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Hopewell Archeology: Volume 1, Number 1, May 1995

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Hopewell Archeology:

The Newsletter of Hopewell Archeology in the Ohio River Valley

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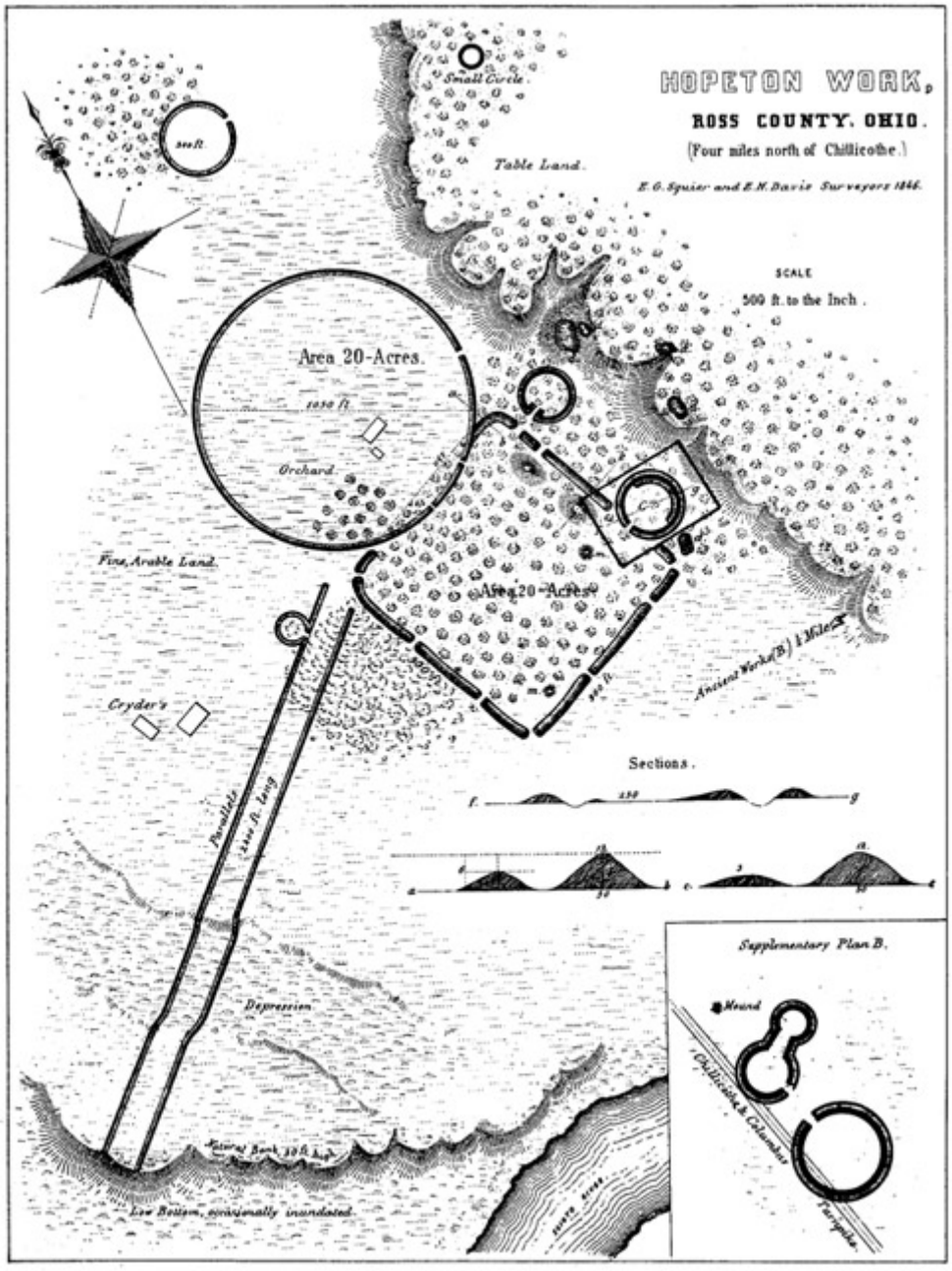
1. Editorial Policy and Numbering Procedure

This newsletter is intended to provide an informal forum for distributing and exchanging news about research, data, interpretation, public education, and events relating to Hopewell archeology in the Ohio River valley. It will promote the study of Hopewell archeology, cooperation between researchers, and public education about Hopewell archeology. The Newsletter is a joint effort of the Midwest Archeological Center in Lincoln, Nebraska and Hopewell Culture National Historical Park in Chillicothe, Ohio. Hopewell Archeology is published twice a year, and is numbered consecutively.

Hopewell Archeology publishes short news items, book reviews, short research papers and research notes relating to Hopewell archeology in the Ohio River valley. Information about other Middle Woodland cultures that relate to the Hopewell will also be considered for publication. Items for potential inclusion to the newsletter may be submitted to either office.

2. From the Editor, *Mark J. Lynott*

When I first visited Ross County in 1978, I felt very fortunate to get to see some of the Hopewell sites which are so well known in North American archeology. I was very impressed with the number, size and configuration of the earthworks that had been described by Squier and Davis in 1848. At that time, the National Park Service was involved in what they called a "new area study" of the Hopeton Earthworks. The Hopeton Earthworks was recommended for inclusion in the National Park System as an important manifestation of the Hopewell culture, and because the Hopewell culture remains a fascinating and important part of humanity's past.



In 1845, Ephriam George Squier, editor of The Chillicothe Gazette, joined with a local physician, Dr. Edwin H. Davis in a landmark study of the mounds and earthworks in Ohio. Their detailed maps, written descriptions of the mounds and their contents and classifications of the mounds and earthworks represents one of the first scientific archeological studies in North America. The results of their research was titled Ancient Monuments of the Mississippi Valley: Comprising the Results of Extensive Original Surveys and Exploration, and was published in 1848 as the first volume of Smithsonian Contributions to Knowledge.

In the subsequent seventeen years, I have participated in other feasibility studies and meetings that have considered whether other Hopewell sites warrant protection. During that same period, I

have had the opportunity to periodically visit some of the sites in Ross County and watch the deterioration of these valued records of humankind's past. The annual impact of agriculture is clearly taking its toll. Independent studies of these sites indicate plowing has lowered earthworks and mounds on the average of an inch per year since the introduction of larger, more powerful tractors in the 1950s. Since my first visit to the Hopeton Earthworks, agriculture has eliminated any visible evidence of the parallel walls, and has lowered most of the remainder of the earthwork to the point it cannot be distinguished by the untrained eye.

The impact at the Hopeton Earthworks has been further accelerated by commercial gravel quarrying. This has left a massive scar on the scenic value of this National Historical Landmark, and destroyed an untold amount of archeological information.

Other archeological resources in Ross County are also threatened by agriculture, mining, highway construction and urban growth. At the rate these actions are continuing, we have only a few years to set aside these important sites. When were recorded by Squier and Davis, the earthworks and mounds must have been truly impressive. Today, they are as important to understanding the archeology of Eastern North America, as Chaco Canyon and Mesa Verde are to the Southwest. If we do not take decisive action soon, future generations will never be able to appreciate the wonderful sites that Squier and Davis described in Ross County nearly 150 years ago. We do not have another twenty years to preserve the Hopewell sites of Ross County.

This publication was initiated to promote interest in the study and interpretation of Hopewell archeology. We are planning to issue the Newsletter twice a year, spring and fall, and hope to include a lot of short, non-technical notes about the research archeologists are conducting. In addition, we plan to include notes about programs, exhibits, and events that interpret Hopewell archeology. We will also try to include at least one short research report in each issue, and notes on any books, published papers, conference papers, that report research on Hopewell archeology.

3. 1992 Legislation Means Change

On May 27, 1992, Public Law 102-294 mandated significant changes for Mound City Group National Monument and Hopewell archeology. In addition to changing the name of Mound City Group National Monument to Hopewell Culture National Historical Park, it expands the boundary of the park to include:

a. additions to Hopeton Earthworks,
b. High Banks Works,
c. Hopewell Mound Group,
d. Seip Earthworks.

Final land acquisition boundaries for each of these sites were not established through this act, but are to be established on the basis of archeological research (Section 4. Studies [a]). The legislation also directs the Service to conduct archeological studies at Spruce Hill Works, Harness Group, and the Cedar Bank Works and other areas significant to the Hopewell culture "to evaluate the desirability of adding them to the park, and shall report to Congress on any such areas that are recommended for addition to the park" (Section 4, Studies, [b]).

Like many federal laws, this legislation authorized the acquisition of these important sites without authorizing full funding for their purchase. With the authorized funding, the National Park Service has acquired additional lands around the Hopeton Earthworks. In 1995, the land acquisition process will be directed toward the Hopewell Mound Group.

4. Profile of an Archeologist: Bret J. Ruby

On January 23, 1995, Bret J. Ruby started a new phase in his life when he began his duties as Park Archeologist at Hopewell Culture National Historical Park. Bret was hired as part of the National Park Service's Cultural Resources Professionalization Initiative. This initiative is designed to improve cultural resource management in the parks by increasing the number of professionals assigned to park staffs.

Bret J. Ruby

In addition to advising park managers about cultural resource management issues, Bret will conduct research in Ross County, Ohio. He comes to the job with considerable experience in Hopewell archeology. As Prehistory Research Fellow and Associate Instructor at the Glenn A. Black Laboratory of Archaeology at Indiana University, Bret conducted research on Hopewell in

southern Indiana. His research included the study of the Mann site, Posey County, Indiana. The Mann site is the largest Hopewell site in Indiana, and one of the few documented geometric earthwork sites dating to the Middle Woodland substage outside of southern Ohio.

Bret grew up in Akron, and started his archeological career in Ohio as a student at Kent State University where he received a Bachelor of Arts degree in 1987. His interest in archeology was fueled by interaction with Olaf Prufer and Mark Seeman. He conducted his first field research in a field school directed by Seeman at the Kramer Village site in Ross County, Ohio. Bret's early interest in Hopewell archeology is documented in his undergraduate thesis, which looked at Hopewell research in an historical perspective.

Bret carried his interest in Hopewell studies to Bloomington, Indiana where he focused his research on the Crab Orchard and Mann phase occupations of the lower Wabash and Ohio River valleys. He received a Master of Arts degree in Anthropology at Indiana University in 1991.

Bret is currently working on his dissertation at Indiana University, which will describe his research on the late Hopewellian Mann phase in southern Indiana. His dissertation research included two seasons of surface survey funded by the Indiana Department of Natural Resources, Division of Historic Preservation and Archaeology. A third season was devoted to test excavations at a small habitation site, funded by the Indiana Historical Society and the Glenn Black Laboratory of Archaeology. His research has attempted to integrate material culture studies and settlement patterns studies through a cultural ecological perspective. He plans to correlate site type variability with local ecological factors through Geographic Information Systems applications. His research will also compare settlement variability in the Mann phase with the earlier Crab Orchard tradition, and the later Emergent Mississippian (Yankeetown phase) occupation.

In his new position with the National Park Service, Bret will be active in park research and public education programs. His research will be aimed at developing a better understanding of the rich cultural heritage in Ross County. His professional skills and experience will be a valuable asset to Hopewell Culture National Historical Park, and the community of Chillicothe.

5. Research Notes

Hopeton

In August, 1994, Mark Lynott (NPS) directed a crew from the Midwest Archeological Center in test excavations. The testing was conducted in the area where the parallel walls entered the floodplain of the Scioto River. Fifteen square meters were excavated, and a light scatter of habitation debris was found across the entire landform. A single pit feature containing fire-cracked rock, macrobotanical remains, and a small amount of lithic debris was exposed. Analysis of this material is ongoing at the Midwest Archeological Center. Further studies relating to Hopeton will continue in 1995.

Seip

N'omi Greber (Cleveland Museum of Natural History) is working on a report of her field investigations at Seip. Her study will also attempt to construct a base map and identify areas theat have been studied by previous investigators.

Hopewell

William Dancey (Ohio State University) has been conducting survey on the north and east sides of the Hopewell site. Dancey's surveys are aimed at locating habitation areas and better defining the settlement systems associated with this important mound and earthwork site. The study is part of long-term catchment survey being conducted as part of a cooperative agreement with the National Park Service, and is intended to help the National Park Service better determine boundaries for their future land acquisition efforts.

Geophysical Surveys

In recent years, archeologists have employed several different geophysical survey instruments to detect subsurface archeological features. Each of the instruments uses a different technique to measure subsurface differences in soil matrix. Magnetometers measure subtle differences in the earths magnetic field. Resistivity meters measure difference in the resistivity of soils. Ground penetrating radar uses radar to identify subsurface features in much the same way that aerial radar is used to detect aircraft. The advantage of these research techniques is that they permit archeologists to get an idea of what may lie under the ground without actually digging. Variations in soil and local environmental conditions generally dictate which technique is most appropriate.

Cedar Bank

Commonwealth Associates received a purchase order from the National Park Service to do a reconnaissance survey and prepare an overview of the archeological resources at Cedar Banks. Little is known about this site, and it is located on a landform that is being rapidly developed for industry and business. No progress has been made on this study because the people who own the site will not grant permission for the archeological study.

Mound City Group

James Brown (Northwestern University) has been working on a synthesis of archeological research at Mound City Group. The study, which included analysis of extant collections and extensive archival research, is nearing completion. A preliminary draft manuscript describing this research has been submitted to the National Park Service. Brown plans to revise the manuscript for future publication.

Mound City Group

Paul Sciulli (Ohio State University), through a cooperative agreement with the National Park Service, is conducting an inventory of the human remains from Mound City Group. The study is required by the Native American Graves Protection and Repatriation Act, and should supplement the research conducted by James Brown.

Geophysical Surveys

The National Park Service issued a purchase order to John Weymouth (University of Nebraska) for geophysical surveys at the Hopeton and High Banks Earthworks. The work at Hopeton is being conducted with Mark Lynott (Midwest Archeological Center), and the work at High Banks is being conducted with N'omi Greber (Cleveland Museum of Natural History). In 1994 the surveyors used proton magnetometers and a soil resistance meter, instruments which are intended to locate subsurface features. Weymouth is currently analyzing this data and preparing for additional surveys in 1995.

Mann
Gray and Pape, Inc. received a purchase order from the National Park Service to prepare an overview and assessment of this important Hopewell site in Posey County, Indiana.

Bibliography
Mark Seeman (Cultural Resource Analysts, Inc.) has completed a bibliography of archeological research in Ross County, Ohio. The study was funded by a purchase order from the National Park Service. The bibliography is very comprehensive, with annotations, and will be a significant aid to anyone interested in Hopewell archeology. A computer file containing the bibliographic entries is being maintained and updated at Hopewell Culture National Historical Park.

6. 1995 Research at the Hopeton Earthworks

The National Park Service and The Ohio State University are planning a cooperative research program at a site near the Hopeton Earthworks. The site is located on lands owned by the Chillicothe Sand and Gravel Company, who have agreed to make the site available for research. The Ohio State University will offer a fieldschool in archeological methods, and the National Park Service will provide equipment and personnel to participate in the research. The project will begin June 19, 1995 and continue through July 25, 1995. The National Park Service plans to sponsor a series of public lectures in association with the field school.

General Management Plan

The National Park Service is involved in planning for future management of Hopewell Culture National Historical Park. Long-term management of units of the National Park System is guided by a General Management Plan. The General Management Plan is a document which presents a practical framework for making decisions about issues relating to resource management, the desired visitor experience, and other aspects of park management. Development of the General Management Plan requires everyone with an interest in the park receive an opportunity to exchange views and provide input into the development of the plan.

Development of the General Management Plan is being coordinated by a team of planners from the National Park Service's Denver Service Center. The team is led by Marilyn Habgood, who arranged a week of meetings for Park Service personnel that culminated in public presentation of alternatives for managing the park. Habgood and the planning team are developing a written statement of the management alternatives, and continue to request comments from archeologists and the public.

General management plans present a vision of how the National Park Service will manage a specific park. These plans frequently identify needs for facilities, staffing, research, and visitor services. Current proposals for management of Hopewell Culture National Historical Park call for an increase in archeological research activities, as well as expanded visitation and interpretation at some of the sites recently added to the park.

New Look at Mound City

For those of you who have not visited Hopewell Culture National Historical Park recently you will discover some changes in the park's visitor center and self-guiding interpretive programs.

The recently remodeled visitor center includes a new auditorium and an expanded book sales area. The auditorium is used for school programs, conferences, meetings, special programs, and to show the new 17 minute video "Legacy of the Mound Builders" winner of three prestigious awards.

Also, the three outside audio programs have been revised and new programs and equipment will be installed by early May. Interpretive signs will be installed along the trail on the south perimeter of the earth wall. These signs will discuss how the landscape at Mound City has changed from early prehistoric times to the present. Finally, a self-guiding booklet keyed to numbered posts will help identify trees and other plants found along the nature trail and discuss their ethnographic use. For more information on programs and other activities contact the visitor center at (614) 774-1126.

7. Recent Archeological Explorations at the Newark Earthworks By Dr. Bradley Lepper of the Ohio Historical Society

In 1815, Robert Walsh, Jr. made a map of the Newark Earthworks which represents one of the earliest efforts to record the grand complex of Hopewellian geometric enclosures in the Raccoon Creek valley. This map, while neither remarkably accurate, nor complete, is significant for historical reasons certainly, but also because Walsh made observations which document features not noted by previous or subsequent students of the Newark Works. Recent developments at Octagon State Memorial afforded the opportunity for archeologists from the Ohio Historical Society (OHS) to look for surviving traces of one of these features.

Radiocarbon

Radiocarbon dating has become the most effective and widely used method of dating prehistoric archeological sites in North America. The technique is based on the knowledge that the element carbon has several inert and several radioactive isotopes. All living things absorb the radioactive isotope carbon-14 from the atmosphere. Science has learned the rate of decay of carbon-14 is constant and can be measured. When a plant or animal dies, the only change in the proportion of carbon-14 to the isotope carbon-12 in the remains of the organism will be the decay of carbon-14. Consequently, laboratory analysis makes it possible to measure the carbon-14 content of organic materials, like soil humates, wood charcoal, animal bone, or mussel shell, and estimate how long it has been since the organism stopped ingesting carbon-14 (and died).

Moundbuilders Country Club leases Octagon State Memorial from the Ohio Historical Society for use as a golf course. They have leased the site since 1910 when the owner of the site was the Newark Board of Trade. The Country Club has plans to enlarge a maintenance facility located near one of the gateways into the octagonal enclosure. In this general locations, adjacent to one of the platform mounds which stands just inside he opening, Robert Walsh documented the presence of a "sunken well" or "cavity in the earth." Brad Lepper (Ohio Historical Society) directed a team of OHS archeologists and volunteers from The Ohio State University in testing this area. They

discovered the truncated remnants of a large, egg-shaped basin 1.7 m long by 0.7 m wide filled with coarse gravel at the base of the platform mound. The excavators identified a single postmold, 8 cm in diameter, in the center of this basin. No artifacts of any kind were recovered. Paleoethnobotanist Dee Anne Wymer (Bloomsburg University) studied sediment samples from both the basin and the postmold and did not identify any prehistoric botanical material. Sediment samples from the feature were submitted to Beta-Analytic, Inc. for radiocarbon dating of soil humates.

Two samples have been dated, one from Feature 2, the postmold, and one from Feature 3, the gravel-filled basin (Feature 1 was an historic postmold). Feature 2 produced a date of 1,650+-80 BP (Beta-76908) and Feature 3 produced a date of 1,770 +-80BP (Beta-76909). These dates are significant because they are the only radiocarbon dates related to the prehistoric use of Newark's octagonal enclosure. Moreover, they add to the small but growing corpus of dates for the Hopewellian occupation of the Raccoon Creek drainage.

8. Ceramic Compositional Analysis

Mark Lynott (Midwest Archeological Center), Michael Glasscock and Hector Neff (Missouri University Research Reactor) have initiated a ceramic compositional study aimed at southern Ohio. The study will compare the elemental composition of samples of geological clay with Hopewell ceramics. The staff at the Missouri University Research Reactor will radiate both geological clay samples and prehistoric Hopewell ceramic sherds in the nuclear research reactor, and compare the amounts of selected elements in each sample.

The data, while somewhat complicated to interpret, yields an fingerprint of variations in specific elements. This technique is proving quite successful in research in the Eastern Ozark region of southeast Missouri, and likely to be helpful in sorting out many of the questions that have been raised about Hopewell settlement systems and the movement of people and pots associated with the Hopewell sites in southern Ohio. If you have specific samples of Hopewell ceramics or geological clays from southern Ohio that you would like to include in this study, you are encouraged to contact Mark Lynott.

9. Hopewell Archeology at the British Museum

Hopewell archeology will be featured in the North American Gallery at the British Museum, scheduled to open in 1997. The staff at Hopewell Culture National Historical Park hosted a visit in March from Jonathan King, Assistant Keeper at the British Museum. King gathered information and photographed mounds and earthworks at the Mound City Group for use in the introduction to the North American Gallery. The exhibit will feature artifacts collected by E. G. Squier and E. H. Davis during their pioneering mound explorations in the 1840s.

10. Education: Reaching Out to Schools

Hopewell Culture National Historical Park is developing a curriculum guide on the Hopewell culture, archeology and the importance of archeological resources for use in the fourth, fifth and sixth grades. It is being developed with assistance from local teachers and curriculum coordinators. The work is challenging because the guide is being designed to complement the fourth and sixth grade proficiency tests. If you are interested in reviewing materials for the guide, please contact Rebecca Jones at (614) 774-1126.

The park has received two grants, one from the Mead Fine Paper Division and the other from the National Park Foundation, to fund the printing of the curriculum guide, as well as provide staff support during the development stages. Additional funds have been made available to assist local schools in providing buses to visit the park. Planning has begun for National Park Week when a series of activities and programs on archeology and the Hopewell culture will be scheduled for area school children from May 22-26, 1995.

11. Investigations at the Flint Ridge State Memorial, Ohio, 1987-1988 By Richard W. Yerkes, Ohio State University

In 1987 and 1988, the Ohio State University summer field school in archeology was held at Flint Ridge State Memorial. These investigations were designed to collect a sample of artifacts from the quarries and workshops that could be used to analyze the prehistoric methods used to extract the flint and produce the large bifaces and bladelet cores of Flint Ridge Flint that were transported to local and distant sites. We also wanted to know if most of the quarrying took place during the Middle Woodland period, and if there were any habitation or settlement areas adjacent to the quarries. Limited survey and test excavations were conducted during the two ten- week field seasons, but a total of 123, 972 pieces of chipped flint, 10 hammerstones, an anvil stone, and one piece of ground stone were recovered from 28 test units and 75 surface collection squares.

Thirty Ohio State University students helped with the cataloging and analysis of this large volume of lithic materials between 1987 and 1993. The final report on the Ohio State University field school investigations and the collected artifacts was submitted to the Ohio Historical Society for curation in May 1993.

These field school investigations were certainly not the first explorations at Flint Ridge. Study of the "Great Indian Quarry" began in the 19th century with the publications and correspondence of Caleb Atwater (1820) and Samuel Hildreth (1838). Several decades later, Gerard Fowke conducted the first systematic study of Flint Ridge which he published (under the pen name "Charles Smith") in the 1884 annual report of the Smithsonian Institution (Smith 1885). Flint Ridge was mentioned in many late 19th and early 20th century discussions of the "Moundbuilders" and their works, but the definitive study of the quarries was conducted by William Corless Mills for the Ohio Archaeological and Historical Society (which he published in 1921). In 1933, the Flint Ridge State Memorial was set aside by the State of Ohio to preserve parts of the quarry site. Since then, Jeff Carskadden (1969), James Murphy (1989) and others have investigated several quarry, workshop, and habitation sites in this unglaciated region in Licking and Muskingum Counties, Ohio.

Remote Sensing

Grass and woods cover most of the Flint Ridge State Memorial, so prior to the start of the field school, a ground-penetrating radar (GPR) survey of portions of the east field was carried out to try and locate buried features. Unfortunately, the GPR survey did not reveal any clear subsurface anomalies. Twelve 2x2 m test excavation units were opened in the east field, and two 2x2 m units were excavated 40 meters to the west in the middle field. In the wooded area north of Flint Ridge Road and east of State Road 668, two 1x1 m units were excavated near several quarry pits, and a controlled surface collection of 75 one meter squares was completed. At the suggestion of Martha Otto (Ohio Historical Society), three 1 m wide profiles were cut along the bank north of Flint Ridge Road. In 1988, 12 additional 1x1 m squares were excavated in the east field, and James Foradas (Ohio State University) carried out a magnetometer survey in the areas where the GPR survey had been conducted. The only anomaly detected by the magnetometer was a buried metal container.

Number and Density of Artifacts Recovered

An average of 4,291 artifacts were found in each of the test excavation units, ranging from 383 in an historically disturbed unit to 22,118 in one of the units in the middle field. The average for the surface collection units was 51 artifacts. The density of chipped stone in the test units ranged from 319 artifacts per cubic meter of fill in the "disturbed" unit to 42,117 artifacts per cubic meter in a unit located where "natural" flint is exposed on the surface. The average density of the test units was 7,046 artifacts per cubic meter. Of course, the bulk of the artifacts at Flint Ridge would be classified as debitage (flint chips, chunks of flint, or other waste). Only 11 complete or broken projectile points were recovered, and only five of these could be classified. One of the vexing problems facing the investigator at Flint Ridge is the lack of chronologically sensitive stone tools (or pottery) among the vast quantities of non-diagnostic flint artifacts (cf. Mills 1921: 171).

The Extent of the Quarries and Workshops on Flint Ridge

The soils on Flint Ridge contain large quantities of flint fragments, and in places, large boulders and outcrops of flint are found on the surface (Wildermuth et al. 1938). The areas identified as "flint-bearing soils" on the U.S.D.A. soil maps for Licking and Muskingum counties were used to estimate the geographic extent of the ancient quarries and workshops (approximately 880 ha or 2,175 acres). This is slightly less than the extent of the Vanport flint beds on the ridge (about 1,000 ha). However, these data do not provide an accurate estimate of the number of quarry pits and workshops on Flint Ridge. Fowke made a sketch map of the "hundreds" of quarry pits around the crossroads and (Clark's) blacksmith shop (see Holmes 1919). This area now lies within the boundaries of the Flint Ridge State Memorial. The most detailed map of the extent of the flint quarries is the one prepared by Mills in 1921 and modified by Ernest H. Carlson (1987: 416; 1991: 66), but it does not show the total number of quarry pits or workshops.

Flint Ridge Flint is part of the upper member of the Vanport Formation of the Allegheny Group of Pennsylvanian fresh-water and marine limestones, clays, and coals. These beds formed during the transgressions and regressions of a shallow sea that covered parts of Ohio, Pennsylvania, West Virginia, and Kentucky around 320 million years ago. The upper member of the Vanport Formation contains a flint facies that forms the cap rock of Flint Ridge (because of its resistance to weathering). Flint Ridge Flint outcrops in discontinuous weathered beds with an average thickness of 1.2 meters (four feet) along the ridge. The outcrops have a lateral extent of several kilometers.

Flint Ridge Flint formed in shallow, near shore, brackish waters at the front of a delta. James Foradas noted that these kinds of shallow, brackish water depositional environments produced flints that are not homogeneous (like those formed in deep water settings) but have a high degree of morphological, mineralogical, and chemical variation. Carlson recognized four varieties of Flint Ridge Flint: (1) an impure, opaque, massive, white flint and (2) a pure, translucent, bluish-gray flint. Outcrops of these two types were common in and around the State Memorial, while the third variety, (3) colorful, banded, ribbon flint, was more common on the Nethers property in Muskingum County near the old Flint Ridge school. The last type (4) is an impure, porous, light brown flint with uneven fracture. It occurs along the western and southeastern portions of the ridge. Much of the porous flint was unsuitable for lithic artifact production, but early Euro-American settlers used it to make buhr-stones for their flour mills.

Carlson's four part classification was used in our macroscopic analysis of the artifacts from the test units at Flint Ridge State Memorial, but recent work by Foradas (1994) showed how the geochemical variation in Vanport cherts and flints could be used to discriminate between artifacts made of Flint Ridge Flint and artifacts made of flints or cherts from other sources (even if those other cherts look like Flint Ridge Flint). The shallow basins along the shore of the "Vanport sea" received sediments and detritus carried by streams flowing northwest from the Appalachian highlands, the mineral composition of the flint deposits would vary from basin to basin. The types of detrital minerals and their concentrations in the flints of the Vanport Formation would differ from patterns observed in other geological deposits. In addition, weathering of Flint Ridge Flint would result in different abundances of secondary minerals filling the fractures and cavities of the flint. By comparing the types and concentrations of detrital and secondary minerals from different rock formations or from different "quarry areas" with concentrations found in flint or chert artifacts, it is possible to identify the type of flint that was used, and even the specific quarry zone where the raw material was obtained.

The Age of the Quarries and Workshops

Mills (1921: 209-221) concluded that most of the manufacturing activities at Flint Ridge were geared toward the production of bifacial blanks (or "cache blades") and bladelet cores and bladelets. These artifacts are associated with the Adena-Hopewell complex. Six mounds and four earthworks were recorded along Flint Ridge, and Mills excavated an elaborate Hopewell burial at one of them (the Hazlett Mound on the western end of the ridge). The association of the mounds, bifacial blanks, bladelets and bladelet cores suggested to Mills that the Hopewell were responsible for much of the prehistoric quarrying and artifact manufacturing on Flint Ridge. Six of the 11 points and point fragments that we recovered could be classified. Two Early Archaic types were identified: one MacCorkle Stemmed and one Kanawha Stemmed, three Middle-Late Woodland types were found: two Jack's Reef points and a Raccoon Notched point. A Late Prehistoric triangular point was also found (Madison type). The temporal range of the points indicates that the Flint Ridge quarries and workshops have been operating for the past 9000 years.

Changes in the Utilization of Flint Ridge Flint Through Time

Lepper (1989) noted that there are many reports that artifacts made of Flint Ridge Flint have been found at sites across Eastern North America, but the most reliable of these reports involve finds from Paleo-Indian or Middle Woodland sites. Prufer and Baby (1963) found that FRF was the second most common raw material used for Paleo-Indian points found in Ohio (after Upper Mercer chert) and Lantz (1984) reports that Flint Ridge Flint was the third most common raw material used to make the Paleo-Indian points found in western Pennsylvania (after Upper Mercer

and Onondaga chert). This suggests that Flint Ridge Flint was often utilized by the earliest inhabitants of this region. Carskadden (1969) suggests that the use of Flint Ridge Flint increased during the Archaic period (7,000 to 3,000 B.P.), but that extensive quarrying operations on Flint Ridge probably did not begin until Early Woodland times. Murphy (1989:35) found that Flint Ridge Flint artifacts and debitage were common at Archaic and Woodland sites in the Hocking Valley (there are very few recorded Paleo-Indian sites), and like Lepper and Carskadden, he believes that the most intensive exploitation of Flint Ridge occurred during the time of the Adena-Hopewell (2500 to 1500 years ago). During the Late Woodland and Late Prehistoric periods (1500 to 400 years ago) there seems to have been a decline in the use of Flint Ridge Flint (Carskadden 1969; Lepper 1989; Murphy 1989).

It is clear that the Flint Ridge quarries and workshops were used to manufacture Adena/Hopewell bladelet cores and bladelets. The area that we investigated in 1987 and 1988 was within the zone of workshops "south and southeast of the blacksmith shop" where Mills (1921: 215) found that most of the core-and-bladelet manufacturing took place. In fact Mills remarked the bladelet cores and bladelets were rarely found outside of this area on Flint Ridge. We did not find any evidence for the production of Paleo-Indian artifacts (e.g. fluted points) during our investigations, although we did recover several Early Archaic projectile points. The impression that one gets from this is that the most intensive utilization of the Flint Ridge quarries was during the Adena/Hopewell times (as everyone has suggested), however this may be due to the fact that the "cache blades," bladelets, and bladelet cores that serve "type fossils" for the Early and Middle Woodland periods are easy to recognize. The flakes and cores that are the byproducts of flake core and biface manufacturing are much more generic. It is possible that the area of Flint Ridge that we tested was not intensively utilized until Adena-Hopewell times, or evidence for earlier and/or later uses of the area may have been masked by Hopewell core-and-bladelet production.

Quarrying and Stone Tool Production

Mills (1921) identified three stages in the manufacturing of bifaces at Flint Ridge. The first stage was quarrying the flint, the second stage was "blocking out" the flint into general bifacial form before it is taken to the workshops, and the third stage was shaping the blocked-out pieces into bifacial blanks or cache blades that could be transported to distant sites where they could be made into points, drills, or other bifacial tools. Mills noted that the workshops where the third production stage took place were located near the quarries on Flint Ridge and at more distant locations. Since Mills' day there have been a number of technological studies of biface manufacturing based on modern replication experiments (Ahler 1986; Callahan 1979; Johnson 1979, 1981). These studies revealed that one of the most crucial factors in biface production is maintaining the width of the tool while reducing the thickness. The thinner the biface, the more nearly complete it is (Johnson 1981: 13). The ratio of maximum width to maximum thickness is a key element of Callahan's (1979) five-stage biface manufacturing sequence (Ahler 1986: 59). Callahan's scheme takes Mill's three production stages (which take place at or near quarries) and adds two final stages when the "finishing touches" are given to blades. Callahan's Stage 4 bifaces have been secondarily thinned, and exhibit noticeably flattened cross-sections. His Stage 5 bifaces are prepared for use and/or hafting. They are preforms for projectile points, bifacial knives, or other tools.

Stone Tools

The oldest known human-made tools are made from stone and have been found in Africa. From the earliest stages of human evolution, until the discovery of metal-working techniques, people have used stone to make tools. The two basic techniques of making stone tools involve grinding a stone into the desired shape, or chipping flakes off the stone until the desired shape is achieved. Flint is the most commonly used rock for the manufacture of chipped stone, and the flint found at Flint Ridge State Memorial was used by prehistoric Indians throughout Ohio. Archeologists give specific names to the products and bi-products of stone tool manufacture. Some of these include:

core - the original block, cobble or slab of rock from which flakes have been removed. Cores are frequently found at quarries and other sites close to the source of the raw stone material.

flake - a piece of stone that has been chipped from a core or other stone tool. Flakes are recognized by the presence of a striking platform and bulb of percussion, which are located at the point where the flake was removed from the core. The presence of a striking platform and bulb of percussion helps archeologists distinguish between natural pebbles and human-made stone chipping debris.

blade - a blade is a flake that is made from a specially prepared core. Blades are at least twice as long as they are wide, and have straight, parallel sides. One of the characteristics of Hopewell sites in southern Ohio is the presence of small blade-lets made from special blade cores.

biface, bifacial - this refers to tools that have been chipped on opposing surfaces to shape a piece or produce a working edge. A bifacial cutting edge is similar to sharpening both sides of a knife blade. Most arrow and spear points are bifacially shaped. If a stone tool is chipped on only one surface, it is called a uniface. Scrapers and spokeshaves are examples of unifacial stone tools.

Mills (1921) implied that the final shaping of bifaces made of Flint Ridge Flint would probably have taken place at domestic sites away from the quarries and workshops. However, he did find a number of finished projectile points and some finely retouched bifaces that would be classified as Stage 5 bifaces at Flint Ridge, but it is not clear if these final stage bifaces were found in the quarry zones or at some of the workshops such as the "Graham place" that also contained domestic refuse (Mills 1921: 219).

We recovered 152 bifaces in our test units at Flint Ridge State Memorial. Eleven of these were points that may have been brought to the quarries and workshops and discarded during "retooling" operations. Of the remaining 141, nearly half of the bifaces that we recovered from workshop areas near the quarries were stage 2 bifaces, while 43% exhibited the primary or secondary shaping that Mills described as occurring during stages 3 and 4. Only 8% could be considered preforms or "finished" bifaces (stage 5). It should be noted that 10 of the 11 stage 5

bifaces (or preforms) were broken, and the types of fracture that they exhibited suggested that they had snapped during manufacturing.

Jay Johnson (1981) used a thinning index in his study of biface production trajectories in Mississippi. He suggested that the ratio between the weight of the biface and its surface area is a more accurate gauge of how "complete" or "finished" the biface is. He found that a thinning index >= 3.1 gm/cm2 identified early stage bifaces that are usually found at quarry sites, while an index between 1.7 and 3.1 is typical of middle stage bifaces, while late stage bifaces would have a thinning index <1.7 (Johnson 1981:25).

The computed thinning indices for the 49 whole (or nearly whole) bifaces from Flint Ridge averaged 0.90 for the points, 1.74 for the small thin bifaces, 1.72 for the large thin bifaces, and 2.43 for the crude unpatterned bifaces (only two of the 34 crude bifaces had a thinning index that was >= 3.1). This shows that while the later stage bifaces from Yellow Creek and Flint Ridge were thinned to the same degree, the early stage bifaces were thinner at Flint Ridge. Johnson found that 92% of the bifaces at his quarry sites were early stage bifaces (similar to the crude bifaces found at Flint Ridge), while 87% of the bifaces found at his late stage biface manufacturing workshops were thinned or completed types. There seems to have been a distinct separation of the biface production trajectory between Johnson's quarry sites and late stage workshops. In our sample from Flint Ridge, we found that 54% of the bifaces were early stage types (crude) while 46% were later stage forms. The complete biface trajectory seems to be represented at the Flint Ridge State Memorial, without the spatial separation of production stages that was observed in the Yellow Creek region.

The Hopewell Bladelet Industry

The second industry that Mills (1921) recognized at Flint Ridge involved the manufacture of bladelet cores and bladelets. He noted that most of the bladelet cores were manufactured at workshops located south and southeast of the crossroads at the blacksmith shop (within the boundaries of the Flint Ridge State Memorial). Mills found that the manufacturing carried on at the Flint Ridge workshops was aimed at producing bladelet cores rather than bladelets. He mentioned that many of these bladelet cores were carried to distant points where bladelets could be struck off as needed (1921: 219). Our investigations confirmed this. We recovered over 800 bladelets or fragments (most of which were struck off during the early stages of blade core preparation), but only a dozen bladelet cores or core fragments. The bladelet cores seem to have been produced by free-hand percussion. Most of the bladelets and bladelet fragments that we recovered had large striking platforms. The flaking scars on the cores and bladelets suggest that hard and soft hammers were used. Almost all of the bladelet cores and core fragments that we recovered were heat-treated, and 59% of the bladelets and fragments showed some sign of heat treatment (luster, crazing, or potlids). This suggests that some bladelets were struck off the cores before they were heated. While it appears that the heat treatment of bladelet cores took place at the quarry workshops, we did not find any features that could be classified as heat-treatment facilities during our excavations.

We found no evidence for restricted access to the Flint Ridge Flint quarry zone. We exposed no habitation features during our testing program. Mills (1921) concluded that the Flint Ridge Flint quarries were common property among the tribes of the Ohio Valley. He noted that the only place on Flint Ridge that seemed to have a more or less permanent abode was the Hopewell Hazlett Mound that he excavated on the extreme western edge of the quarry zone. Mills (1921: 219)

mentioned another habitation site on Flint Ridge that was found at the "Graham Place." He referred to this site as a workshop that contained pottery, animal bones, and evidence for a more or less permanent habitation. Murphy and Morton (1984) argue that the Graham site is identical to the Dodson Village that is described by Bernhardt (1976) as a production/distribution site in the Hopewell exchange network. Murphy and Morton relocated the Dodson/Graham site approximately 1 mile south of the Flint Ridge State Memorial.

They reviewed the history of excavations at the site, reexamined the ceramics, lithic artifacts, and faunal materials, and concluded that the Dodson/Graham site was occupied for very short periods of time by small groups of people that came to the Flint Ridge quarries to obtain flint. The most frequent use of the site was during the Early, Middle, and Late Woodland periods, but it cannot be demonstrated that the flint quarrying and lithic manufacturing that went on at the Dodson/Graham "village" was linked to any larger lithic production and distribution system. The results of these kinds of investigations support Mills' conclusion that there was no restricted access to the quarries and that there do not appear to have been any permanent habitation sites on Flint Ridge. Our 1987 and 1988 investigations were limited to the Flint Ridge State Memorial, and we were not able to obtain data on the distribution of Flint Ridge Flint outside of the primary source area. The prehistoric exchange and redistribution of Flint Ridge Flint among ancient societies in Ohio and other regions of North America may have reached its peak during the Early and Middle Woodland periods, but most of the evidence for this has come from sites found outside of the quarry area.

Our two short seasons at Flint Ridge allowed us to test several methods of data collection, and to train students in archeological field methods. Our work supported most of the earlier observations made by Mills about the nature of the activities at Flint Ridge. We agree with his observation (Mills 1921: 224) that, "It is very fortunate for those who wish to verify or disprove the statements made in this study of Flint Ridge that the full range of quarrying is still well within the reach of all investigations and needs only to be properly examined to reveal the facts." It is hoped that in the future, archaeologists will continue the investigations at Flint Ridge that he and Fowke began nearly a century ago.

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12. Meeting and Events Calender

Society for American Archaeology, 60th Annual Meeting, Minneapolis Hilton and Towers, Minneapolis, MN, May 4-7, 1995. Paul Minnis, University of Oklahoma, Program Chair.

National Park Week, special activities for school children at Hopewell Culture National Historical Park, May 22-26, 1995

Midwest Archaeological Conference, Beloit College, Beloit Wisconsin, October 25-28, 1995

Southeastern Archaeological Conference, Knoxville Tennessee, November 9 - 12, 1995.

Ohio Archaeological Council, Hunter-Gatherers to Horticulturalists: The Archaic Prehistory of the Ohio Area, November 17 -18, 1995, Cleveland State University, Cleveland, Ohio. Kent Vickery, PAC Conference Coordinator.