points.
Figure 19. Medium Corner Notched Points.
Figure 19 – Continued.
Figure 19 – Continued.
Figure 19 – Continued.
Figure 20. Expanding Stem Points.
Figure 20 – Continued.
Figure 20 – Continued.
Figure 21. Small Notched Points.
Figure 22. Miscellaneous Expanding Stem Points.
Figure 23. Late Woodland Triangular Points.
Figure 24. Archaic and Unclassified Points.
Figure 25. Stage 1/2 Bifaces.
Figure 26. Stage 2/3 Bifaces.
Figure 26 – Continued.
Figure 27. Broken Staged Bifaces.
Figure 28. Cores.
Figure 28 – Continued.
Figure 29. Bipolar Lithics.
Figure 30. Hafted Tools and Drills/Reamers.
Figure 31. Retouched Unifacial Scrapers.
Figure 32. Flake Tools.
Figure 32 – Continued.
Figure 32 – Continued.
Figure 33. Slate Tools.
Figure 33 – Continued.
Figure 34. Heavy Duty Non-Chert Tools.
Figure 34 – Continued.
Appendix C

Projectile Point Metrical Data
and Raw Material Type by Sector
Abbreviations Used in the Following Tables.

L = Maximum Length
W = Maximum Width
T = Maximum Thickness
BW = Base Width
NW = Neck Width
SL = Stem Length

Note: All measurements are in millimeters. Those in parenthesis are broken; measurements are estimated.
# APPENDIX C

**Projectile Point Metrical Data and Raw Material Type**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Unit</th>
<th>Figure</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>BW</th>
<th>NW</th>
<th>SL</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stemmed Projectile Points</strong> (N=6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>WM</td>
<td>16A</td>
<td>41.3</td>
<td>24.5</td>
<td>8.0</td>
<td>--</td>
<td>--</td>
<td>16.6</td>
<td>Wyandotte/Cobden</td>
</tr>
<tr>
<td>West</td>
<td>37</td>
<td>16B</td>
<td>40.0</td>
<td>19.7</td>
<td>8.1</td>
<td>13.5</td>
<td>12.1</td>
<td>14.4</td>
<td>Pale Bayport 2.5Y 7/2</td>
</tr>
<tr>
<td>West</td>
<td>10</td>
<td>16C</td>
<td>48.0</td>
<td>27.1</td>
<td>8.5</td>
<td>--</td>
<td>--</td>
<td>18.7</td>
<td>Bayport 10 YR 5/1</td>
</tr>
<tr>
<td>East</td>
<td>79</td>
<td>16D</td>
<td>51.9</td>
<td>22.3</td>
<td>8.6</td>
<td>15.5</td>
<td>13.7</td>
<td>16.5</td>
<td>Unidentified/Local</td>
</tr>
<tr>
<td>Center</td>
<td>OO</td>
<td>16E</td>
<td>60.0</td>
<td>24.7</td>
<td>10.5</td>
<td>(20.4)</td>
<td>19.3</td>
<td>(15.7)</td>
<td>Lambricx/Deer Lick Creek</td>
</tr>
<tr>
<td>East</td>
<td>WP</td>
<td>16F</td>
<td>80.2</td>
<td>28.5</td>
<td>11.2</td>
<td>20.3</td>
<td>17.3</td>
<td>15.5</td>
<td>Wyandotte/Cobden</td>
</tr>
<tr>
<td><strong>Large Corner Notched Points</strong> (N=5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>4</td>
<td>17A</td>
<td>57.6</td>
<td>27.2</td>
<td>12.5</td>
<td>27.2</td>
<td>17.4</td>
<td>16.2</td>
<td>Lambricx/Deer Lick Creek – Heat Altered</td>
</tr>
<tr>
<td>West</td>
<td>63</td>
<td>17B</td>
<td>67.7</td>
<td>33.7</td>
<td>11.7</td>
<td>--</td>
<td>(17.0)</td>
<td>(13.0)</td>
<td>Lambricx/Deer Lick Creek</td>
</tr>
<tr>
<td>Center</td>
<td>WZ</td>
<td>17C</td>
<td>65.0</td>
<td>29.9</td>
<td>8.5</td>
<td>--</td>
<td>17.5</td>
<td>--</td>
<td>Purple</td>
</tr>
<tr>
<td>West</td>
<td>56</td>
<td>17D</td>
<td>58.8</td>
<td>27.2</td>
<td>10.4</td>
<td>25.5</td>
<td>17.0</td>
<td>13.8</td>
<td>Bayport 10 YR 7/2 – 4/1</td>
</tr>
<tr>
<td>West</td>
<td>39</td>
<td>17E</td>
<td>53.2</td>
<td>22.3</td>
<td>8.3</td>
<td>22.3</td>
<td>16.1</td>
<td>12.7</td>
<td>Lambricx/Deer Lick Creek</td>
</tr>
</tbody>
</table>

137
### Appendix C – Continued

<table>
<thead>
<tr>
<th>Sector</th>
<th>Unit</th>
<th>Figure</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>BW</th>
<th>NW</th>
<th>SL</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mushroom Site Large Corner Notched Points</strong>  (N=4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SQ-B</td>
<td>17F</td>
<td>--</td>
<td>32.7</td>
<td>10.0</td>
<td>(22.6)</td>
<td>17.4</td>
<td>14.6</td>
<td>Bayport</td>
</tr>
<tr>
<td></td>
<td>TP-23</td>
<td>17G</td>
<td>52.6</td>
<td>27.0</td>
<td>8.7</td>
<td>21.3</td>
<td>16.9</td>
<td>10.9</td>
<td>Bayport</td>
</tr>
<tr>
<td></td>
<td>A-north</td>
<td>17H</td>
<td>--</td>
<td>31.5</td>
<td>8.5</td>
<td>21.5</td>
<td>16.9</td>
<td>14.8</td>
<td>Bayport</td>
</tr>
<tr>
<td></td>
<td>C-north</td>
<td>17I</td>
<td>53.1</td>
<td>31.0</td>
<td>11.5</td>
<td>(20.0)</td>
<td>17.5</td>
<td>10.1</td>
<td>Lambrix/Deer Lick Creek – Heat Altered</td>
</tr>
<tr>
<td><strong>Broken Large Corner Notched</strong>  (N=4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>West</td>
<td>45</td>
<td>18A</td>
<td>--</td>
<td>(24.8)</td>
<td>(9.0)</td>
<td>22.5</td>
<td>16.2</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>Center</td>
<td>WW</td>
<td>18B</td>
<td>--</td>
<td>23.0</td>
<td>10.5</td>
<td>23.2</td>
<td>15.5</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td>Center</td>
<td>17</td>
<td>18C</td>
<td>--</td>
<td>(9.8)</td>
<td>24.6</td>
<td>(17.7)</td>
<td>--</td>
<td>Lambrinx/Deer Lick Creek – Heat Altered</td>
</tr>
<tr>
<td></td>
<td>Center</td>
<td>WV</td>
<td>18D</td>
<td>--</td>
<td>(9.0)</td>
<td>21.2</td>
<td>(19.0)</td>
<td>(13.1)</td>
<td>Lambrinx/Deer Lick Creek</td>
</tr>
<tr>
<td><strong>Medium Corner Notched</strong>  (N=24)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>West</td>
<td>38</td>
<td>19A</td>
<td>38.7</td>
<td>(27.5)</td>
<td>8.6</td>
<td>--</td>
<td>(14.0)</td>
<td>12.3</td>
</tr>
<tr>
<td></td>
<td>East</td>
<td>K</td>
<td>19B</td>
<td>37.7</td>
<td>26.3</td>
<td>6.3</td>
<td>--</td>
<td>12.5</td>
<td>10.5</td>
</tr>
</tbody>
</table>
### Appendix C – Continued.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Unit</th>
<th>Figure</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>BW</th>
<th>NW</th>
<th>SL</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>61</td>
<td>19C</td>
<td>20.8</td>
<td>7.3</td>
<td>--</td>
<td>12.2</td>
<td>9.5</td>
<td>Gray-White</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>36</td>
<td>19D</td>
<td>25.0</td>
<td>7.7</td>
<td>16.8</td>
<td>15.1</td>
<td>9.5</td>
<td>Purple</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>49</td>
<td>19E</td>
<td>--</td>
<td>9.2</td>
<td>20.9</td>
<td>14.0</td>
<td>8.1</td>
<td>Norwood 2.5Y 8/1 – 5/1</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>65</td>
<td>19F</td>
<td>24.3</td>
<td>8.7</td>
<td>24.0</td>
<td>17.2</td>
<td>13.3</td>
<td>Norwood 2.5Y 8/1 – 6/1</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>55</td>
<td>19G</td>
<td>24.1</td>
<td>8.2</td>
<td>23.7</td>
<td>18.2</td>
<td>14.5</td>
<td>Pale Bayport 2.5Y 7/2</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>WO</td>
<td>19H</td>
<td>23.9</td>
<td>9.5</td>
<td>22.8</td>
<td>17.0</td>
<td>13.8</td>
<td>Pale Norwood 10YR 8/1 – 7/1</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>WO</td>
<td>19I</td>
<td>26.5</td>
<td>9.9</td>
<td>--</td>
<td>13.6</td>
<td>11.0</td>
<td>Bayport 10YR 6/1 – 5/1</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>Trench 3</td>
<td>19J</td>
<td>25.5</td>
<td>7.9</td>
<td>20.4</td>
<td>15.0</td>
<td>9.8</td>
<td>Burlington</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>53</td>
<td>19K</td>
<td>24.7</td>
<td>8.0</td>
<td>18.5</td>
<td>14.1</td>
<td>12.7</td>
<td>Bayport 10YR 7/1 – 6/1</td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>SS</td>
<td>19L</td>
<td>24.5</td>
<td>7.5</td>
<td>--</td>
<td>14.1</td>
<td>12.3</td>
<td>Purple</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>43</td>
<td>19M</td>
<td>21.8</td>
<td>6.2</td>
<td>20.5</td>
<td>15.5</td>
<td>12.6</td>
<td>Lambrix/Deer Lick Creek</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>38</td>
<td>19N</td>
<td>20.0</td>
<td>6.8</td>
<td>18.1</td>
<td>13.0</td>
<td>12.5</td>
<td>Unidentified/Local</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>40</td>
<td>19O</td>
<td>22.0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>10.1</td>
<td>Flint Ridge</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>53</td>
<td>19P</td>
<td>--</td>
<td>8.1</td>
<td>--</td>
<td>(15.0)</td>
<td>12.3</td>
<td>Unidentified/Local</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>2</td>
<td>19Q</td>
<td>--</td>
<td>(9.5)</td>
<td>19.8</td>
<td>16.3</td>
<td>13.1</td>
<td>Lambrix/Deer Lick Creek</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>38</td>
<td>19R</td>
<td>20.5</td>
<td>7.6</td>
<td>19.2</td>
<td>13.5</td>
<td>12.5</td>
<td>Gray-White</td>
<td></td>
</tr>
<tr>
<td>Sector</td>
<td>Unit</td>
<td>Figure</td>
<td>L</td>
<td>W</td>
<td>T</td>
<td>BW</td>
<td>NW</td>
<td>SL</td>
<td>Material</td>
</tr>
<tr>
<td>--------</td>
<td>------</td>
<td>--------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>West</td>
<td>39</td>
<td>19S</td>
<td>34.5</td>
<td>20.4</td>
<td>10.2</td>
<td>17.3</td>
<td>11.0</td>
<td>13.1</td>
<td>Gray-White</td>
</tr>
<tr>
<td>West</td>
<td>48</td>
<td>19T</td>
<td>33.1</td>
<td>24.3</td>
<td>11.2</td>
<td>15.1</td>
<td>12.0</td>
<td>13.5</td>
<td>Burlington</td>
</tr>
<tr>
<td>West</td>
<td>60</td>
<td>19U</td>
<td>31.3</td>
<td>21.0</td>
<td>9.2</td>
<td>17.7</td>
<td>12.7</td>
<td>13.0</td>
<td>Lambrix/Deer Lick Creek</td>
</tr>
<tr>
<td>East</td>
<td>WS</td>
<td>19V</td>
<td>30.6</td>
<td>20.6</td>
<td>9.6</td>
<td>19.9</td>
<td>16.1</td>
<td>14.6</td>
<td>Bayport 10YR 6/1 – 5/1</td>
</tr>
<tr>
<td>East</td>
<td>PP</td>
<td>19W</td>
<td>(38.0)</td>
<td>22.5</td>
<td>(7.8)</td>
<td>--</td>
<td>14.4</td>
<td>--</td>
<td>Gray-White</td>
</tr>
<tr>
<td>East</td>
<td>A</td>
<td>19X</td>
<td>(34.0)</td>
<td>21.5</td>
<td>8.9</td>
<td>19.5</td>
<td>14.6</td>
<td>13.5</td>
<td>Purple</td>
</tr>
</tbody>
</table>

**Expanding Stem Points (N=26)**

<table>
<thead>
<tr>
<th>Center</th>
<th>PP</th>
<th>20A</th>
<th>--</th>
<th>22.5</th>
<th>8.1</th>
<th>15.7</th>
<th>11.8</th>
<th>10.8</th>
<th>Lambrix/Deer Lick Creek</th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>Y</td>
<td>20B</td>
<td>33.4</td>
<td>19.1</td>
<td>8.4</td>
<td>17.0</td>
<td>11.5</td>
<td>14.2</td>
<td>Purple</td>
</tr>
<tr>
<td>East</td>
<td>24</td>
<td>20C</td>
<td>--</td>
<td>22.0</td>
<td>6.5</td>
<td>14.0</td>
<td>11.7</td>
<td>10.4</td>
<td>Norwood 10YR 6/1 – 4/1</td>
</tr>
<tr>
<td>East</td>
<td>Y</td>
<td>20D</td>
<td>41.6</td>
<td>22.1</td>
<td>7.5</td>
<td>16.1</td>
<td>13.5</td>
<td>13.0</td>
<td>Lambrix/Deer Lick Creek</td>
</tr>
<tr>
<td>East</td>
<td>K</td>
<td>20E</td>
<td>37.0</td>
<td>23.2</td>
<td>8.3</td>
<td>15.9</td>
<td>13.6</td>
<td>12.4</td>
<td>Gray-White</td>
</tr>
<tr>
<td>East</td>
<td>WI</td>
<td>20F</td>
<td>31.9</td>
<td>20.2</td>
<td>8.0</td>
<td>19.0</td>
<td>15.4</td>
<td>13.2</td>
<td>Unidentified</td>
</tr>
<tr>
<td>West</td>
<td>36</td>
<td>20G</td>
<td>29.4</td>
<td>18.9</td>
<td>7.9</td>
<td>17.5</td>
<td>14.4</td>
<td>13.0</td>
<td>Dense Cortex</td>
</tr>
<tr>
<td>East</td>
<td>R</td>
<td>20H</td>
<td>38.7</td>
<td>18.7</td>
<td>8.5</td>
<td>18.0</td>
<td>15.0</td>
<td>14.5</td>
<td>Cortex</td>
</tr>
</tbody>
</table>
## Appendix C – Continued

<table>
<thead>
<tr>
<th>Sector</th>
<th>Unit</th>
<th>Figure</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>BW</th>
<th>NW</th>
<th>SL</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center</td>
<td>RR</td>
<td>20L</td>
<td>20.2</td>
<td>7.6</td>
<td>18.5</td>
<td>13.0</td>
<td>10.5</td>
<td>Unidentified White</td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>WC</td>
<td>20J</td>
<td>--</td>
<td>--</td>
<td>(17.5)</td>
<td>7.9</td>
<td>(19.6)</td>
<td>15.2</td>
<td>Unidentified White</td>
</tr>
<tr>
<td>West</td>
<td>94</td>
<td>20K</td>
<td>37.3</td>
<td>8.2</td>
<td>19.9</td>
<td>15.1</td>
<td>13.4</td>
<td>Unidentified White</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>L-Ext.</td>
<td>20L</td>
<td>--</td>
<td>--</td>
<td>21.1</td>
<td>--</td>
<td>16.1</td>
<td>13.5</td>
<td>(12.4) Gray-White</td>
</tr>
<tr>
<td>West</td>
<td>9</td>
<td>20M</td>
<td>24.3</td>
<td>6.6</td>
<td>18.6</td>
<td>14.1</td>
<td>11.0</td>
<td>Lambrix/Deer Lick Creek</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>WS</td>
<td>20N</td>
<td>18.3</td>
<td>7.5</td>
<td>17.0</td>
<td>12.7</td>
<td>12.5</td>
<td>Gray-White</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>WQ</td>
<td>20O</td>
<td>49.0</td>
<td>21.5</td>
<td>7.5</td>
<td>19.5</td>
<td>16.2</td>
<td>14.0</td>
<td>Purple</td>
</tr>
<tr>
<td>East</td>
<td>WQ</td>
<td>20P</td>
<td>--</td>
<td>14.9</td>
<td>5.5</td>
<td>(13.0)</td>
<td>10.4</td>
<td>12.4 Purple</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>II</td>
<td>20Q</td>
<td>33.2</td>
<td>6.3</td>
<td>14.4</td>
<td>10.5</td>
<td>11.3</td>
<td>Unidentified/Local</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>WS</td>
<td>20R</td>
<td>--</td>
<td>--</td>
<td>6.5</td>
<td>12.5</td>
<td>8.5</td>
<td>13.0</td>
<td>Lambrix/Deer Lick Creek</td>
</tr>
<tr>
<td>East</td>
<td>K</td>
<td>20S</td>
<td>31.5</td>
<td>7.4</td>
<td>15.6</td>
<td>13.2</td>
<td>11.8</td>
<td>Gray-White</td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>WA</td>
<td>20T</td>
<td>(28.1)</td>
<td>8.2</td>
<td>(11.0)</td>
<td>(10.8)</td>
<td>13.2</td>
<td>Gray-White</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>91</td>
<td>20U</td>
<td>45.4</td>
<td>18.5</td>
<td>8.8</td>
<td>15.5</td>
<td>12.2</td>
<td>10.6</td>
<td>Gray-White</td>
</tr>
<tr>
<td>East</td>
<td>Z</td>
<td>20V</td>
<td>--</td>
<td>--</td>
<td>(16.1)</td>
<td>6.4</td>
<td>17.5</td>
<td>13.5</td>
<td>12.0 Dense Cortex</td>
</tr>
<tr>
<td>Center</td>
<td>16</td>
<td>20W</td>
<td>28.4</td>
<td>7.5</td>
<td>11.8</td>
<td>11.0</td>
<td>10.7</td>
<td>Unidentified/Local</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>48</td>
<td>20X</td>
<td>19.4</td>
<td>7.5</td>
<td>12.2</td>
<td>12.0</td>
<td>13.9</td>
<td>Lambrix/Deer Lick Creek</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>WH</td>
<td>20Y</td>
<td>--</td>
<td>--</td>
<td>8.5</td>
<td>15.7</td>
<td>12.1</td>
<td>(13.6) Cortex</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>KK</td>
<td>20Z</td>
<td>26.0</td>
<td>18.7</td>
<td>7.5</td>
<td>13.4</td>
<td>11.0</td>
<td>14.0</td>
<td>Cortex</td>
</tr>
</tbody>
</table>
Appendix C – Continued

<table>
<thead>
<tr>
<th>Sector</th>
<th>Unit</th>
<th>Figure</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>BW</th>
<th>NW</th>
<th>SL</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Small Notched Points (N=6)</td>
</tr>
<tr>
<td>Center</td>
<td>WC</td>
<td>21A</td>
<td>25.1</td>
<td>19.8</td>
<td>7.7</td>
<td>17.0</td>
<td>13.8</td>
<td>12.1</td>
<td>Lambrix/Deer Lick Creek</td>
</tr>
<tr>
<td>Center</td>
<td>103</td>
<td>21B</td>
<td>(28.0)</td>
<td>16.6</td>
<td>5.0</td>
<td>15.7</td>
<td>12.3</td>
<td>9.8</td>
<td>Cortex</td>
</tr>
<tr>
<td>Center</td>
<td>WZ</td>
<td>21C</td>
<td>32.4</td>
<td>17.1</td>
<td>7.8</td>
<td>12.3</td>
<td>10.4</td>
<td>11.0</td>
<td>Lambrix/Deer Lick Creek</td>
</tr>
<tr>
<td>East</td>
<td>WN</td>
<td>21D</td>
<td>28.6</td>
<td>17.3</td>
<td>7.6</td>
<td>(18.0)</td>
<td>13.5</td>
<td>12.0</td>
<td>Unidentified</td>
</tr>
<tr>
<td>East</td>
<td>WO</td>
<td>21E</td>
<td>28.0</td>
<td>(20.0)</td>
<td>--</td>
<td>16.5</td>
<td>13.0</td>
<td>9.5</td>
<td>Lambrix/Deer Lick Creek</td>
</tr>
<tr>
<td>East</td>
<td>Y</td>
<td>21F</td>
<td>23.9</td>
<td>17.1</td>
<td>6.4</td>
<td>16.9</td>
<td>12.1</td>
<td>9.4</td>
<td>Cortex</td>
</tr>
</tbody>
</table>

|        |      |        |      |      |      |     |     |     | Miscellaneous Expanding Stem Points (N=5)    |
| Center | PP   | 22A    | (52.5)| 22.0 | 10.5 | 22.0| 17.5| 14.9| Unidentified                                 |
| West   | 62   | 22B    | 43.9 | 18.2 | 9.5  | 15.8| 13.9| 12.0| Lambrix/Deer Lick Creek                      |
| East   | 89   | 22C    | 39.4 | 20.1 | 9.2  | 18.5| 15.3| 13.0| Unidentified White                           |
| West   | 39   | 22D    | 37.3 | 27.9 | 8.2  | (15.0)| 14.0| 10.2| Norwood 2.5Y 7/1 – 5/1                        |
| East   | 24   | 22E    | (33.8)| 23.6 | (6.2)| --  | --  | --  | Bayport 10YR 7/1 – 6/1                       |
## Appendix C – Continued

<table>
<thead>
<tr>
<th>Sector</th>
<th>Unit</th>
<th>Figure</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>BW</th>
<th>NW</th>
<th>SL</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Late Woodland Triangular Points (N=9)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>PP</td>
<td>23A</td>
<td>--</td>
<td>23.7</td>
<td>6.2</td>
<td></td>
<td></td>
<td></td>
<td>Unidentified</td>
</tr>
<tr>
<td>West</td>
<td>45</td>
<td>23B</td>
<td>28.9</td>
<td>21.4</td>
<td>8.4</td>
<td></td>
<td></td>
<td></td>
<td>Lambrix/Deer Lick Creek</td>
</tr>
<tr>
<td>West</td>
<td>38</td>
<td>23C</td>
<td>25.2</td>
<td>20.0</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
<td>Gray-White</td>
</tr>
<tr>
<td>West</td>
<td>58</td>
<td>23D</td>
<td>25.0</td>
<td>22.6</td>
<td>6.1</td>
<td></td>
<td></td>
<td></td>
<td>Lambrix/Deer Lick Creek</td>
</tr>
<tr>
<td>West</td>
<td>53</td>
<td>23E</td>
<td>33.0</td>
<td>23.4</td>
<td>5.8</td>
<td></td>
<td></td>
<td></td>
<td>Unidentified</td>
</tr>
<tr>
<td>West</td>
<td>N</td>
<td>23F</td>
<td>37.2</td>
<td>22.8</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
<td>Cortex</td>
</tr>
<tr>
<td>West</td>
<td>WH</td>
<td>23G</td>
<td>--</td>
<td>23.1</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
<td>Gray-White</td>
</tr>
<tr>
<td>West</td>
<td>46</td>
<td>23H</td>
<td>29.3</td>
<td>17.6</td>
<td>4.4</td>
<td></td>
<td></td>
<td></td>
<td>Gray-White</td>
</tr>
<tr>
<td>West</td>
<td>51</td>
<td>23I</td>
<td>22.2</td>
<td>20.6</td>
<td>3.2</td>
<td></td>
<td></td>
<td></td>
<td>Cortex</td>
</tr>
<tr>
<td><strong>Archaic Points (N=2)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>11A</td>
<td>24A</td>
<td>44.1</td>
<td>29.0</td>
<td>9.4</td>
<td>24.3</td>
<td>17.4</td>
<td>12.9</td>
<td>Burlington – Heat Altered</td>
</tr>
<tr>
<td>West</td>
<td>59</td>
<td>24B</td>
<td>31.1</td>
<td>23.4</td>
<td>7.7</td>
<td>23.4</td>
<td>15.0</td>
<td>14.8</td>
<td>Unidentified</td>
</tr>
</tbody>
</table>
### Appendix C – Continued

<table>
<thead>
<tr>
<th>Sector</th>
<th>Unit</th>
<th>Figure</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>BW</th>
<th>NW</th>
<th>SL</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclassified Points (N=4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>21</td>
<td>24C</td>
<td>49.5</td>
<td>19.0</td>
<td>6.5</td>
<td>(19.0)</td>
<td>12.3</td>
<td>10.0</td>
<td>Unidentified</td>
</tr>
<tr>
<td>West</td>
<td>48</td>
<td>24D</td>
<td>39.9</td>
<td>29.4</td>
<td>6.5</td>
<td>14.0</td>
<td>13.1</td>
<td>13.0</td>
<td>Norwood</td>
</tr>
<tr>
<td>West</td>
<td>63</td>
<td>24E</td>
<td>--</td>
<td>24.8</td>
<td>5.1</td>
<td>14.1</td>
<td>12.6</td>
<td>10.9</td>
<td>Unidentified</td>
</tr>
<tr>
<td>East</td>
<td>F</td>
<td>24F</td>
<td>32.4</td>
<td>22.7</td>
<td>6.2</td>
<td>(11.5)</td>
<td>11.3</td>
<td>(9.3)</td>
<td>Unidentified</td>
</tr>
</tbody>
</table>
Appendix D

Distribution of Selected Artifacts and Raw Material Types by Sector
Figure 35. Distribution of Staged Bifaces.

A = Stage 1/2 Biface (N=25)
B = Stage 2/3 Biface (N=19)
Figure 36. Distribution of Staged Biface Fragments.
Figure 37. Distribution of Biface Tips and Point Blades.
Armintrout-Blackman Site (20AE812)

Note: Circles Represent High Debitage Density Areas

= Site Datum
--- = Bluff Edge Contour
---- = Mechanical Stripped Margin

= Ditch Feature

West Sector

Center Sector

East Sector

C = Core (N=6)
F = Core Fragment (N=36)

Figure 38. Distribution of Cores and Core Fragments.
Figure 39. Distribution of Bipolar Lithics.
Figure 40. Distribution of Retouched Unifacial Scrapers.
R = Retouched Lamellar Knife (N=4)
U = Unretouched Lamellar Flake Tool (N=7)
T = Thick Debitage Tool (N=8)
S = Small Utilized Flake Tool (N=7)

Figure 41. Distribution of Flake Tools.
Figure 42. Bayport Chert Debitage Distributions.
Figure 43. Norwood Chert Debitage Distributions.
Figure 44. Burlington Chert Debitage Distributions.
Figure 45. Heat Altered Burlington Chert Debitage Distributions.
Armintrout-Blackman Site (20AE812)

West Sector

Center Sector

East Sector

0 2 Meters

□ = Site Datum
--- = Bluff Edge Contour
----- = Mechanical Stripped Margin
\= Ditch Feature

Figure 46. Wyandotte/Cobden Chert Debitage Distributions.
Figure 47. Flint Ridge Chert Debitage Distributions.
Appendix E

Lithic Raw Material Distributions by Artifact Class
### Abbreviations Used in the Following Tables

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lx/Dl</td>
<td>= Lambrix/Deer Lick Creek Chert</td>
</tr>
<tr>
<td>Pur</td>
<td>= Purple Chert</td>
</tr>
<tr>
<td>G-W</td>
<td>= Gray-White Chert</td>
</tr>
<tr>
<td>Ctx</td>
<td>= Cortex</td>
</tr>
<tr>
<td>UI</td>
<td>= Unidentified</td>
</tr>
<tr>
<td>Bay</td>
<td>= Bayport Chert</td>
</tr>
<tr>
<td>Nor</td>
<td>= Norwood Chert</td>
</tr>
<tr>
<td>Burl</td>
<td>= Burlington Chert</td>
</tr>
<tr>
<td>W/C</td>
<td>= Wyandotte/Cobden Chert</td>
</tr>
<tr>
<td>FR</td>
<td>= Flint Ridge Chert</td>
</tr>
</tbody>
</table>
## Appendix E

### Lithic Raw Material Distributions by Artifact Class

<table>
<thead>
<tr>
<th>Sector</th>
<th>N</th>
<th>Local</th>
<th>Exotic</th>
<th>Lx/Dl</th>
<th>Pur</th>
<th>G-W</th>
<th>Ctx</th>
<th>UI</th>
<th>Bay</th>
<th>Nor</th>
<th>Burl</th>
<th>W/C</th>
<th>FR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stemmed Points (N=6)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>2</td>
<td>---</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>Large Corner Notched Points (N=5)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>1</td>
<td>1</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Broken Large Corner Notched (N=4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>1</td>
<td>1</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix E – Continued.

<table>
<thead>
<tr>
<th>Sector</th>
<th>N</th>
<th>Local</th>
<th>Exotic</th>
<th>Lx/Dl</th>
<th>Pur</th>
<th>G-W</th>
<th>Ctx</th>
<th>UI</th>
<th>Bay</th>
<th>Nor</th>
<th>Burl</th>
<th>W/C</th>
<th>FR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Medium Corner Notched Points (N=24)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>16</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>1</td>
<td>1</td>
<td>---</td>
<td>---</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>14</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Expanding Stem Points (N=26)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>5</td>
<td>5</td>
<td>---</td>
<td>---</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>5</td>
<td>5</td>
<td>---</td>
<td>---</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>16</td>
<td>15</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>25</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Small Notched Points (N=6)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>3</td>
<td>3</td>
<td>---</td>
<td>---</td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>3</td>
<td>3</td>
<td>---</td>
<td>---</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>6</td>
<td>---</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Appendix E – Continued.

<table>
<thead>
<tr>
<th>Sector</th>
<th>N</th>
<th>Local</th>
<th>Exotic</th>
<th>Lx/Dl</th>
<th>Pur</th>
<th>G-W</th>
<th>Ctx</th>
<th>UI</th>
<th>Bay</th>
<th>Nor</th>
<th>Burl</th>
<th>W/C</th>
<th>FR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Miscellaneous Expanding Stem (N=5)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>1</td>
<td>1</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Late Woodland Triangular Points (N=9)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>8</td>
<td>8</td>
<td>---</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>1</td>
<td>1</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>9</td>
<td>---</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Archaic and Unclassified Points (N=6)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>1</td>
<td>1</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>1</td>
<td>1</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td></td>
<td></td>
<td>4</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E – Continued.

<table>
<thead>
<tr>
<th>Sector</th>
<th>N</th>
<th>Local</th>
<th>Exotic</th>
<th>Lx/Di</th>
<th>Pur</th>
<th>G-W</th>
<th>Ctx</th>
<th>UI</th>
<th>Bay</th>
<th>Nor</th>
<th>Burl</th>
<th>W/C</th>
<th>FR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Point Tips, Blades, Bases (N=62)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>33</td>
<td>22</td>
<td>11</td>
<td>11</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>13</td>
<td>13</td>
<td>---</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>16</td>
<td>13</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>48</td>
<td>14</td>
<td>22</td>
<td>1</td>
<td>7</td>
<td>4</td>
<td>14</td>
<td>8</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Staged Bifaces, Tips, Fragments (N=142)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>53</td>
<td>52</td>
<td>1</td>
<td>28</td>
<td>1</td>
<td>4</td>
<td>18</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>29</td>
<td>29</td>
<td>---</td>
<td>12</td>
<td>3</td>
<td>4</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>60</td>
<td>55</td>
<td>5</td>
<td>23</td>
<td>3</td>
<td>10</td>
<td>2</td>
<td>17</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>142</td>
<td>136</td>
<td>6</td>
<td>63</td>
<td>7</td>
<td>18</td>
<td>43</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cores and Core Fragments (N=39)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>17</td>
<td>17</td>
<td>---</td>
<td>14</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>7</td>
<td>7</td>
<td>---</td>
<td>5</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>15</td>
<td>15</td>
<td>---</td>
<td>6</td>
<td>2</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td>39</td>
<td>---</td>
<td>25</td>
<td>2</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sector</td>
<td>N</td>
<td>Local</td>
<td>Exotic</td>
<td>Lx/Dl</td>
<td>Pur</td>
<td>G-W</td>
<td>Ctx</td>
<td>UI</td>
<td>Bay</td>
<td>Nor</td>
<td>Burl</td>
<td>W/C</td>
<td>FR</td>
</tr>
<tr>
<td>----------</td>
<td>----</td>
<td>-------</td>
<td>--------</td>
<td>-------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>----</td>
<td>-----</td>
<td>-----</td>
<td>------</td>
<td>-----</td>
<td>----</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Miscellaneous Bifacial Fragments (N=36)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>10</td>
<td>10</td>
<td>---</td>
<td>5</td>
<td>4</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>11</td>
<td>11</td>
<td>---</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>15</td>
<td>14</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>35</td>
<td>1</td>
<td>20</td>
<td>6</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bipolar Lithics (N=81)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>46</td>
<td>44</td>
<td>2</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>17</td>
<td>16</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>18</td>
<td>18</td>
<td>---</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>81</td>
<td>78</td>
<td>3</td>
<td>37</td>
<td>7</td>
<td>19</td>
<td>15</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hafted Tools and Drills/Reamers (N=19)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>10</td>
<td>8</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>4</td>
<td>4</td>
<td>---</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>5</td>
<td>5</td>
<td>---</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>17</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E – Continued.

<table>
<thead>
<tr>
<th>Sector</th>
<th>N</th>
<th>Local</th>
<th>Exotic</th>
<th>Lx/Dl</th>
<th>Pur</th>
<th>G-W</th>
<th>Ctx</th>
<th>UI</th>
<th>Bay</th>
<th>Nor</th>
<th>Burl</th>
<th>W/C</th>
<th>FR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retouched Unifacial Scrapers (N=54)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>28</td>
<td>19</td>
<td>9</td>
<td>12</td>
<td>3</td>
<td>3</td>
<td></td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>10</td>
<td>10</td>
<td>---</td>
<td>8</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>16</td>
<td>16</td>
<td>---</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>45</td>
<td>9</td>
<td>27</td>
<td>6</td>
<td>8</td>
<td></td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flake Tools (N=19)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>9</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>6</td>
<td>6</td>
<td>---</td>
<td>4</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>13</td>
<td>6</td>
<td>10</td>
<td>2</td>
<td>1</td>
<td></td>
<td>4</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Adams, Jenny L.

Bell, Pat, and David Wright

Bettarel, Robert L., and Hale G. Smith

Branstner, Mark C., Todd M. Branstner, Sean B. Dunham and Michael J. Hambacher

Brashier, Janet G.

Brashier, Janet G., Matthew R. Laidler and Terrance J. Martin

Brashier, Janet G. and Elizabeth B. Garland

Brashier, Janet G., Elizabeth B. Garland and William A. Lovis
Brashier, Janet G., and Barbara E. Mead  

Brewer, Richard  
1980 Vegetation of Southwestern Michigan at the Time of Settlement. Map compiled by Richard Brewer, Department of Biological Sciences, Western Michigan University.

Brown, James A.  

Caldwell, Joseph R.  

Campbell, Amy  


Cantwell, Anne-Marie  


Clark, Cavin P.  


Crabtree, Don E.

DeRegnaucourt, Tony

DeRenaucourt, Tony, and Jeff Georgiady

DesJardins, Arthur L.

Farrand, William R.
Fitting, James E., editor

Flanders, Richard E.

Garland, Elizabeth B., and Arthur L. DesJardins


Garland, Elizabeth B., Cavin P. Clark and Kathryn E. Parker

Goatley, Daniel B.
1992 *Local Raw Materials Utilized by the Prehistoric Inhabitants of Southwest Michigan*. Manuscript on File, Department of Anthropology, Western Michigan University, Kalamazoo.

1993 *Lithic Raw Material Utilization and Social Interaction in the Late Prehistory of the Lower Kalamazoo River Valley*. Master’s Thesis, Department of Anthropology, Western Michigan University, Kalamazoo.

Gibeson, Jeanette E.

Griffin, James B., Flanders, Richard E., and Paul F. Titterington
Hambacher, Michael J., Sean B. Dunham and William G. Monaghan.  

Higgins, Michael J.  

Jeske, Robert J, and Rochelle Lurie  

Johnson, Jay K.  

Justice, Noel D.  

Kingsley, Robert G.  


Knapp, Bruce D.

LeBlanc, Raymond

Lothrop, Johnathan C., and Richard M. Gramly

Luedtke, Barbara E.
1976 *Lithic Material Distributions and Interaction Patterns During the Late Woodland Period in Michigan.* Ph.D. Dissertation, University of Michigan, Ann Arbor.


Luxemberg, Barbara

Mangold, William M.
1981 *Middle Woodland Ceramics in Northwestern Indiana and Western Michigan.* Master’s Thesis, Department of Anthropology, Western Michigan University.


Mangold, William L., and Elizabeth B. Garland
McMullen, Michelle
1996 *The Creation and Documentation of a Reference Collection of Stone Tool Microwear*. Project funded by the Western Michigan University Undergraduate Research and Creative Activities Award. Donated to the Department of Anthropology, Western Michigan University, Kalamazoo.

Meyers, Thomas J.

Montet-White, Anta M.


Morse, Dan F.

Munson, Patrick J.

Murphy, Michael L.
1986 *A Statistical Analysis of the Lithic Material from The Zemaitis Site (20OT68), Ottawa County, Michigan*. Master’s Thesis, Department of Anthropology, Western Michigan University, Kalamazoo.

Odell, George H.

Odell, George H., and Frank Cowan

Odell, George H., and Frieda Odell-Vereecken

Ozker, Doreen

1981 *An Early Woodland Community at the Schultz Site (20SA2) in the Saginaw Valley and the Nature of the Early Woodland Adaptation in the Great Lakes Region*. Anthropological Papers 70, Museum of Anthropology, University of Michigan, Ann Arbor.

Overstreet, David F.

Prahl, Earl J.


Quattrin, Dale W.

Quimby, George I.

Rick, John W.

Ritzenthaler, Robert

Sheets, Payson

Sorensen, Jerrel H.

Spero, George B., Maxine M. Spero, Lawrence G. Dorothy, and Alice C. Noecker

Stout, Charles B.
1984 *A Distributional Analysis of the Cultural Materials from the Mushroom Site (20AE88), Allegan County, Michigan*. Master’s Thesis, Department of Anthropology, Western Michigan University, Kalamazoo.

Stuiver, Minze and Paula J. Reimer

Tringham, Ruth, Glenn Cooper, George Odell, Barbara Voytek and Anne Whitman

Towner, Ronald H., and Miranda Warburton

Williams, Joyce A.