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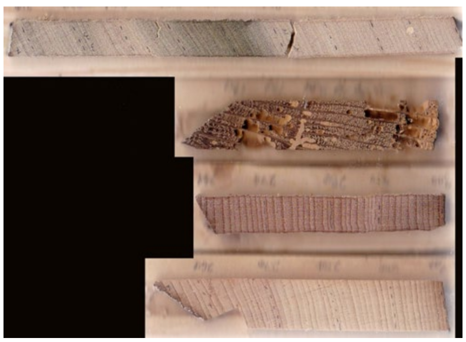

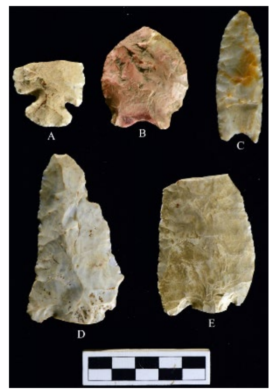

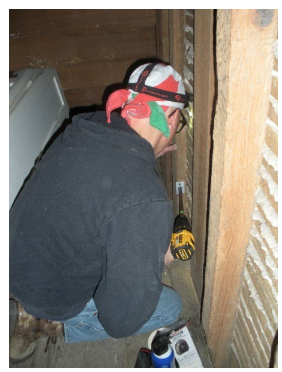

INDIANA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF HISTORIC PRESERVATION AND ARCHAEOLOGY (DHPA)

DNR Indiana Department of Natural Resources | Historic Preservation & Archaeology

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Indiana Department of Natural Resources
Alan Morrison, Director and State Historic Preservation Officer

Division of Historic Preservation and Archaeology (DHPA)
Beth K. McCord, Director and Deputy State Historic Preservation Officer

DHPA Archaeology Team Staff
Amy L. Johnson, State Archaeologist, Archaeology Outreach Coordinator and
Team Leader for Archaeology
Cathy L. Draeger-Williams, Senior Archaeologist
Wade T. Tharp, Archaeologist
Melody K. Pope, Ph.D., Archaeologist

Editor: Amy L. Johnson

Editorial assistance: Beth K. McCord

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Mission statement: The Division of Historic Preservation and Archaeology promotes the conservation of Indiana's cultural resources through public education efforts, financial incentives including several grant and tax credit programs, and the administration of state and federally mandated legislation.

For further information contact:

Division of Historic Preservation and Archaeology
402 W. Washington Street, Room W274
Indianapolis, IN 46204-2739
Phone: 317/232-1646
Email: dhpa@dnr.IN.gov
on.IN.gov/dhpa
facebook.com/INdhpa

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This is a refereed, open access journal. All articles and reports/features are reviewed by the editor, the DHPA director, and two professional archaeologists not with the DHPA.

INTRODUCTION

This is the 20th *Indiana Archaeology* journal, and it has been a pleasure to be part of this publication from its inception. Through the years, there have been featured articles covering various sites and time periods in our state, special archaeological research, and more, and it is hoped that the readers have enjoyed these unique insights into Indiana's past. The journal would not be possible without the efforts of the authors who have submitted their work to us for publication, and we thank them all.

Per state statute (Indiana Code 14-21-1-12), one of the duties of the DHPA is to develop a program of archaeological research and development, including the publication of information regarding archaeological resources in the state. This journal is one of the ways that our office continues to address that mandate. Also, Indiana Code 14-21-1-13 states that the Division may conduct a program of education in archaeology. Indiana's cultural resources management plans have also listed educating the public about Indiana's Native American cultures and identifying, and studying Native American, African American, and other ethnic and cultural heritage resources, as ways to accomplish several preservation goals. The variety of archaeological sites in Indiana, and what has been learned about the sites, is wide-ranging and impressive.

For those who may not be familiar with some archaeological terms, a helpful glossary of some of these general terms is included in the back of this journal. To also aid the lay reader, a general overview of precontact time periods may be found at the end of this volume. Additional archaeological outreach documents, including *Early Peoples of Indiana* and previous volumes of *Indiana Archaeology*, may be accessed at on.IN.gov/archaeo-pubs.

- We appreciate the peer reviews from archaeology colleagues.
- In addition, I thank DHPA Director Beth McCord for her editorial assistance with this volume.

This volume is dedicated to the memory of archaeologists Dr. William (Bill) L. Mangold and Cheryl Ann Munson. They were individuals who for decades made important contributions to archaeology in our state, and both had articles published in past *Indiana Archaeology* journals. Bill and Cheryl both passed away in 2024 and will be missed by their many colleagues and friends.

—ALJ

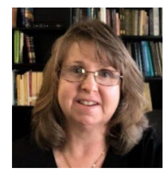
EDITOR AND EDITORIAL ASSISTANCE

Editor

Johnson, Amy L.– Ms. Johnson, State Archaeologist, Archaeology Outreach Coordinator, and Team Leader for Archaeology, has worked for the DHPA since 1991. She is also Indiana's state network coordinator for the Public Education Committee of the Society for American Archaeology. Ms. Johnson holds a B.S. and a M.A., both in Anthropology, from Ball State University. Her main research interests are precontact archaeology (specifically the Adena and Hopewell periods), historic cemeteries, and public outreach regarding archaeological resources.

Editorial assistance

McCord, Beth– Ms. McCord, Director of the Indiana Division of Historic Preservation and Archaeology and Deputy State Historic Preservation Officer, has worked in cultural and heritage management for more than 25 years. She received her M.A. in Anthropology from Ball State University. During her career, she has worked with clients in the government, engineering, transportation and energy sectors. McCord has also worked on several state and federal grant projects, authored published articles and technical reports, and presented her research to a variety of audiences.



ESTABLISHING A BUILD DATE FOR THE BRONNENBERG I-HOUSE (MOUNDS STATE PARK SITE 12M2, MADISON COUNTY, INDIANA) USING TREE-RING ANALYSIS

LIZ MARTHALER[1], RUSSELL C. BAAS[2], LAURYNN THIEME[3], CHRISTOPHER BAAS[4], AND DARRIN L. RUBINO[5]

[1,3,4]DEPARTMENT OF LANDSCAPE ARCHITECTURE, BALL STATE UNIVERSITY, MUNCIE, IN

[2]DEPARTMENT OF HISTORY, BALL STATE UNIVERSITY, MUNCIE, IN

[5]BIOLOGY DEPARTMENT, HANOVER COLLEGE, HANOVER, IN

INTRODUCTION

The Bronnenberg I-house is located within Mounds State Park near Anderson, Madison County, Indiana, USA (Figure 1). The house's construction and expansion are connected to several members of the Bronnenberg family. Frederick (Frederick Sr.) and Barbara Bronnenberg reportedly arrived in Madison County in the 1820s. The couple had twelve children including Frederick Bronnenberg Jr. (Frederick Jr.) who married Hulda Free. This couple had six children including Ransom Bronnenberg (IDNR 2008). However, when and who built and/or modified the house are mysteries.

Estimating construction dates for historic buildings is typically limited to archival documents paired with field work that chronicle and interpret building types, architectural styles, and construction methods. Using archival documents, the house was thought to be constructed between the years of 1840 and 1850, but due to the loss of Madison County property records for parts of the nineteenth century, it is unclear exactly when a Bronnenberg purchased the property on which the house resides (McCord 2006).

Tree-ring analysis, combined with archival documents and field study, provides accurate construction and alteration dates for historic sites allowing archaeologists and preservationists to better identify and interpret historic resources. Additionally, it provides cultural information such as builders' timber preference and scientific data about past forest structure and composition (Rubino and Baas 2019; Trouet et al. 2017).

Dendroarchaeology is a sub-field of dendrochronology that deals specifically with the sampling of historically constructed buildings (and other wooden objects). Dendroarchaeological analysis of timber provides an accurate and reliable means of determining construction dates (Rubino and Baas 2019). In dendroarchaeological studies, the date of formation of individual tree rings in building timbers is unknown. These dates, however, can be accurately determined through a process called crossdating. Crossdating is performed by matching (both visually and with computer assistance) the pattern of small and large rings in a sample of unknown age to samples with rings of known age. Crossdating is a highly reliable method for dating wood, and dendroarchaeological techniques have proven to be powerful and effective research tools. Dendroarchaeological techniques and crossdating have been successfully used to determine and/or verify the date of construction (and/or subsequent modification) of buildings by numerous researchers throughout the United States and Europe.

Tree-ring analysis has been used to identify construction dates for a variety of Indiana historic sites (and reported in *Indiana Archaeology*; Baas and Rubino 2012 and 2013; Baas et al. 2017; Hall et al. 2021). Prior tree-ring analysis at Mounds State Park examined the farmstead's spring house located in the ravine east of the house (Petro et al. 2021; Rubino and Baas 2020). This article reports the tree-ring analyses of the Bronnenberg I-house. The goals of this investigation were to: a.) determine the construction date of the house; b.) determine the date(s) of the house's additions; and c.) place the findings within existing archaeological studies to add to and enhance the interpretation of this historic resource.

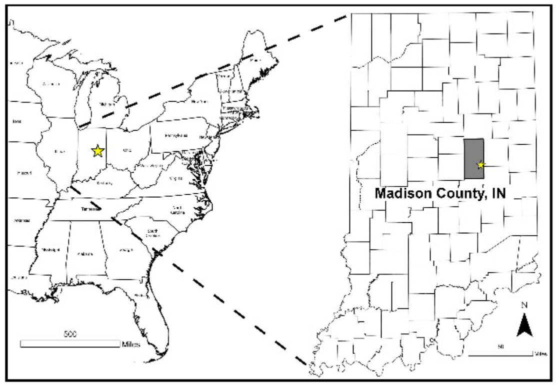


Figure 1. Location of the Bronnenberg I-house in Madison County, Indiana (Image credit: Christopher Baas).

THE BRONNENBERG I-HOUSE

The Bronnenberg I-house is located in Mounds State Park (Figure 2). Historically, the I-house was part of a multi-building farmstead, but only the house is extant. The house's current use is a museum that interprets the history of the Bronnenberg family (IDNR 2011).

The term I-house was established by Fred Kniffen to describe a nineteenth century vernacular house type mostly found in rural Indiana, Illinois, and Iowa. The I-house form has British roots, was established in the mid-Atlantic colonies, and was transplanted to the Midwest over generations along western migration routes. In plan, I-houses are typically two rooms wide, one room deep and can display either end or interior chimneys. In elevation, the houses are two full stories in height, have a gable roof and a symmetrical front façade typically divided into three, four or five bays (bays are the spatial division of the main façade; in an I-house a bay is characteristically recognized by vertically aligned first and second story windows, or the front entrance below a second-story window). Houses typically, but not always, contain a central hallway running the house's length flanked by parlors. I-houses can be constructed from timber, stone, or brick. A one- or two-story wing, known as an "ell," is commonly added to the rear of the house (Glassie 1971; Kniffen 1986; Kniffen and Glassie 1966).

The Bronnenberg house is a typical example of a brick, five bay I-house. The house is two rooms wide, two stories tall and has a central hall with stairs. In elevation, it is five bays wide with a gable roof and end chimneys. The north end of the rear, or west, façade contains a one-story ell. An examination of the house's masonry indicates a second story was added to the el, and a two-story kitchen and bedroom addition was added to the house sometime after its initial construction (Figure 3).

A variety of build dates for the house have been identified. Secondary sources have reported a specific year or range of years for the construction of the house. Two newspaper articles, published when the site was purchased and dedicated as a state park, report a precise year of 1853 and a vague "about 1844" as construction dates (Hanna 1931; Louise 1930). A 1970 article advocating for the house's preservation did not identify a construction date but claimed that it was built by Frederick Jr.'s son, Ransom Bronnenberg (Beck 1970). Thus suggesting it was built as early as the 1840s and as late as the 1870s when Ransom would have reached adulthood.

Beth McCord's report summarizing the 2005 archaeological investigations of the Bronnenberg House used a variety of primary and secondary documents such as maps, population censuses, newspaper articles, and local histories to estimate the house's construction date. The report concluded:

> *From historic records, it is unclear when the house was built. The current research did not find documentation for when the property was first purchased. Information on file at Mounds State Park relates the land was given to Frederick Jr. by his father, but when this occurred is not known. The most likely time period for the construction of the house is between 1840 and 1850* [McCord 2006].

The Mounds Interpretive Plan and an interpretive brochure were likely informed by McCord and identify the house as "built by Frederick Jr. during the 1840-1850 time frame." The plan also explains how Ransom Bronnenberg altered the house following Frederick Jr.'s passing in 1901. "A second floor was added to the one-story "ell." The back porch was enclosed, and a second floor added to it" (IDNR 2008, 2011).

Figure 2. Bronnenberg I-house east façade (Photo credit: Christopher Baas).

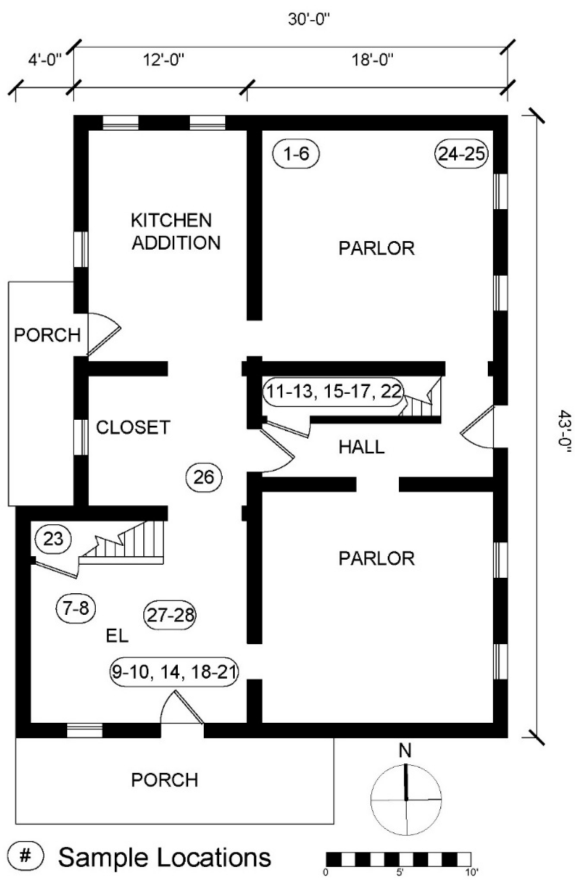


Figure 3. Sketch of Bronnenberg I-house ground floor plan and sampling locations. Samples 1-6 are located in the main house's attic. Samples 7 and 8 are rafters in the ell's attic. Samples 9-10, 14, 18-20 are loose samples found in the ell's attic and presumed to be from the west slope of the main house's roof above the south parlor. Samples 11-13, 15-17, and 22 are located in the closet below the main stairs. Sample 21 is a loose tongue-and-groove floorboard found in the ell's attic. Sample 23 is located in the closet below the ell's stairs. Samples 24-25 are located in the crawlspace of the north parlor. Sample 26 is located in the crawlspace of the hallway near the storage closet. Samples 27 and 28 are located in the ell's cellar (Image credit: Christopher Baas).

METHODS

The authors sampled the Bronnenberg I-house over two days in December 2022. Dating the construction and modification of a structure requires sample collection, sample surface preparation, and crossdating so that precise dates of formation can be assigned to individual tree rings in a building's timbers. When numerous samples from a structure or a portion of a structure, such as an addition, have a similar harvest or death date, a construction date can be determined. Dating was performed using standard dendrochronological and dendroarchaeological procedures (Rubino and Baas 2019; Speer 2010; Stokes and Smiley 1968). A detailed explanation of methodology (and pertinent references) can be found in related *Indiana Archaeology* publications (e.g., Baas and Rubino 2012, 2013; Baas et al. 2017; Hall et al. 2021).

Most samples were obtained using a drill and dry wood boring bit (Figure 4). Sampling focused on timbers with bark or a waney edge since the outermost ring in these timbers would represent the last year the tree formed a ring before being harvested. Given that the house has several additions, samples were obtained from throughout the structure so that dates could be determined for the original construction and subsequent modification(s). A battery-powered reciprocating and circular saw were used to obtain cross sections from studs and loose boards found in the attic.

Figure 4. Collecting a core sample from a closet under the main stairway at the Bronnenberg I- House. The arrow points to the borer chucked in a drill (Photo credit: Christopher Baas).

The provenance of each sample was recorded, and photos of the timbers were taken. Samples were assigned an identification containing three parts: a three-letter structure identification (BIH for Bronnenberg I-house), a two-digit provenance identification (individual timber), and a letter indicating the individual sample obtained from a timber. For example, BIH03B identifies the second sample (B) taken from the third timber analyzed (03) in the house. Often, more than one sample was taken from an individual timber to help ensure that a timber did in fact have a waney edge, to assist dating when ring-width patterns were affected by scars or branches, and to provide datable material when timbers were damaged by decay and/or insects.

Most timbers were sampled *in situ*. However, in the attic of the ell several loose boards were found. Samples 9, 10, 14, and 18-20 appeared to have been removed from the original west shed of the roof above the parlor when ductwork was installed. Sample BIH10 is a rafter, and BIH09, 14, and 18-20 are pieces of decking. The dimensions and patina of the samples match that of the main house's original roof. The samples appear to have been cast aside when a hole was made in the roof. Sample BIH21 is a loose tongue and groove floorboard. Its original location in the building is unknown (Figure 3).

All samples were sanded with progressively finer grits of sandpaper (80- to 600-grit) to allow for ring boundary identification, ring-width measurement, and, ultimately, assignment of calendar years to individual rings (Figure 5). For each sample, tree rings were assigned relative years, not calendar dates, and skeleton plots, graphs that highlight unusually large and small annual rings, were made (Stokes and Smiley 1968; Figure 6). Tree rings were measured to the nearest 0.001 mm at 45×.

Figure 5. Sanded and mounted cores from the Bronnenberg I-house. From top to bottom: tulip poplar BIH13B; white oak BIH24A; beech BIH02A; and white pine BIH07A. The outermost ring in each sample is to the right. Note the variation in ring width; this variation is necessary for accurate crossdating (Photo credit: Darrin L. Rubino).

Figure 6. Skeleton plots created for six beech samples obtained from the Bronnenberg I-house (Madison County, Indiana). In the plots, each line of the strip of graph paper represents one year. A vertical line is drawn to represent the inverse size of a ring (the larger the line, the smaller the tree ring) so as to highlight decreases in annual growth when neighboring rings are compared. The plots are slid along each other to match the pattern and size of lines made for various years. The values in red represent decades that were determined via crossdating (Photo credit: Darrin L. Rubino).

At this stage in the dating process, each sample is considered floating (in time) since individual rings have not yet been assigned actual calendar years of formation. Crossdating was performed and verified using skeleton plots and correlation analysis of ring-width measurements. Initially, samples were grouped by timber type/taxon (e.g., white oak), and each taxon was analyzed separately since regional reference chronologies (series of accurately dated and measured tree rings) prepared from the same taxon often provide the most reliable crossdating (Rubino and Baas 2019). Skeleton plots were used to identify similar growth patterns among individual samples. Once growth-pattern matching was complete, a composite chronology for each taxon was made by combining all the crossdated samples. Correlation analyses of 50-year segments overlapping by 25 years were used to assess if crossdating among samples was successful by comparing each segment to the composite chronology (Holmes 1983).

Once the composite chronology was free of dating and measurement errors, it was crossdated with accurately dated regional reference chronologies prepared from crossdated timbers sampled from historic buildings and from old-growth forest trees. To minimize the impact of individual trees with abnormal growth patterns from affecting growth-pattern matching, the chronologies were truncated to only the years in which five or more ring-width measurements were present (Hall et al. 2022; Herrick and Baisan 2019; Malone et al. 2024). Upon successful crossdating with other regional chronologies, calendar years were assigned to the composite chronology and the individual samples.

Wood identification was performed for each of the samples used for dendrochronological analysis. Identifications were performed by noting macro- and microscopic anatomical characteristics and by using identification keys developed by Panshin and de Zeeuw (1980). Microscopic wet mounts of the sample's transverse, radial, and tangential surfaces were made using a double-edged razor blade and studied with a compound microscope (40 – 400×). Samples were identified to the lowest possible taxonomic rank. Not all samples can be identified to species because more than one species may fall into a single timber type/taxon using wood anatomy. For example, both swamp white oak and bur-oak fall into the "white oak" timber taxon despite being two different species (Table 1).

RESULTS

TIMBER TAXA ANALYSIS

Timber taxa commonly encountered in regional nineteenth century buildings (Rubino and Baas 2019) were used in construction of the Bronnenberg I-house: beech, ash, tulip poplar, and white oak. Additionally, a less-frequently encountered timber type, black walnut, was used. Along with native timber taxa, white pine was present in the building; it was used to make rafters in the ell addition. (Tables 1 and 2).

Table 1. Timber taxa analyzed from the Bronnenberg I-house (Madison County, Indiana). More than one species of tree may be called by a single timber taxon because identification of wood is not possible to the species level for various timber types. A species is considered possible if its natural distribution occurs in Madison County, Indiana, according to Jackson (2004); taxonomy and nomenclature follows Gleason and Cronquist (1991).

Timber taxon	Scientific name	Common name
Ash	*Fraxinus americana* L.	White ash
	F. nigra Marshall	Black ash
	F. pennsylvanica Marshall	Green ash
	F. quadrangulata Michx.	Blue ash
Beech	*Fagus grandifolia* Ehrh.	American beech
Tulip poplar	*Liriodendron tulipifera* L.	Tulip poplar
Black walnut	*Juglans nigra* L.	Black walnut
White oak	*Quercus alba* L.	White oak
	Q. bicolor Willd.	Swamp white oak
	Q. macrocarpa Michx.	Bur-oak
	Q. muehlenbergii Engelm.	Chinkapin oak
White pine	*Pinus strobus* L.	White pine

DENDROARCHAEOLOGICAL ANALYSIS OF THE BRONNENBERG I-HOUSE

A total of 40 samples were collected from 27 timbers located throughout the house (BIH04 is a piece of lath and was used for timber identification, not tree-ring analysis). Of these, 29 samples from 16 different timbers were successfully dated (Tables 2 and 3) using skeleton plots and correlation analysis of the ring-width measurements. Accurate crossdating could not be performed for 11 samples. Tree-ring analysis yielded chronologies that spanned from 1704 to 1852 (1738 total rings; Table 3). Composite chronologies were successfully created for three timber taxa, beech, tulip poplar, and white oak (Table 2). Failure to accurately crossdate samples was most commonly due to the samples not having enough rings for reliable growth-pattern matching.

The longest composite chronology was created from American beech (9 samples; 6 timbers) and consists of 757 rings that span from 1704 to 1851. The tulip poplar chronology (13 samples; 8 timbers) was built with 690 rings and spans from 1758 to 1852 (Figure 7). The white oak chronology (7 samples; 2 timbers) contains 291 rings and spans from 1770 to 1852. Chronology construction for ash, black walnut, and white pine was not possible since the samples could not be reliably crossdated (Table 3).

Crossdating was facilitated by the presence of marker years, rings that consistently exhibit an abrupt reduction in growth relative to neighboring rings. In both the American beech and tulip poplar chronologies 1774, 1806, 1816, and 1839 were marker years (Figure 7). Similar marker years were noted in tree-ring studies performed in Fayette (Hall et al. 2020), Rush (Hall et al. 2022), and Jefferson counties (Malone et al. 2024). The 1774 ring is a marker year in all taxa from the region (Rubino and Baas 2014; Rubino et al. 2019; Hall et al. 2020, 2022); Pederson et al. (2014) document a widescale decline in forest growth in eastern North America in the following year.

Table 2. Samples collected from the Bronnenberg I-house (Madison County, Indiana). See text for an explanation regarding the identification code of individual samples obtained from a timber. Sample location is provided in Figure 3. If more than one sample was taken from an individual timber, the provenance description and timber taxon are only given once and not for each sample. First and last refers to the first and last rings present in each sample. If no data is provided, the sample could not be reliably crossdated. Outer refers to the outermost ring in a sample. A "b" in this column indicates the presence of bark, and a "w" indicates the presence of wane; both b and w indicate a harvest date. A number preceded by a plus sign indicates the estimated number of rings that are present in a sample after the outermost dated ring (estimates had to be made due to extensive insect damage and/or decay that prohibited identification of clear ring boundaries and cellular structure; see the white oak sample in Figure 5). A blank in the outer ring column indicates that the outermost year of the sample does not represent a death or harvest date. *r* is the correlation coefficient obtained by correlating the ring widths of a sample with the composite chronology of the same taxon. The mean and SD are provided in mm. Provenance is the timber's function in a structure. All samples have been archived in the Hanover College botanical collection. BIH04 (a piece of loose lath) was collected for species identification, not dating analysis.

Sample	Taxon	First	Last	Outer	*r*	Mean	SD	Provenance
BIH01A	Walnut							Stud, north wall, 3rd from west wall, attic over north bedroom
BIH02A	Beech	1811	1852	w	0.712	1.47	0.41	Stud, north wall stud, 4th from west wall, attic over north bedroom
BIH03A	Tulip	1804	1852	w	0.797	0.84	0.33	Stud, north wall, 2nd from west wall, attic over north bedroom
BIH03B		1790	1852	w	0.728	0.87	0.31	
BIH04A	Tulip							Lath, north wall, attic over north bedroom

BIH05A	Walnut							Stud, north wall, 1st from west wall, attic over north bedroom
BIH06A	Beech	1805	1852	w	0.737	1.20	0.43	Roof rafter, west slope, against north chimney
BIH06B		1815	1852	b	0.824	1.14	0.44	
BIH07A	White pine							Roof rafter, 2nd from west wall, north slope, from attic space over ell 2nd story addition
BIH08A	White pine							Roof rafter, 5th from west wall, north slope, from attic space over ell 2nd story addition
BIH09A	Beech	1762	1852	b	0.772	1.67	0.70	Roof decking from west slope of main house; loose, from attic space over ell 2nd story addition
BIH09B		1763	1852	b	0.793	1.60	0.64	
BIH10A	Beech							Rafter from west slope of main house; loose, from attic space over ell 2nd story addition
BIH11A	Tulip	1827	1852	w	0.839	0.94	0.28	Riser, main stairs, 6th from floor
BIH12A	Tulip	1815	1852	w	0.820	0.84	0.23	Riser, main stairs, 8th from floor
BIH13A	Tulip	1757	1826		0.782	1.08	0.26	Nailer, south wall of staircase closet
BIH13B		1757	1852	w	0.814	1.04	0.27	
BIH13C		1794	1852	w	0.746	1.09	0.28	
BIH14A	Beech							Roof decking from west slope of main house; loose, from attic space over ell 2nd story addition
BIH15A	Tulip	1766	1852	w	0.770	1.31	0.40	Nailer, south wall of staircase closet
BIH16A	Tulip	1791	1852	w	0.808	1.07	0.50	Stringer, north of main staircase
BIH16B		1812	1852	w	0.931	0.99	0.47	
BIH17A	Tulip	1807	1853	w	0.807	0.85	0.34	Stud, staircase closet, west wall
BIH17B		1815	1853	w	0.833	0.78	0.32	
BIH18A	Beech	1789	1852	b	0.622	1.88	0.75	Roof decking from west slope of main house; loose, from attic space over ell 2nd story addition

BIH19A	Beech	1704	1852		0.876	1.38	0.72	Roof decking from west slope of main house; loose, from attic space over ell 2nd story addition
BIH19B		1703	1852	w	0.876	1.36	0.71	
BIH20A	Beech	1750	1852	b	0.698	1.73	0.77	Roof decking from west slope of main house; loose, from attic space over ell 2nd story addition
BIH21A	Ash							Tongue-and-groove floorboard, loose, from attic space over ell 2nd story addition
BIH22A	Tulip	1814	1853	b	0.774	0.78	0.34	Stud, staircase closet, east wall
BIH23A	Tulip							Riser, backstairs closet
BIH24A	White oak	1780	1839		0.652	0.70	0.22	Joist, north parlor, 2nd from north wall
BIH24B		1769	1843		0.625	0.76	0.30	
BIH24C		1796	1853	w	0.735	0.66	0.19	
BIH25A	White oak	1799	1830		0.689	1.24	0.34	Joist, north parlor, 1st from north wall
BIH25B		1805	1833		0.724	1.33	0.36	
BIH25C		1821	1849	+3	0.696	1.22	0.31	
BIH25D		1820	1847	+5	0.822	1.24	0.31	
BIH26A	White oak							Joist, hall between kitchen and ell
BIH27A	White oak							Joist, cellar, 4th from west wall
BIH28A	White oak							Joist, cellar, 7th from west wall

Table 3. Composite timber taxon chronologies prepared from the Bronnenberg I-house (Madison County, Indiana). Samples and timbers are the number of successfully crossdated samples and timbers from the residence. Undated is the number of timbers that could not be crossdated reliably. First and last are the first and last year in each taxon's chronology. Rings is the number of crossdated rings in each chronology. *r* is the mean correlation coefficient for each timber taxon; an *r*-value is not provided for ash, walnut, and white pine since no timbers were dated. Mean and standard deviation are in mm. No total *r*, mean, or SD are provided since each chronology was prepared using only a single timber taxon. BIH04 is not included in the summaries since it was collected for wood identification and not tree-ring analysis.

Taxon	Timbers	Samples	Undated	First	Last	Rings	*r*	Mean	SD
Ash	0	0	1	---	---	---	---	---	---
Beech	6	9	2	1704	1851	757	0.790	1.51	0.66
Tulip	8	13	1	1758	1852	690	0.796	1.00	0.33
Walnut	0	0	2	---	---	---	---	---	---
White oak	2	7	3	1770	1852	291	0.691	0.91	0.27
White pine	0	0	2	---	---	---	---	---	---
Total	16	29	11	1704	1852	1738			

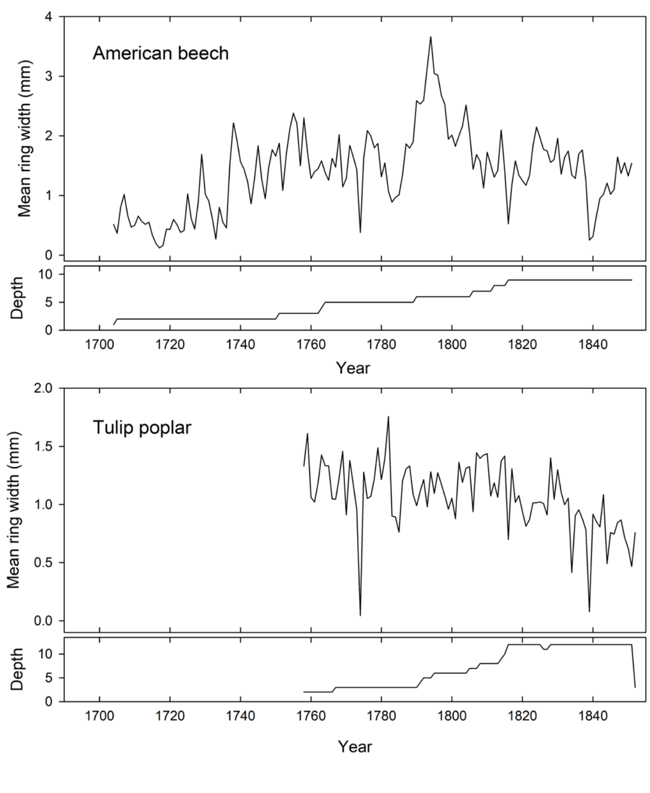


Figure 7. Mean ring-width chronology and sample depth (number of samples with a ring present in an individual year) for American beech (upper panels) and tulip poplar (lower panels) samples obtained from the Bronnenberg I-house (Image credit: Darrin L. Rubino).

Correlation analysis of the 50-year-long segments lagged by 25 years suggested accurate crossdating among the samples as consistently significant ($P < 0.01$) correlations with the composite chronology for both beech and tulip poplar were obtained (Table 4). Strong correlations were also observed between individual (entire) samples and the composite chronology (Table 2) and among all the samples combined in the composite chronology (Table 3). Crossdating the composite beech and tulip poplar chronologies with regional reference chronologies suggests accurate date assignment for the Bronnenberg samples. For both taxa, significant correlations were found between the Bronnenberg chronologies and regional reference chronologies (Table 5). Stronger correlations were generally found with reference chronologies closer to the Bronnenberg I-house (Figure 8).

A cutting or harvest date was determined for 15 sampled timbers. An 1852 and 1853 harvest date were found for 12 and 3 timbers, respectively (Table 2). The time between harvesting a tree, processing it into building materials, and incorporating the lumber into a dwelling is not usually known. We assume that the timbers used for mid-nineteenth century buildings were sourced from near the construction site. Structures built with hewn or split timbers used green or unseasoned wood as notching and cutting to size would be much more difficult on seasoned wood (Hutslar 1986; Rempel 1980; Roberts 1996). The lag time between harvesting timber, cutting it into dimensional lumber, and incorporating it into a structure is also rarely known. We assume that, like hewn timbers, milled lumber was incorporated into a structure soon after its harvest date. All of the timbers with a determinable harvest date were obtained from the original house thus suggesting that it was constructed in 1853. The harvest date of timber BIH25, a floor joist in the north parlor (Figure 3) could not be determined due to extensive decay and/or insect galleries. The outermost datable ring for BIH25C is 1849 and 1847 for BIH25D. An additional three and five rings were identifiable in BIH25C and BIH25D thus suggesting 1852 as the earliest harvest date for the timber. No samples from the ell or from the hallway joining the kitchen addition and the ell could be reliably crossdated, and no samples were obtained from the kitchen addition so their construction dates cannot be determined.

Table 4. Correlation analysis results for 50-year segments (overlapping by 25 years) for dated American beech and tulip poplar samples from the Bronnenberg I-house (Madison County, Indiana). Correlation values were obtained by correlating each segment with the composite chronology. A correlation coefficient > 0.33 indicates a significant correlation ($P < 0.01$) for a 50-year segment. Span is the portion of the sample for which five or more samples were present in the composite chronology (American beech 1764 - 1849; tulip poplar 1792 - 1851).

Sample	Span	1750-1799	1775-1824	1800-1849	1825-1874
Beech					
BIH02A	1812-1849			0.73	
BIH06A	1806-1849			0.76	
BIH06B	1816-1849			0.84	
BIH09A	1764-1849	0.76	0.84	0.82	
BIH09B	1764-1849	0.71	0.75	0.85	
BIH18A	1790-1849		0.55	0.63	
BIH19A	1764-1849	0.84	0.86	0.90	
BIH19B	1764-1849	0.87	0.82	0.87	
BIH20A	1764-1849	0.67	0.65	0.70	
Tulip poplar					
BIH03A	1805-1851			0.80	
BIH03B	1792-1851		0.72	0.73	0.75
BIH11A	1828-1851				0.84
BIH12A	1816-1851			0.82	
BIH13A	1792-1825		0.52		
BIH13B	1792-1851		0.73	0.73	0.71

BIH13C	1795-1851	0.74	0.76	0.75
BIH15A	1792-1851	0.69	0.73	0.77
BIH16A	1792-1851	0.79	0.85	0.86
BIH16B	1814-1851		0.93	
BIH17A	1808-1851		0.80	
BIH17B	1816-1851		0.83	
BIH22A	1815-1851		0.77	

Table 5. Correlation results (*r*- and *t*-values and associated probability, *p*) of the Bronnenberg I-house American beech and tulip poplar composite chronologies with regional reference chronologies of the same taxon. Chronology is the Indiana county from which a chronology was created. The chronologies were created from tree-ring analysis of historic buildings and old-growth forests (by DLR and CB; samples and data archived in the Hanover College botanical collections). Span is the entire span of the reference chronology, and Span ≥ 5 is the portion of the reference chronology with 5 or more samples present. Overlap is the number of years that overlap between a reference chronology and the composite Bronnenberg chronology where 5 or more samples were present in both. Results are reported only if 50 or more years overlapped between the Bronnenberg and reference chronologies.

Chronology	Span	Span ≥ 5	*t*	*r*	*p*	Overlap
Beech						
Cass[1]	1704 - 1868	1756 - 1868	7.84	0.646	< 0.001	88
Wayne[2]	1701 - 1841	1724 - 1840	7.46	0.653	< 0.001	77
Jackson	1708 - 1889	1750 - 1875	5.70	0.524	< 0.001	88
Carroll[1]	1740 - 1865	1779 - 1865	5.35	0.536	< 0.001	73
Wayne	1687 - 1849	1743 - 1835	5.19	0.527	< 0.001	72
Morgan	1713 - 1874	1738 - 1873	5.01	0.475	< 0.001	88
Morgan	1708 - 1890	1769 - 1890	4.79	0.470	< 0.001	83
Jennings	1681 - 1816	1721 - 1816	4.60	0.541	< 0.001	53
Ripley[3]	1684 - 2010	1752 - 2003	4.51	0.437	< 0.001	88
Switzerland[1]	1714 - 1879	1731 - 1861	4.39	0.428	< 0.001	88
Rush[4]	1690 - 1853	1734 - 1853	4.15	0.409	< 0.001	88
Switzerland[1]	1701 - 1827	1736 - 1827	4.03	0.456	< 0.001	64
Fayette[5]	1725 - 1833	1763 - 1829	3.31	0.383	0.002	66
Clark	1681 - 1818	1705 - 1818	3.08	0.389	0.003	55
Jefferson	1729 - 1853	1756 - 1853	2.28	0.238	0.025	88
Jennings	1769 - 2009	1784 - 2008	2.22	0.263	0.030	68
Jefferson[1]	1749 - 1890	1799 - 1889	0.01	0.001	0.993	53
Tulip poplar						
Putnam	1589 - 1877	1611 - 1877	7.36	0.695	< 0.001	60
Harrison	1575 - 1901	1634 - 1896	6.85	0.669	< 0.001	60
Rush[4]	1741 - 1853	1768 - 1853	6.68	0.659	< 0.001	60
Putnam	1685 - 1856	1715 - 1856	5.39	0.578	< 0.001	60

Clark[1]	1698 - 1867	1709 - 1864	5.22	0.565	< 0.001	60
Washington	1637 - 1882	1654 - 1882	5.03	0.551	< 0.001	60
Jackson	1686 - 1882	1714 - 1880	5.01	0.549	< 0.001	60
Washington	1642 - 1882	1656 - 1882	4.77	0.531	< 0.001	60
Dearborn	1528 - 1852	1705 - 1848	4.54	0.522	< 0.001	57
Wahington	1721 - 1887	1725 - 1885	4.41	0.501	< 0.001	60
Posey[1,6]	1686 - 1885	1704 - 1858	4.00	0.465	< 0.001	60
Jefferson[7]	1590 - 1861	1737 - 1851	3.98	0.463	< 0.001	60
Switzerland	1701 - 1859	1735 - 1858	3.86	0.452	< 0.001	60
Orange	1530 - 1869	1569 - 1846	3.80	0.462	< 0.001	55
Harrison	1621 - 1878	1664 - 1860	3.56	0.423	< 0.001	60
Vanderburgh	1660 - 1870	1751 - 1845	3.50	0.437	< 0.001	54
Orange	1562 - 1850	1765 - 1850	3.36	0.407	0.001	59
Washington	1610 - 1860	1642 - 1827	3.25	0.405	0.002	56
Floyd	1598 - 1866	1627 - 1866	3.04	0.371	0.004	60
Ripley	1597 - 1845	1700 - 1845	2.97	0.381	0.004	54
Jefferson	1561 - 1848	1730 - 1848	2.95	0.369	0.005	57
Jefferson[1]	1630 - 1869	1652 - 1857	2.80	0.346	0.007	60
Posey[8]	1682 - 1851	1714 - 1851	2.52	0.314	0.015	60
Clark	1498 - 1878	1691 - 1842	2.41	0.326	0.020	51
Floyd	1727 - 1863	1783 - 1863	1.91	0.243	0.061	60
Orange	1774 - 1841	1791 - 1841	1.79	0.250	0.080	50

1 = Rubino and Baas 2019; 2 = Hall et al. 2021; 3 = Rubino et al. 2019; 4 = Hall et al. 2022; 5 = Hall et al. 2020; 6 = Baas and Rubino 2013; 7 = Malone et al. 2024; 8 = Rubino and Baas 2014.

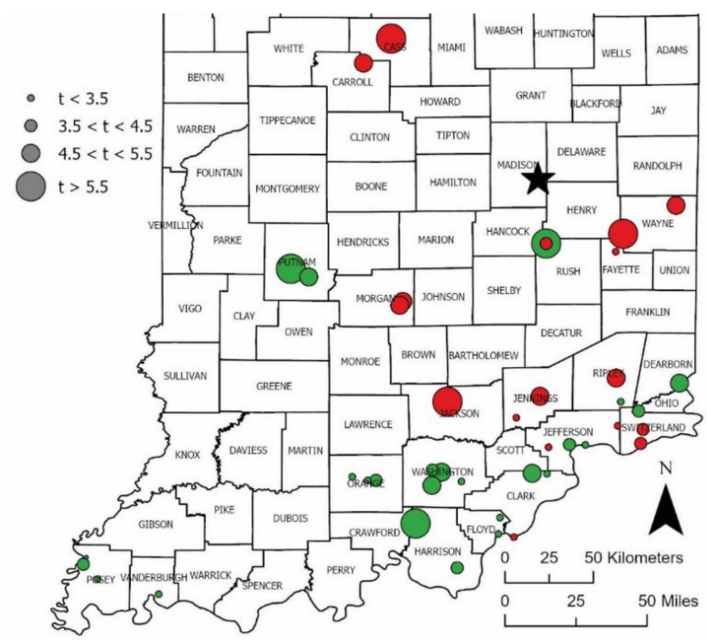


Figure 8. Crossdating results (t-values) obtained by correlating the Bronnenberg I-house American beech chronology with regional American beech chronologies (shown in red) and tulip poplar chronology with regional tulip poplar chronologies (shown in green); r-values and their associated probabilities and n (years of overlap) for each correlation are provided in Table 5. Star represents the house location (Image credit: Christopher Baas).

CONCLUSIONS

Tree-ring analysis at Mounds State Park supports the building of regional tree-ring chronologies in an area of Indiana with limited dendrochronological sampling and contributes to the interpretation of the state's nineteenth century vernacular architecture. Including the examination of the Bronnenberg spring house in 2020, the house is the second endeavor to use tree-rings to contribute to the archaeology of the state park (Petro et al. 2021; Rubino and Baas 2020).

Sampled timbers with wane or bark from the primary, rectangular block of the Bronnenberg I-house had a harvest date of either 1852 or 1853. Since no timbers dated beyond 1853, tree-ring analysis suggests an 1853 construction date for the primary, two-story house structure. Identifying a construction date for the house's ell, whose masonry suggests that it was constructed at the same time as the primary I-house structure, and the additions to the I-house was prohibited by accessibility to timbers with bark or wane, imported timbers (i.e., the pine from the addition above the ell is not from regional forests), and timbers with too few rings to reliably crossdate.

The 1853 date was near the build date (between 1840 and 1850; or 3 to 13 years) researchers estimated based upon archival materials. Interestingly, 1853 is the date reported in *Muncie Sunday Star* journalist Byron E. Louise's 1930 article (Louise 1930). In 1930, Louise wrote in a photo caption the "old Fred Bronnenberg homestead, built seventy-seven years ago." Louise does not cite his sources, but he appears to have had access to persons in the know, or documentation currently unknown to researchers or lost to history.

The vernacular I-house form, and similar central passage house forms, are extremely common throughout Indiana (Bastian 1977; McAlester and McAlester 1988; Peat 1963). It is one of the most common nineteenth century house types in Indiana, is constructed in different variations, and can be easily modified to represent current architectural styles (Bastian 1977; McAlester and McAlester 1988). Tree-ring analysis of several Hoosier I-house and central passage forms is just a start at attempting to identify if temporal and regional variations exist. Even in our small sample of five dated houses we have seen considerable differences. Tree ring analysis has demonstrated that the form was persistent in both urban and rural locations nearly the entire span of the nineteenth century. The rural George Ash House in Switzerland County, Indiana was built in 1809 and is considered one of the oldest houses in the state (Rubino and Baas 2019). By contrast, nearly 80 years later, the Montgomery House in Paoli, Indiana was built in 1892. The Bronnenberg House, the Lindley House in Paoli, Indiana, and the Thiebaud House in Switzerland County, Indiana, were all constructed in the mid-1850s. However, they represent variations in the architectural division of the front façade of three, five, and six bays, the building height of two stories versus one-and-one-half stories, and the construction methods of brick and wood frame.

Other variations of form exist. Notable is the 1841-constructed Huddleston House in Wayne County, Indiana that is raised on a "walkout" basement story, making its main façade three stories in height. The basement story allowed the family to sell supplies to travelers on the National Road (Hall et al. 2021). The I-house's ability to display current architectural styles is also evident. The early nineteenth century constructed Ash, Huddleston, and Bronnenberg houses display Federal style details, the mid-nineteenth century Lindley and Thiebaud houses display Greek Revival details, and the late-nineteenth century Montgomery House displays an eclectic mixture of Greek Revival, Italianate, and Queen Anne details.

Timber species selection is typical for nineteenth century construction in Indiana (Rubino and Baas 2019). White oak is commonly used as ground-floor joists as it was for the north parlor and the ell. White oak is rot resistant and structurally strong and dense (Hutsler 1986; USDA 2007). Tulip poplar is used extensively in the main stairs and hallway closet, as well as the stairs in the ell. Tulip poplar timber was often preferred given its insect resistance and characteristically long, defect-free trunks that yield clear timbers (Cassens et al. 2009; Hill and Shelly 1985; Rehder 2012). Beech is commonly found in nineteenth century buildings and was used in a variety of ways in the house (Table 2; Rubino and Baas 2019; Hall et al. 2021, 2022) despite its lack of decay resistance (Gibson 1913). It is however dense and strong (US Forest Products Laboratory 1974). The use of white pine in the addition is not surprising since conifer has been imported into the region from Mid-Atlantic states since the 1820s (Rubino and Baas 2019). The pine rafters from the ell's roof addition were not dated because the collected samples were too short to accurately date and contained too few rings to accurately determine the geographic origin/provenance of the timber.

Although tree-ring analysis provided an accurate construction date to the house, it could not resolve the identity of who constructed it. The Bronnenberg farmstead is located in Section 16 of Union Township, but it is unclear when Frederick Sr. or Frederick Jr. purchased the property. McCord's archaeological investigation of the house sought to identify the purchase date of the property by the Bronnenberg family through a deed record search. In summary, prior to 1840 neither Frederick Sr. nor Frederick Jr. had purchased property in Section 16 of Union Township. Tax records from 1842 indicate that Frederick Jr. owned property in Section 16 of Union Township, but in Chesterfield, Indiana which is approximately 1.5 miles north of the I-house. The 1850 population census identifies Frederick Jr. and his wife Hulda as residents of Union Township. However, the census does not identify the location of their residence. Finally, a fire destroyed county property records, so the first archival document clearly identifying a property owner is an 1880 plat map that names Frederick Jr. as the property owner. Therefore, without supporting archival material that identifies the property's owner in 1853, tree-ring analysis could not clearly identify the house's builder as Frederick Sr., Jr., or some earlier property owner. Additional tree-ring analysis should be considered when opportunities are presented to access timber from the ell (floor joists and wall studs) that might confirm that it is contemporary with the main house, and the kitchen addition (roof, wall, and floor) to confirm that it was built by Frederick Jr. or Ransom (McCord 2006).

The scientific study of historic structures and landscapes offers both cultural and scientific information. Tree-ring analysis of the Bronnenberg I-house adds to the Mounds State Park's archaeological record by establishing a construction date. Field study also adds to the knowledge base of central Indiana's architecture by identifying build dates and the species of timber preferred by early builders.

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AN EXAMINATION OF TEMPORALLY DIAGNOSTIC HAFTED BIFACES AND OTHER CHIPPED STONE TOOLS FROM THE CLOE MORRIS COLLECTION, STRAWTOWN, HAMILTON COUNTY, INDIANA

CHRISTOPHER R. MOORE
DEPARTMENT OF ANTHROPOLOGY
UNIVERSITY OF INDIANAPOLIS
INDIANAPOLIS, IN

INTRODUCTION

As a keeper of local history and steward of cultural resources for the town of Strawtown, Indiana, Cloe Morris was something of a local legend. Dubbed 'The Mayor of Strawtown,' Morris's interests ranged from Clovis period archaeology to Strawtown during the Prohibition Era (Neal 1978). From his childhood in the early decades of the 20th century until his elder years, Morris accumulated a sizable number of artifacts, most of which he collected from the fields and gravel pits located around his hometown. Through the generosity of Morris's family, much of his former collection is now preserved at the Taylor Center of Natural History at Strawtown Koteewi Park, where it is accessible to educators and researchers. Unfortunately, the collection does not include provenience information, so it is possible that some of the artifacts contained therein originate from outside Hamilton County. Nevertheless, most of the artifacts and chert types represented are consistent with those identified through professional surveys and excavations and, thus, provide insights into changing technologies and raw material selection choices over time. This article summarizes the results of my recent study of the chipped stone tools from the Morris collection curated at the Taylor Center.

The purpose of this article is to 1) make the Morris collection more readily accessible to the general public and 2) provide the results of my descriptive analysis of the collection to professional archaeologists who may wish to integrate it into regional syntheses or refinements of local point typologies. It provides detailed metric and non-metric descriptive data for all point clusters, as well as chert type identifications that can be useful for understanding broader patterns of settlement, mobility, and exchange over time (see, e.g., Cantin 1989; Moore 2008). My intention is to share data that can be incorporated into broader comparative analyses. To facilitate this, I provide a summary of point type and chert usage data from Hamilton County compiled from SHAARD and some comparative data on point metrics from the published literature. The focus of this paper, however, is a description of the Morris collection and what it can tell us about the culture history of Hamilton County. A more detailed description and analysis of the entire collection can be found in Moore (2022).

The Morris collection includes 77 diagnostic hafted bifaces (also referred to as "projectile points" or "points" throughout). Based on comparisons with artifacts reported from professional surveys and excavations, these points range in age from the Late Paleoindian (ca. 10,500 to 10,000 BC) to the Late Precontact (ca. AD 1000 to 1600) periods, with Early Archaic (ca. 10,000 to 7000 BC) and Late Precontact points particularly well represented (Justice 1987). Comparison of chert usage patterns with data from other sites curated in SHAARD indicates that Indigenous flintknappers who made these points preferentially selected locally available Fall Creek, Liston Creek, and unidentified (UID) Glacial cherts throughout all time periods, accessing non-local and exotic cherts more often during the Paleoindian, Early Archaic, and Early Woodland (ca. 1000 to 200 BC). Although interpretations are limited by small sample sizes for several major time periods, it is possible that changing raw material preferences can be linked to changes in group mobility and regional interaction networks over time.

HAMILTON COUNTY ARCHAEOLOGY

While archaeologists have recorded hundreds of archaeological sites in Hamilton County, we have not yet adequately synthesized this work into a local culture history. It remains common practice for archaeologists working in Indiana to draw on decades-old published syntheses to provide generic cultural contexts for projects. Such macroregional summaries mischaracterize archaeological cultures as internally homogeneous and fail to identify microscalar patterns of variation and change that are key to crafting compelling human-centered narratives of the past. Detailed summaries of even small assemblages like the Morris collection provide the building blocks (raw data) necessary to begin this process of refining local chronologies. While compiling such a culture history is beyond the scope of the present study, I provide a brief and incomplete summary of some of the more intensive investigations in

Hamilton County to date for the purpose of better framing the Morris collection study, particularly for readers who may be unfamiliar with the broader outlines of Indiana culture history.

Stripping away the generic, it seems we know very little about the earliest peoples who called Hamilton County home. For instance, while we know that Paleoindian, Archaic, and Woodland peoples lived across central Indiana due to the widespread occurrence of hafted bifaces diagnostic of these periods, we have very little detailed information about specific individuals and groups: who they were, how they lived, who they interacted with, and how they were related to the groups who came before and after (DHPA 2007).

One limited exception to this general pattern derives from early excavations at the late Middle to Late Archaic McKinley site (12H1), located on a terrace overlooking the West Fork of the White River in southeastern Hamilton County (Justice 1994; Little 1970, 1972). The McKinley site appears to have been a multicomponent, zoned shell and dirt/rock midden containing evidence of Early Archaic through Late Woodland occupations. While Little (1970) illustrates Early to early Middle Archaic Thebes, Kirk, Bifurcate, and Large Side Notched Cluster projectile points from the site, significant midden accumulation likely did not begin until the late Middle Archaic period.

The lowest stratum at the McKinley site is a light-colored stratum containing shell concentrations, similar to shell midden sites commonly found in the lower reaches of the White and Ohio rivers but that are less well documented in the upper White River drainage. Like many shell middens farther south, the McKinley site occupants appear to have shifted away from harvesting mussels at some point in the site's history, as this lower shell midden is capped by a darker dirt/rock midden (Justice 1994; Little 1970). In addition to the domestic and hunting-related activities that indicate McKinley was a significant late Middle to Late Archaic habitation site, Little (1970) also discovered 18 individuals buried at the site. While it is possible that later Oliver Phase occupants interred their dead there (Justice 1994), this cemetery indicates that it was a culturally significant location utilized as a resting place for deceased community members at some point in the site's history.

Examination of the projectile points illustrated by Little (1970) indicates that the site's late Middle to Late Archaic inhabitants manufactured diagnostic Brewerton/Matanzas, Late Archaic Stemmed, Rowlett/McWhinney, Riverton, and possibly Saratoga Cluster projectile points. Justice (1994) notes that McWhinney Heavy Stemmed points are the dominant Late Archaic type at the site. This diversity of projectile point types spanning several hundred years of occupation, coupled with the use of the site as a burial ground, indicates that McKinley was an important focus of cultural activities for a variety of distinct groups over an extended period of time. Unfortunately, the current resolution of archaeological data in Hamilton County precludes a better definition of these distinctions or the nature of interactions among these various groups.

While archaeologists have not yet conducted a focused investigation of the Paleoindian, Archaic, or earlier Woodland groups who lived in Hamilton County, McCord (2005) has summarized well our current knowledge of the Late Woodland Albee Phase, which is currently dated to ca. AD 800 to 1300. Albee Phase peoples lived in dispersed communities united through communal mortuary rituals (Emerson et al. 2019). They practiced a subsistence strategy consisting of hunting and gathering and maize horticulture, with the use of maize intensifying after AD 1000 (Blankenship 2022; McCord and Cochran 2003; McCord and Cochran 1994). McCord (2005) identified a total of 80 archaeological sites, distributed throughout west and west-central Indiana, that could be assigned definitively to the Albee Phase based on the presence of diagnostic grit-tempered, cordmarked pottery with wedge-shaped collared necks. Although Jack's Reef Cluster projectile points have sometimes been attributed to the Albee Phase, McCord (2005) convincingly argues that Jack's Reef likely represents a distinct but currently poorly defined earlier Late Woodland group or groups. Rather, Albee Phase people manufactured Small Triangular Cluster projectile points that currently cannot be differentiated morphologically from similar points made by all central Indiana indigenous cultures after AD 1000 (McCord 2005; McCullough and Graham 2010).

Archaeologists divide the Late Precontact period in central Indiana into three phases, marked by the arrival of three materially distinct but temporally overlapping populations: the Western Basin tradition Castor Phase (ca. AD 1000 to 1200), the Fort Ancient tradition Oliver Phase (ca. AD 1200 to 1450), and the Oneota tradition Taylor Village Phase (ca. AD 1400 to 1450+). Following McCullough and Graham's (2010) synthesis of central Indiana culture history, dispersed terminal Late Woodland Albee Phase groups occupied Hamilton County prior to AD 1100. By the 12^{th} century, communities of Western Basin tradition Castor Phase peoples from the western Great Lakes were well-established in the region. These Castor Phase peoples likely moved to central Indiana from the lower Maumee River valley. They were village agriculturalists who practiced swidden horticulture focused on maize cultivation. Castor Phase pottery consists of subglobular jars with strongly everted rims and cord- and tool-impressed decorations. The Castor Farm site (12H3), located at Strawtown Koteewi Park, was a large, palisaded, Castor Phase village that was surrounded by numerous outlying farmsteads. Excavations at Castor Farm revealed large, semi-subterranean, communal pit structures with double post construction that were likely walled with bark, mats, and/or bundled grass rather than daub (McCullough 2012; McCullough and Graham 2010).

Beginning in the early 1200s, Anderson Phase peoples of the Fort Ancient tradition began migrating into the upper White River valley. Relations between these newcomers and the resident Castor Phase peoples appear to have been peaceful because these groups eventually integrated to form the Oliver Phase. Like their Castor and Anderson Phase ancestors and contemporaries, Oliver Phase peoples were village agriculturalists who practiced swidden horticulture. Oliver Phase villages like Strawtown (12H883) were palisaded with central plazas surrounded by mortuary and living areas. Strawtown also was surrounded by an earthen embankment. Oliver Phase peoples continued to practice a mixed hunting and gathering and agricultural subsistence strategy; they intensively cultivated maize and tropical beans, but also included a wide variety of wild plants and animals in their diets. Oliver Phase pottery includes both Castor Phase vessels and Anderson Phase Fort Ancient-style subglobular jars with rounded bottoms and excurvate rims with decorated rim folds. The necks of these latter vessels are often decorated by trailed line motifs, including the distinctive Fort Ancient guilloche motif. Oliver Phase structures were highly variable, including both bent pole and wall trench construction (McCullough 2012; McCullough and Graham 2010).

By the early 1300s, Oneota tradition populations related to groups from southern Wisconsin, northern Illinois, and northwestern Indiana had moved into central Indiana. Originating from the northwest, these groups preferentially settled in prairie pockets adjacent to wetlands. They were village agriculturalists who focused on cultivating the rich soils found in this biome. This is also the only documented Late Precontact group in central Indiana to harvest wild rice, which was discovered at Site 12JO5 in Johnson County. Interactions between these Oneota groups and the resident Oliver populations appear to have been largely peaceful but limited in nature, as Oliver peoples were migrating south along the White River by this time (McCullough and Graham 2010).

The first documented population of Oneota peoples in the region settled in what is now Johnson County and formed the late 13th to early 15th century Smith Valley Phase. Smith Valley peoples manufactured shell-tempered pottery with short, everted necks and plain or smoothed-over cordmarked bodies with little decoration, similar to Oneota tradition Fisher Phase pottery from northwestern Indiana. Meanwhile, to the north in Hamilton County, a second Oneota group settled at the Taylor Village site (12H25), located just across the White River from the Strawtown Enclosure. While the nature of interactions between Oliver and Taylor Village Phase peoples is unclear, there is no evidence of conflict between the two groups. Taylor Village Phase pottery is shell-tempered with sharply angled rims, trailed line decorations, and small loop or punched handles (McCullough and Graham 2010).

METHODS

Archaeologists base North American culture chronologies predominately on documented diachronic trends in chipped stone hafted biface and ceramic technological and decorative styles. Twentieth century archaeologists modeled projectile point typologies after earlier ceramic typologies with the goal of correlating point 'types' with existing temporally and/or spatially defined cultural units. Unfortunately, these point types were not as rigorously defined as ceramic types, such that widely used typologies (e.g., Justice 1987) rarely differentiate attributes that define a type (and, thus, are temporally sensitive and/or always present) from those that are simply characteristic of it (i.e., common but not always present) (Dunnell 1986). While these widely used but broadly defined types are useful for cross-correlating assemblages over large geographic regions and broad temporal spans, they are not as sensitive to the shorter-term temporal changes or other kinds of cultural variation that archaeologists are increasingly more interested in. Fortunately, over the past couple of decades archaeologists have begun to reevaluate existing typologies, expanding the range of metric and non-metric data collected from hafted bifaces (e.g., Cook and Comstock 2014; Shott et al. 2024). This study follows this trend by providing detailed metric and non-metric data collected from the Morris collection points in the hopes that these data can aid future researchers who may wish to use them to address research questions that go beyond the simple cultural historical ones asked by this study.

I conducted all documentation of the Morris collection artifacts at the Taylor Center of Natural History at Strawtown Koteewi Park. University of Indianapolis (UIndy) Department of Anthropology adjunct faculty member Elizabeth Straub took all the photographs utilized in this article. I collected all metric data using Mitutoyo Absolute Digimatic calipers and an O'Haus Scout scale and compiled all summary statistics using the Statistical Package for the Social Sciences (SPSS) Version 28.

I collected a maximum of nine measurements from each hafted biface (Figure 1). Maximum length consists of the length of a line running from the most distal point of the biface tip to the most distal point on the base immediately opposite the tip. Maximum width is the length of the longest line running from each side of the biface perpendicular to the maximum length, and maximum thickness is the length of the longest line running perpendicular to the maximum length and maximum width (the z-axis when holding the biface in a flat plane with the tip up and the base down). The maximum length is subdivided into the blade length and the haft length, with the former consisting of the subsection of the maximum length line running from the tip of the longest barb or the shoulder to the tip of the biface, whichever is longest, and the latter consisting of the subsection of the maximum length line running from the base to the shoulder or most distal portion of the biface exhibiting hafting wear. The sum of the blade length and the haft length does not always equal the maximum length as the blade and haft may overlap.

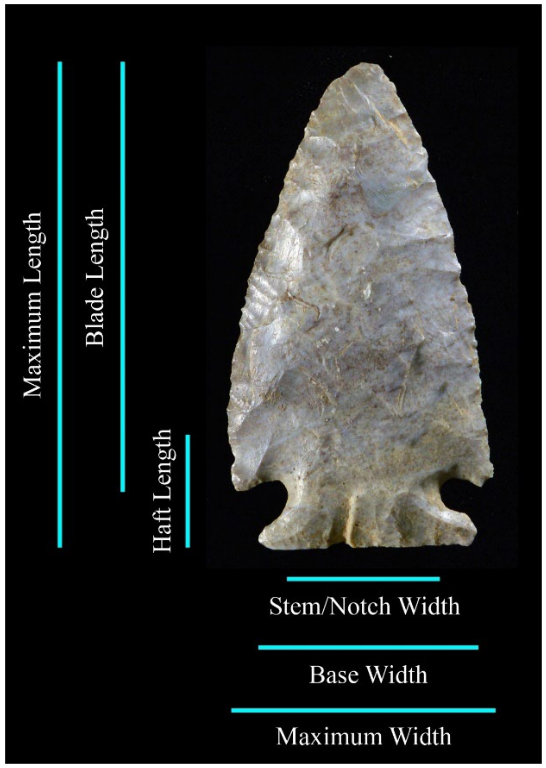

Figure 1. Hafted biface measurements utilized in this study.

The base width is the length of the longest line running perpendicular to the maximum length from two opposite edges of the base. The stem/notch width is the length of the shortest line running perpendicular to the maximum length from two opposite edges of the stem or between two notches. The blade midsection width and blade midsection thickness are the lengths of lines running from edge-to-edge of the blade and through the z-axis of the blade, respectively, at a point halfway up the blade length. I collected these measurements by dividing the blade length in half and then measuring from the tip down to this halfway point, where the blade midsection measurements were collected.

Chert identification focused on differentiating between local, non-local, and exotic (distant) chert sources to ascertain broader regional and extra-regional connections between Hamilton County and surrounding groups over time. Toward this end, I conducted only macroscopic identifications using a small number of comparative hand samples curated at the Taylor Center and the University of Indianapolis. Chert identifications can be considered accurate at this scale (local vs. non-local vs. exotic), but specific chert type identifications (e.g., Fall Creek vs. Liston Creek cherts) should be considered tentative.

As utilized herein, "local" cherts refer to Liston Creek, Fall Creek, Fall Creek Quartzite, and unidentified (UID) Glacial cherts available as secondary deposits in glacial till and river gravels, with the primary source likely being gravel bars that accumulate along the White River (Cantin 2008; Cochran 2002). This is consistent with Cantin's (1989) local (< 3 km distant) and semi-local (3-30 km) distances and MacDonald et al.'s (2006) "micromovements" (< 30 km), which includes both a daily foraging radius and camp-to-camp movements for social gatherings and visitations. In short, locally available cherts are those that were readily available nearby and easily obtained throughout the course of other daily or weekly activities.

Non-local cherts, as defined herein, consist of cherts available within 30 to 50 km. This includes the lower end of distances Cantin (1989) referred to as "foreign" (> 30 km) but is consistent with MacDonald et al.'s (2006) "mesomovements" (30-50 km). This distance includes ethnographically recorded annual ranges covered by hunting bands and encapsulates movements to visit semi-distant family members and friends. Only one chert identified by this study falls within this range: Attica/Sugar Creek chert. Sugar Creek chert outcrops in Boone County, Indiana, so would have been local for some parts of Hamilton County, but falls within the non-local range when measured from Cloe Morris's home at Strawtown. It is possible that all or some of the chert identified as Attica/Sugar Creek originates from outcrops farther to the northwest in Warren and Tippecanoe Counties, which would fall within the 'exotic' chert category (Cantin 2008).

Exotic cherts refer to those whose provenance occurs greater than 50 km from Hamilton County. This is consistent with the upper end of Cantin's (1989) "foreign" category and MacDonald et al.'s (2006) "macromovements" (> 50 km). Macromovements encompass the extended or lifetime ranges of ethnographically documented hunting bands and include long-distance movements for travel to sacred sites or for purposes of long-distance exchange, vision questing, and pilgrimages (e.g., Carr 2006). Cherts identified in this study that are included in the "exotic" category include Kenneth, Harrodsburg/Allens Creek, Stanford, Indian Creek, Jeffersonville, Laurel, Holland, Wyandotte, Burlington, Kaolin, Delaware, Flint Ridge, Upper Mercer, and Zaleski cherts (Cantin 2008; DeRegnaucourt and Georgiady 1998).

HAFTED BIFACES FROM THE CLOE MORRIS COLLECTION

While studies like those from the Caesars Archaeological Project (Stafford and Cantin 2009) have improved our understanding of projectile point/hafted biface time/space systematics in Indiana, it remains the case that our understanding of change over time in hafted biface styles and morphologies remains coarse. This coarseness stems largely from the fact that 1) many archaeologists abandoned the goal of refining local chronologically sensitive typologies once the culture history paradigm fell out of vogue in the 1960s (Dunnell 1986) and 2) most archaeologists continue to submit radiocarbon samples intended to date archaeological sites rather than specific events (like the manufacture and use of a particular hafted biface style or attribute) (see Thompson and Krus [2018] for common pitfalls and best practices). These site-level dates are rarely discussed in terms of their material associations, greatly limiting their utility in resolving questions about change in material culture over time. This problem is particularly acute for the approximately 7,000-year period we refer to as the Archaic, which continues to largely be studied in coarse macrocultural terms such as the "Shell Mound Archaic" or "Riverton Culture." Fortunately, with the adoption of Bayesian modeling (e.g., Bayliss 2015) by archaeologists and the recent creation of a nationwide database for radiocarbon data (Kelly et al. 2022), it is more possible than ever to precisely model changes in hafted biface and other material culture forms over time and space (see Thompson [2019] for an excellent example), particularly if dates are reported in conjunction with detailed, attributes-level analyses like the one provided here.

Unfortunately, Cloe Morris did not record any of the specific locations where he found the hafted bifaces donated to the Taylor Center of Natural History, although we can assume that all or most came from Morris's home and primary area of interest in and around Hamilton County. This lack of provenience information is common to private collections whose owners have passed away and is one of the major limitations of using these kinds of data. Nevertheless, the fact that private collectors often accumulate artifacts from a relatively small area over the course of several decades means that such collections often provide a much more representative sample of artifact variability than would be expected from a collection made by archaeologists in a few weeks or years (e.g., Shott et al. 2024). In the discussion that follows I will interpret the data from the Morris collection as though all the points originated in Hamilton County, although some degree of error is likely. It is my hope that, despite these limitations, the detailed attributes analysis I provide below and in Moore (2022) can contribute raw data useful toward acquiring a higher resolution understanding of projectile point/hafted biface morphologies in Hamilton County and central Indiana. Though beyond the scope of this paper, the ultimate goal is that these data be articulated with a more precise radiocarbon record from the region, thereby contributing to a deeper understanding of the history of the region's indigenous peoples.

Table 1 lists the 77 diagnostic hafted bifaces currently curated as part of the Morris collection by general time period and point cluster, following a modified terminology derived from Justice (1987). As is often the case south of the Great Lakes, the Early Archaic period is overrepresented in the collection. Archaeologists have been debating the meaning of the high frequency of Early Archaic points found across the Midwest and Midsouth for decades, with the consensus generally being that this pattern reflects a combination of factors, including increasing population densities, lower curation and recycling rates, and imprecision in our typologies (i.e., some of the points we call Early Archaic actually date to later time periods) (e.g., Jefferies 2008).

The Morris collection does not include any Clovis, Cumberland, or related point types reflective of the earliest documented Paleoindian occupation of central Indiana. The oldest points include a single late Paleoindian Hi-Lo point made from a heat-treated creamy, white-colored chert similar to Burlington chert, which outcrops in southern Illinois and Missouri (Meyers 1970; Odell 1984; Ray 1982) (Figure 2B), and a late Paleoindian to early Early Archaic Dalton point made from local Fall Creek chert (Figure 2C).

Table 1. Projectile Points by Time Period and Cluster.

Time Period	Calibrated Ages	Cluster	Count
Late Paleoindian	10,500 to 10,000 BC	Hi-Lo	1
		Dalton	1
Early Archaic	10,000 to 7000 BC	Thebes	3
		Kirk Corner Notched	17
		Bifurcate	5
		UID	4
Middle Archaic	7000 to 4250 BC	Large Side Notched	3
		Matanzas	2
		Brewerton	5
		UID	2
Late Archaic	5000 to 1000 BC	Late Archaic Stemmed	3
		Susquehanna	1
		Riverton	2
		Terminal Archaic Barbed	5
		UID	1
Early Woodland	1000 to 200 BC	Early Woodland Stemmed	3
Middle Woodland	200 BC to AD 600	Snyders	3
		Lowe	2
Late Woodland	AD 600 to 1300	Jack's Reef	3
Late Precontact	AD 1000 to 1600	Triangular	11

The Morris collection Hi-Lo point (Figure 2B) exhibits a distinct, short, slightly expanding stem and a concave base with crude basal thinning and heavy basal grinding. The lateral haft margins are only very slightly ground. Overall, the point exhibits relatively crude workmanship, with major hinge and step fractures on both faces, resulting from coarse percussion shaping of the preform. Pressure retouch to the excurvate blade margins is irregular, forming no distinct pattern, and the point's cross-section is asymmetrical. This point is slightly wider and thicker than examples reported from the Hi-Lo type site in Michigan (Justice 1987:243; Table 2).

The Morris collection Dalton point (Figure 2C) is lanceolate in form with a concave base formed by basal thinning, a converging stem, and excurvate blade margins. The point exhibits slight basal and lateral haft grinding and has a twisted cross-section formed by left-hand alternate edge beveling, although one side is bifacially beveled, and the point is also finely serrated. All measurements fall within those reported by Justice from the Brand site in Arkansas (1987:243; Table 2).

Three points in the Morris collection belong to the Thebes Cluster. One is a St. Charles point, characterized by corner notching and a distinctly convex base (Figure 2A), and the other two are broken points that could not be assigned more precisely than to a cluster (Figure 2D-E). Thebes points are typically well-made from large bifacial preforms shaped by large, irregularly placed, shallow percussion flaking and resharpened by pressure flaking that often results in blade serration and/or alternate edge beveling (Justice 1987, 2006).

All three of the Thebes points from the Morris collection are made from local Fall Creek and Liston Creek cherts (Table 3). The St. Charles point is the most complete (Figure 2A). It exhibits deep corner notching formed by the removal of distinct hertzian cone flakes, likely indicating indirect percussion. The point exhibits the diagnostic expanding stem with convex base characteristic of the St. Charles type. The base is slightly ground. Heavily resharpened, one shoulder exhibits a slight barb, while the other is obtuse-angled. The point is lenticular in cross-section. The other two Thebes Cluster points (Figure 2D-E) are barbed and biconvex or approaching biconvex in cross-section. One exhibits a recurvate blade margin and fine serrations.

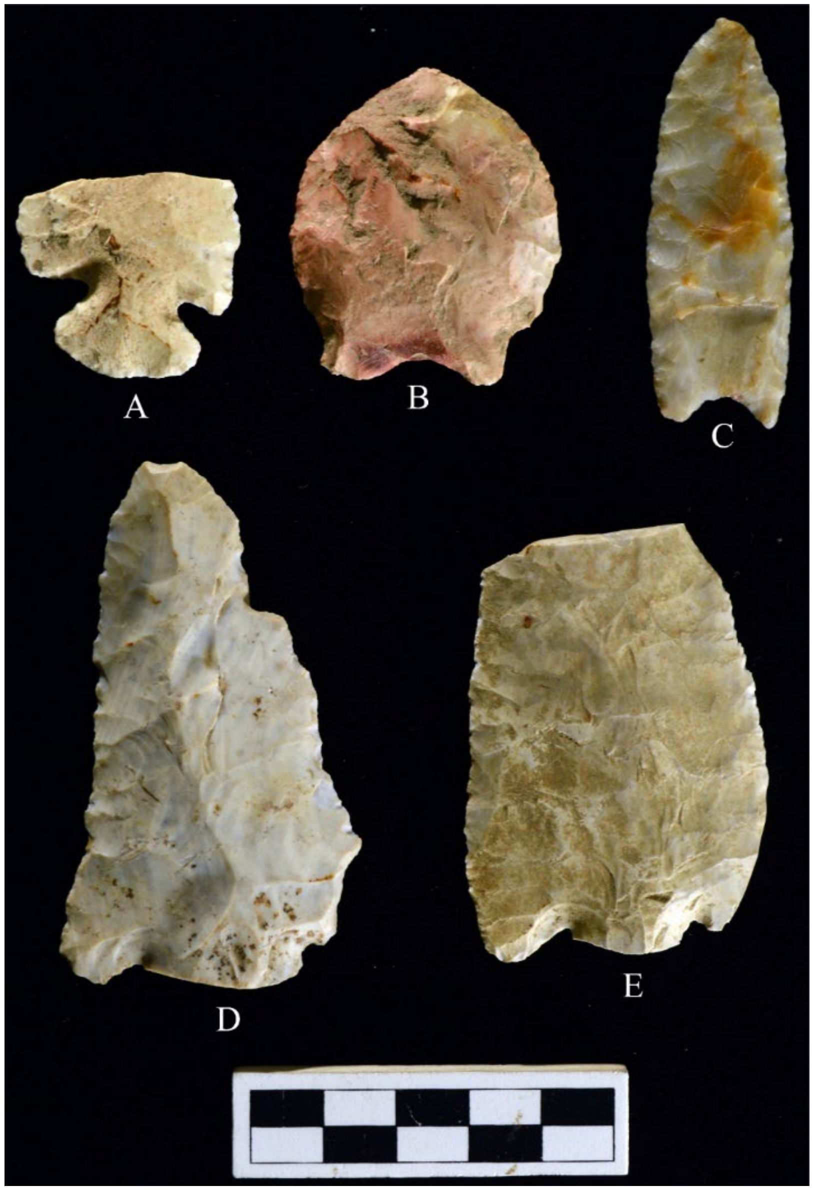

Figure 2. Late Paleoindian (B-C) and Thebes Cluster (A, D-E) Hafted Bifaces.

The Kirk Corner Notched Cluster is the best represented in the Morris collection (Figure 3). According to Justice (2006), Kirk flintknappers often used more pressure flaking relative to their predecessors, resulting in a higher amount of waste and a need for more frequent retooling, a fact that might have contributed to the high number of Kirk points found in the Morris collection and across Indiana more generally.

Table 2. Summary of Metric Data (in mm) by Point Cluster.

Cluster	Ct	Max Length	Max Width	Max Thickness	Blade Length	Haft Length	Base Width	Stem/Notch Width	Blade Midsection Width	Blade Midsection Thickness
Hi-Lo	1	**44.2**	**37.9**	**11.1**	**35.3**	**8.9**	**25.6**	**25.3**	**36.1**	**9.1**
Dalton	1	**57.6**	**20.8**	**6.8**	**40.2**	**17.4**	**20.4**	-	**18.0**	**5.8**
Thebes	3	-	-	-	-	**13.9**	**21**	18.8 (3)	-	-
Kirk Corner Notched	17	39.4 (12)	23.0 (12)	6.7 (16)	32.1 (11)	8.0 (15)	18.4 (11)	14.4 (13)	18.3 (11)	6.3 (11)
Bifurcate	5	27.5 (2)	20.8 (4)	5.5 (4)	20.9 (2)	10.4 (5)	12.4 (5)	11.8 (5)	15.4 (2)	4.9 (2)
Large Side Notched	3	47.4 (2)	27.0 (3)	8.1 (2)	33.2 (2)	14.2 (2)	25.7 (3)	19.5 (3)	16.8 (2)	7.6 (2)
Matanzas	2	37.0 (2)	**21.3**	**6.9**	**29.0**	**13.7**	17.5 (2)	**14.4**	**17.0**	**5.3**
Brewerton	5	42.1 (4)	24.7 (3)	8.5 (5)	25.7 (2)	13.5 (3)	19.8 (4)	17.0 (5)	20.2 (2)	7.3 (2)
Late Archaic Stemmed	3	**55.1**	25.6 (3)	9.0 (3)	55.9 (2)	13.4 (2)	15.8 (2)	15.8 (2)	22.1 (2)	9.6 (2)
Susquehanna	1	**78.5**	**36.7**	**10.4**	**45.3**	**33.2**	**26.2**	**21.6**	**23.7**	**9.8**
Riverton	2	20.0 (2)	11.9 (2)	4.0 (2)	14.8 (2)	5.4 (2)	8.6 (2)	6.4 (2)	10.5 (2)	3.7 (2)
Terminal Archaic Barbed	5	46.1 (2)	26.3 (2)	7.3 (5)	**33.1**	14.5 (3)	18.2 (4)	15.8 (4)	**18.8**	**6.6**
Early Woodland Stemmed	3	**63.8**	36.2 (2)	10.8 (2)	**44.4**	18.0 (3)	17.5 (3)	21.2 (3)	**26.9**	**9.9**
Snyders	3	-	47.3 (2)	9.6 (3)	51.8 (2)	**12.6**	-	19.8 (3)	41.5 (2)	9.6 (2)
Lowe	2	**44.1**	**29.7**	7.3 (2)	30.6 (2)	**14.7**	**21.3**	**17.1**	21.7 (2)	7.0 (2)
Jack's Reef	3	29.9 (2)	17.7 (3)	4.6 (3)	23.0 (2)	8.1 (3)	16.0 (3)	11.3 (3)	16.1 (2)	3.6 (2)
Triangular	11	26.8 (6)	18.3 (10)	4.7 (10)	14.8 (4)	10.6 (6)	18.0 (10)	-	8.9 (4)	3.4 (4)

Note: Bolded numbers indicate measurements on a single point. All other measurements are means, with the count in parentheses after.

Table 3. Distribution of Morris Collection Chert Types by Distance from Source.

Time Period	Point Cluster/ Artifact Type	Local Chert	Non-Local Chert	Exotic Chert
Paleoindian	Hi-Lo	0	0	1
	Dalton	1	0	0
Early Archaic	Thebes	3	0	0
	Kirk Corner Notched	10	7	0
	Bifurcate	2	0	3
	UID	2	1	1
Middle Archaic	Large Side Notched	2	0	0
	Matanzas	2	0	0
	Brewerton	2	0	2
	UID	2	0	0
Late Archaic	Late Archaic Stemmed	2	0	1
	Susquehanna	0	0	1
	Riverton	2	0	0
	Terminal Archaic Barbed	5	0	0
	UID	1	0	0
Early Woodland	Early Woodland Stemmed	3	0	0
Middle Woodland	Snyders	1	0	2
	Lowe	2	0	0
Late Woodland	Jack's Reef	2	1	0
Late Precontact	Triangular	6	2	3
	Humpbacked Knife	1	0	0
Non-diagnostic	UID Point Fragments	1	0	3
	Bifaces	16	1	5
	Bladelets	0	0	1
	Other Chipped Stone	7	0	0

Note: Artifacts made from materials whose distance from source could not be identified are not tabulated here.

Figure 3. Kirk Cluster Hafted Bifaces.

Our understanding of the Kirk Corner Notched Cluster in Indiana suffers from a lack of temporal and technological precision, as archaeologists in the state have drawn on types developed from outside the state to classify points without testing the validity of these types for the region (e.g., Justice 1987). Following the standard typology, seven of the Kirk Corner Notched Cluster points from the Morris collection fall within the generic "catch-all" Kirk Corner Notched type (Figure 3C, G-I, O-Q), while one is an asymmetrical-bladed Charleston Corner Notched point (Figure 3K); two are Palmer Corner Notched points (Figure 3D, F), identified by their small size and heavy basal grinding; and one is a Pine Tree Corner Notched point with diagnostic incurvate blade margins (Figure 3J). The other six points are too fragmentary or heavily reworked to assign to a type following Broyles (1971) and Justice (1987) (Figure 3A-B, E, L-N).

Types such as these may be valid in the Southeast, but they should be considered tentative when applied to Indiana assemblages like the Morris collection. The only way to validate or refute the applicability of the Southeastern Kirk typology to Indiana is to isolate secure, datable Kirk contexts and provide detailed, attribute-based analyses of these points that will elucidate any temporal, technological, functional, or other variability of typological significance.

In what follows, I provide a detailed description of the Morris collection Kirk assemblage. I have provided attributes of individual points in Moore (2022).

The 17 points from the Morris collection are smaller than the Kirk Cluster points reported in Justice (1987:245; Table 2). Interestingly, the Morris collection Kirks are made predominately of local UID Glacial (n = 3), Fall Creek or Fall Creek-like (n = 3) and Liston Creek (n = 4) cherts or non-local Attica/Sugar Creek (n = 7) chert (Table 3). While the preference for Attica is consistent with Moore (2008), the lack of Wyandotte or other exotics is surprising considering the larger home range of Kirk peoples identified by Cantin (2000).

Variation in attributes across the Morris collection Kirk Corner Notched Cluster points suggests some degree of variability within the assemblage that is not captured by the Southeastern typology. Morris collection Kirk bases range from concave (n = 5) to straight (n = 5), to slightly convex (n = 1) or convex (n = 4), with one point base identified as irregular in form. Additional basal attributes include two points marked by basal thinning (including one with deep or "scoop" basal thinning), one with a bifacially beveled base, and one that exhibits possible burination on one side of the base, with the other side remaining unfinished, suggesting the burination may be an unintentional manufacturing error or use damage. Burination involves striking an object along its edge to remove a flake perpendicular to the usual striking plane. On points, this removes the striking platforms for basal thinning flakes and creates a slightly thicker, flat base.

All the Kirk Corner Notched Cluster points in the Morris collection exhibit corner-notching with an expanding stem, traits that are diagnostic of the cluster. However, variation in hafting methods is suggested by the fact that six points exhibit no basal grinding, and another seven points exhibit heavy (n = 6) or very heavy/obliterated (n = 1) basal grinding. Four points fall in between with very slight (n = 1) to slight (n = 3) basal grinding.

Similarly, six Kirk points exhibit no lateral haft grinding, while seven exhibit heavy (n = 6) to obliterated (n = 1) lateral haft grinding. One point has very slight and three slight lateral haft grinding. Typically, the degree of basal and lateral haft grinding are the same, with points exhibiting heavy basal grinding also having heavy lateral haft grinding. However, one point typed as Kirk Corner Notched has heavy basal grinding and only slight lateral haft grinding, while another Kirk Corner Notched Cluster point of unidentified type has slight basal grinding but obliterated lateral haft grinding.

Variation within the collection continues when examining blade attributes. Examining individual blade margins, the 17 Kirk Corner Notched Cluster points from the Morris collection have 34 potential blade margin attributes. Of these, twelve are excurvate, eight are amorphous (are irregular in outline), five are recurvate, three are incurvate (including both blades of the Pine Tree point), and two are straight-sided. Four points have broken blades that could not be classified.

Barbs are common on Kirk Corner Notched Cluster points, with five examples from the Morris collection having distinctive barbs and another five having diminutive barbs. The remaining points had rounded (n = 1), acute-angled (n = 3), one obtuse and one acute-angled (n = 1), and broken (n = 1) shoulders.

Cross-sections typically reflect the higher quality manufacture and greater attention to blade thinning characteristic of Early Archaic points. Eight points have twisted (n = 6) or twisted/rhomboidal (n = 2) cross-sections indicative of the use of alternate edge beveling (n = 7 left and 1 right-hand) to resharpen these points. Two points have hexagonal cross-sections resulting from the use of fine, parallel pressure flaking to bifacially resharpen blade margins. Two points exhibit biconvex cross-sections, one has a lenticular cross-section, and four have asymmetrical cross-sections, often formed by hinge scars or other production mistakes or use damage and resharpening. Six of the Kirk Corner Notched Cluster points exhibit fine serration, and two have been coarsely serrated.

Evidence of the initial reduction of the flakes and preforms used to manufacture the Morris collection Kirk Corner Notched Cluster points is largely obliterated by later pressure flaking. Of those points with percussion flake scars evident, five exhibit fine but irregular percussion thinning, one has evidence of fine-parallel percussion, and three are marked by deeper thinning flake scars indicative of coarse-irregular thinning. Only three Morris collection points have slight median ridges.

Pressure flaking was heavily utilized by Kirk peoples, and this is evident in the Morris assemblage. Kirk pressure flaking was typically controlled and regular, resulting in a pattern of parallel (n = 6) or parallel-oblique (n = 6) pressure flake scars. Five examples exhibit an irregular pressure flaking pattern. Kirk flintknappers also used pressure flaking to notch their points, as all 17 of the Morris collection examples have small, circular (hertzian) pressure flake scars within their notches.

Bifurcate Cluster points from the Morris collection include one point classified as a MacCorkle Stemmed (Figure 4A), three Lake Erie Bifurcated Base points (Figure 4C-E), and one Bifurcate Cluster point that could not be associated with a named type (Figure 4B). The MacCorkle Stemmed point is made from Upper Mercer chert from Ohio (or possibly Dark Holland chert from southern Indiana). This point is identified as a MacCorkle based on the presence of rounded basal ears. Justice (1987) notes that MacCorkle points typically exhibit heavy basal grinding, but no grinding is present on either the base or the lateral haft element of the Morris collection example. The point was originally well-made through the use of fine-irregular percussion flaking to thin the blade, and it is possible that the break at the tip occurred during the final stages of manufacture (also explaining the lack of haft grinding). This breakage runs along one blade margin, making it impossible to discern the blade cross-section, but it was likely lenticular or plano-convex.

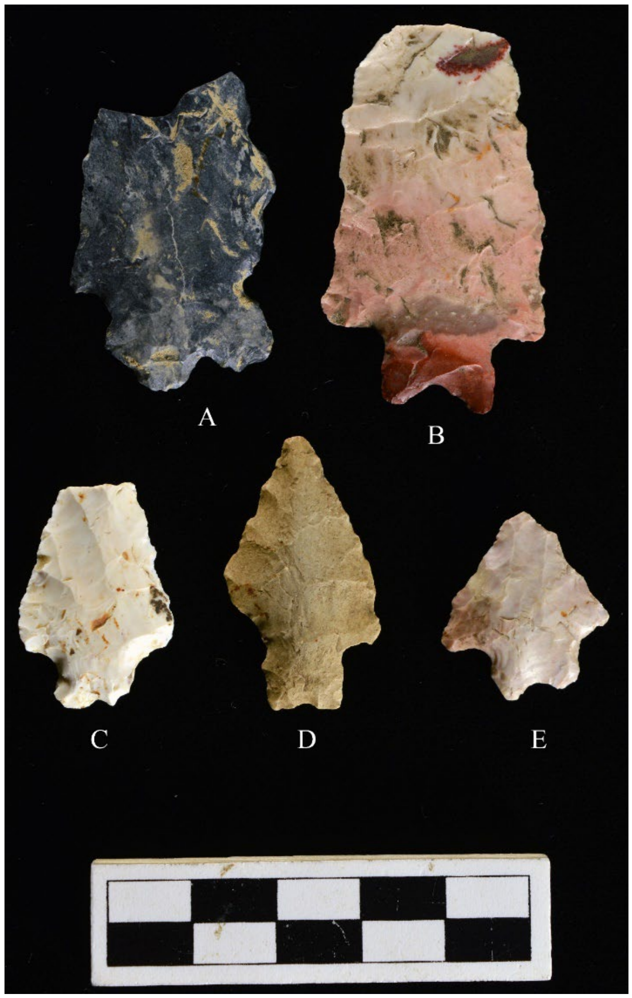

Figure 4. Bifurcate Cluster Hafted Bifaces.

The other four Bifurcate Cluster points from the Morris collection are manufactured from Burlington-like (n = 1), Jeffersonville-like (n = 1), and Liston Creek cherts (n = 2) (Table 3). The three shorter points (Figure 4C-E) all exhibit the long, narrow stems, short bifurcations, and triangular blades characteristic of Lake Erie Bifurcated Base points. Other than the bifurcations, base attributes are inconsistent and include basal thinning (n = 1) bifacial beveling (n = 1), and unifacial beveling (n = 1), of an expanding (n = 1), straight (n = 2), or asymmetrical (n = 1) stem. Basal and lateral haft grinding ranges from absent (n = 2) to very slight (n = 1), to slight (n = 1). One Lake Erie point exhibits a rhomboidal/twisted cross-section resulting from alternate edge (left-hand) beveling. The other three points have lenticular (n = 2) and plano-convex (n = 1) cross-sections. Blades are variable in form, likely due to resharpening. The larger, unidentified Bifurcate point exhibits coarse serration and some parallel pressure flaking, and one of the Lake Erie points also exhibits parallel pressure flaking. Basal notch depths range from 0.8 to 1.5 mm on the Lake Erie points. The remaining point has a basal notch depth of 2.9 mm. Metric data are consistent with Bifurcate points from the St. Albans site in West Virginia provided by Justice (1987:246; Table 2).

Four points in the Morris collection have attributes indicative of the Early Archaic time period but are too fragmentary to assign to a specific cluster or type. These points are made from UID Glacial (n = 1), UID Fossiliferous (likely Harrodsburg or Allen's Creek) (n = 1), Liston Creek (n = 1), and probable Attica/Sugar Creek (n = 1) cherts (Table 3). One exhibits fine serration, and two exhibit alternate edge beveling (one right-hand and one left-hand). Parallel pressure flaking is present on two of these unidentified points, and one exhibits oblique-parallel pressure flaking.

To date, the Large Side Notched Cluster is the most widely documented Middle Archaic hafted biface cluster in Indiana and the Ohio River valley. These points, often assigned to the Raddatz or Godar types after the Raddatz Rockshelter in Wisconsin (Wittry 1959) and the Godar site in Illinois (Titterington 1950), are medium-sized points manufactured from trianguloid preforms through a combination of percussion and pressure flaking.

All three Large Side Notched Cluster points from the Morris collection are squared-stemmed, side-notched Raddatz-like points (Figure 5C-E). One is manufactured from local Liston Creek chert, one is made from local Fall Creek quartzite, and the third is burned to the point that the chert type cannot be identified macroscopically (Table 3). Two of the points are well made, lacking median ridges and exhibiting fine-irregular percussion flaking scars (Figure 5D-E). These two points have biconvex (n = 1) and asymmetrical (n = 1) cross-sections. The other point exhibits coarse-irregular percussion flaking, lacks a median ridge, and has an asymmetrical cross-section that approaches diamond-shaped (Figure 5C). Blades and bases are variable in form, but three blades were shaped and/or resharpened with irregular pressure flaking. Shoulders lack barbs and are acute-angled in five cases and obtuse-angled in one. All three points exhibit some degree of basal thinning and slight basal grinding. Two exhibit heavy lateral haft grinding, while the lateral haft grinding on the third is slight. One of the well-made points exhibits a slight left-hand bevel, while the more coarsely made point has a bifacially beveled blade. Metric data indicate the Morris collection Large Side Notched points are very similar in size to Raddatz points from the Raddatz Rock Shelter in Wisconsin and the Richardson site in Illinois (Justice 1987:244-245; Table 2).

The late Middle to Late Archaic transition in the Ohio River valley and central Indiana is marked by the Matanzas and Brewerton Clusters, which, like Large Side Notched Cluster points, are commonly recovered from Ohio River shell midden sites (e.g., Bader 2021). Matanzas points, defined by Munson and Harn (1966) based on points recovered from the West Matanzas site (11F1114) in Fulton County, Illinois, likely represent a continuation of Large Side Notched Cluster point technology and, like them, are medium-sized points manufactured on trianguloid preforms, often from lower grade, locally available gravel- or glacially derived cherts. At large Ohio valley midden sites, Large Side Notched Cluster points grade into Matanzas forms, which are differentiated from the former primarily by the presence of wider, shallower notches placed very low on the preform (Justice 1987). Many points identified as Brewerton Side Notched in the Ohio valley are identical to Matanzas forms, although a distinctive Brewerton Corner Notched form, identified by corner notching on relatively thick, wide-bladed points with wide shoulders that extend beyond the ears, also occurs (Justice 1987). The relationship between these two clusters in Indiana is currently unknown as both commonly co-occur on the same sites.

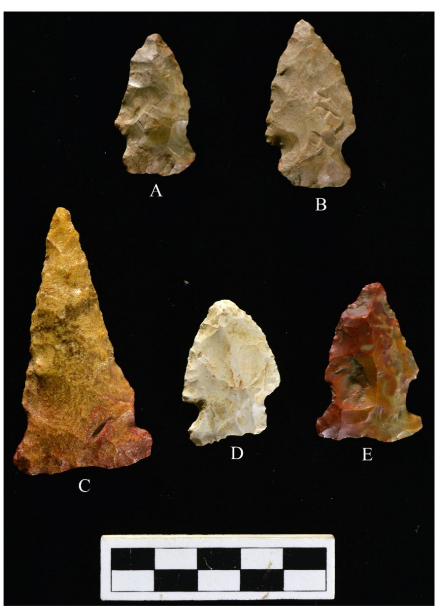

Figure 5. Large Side Notched (C-E) and Matanzas (A-B) Cluster Hafted Bifaces.

Two Matanzas Cluster points are present in the Morris collection (Figure 5A-B). These points are shorter than those reported from Koster and other sites in Illinois (Justice 1987:248), but are otherwise similar in size (Table 2). The points are made from local cherts; one is possibly Fall Creek and the other is burned but is either Fall Creek or Liston Creek chert (Table 3). Both points exhibit straight bases and side notches that create expanding stems. One has slight basal and lateral haft grinding, and the other exhibits basal thinning with heavy basal and lateral haft grinding. Both points lack a median ridge, but one is well thinned via fine-irregular percussion flaking, while the other exhibits coarse-irregular percussion flaking. Both points have been shaped and/or resharpened via irregular (non-patterned) pressure flaking, leaving both excurvate (n = 1) and incurvate/excurvate (n = 1) blade margins. Both points exhibit acute-angled shoulders, and one shoulder of one point exhibits a slight barb. Cross-sections are asymmetrical (n = 1) and biconvex (n = 1).

All five Brewerton Cluster points from the Morris collection are of the Brewerton Corner Notched type (Figure 6A, C-F). These points are smaller than those reported from the Brewerton type site and other sites in New York but longer than Brewerton points reported from the Mixter site in Ohio (Justice 1987:247-248; Table 2). One Brewerton point is made from Fall Creek chert, two from Burlington-like chert, one from UID local chert (Fall Creek, Liston Creek, or UID Glacial), and one is an unidentified burned chert (Table 3). Two points have cortex remaining – one on the base and one on the blade – illustrating the overall lower quality of workmanship evident in late Middle and Late Archaic points in the region. Nevertheless, none of the Brewerton points have a median ridge.

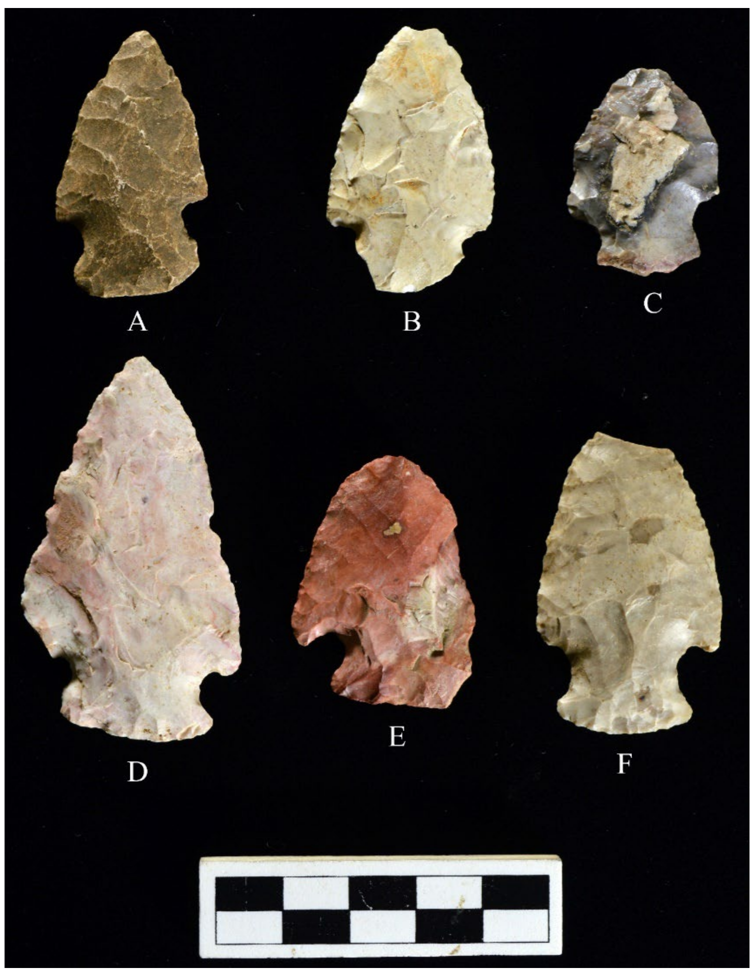

Figure 6. Brewerton (A, C-F) and Possible Brewerton (B) Cluster Hafted Bifaces.

The presence of Brewerton points made from Burlington-like chert is intriguing, since Brewerton points are more typically associated with sites to the east. It is possible that the Morris collection Brewerton points are actually a variant of Snyders Cluster point that mimics Late Archaic Brewerton points or that the Burlington-like chert these points are made from are a variant of Laurel or an unidentified local chert. In either case, more research is warranted to more specifically identify the age of Brewerton (or Brewerton-like) points in central Indiana and the origins of Burlington-like chert in the region.

The hafting elements of Brewerton points from the Morris collection are consistent in form. Three exhibit a convex base, and two have straight bases; the corner notching of four create expanding stems, while the fifth point has a squared stem. Three exhibit basal thinning. Grinding is present on all five points, with four exhibiting slight basal grinding and one heavy basal grinding. Three exhibit slight and one very slight lateral haft grinding.

Like Matanzas points from the Morris collection, blades of Brewerton points are highly variable in form, with most blade margins being amorphous (n = 5) or excurvate (n = 3). One blade edge is straight and the other broken. Preforms were shaped via a combination of coarse-irregular (n = 2) and fine-irregular (n = 2) percussion, resulting in biconvex (n = 2) and asymmetrical (n = 2) cross-sections. Blade edges exhibit irregular (n = 3), parallel (n = 1), and parallel-oblique (n = 1) pressure flaking, resulting in coarse serration in one case and fine serration in another. Corner notches on all points were formed through the removal of relatively large circular (hertzian) percussion flakes.

Two point fragments in the Morris collection date to the Middle to Late Archaic period but could not otherwise be identified as to cluster or type. One is possibly a Brewerton Corner Notched point (Figure 6B). One is Liston Creek chert, and the other is burned but probably Fall Creek chert. The possible Brewerton point is 25.3 mm wide and 7.0 mm thick. This point is corner notched with heavy basal grinding, an asymmetrical cross-section, excurvate blade margins, and one slight barb and one rounded shoulder. The other point is highly fragmentary but exhibits fine-irregular percussion flaking, irregular pressure flaking, and a slight median ridge (Figure 7E).

The Late Archaic Stemmed Cluster is perhaps the most generic and imprecise of Justice's (1987) projectile point clusters; much could likely be learned by more detailed, attributes-based studies of these points. In general, Late Archaic Stemmed Cluster points are crudely made forms with relatively short, squared or rounded, unground stems. Similar to Middle Archaic side-notched forms, Late Archaic flintknappers typically utilized low-to-medium grade, locally available cherts, including gravel- and glacially derived materials (Cantin 1989; Moore 2008; Tomak 1981), to make these points, even in places where higher quality raw materials were readily available (e.g., Edler 1976).

Late Archaic Stemmed Cluster points in the Morris collection include one Karnak-like point (Figure 7C), one McWhinney Heavy Stemmed point (Figure 7A), and one probable McWhinney point with a broken base (Figure 7B; Table 2). The Karnak-like point is made from Liston Creek chert and has an expanding stem with a straight base that exhibits basal thinning, very slight basal grinding, and slight lateral haft grinding. The blade is excurvate and exhibits coarse-irregular percussion scars that resulted in a slight median ridge, a right-hand bevel, and a twisted cross-section. The shoulders are obtuse-angled on one side and upswept on the other, and the blade was finished and/or resharpened by irregular pressure flaking.

The McWhinney Heavy Stemmed point is made from Fall Creek chert and exhibits slight side-notching, resulting in the rounded stem with convex base diagnostic of the type. The base also exhibits a snap fracture. The entire stem is unground. The blade was initially shaped via coarse-irregular percussion. The blade shape is amorphous with a slight median ridge, and the blade edges exhibit irregular pressure flaking that resulted in bifacial beveling and an asymmetrical cross-section that approaches hexagonal. One side of the shoulder is slightly barbed, and the other is obtuse-angled.

The third Late Archaic Stemmed Cluster point is probably a McWhinney Heavy Stemmed, but the base is broken so it cannot be assigned definitively to a type. The point was shaped via coarse-irregular percussion and finished and/or resharpened via irregular pressure flaking, resulting in a plano-triangular cross-section reflective of a marked median ridge. Both blade margins are excurvate, and the shoulder is obtuse-angled.

The single Susquehanna point from the Morris collection (Figure 7D; Table 2) is made from an exotic chert type that resembles Zaleski Chert from southeastern Ohio (DeRegnaucourt and Georgiady 1998), suggesting it was either traded into the region by Late Archaic peoples or Morris obtained it from outside of Hamilton County. Susquehanna points are a broad-bladed type marked by a trianguloid blade, expanding stems, and distinctive, upswept shoulders (Justice 1987). The Morris collection Susquehanna point exhibits a convex base, slight basal and lateral haft grinding, a biconvex cross-section, one slightly recurvate and one amorphous blade margin, and evidence of fine-irregular percussion flaking and irregular pressure flaking.

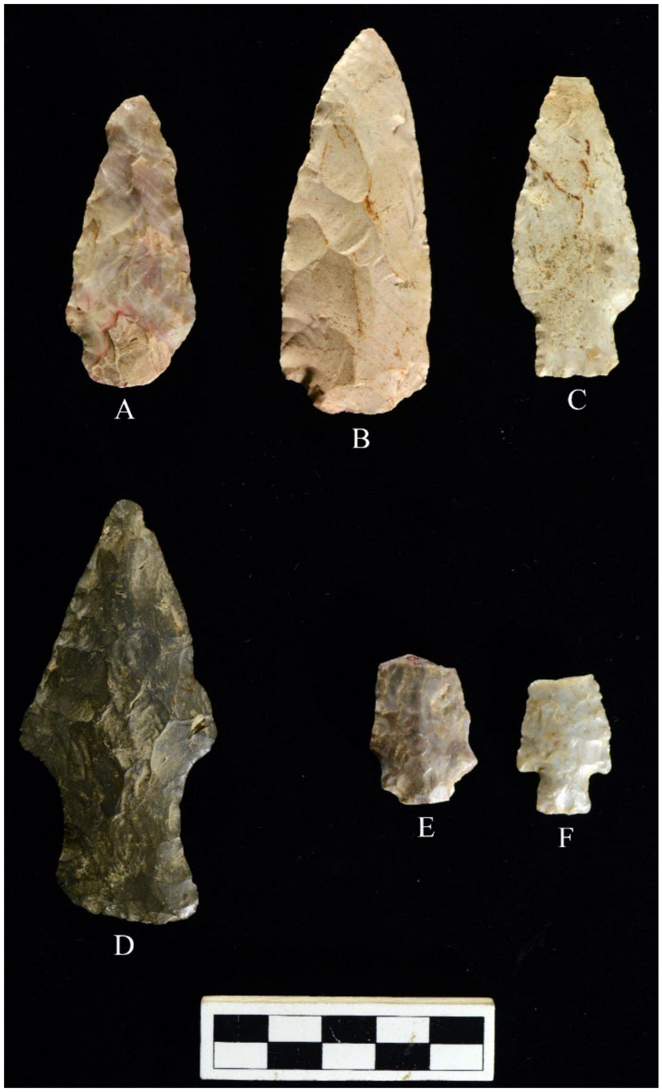

Figure 7. Late Archaic Stemmed Cluster (A-C), Susquehanna (D), and Unidentified Middle to Late Archaic (E-F) Hafted Bifaces.

The Riverton Culture in the lower Wabash River valley is a terminal Late Archaic culture marked by a small tool lithic tradition, large shell and dirt/rock middens (Winters 1969), a fully developed system of low-level food production (Smith and Yarnell 2009), a high level of interpersonal violence (Mocas and Simpson 2021; Schmidt et al. 2010), and a well-developed bone and antler tool technology (Moore 2017; Winters 1969).

Riverton points are very small forms that range from side and corner-notched to stemmed and that include small flakes that have been incompletely worked into one of these forms (Justice 1987). In fact, these points are so small that Bradbury (1997) argued they represent the first appearance of the bow-and-arrow in the Ohio valley. While Winters (1969) differentiated between the Merom and Trimble types, Tomak's (1982) study of Riverton points from west-central Indiana convincingly demonstrated that these types grade into one another such that differentiating between them has no temporal or cultural meaning.

The two Riverton points from the Morris collection are made from local UID Glacial chert (Figure 8A-B; Table 3). One is side-notched and the other corner-notched, and the bases of both are straight (one base is bifacially beveled). Both points lack basal grinding, but one exhibits slight lateral haft grinding. The corner-notched example exhibits an expanding stem, while the other is asymmetrical. Cross-sections of both are asymmetrical, and both blades were shaped through the removal of irregularly patterned pressure flakes that resulted in serrations. One exhibits an amorphous blade shape, while the other has excurvate blade margins. The Morris collection Riverton points fall within the low range of variation exhibited by Riverton points from the Riverton and Robeson Hills type sites in Illinois (Justice 1987:249; Table 2).

Terminal Archaic Barbed Cluster points represent a break from the lower quality points of the Late Archaic, resulting in part from a return to the selective use of Wyandotte chert and other higher grade raw materials (e.g., Mocas and Simpson 2021; Tomak 1990). Terminal Archaic Barbed Cluster points are defined by well-thinned, trianguloid blades with straight to excurvate blade margins and distinctive, downward-projecting barbs; lenticular to biconvex cross-sections; and straight, parallel-sided stems that sometimes exhibit snap-fractured bases (Justice 1987; Tomak 1990).

Figure 8. Riverton (A-B) and Terminal Archaic Barbed (C-G) Cluster Hafted Bifaces.

Only one of the five Terminal Archaic Barbed Cluster points from the Morris collection is complete (Figure 8C-G). Those from which measurements could be obtained are consistent with the Delhi, Wade, and Buck Creek Barbed points reported by Justice (1987:252-253; Table 2). Interestingly, all five Terminal Archaic Barbed Cluster points from the Morris collection are made from local cherts, including Liston Creek (n = 3), possible Liston Creek (n = 1), and possible Fall Creek (n = 1) (Table 3).

One of the Terminal Archaic Barbed Cluster points can be classified as a Delhi point on the basis of its squared stem and finely serrated blade (Justice 1987) (Figure 8F). This point exhibits a convex base with basal thinning, lacks basal and lateral haft grinding, and has a straight stem and plano-convex cross-section. The preform was initially shaped via coarse-irregular percussion and resharpened by irregular pressure flaking that resulted in fine serrations and one slightly incurvate and one slightly recurvate blade margin. The tip has been removed by an impact fracture. Neither this nor any of the other Terminal Archaic Barbed Cluster points exhibit a median ridge.

Another Terminal Archaic Barbed Cluster point exhibits the wide, deeply notched barbs indicative of the Wade type (Justice 1987) (Figure 8G). This point has an expanding stem with a convex base exhibiting very slight basal grinding and no lateral haft grinding. The preform was shaped via coarse-irregular percussion that resulted in an asymmetrical cross-section. Irregular pressure flaking was used to shape and/or resharpen the blade. The stem and barbs were formed via the removal of large, circular (hertzian cone) flakes using a corner-notching technique.

The Buck Creek Barbed-like point also was shaped by coarse-irregular percussion flaking and irregular pressure flaking, but this point is very thin, and exhibits a lenticular cross-section (Figure 8C). The point is stemmed with a broken base and lacks lateral haft grinding. One blade margin is excurvate and the other is amorphous.

The remaining two Terminal Archaic Barbed Cluster points could not be attributed to a named type. Both exhibit unmodified striking platforms on their bases. One is corner-notched and has a stem that exhibits an unusual double notch (Figure 8D). This point was shaped via coarse-irregular percussion and irregular pressure flaking, exhibits a biconvex cross-section, excurvate blade margins, and lacks basal or lateral haft grinding. The other is expanding stemmed and was shaped via fine-irregular percussion and irregular pressure flaking (Figure 8E). It exhibits a hexagonal cross-section resulting from bifacial blade beveling, recurvate blade margins, and slight basal and lateral haft grinding. The barbs of this point were formed by the removal of small, bifacial hertzian cone notching flakes.

One small, slightly expanding stemmed point from the Morris collection likely dates to the Late Archaic period but could not otherwise be assigned to a type (Figure 7F). This point is made from Fall Creek chert and measures 18.1 mm wide and 5.7 mm thick. It has a straight base, exhibits basal thinning, and is heavily ground on both the base and lateral haft element. The point lacks a median ridge but is barbed and has a trapezoidal cross-section and an incurvate/excurvate blade margin. No evidence of percussion flaking remains, but irregular pressure flaking resulted in a unifacial beveling of the blade. The stem and barbs were formed by the removal of small circular (hertzian cone) notching flakes.

Early Woodland Stemmed Cluster Robbins points are broad-bladed, straight-stemmed points with excurvate blade margins and well-defined shoulders (Justice 1987). These points are typically associated with Late Adena contexts in Ohio and Kentucky, where they are found alongside Adena Plain pottery (Carskadden 2008; Schweikart 2008; Seeman 1992). In east-central Indiana, these points are considered diagnostic of the Middle Woodland New Castle Phase, which includes grit-tempered New Castle pottery and artifacts originating from both the Adena and Hopewell interaction spheres (McCord and Cochran 2014).

Three Early Woodland Stemmed Cluster Robbins-like points are included in the Morris collection (Figure 9). They are made from Liston Creek (n = 2) and possibly Fall Creek (n = 1) chert (Table 3). They are comparable in length and width but are slightly thicker than the twelve Robbins points from the Cresap Mound reported in Justice (1987:253; Table 2). All three are stemmed with convex bases and excurvate blade margins, and all three were shaped by fine-irregular percussion flaking, resulting in biconvex cross-sections.

Figure 9. Early Woodland Stemmed Robbins-like Points.

One point retains waterworn cortex at the base, which is more consistent with the Terminal Archaic Barbed Cluster; however, an attempt has been made to thin the base using the cortex as a platform, and this may have been abandoned due to the presence of a quartz-filled stress fracture. The base of one of the other Robbins-like points also exhibits basal thinning, while the third has a bifacially beveled base. Basal grinding is absent on two of the points but heavy on the third; lateral haft grinding ranges from very slight (n = 1), to slight (n = 1), to heavy (n = 1).

The stems of the three points are somewhat variable, ranging from ovate (n = 1), to straight (n = 1), to converging (n = 1). Two have squared shoulders, while the third is slightly barbed on one side and obtuse-angled on the other. The barbs of this point were created by the removal of large, deep flakes from one side and smaller percussion flakes from the opposite side. Two points exhibit irregular pressure flaking along the blade margins, while the third exhibits parallel pressure flaking.

Snyders points are typically associated with Middle Woodland Hopewell contexts in the Midwest. They are broad-bladed points manufactured from ovate preforms and are characterized by wide corner notches created by indirect percussion, which leaves broad, hertzian cone flake scars that are often pressure retouched (Justice 1987).

Researchers have noted a clear preference for certain kinds of cherts by the indigenous flintknappers who made Snyders points. They are often made of imported Burlington chert from southern Illinois and northern Missouri or high-quality Wyandotte chert from southern Indiana at Goodall Phase sites (Mangold and Schurr 2006) and in the middle Wabash River valley (Moore 2008). Tomak (1970, 1983) noted a preference for Burlington chert at Worthington Phase sites in the lower Wabash, while Seeman (1975) identified a preference for Wyandotte in southern Indiana. Blosser (1996), on the other hand, found a preference for Ohio Flint Ridge and Upper Mercer cherts at the Whitacre site, possibly reflecting this site's closer connections with Ohio Hopewell (Blosser 1996).

The three Snyders points from the Morris collection are made from Liston Creek (n = 1), Wyandotte (n = 1), and Burlington (n = 1) cherts (Figure 10C-E). All three are broken but are comparable in size to Snyders points from Illinois (Justice 1987:254; Table 2). All three points are well-made using fine-irregular percussion flaking and irregular pressure flaking that did not result in a median ridge. Cross-sections vary from lenticular (n = 1), to plano-convex (n = 1), to asymmetrical (n = 1). All three are barbed and exhibit excurvate blade margins. Two exhibit evidence of the removal of broad notching flakes using indirect percussion. The one nearly complete point is expanding stemmed with a straight base that exhibits basal thinning, very slight basal grinding, and heavy lateral haft grinding.

Figure 10. Snyders (C-E) and Lowe (A-B) Cluster Hafted Bifaces.

Lowe Cluster points are well-made expanding stemmed points that are diagnostic of the Middle Woodland Mann Phase in southwestern Indiana (Doperalski 2017; Ruby 2006) and the Middle to Late Woodland Allison-LaMotte culture in the lower Wabash River valley (Higginbotham 1983; Redmond and McCullough 2000; Tomak 2021; Tomak 1970, 1983). In the Falls region, Lowe points post-date Snyders points and are associated with clay-tempered sherds at the Custer site (Mocas 2021). In southeastern Indiana and north-central Kentucky they are diagnostic of the Late Woodland Newtown Phase (Seeman 1992). Like Snyders points, Lowe points are often made from high-quality raw materials, particularly Wyandotte chert (Doperalski 2017; Mocas 2021; Tomak 2021).

Interestingly, the two Lowe Cluster points from the Morris collection are both made from local Liston Creek chert. One of these points exhibits an expanding stem that was created by the same indirect percussion and pressure retouch technique found in Snyders points, a characteristic of the Steuben Expanding Stem type (Justice 1987) (Figure 10A). This point measures 44.1 mm long, 29.7 mm wide, and 7.8 mm thick (Table 2). The point has an irregularly shaped base marked by basal thinning, with slight basal grinding and heavy lateral haft grinding. The blade is excurvate, with one slightly barbed shoulder and one obtuse-angled shoulder. The blade was shaped via fine-irregular percussion and irregular pressure flaking. It lacks a median ridge and exhibits a biconvex cross-section.

The second Lowe Cluster point exhibits the parallel, bifacial marginal blade retouch and resulting hexagonal cross-section diagnostic of the Lowe Flared Base type (Justice 1987) (Figure 10B). Only a 6.7 mm thick fragment of the point remains (Table 2). The fragment exhibits one rounded and one obtuse-angled shoulder and excurvate blade margins. The point was shaped via fine-irregular percussion flaking and lacks a median ridge.

Jack's Reef Cluster points are small, very thin, notched points modified from flakes via an irregular (unpatterned) pressure flaking technique (Justice 1987). These points represent the first true arrowheads in the Midwestern United States, signaling a major shift in both hunting technologies and strategies of conducting warfare (Blitz 1988).

The Morris collection Jack's Reef Cluster points include one side-notched Raccoon Notched point (Figure 11C) and two Jack's Reef Corner Notched points (Figure 11A-B). The Raccoon Notched point is unusually thick (6.4 mm) due to an error in thinning that resulted in multiple, overlapping step fractures. Otherwise, the Morris collection points are comparable to those from New York and Ohio described in Justice (1987:255; Table 2). The Raccoon Notched point is made from possible Fall Creek chert, while one Jack's Reef Corner Notched point is made from Fall

Creek or Liston Creek (UID local) chert and the other from Attica/Sugar Creek chert. The latter point appears to have been resharpened following an impact fracture.

All three points were thinned via a combination of irregular percussion and pressure flaking. The step fractures on the Raccoon Notched point result in an asymmetrical cross-section; the other two points have lenticular cross-sections. The Raccoon Notched point has a squared stem and irregularly shaped base marked by basal thinning and very slight basal and lateral haft grinding. The shoulders are squared on one side and obtuse-angled on the other, and the blade is excurvate on one side and truncated (half of a pentagon) on the other. The blade exhibits fine serration.

Figure 11. Jack's Reef (A-C) and Small Triangular (D-G, I-M) Cluster Hafted Bifaces and a Humpbacked Knife (H).

The two Jack's Reef Corner Notched points have concave bases. One has a squared stem and the other stem is expanding. Both exhibit basal thinning. One has very slight basal and lateral haft grinding, while the other has slight lateral haft grinding and no basal grinding. Both points are slightly barbed, with one having one obtuse-angled shoulder. One point is fully pentagonal, while the other is truncated (half of a pentagon) along one blade margin and amorphous along the other. The fully pentagonal point exhibits fine serration.

Small Triangular Cluster points are ubiquitous throughout the eastern Woodlands. These consist of small triangles manufactured from thin flakes via pressure retouch (Justice 1987). Originating in the later part of the Late Woodland, Small Triangular Cluster points are the dominate point type of the Albee Phase (McCord and Cochran 2003) and all Late Precontact phases in Indiana, including Angel (Black 1967), Caborn-Welborn (Pollack 2004), Vincennes (Wells 2008; Winters 1967), Castor (McCullough and Graham 2010), Oliver (McCullough 2000), Anderson, Madisonville (Moore and Raymer 2014), Fisher/Huber (Faulkner 1972), and Taylor Village (McCullough 2009).

Table 4. A Summary of the Railey (1992) Small Triangular Point Typology.

Type	Diagnostic Type Traits	Common Type Traits	Temporal Range	Sources
Railey Type 1 Fine Triangular: Small, Tri-Incurvate	Small with incurvate blades and incurvate bases		Non-diagnostic, potentially Early Fort Ancient	Henderson 2008, Railey 1992
Railey Type 2 Fine Triangular: Flared Base	Flared convex to straight bases, incurvate blades	Well made to delicate	Early to Middle Fort Ancient	Railey 1992
Railey Type 2.1 Fine Triangular: Basal Ears	Flared convex to straight bases with distinctive ears, incurvate blades		Early Fort Ancient	Henderson 2008
Railey Type 3 Fine Triangular: Coarsely Serrated	Coarsely serrated with straight to nearly parallel blade margins, straight to convex base	Same as Type 5 but coarsely serrated	Middle Fort Ancient	Railey 1992
Railey Type 3.1 Fine Triangular: Finely Serrated	Finely serrated with straight to nearly parallel blade margins, straight to convex base	Same as Type 5 but finely serrated	Late Early to Early Middle Fort Ancient	Henderson 2008
Railey Type 4 Fine Triangular: Short, Excurvate	Less than 25 mm in length with excurvate blade margins and straight to convex bases	Bases can be concave. Most Type 4s are symmetrical and well made, but some are crude.	Late Fort Ancient (peak popularity in late Late FA)	Pollack et al. 2012, Railey 1992
Railey Type 5 Fine Triangular: Straight Sided	Straight blade margins with straight to very slightly convex bases	Parallel blades or expanding bases, angular to somewhat rounded basal ears. Type 5s range from crude to well-made with lenticular to biconvex cross-sections.	End of Early to throughout Late Fort Ancient	Pollack et al. 2012, Railey 1992
Railey Type 6 Fine Triangular: Concave Base	Concave bases, straight or excurvate blade margins, narrow to medium basal widths	Parallel blades or expanding bases, acute to slightly rounded ears. Types 6s range from crude to well-made with lenticular to biconvex cross-sections.	Late Fort Ancient (peak popularity in late Late FA)	Pollack et al. 2012, Railey 1992
Railey Type 7 Fine Triangular: Thick, Wide Base	Thick with biconvex or diamond-shaped cross-sections, symmetrical with circumferential retouch		Non-diagnostic	Railey 1992
Railey Type 8 Fine Triangular: Deeply Concave Base	Deeply concave base, very thin, extremely long		Late Fort Ancient	Henderson 2008

While Justice (1987) assigns Small Triangular points to named types utilized throughout the Eastern Woodlands, Fort Ancient researchers in the Ohio River valley prefer to use a locally derived typology developed by Jim Railey (1992) for Fort Ancient sites (see Table 4). Justice's (1987) typology is limited in that it includes only four types, with most Small Triangular points belonging to a catch-all type – Madison Triangular. The Railey (1992) typology, on the other hand, originally identified eight morphologically distinctive types, with later researchers expanding this to ten types (Henderson 2008). While some researchers have questioned the utility of the Railey typology (e.g., Bradbury et al. 2011; Bradbury and Richmond 2004), studies involving large samples drawn from multiple sites crossing all Fort Ancient time periods confirm its general utility as a chronological marker among Kentucky Fort Ancient sites (Pollack et al. 2012) and to a more limited extent in Ohio (Cook and Comstock 2014). Notably, Bradbury and Richmond (2004) confirmed Railey's (1992) observation that Fort Ancient points get narrower and thicker over time and that there is a temporal shift from incurvate to excurvate blade margins. A study of Oliver Phase Triangular points in central Indiana suggests the Railey typology may need to be refined for this region (Hipskind 2005) but did identify the same trend toward narrower points over time. Although the Railey typology may not be a useful tool for evaluating the age of the Morris collection Small Triangular points, its detail and ease of use make it a great starting point for describing them.

The eleven Small Triangular Cluster points (Figure 11; Table 2) from the Morris collection include four Railey Type 2, one Railey Type 3.1, two Railey Type 4, two Railey Type 5, one Railey Type 7, and one fragment of an unidentified fine triangular point. Interestingly, two of the three Small Triangular Cluster points made from exotic cherts and one of the two made from non-local cherts are Railey Type 2 points (Figure 11J). These points are Stanford-like, Laurel-like, and Attica/Sugar Creek-like cherts. Stanford chert outcrops along the East Fork of the White River to the south, and Laurel chert outcrops in southeastern Indiana (Cantin 2008), closer to the presumed homeland of the Fort Ancient peoples who migrated north to form the Oliver Phase (Moore and Raymer 2014). It is possible these Railey Type 2 points indicate that central Indiana Late Precontact peoples (presumably Oliver Phase) were maintaining contacts with other Oliver and Fort Ancient peoples to the south. The one Type 2 point made from a locally available chert is made from Liston Creek (Figure 11L).

The four Type 2 points (Figure 11J, L) have irregular (n = 1), straight (n = 2) and convex (n = 1) bases and plano-triangular (n = 1), twisted (n = 1), and lenticular (n = 2) cross-sections. The point with the plano-triangular cross-section exhibits a marked median ridge, while the point with the twisted cross-section has a slight median ridge (the other two have none). Two of the points exhibit evidence of basal thinning. Basal grinding ranges from absent (n = 1) to very slight (n = 2) to slight (n = 1). Lateral haft grinding ranges from very slight (n = 2) to slight (n = 2). One point exhibits blade shaping via parallel pressure flaking, while the other three are marked by irregular pressure flaking.

The one Railey Type 3.1 point (Figure 11M) is made from Attica/Sugar Creek chert. It has a straight base with very slight basal and lateral haft grinding and a lenticular cross-section. By definition, the point exhibits a finely serrated blade. It lacks a median ridge and was shaped by irregular pressure flaking.

The two Railey Type 4 points (Figure 11D, G) are made from possible Fall Creek and Liston Creek cherts. One has a concave base marked by basal thinning and very slight basal and lateral haft grinding. The other has a convex base that lacks basal grinding but exhibits very slight lateral haft grinding. The cross-sections of both are asymmetrical. One exhibits a slight median ridge, while both were shaped via irregular pressure flaking.

The two Railey Type 5 points (Figure 11I, K) are made from Liston Creek and possible Liston Creek cherts. Both exhibit convex bases. One lacks basal grinding, and the other has very slight basal grinding. Both exhibit slight lateral haft grinding. One point has a plano-triangular cross-section resulting from a marked median ridge, while the other has an asymmetrical cross-section but lacks a median ridge. Both exhibit evidence of irregular percussion flaking (one fine and one coarse) and have blades shaped by irregular pressure flaking.

The one Railey Type 7 point (Figure 11E) is made from Laurel-like chert. It has a straight base, lacks basal and lateral haft grinding, and has an asymmetrical cross-section. The point exhibits a slight median ridge and evidence of shaping via coarse-irregular percussion and irregular pressure flaking.

The last Small Triangular Cluster point is an unidentifiable point fragment made from UID Glacial chert (Figure 11F). This point is fragmentary but does exhibit evidence of irregular pressure flaking. It is unique in that it has a rhomboidal cross-section.

In addition to these named types, the Morris collection contains four unidentifiable point fragments made from Jeffersonville-like chert, possible Fall Creek chert, a Burlington-like chert that may be a local Liston Creek or Fall Creek variant, and UID Fossiliferous (possibly Harrodsburg or Allens Creek) chert (Table 3). One point is corner-notched with fine serrations, and another has an expanding stem.

OTHER BIFACES

One triangular humpbacked knife from the Morris collection dates to the Late Precontact period (Figure 11H). This object is made from Liston Creek chert and measures 51 mm in maximum length, 29.2 mm in maximum width, and 14.5 mm in maximum thickness.

Additionally, the Morris collection includes 23 non-diagnostic chipped stone bifaces. Seven of these are middle-stage bifaces, with evidence of hard hammer percussion and some bifacial thinning, fifteen are late-stage bifaces that are all or mostly thinned with some degree of edge retouch, and one is an unidentified biface fragment. Many of these artifacts are broken fragments, but those that could be measured range in maximum length from 23.0 to 86.6 mm (mean = 52.0 +/-18.1 mm), maximum width from 21.4 to 40.0 mm (mean = 30.9 +/-6.4 mm), and maximum thickness from 5.5 to 11.9 mm (mean = 9.0 +/-1.8 mm). One biface has a rounded base and may be a scraper. One may be a preform for a Jack's Reef point. Another may be a broken drill or graver, while a fourth has a pointed/rounded base and may be a drill or reamer. A fifth biface is heavily ground along one long edge and has heavy use-damage along the opposite long edge, suggesting it functioned as a knife and/or chopping tool. Finally, a sixth biface may have been reused as a core.

Most of the non-diagnostic bifaces are made from local cherts, including Fall Creek (n = 2) and possible Fall Creek (n = 4), Liston Creek (n = 7), possible Liston Creek (n = 1), and UID Glacial (n = 2) cherts. One biface is made from non-local Attica/Sugar Creek chert, three from exotic Jeffersonville-like chert, two from exotic Kenneth-like chert, and one from a UID fossiliferous chert (Table 3).

OTHER CHIPPED STONE TOOLS

Other chipped stone tools found in the Morris collection include three lamellar bladelets, one straight-sided drill, two T-shaped drills, three flake tools, and a spokeshave. The three bladelets are made from Wyandotte (n = 1) and UID heat-treated (n = 2) cherts (Table 3). They range in length from 44.4 to 50.5 mm (mean = 48.1 +/-3.3 mm), maximum width from 11.0 to 17.7 mm (mean = 13.4 +/-3.7 mm), and in maximum thickness from 3.0 to 4.5 mm (mean = 3.7 +/-0.8 mm). Lamellar bladelets such as these date from the Middle Woodland to the Late Precontact periods in central Indiana (Doperalski 2017; McCord and Cochran 2014; McCullough 2011).

All three drills are made from local UID Glacial chert (Table 3). The straight-sided drill measures 38.7 mm in maximum length, 9.6 mm in maximum width, and 5.7 mm in maximum thickness. One T-shape drill is a broken fragment, but the other measures 32.1 mm in maximum length, 21.6 mm in maximum width, and 4.8 mm in maximum thickness.

Three flake tools are made from Liston Creek (n = 2) and Fall Creek-like (n = 1) cherts, and a spokeshave is made from Liston Creek chert (Table 3). Finally, 21 pieces of chipped stone debitage weighing 78.0 grams are included in the Morris collection assemblage.

HAMILTON COUNTY CHERT USAGE PATTERNS

As noted above, a major goal of this study of the Morris collection points was to facilitate the development of a local culture history that could be used to better guide archaeological research in Hamilton County and adjacent areas in Indiana. Toward this end, I examined all Hamilton County site forms and archaeological reports available in SHAARD for identified point and chert types. Table 5 integrates these data with the Morris collection points, highlighting major chert consumption patterns over time.

While local Fall Creek and Liston Creek cherts are well represented throughout all time periods, patterns emerge in the use of non-local Attica/Sugar Creek and exotic cherts over time (Table 5). Consistent with other chert types studies in Indiana, Paleoindian and Early Archaic points are more likely to be made from cherts obtained from distant sources, likely indicating high mobility and large group territories during these periods (Moore 2008). Paleoindian groups in Hamilton County appear to have preferred Wyandotte chert from southern Indiana and Flint Ridge Flint from Ohio, while Early Archaic Kirk groups commonly selected non-local Attica/Sugar Creek chert. This preference for Attica chert during the Early Archaic is consistent with Cantin's (1989) study of chert usage in southwestern Indiana and Moore's (2008) analysis of chert usage in the middle Wabash River valley. Early Archaic Hamilton County flintknappers also commonly selected exotic Wyandotte and Laurel cherts (Table 5).

Exotic chert usage declines during the Middle and Late Archaic periods throughout Indiana (Cantin 1989; Moore 2008), and this pattern is repeated in Hamilton County. When Middle Archaic flintknappers were selecting cherts from distant sources, they tended to use Laurel chert, while Late Archaic groups used Laurel, Jeffersonville, and Wyandotte cherts (Table 5). This may indicate that the Laurel and Jeffersonville outcrops, located between 75 and 125 km to the southeast (Cantin 2008), were located within these groups' annual ranges or that they maintained connections with groups living to the southeast of Hamilton County through trade, intermarriage, or other forms of alliance building (Moore 2008). Two of the four Late Archaic points made from Wyandotte chert are terminal Late Archaic Turkey-tail points, a usage pattern Justice (1987) notes is common to the type.

Table 5. Point and Chert Types Reported from Hamilton County, Indiana.

Time Period	Point Cluster/ Artifact Type	Count	Local Chert	Non-Local Chert	Exotic Chert
Paleoindian	Clovis	6	16.7%	16.7%	66.7%
	Hi-Lo	3	0%	33.3%	66.7%
	Dalton	4	25%	25%	50%
	Total	**13**	**15.4%**	**23.1%**	**61.5%**
Early Archaic	Thebes	8	62.5%	12.5%	25%
	Hardin Barbed	1	100%	0%	0%
	Kirk Corner Notched	37	43.2%	32.4%	24.3%
	Bifurcate	25	52%	8%	40%
	UID	8	50%	12.5%	37.5%
	Total	**79**	**49.4%**	**20.3%**	**30.4%**
Middle Archaic	Morrow Mountain	1	100%	0%	0%
	Large Side Notched	11	45.5%	9.1%	45.5%
	Matanzas/ Brewerton	48	68.8%	8.3%	23.0%
	UID	2	100%	0%	0%
	Total	**62**	**66.1%**	**8.1%**	**25.8%**
Late Archaic	Late Archaic Stemmed	19	78.9%	5.3%	15.8%
	Saratoga	1	100%	0%	0%
	Nebo Hill	1	100%	0%	0%
	Susquehanna	1	100%	0%	0%
	Genesee	1	0%	0%	100%
	Lamoka	12	50%	0%	50%
	Riverton	30	80%	6.7%	13.3%
	Terminal Archaic Barbed	7	100%	0%	0%
	Turkey-Tail	3	33.3%	0%	66.7%
	UID	10	60%	10%	30%
	Total	**85**	**71.8%**	**4.7%**	**23.5%**
Early Woodland	Meadowood	2	100%	0%	0%
	Early Woodland Stemmed	9	55.5%	0%	44.4%
	Dickson	13	23.1%	7.7%	69.2%
	UID	1	0%	0%	100%
	Total	**25**	**40%**	**4%**	**56%**
Middle Woodland	Snyders	8	50%	0%	50%
	Lowe	12	50%	8.3%	41.7%
	Total	**20**	**60%**	**5%**	**35%**
Late Woodland	Jack's Reef	13	61.5%	23.1%	15.4%
	UID	1	100%	0%	0%
	Total	**14**	**71.4%**	**14.3%**	**14.3%**
Late Woodland/ Late Precontact	**Triangular**	**607**	**89.1%**	**3.5%**	**7.4%**

This preference for southern Indiana Wyandotte chert continues into the Early and Middle Woodland periods (Table 5), consistent with Cantin (1989) and Moore (2008) for other parts of the state. Unexpectedly based on these previous studies, the use of exotic cherts declines during the Middle Woodland relevant to the Early Woodland, and Burlington chert does not appear to have been popular during the Middle Woodland, as it was in southwestern Indiana and in the middle Wabash River valleys.

As is true elsewhere in the state, the Late Woodland and Late Precontact periods are marked by a return to the use of predominately local cherts (Table 5). Both of the Jack's Reef points made from exotic chert are Jeffersonville, and Laurel is the most common exotic chert used to make Small Triangular Cluster points. Both types suggest a southeastern orientation for these groups.

DISCUSSION AND CONCLUSIONS

My analysis of the assemblage of chipped stone tools donated as part of the Morris collection provides a sketch of local Hamilton County culture history and insights into chert procurement and mobility practices. Diagnostic hafted bifaces included in the assemblage range in age from the Late Paleoindian through the Late Precontact periods. The Early Archaic and Late Precontact periods are the best represented, likely reflecting the age of the sites preferentially collected by Mr. Morris.

Compilation of SHAARD data provides a more even distribution of points by time period, with the much higher frequency of Small Triangular points reflecting the numerous excavations carried out at Late Precontact villages near Strawtown (Table 5). Given the amount of survey and excavation that has occurred in Hamilton County, the dearth of Early and Middle Woodland points recorded in SHAARD may indicate a real pattern of limited usage of the area during this time. Hamilton County appears to have been peripheral to major Early to Middle Woodland New Castle Phase populations located not far to the east (McCord and Cochran 2014).

Given that the Morris collection included only a small sample of 77 diagnostic hafted bifaces, it is not surprising that no Early or Middle Paleoindian Clovis or Cumberland points are represented. The collection includes two Late Paleoindian points, however. One of these is a Hi-Lo point, which is a type that is common in the region, while the other is a Dalton point. Dalton points are known to occur in small quantities throughout Indiana but are not very common outside of the Ohio River valley (Justice 1987).

The Early Archaic period is well represented in the Morris collection and includes points belonging to the classic Thebes/Kirk/Bifurcate sequence known throughout the region (e.g., Stafford and Cantin 2009). Interestingly, the Morris collection Early Archaic points are largely made from local cherts and non-local Attica/Sugar Creek chert, while Hamilton County Kirk points indicate a general preference for Attica/Sugar Creek chert during this period (Table 5). Moore (2008) found a similar preference for Attica chert among Early Archaic flintknappers to the north in Carroll County.

The lack of clear evidence of early Middle Archaic points in the Morris collection is not surprising given the widespread use of a southern-derived point typology that includes types that only rarely are found in Indiana. Jefferies (2008) had a similar problem identifying early Middle Archaic assemblages in the Ohio River valley. Stafford and Cantin's (2009) analysis of the Caesars Archaeological Project assemblages provides the clearest evidence to date that a new typology is needed to clarify regional Middle to Late Archaic time/space systematics.

While analysis of the Morris collection cannot resolve these questions, it does confirm evidence from the McKinley site (12H1) indicating the presence of significant occupations by Middle to Late Archaic peoples who manufactured Large Side Notched Cluster, Matanzas Cluster, Brewerton Cluster, and Late Archaic Stemmed Cluster points (Justice 1994; Little 1970, 1972). Whether these points were made at different times by different peoples or whether multiple types were in use contemporaneously remains unknown, however.

Additionally, compilation of points identified from across Hamilton County indicates that several Middle to Late Archaic point types not found in the Morris collection occur in small quantities throughout the county. These include Morrow Mountain, Saratoga, Nebo Hill, and Genesee points. The presence of a single Susquehanna Cluster point in the Morris collection also is an enigma, although it is perhaps most parsimonious to infer that Morris obtained this point from outside of Hamilton County.

The Morris collection also confirms that groups who made Riverton and Terminal Archaic Barbed Cluster points inhabited Hamilton County at the end of the Late Archaic period. This is followed by the relative lack of Early and Middle Woodland points noted above.

The Robbins/Snyders/Lowe sequence, present in the Morris collection, is common among Hopewell-related sites in the Ohio and Wabash valleys. Interestingly, most of the Robbins, Snyders, and Lowe points in the Morris collection were made from locally available raw materials, a reversal of Moore's (2008) finding that middle Wabash River valley Early to Middle Woodland groups preferred exotic Wyandotte and Burlington cherts. Analysis of all identified Early and Middle Woodland points in Hamilton County confirmed a preference for Wyandotte chert, but the lack of Burlington chert appears to be a real pattern that merits additional investigation (Table 5).

Similar to Moore's (2008) Carroll County study, Jack's Reef Cluster points are present in low numbers in the Morris collection and made of locally available raw materials. These early Late Woodland points, most likely the region's first true arrowheads, are followed in time by Late Woodland and Late Precontact Small Triangular Cluster points. Unfortunately, our current lack of understanding of regional diachronic trends in Small Triangular point morphologies precludes any more specific cultural or temporal associations. It is possible that the Albee, Oliver, Taylor Village and/or other late phases are all represented by these points.

Both the Morris collection and Hamilton County points in general indicate an overall emphasis on the use of locally available Fall Creek, Liston Creek, and UID Glacial cherts throughout all time periods (Table 5). Consistent with other regional studies (e.g., Cantin 1989; Moore 2008; Tomak 1981), the use of non-local cherts was most prevalent in the Paleoindian, Early Archaic, and Early Woodland periods. Unlike earlier studies, the return toward the use of predominately local cherts appears to begin during the Middle Woodland period in Hamilton County.

While the research value of assemblages like the Morris collection are limited due to a lack of context, this study illustrates how even relatively small assemblages of surface collected artifacts have a story to tell. It is certainly in our best interest as archaeologists to work with collectors to document their collections and to encourage them to record contextual information like recovery locations so as to maximize the research potential of their collections. Such work provides both depth and breadth to professional archaeological research projects that tend to last for a much shorter period and cover less territory than the dedicated collector. Perhaps this combination of targeted excavation and detailed study of private collections will permit us to finally revise and update our hafted biface typologies, providing them with much-needed nuance and heightened resolution.

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GLOSSARY OF TERMS

A-HORIZON SOIL
The upper layer of soil, nearest the surface.

ANTHROPOLOGY
The study of humankind, with particular emphasis on its cultural and biological adaptations.

ARCHAEOLOGY
The anthropological study of past lifeways, cultures, and cultural processes through the investigation of material remains left behind by humans.

ARTIFACT
Any portable object made, used, and/or modified by humans. Or, more generally, any evidence of human behavior. Common precontact artifacts found archaeologically include spear points, arrowheads, knives, chipped or broken stone debris, ground stone axes, grinding stones, mortars and pestles, awls, adzes, gouges, pottery, clothing and ornamental pins, decorative items and ornaments, scraping tools, hammerstones, bone fishhooks, stone perforators, and beads.

ASSOCIATIONS
The relationships of artifacts and features at a site, based on provenience and context.

ATLATL
A spearthrower.

AVOCATIONAL ARCHAEOLOGIST
A person who participates in archaeology but does not practice it as a profession. Avocational archaeologists may volunteer to work with qualified professional archaeologists, and many take courses and gain substantial experience in archaeological methods and techniques. Others may be involved in archaeology as a hobby. Generally, avocational archaeologists subscribe to a preservation ethic to protect archaeological resources and to responsibly and legally preserve and study information from sites.

BP
Before present. By professional agreement present was established to be AD 1950 based on radiocarbon dating. For example, 1000 BP means 1,000 years before AD 1950, or AD 950.

CELT
An ungrooved axe. Celts may be made of pecked and ground stone, or hammered copper. It is thought that celts appeared in Late Archaic times, and they continue to occur through later prehistory.

CERAMICS
Pottery vessels or potsherds.

CHERT
Stone of microscopic or small quartz particles used for the making of stone tools. Some types of chert include flint, agate, and jasper.

CHIEFDOM
A non-egalitarian hierarchial social organization with a fixed and permanent role for a chief/leader.

COLLARED
A thickened area present below the rim and above the neck on a clay pottery vessel.

COMPLICATED STAMPED
Decorations of curvilinear or rectilinear design paddle stamped into a clay vessel.

CONTEXT
The position of an artifact or feature in its soil matrix, horizontal, and vertical location, and its relationship with other artifacts and features, related to the behavioral activities which placed it there.

CORD-IMPRESSED
Impression into a clay vessel surface before firing by a stick wrapped with cord, or cord on the edge of a paddle.

CORDMARKED
Cordage impressions on a pottery vessel as a result of stamping with a cord-wrapped paddle.

CORE
A stone which exhibits one or more flake scars, showing that it has been used as a raw material for flintknapping.

CRM
Cultural resource management. The protection, preservation, and recovery of information from archaeological sites, under federal and state laws. Universities and private archaeological companies often are hired to conduct CRM archaeology mandated under federal or state statutes.

CULTURE
A system of shared, learned, symbolic human behavior for adaptation to our natural and social environment. Culture may be thought of as a system composed of interrelated parts or subsystems, where a change in one part affects or influences the other parts. Subsystems interrelated with culture include technology, communication (and language), biological and physical characteristics, psychology, economics, social and political organization, beliefs and values, subsistence, settlement, environment, etc.

EXCAVATION
The systematic recovery of archaeological deposits through the removal and screening of soil. These can be either test excavations (termed Phase II in CRM investigations) or large-scale excavations (termed Phase III in CRM investigations).

FABRIC-IMPRESSED
Impressions of woven fabric in the surface of a pottery vessel.

FEATURE
Non-portable evidence of past human behavior, activity, and technology found on or in the ground. Precontact features commonly include fire pits and hearths, burned earth and clay, trash and garbage pits, post molds, evidence of house floors or basins, storage pits, clusters of artifacts (e.g., chipped and broken stones, caches of projectile points, ceramics or pottery sherds), human and animal burials, clusters of animal bone, earthworks (such as mounds and circular enclosures), petroglyphs and pictographs, and middens.

FLAKE
A by-product of flintknapping, toolmaking, use, or other human activities, resulting in a fragment of stone detached from a parent stone. Often, a flake has evidence of purposeful removal, including a bulb of percussion, ripple marks, a striking platform, etc.

GORGET
Decorative object worn on the chest.

GROG-TEMPERED
Ceramics tempered with fragments of crushed pottery.

LITHICS
Stones used or modified for human activities such as the manufacture of precontact tools, cooking, hunting, etc.

MICROTOOLS
Small tools, predominately of stone, manufactured and used to perform certain tasks.

MIDDEN
Cultural refuse or deposits built up at a site.

MULTICOMPONENT
An archaeological site with occupations from more than one culture or time period.

PETROGLYPHS
Naturalistic or symbolic representations or depictions carved into stone.

PICTOGRAPHS
Pictures or drawings painted on rocks, cave walls, stone outcrops, or rockshelters.

PRECONTACT
Human activities, events, and occupations before written records. In North America, this primarily includes Native American precontact cultures, but does not imply that these cultures did not have long, rich, and varied cultural and oral histories and traditions.

PROTOHISTORY
Protohistoric cultures can be defined as those precontact groups developing or continuing directly into early recorded history, some associated with early historic artifacts.

PROVENIENCE
The horizontal and vertical location of an artifact at a site.

RED OCHRE
Late Archaic-Early Woodland culture with burial practices, usually in mounds, involving the use or placement of red ochre (a red hematite pigment).

SHAARD
The Indiana State Historic Architectural and Archaeological Research Database (SHAARD) of the Division of Historic Preservation and Archaeology.

SHELL-TEMPERED
Ceramics (pottery) tempered with fragments of crushed shell.

SITE
The presence or occurrence of one or more artifacts or features indicates an archaeological site. An archaeological site is an instance of past human behavior or activity, where humans conducted some activity and left evidence of it behind, on or in the ground. Some common precontact site types include artifact caches, villages and camps, cemeteries, burials, workshops (e.g., stone debris from flintknapping activities), quarries, and earthworks (mounds, embankments, enclosures, fortifications, etc.).

STRATIGRAPHY
Horizons, strata, or layers of soil deposited at a location, where the deepest strata were deposited the earliest, and the more recent layers deposited higher in the stratigraphic sequence.

SURVEY
The systematic discovery, recovery, and recording of archaeological information such as site locations, artifacts, and features by visually inspecting the surface of the ground if the soil is visible. Or, the use of shovel probes, cores, and/or augers near the surface, if surface visibility is restricted or poor. Termed Phase I in CRM investigations.

TEST EXCAVATION
Systematic excavation of a representative portion or percentage of a site to evaluate and determine its nature and extent, what information is present, whether there are intact or in situ deposits present, and the degree of disturbance to the site, often to determine whether it is eligible for the National Register of Historic Places. Termed Phase II in CRM.

WYANDOTTE
A type of dark blue-gray chert found in southern Indiana.

For those with access to the internet, the following sites also provide opportunities to access definitions and additional information regarding archaeological terms and concepts:

archaeological.org/education/glossary
archaeology.about.com/od/rterms/g/radiocarbon.htm

PRECONTACT INDIANS OF INDIANA

PALEOINDIANS

Paleoindians are the first known people who lived in the Americas, including Indiana. They lived here during the last stages of the last glacial advance, or ice age, and the early part of a changing environment and climate as the glaciers retreated. These people occupied the area now known as Indiana some 12,000 years ago and lasted until about 10,000 years ago.

These early peoples probably lived in small groups of related individuals who moved around a lot, hunting large game animals, including some now extinct, such as the mastodon, a large elephant-like creature. They also relied upon the gathering of wild plants to eat for their survival. Their population was very low.

The Paleoindians had very well-made stone tools, composed of a type of stone archaeologists call chert, which is a fine-grained rock that breaks a little like glass when hit by hard materials like another rock or a piece of deer antler. The tools they made by chipping, flintknapping, and flaking included long spearpoints, cutting and scraping implements, and engraving items. Some of their spear and piercing tools are called Clovis, Gainey, Barnes, Cumberland, Holcombe, Quad, Plainview, Hi-Lo, and Agate Basin points.

Evidence of these peoples is often found in Indiana on land near water sources like major rivers and springs, and where chert is found. Little is known about the Paleoindians since they moved around a lot and did not occupy any one place for a very long time. Therefore, they did not leave behind much evidence of their lives in any one place.

ARCHAIC PEOPLES

American Indians known as the Archaic peoples lived here for a long time: around 6-7,000 years. Although these people did change over time, increasing in population and using new tool types and food preparation techniques, they did share certain general characteristics. These included new types of spear points and knives, with various types of notches and stems for hafting to wooden handles and shafts. Some of the projectile point types of the Archaic Period are called Kirk, Thebes, MacCorkle, LeCroy, Faulkner, Godar, Karnak, Matanzas, Brewerton, Riverton, and Terminal Archaic Barbed points.

They also used ground stone tools such as stone axes, woodworking tools, and grinding stones. The grinding stones were used to pound, crush, and grind wild nuts, berries, seeds, and other plant foods. They were hunters and gatherers of wild plants and animals, and moved around in their natural environments by season, often scheduling their movements to coincide with the appearance of foods like nuts, fish, deer, and wild seeds. Over time, they became very selective in what kind of resource they were pursuing.

During the Archaic Period, the spearthrower was used. This consisted of a shaft with a handle, weighted for balance with a ground and smoothed stone, and a hook on the end. A spear was fitted onto the hook and was thrown with the spearthrower shaft.

Toward the end of the Archaic, more evidence of mortuary activities is found, including human burials with a red pigment coloring remains or grave goods. Burial mounds appear. During the Archaic, the cultures became more different from one another, and more types of artifacts were used. Their settlements became more permanent. One type of settlement was along large rivers, where they discarded large amounts of mussel shells. These sites are called shell middens or "mounds," although they are not really constructed, burial mounds. The general Archaic Period ended at about 1500 BC, although some Terminal Archaic peoples lived until 700 BC.

WOODLAND PEOPLES

During the Woodland Period, a number of new cultural characteristics appeared. A notable event was the appearance and use of ceramics and pottery vessels. Another significant occurrence was the use and increase of horticulture. A remarkable feature of some Woodland sites is earthen mounds and earthworks, such as embankments. The Woodland peoples persisted for over 1,500 years in Indiana.

During the early portion of the Woodland Period, the pottery was thick and heavy. One early Woodland culture called the Adena people had elaborate mortuary rituals, including log tombs beneath earthen mounds. Projectile points during this time included Adena, Kramer, Dickson, and Gary Contracting Stemmed types.

A little later, in the Middle Woodland, there were elaborate burial rituals, but also long-range trade of exotic goods like mica, marine shells, copper, obsidian, copper axes, drilled wolf and bear teeth, and other goods from region to region throughout the Eastern Woodlands area of North America. Some of these groups were called Hopewell peoples. Their ceramics had all kinds of incised and stamped decorations. During this time, the Woodland Indians were likely organized into groups we might recognize as what we today call tribes. Projectile points from the Middle Woodland include Snyders, Lowe Flared Base, Steuben, Chesser, and Baker's Creek.

The latter part of the Woodland Period is called Late Woodland. In Late Woodland, two important events occur. One is the first appearance of agriculture; that is, intensive cultivation and modification of crops such as corn and squash. Another important occurrence is the appearance of the bow and arrow. Before this time, most of the chipped stone tools were either spearheads, knives, engraving tools, or scrapers. In Late Woodland, however, small, triangular points occurred that are true arrowheads. One type of these arrowheads is called Madison. Other point types are termed Jack's Reef Pentagonal and Raccoon Notched. Settlement during the Late Woodland time changed from the earlier more permanent and nucleated villages to a pattern of smaller sites dispersed more over the landscape. In some regions of the state, Woodland groups may have persisted almost until historic times, although in general, the Woodland Period ended at AD 1000.

MISSISSIPPIAN PERIOD

The Mississippian peoples In Indiana lived in some cases almost until contact with early European explorers, missionaries, soldiers, and traders. They lived from about AD 1000 until possibly as late as AD 1650. A noticeable change during this period was the nucleation of some peoples into large settlements akin to "towns," such as at the Angel Mounds site near Evansville, Indiana. These towns had large public areas such as plazas and platform mounds—like truncated or flat-topped pyramids—where influential or important public individuals lived or conducted rituals. Thus, there was social stratification and ranking of individuals in Mississippian societies. There were probably chiefs and religious leaders. The towns were supported by the harvesting of large agricultural fields growing corn, beans, and squash. People living in sites such as these are termed Middle Mississippian.

Notable artifacts indicating Mississippian settlements include large, chipped stone hoes, and pottery bowls and jars tempered with crushed shell. Straps, loops, and handles for these containers characterize this time period as well. Stone tools include point types known as Madison, Nodena, and Cahokia, and other implements such as mortars, pestles, pendants, beads, anvils, abraders, and other items.

Another less elaborate type of Mississippian society called Upper Mississippian was present in the state, with people living in hamlets and villages. Many of these people lived in northern and southeastern Indiana. They also grew and harvested maize, beans, and squash. One group to the southeast was called Fort Ancient, and lots of shell-tempered vessels with straps are found at these sites. In northern Indiana, incised shell-tempered pottery fragments are found on Upper Mississippian sites that are often located near the beds or former beds of lakes.