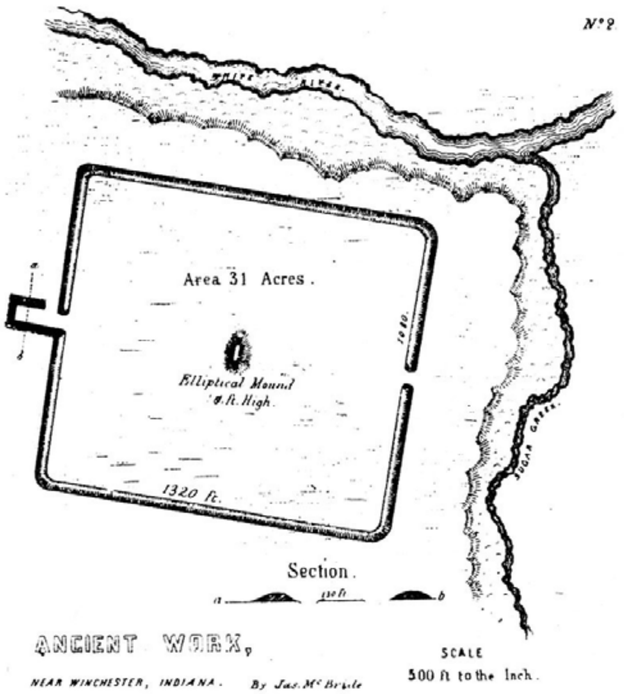
THE FUDGE SITE: A NEW LOOK AT AN ANCIENT MONUMENT RANDOLPH COUNTY, INDIANA



by
Beth K. McCord

with sections by
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Reports of Investigation 67

June 2006

Archaeological Resources Management Service
Ball State University
Muncie, Indiana 47306

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ACKNOWLEDEMENTS

The report is dedicated to Mr. Bob Manning. Our work at the Fudge site would not have been possible without Bobby's effort and support throughout this entire project. Bobby invested a great deal of his time in this project. We learned a lot from each other over the last year. We will always be in his debt.

I would like to thank the Division of Historic Preservation and Archaeology and Ball State University for providing the monetary support for this project. This project was funded in part by a Department of the Interior grant administered by the Division of Historic Preservation and Archaeology, Indiana Department of Natural Resources. Special thanks to Amy Johnson and Malia Savarino for your assistance on this project. Matching funds for this project were furnished by Ball State University. Thanks to Jay Javed in Contracts and Grants at Ball State for managing the accounting for this project.

I want to recognize the kindness and cooperation of the landowners involved in the project. The Fudge site encompasses several landowners and we would have never been able to complete our work without your help and understanding. Thanks to Mr. and Mrs. Earnest Ashley, Mr. and Mrs. Gary Fisher, Mr. Randy Hahn, Mr. and Mrs. Donald Hahn, Mr. David Howard and Mr. Herbie Meinerding, Jr. Mr. and Mrs. Fisher even donated an artifact collection to ARMS. Mr. Howard lost his struggle with cancer during this project, but we will always be grateful for his interest. He got the ball rolling when we needed landowner permission.

I also want to express my appreciation to the residents of Winchester and Randolph County. We had numerous visitors stop and talk to us when we were working at the site. Thanks to everyone that shared your information. Mr. Halbert Cox donated early photographs he had of the site. Mrs. Monisa Wisener of the Randolph County Historic Musuesm graciously opened the doors of the museum for a presentation and allowed us access to the artifact collections. We also received a wonderful response to local presentations.

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As always, Mitch Zoll and Don Cochran provided any and all assistance throughout this project. Mitch kept the payroll and student schedules straight. Don offered his arguments and encouragement. His direction and editing of the report were essential. Thank you both.

Finally, thanks to the Fudge site for revealing some of yourself to us.

ABSTRACT

The Archaeological Resources Management Service (ARMS) at Ball State University conducted a FY2005 Historic Preservation Fund Grant to investigate the Fudge site. This project reviewed the archaeological setting, changes in landuse, and involved pedestrian surveys of the enclosure and surrounding area, an instrument survey of portions of the site, and limited test excavations along the northern embankment wall. The main objective of the project was to further our understanding of Early/Middle Woodland ceremonial and settlement systems in eastern Indiana and the Ohio River Valley through investigations of the Fudge site chronology, construction and function.

The project recorded 27 archaeological sites through pedestrian survey of approximate 170 acres. Besides the Fudge site, a Late Archaic lithic scatter (12R328), the old Randolph County Fairground (12R10 and 554) and a historic structure (12R578) were recommended for further investigation. The pedestrian surveys confirmed the absence of large amounts of habitation debris within the enclosure and found only tentative examples of Middle Woodland occupation in the nearby area.

Investigations at the Fudge site documented that over half of the embankment walls were visible although they were reduced significantly in height. Subsurface anomalies relating to the excavated mound and the plowed-down western gateway extension were documented through magnetometer surveys. Excavations recovered few artifacts but three radiocarbon dates ranging between cal 110 BC to AD 220 were obtained. The radiocarbon dates and the stratigraphy suggest multiple stages of construction involving preparation of the original ground surface and construction of the northern embankment wall from locally available soils.

Further understanding of Early/Middle Woodland ceremonial and settlement systems were obtained through investigations of the Fudge site chronology, construction and function. From all the information we have collected from the east central Indiana earthworks, it is apparent that they are part of a regional network. The clear regional pattern in chronology, sites, artifacts, mortuary practices and ceremonialism led to the redefinition of the New Castle Phase.

In sum, the project confirmed that important archaeological information still exists within the Fudge site and it was nominated to the National Register of Historic Places. The site has already yielded important information in Early and Middle Woodland prehistory and contains intact, unexplored deposits that may further our understanding of the site.

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INTRODUCTION

The Archaeological Resources Management Service (ARMS) at Ball State University conducted a FY2005 Historic Preservation Fund Grant to investigate the Fudge site. The project involved a pedestrian survey of the site and surrounding area, an instrument survey of the site, limited test excavations, completion of a National Register nomination, and public outreach. The main objective of the project was to further our understanding of Early/Middle Woodland ceremonial and settlement systems in eastern Indiana and the Ohio River valley through investigations of the Fudge site chronology, construction and function.

The Fudge site (12R10) is the largest earthern enclosure recorded in Indiana (Lilly 1937) and is the only Indiana site to be featured in *Ancient Monuments of the Mississippi Valley* (Squier and Davis 1848) (Figure 1). The site is in Randolph County near Winchester. The site originally consisted of a large rectangular earth enclosure surrounding 31 to 43 acres, depending on the reporting source. An elliptical mound 100' in diameter and 8' to 15' high was in the center of the enclosure (Squier and Davis 1848:93, Cox 1879:135, Tucker 1882:14, Setzler 1931, Lilly 1937). As early as 1865, the earthwork was being destroyed by various activities associated with the Randolph County fairgrounds, quarrying for clay and gravel, and agricultural, residential, transportation and communication activities (Anonymous 1885, 1980; Cox 1879:134; Phinney 1882:193; Tucker 1882:14). The central mound was excavated in 1929 by Frank Setzler (1931).

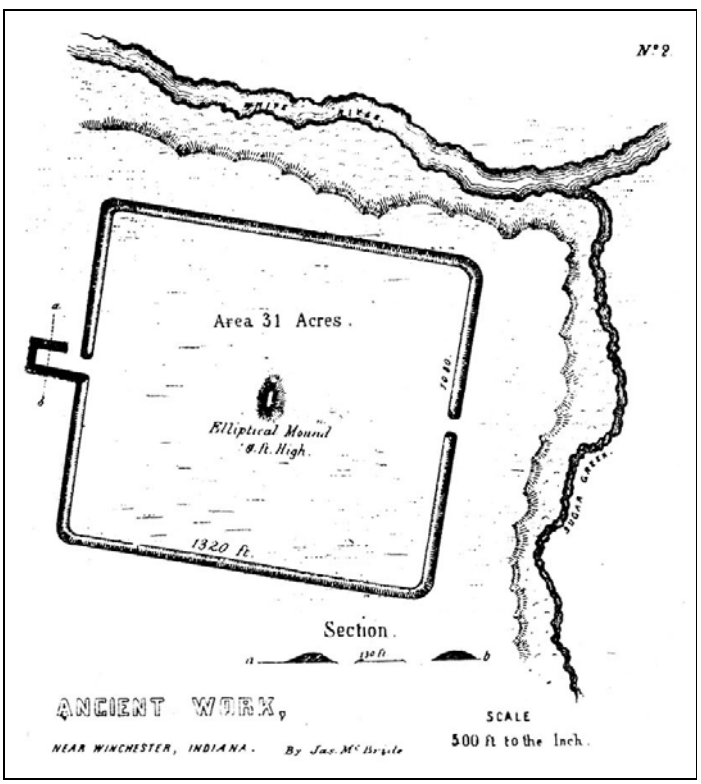

Figure 1. McBride map of the Fudge site published in Squier and Davis (1848).

The mounds and enclosures of east central Indiana have long been considered essential to understanding the relationships between the Middle Woodland Adena and Hopewell complexes (Griffin 1979:226, Kellar 1983:46-47, Swartz 1971). For nealy 20 years, we have intensively investigated these sites (Cochran 1988, Cochran 1992, Cochran 1996, Cochran and McCord 2001, Kolbe 1992, McCord and Cochran 1996, McCord and Cochran 2000). While our understanding has evolved with the acquisition of new data, we are finally able to seriously address the problem of the chronological and cultural relationships between the two complexes (McCord and Cochran in press).

Throughout the Ohio Valley, there is a consensus that the Adena Complex is a chronological and cultural precursor of the Hopewell Complex (eg. Fagan 2000). Data from mound and enclosure sites in east central Indiana, however, requires a different perspective. The radiocarbon database from the region shows that the mounds and enclosures are contemporary regardless of whether Adena or Hopewell Complex artifacts are present. In addition, contextual analysis of the sites shows that Adena and Hopewell Complex artifacts occur together in some features although they are segregated in different types of sites. These chronological and contextual relationships indicate that the two complexes are contemporary and that they represent different parts of the same ceremonial system (McCord and Cochran in press). Currently, we are testing this hypothesis against data from east central Indiana.

The Fudge site became central to this investigation since a cache of artifacts associated with the mound contained both diagnostic Adena and Hopewell artifacts (McCord and Cochran 2000). The enclosure, however, has been characterized as atypical for Adena (Griffin 1971:136). No radiocarbon dates were available from the site although charcoal, bark and fiber have been recovered from the central mound (Setzler 1931, McCord and Cochran 2000). Obtaining radiocarbon dates from the site became crucial to examining the relationships between Fudge and other earthworks in east central Indiana and throughout the Ohio Valley.

In addition, Fudge represents one of three sites with rectangular enclosures in east central Indiana. While the circular complexes have been extensively studied, we have little modern data from any of the rectangular enclosures. We also investigated whether Fudge was an “empty” or “occupied” enclosure, a topic of considerable debate associated with large geometric enclosures in Ohio (Dancey and Pacheco 1997, Prufer 1964, 1996).

Several research questions were pursued during this project. The following questions directed the project.

1. What is the chronology of the Fudge site?
    a. When was the site constructed and how long was it used?
    b. Were the mound and embankment constructed at the same time?
2. What construction episodes can be defined?
    a. How was the embankment built?
    b. Are there undocumented features at the site?

3. Is the enclosure a vacant or occupied center?
    a. Are there associated sites within or near the enclosure?
4. What activities occurred at the site?
5. How does the site relate to other earthworks in east central Indiana?

BACKGROUND

Since the Fudge site is located northwest of Winchester in Randolph County, Indiana, background information was primarily complied from Randolph County sources. The Fudge site is part of the Middle Woodland ceremonial landscape that was built in east central Indiana and recognized by the presence of mounds and enclosures. Therefore, references from the broader east central Indiana area including Delaware, Madison, Wayne and Henry counties will be included, as relevant. The environmental setting will be presented first following by the archaeological setting and specific information from previous investigations at the Fudge site.

Environmental Setting

Location

The Fudge site (12R10) is in White River Township in Randolph County and located in the SW 1/4 of the SW 1/4 of Section 17, Township 20N, Range 14E as shown on the USGS 7.5' Winchester Quadrangle (Figure 2). Randolph County encompasses approximately 290,253 acres or 453.5 mi^2 (Neely 1987). It is bordered by Darke County (Ohio) to the east and Wayne and Henry County to the south, Delaware County to the west and Jay County to the north.

Image Removed

Site Locations Confidential

Not for Public Disclosure

Figure 2. A portion of the USGS 7.5' Winchester, Indiana Quadrangle showing the location of the Fudge site.

Geology

The bedrock physiography of Randolph County is characterized as the Bluffton Plain. This plain is a nearly flat limestone upland, but slopes with the regional dip of the Cincinnati Arch. It was formed over Ordovician and Silurian limestones and dolomites. The Bluffton Plain is covered by unconsolidated glacial deposits (Chen and Chaturvedi 1992:19, Schneider 1966:56, Wayne 1958:29-30).

Few exposures of bedrock are reported in the county (Phinney 1882:184, Chen and Chaturvedi 1992:24). Outcrops are only reported at various places along the Mississinewa and White Rivers (Taylor 1910:48). An outcrop at Maxsville is described as "a soft, friable and coarse grained limestone … suitable only for lime" (Phinney 1882:184). Another exposure, reported at Ridgeville, is described as a "whitish, coarse-grained limestone … and forms the principal stone used in the vicinity for walls and building" (Phinney 1882:186). Salamonie Dolomite was encountered at a stone quarry near Ridgeville (Chen and Chaturvedi 1992:27). Overlying the Salamonie Dolomite is the Pleasant Mill Formation. Dolomite, limestone and argillaceous dolomite occur. In the Louisville Member of the Formation, chert is common (Chen and Chaturvedi 1992:27).

No natural chert outcrops are reported for Randolph County. The closest recorded chert outcrops to the Fudge site are Liston Creek in Huntington County and Laurel in Wayne County (Cantin 2005). Liston Creek chert occurs in the Liston Creek Member of the Wabash Formation (Cantin 2005:25). Laurel chert is found in the Laurel Limestone Member of the Salamonie Dolomite (Cantin 2005:22). It is possible the chert noted in the stone quarry near Ridgeville is Laurel, but no natural outcrops have yet been reported. Gravel cherts were locally available in the unconsolidated glacial drift (Cantin 2005:14).

Glacial History

Randolph County was covered by glacial ice leaving behind glacial drift as it retreated. The present day thickness of the Wisconsin age drift ranges from a few feet to over 300 feet (Chen and Chaturvedi 1992:19). The glacial drift occurs within the county as a series of ground or ridge moraines (Chen and Chaturvedi 1992:27). The ground moraine occupies the largest portion of the county. Three ridge moraines occur in the county coinciding with watershed divides. The Mississinewa moraine occurs across the northern portion of the county, the Union City moraine extends east and west throughout the central portion of the county along the White River, and the Knightstown moraine occurs across southern portions of the county. The Fudge site is located just south of the Union City moraine on a ground moraine.

The unconsolidated Wisconsin age glacial drift is part of the Cartersburg Till Member of the Trafalgar Formation (Wayne 1966:26). Tills of the Trafalgar Formation are primarily calcareous conglomeratic mudstones, but lenses of silt, sand and gravel are also present (Chen and Chaturvedi 1992:31). The Atherton Formation deposits are extraglacial consisting of gravel, sand, silt and clay and occur in either lacustrine or outwash facies within the county (Chen and Chaturvedi 1992:31). Martinsville Formation deposits are also post glacial in age and occur in two facies in the county. The Alluvial facies is associated with flood plain deposition and the Paludal facies is formed in still waters (Chen and Chaturvedi 1992:31). The Fudge site occurs on the glacial drift of the Trafalgar Formation.

Physiography

Randolph County is part of the Central Till Plain Region (Gray 2000). It is within two subdivisions: the Bluffton Till Plain and the New Castle Till Plains and Drainageways. The Bluffton Till Plain is dominanted by a till plain of low relief, but includes a defined concentric series of moraines (Gray 2000:5). These moraines were created by minor re-advances of glacial ice and incorporated clayey material from lake deposits. The New Castle Till Plains and Drainageways is characterized as a relatively featureless till plain of low relief dissected by a crisscross pattern of meltwater features (Gray 200:6). The tunnel valleys fed the West Fork of the White River, several tributaries of the East Fork of the White River and the forks of the Whitewater River.

Randolph County has seven physiographic divisions: the Knightstown end moraine, the Mississinewa end moraine, the Union City end moraine, till plains, outwash plains, bottom land and lake plains (Chen and Chaturvedi 1992:15). The end moraines have the most dramatic changes in slope, and the till plains are nearly flat, but may have gently to moderate slopes along the river valleys. The outwash plains are broad plains formed by glacier meltwater and occur along the major river and streams. The bottom lands are nearly level, but narrow and restricted. The lake plains are usually ponded and most occur south of the White River (Chen and Chaturvedi 1992:32-40).

The topography of Randolph County is described as “a gently undulating plain, containing shallow stream valleys” (Taylor 1910:18). The counties to the south become more rolling and have deeper stream valleys (Taylor 1910:18). The undulating terrain is primarily associated with moraines (Taylor 1910:48).

The Fudge site is within the New Castle Till Plains and Drainageways and the surrounding terrain is characterized as a relatively featureless till plain of low relief. The topography is nearly level to moderately sloping. The northern side of the site has the most slope, particularly the northeast corner, as the site intersects with the White River and Sugar Creek valleys.

Water Resources

Randolph County contains the highest elevation recorded in the State at 1257 feet (Chen and Chaturvedi 1992:17). This area, known as the “Summit”, lies between Martindale Creek and Green’s Fork and forms the watershed divide between the White and Whitewater Rivers (Taylor 1910:48). Randolph County contains the headwaters for three of Indiana's major river systems (Chen and Chaturvedi 1992:6). The northern part of the county is drained by the Mississinewa River and its branches: Elkhorn Creek, Bear Creek and the Little Mississinewa. The central portion of the county is drained by the White River and its tributaries: Little White River, Cabin Creek, Sugar Creek and Salt Creek. The southern part of the county is drained by the Whitewater River and its tributaries: West River, Martindale Creek, Green's Fork, Noland's Fork, Greenville Creek and Dismal Creek (Phinney 1882:179). No natural lakes occur within the county (Chen and Chaturvedi 1992:10).

The Fudge site is located within the West Fork of the White River drainage basin. It is on the southwest side of the confluence of the White River and Sugar Creek. A spring is reported east of the northeast corner of the embankment (Phinney 1882:193).

Soils

The parent materials for Randolph County soils were generally deposited by glaciers or by meltwater as the glaciers receded (Neely 1987:75). The dominant parent materials in the county are glacial till, outwash, lacustrine material, alluvium and organic material (Neely 1987:75). The soils of the county were separated into six general soil associations based on distinctive patterns of the soils, relief and drainage (Neely 1987:5). Two of these associations are relevant to this project: the Celina-Patton-Losantville association and the Eel-Sloan-Fox association. The Celina-Patton-Losantiville association is "nearly level to moderately steep, deep, moderately well drained, poorly drained, and well drained, medium textured and moderately fine textured soils formed in loess and in the underlying glacial till, in glacial till, and in lacustrine sediments; on uplands and lake plains" (Neely 1987:6). The Eel-Sloan-Fox association is "nearly level to moderately sloping, moderately well drained, very poorly drained, and well drained, medium textured soils that are deep or are moderately deep over sand and gravel; formed in alluvium and outwash on flood plains and stream terraces" (Neely 1987:7). Specific soil phases within the areas investigated during this project are presented in Table 1.

Table 1
Soils within Areas Investigated

Soil Phase	Drainage	Parent Material	Physiography	Soil Order
Celina silt loam, 1 to 4% slopes (CeB)	moderately well drained	loess and glacial till	upland	Alfisol
Fincastle-Crosby silt loam, 0 to 1 % slopes(FcA)	somewhat poorly drained	loess and glacial till	upland	Alfisol
Fox loam, 0 to 2 % slopes (FoA)	well drained	outwash	terrace	Alfisol
Miami silt loam, gravelly substratum, 0 to 2 % slopes (MoA)	well drained	loess and glacial till	upland	Alfisol
Miami silt loam, gravelly substratum, 2 to 6% slopes (MoB2)	well drained	loess and glacial till	upland	Alfisol
Treaty silt loam (Tr)	very poorly drained	loess and glacial till	upland	Mollisol
Udorthents, loamy (Ud)				

The soils relevant to this project are grouped as either Alfisols or Mollisols. Alfisols began forming after the last glaciation typically under deciduous forest vegetation (Fanning 1989:268). Alfisols form primarily from eluviation (downward movement of dissolved or suspended material within soil) and illuviation (deposition of material in an underlying soil layer leached out of an overlying soil layer) of silicate clay and iron oxides (Fanning 1989:267). The age of the Mollisols in the project is more variable; mollic epipedons have been noted to form in fewer than 900 years, but they could be as old as the last glaciation (Fanning 1989:256-257). They most likely developed in native grasslands since they have high levels of calcium humates (Fanning 1989:255-256). Mollisols form primarily from calcification or the underground decomposition of organic matter, especially grass roots, in the presence of calcium, faunal bioturbation and eluviation and illuviation (Fanning 1989:255). Only one soil series, Treaty silt loam, is identified as a Mollisol.

The soils expected to be encountered during this project all had the potential to support or attract human occupation. The very poor drainage and mollic epipedon of Treaty soils indicates the presence of wet prairies. These areas may not have been suitable for habitation, but likely contained animal and plant species useful to prehistoric populations. The Fincastle-Crosby soils were probably not very attractive for habitation due to poor drainage. The remaining soils were all well or moderately well drained and could have supported human habitation and a woodland biotic community.

Flora

As the climate shifted in Indiana after the end of the Pleistocence, so did the plant species. Table 2 presents the transformation of the vegetative sequence constructed by Shane (1976) to reflect the general changes that took place with the region since the retreat of the glacial ice. Table 2 is a regional generalization and is not specific to Randolph County.

Table 2
Vegetation Sequence of Central Indiana
(Cochran and Buehrig 1985:9, after Shane 1976)

AD 2000	Historic	Deciduous Forest
AD 1000	Late Woodland	
0	Middle Woodland	
1000 BC	Early Woodland	
2000 BC	Late Archaic	
3000 BC		
4000 BC	Middle Archaic	
5000 BC		Prairies and Open Vegetation
6000 BC		
7000 BC	Early Archaic/ Late Paleo Indian	Deciduous Forest
8000 BC		
9000 BC		Pine Maximum
1000 BC	Early Paleo Indian	Conifer-Deciduous Woodland
11000 BC		
12000 BC		Boreal Forest
13000 BC		Park Tundra
		Tundra or Open Areas
14000 BC		Periglacial Zone
15000 BC		Wisconsin Ice

With historic documentation, more detailed descriptions of the vegetation in central Indiana can be given. The historic forest descriptions should be representative of the deciduous vegetation occurring during the Woodland period. Petty and Jackson's (1966) study of the natural vegetation of Indiana in 1816 show Randolph County dominated by the beech-maple forest association. The beech-maple forest developed from the mesophytic forest as northward postglacial migration occurred. Beech-maple forests usually have beech as the most abundant canopy tree with sugar maple co-dominate in the canopy and dominant in the understory. Other species occurring in beech-maple forests include: black walnut, white oak, burr oak, red oak, tulip poplar, white ash, American elm, slippery elm, cork elm, basswood, black gum, hickory sassafras and black cherry. Small tree understory is generally either redbud-dogwood-blue beech or dogwood-hop hornbeam. Shrub layers usually include pawpaw, spicebush, greenbriar, elderberry, leatherwood, wahoo and maple-leaf viburnum. The most prominent herbs occur in the spring with rue anemone, jack-in-the-pulpit, spring beauty, cutleaf toothwort, pretty bedstraw, mayapple, false Solomon's seal and wild ginger. The oak-hickory forest is dominated by white and red oak trees with sugar maple, swamp white oak, pignut and shagbark hickory, bur and chinquapin oak, American and slippery elm, American beech, white ask and bur oak secondary. Wet or lowland oak-hickory forests contain bur oak, pin oak, swamp white oak, Shumards oak and bitternut hickory. The understory of oak-hickory forests is less well developed than beech-maple forests and frequently contains only one or two of the hop hornbeam, blue beech, dogwood, serviceberry and maple species. Oak-hickory forests have more herbaceous species than beech-maple forests including pussy-toes, common cinquefoil, wild licorice, tickclover, blue phlox, waterleaf, bloodroot, Joe-pye-weed, woodland asters and goldenrods, wild geranium and bellwort that are more prominent in late summer and autumn (Petty and Jackson 1966).

Generalized maps of forest associations do not account for smaller areas of different vegetation. The White River is immediately adjacent to areas covered during this project, and flood plain forests and prairies may have been exploited by prehistoric populations. A study of flood plain forests along the East and West forks of the White River found the following species dominant: silver maple, sycamore, American elm, cottonwood, hackberry, cork elm, box-elder, black willow, white ash and red elm (Petty and Jackson 1966:276). The same study found the predominance of hawthorn, redbud, wild plum, hop hornbeam and flowering dogwood in the understory; elderberry, spice bush, wahoo, swamp-privet, wafer-ash and pawpaw in the shrubbery; and poison-ivy, gapes, green briar, trumpet creeper and Virginian creeper in the vines (Petty and Jackson 1966:276). Beech and tulip poplar would have been important in flood plain forests in pre-Euroamerican times, but are now absence due to the clearing of the forests for agriculture and more widely fluctuation stream levels (Petty and Jackson 1966:277).

A more specific reference for historic vegetation around the Fudge site is contained in the General Land Office (GLO) survey records. On the boundary lines of Section 17, Township 20 N, Range 14 East, beech, sugar, ash, oak, hickory, elm and walnut are reported (Fowler 1811).

Fauna

The animals living in Indiana would have changed from the end of Pleistocene through Holocene times. Various Pleistocene age fauna have been found in Indiana. Early twentieth century accounts list bison, giant beaver, caribou, Virginia deer, dire wolf, elk, horse, mammoth, mastodon, musk-ox, peccary, sloth and perhaps moose (Moodie 1929, Lyon 1936). More recent investigations have expanded this list to include moose, caribou, black bear, giant short-faced bear, giant tortoise, white-tailed deer, Canadian goose, armadillo, jaguar, sabertooth tiger and camel (Richards 1984).

In 1816, an estimated 66 species of mammals were present in Indiana (Mumford 1966:475). Some of the common mammals found in Indiana include opossum, eastern cottontail, eastern chipmunk, white-tailed deer, beaver, deer mouse, white-footed mouse, meadow vole, pine vole, muskrat, southern bog lemming, Norway rat, coyote, red fox, gray fox, raccoon, long-tailed weasel, various species of squirrels, mice and shrews. Twelve species are listed as exterminated from Indiana and include bison, wapiti, porcupine, gray wolf, red wolf, black bear, fisher, eastern spotted skunk, wolverine, river otter, mountain lion and lynx (Mumford 1966:475).

Historic sources also report a large variety of other fauna in Indiana. Webster (1966:455-473) identifies 366 species of birds. A total of 177 species of fish have been identified (Gammon and Gerking 1966:401-425). Approximately 200 species of mollusks and 400 species of crustaceans occurred in Indiana waters. Approximately 82 species of amphibians and snakes have been identified (Minton 1966:426-451). The species can be subdivided into 19 species of salamanders, 2 species of toads, 11 species of frogs, 6 types of lizards, some 30 types of snakes, and 14 turtle varieties (Minton 1966:426-451).

Summary

As the ecological and natural setting of the project area changed and evolved over the last several thousand years, human settlement would also have changed. Settlement and use of resources within the project area would have been influenced by potential plant and animal resources and, conversely, may have influenced changes in flora and fauna (Delcourt and Delcourt 1991:87-89). The generally homogenous environment of till plain regions in Indiana, including Randolph County, shaped a dispersed prehistoric settlement pattern (Wepler and Cochran 1983:90, Cochran 1994:6).

Archaeological Setting

Culture History

The natural setting of Randolph County and the Upper White River Valley demonstrates a hospitable environment following the retreat of the glaciers. Native Americans inhabited the region from the Paleoindian through the Historic period. A brief review of our current understanding of the culture history of Randolph County follows (Cochran 1994, Cochran 2004, Jones and Johnson 2003, Justice 1987, Kellar 1983, Swartz 1981). A review of Woodland settlement focusing on the Middle Woodland period will also be presented.

Paleoindian cultures entered Indiana as the Wisconsin glacial advance began retreating to the north circa 12,000 to 10,000 BP. Paleoindian sites are generally small surface scatters located in upland areas resulting from small family bands wandering over large territories in search of game animals. The defining artifacts from this time period are the lanceolate point forms including fluted Clovis points and unfluted Agate Basin, Hi-Lo, Holcombe, Plainview and Dalton points. No Paleoindian sites with *in situ* deposits have been excavated in Randolph County or Indiana.

During the Early Archaic (10,000 to 8,000 BP), people were adapting to a warming environment that changed floral and faunal resources in the region. Early Archaic sites may be larger than the previous Paleoindian sites, but data for the Upper White River Valley does not confirm this. Early Archaic sites are found on almost every land form and Early Archaic point styles are the second most frequently found in the region. Technological changes are displayed in a larger diversity of projectile points with new hafting techniques. Point forms such as Big Sandy, Lost Lake, Charleston, St. Charles, Thebes, Decatur, Kirk, Palmer, MacCorkle, St. Albans, LeCroy and Kanawha have been reported from the Upper White River Valley. While Thebes, Kirk and Bifurcate Traditions occur in the region, no excavation data is available from the region. Ground stone tools make their first appearance during this time.

Middle Archaic (8,000 to 5,000 BP) cultures are associated with a warming and drying period that occurred across the Midwest, once again changing the resources available. More residential stability and a broader food base are suppose to occur during the Middle Archaic, but very few sites of this age are found in the Upper White River Valley. Sites are found in valley and valley edge settings with supposed decreased emphasis on the uplands. Point styles from this period found in the region include: Raddatz, Godar, Stanley, Karnak and Matanzas. Ground stone tools become more varied during this time.

With the Late Archaic (5,000 to 3,000 BP), the environment stabilizes to the conditions and deciduous forests encountered by Historic Euroamericans. Late Archaic artifacts are the most frequently encountered in the region and occur across the landscape. While Late Archaic sites are some of the largest in the region, they are often multicomponent. The exact nature of Late Archaic settlement is unclear although seasonal, scheduled occupations are suspected. The economy appears to have been diffuse and the cultivation of native plants develops. The high frequency of these sites has led some to conclude that populations increased. Trade networks are more visible than in previous periods with the occurrence of copper and marine shell. Diagnostic projectile points from the region include: Mantanzas, Late Archaic Stemmed, McWhinney, Karnak, Lamoka, Table Rock, Brewerton, Riverton and Turkey Tail. The worked bone industry seems more elaborate. Cultures, phases or foci from this period include French Lick, Maple Creek, Glacial Kame and Riverton. The McKinley site (Justice 1993) is a regional example of a multicomponent site with a Late Archaic occupation.

The Early Woodland period (3,000 to 2,200 BP) is marked by the introduction of pottery. Ceremonialism is visibly heightened as evidenced by the construction of mounds and earthworks. Early Woodland habitations occur infrequently in the region, but the ceremonial sites are very visible. Hunting and gathering continue during this period supplemented by limited horticulture. Early Woodland ceramics found in the region are defined as Marion Thick. Diagnostic points include Cypress, Motley, Dickson, Kramer, Cresap, Adena and Robbins. Archaeological units that may occur in the area are Marion and Adena. No Early Woodland habitations have been excavated in the area. The Fudge site contains artifacts relating to the Adena Complex (Kellar and Swartz 1971, McCord and Cochran 2000, Setzler 1931).

The Middle Woodland period (2,200 to 1,400 BP) marks a climax in ceremonial behavior. The habitations, similar to Early Woodland, occur infrequently in the region.

The economy continues to focus on hunting, gathering and limited horticulture, but maize is introduced during this time. Exotic goods are frequently found at the ceremonial sites and demonstrate an expansion of trade networks. Middle Woodland ceramics found in the region are New Castle Incised, and styles similar to Adena Plain, McGraw and Scioto series. Diagnostic lithics include Robbins, Snyders, Lowe, Chesser, and Steuben points and lamellar bladelets. Archaeological units that may occur in the area are Adena and Scioto. No habitation sites with *in situ* Middle Woodland deposits have been excavated in the region. The Fudge site has been related to the Hopewell complex of the early Middle Woodland period (Cochran 1996, Griffin 1971, McCord and Cochran 2000). The Middle Woodland period will be expanded below.

The Late Woodland period (1,400 to 300 BP) sites occur in the third highest frequency in the region. The period shows a decline in the importance of mounds. The bow and arrow is introduced and the cultivation of domestic crops rises in importance. Maize becomes an important addition to the diet. Pottery is rarely found outside of the floodplain. Ceramic styles found in the region include Jack's Reef, Albee and Oliver. Diagnostic lithics include Lowe, Chesser, Steuben, Racoon Side Notched, Jack's Reef Corner Notched and Triangular Cluster points. Archaeological Phases recognized in the region include Intrusive Mound, Albee and Oliver (McCord and Cochran 1996, McCord 2005).

The historic occupation of Indiana encompasses about the last 400 years. This period reflects radical changes in human culture and technology and use of the landscape. Historic Period settlement of the Randolph County area began in 1814 (Tucker 1882:36). Since Randolph County lies east of the Greenville Treaty line, this area was on of the first areas settled in Indiana. Thomas Parker and his family, Quakers from North Carolina, are credited with the first settlement in the county (Tucker 1882:36). The earliest land entries for the county occurred in Greensfork Township (Tucker 1882:37). The highest number of settlers recorded in the early county history occurred during the periods of 1817 to 1818 and 1833 to 1837 (Tucker 1882:38).

Middle Woodland Landscape

Since the Fudge site is associated with the Middle Woodland period, settlement patterns relating to this period were further explored. Information from the Early Woodland period was also included since diagnostic artifacts overlap these two time divisions. Information from a recent grant project in the Upper White River drainage provided information on Woodland habitations. In addition, information concerning the Fudge site and Middle Woodland settlement was obtained from local collectors. Collections at the Randolph County Historical Museum were also reviewed.

Habitations

Data from Randolph County provided only three sites with Middle Woodland components. To provide a larger information pool, data complied as part of a recent grant project on Woodland settlement in the Upper White River drainage in Randolph, Delaware, Madison and Hamilton counties were reviewed (McCord 2005)(Appendix A). Information from ARMS and DHPA site files was collected for Woodland and Late Prehistoric components within the Upper White River drainage above the Marion/Hamilton county line. The data were primarily derived from surface collections. Only habitation site data were used for this study. Mortuary and mound sites were considered separate from secular use of the landscape and were not included at this time.

The study found 305 Woodland/Late Prehistoric sites in the Upper White River drainage. By county and drainage basin area, the distribution was as follows: 149 sites in Hamilton County in approximately 401 mi^2, 49 sites in Madison County in approximately 171 mi^2, 97 sites in Delaware County in approximately 264 mi^2, and 10 sites in Randolph County in approximately 120 mi^2. The number of Woodland/Late Prehistoric sites within the Upper White River drainage is fairly evenly distributed per square mile in Hamilton, Madison and Delaware counties. (One site between 2.7 and 3.5 mi^2). Randolph County is poorly represented (one site per 12 mi^2), but this is likely due to sampling error since far fewer surveys and sites are recorded in Randolph County (McCord 2005:22)

The distribution of Woodland/Late Prehistoric sites was examined by environmental zone and landform. The specific landform and adjacent landforms were taken from the county soil surveys (Hosteter 1978, Huffman 1972, Neely 1987, Schermerhorn 1967) and USGS topographic maps. Only the data relating to period of earthwork construction in east central Indiana (ca. 250 B.C. to A.D. 350) is reiterated here. The data is reliant solely on surface collected material. Since Early Woodland point styles such as Robbins points have been found in regional earthworks, diagnostic artifacts from this period were also included. Table 3 provides a breakdown of Early and Middle Woodland diagnostic artifacts ranging from ca. 500 B.C. to A.D. 200 (Justice 1987). While Middle Woodland Expanding Stem points may overlap with this time frame, they were not included since they are not associated with the Adena or Hopewell complexes in east central Indiana. No confirmed Early or Middle Woodland ceramics have been recovered from habitation sites in the region.

Table 3
Settlement by Landform by Diagnostic Artifacts

Landform	Adena (n=21)	Robbins (n=4)	Dickson (n=3)	Snyders (n=21)	Bladelet (n=13)	Total (n=62)
Till Plain	42.9%	25.0%		38.1%	15.4%	32.2%
Floodplain	4.8%	25.0%		23.8%	46.2%	21.0%
Outwash Terrace	42.9%	25.0%	100.0%	28.6%	23.1%	35.5%
Outwash Plain	4.8%					1.6%
Lakebed						
Kame/Esker						
Floodplain/Outwash Terrace	4.8%	25.0%		9.5%	15.4%	9.7%
Total	100.2%	100.0%	100.0%	100.0%	100.1%	100.0%

As Table 3 displays there is a definite affinity for valley settings during the time of earthwork construction in east central Indiana. Floodplains and outwash terraces represent ⅔ (66.2%) of the landforms occupied. There is some internal variation between specific artifact styles. For example, far more Synders points have been recovered from floodplain settings than Adena points. While valley settings dominate the landforms occupied, till plain settings are well represented. The settlement pattern recognized for the time of earthwork construction in this area, therefore, appears to be rather dispersed. In reviewing the site components, the Early and Middle Woodland sites appear to represent small site size as well. Rarely are more than one or two diagnostic Early or Middle Woodland artifacts found at one site. This pattern of small, dispersed sites is not unexpected for the Till Plain region of Indiana. As stated previously, the generally homogenous environment of the Till Plain region shaped a dispersed prehistoric settlement pattern (Wepler and Cochran 1983:90, Cochran 1994:6).

Mortuary Sites

Mortuary sites, including mounds and earthworks had been excluded from McCord's (2005) review. For this project mortuary sites were an important element and were added to the habitation data (Appendix A). Mortuary sites were recognized as single burials or cemeteries associated with habitation sites or mound and earthworks even though human remains have not reported for all due to a lack of excavation data. It is assumed that the mounds and earthworks in the region are associated with the Adena and Hopewell complexes even if excavation data was not available for all. While mounds were constructed during the Late Woodland period, none of the region mounds has been confirmed as Late Woodland.

The review of mortuary sites found 17 sites within the Upper White River drainage and Randolph County. Eleven of these sites were felt to be associated with the Adena and Hopewell complexes. The review found that no confirmed Early or Middle Woodland burials have been found outside of earthworks. However, a donation made to the ARMS lab in 1987 contained the remains of two individuals recovered from a gravel bank at Strawtown in Hamilton County in 1938 or 1939. Associated with the remains were two conch shell containers, shell beads, a copper pin, an antler beam, 3 chert flakes, and three small pieces of grit tempered pottery (ARMS files Acc. # 87.49). This burial was never recorded on the state site inventory due to the ambiguous location, but it does suggest a Middle Woodland association. Even though a specific location is not known, the notation of a gravel bank suggests an outwash terrace landform.

Of the 11 recorded earthwork and mound sites, one was located in Madison County (12M2), five were located in Delaware County (12Dl12, 17, 18, 21, 22 and 63) and five were located in Randolph County (12R1, 10, 18, 19 and 31). While Randolph County was poorly represented in the examination of habitation sites, it was well represented in mortuary sites. Table 4 displays the landforms associated with mounds and enclosures in the Upper White River drainage.

Table 4 Earthworks by Landform			
Landform	Mounds (n=9)	Complexes (n=2)	Total (n=11)
Till Plain	55.6 %	50.0 %	54.5%
Floodplain			
Outwash Terrace	33.3%		27.2%
Outwash Plain			
Lakebed			
Kame/Esker			
Floodplain/Outwash Terrace			
Till Plain/Outwash Terrace	11.1%	50.0%	18.2%
Outwash Terrace/Outwash Plain			
Total	100.0%	100.0%	99.9%

Till plain landforms would appear to dominate the locations chosen for mounds or enclosures; however, all of the mounds and earthworks except for two are adjacent to valleys. The Baxter (12R19) and Johnson (12R18) mounds are truly the only earthworks no immediately adjacent to a stream or river. These two mounds are located on the divide between the White River and Whitewater drainage basins. Overall, the earthwork locations appear to follow a congruent trend with habitation data focusing primarily on valley settings, specifically the valley/till plain edge, but also utilizing the till plain region.

Local collections

Local collections were also reviewed during this project. While private artifact collections rarely provide specific locations for artifacts, they can provide an idea of the range of materials that are present in a region.

A review of collections at the Randolph County Museum documented several projectile point styles from the Early and Middle Woodland period. Most of the collections at the museum were gathered by Philip Kabel, a local resident. Museum staff felt that most of the collection came from Randolph County. Setzler (1931) documented this collection in his archaeological survey of the county. The museum also had the Clevenger collection, which was believed to have come from Randolph County. Table 5 displays the information obtained from the museum. The museum housed 71 points from the Adena/Hopewell time frame.

Table 5
Points at the Randolph County Museum

Point/Artifact	Raw Material	No	Point/Artifact	Raw Material	No.
Kabel Collection			Kabel Collection		
Adena	Laurel	5	Biface (Snyders)	Burlington	1
	HT Laurel	1	Bipoint	Wyandotte	1
	Wyandotte	11	Cypress	Burlington-like	1
	Delaware	1	Clevenger Collection		
	Flint Ridge	1	Adena	Wyandotte	4
	Holland	1		Unknown	1
	Unknown	3	Robbins	Laurel	4
Robbins	Laurel	1		Jeffersonville	1
	Flint Ridge	2		HT Burlington	1
	Wyandotte	1		Unknown	4
	Unknown	2	Snyders	Laurel	3
Robbins-like	Wyandotte	1		Jeffersonville	1
Snyders	Laurel	1		Flint Ridge	1
	Flint Ridge	1		Burlington	1
	Burlington	2		Wyandotte	1
	HT Burlington	1		Unknown	2
	Wyandotte	6			
	Unknown	3			

Members of the Upper White River Archaeological Society also provided information from their collections from Randolph County. The members had 14 Adena and Synders points from the county. Raw materials included: 8 Wyandotte, 2 Burlington, 1 Laurel, 1 Holland, 1 Liston Creek and 1 unknown.

The collections reviewed by this project documented 85 diagnostic artifacts from the period of earthwork construction in Randolph County. Only four artifacts dating to this period were documented in state site records for Randolph County. The low number of artifacts documented in state records is a sampling bias. The private collections provided a better reflection of Early and Middle Woodland habitations for the county. Unfortunately, the local collections lack specific context and cannot be used in settlement pattern analysis.

Summary

The review of site information and local collections for the Early and Middle Woodland period in Randolph County did document a substantial presence in Randolph County. The lack of a contextual sample is a problem in examining Randolph County exclusively. Regionally, surface collections indicate that valley settings were important for habitations, but till plain regions were also utilized. Unfortunately, we have no excavation data for an Early or Middle Woodland habitation in the region. We also have no ceramics from this period outside of earthwork contexts. A pattern of small dispersed sites was not unexpected for the Till Plain region of Indiana (Wepler and Cochran 1983:90, Cochran 1994:6).

A review of environmental and natural features in relation to the choice of the location of the Fudge site and other regional earthwork complexes has been previously documented (Cochran 1999). This study found that there was no apparent environmental pattern, such as a physiographic boundary, river confluence or springs, for the placement of the complexes. The construction of the layout and placement of earthworks in the Middle Woodland ceremonial landscape of east central Indiana was not reliant on any observable, recurring pattern of natural features. Instead, the ceremonial landscape was apparently conceived as a cognitive map of interconnected and interrelated places of unique importance to the people living in east central Indiana at the time the landscape was constructed.

The pattern of small, dispersed Middle Woodland habitations has also been recognized in the Scioto region in Ohio (Dancey and Pacheco 1997, Prufer 1964, 1996). The east central Indiana mound and enclosure sites also follow a similar pattern focusing primarily on valley settings, specifically the valley/till plain edge, but also utilizing the till plain region. This pattern contrasts with information from several drainages in Ohio. Weets et al. (2005:547-548) review a pattern of mounds being fairly evenly dispersed and in a greater variety of environmental settings, while Hopewell earthworks were more clustered in a few localities and commonly occur on terraces of main river valleys. The construction of the east central Indiana landscape will be further explored in the Discussion section of this report.

Previous Investigations at Fudge

Early Reports

The Fudge site was first documented in *Ancient Monuments of the Mississippi Valley* (Squier and Davis 1848) (Figure 1). The reference did not provide much of a verbal description, but relied on a drawing by James McBride to convey information concerning the dimensions of the site. An adaptation of this drawing was included in several other references (Baldwin 1872:40, Bancroft 1883:762-763, Shetrone 1930). The *Indiana Gazetter* of 1849 reported an earth wall enclosing about 20 acres, a high mound in the center and a gate at the southwest corner on the land of W.M. Way (Anonymous 2005a). The 1865 Randolph County Wall Map notes Ancient Fortifications and Fairground at the location of the Fudge site in White River Township (Anonymous 1980).

The later nineteenth century references provide more written details and document a history of disturbances that have occurred on the site. Cox (1879:134-137) provides a new map of the site produced by Dr. G.M. Levette and a written description of site size and features (Figure 3). He states that part of Fudge lies within the Randolph County fairground and the remaining portions were in cultivated fields and being destroyed. Two roads, the present Stockyard Road and Martin Street, cut across the site. The mound was used by spectators during the horse races at the fair (Cox 1879:134). Phinney (1882:192) also provides a written description of the site and notes similar disturbances. He states that the western gateway was no longer visible. He also reports that excavations into the mound to a depth of seven or eight feet found nothing. When John K. Martin removed part of the eastern wall north of the gateway, he apparently found several holes about 15” in diameter and extending seven or eight feet below the summit of the wall (Phinney 1882:193). To the inside of the embankment about three feet from the surface, ashes and charcoal were found that had been covered by wash from the walls (Phinney 1882:193). Tucker (1882:14) provides his description of the site, which differs in measurements from other sources. While he notes the enclosure has been lowered through cultivation, it was plainly traceable along its entire extent. He also reports charcoal was scattered throughout the clay of the eastern embankment when it was excavated for brick-making (Tucker 1882:14). The site is also mentioned in the *Indianapolis News* in 1885. The article relates the site was being destroyed and states few relics had been found (Anonymous 1885).

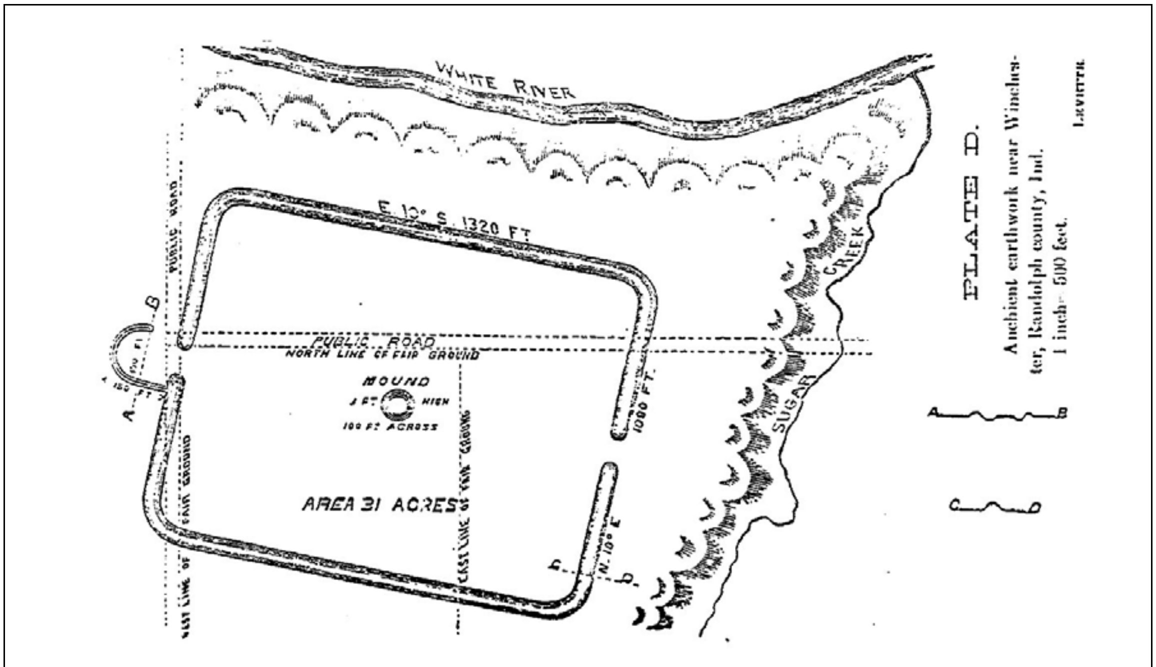

Figure 3. Levette's drawing of the Fudge site (Cox 1879).

A 1914 county history provides few new details concerning the site (Smith and Driver 1914:53-55). The report does state that all the walls, except to the south, had been removed for brick making. The earliest photos of the site were also published in this document.

Seztler's Excavations

Most of the archaeological information from the Fudge site was obtained by Frank Setzler. Setzler's survey of Randolph County and excavations were under the auspices of the Indiana Historical Bureau, Indiana Historical Society and Smithsonian Institution. In regards to the condition of the site, Setzler (Anonymous 1929:20) noted that the walls of the enclosure were almost impossible to trace and the east and west gateways were gone. Setzler (1930:219) also noted part of the wall was destroyed to make room for fairground buildings. No evidence of the excavations mentioned by Phinney (1882) were seen (Setzler 1931:29). The mound had been reduced by cultivation, but in 1929, Setzler (1931) excavated the mound and tested a portion of the embankment. Setzler's (1931) excavation occurred just before the landowner had planned to remove the mound with a steam shovel to level the ground for farming. As with his other excavations, Setzler (1931) used 10' trenches to excavate the mound. The trenching started on the south end of the mound and proceeded until the central tomb area was reached. The central tomb was isolated by continuing the trench cuts around both sides while the central tomb was excavated.

The mound contained a submound burial pit 3' deep containing the skeleton of an adult male (Figure 4). The skeleton had been placed on a layer of bark within a wooden structure. Along the sides of the pit, vertical post holes 6" in diameter had been placed. The burial was disarticulated, apparently due to settling of the mound after burial. Above the abdomen of the burial was a human skull of an adult. Earth had been placed over the body and the wooden structure was burned. No artifacts were found within the burial pit. Around the burial pit on the north, west and east sides were found 2 distinct lines of vertical posts on the original ground surface. Unfortunately the post hole pattern was not noticed within the pit or around it on the south side until that area had been excavated, but it was assumed that the post hole pattern encompassed the burial pit. A layer of red ocher and bark covered an area of 20 by 20 feet above the burial pit (Setzler 1930, 1931).

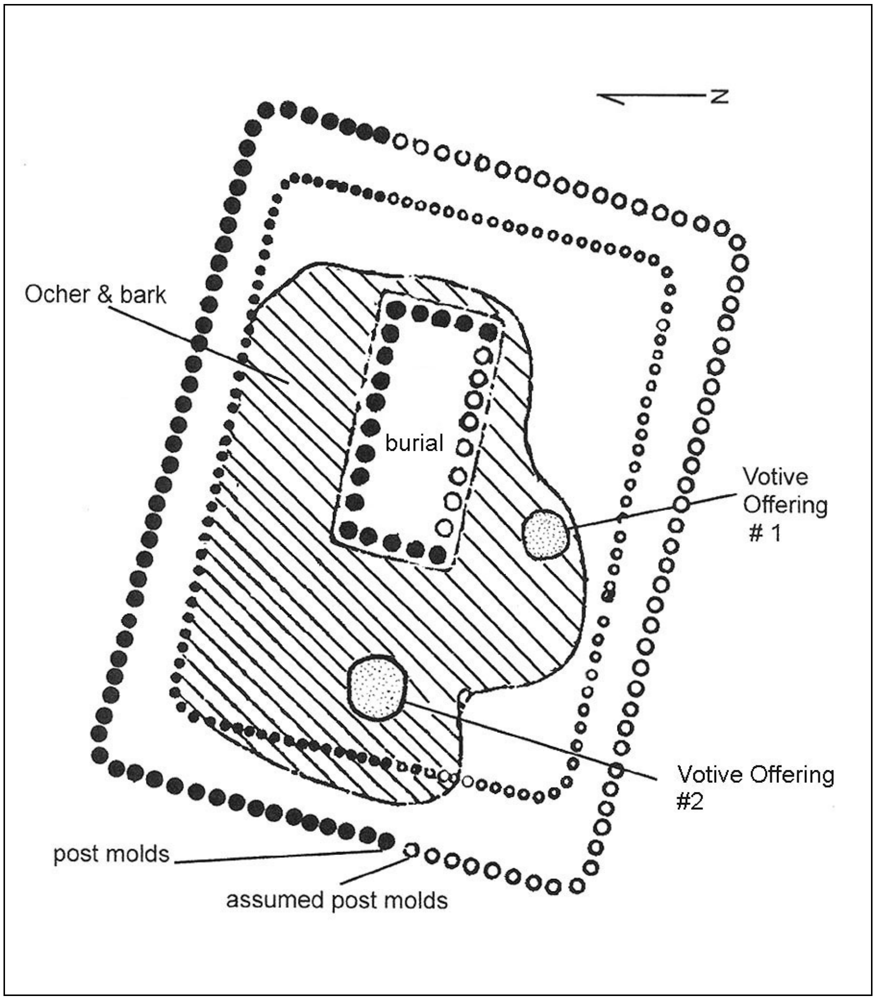

Figure 4. Plan of Setzler's (1931) excavation (after McCord and Cochran 2000).

Although not mentioned in the written reports of the excavation, several photographs in the Indiana State Archives show the excavation of a large burned log. The caption on the back of photo 562 says that the log is "burned on the outside before placed in mound. This is over burial pit." Thus it seems that a large burned log was above the central burial pit, but there is no stratigraphic record of the position of the log in the site documentation.

Two caches of artifacts, called Votive Offering # 1 and # 2, were recovered from the mound. Votive Offering # 1 contained cremated animal and bird bones, two large points, a sandstone tablet, and a concave-sided gorget. The artifacts were placed over the cremated bone. The cache was "covered with a heavy layer of bark and ocher" (Setzler 1930:220). Votive Offering # 2 was deposited on the original sod line and was surrounded by ocher, bark and cremated animal bone. It contained two badly decomposed leather pouches containing eight copper bracelets in each. The pouches were lined with several layers of twined cloth. The bracelets encircled strips of bark and a material that looked like human arm bones. An undrilled expanded center gorget was found beneath one of the pouches (Setzler 1931). This offering was also covered with bark and red ocher (Setzler 1930:221). In addition to the two caches, five broken chipped flint objects and one piece of pottery were recovered from the mound fill (Setzler 1930, 1931:27-35, plate 21).

The test excavation in the south wall of the embankment revealed the same kind of soil found in the mound. Small fragments of charcoal, burnt clay and ashes were above the original sod line and a heavy concentration of charcoal was found near the center of the embankment. No evidence of the posts reported by Phinney (1882) was found (Setzler 1931:35).

Setzler (1931:35-37) related the mound to the Ohio Adena culture based on its construction and artifacts. More recently, the site was included with Adena sites in the region (Kellar and Swartz 1971). Griffin (1971:136), however, noted that the enclosure was not characteristic of Adena. Although the Fudge site had only one enclosure, it has been included with other earthwork complexes in east central Indiana due to its size (Cochran 1992, McCord and Cochran 1996, Cochran 1996).

An evaluation of Setzler's reports (1930, 1931) and documents curated at the Indiana State Archives, and a reanalysis of the artifacts curated at Glenn A. Black Laboratory of Archaeology at Indiana University was conducted recently (McCord and Cochran 2000). The evaluation pointed out some ambiguities and inconsistencies in the Setzler data. For example, Setzler (1930:221, 1931:31) stated that the posts lining the burial pit were burned because of the presence of charcoal in the post holes, but he does not mention heat alteration of the sides of the pit or layers of charcoal indicating that a structure had been burned. New information was also assembled from the reanalysis. Primarily, the identification of Adena complex artifacts and Hopewell complex artifacts in Votive Offering #1 in the same cache provided supporting information that Adena and Hopewell in east central Indiana were part of the same ceremonial system (Cochran 1996, Cochran and McCord 2001, McCord and Cochran 1996, McCord and Cochran 2000, McCord and Cochran in press). In addition, a new interpretation of Votive Offering #2 containing the leather pouches, revealed the cache was likely the surviving vestiges of the forearms of a human burial that had been encircled by copper bracelets and clothing (McCord and Cochran 2000).

This evaluation also recognized that this site still contained tremendous potential for understanding the regional Early/Middle Woodland ceremonial/mortuary system (McCord and Cochran 2000). Several recommendations for further work were made (McCord and Cochran 2000:76-77) and are rephrased below.

1. While the entirety of the Fudge Mound was excavated by Setzler (1931), there is a potential that some submound deposits remain, perhaps around the margin of the excavated area. This area should be investigated.

2. The leather, cloth and bark from the site need further identification. If other sources of carbon cannot be obtained from the site, a small sample from these organics could by sacrificed for an AMS radiocarbon date.

3. The remaining portions of the embankment need to be tested before they are completely destroyed. The best section remains at the corner of a farm field; a profile of the embankment at this location should be acquired. The remainder of the embankment should be sampled to determine whether features are present below the embankment.

4. The site should be nominated to the National Register of Historic Places and the Indiana Register of Historic Places. Given that Fudge was the largest enclosure in the state of Indiana, it deserves adequate recognition and whatever protection listing could afford.

The evaluation and recommendations became the foundation for the current project.

CURRENT INVESTIGATIONS

The project was structured to address the recommendations listed above and include some new goals to match our current thinking. The mounds and enclosures of east central Indiana have long been considered essential to understanding the relationships between the Early and Middle Woodland Adena and Hopewell complexes (Griffin 1979:226, Kellar 1983:46-47, Swartz 1971). While our understanding has evolved with the acquisition of new data, we are finally able to seriously address the problem of the chronological and cultural relationships between the two complexes (McCord and Cochran in press).

The Fudge site is central to this investigation since a cache of artifacts associated with the mound contained both diagnostic Adena and Hopewell artifacts (McCord and Cochran 2000). The enclosure, however, has been characterized as atypical for Adena (Griffin 1971:136). Dates from the site are critical to our testing of the relationships between Fudge and others in east central Indiana and throughout the Ohio Valley.

In addition, Fudge represents one of three sites with rectangular enclosures. While the circular complexes have been extensively studied, we have little modern data from any of the rectangular enclosures. We will also investigate whether Fudge was an "empty" or "occupied" enclosure, a topic of considerable debate associated with large geometric enclosures in Ohio (Prufer 1964, Dancey and Pacheco 1997).

The research questions and goals were pursued through several avenues. A review of historical changes in landuse at the site was undertaken. A pedestrian survey of the Fudge site and surrounding agricultural fields was conducted. An instrument survey and magnetometer survey of portions of the sites was performed. In addition, limited test excavations at the site were done. Each of these tasks are discussed below.

Changes in Historic Landuse

A brief review of historic documents relating to changes in the use of Fudge site area was undertaken to better understand transformations and disturbances of the site. Information for this section relied strongly on Tucker's (1882) *History of Randolph County*. Several county atlases and news paper articles also helped document the historic activities that occurred at the Fudge site. A partial deed search beginning in 1870 helped to supplement the other documentation.

The historic use of the site area apparently begins in 1816. The first land entry for the SW ¼ of Section 17, Township 20N, Range 14E where the Fudge site is located was for William Haworth on October 19, 1816 (Tucker 1882:330). William Haworth is noted as one of the earliest settlers in White River Township (Tucker 1882:37, 92) preceded by Paul W. Way, Henry H. Way, William Way, Robert Way and William Diggs, Jr., all Quakers from South Carolina (Tucker 1882:38, 41, 329, 340). Later, the *Indiana Gazetter* of 1849 states an earthern enclosure was on the land of W.M. Way [probably William Way] (Anonymous 2005a). Little is known about the first historic activities associated with the Fudge site, but settlement and clearing of the land for farming is assumed. Some of the earliest descriptions of the Fudge site state it was being affected by cultivation (Anonymous 1885, Cox 1879:134-137, Phinney 1882:192, Smith and Driver 1915:53-55, Tucker 1882:14).

The 1865 Randolph County Wall Map notes “Ancient Fortifications” and “Fairground” at the location of the Fudge site in White River Township with other portions of the site owned by J. Moorman and D. Heaston (Anonymous 1980) (Figure 5). The county fairs began in 1852 and were held at various locations around Winchester on rented ground. In 1871, possibly earlier since the fairground is noted on the 1865 atlas, the Randolph County Agricultural, Horticultural and Mechanical Association purchased a 22 acre tract of land from L.L. Heaston “occupying a part of the old fort of the Mound-Builders, and containing the great mound in the center of the ancient inclosure” (Tucker 1882:207). The county fairs attracted numerous people to the area over the years it was held at this location (Tucker 1882). Horse racing is one event documented by numerous people and several cite the mound was used for viewing the races (Anonymous 1885, Cox 1879:134). Buildings associated with the fair were referenced by Setzler (1930:219) as destroying part of the enclosure, but the location and arrangement of these buildings is unknown. The fairgrounds expanded in 1893 adding 40 acres (Deed Records). An 1896 announcement of the Randolph County fair relates that the Randolph County Union Agricultural Association owned 62 acres of land containing one of the best preserved and most extensive works of the Mound Builders (Hoffman 1896). Religious camp meetings were also referred to have taken place at the Winchester fairground (Tucker 1882:153). One of the latest references to the fairground is the 1909 atlas, showing the Randolph County Agricultural, Horticultural and Mechanical Association owning 60 acres (Anonymous 1980). In 1913, the Randolph County Union Agricultural Association sold 62 acres to members of the Fudge family. A few local residents told us that there was a Civil War encampment located within the fairground area. None of the local histories support a camp at this location. Most of the men from Randolph County mustered in Indianapolis or Richmond (Tucker 1882:247-276). Military styles buttons were observed in one collection from the fairground area. It is possible that these were derived from post War meetings or gatherings held at the fairgrounds not from a Civil War camp. The land was under cultivation by Albert Fudge when Seztler excavated the mound in 1929 (Setzler 1931).

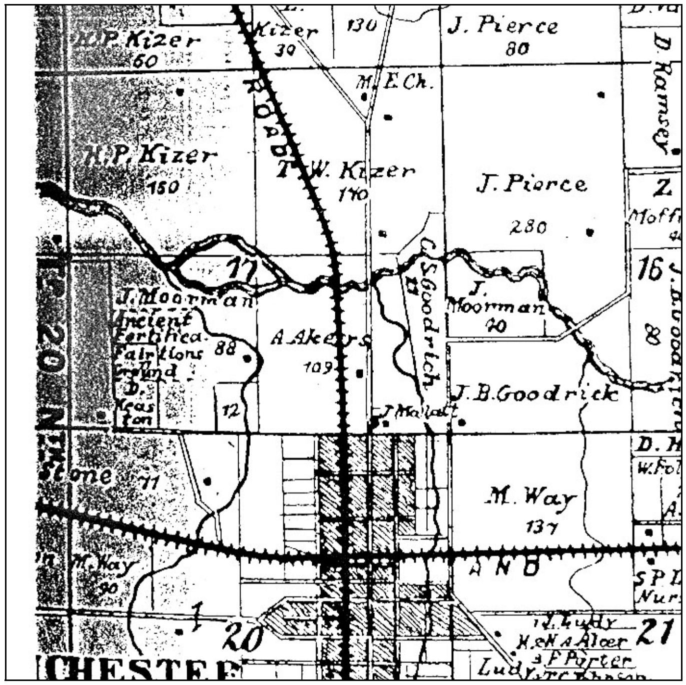

Figure 5. Portion of the 1865 atlas (Anonymous 1980).

Besides the use as a fairground and for agriculture, the Fudge site was also impacted by brick making and gravel mining. Some of the land owners of Fudge were prominent members of the community. A brief review follows.

David Heaston owned a portion of the Fudge site from ca. 1832 to 1865. He was born in Virginia and moved with his parents to Ohio in 1801. After he married, he moved to Randolph County, south of Winchester in 1819. In 1832, he bought 140 acres immediately adjoining Winchester to the west. This land was known as the David Stout farm and had a log-cabin and few acres cleared. David Stout donated 18 acres when Winchester was laid out in 1818 (Tucker 1882:53). Heaston added to his original purchase of land until it consisted of a section. He lived there until he died in 1865. He was noted for his kindness and liberality. He had four children: David Heaston, deceased; Mary Ann Wright, Randolph County; Nathaniel P. Heaston, Adams County; and Lewis L. Heaston, Jay County (Anonymous 1980, Tucker 1882:348-349).

The duration of J. Moorman's ownership of the site is less certain. James Moorman moved with his family to Wayne County in 1822. He built his wealth through hard work and in 1860 moved to Winchester and was recognized as one of the wealthiest men in eastern Indiana. In Winchester, he started the Winchester Bank. He maintained success in his business ventures by careful and judicious investments (Tucker 1882:319). James Moorman sold 16 acres of land to William Locke in 1870 at the same time Thomas Moorman sold 60 acres to Locke (Deed Records).

The 1874 Atlas does not illustrate the Fudge enclosure, but shows the Fairgrounds and that the land was owned by T. Moorman and T. Ward (Anonymous 1980). A brickyard is in shown to the southeast of the Fudge site on T. Ward’s property (Figure 6). This brickyard was not located on the site, but part of the embankment was reportedly removed for brick manufacture (Phinney 1882:192-193).

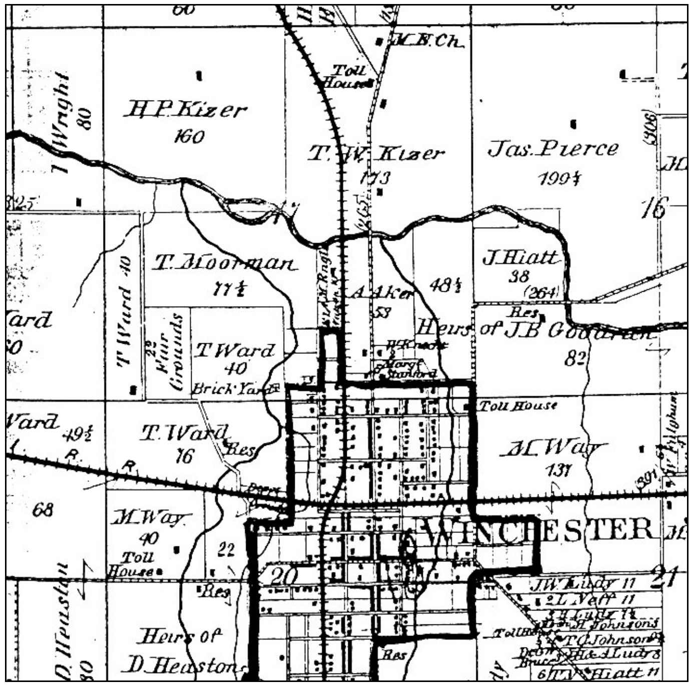

Figure 6. Portion of the 1874 atlas (Anonymous 1980).

T. Moorman refers to Thomas Moorman, son of Tarlton Moorman, an early pioneer in Randolph County (Tucker 1882:353). Tarlton Moorman is the older brother of James Moorman, so Thomas would be James’s nephew. William Locke purchased 78 acres from James and Thomas Moorman in March of 1870 and in December he sold 80 acres to Thomas Ward (Deed Records).

Thomas Ward’s father, Joab, came to Randolph County with his father in 1819. Thomas was raised in a pioneer settlement and had a talent for trading and making a profit. His first farm was near Ridgeville; he then moved to Winchester (ca. 1845) and became a merchant. In 1864 he was elected to the Indiana Senate and later he was active in several local banks. He was regarded as one of wealthiest citizens of Winchester and a man of kindness and high integrity (Tucker 1882:327-328).

Tucker’s 1882 Atlas shows the same land owners of T. Moorman and T. Ward and Fairground area (Tucker 1882) (Figure 7). A brickyard is shown to the west of the enclosure, just south of present Martin Street. An 1895 Atlas shows the property was owned by A. Hirsh et al., the R.C.F Association [Randolph County Fairground?], A. Martin and T.R. Moorman (Anonymous 2005b) (Figure 8). A. Hirsh et al. refers to Adam Hirsh, D.E. Hoffman, John Wrizn and Will Filzmauriee who each owned 10 acres (Deed Records). The Martin family was heavily involved with brick manufacture. A.

Martin may be a misprint and actually refer to E.[Elisha] Martin, who is documented as owning the property in 1909.

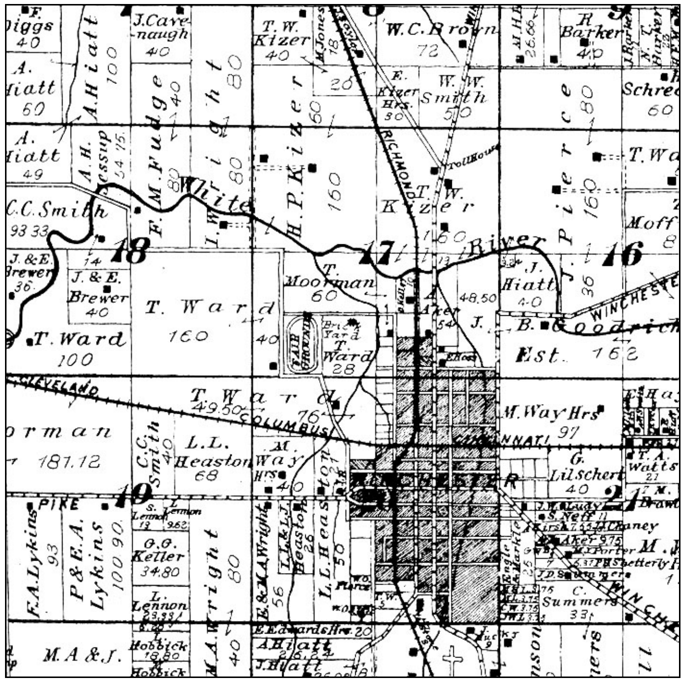

Figure 7. A portion of the 1882 atlas (Tucker 1882).

The manufacture of the first drain tile in the county and the State is credited to John K. Martin (Tucker 1882:42). In a machine he made, he made 200 rods of tile and burned them in a brick-kiln in his father's (Elisha Martin) yard in 1856 (Tucker 1882:42, 320). Elisha Martin came to Randolph County in 1832 and settled southwest of Winchester two years later (Tucker 1882:337). Phinney (1882:193) reported when John K. Martin removed part of the eastern enclosure wall of Fudge north of the gateway, he found several holes about 15" in diameter and extending seven or eight feet below the summit of the wall.

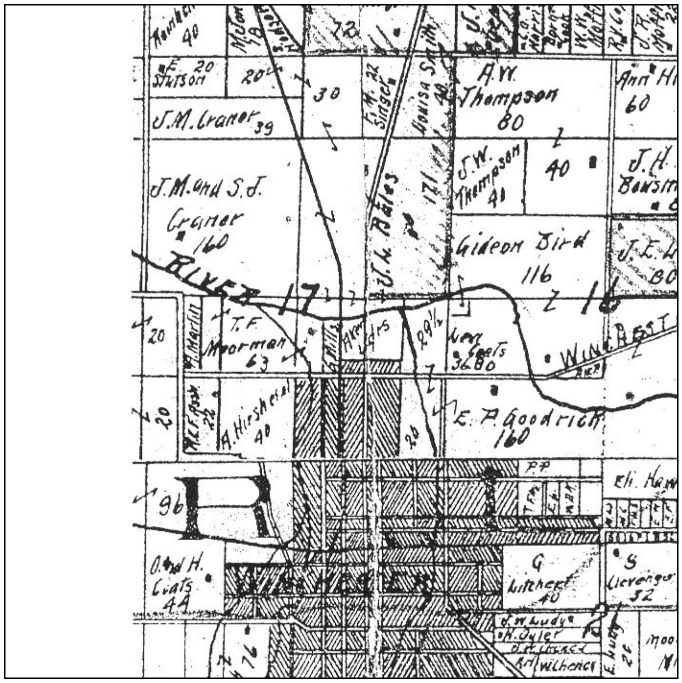

Figure 8. Portion of the 1895 atlas (Anonymous 2005b).

The 1909 atlas indicates the Fudge site was owned by the Randolph Co. Agricultural, Horticultural and Mechanical Association, William E. Miller, Thomas B. Sellers, and E.B. Martin (Anonymous 1980)(Figure 9). This map show the first house built within the enclosure associated with E.B. Martin. Two gravel pits are also shown near the enclosure. The southern gravel pit was expanded over the years and is responsible for the destruction of most of the eastern embankment wall. Nothing is known about the history of William Miller or Thomas Sellers. The 1918 atlas indicates the Fudge site is owned by A.E. and L. Fudge and T.B. and N. Sellers (Figure 10). Albert E. Fudge was the landowner and name sake for the site when Setzler (1931) excavated the mound.

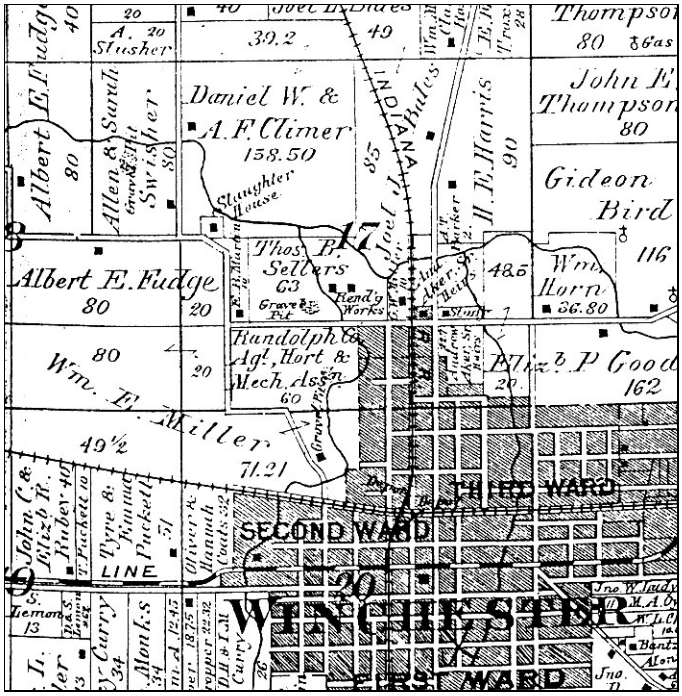

Figure 9. Portion of the 1909 atlas (Anonymous1980).

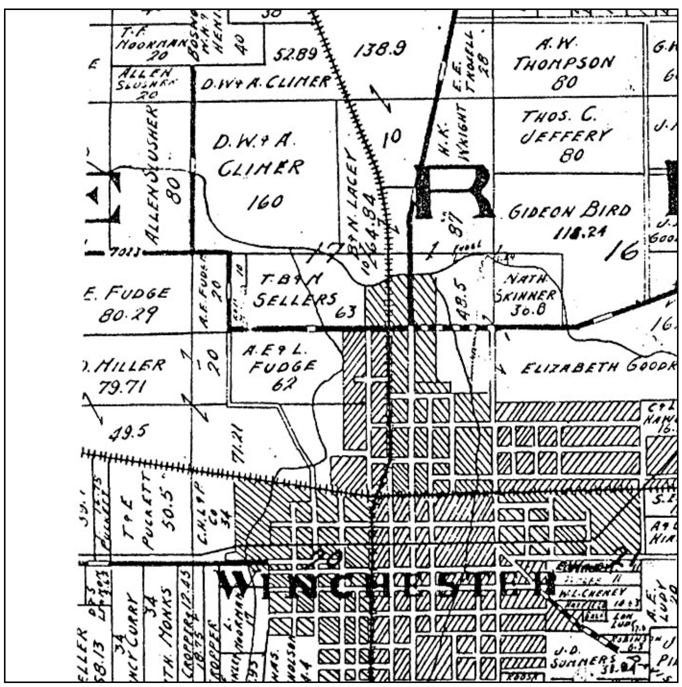

Figure 10. Portion of the 1918 atlas (Anonymous 2003).

Currently, the land use of the site is primarily agricultural. The main portion of the enclosure, including the southern embankment wall and the mound, is presently in a cultivated field (Figure 11). The majority of the northern embankment wall is in a horse pasture (Figure 12). However, a communication tower is at the northwest corner of the enclosure and a mobile home exists on the wall in the central portion. Most of the eastern wall is no longer visible due to the gravel operations in the area that are now reclaimed as a pond. In addition, a home was constructed near or on the eastern wall. The northeast corner of the enclosure is visible north of Martin Street (Figure 13). Several homes were built to the interior of the enclosure on the north side of Martin Street and the east side of Stockyard Road. A portion of the western enclosure wall was destroyed by Stockyard Road and an associated ditch. The southwestern corner is visible as a rise in the cultivated field west of Stockyard Road. The western gateway is preserved in grass and trees at the corner of Stockyard Road and Martin Street (Figure 14). This section of embankment is one of the tallest surviving portions. The western gateway extension is not visible in the cultivated field to the west of Stockyard Road. The remainder of the western wall is difficult to discern in grass covered areas around the communication tower at the northwest corner (Figure 15).

Figure 11. Portion of the southern wall near the southeast corner, looking north.

Figure 12. Portion of the northern wall, looking southwest.

Figure 13. Portion of the northeast corner, looking northwest.

Figure 14. Area of western gateway, looking northeast.

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Figure 15. Aerial photo of the Fudge site area showing historic disturbances.

Summary

From the historic documents, it is apparent that the principal historic use of the Fudge site was for agricultural purposes. Other activities were tied to early industries of brick manufacture and gravel mining. Several of the landowners connected to the property were prominent in the founding of Winchester and Randolph County. The activities tied to the fairground also had an impact on the site, though it is unclear what the full range of activities were. Certainly gatherings of large numbers of people occurred here in historic times to enjoy games, entertainment and perhaps religious functions. It is interesting that these historic activities echo the prehistoric use of the site as well.

Pedestrian Survey

A portion of the project involved a pedestrian survey of the cultivated section of the Fudge enclosure and surrounding areas. One of the goals was to determine if the enclosure had an “empty” or “occupied” center, a topic of considerable debate associated with large geometric enclosures in Ohio (Dancey and Pacheco 1997, Prufer 1964). Related to that question was a determination of what activities occurred at the site. It was hoped that the pedestrian survey would also identify habitations or other sites in the immediate vicinity related to the Fudge Site.

Methods

The survey was conducted by ARMS personnel and authorized under DHPA approved plan #200534. The field survey was executed using pedestrian transects spaced at 10 meter intervals. The survey interval was reduced to 5 meters when artifacts were encountered. The areas surveyed by pedestrian transects had between 0 and 95% ground surface visibility. All artifacts, excluding fire-cracked rock and brick, were collected and bagged by site specific provenience. Fire-cracked rocks and bricks were counted in the field, but were not collected. Artifact locations were assigned temporary site numbers and recorded on an aerial map of the area and the artifact and site coordinates were collected with a Sokkia Axis^3 GPS using NAD 1983. Field notes were maintained by the author.

All artifacts were taken to the ARMS laboratory for processing, identification, analysis and temporary curation. Artifacts were cleaned, classified and catalogued. Definitions used for classifying prehistoric lithic artifacts were related to Appendix B. Metrical attributes and raw material identifications were recorded as appropriate. Lithic raw materials were identified by comparison with reference samples and published descriptions on file in the ARMS laboratory (Cantin 2005). Historic artifacts were identified and dated using several references (Feldhues 1995, Fike 1984, IMACS 1984, Loftstrom et al. 1982, Majewski and O’Brien 1987, Miller 1995, Nelson 1964, Newman 1970, ODOT 1991). Notes, maps and photographs were reviewed and prepared for illustration and curation. State site numbers were obtained and a DHPA Sites and Structures Inventory form was completed for each site identified during the project. The GPS site coordinates collected during this project and digitized topographic maps, aerial photographs, and soil surveys that were download from http://danpatch.ecn.purdue.edu/~caagis/ftp/gisdata/data.html, http://www.co.hamilton.in.us/gis/download.html, and Engel et al. (n.d.) were imported into ARCGIS 9.0 to create spatial maps and figures for this report. All materials generated by this project were accessioned under # 05.52. Artifacts from Survey Areas 2 and 3 were curated at Ball State and artifacts from Survey Areas 1 and 4 were returned to the landowner after documentation as required by DHPA.

Results

Approximately 171 acres were covered by the systematic survey. The survey documented 25 new archaeological sites and resurveyed two existing sites. From the survey, 192 historic artifacts, 61 prehistoric artifacts, 1 piece of bone and 1 piece of shell were recovered. The survey was conducted at four locations near or within the Fudge enclosure. The results will be discussed by survey area.

Survey Area 1

Survey Area 1 is located on an upland till plain in the SW ¼ of Section 17, Township 20 North, Range 14 East as shown on the USGS 7.5' Winchester Quadrangle. The survey area is on the south side of the White River and the west side of Sugar Creek, now a reclaimed gravel pit. The topography is nearly level to gently rolling (Figure 16).

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Figure 16. Aerial photo showing Survey Area 1 and sites 12R10 and 554.

The property in Survey Area 1 contained the majority of the Fudge site (12R10)(Figure 16). The area under cultivation was approximately 30 acres. The survey was conducted on June 16th and 20th, 2005. Surface visibility ranged between 70 and 85% and was affected primarily by 0.15 to 0.6 m tall corn. The survey area contained well drained, Miami silt loam, gravelly substratum, 0 to 2 % slopes (MoA) and Miami silt loam, gravelly substratum, 2 to 6% slopes (MoB2)(Neely 1987:map sheet 30).

To avoid confusion with the existing site boundaries of the Fudge enclosure, only two archaeological sites were recorded in the project area: the Fudge enclosure and the old Randolph County Fairground. Individual artifact locations were recorded within each site as a locus, so artifact locations within the large site boundaries were discernable.

Artifacts

A total of 76 artifacts were recovered during the field survey. Thirty-eight of the artifacts had a recorded locus, the remaining 38 artifacts (all historic) were provenienced only to the western side of the survey area. Table 6 provides a list of the artifacts recovered by category. In addition to the artifacts recovered, 43 fire-cracked rocks and 6 additional brick fragments were documented in Survey Area 1. Artifacts are listed by individual site and loci in Appendix C.

Table 6
Artifacts Recovered from Survey Area 1

Category	No.	Category	No.
Flakes	23	Stoneware	4
Core	1	Nail, square	2
Other chipped stone	1	Field tile	1
Glass, container	29	Clay pigeon	7
Glass, button	1	Brick	1
Whiteware	6		

Of the 24 prehistoric chert artifacts, the majority were manufactured from Laurel chert. Table 7 provides a breakdown of the chert resources utilized.

Table 7
Chert Types from Survey Area 1

Chert	No.	%	Chert	No.	%
Laurel	15	62.5	Flint Ridge	1	4.2
Wyandotte	2	8.3	Upper Mercer	1	4.2
Burlington	1	4.2	Unknown	4	16.7

None of the prehistoric artifacts were temporally diagnostic. However, the presence of Burlington chert suggests a Middle Woodland component, since it is currently associated exclusively with Snyders points in east central Indiana (Hicks 1992:25, McCord and Cochran 2000). Flint Ridge may also be associated with a Middle

Woodland component, since it is often the raw material selected for the production of lamellar bladelets and Snyders points (McCord 1999, McCord and Cochran 2000). However, Flint Ridge is associated with other prehistoric components in east central Indiana, notably Paleoindian and Early Archaic.

The historic artifacts represent a range of manufacturing primarily between 1830 and the present (Figure 17). The glass container fragments were aqua, amethyst, clear and amber in color. The aqua colors were produced primarily between 1800 and 1910 (Fike 1984), amethyst glass was produced from 1880 to 1925 (Newman 1970), amber glass from 1860 to present (Fike 1984) and clear glass from 1880 to present (Fike 1984). The milk glass button was likely produced between 1890 and 1960, based on milk glass manufacture (Fike 1984). Whiteware was introduced ca. 1830 (Loftstrom et al. 1982). Only one whiteware sherd was decorated with a green floral transferprint and was produced between 1830 and 1850 (Lofstrom et al. 1982). The square cut nails are from a post 1800 period and were largely replaced after 1890 by wire nails (IMACS 2001).

Figure 17. Representative Historic artifacts recovered from Survey Area 1: a) aqua glass, b) amethyst glass, c) amber glass, d) clear bottle top, e) clear flat glass, f), milk glass button, g) undecorated whiteware, and h) green transferprint whiteware.

Sites

Only two archaeological sites were recorded in Survey Area 1 (Figure 16). Summaries for each site are contained in Appendix D.

The Fudge site (12R10) was defined by the boundary of the extant earthern walls, rather than a continuous artifact scatter. Only 16 prehistoric artifacts were recovered from the enclosure. Most of the artifacts occurred as single artifact finds; loci #11 had the highest number of artifacts with four. An interesting pattern in the artifact distribution was noted; half of the artifacts were recovered from the area of the southern embankment wall. In addition, almost 1/3 of the fire-cracked rocks noted in the field were on the embankment wall. Only one flake was recovered from the area of the nonextant mound. None of the artifacts could be associated with a Middle Woodland occupation. This survey area covered approximately 20 acres of the 31 acre site. Based on the results of survey, the interior of the enclosure was not heavily occupied during the Middle Woodland period. An 1885 newspaper article on the Fudge site reported that few relics had been recovered (Anonymous 1885). Local collectors report finding a few artifacts from this field, but all of the diagnostic points are from the Archaic period. While the site is disturbed and this portion of the site is under active cultivation, the southern embankment wall is visible. It is possible that activity areas do exist within the interior of the enclosure, but are not apparent on the surface. It is believed that important information could still be obtained from this portion of the site. The northern portion of the old Randolph County Fairground is within the western half of 12R10 and may contain important information on the historic use of the area as well. The site was nominated for listing on the Indiana and National Register of Historic Places.

Site 12R554 represents the southern half of the old Randolph County fairground. The county fairground extended to the north and it is subsumed under the previously recorded site 12R10. The fairground is shown on historic atlases and maps beginning in 1865 (Anonymous 1980) through 1882 (Tucker 1882). The fairground does not appear on the 1909 atlas (Anonymous 1980) and the fairground property was sold in 1913 (Deed Records). Most of the artifacts recovered from the survey area could date to this time period. Several local residents reported that the Fudge Enclosure (12-R-10) and this area have been walked numerous times over the years by local collectors. Metal detectors were sometimes used. Numerous historic artifacts have been reportedly recovered from the fairgrounds area. One collection reported to be from this area included several coins, military buttons, and lead shot. The site area also contains a prehistoric component. Nine prehistoric artifacts were scattered across the site area. A flake of Burlington chert (Loci #2) suggests a Middle Woodland component outside the enclosure walls. The site may contain information on the early Historic use of the area as a fairground. This survey did not recover large amounts of historic material, but local residents and collectors report numerous artifacts have been taken from the site area. Since the site may contain important local and regional information, archaeological testing is recommended.

Survey Area 2

Survey Area 2 is located in on upland till plain in the NE ¼ of the SE ¼ of the NW ¼ of the SW ¼ of Section 17, Township 20 N, Range 14 East as shown on the USGS 7.5' Winchester Quadrangle. The survey area is on a gentle slope located between the northern embankment wall of Fudge enclosure and the White River valley. The survey area was only 0.2 acres in size. The survey area presented itself when a portion of horse paddock was plowed. The area was surveyed on June 14th, 2005. Surface visibility was approximately 95% affected only by traces of pasture grass. The survey area contains well drained, Miami silt loam, gravelly substratum, 2 to 6% slopes (MoB2)(Neely 1987:map sheet 30). One site was recorded within the survey area (Figure 18).

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Figure 18. Aerial photo showing Survey Area 2 and site 12R555.

Artifacts

The survey recovered two unmodified flakes of Laurel chert, and one fragment of other chipped stone. Twelve fire-cracked rocks were also noted in the survey area. No temporally diagnostic artifacts were recovered

Sites

One site, 12R555, was recorded within the survey area (Figure 18). The site boundaries were defined on visibility. Visibility was approximately 0 to 5% surrounding the survey area and it could not be determined if the site extended outside the survey area. The site may extend to the south and/or east. The northern wall of the Fudge enclosure is approximately 25 meters to the south of the site, but without diagnostic artifacts it is unclear if this site was related to the Fudge site. Site 12R555 should be re-surveyed and shovel tested if necessary to determine the site boundaries.

Survey Area 3

Survey Area 3 is located on an upland till plain in the southern half of the NE ¼ of Section 18, Township 20 N, Range 14 East as shown on the USGS 7.5" Winchester and Maxville Quadrangles. The survey area is on the south side of the White River and adjacent to the river valley. An area directly north of the survey area has been excavated for gravel. The topography was nearly level to gently sloping (Figure 19).

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Figure 19. Aerial showing Survey Area 3 and sites 12R328, 556 to 569.

The survey area was approximately 41 acres in size. The survey was conducted on June 25th and 27th, 2005. Surface visibility ranged between 60 and 85% and was affected primarily by 0.3 to 1.5 m tall corn. The survey area contained a mix of the moderately well drained, Celina silt loam, 1 to 4% slopes (CeB); the somewhat poorly drained, Fincastle-Crosby silt loam, 0 to 1 % slopes (FcA); the well drained, Fox loam, 0 to 2 % slopes (FoA); the well drained, Miami silt loam, gravelly substratum, 0 to 2 % slopes (MoA); and the very poorly drained, Treaty silt loam (Tr) (Neely 1987:map sheet 30).

Fifteen archaeological sites were recorded in the survey area. The sites ranged in size from isolated finds to $2100m^2$. Components identified from the sites were Early and Late Archaic.

Artifacts

A total of 26 prehistoric artifacts were recovered during the field survey. Table 8 provides a list of the artifacts recovered by category. In addition to the artifacts, recovered over 125 fire-cracked rocks were documented in Survey Area 3. Artifacts are listed by individual site in Appendix C.

Table 8
Artifacts Recovered from Survey Area 3

Category	No.	Category	No.
Flake	18	Perforator	1
Bipolar	1	Points	4
Biface	1	Axe	1

Of the 25 chert artifacts recovered, the majority were manufactured from unidentified cherts. Of the identified cherts, Laurel predominated. Table 9 provides a breakdown of the chert resources.

Table 9
Chert Types from Survey Area 3

Chert	No.	%	Chert	No.	%
Laurel	7	28.0	Flint Ridge	2	8.0
Wyandotte	1	4.0	Zaleski	1	4.0
Burlington	1	4.0	Unknown	13	52.0

The four points recovered were diagnostic of either Early or Late Archaic components (Figure 20). A Big Sandy point of Laural chert was recovered from site 12R558 and was an isolated find. Big Sandy points date between approximately 8000 and 6000 BC (Justice 1987:61). A Kirk Corner-Notched point was recovered from site 12R565 and was an isolated find. The point was manufactured from Zaleski chert. Kirk Corner-Notched points are dated within a range between 7500 and 6900 BC (Justice 1987:71). An unclassified Early Archaic point of unknown chert was recovered from site

12R564 and was an isolated find. A Riverton point (Merom Cluster) was recovered from site 12R568, a small lithic scatter. The point was manufactured from Laurel chert. The Riverton point is Late Archaic in age dating between approximately 2000 and 1000 BC (Justice 1987:131-132).

Figure 20. Artifacts recovered from Survey Area 3: a) Big Sandy (12R558), b) Kirk corner-notched (12R565), c) Unclassified Early Archaic (12R564), d) Riverton (12R568), and e) axe fragment (12R328).

The presence of Burlington chert suggests a Middle Woodland component for site 12R569. Currently, Burlington chert is associated exclusively with Middle Woodland Snyders point manufacture in east central Indiana (Hicks 1991:25, McCord and Cochran 2000).

Sites

Fifteen archaeological sites were recorded in Survey Area 3 (Figure 19). Summaries for each site are contained in Appendix D. Site 12R328 had been previously recorded by a local collector. This survey redefined the site boundaries previously recorded.

Ten of the sites, 12R556, 557, 558, 559, 560, 562, 563, 564, 565, and 566, were isolated finds. Four of the sites, 12R561, 567, 568 and 569 were small lithic scatters between 100 and 350 m^2 in size. Due to the small size and limited numbers of artifacts recovered, none of these sites were recommended for further archaeological investigations.

Site 12R328 was the largest site encountered during the survey at 2100m^2 in size. This site has a Late Archaic component documented on the original collector survey form We found no diagnostic artifacts during the survey. The axe fragment from the site was donated by Bob Manning, who reported that he and several other collectors have surveyed this field. Most of the artifacts he has collected from the field are from the area of site 12R328. Mr. Manning also commented that the old gravel pit located immediately north of this site, may have destroyed a portion of this site. The site did not contain a heavy density of artifacts at the time of our survey, but several collectors know of this site and hunt this field. Given the reported quantity of artifacts and density of fire-cracked rock (80+), the site has the potential to be eligible for listing on the State and National Registers of Historic Places.

Survey Area 4

Survey Area 4 is located on a till plain upland in southern half of the SE ¼ of Section 18, Township 20 North, Range 14 East as shown on the USGS 7.5’ Winchester and Maxville Quadrangles. The survey area is on a broad upland area approximately ½ mile south of the White River. The topography is nearly level to depressional (Figure 21).

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Figure 21. Aerial showing Survey Area 4 and sites 12R570 to 578.

The area surveyed was approximately 100 acres in size. The survey was conducted on November 2nd and 3rd, 2005. Surface visibility ranged between 0 and 75%, being affected primarily by no till conditions with bean and corn debris. The survey area contains the moderately well drained, Celina silt loam, 1 to 4% slopes (CeB); the somewhat poorly drained, Fincastle-Crosby silt loam, 0 to 1 % slopes(FcA); the well drained, Miami silt loam, gravelly substratum, 0 to 2 % slopes (MoA); and the very poorly drained, Treaty silt loam (Tr) (Neely 1987:map sheet 30). The Fincastle-Crosby and Treaty soils represent the majority of the soils within the survey area.

Nine sites were identified within Survey Area 4. Components represented were unidentified prehistoric and Historic. All of the prehistoric sites were isolated finds. The historic sites ranged in size from 150 m^2 to 675 m^2.

Artifacts

A total of 7 prehistoric, 141 historic, 1 piece of bone and 1 piece of shell were recovered from Survey Area 4. Table 10 provides a list of artifacts recovered by category. In addition to the artifacts recovered, 40 fire-cracked rock and over 50 brick fragments were documented in the survey area. Artifacts are listed by individual site in Appendix C.

Table 10
Artifacts Recovered from Survey Area 4

Category	No.	Category	No.
Flakes	3	Nails, square cut	4
Biface	1	Pearlware	1
Other chipped stone	1	Porcelain	2
Gorget perform	1	Redware	11
Anvil/hammerstone/muller	1	Slate, roofing	7
Brick	2	Stoneware	16
Glass	43	Whiteware	49
Button, glass	1	Bone, tooth	1
Metal	5	Shell	1

Of the seven prehistoric artifacts, four were manufactured from chert. The Stage 3 biface and one flake were manufactured from Laurel chert and the other two flakes were manufactured from Wyandotte and an unknown chert type.

The only potentially diagnostic prehistoric artifact was the other chipped stone gorget preform from site 12R576. The preform has the general shape of an unfinished biconcave gorget (Figure 22). This style of gorget has been recovered from the Fudge and Hayes Arboretum Mounds (McCord and Cochran 2000), and may be related to a Middle Woodland component.

Figure 22. Unfinished gorget from 12R576.

The historic artifacts represent a range of manufacture dates (Table11) (Figure 23).

Table 11 Diagnostic Historic Artifacts					
Site No.	Identification	Decoration	No.	Date Range	Reference
12R570	Whiteware	Red tranferprint	1	1830 – 1850	Lofstrom et al. 1982:14
12R577	Pearlware	Molded bead edge	1	1800 – 1830	Lofstrom et al. 1982:14
12R578	Whiteware	Undecorated	33	1830 – present	Lofstrom et al. 1982:8
12R578	Whiteware	Blue sponge	3	1840 – 1860	ODOT 1991:178
12R578	Whiteware	Blue transferprint	7	1830 – 1860	Lofstrom et al. 1982:14
12R578	Whiteware	Brown annular ware	1	1820 – 1850	ODOT 1991:177
12R578	Whiteware	Flowblue, shell edge	1	1830 – 1860	Lofstrom et al. 1982:14
12R578	Whiteware	Flowblue, feather edge	1	1830 – 1860	Lofstrom et al. 1982:14
12R578	Whiteware	Handpainted, line, green	1	1820 – present	ODOT 1991:177
12R578	Glass	Amber	5	1860 - present	Fike 1984
12R578	Glass	Amethyst	1	1880 - 1925	Newman 1970:74
12R578	Glass	Aqua	26	1800 – 1910	Fike 1984
12R578	Glass	Iridized (Carnival)	1	1908 – present	Bowrey 2006
12R578	Glass	Clear	5	1875 – present	Fike 1984
12R578	Glass	Green	4	1860 – present	Fike 1984
12R578	Glass	Milk	1	1890 – 1960	Fike 1984
12R578	Nail	Cut, square	4	Post 1800 – 1890	IMACS 2001

Figure 23. Historic artifacts from Survey Area 4: a) red transferprint (12R570), b) pearlware (12R577), c) blue sponge, d) blue transferprint, e) brown annular ware, f) flowblue shell edge, g) flowblue feather edge, h) handpainted, i) amber glass, j) amethyst glass, k) clear glass, l) iridized glass, m) green glass, c – m 12R578.

Sites

Nine sites were recorded in Survey Area 4 (Figure 21). Six of the sites, 12R 571, 572, 573, 574, 575 and 576, were unidentified prehistoric in age and were isolated finds. Two of the historic sites, 12R570 and 577 did contain early to mid-nineteenth century artifacts. However, due to the small size and limited numbers of artifacts, none of these sites were recommended for further archaeological investigations.

Site 12R578 likely represents a house or farmstead that is shown recorded at this location on an 1865 atlas (Anonymous 1980). The property was later owned by T. Ward (Thomas Ward) who settled with his family in Randolph County in 1819. He was a farmer, a merchant, an Indian State senator and active in Winchester banking (Tucker 1882:327-328). It is unclear if Thomas Ward actually occupied the structure. His residence is noted on the 1874 atlas in another structure to the southeast in Section 16 (Anonymous 1980). The structure did not apparently exist long into the 20th century as it is not shown on the 1909 atlas (Anonymous 1980). The artifacts recovered from the site indicated the occupation may have been as early as the mid 19th century. Given the quantity and diversity of historic artifacts recovered, intact archaeological deposits potentially exist. The site could contain important information on the early Euroamerican settlement of Randolph County and archaeological testing is recommended.

Discussion

The survey documented 27 archaeological sites within the 171 acres surveyed. Site density for this survey is one site per 6.3 acres. This figure is lower than expected for this region. The definition of large sites such as 12R10 and 554 and the poor drainage characteristics of the soils in Survey Area 4 were the likely cause for such a low site density. If Survey Area 3 is taken by itself, than one site per 2.7 acres is the resulting site density. This figure is more in line with predictive models of one site per 3.07 acres in the till plain region of central Indiana (Cree 1994).

Most of the archaeological sites recorded during this survey were small sites with either one or a few artifacts: 12R555 trough 577. Laurel chert dominated in the raw materials. No further archaeological work was recommended for these sites.

Only one prehistoric site, 12R328, other than the Fudge enclosure, was recommended for archaeological testing. Given the reported quantity of artifacts and fire-cracked rock documented at the site, it has the potential to be eligible for listing on the State and National Registers of Historic Places.

Two historic sites, the old Randolph County fairground (12R554 and 12R10) and the possible house (12R578) were recommended for additional work. Both sites have the potential to contribute to the early history of Randolph County. Both sites were recommended for testing.

The pedestrian survey did not indicate a large Middle Woodland presence on the interior of the Fudge enclosure. No definitive Middle Woodland artifacts were recovered from the interior of the enclosure or in the surrounding areas surveyed. Sites 12R554 and 569 did have artifacts of Burlington chert suggesting a Middle Woodland occupation, but this evidence is somewhat tenuous. The gorget preform from site 12R576 may also relate to the Middle Woodland period. However, a convincing Middle Woodland occupation within or near the Fudge enclosure remains elusive. As currently understood, Middle Woodland occupations in the region are more frequent in valley settings than upland till plains (McCord 2005:25).

In addition to the field survey, several other investigations were planned for the Fudge site. In the next section, mapping of the site is discussed.

Mapping

One of the goals of this project was to create an accurate map of the Fudge site through an instrument survey. The only detailed maps and descriptions for the Fudge site date between the mid 1800s and the early 1900s (Squier and Davis 1848:93, Phinney 1882:192-193, Tucker 1882:14, Cox 1879:135-137, Setzler 1931). The only recent depictions of the Fudge site have been interpreted from aerial photographs (McCord and Cochran 1996).

There was also a disparity in the early sources on the enclosure dimensions. The first reports of the site give the dimensions of the embankment walls enclosing 31 acres, rectangular in shape and 1080' wide and 1320' long (Cox 1879:137, Phinney 1882:192-193, Squier and Davis 1848:93) (Figures 1 and 3). Another description reports the site as 43 acres in size and in the form of an exact square (Tucker 1882:14). The orientation of the embankment was reported as either 10^0 east of north (Cox 1879:137) or 13^0 east of north (Setzler 1931:32). Most other sources (Baldwin 1872:40, Bancroft 1883: 763, Shetrone 1930:248) duplicate the map drawn by James McBride and published in Squier and Davis (1848:93). James McBride was a prominent pioneer in Butler County, Ohio and was considered an archaeologist that supplied many sketches on earthworks in the Mississippi Valley (Wikipedia 2005). Cox (1879:134-137), however, noted inaccuracies in the McBride map and published a different version that was measured and drawn by Dr. G.M. Levette. Levette also provided drawings of other Indiana earthworks like those at Mounds State Park (Cox 1879).

The embankment wall was reported to be between eight and nine feet tall (Cox 1879:134) and seven and ten feet tall (Tucker 1882:14). Phinney (1882:193) stated that the eastern half of the southern wall was not disturbed and "though it may have one time been from eight to ten feet in height, it is now not over six feet". Tucker (1882:14) confirms the south side was the best preserved and noted the wall was some "six feet high, and perhaps twenty-five wide". There was no associated ditch to the embankment wall.

Two gateways were noted in the middle of the east and west sides of the walls. Tucker (1882:14) reports the openings were eighty feet wide. Cox (1879:134) reports the eastern gateway was only twelve feet wide. All the reports agree that the eastern gateway was a simple opening, but the western gateway had a surrounding embankment (Cox 1879:134-137, Phinney 1882:193, Squier and Davis 1848:93, Tucker 1882:14). The apparent shape of this gateway addition is shown and reported as either rectangular or curved like a half-circle or horseshoe with the opening to the north (Cox 1879:137, Phinney 1882:192-193, Squier and Davis 1848:93). However, Tucker (1882:14) says the opening was to the south. Both the McBride and Levette maps indicate an interior ditch on the western gateway addition (Cox 1879:137, Squier and Davis 1848:93). Levette's map indicates the addition was 150 feet by 130 feet (Cox 1879:137). Phinney (1882:193) mentions that this surrounding gateway embankment was no longer apparent.

The mound that was located in the center of the enclosure was reported as either circular or elliptical. The McBride map shows an elliptical mound nine feet in height (Squier and Davis 1848:93). Cox (1879:134) reports the mound was 100 feet in diameter and nine feet high and it was used as a spectator platform for horse races during the fair. Phinney (1882:193) reports the mound was circular and about eight feet high. One map shows the mound as 180 feet in diameter (Smith and Driver 1914). Setzler (1931:20) gives the mound dimensions as 80 feet east-west and 90 feet north-south.

Overall, the descriptions concerning the size and shape of the Fudge site are similar, but the details are quite inconsistent. The accuracy of the information concerning the size and layout of the site was tested during this project. An assessment of the current condition of the site and level of destruction was also documented through the instrument survey.

Methods

Several techniques were used to obtain and display spatial information from the site. The instrument survey was conducted primarily along the wall sections of the site. The interior space was too large to make a detailed contour map. Due to the large area covered, temporary datums were established using a Sokkia Axis^3 GPS system set to the1983 NAD. The UTM coordinates were entered into a SET6E Total Station system using an SDR33 fieldbook. Survey readings were taken across the site to obtain elevation information. The instrument survey data was downloaded into ProLink 1.0 software and exported in text format. The data was imported and displayed in SURFER 8.0, ARCMAP 9.0 and ARCSCENE 9.0. The McBride (Squier and Davis 1848:93) and Levette maps (Cox 1879:137) and the 1936 aerial of the site were scanned and "Georeferenced" in ARCGIS for comparative display.

Results

Several sections of the Fudge site were mapped during this project (Figure 24). These sections were primarily areas of the embankment that were still visible and the area of the mound and the western gateway that were no longer visible on the surface. Other sections were not mapped due to disturbance by residential structures, roads and the gravel pit.

Image Removed

Site Locations Confidential

Not for Public Disclosure

Figure 24. Mapped areas of the Fudge site.

Due to the destruction of portions of the site area, the instrument survey was unable to fully reconstruct the site dimensions. However, the combined information from the survey data, aerial photos and the McBride (Squier and Davis 1848:93) and Levette (Cox 1879:137) maps provided the basis for a new map. Each data source was displayed in ARCMAP 9.0 as a layer. With the combined layers, a new site map was generated using the instrument survey data as the foundation and filling in data gaps from other sources. An outline drawing of the site dimensions was then created and presented on a modern aerial (Figure 25).

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Site Locations Confidential

Not for Public Disclosure

Figure 25. Outline of Fudge enclosure on aerial.

The early reports of the site size were found to be inaccurate to some extent. Our survey mapped the enclosure as 330 m NS (1082.4') x 385 m EW (1262.8'). These dimensions are close to the 1080' x 1320' reported for the enclosure and it does encompass 31.4 acres. The enclosure is orientated to approximately 6^0 east of north. Both the McBride and Levette maps were inconsistent with the instrument survey in length, width and/or orientation (Figure 26). However, the McBride map was more accurate and is one of the most accurate early maps from east central Indiana enclosure sites. The perimeter of the embankment wall is approximately 1484 m. Approximately 681 m or 46% of the embankment wall is destroyed or heavily disturbed and no longer visible.

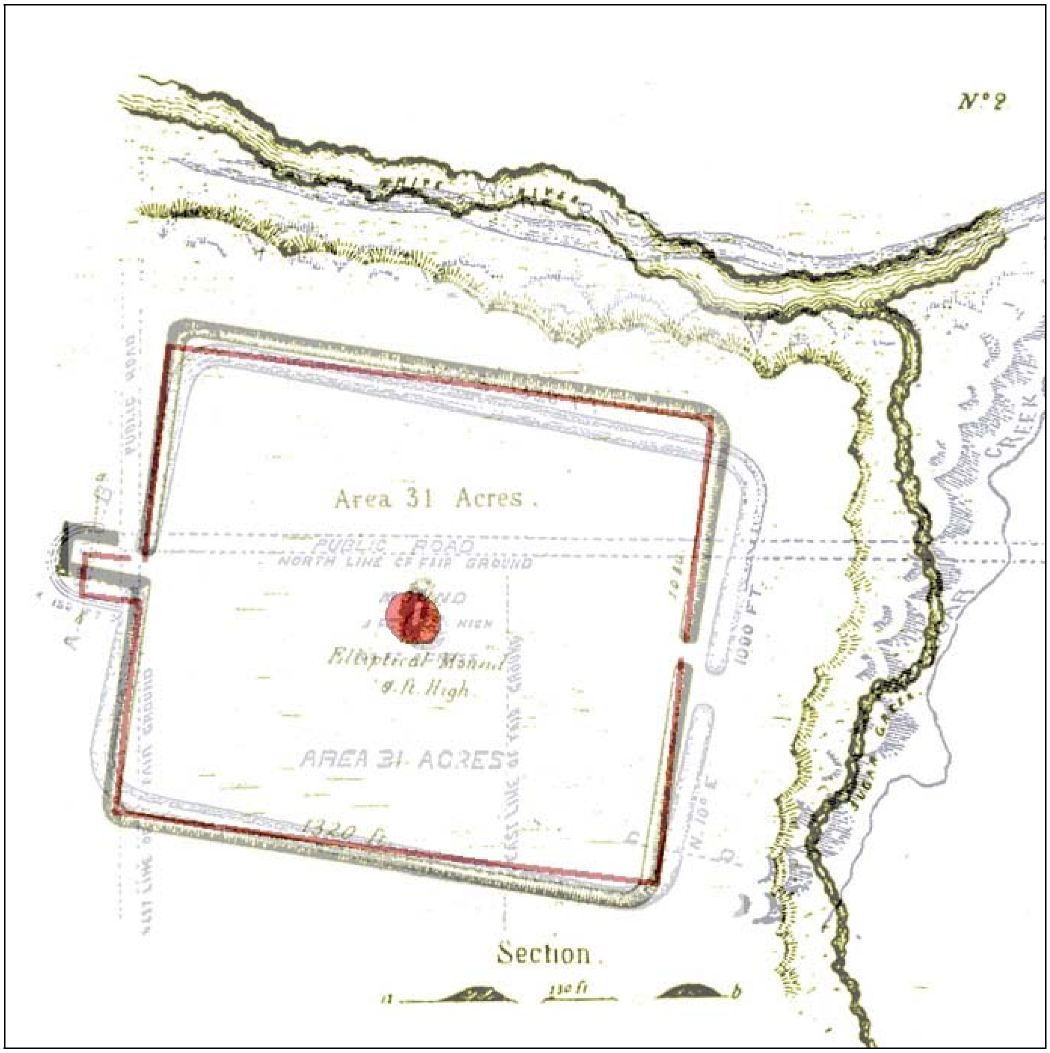


Figure 26. Overlay of McBride map (Squier and Davis 1848) in yellow, and Levette (Cox 1879) map in blue with outline map in red.

The contour maps generated from the survey, show the embankment wall has been significantly reduced from the originally reported height (Figure 27). In most areas where the embankment was mapped, it ranged between 0.5 m and 0.8 m in height above the surrounding ground surface. The best preserved section of the embankment wall, just to the south of Martin Street, the wall was 1.2 m in height. While some reports state the wall was eight or ten feet in height, the six foot height reported by Phinney (1882:193) and Tucker (1882:14) would appear to be a more reasonable height. Perhaps, the reason for the disparity in the reported height is the position of the observer. For example, if one stands to the north of the northern embankment wall, the wall appears much higher because the ground is sloping down toward the river valley. If six feet is taken as a reasonable height for the embankment wall, then nearly one-half of the embankment wall is still preserved in many areas.

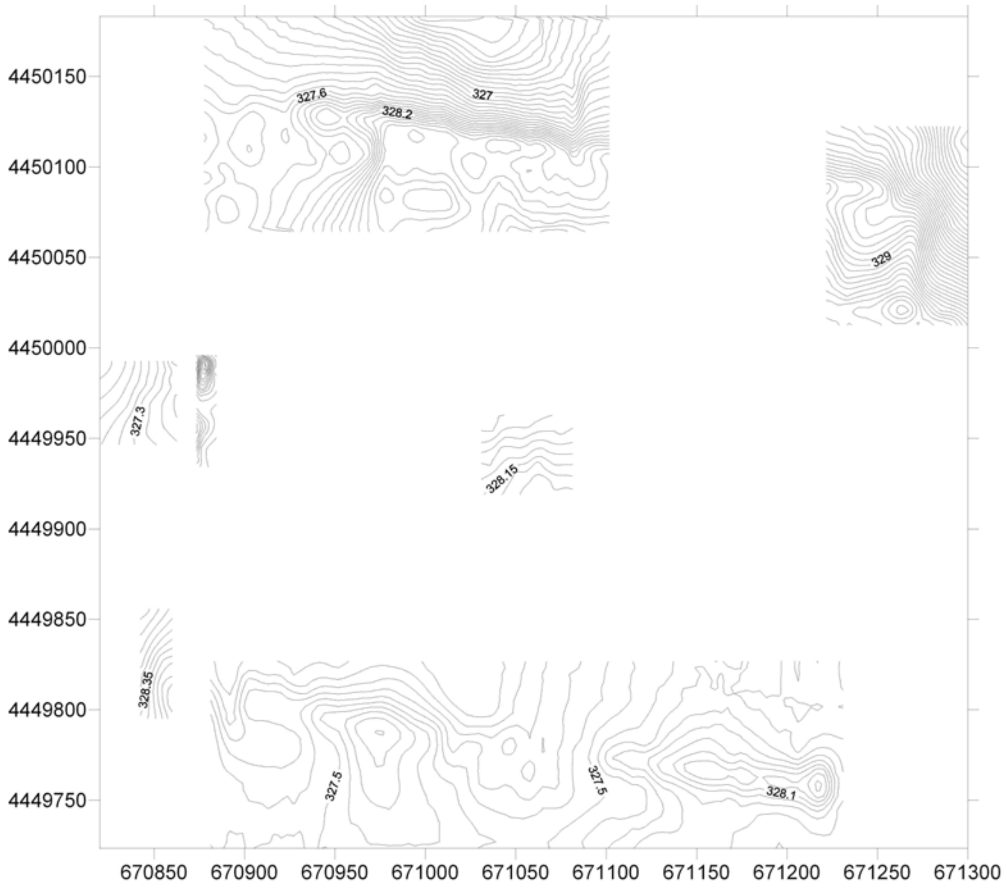


Figure 27. Contour map of Fudge site.

The western gateway embankment was reported to no longer be apparent in 1882 (Phinney 1882:193). However, the gateway opening is actually discernible. The opening is somewhat subtle and difficult to distinguish from surrounding disturbance, but it is clearly evident in the contour map. The opening is approximately 8 m (26') across. While the opening is present the bank and ditch gateway extension is not. The instrument survey of the mound and western gateway extension indicated no surface manifestation of these features. Their locations could not be discerned from the surrounding landscape. While neither of these structures is visible, the magnetometer did detect subsurface anomalies in both locations. Data from the magnetometer survey of these areas was useful and was incorporated into the site map. This provided only the horizontal extent of the mound and gateway. The mound was approximately 33 x 41 m in diameter; the long axis was oriented northwest-southeast. The gateway measured approximately 28 m NS x 42 m EW. The magnetometer survey will be discussed in more detail below.

Discussion

The early reports of the size and layout of the Fudge site were found to be slightly inaccurate. This was not surprising as every earthwork complex we have re-mapped has revealed inaccuracies in earlier maps. The project was able to generate a new site map using the instrument survey data, magnetometer data and early maps to fill in the data gaps.

It was also not surprising to find that a large majority of the site has been heavily disturbed or destroyed. Approximately 46% of the embankment walls are no longer visible or have been destroyed and most of those that remain have been reduced by one-half the original height. The western gateway opening is present, but the ditch and bank gateway extension is no longer visible. There is no surface manifestation of the excavated mound. However, more of the site is intact than originally thought. A substantial portion of the site does remain; almost half of the enclosure. While the mound and western gateway extension is no longer visible, subsurface anomalies were detected by the magnetometer survey.

Magnetometer Survey

A magnetometer survey was proposed to help delimit areas of the embankment and mound that were no longer visible from the surface and detect potential sub-plowzone features. It was apparent from a visual inspection of the site that plowing had significantly reduced the embankment walls and in some areas they were no longer visible. The ditch and associated bank from the gateway addition on the western side of the enclosure and any traces of the mound were no longer visible. It was hoped that the magnetometer survey would help to delineate these lost areas and potentially detect submound features not previously excavated by Setzler (1931). The magnetometer survey was also used prior to any excavation to detect areas with magnetic anomalies that may indicate prehistoric use. The results were then used to assist in the placement of excavation units.

Methods

A total of 19 - 20 x 20 m blocks and 5 - 10 x 10 m blocks were surveyed with the gradiometer. Sections of the embankment wall, the interior of the enclosure, the area of the mound and the area of the western gateway addition were surveyed. The following methods were used for the majority of the survey and exceptions are discussed below. A Fluxgate FM36 gradiometer was used for the survey with the resolution set to 0.1nT. Parallel transects spaced at 0.5 meter intervals were walked with a north heading. Readings were taken along the transect line every 0.25 meters using the external encoder trigger. Exceptions to these methods include: magnetometer grids 3 and 4 were surveyed using 1.0 meter intervals and magnetometer grid 12 was surveyed with a manual trigger and readings were taken every 0.5 meters. All the data collected was processed using GEOPLOT 3.0 software. The location of the gradiometer grids were recorded by a Sokkia Axis^3 GPS system set to the1983 NAD. The GEOPLOT images were imported and displayed in ARCGIS 9.0.

Results

The magnetometer was successful in detecting subsurface anomalies in the embankment wall, the boundaries of the mound and the western gateway. Magnetometer grids 1 to 11 were placed along the northern embankment wall (Figures 28 to 36). These areas are currently used as horse pastures, but were cultivated in the past. Taken individually, the grids did not display much variation, but when combined, the edges of the embankment wall became apparent as changes from higher areas of magnetism to lower areas. This change in magnetism was approximately 9 to 10 meters across. The embankment wall was reported to be 25' (7.6 m) across (Tucker 1882:14). The lower magnetism could possibly relate to erosional wash off the embankment wall (R. Berle Clay, personal communication 2006). In grids 7 to 11, a series of parallel lines were detected (Figures 32 and 33). The origin of these lines is unknown. Magnetometer grid 12 was a small 10 x 10 m block placed on the southern embankment wall (Figure 34). The area was covered with grass and several trees; no substantial anomalies were detected. The boundary of the excavated mound was apparent in grids 21 to 24 as an area of lower magnetism (Figure 36). These lower readings may again define areas of wash off the mound (R. Berle Clay, personal communication 2006). The subsurface pit excavated by Setzler (1931) may have also been detected. This area is currently an agricultural field. The clearest anomalies were detected at the western gateway in grids 13 to 20 (Figure 35). The ditch and bank construction of this gateway, created a magnetic contrast. Several discrete magnetic anomalies were apparent along the edge of the ditch. This area is currently an agricultural field.

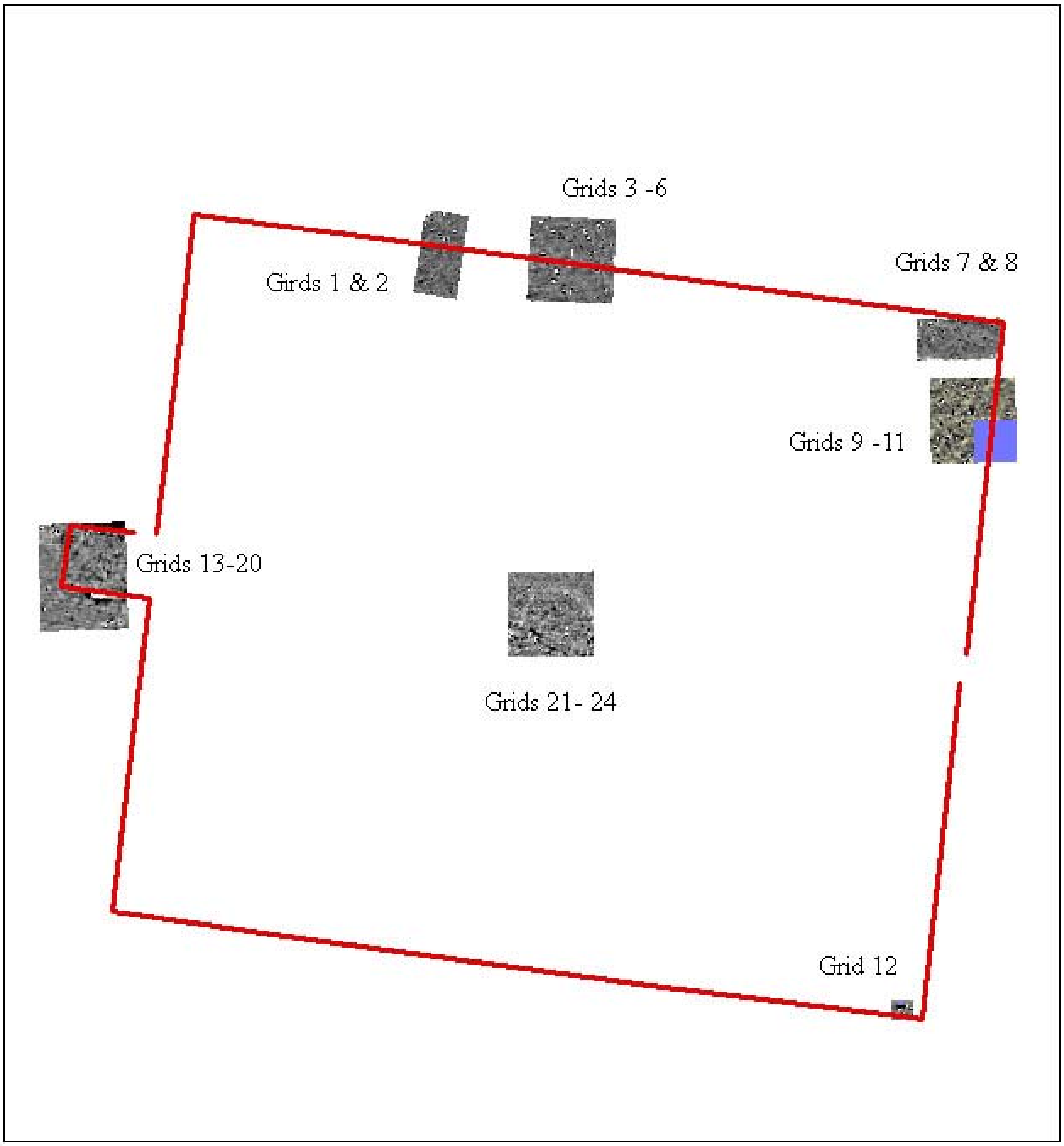


Figure 28. Location of magnetometer grids.

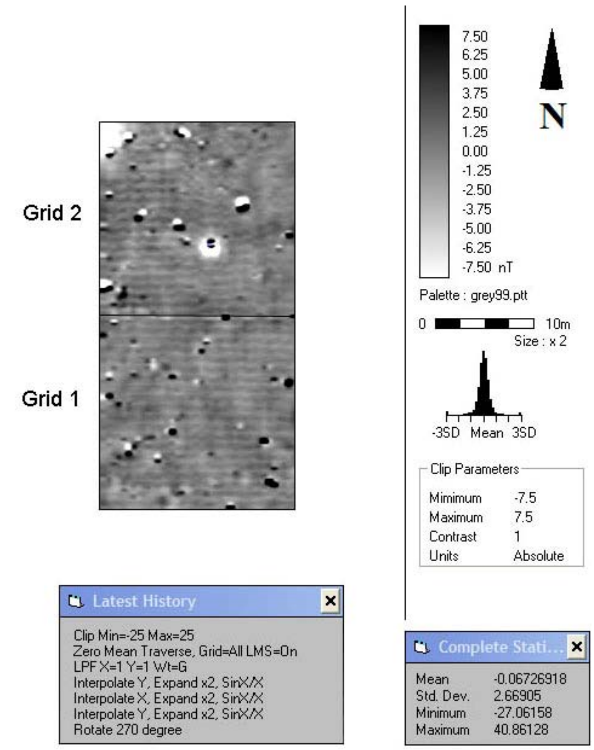


Figure 29. Magnetometer grids 1 and 2.

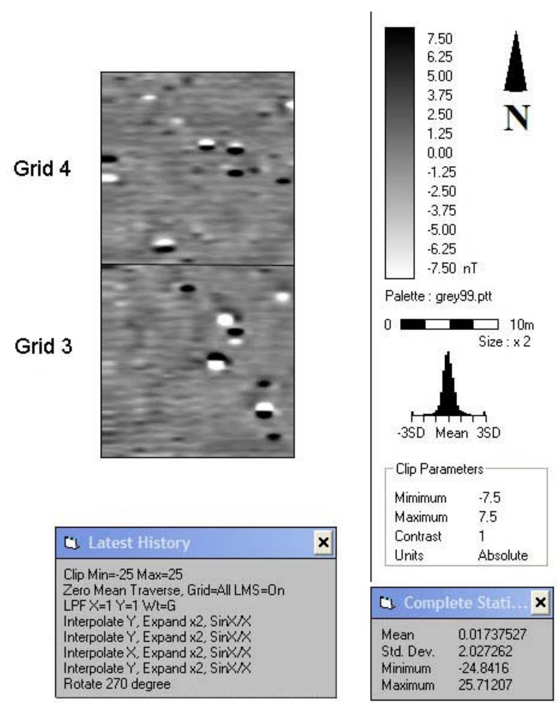


Figure 30. Magnetometer grids 3 and 4.

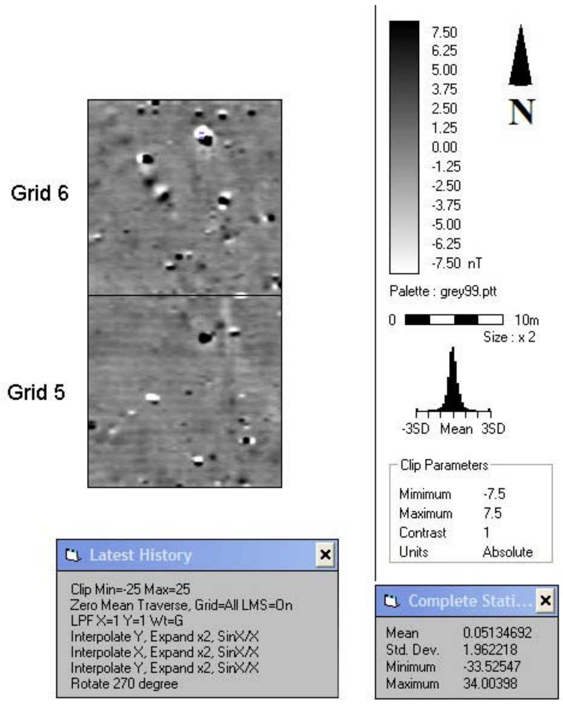


Figure 31. Magnetometer grids 5 and 6.

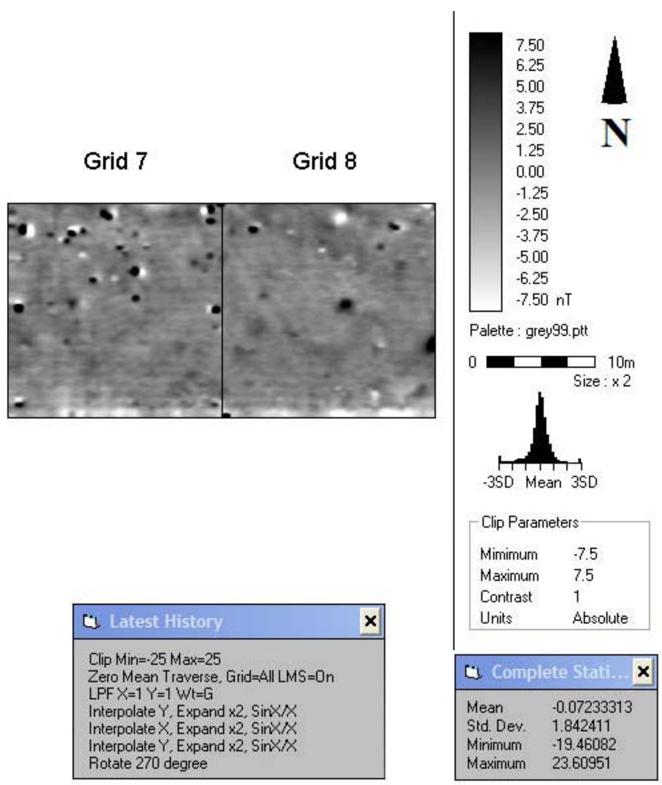


Figure 32. Magnetometer grids 7 and 8.

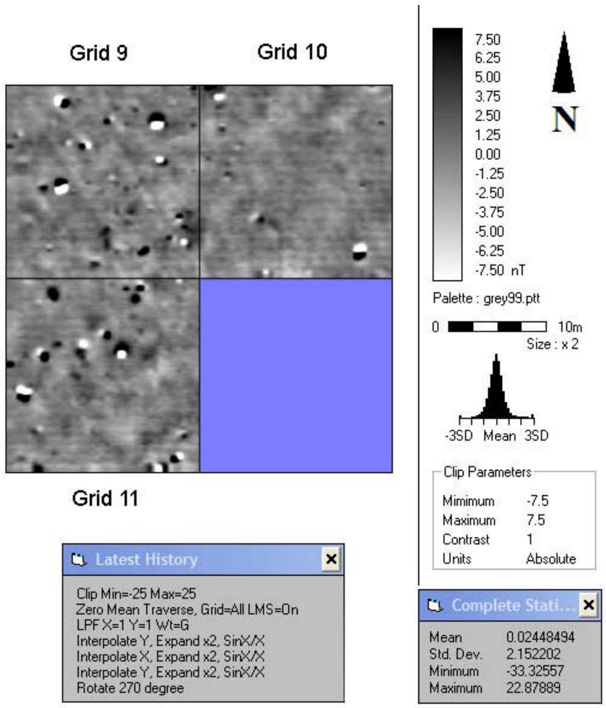


Figure 33. Magnetometer grids 9 to 11.

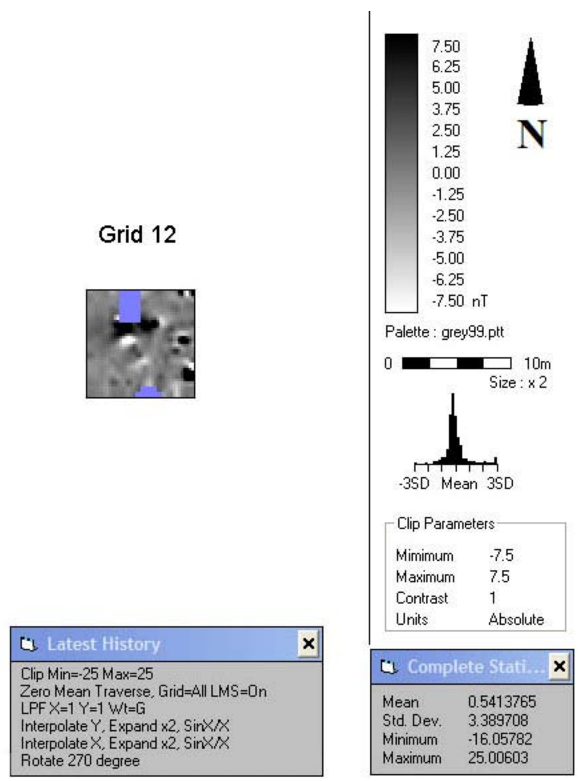


Figure 34. Magnetometer grid 12.

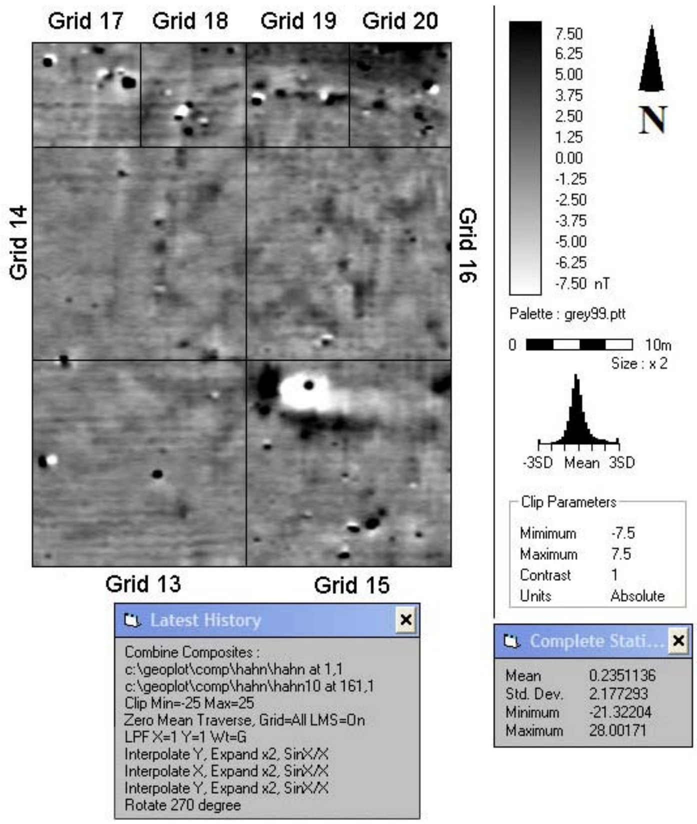


Figure 35. Magnetometer grids 13 to 20.

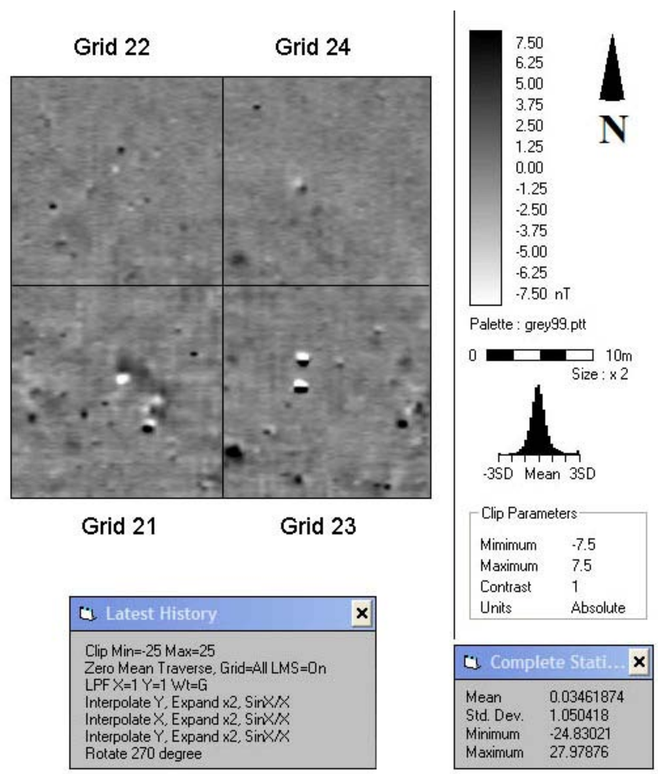


Figure 36. Magnetometer grids 21 to 24.

The ground truthing of discrete prehistoric features was less successful. While numerous anomalies were encountered in each of the grids, few were thought to represent cultural features. Anomalies between 2 and 10 nT were thought to represent the highest probability for archaeological features. Near surface metals provided some background noise in survey grids 1 to 11. The excavations tested only five anomalies, but these were felt to have the highest likelihood of prehistoric features. Due to a lack of landowner permission, we were restricted to excavations along the northern embankment wall. Several promising anomalies detected in the area of the mound and western gateway were not available for testing. None of the anomalies that were tested were cultural in origin. The most common cause for the anomalies found in excavation was burned out trees. Results of the excavation will be discussed in more detail below.

Discussion

The magnetometer provided valuable information on the structure of the Fudge site. The location of the mound and western gateway showed no surface features, but were clearly defined in the magnetometer data. It is doubtful that traditional archaeological techniques would have provided this quality of information given the same amount of time. However, the survey was less successful in providing information on discrete cultural features. This resulted more from the restriction of landowner permission excluding some areas, rather than a fault of the magnetometer survey. Several of the anomalies detected at the mound and western gateways have a high potential for prehistoric origin.

Excavation

Limited test excavations of the Fudge site were undertaken in several areas along the northern embankment wall. While we had hoped to test a section of the seemingly well preserved eastern embankment wall and an area within the excavated mound, a change in ownership of the property restricted the areas available for excavation. Based, on the magnetometer survey results we would have liked to sample anomalies detected at the western gateway, but we were again denied permission for excavation. The data recovered from the northern wall did help to define the chronology of the site and construction episodes.

Methods

The limited testing was conducted in areas that had been surveyed with the magnetometer. Testing was undertaken through hand excavated units either 1 x 1 m or 1 x 2 m in size. The units were designated by sequential numbers as they were excavated. The southwest corner of each unit served as the unit datum. The locations of the excavation units were recorded with a SET6E Total Station system using an SDR33 fieldbook in reference to a datum established using a Sokkia Axis^3 GPS system set to the1983 NAD. UTM coordinates for the units are presented in Appendix E.

The plowzone was excavated as one level and all excavated soil was screened through 6.4 mm mesh. The units were then excavated to sterile deposits in 10 cm arbitrary levels. Any features that were encountered were mapped in plan view. Each cultural feature was bisected and both halves were excavated. The features were excavated in natural levels. Upon completion of the units, at least one unit wall representative of the soil strata was profiled. All units were lined with plastic and backfilled.

Level and feature forms were completed, as appropriate. Notes were maintained by the author. Non-diagnostic artifacts and fire-cracked rock were provenienced by unit, level and/or feature. Diagnostic artifacts were mapped *in situ* and individually bagged. Samples appropriate for radiocarbon dating were collected. Soil samples were collected from each strata identified in each unit. The project was documented by digital photographs and color slides.

All artifacts and samples were taken to the ARMS laboratory for processing, identification, analysis and curation. Artifacts were cleaned, classified and catalogued. Definitions used for classifying prehistoric lithic materials were included in Appendix B. Metrical attributes and raw material identification were recorded as appropriate. Lithic raw materials were identified by comparison with reference samples and published descriptions on file in the ARMS laboratory. Three samples were submitted to Beta Analytic, Inc. for radiocarbon dating. Each of the samples was from wood charcoal and dating using AMS methods. The carbon samples were oven dried, picked for carbon, weighed and repacked in clean foil prior to submission. Phosphate analysis was conducted from the soil samples collected from each unit by Jan Northam. Notes, standardized forms, maps and photographs were reviewed and prepared for illustration and curation. A DHPA Sites and Structures Inventory form was revised for site 12-R-10. All materials generated by this project were catalogued under ARMS accession # 05.52. Artifacts were curated at Ball State University.

Results

Nine small test units consisting of four 1 x 1 m units and five 1 x 2 m units were excavated along the northern embankment wall (Figures 37 and 41). Historic artifacts totaling 46 pieces were recovered from plowzone contexts in all units except Unit 4. Fire-cracked rocks were recovered from all units and totaled 46 pieces (2.99 Kg). Prehistoric artifacts were quite sparse and Units 2 and 8 contained no prehistoric artifacts. The prehistoric artifacts consisted of 11 flakes and 1 biface, none of which were temporally diagnostic of Middle Woodland. The artifacts and fire-cracked rock recovered in the embankment walls were likely incorporated along with the soil brought to the site to construct the wall. Each unit will be discussed separately. The results of the phosphate analysis are presented in Appendix F.

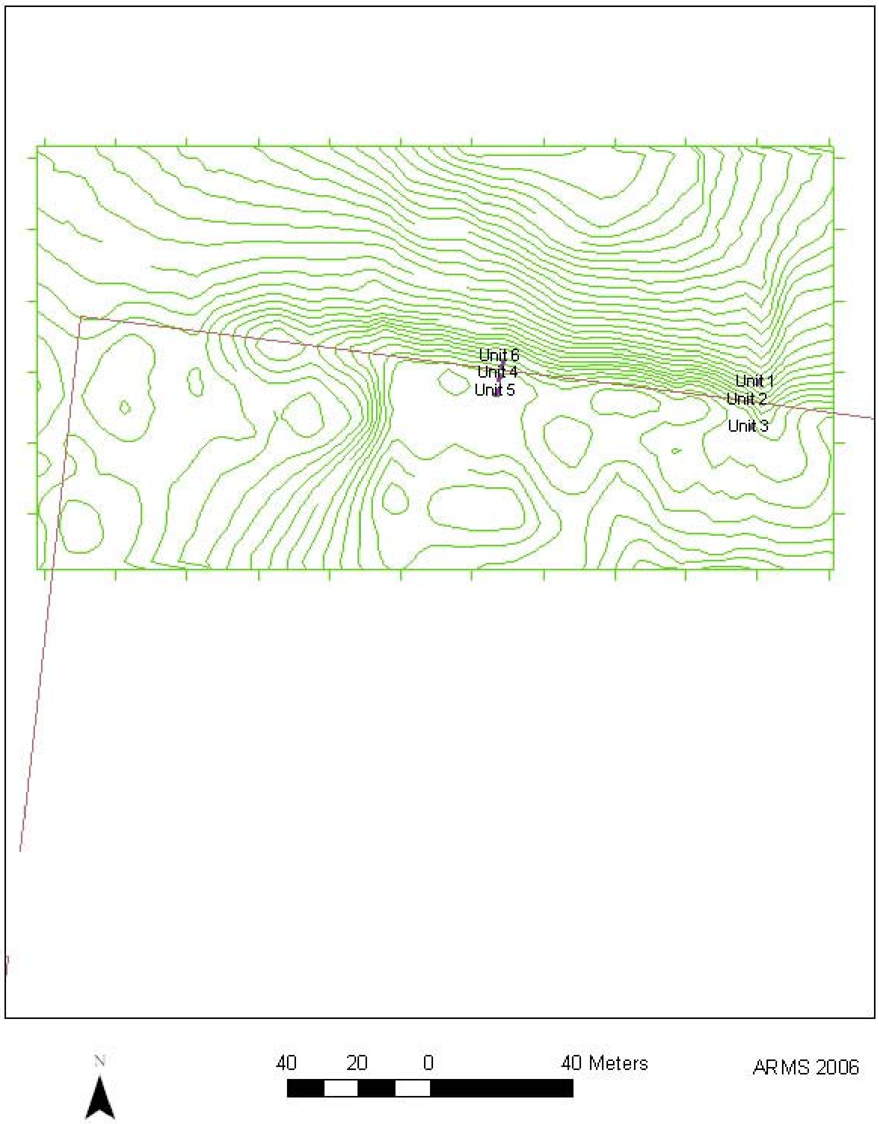


Figure 37. Location of Units 1 to 6.

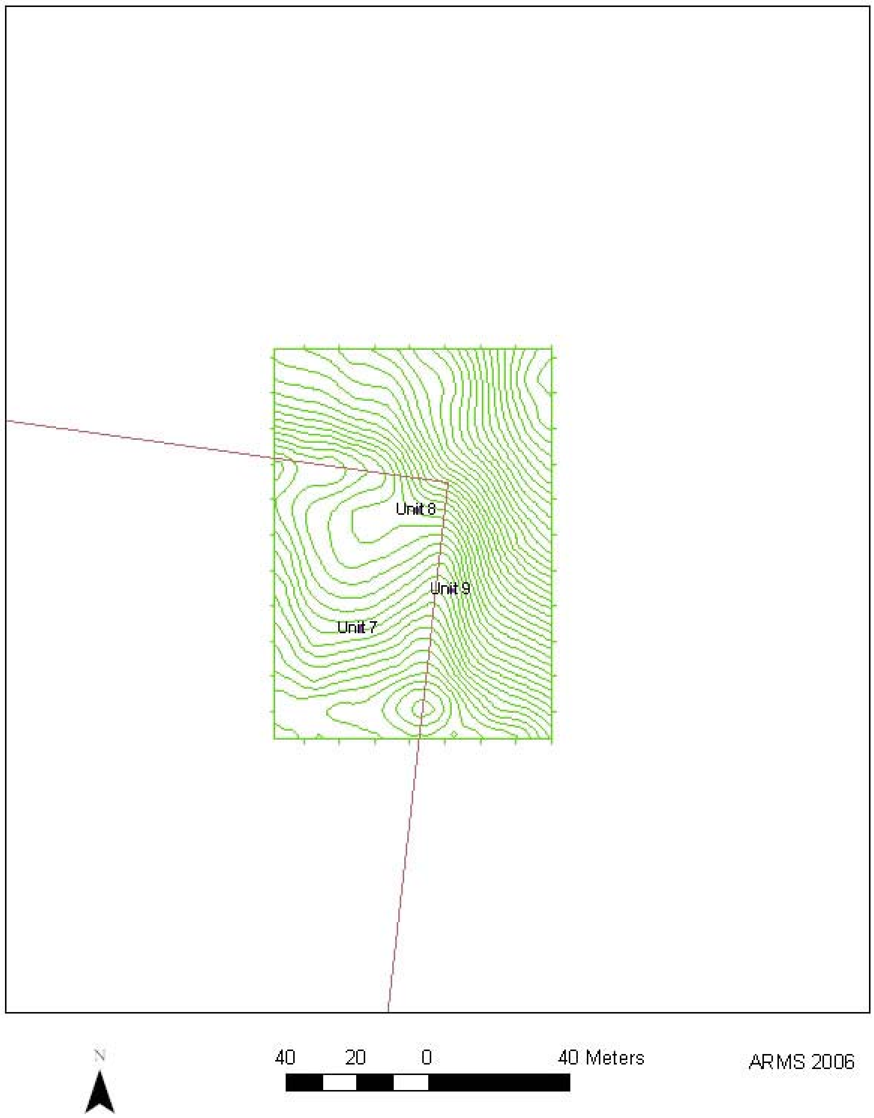


Figure 38. Location of Units 7 to 9.

Figure 39. Excavation of Units 1, 2 and 3, looking east.

Figure 40. Excavation of Units 4, 5 and 6, looking northeast.

Figure 41. Excavation of Unit 9, looking northeast.

Unit 1

Unit 1 was placed on the northern slope of the north embankment wall over a magnetic anomaly. To the east of the unit, a small drainage channel had been cut through the embankment wall during historic times to allow water to drain from the interior of the enclosure. The unit was 1 x 1 m in size and was excavated to approximately 43 cm below the present ground surface. Table 12 provides a listing of material recovered from Unit 1. Prehistoric materials were represented by three flakes and six fire-cracked rocks. No features were identified in the unit and the magnetic anomaly was apparently missed. The stratigraphy recorded for the unit showed a poorly drained B-horizon as the original ground surface at the base of the unit, overlying was an undisturbed section of the embankment wall and then the disturbed plowzone (Figure 42 & 43). The embankment wall was fairly homogenous, but a pocket of mixed soil was identified in the west wall and was suggestive of basket loading.

Table 12 Material Recovered from Unit 1						
Unit	Level	Quantity	Identification	Color	Description	Material
1	1	1	Glass	Clear	Container	
1	1	1	Coal Slag			
1	2	1	Glass	Clear	Flat	
1	2	4	Clay		Burned	
1	2	2	Plastic			
1	2	1	Coal Slag			
1	2	75.0g	Fire Cracked Rock		n=1	
1	3	1	Flake		Unmodified	Laurel
1	3	2.1g	Charcoal			
1	3	1	Chert Sample			Laurel
1	3	182.7g	Fire Cracked Rock		n=3	
1	4	2	Flake		Unmodified	Unknown
1	4	6.4g	Charcoal Deposit			
1	4	93.4g	Fire Cracked Rock		n=2	

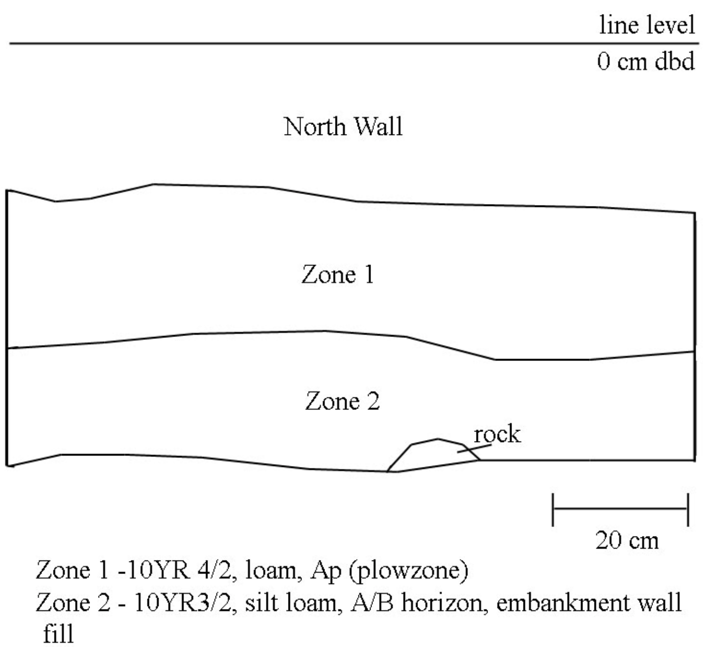


Figure 42. Unit 1 North wall.

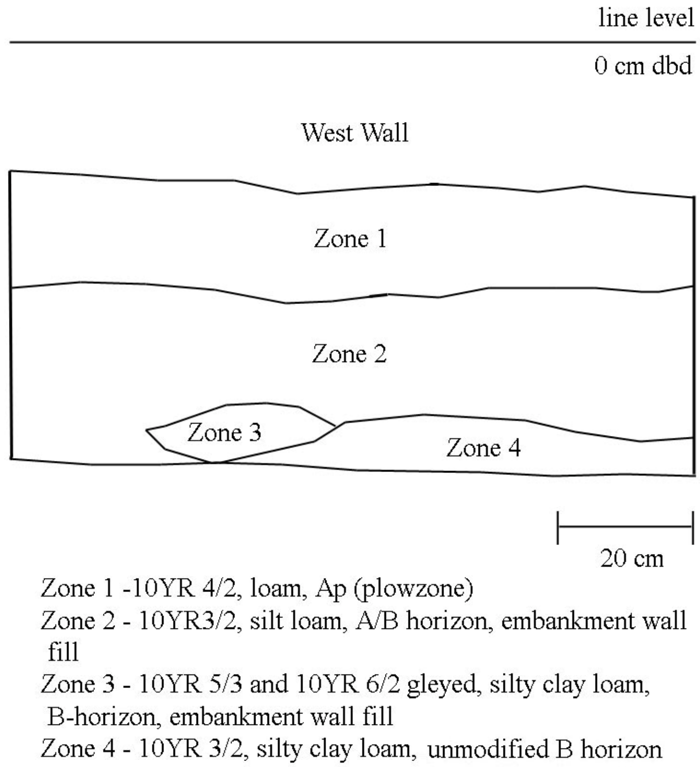


Figure 43. Unit 1 West Wall.

Unit 2

Unit 2 was placed on the apex of the northern embankment wall over a magnetic anomaly. The drainage channel mentioned in the description of Unit 1 was also located to the east of Unit 2. The unit was 1 x 1 m in size and excavated to approximately 48 cm below the present ground surface. One feature was identified at the base of the plowzone, but was identified as a burned out tree upon excavation. This was the source of the magnetic anomaly. Table 13 provides a listing of the material recovered from Unit 2. The only prehistoric materials were six fire-cracked rocks. Two wood charcoal samples were collected for dating. The sample from level 5 was taken on the original ground surface and was submitted for AMS dating. The resultant date was 1910 ± 40 BP; cal 2 sigma AD 20 to 220 (Beta-211085). The stratigraphy recorded in this unit showed a poorly drained B-horizon as the original ground surface at the base of the unit, and overlying were two or three different soil zones comprising the embankment wall (Figures 44 & 45). In the western wall a pocket of soil as suggestive of basket loading. A disturbed plowzone was recorded at the top of the unit.

Table 13 Material Recovered from Unit 2						
Unit	Level	Quantity	Identification	Color	Description	Material
2	1	3	Glass	Clear	Flat	
2	2	105.9g	Fire Cracked Rock		n=2	
2	3	20.9g	Fire Cracked Rock		n=2	
2	4	167.6g	Fire Cracked Rock		n=2	
2	4	~ 1.0g	C^{14} Sample			
2	5	~1.0g	C^{14} Sample			

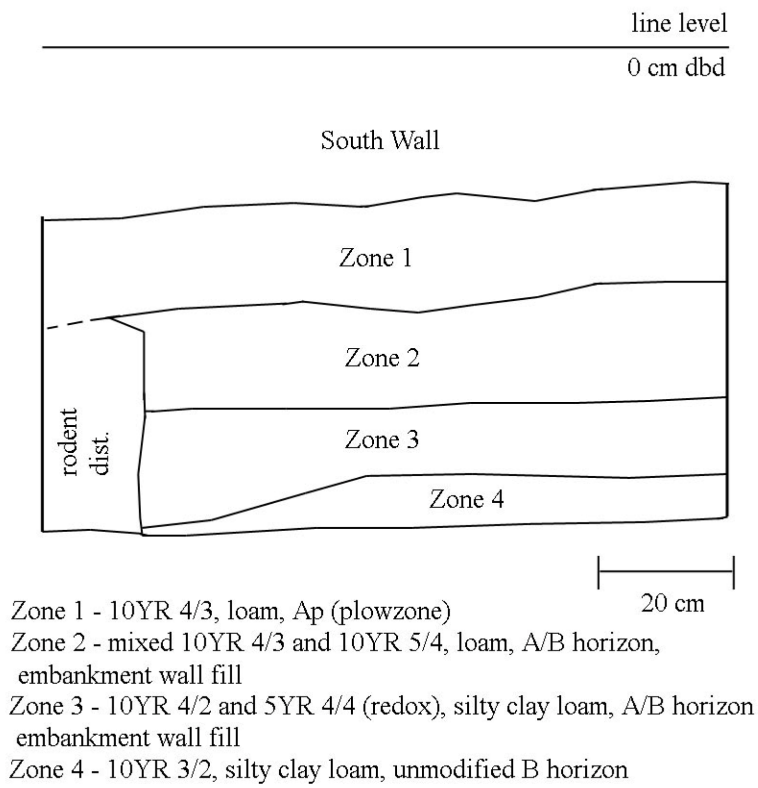


Figure 44. Unit 2 South wall.

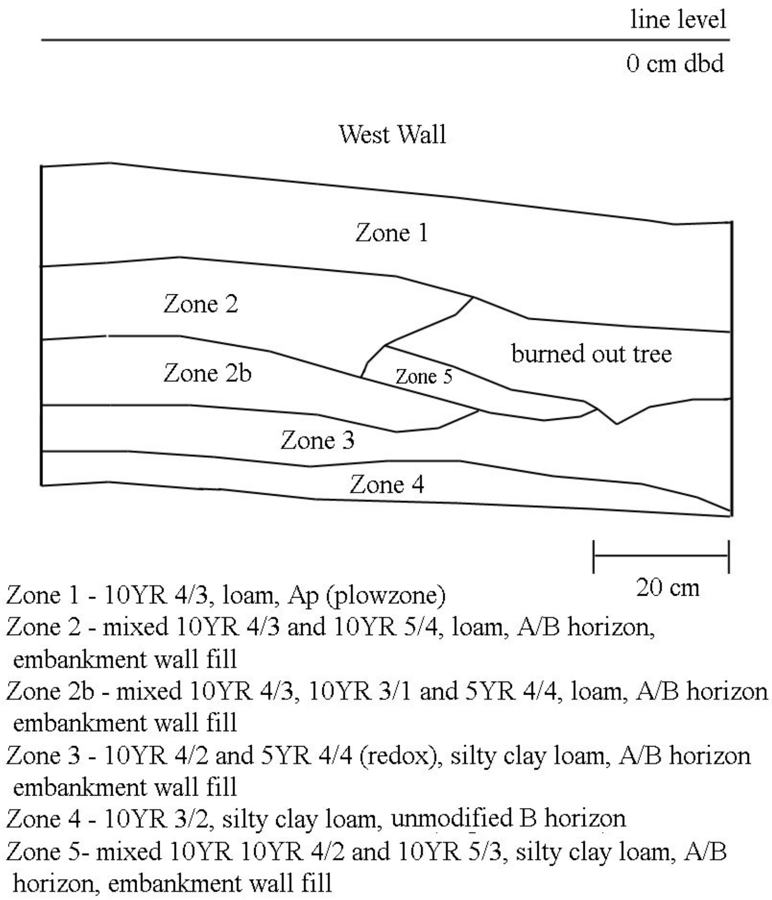


Figure 45. Unit 2 West wall.

Unit 3

Unit 3 was placed to the interior of the northern embankment wall. The unit was 1 x 1 m in size and excavated to a depth of approximately 49 cm below the present ground surface. One flake and one fire-cracked rock were recovered from the excavation representing prehistoric materials (Table 14). The stratigraphy recorded for the unit indicates a natural soil profile (Figure 46). A plowzone was encountered at the top of the unit, followed by a transitional A/B-horizon and a B-horizon. The transitional nature of the second zone may be affected by erosional wash from the embankment wall. The third zone, an unmodified B-horizon, is indicative of poorly drained soils. The ponding of water or poorly drained soils were a likely cause for the historic drainage channel to have been cut through the embankment wall in this area.

Table 14 Material Recovered from Unit 3						
Unit	Level	Quantity	Identification	Color	Description	Material
3	1	1	Glass	Clear		
3	2	1	Clay		Burned	
3	2	4	Coal Slag			
3	3	1	Flake		Unmodified	Unknown
3	3	1	Glass	Clear	Flat	
3	3	61.9g	Fire Cracked Rock		N=1	

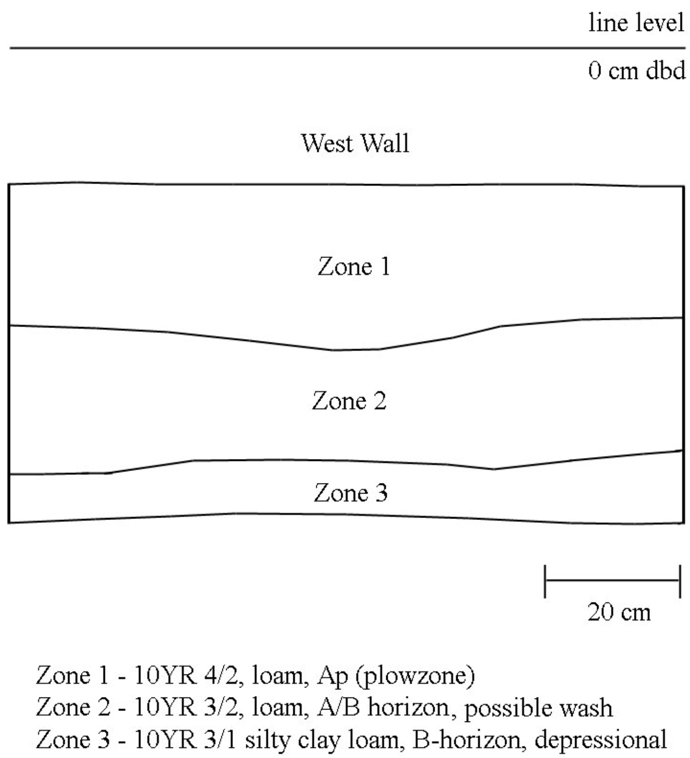


Figure 46. Unit 3 West wall.

Unit 4

Unit 4 was placed on the apex of the embankment wall. The unit was 1 x 2 m in size. The placement of Units 4, 5 and 6 were intended to provide a profile of the embankment wall. Unit 4 was placed over a magnetic anomaly. The unit was excavated to a depth approximately 55 cm below the present ground surface. Table 15 provides a listing of materials recovered including two flakes and one fire-cracked rock. A feature was encounted within the central area of the unit at the base of the plowzone. Upon, excavation the feature was determined to be a burned out tree. This was believed to be the source of the magnetic anomaly. The stratigraphy recorded an unmodified B-horizon at the base of the unit (Figures 47 & 48). This suggests the topsoil was removed prior to the construction of the embankment wall. The remnant of the embankment wall was represented by Zone 2 and this was truncated by the plowzone.

Table 15
Material Recovered from Unit 4

Unit	Level	Quantity	Identification	Color	Description	Material
4	1	1	Flake		Unmodified	Laurel
4	1	38.6g	Fire Cracked Rock		N=1	
4	1	1	Flake		Block	HT Unknown
4	5		C^{14} Sample			
4	5		C^{14} Sample			
4	5		C^{14} Sample			
4	5		C^{14} Sample			
4	5		C^{14} Sample			

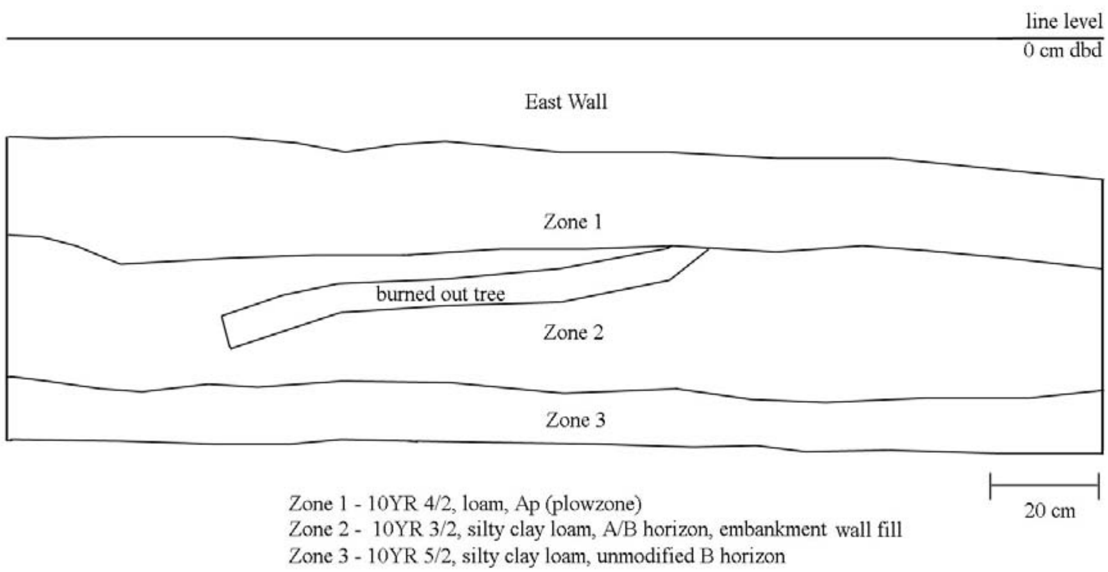
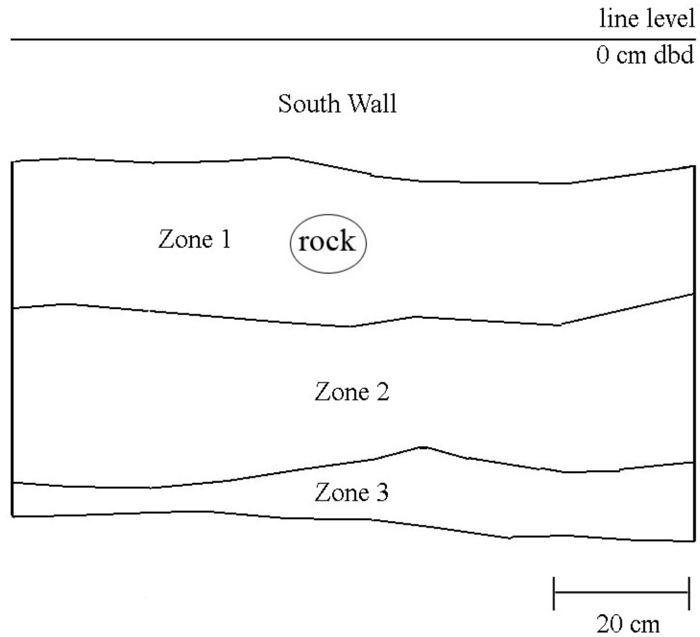


Figure 47. Unit 4 East wall.



Zone 1 - 10YR 4/2, loam, Ap (plowzone)
Zone 2 - 10YR 3/2, silty clay loam, A/B horizon, embankment wall fill
Zone 3 - 10YR 5/2, silty clay loam, unmodified B horizon

Figure 48. Unit 4 South wall.

Unit 5

Unit 5 was located two meters south of Unit 4 to the interior of the embankment wall. The unit was 1 x 2 m in size and excavated to a depth of 50 cm below the present ground surface. Two flakes and ten fire-cracked rocks represent the prehistoric materials recovered from the unit (Table 16). The stratigraphy recorded from the unit showed an unmodified B-horizon at the base of the unit, and overlying this was a transitional A/B horizon (Figures 49 & 50). This transition zone was likely affected by erosional wash from the embankment wall. A difference in the way the soil held moisture was noted as the unit was excavated. The north central and central area of the unit retained moisture longer, but there was no sharp boundary. The moisture difference is also attributed to wash from the embankment wall. Zone 2 was truncated by the plowzone.

Table 16 Material Recovered from Unit 5						
Unit	Level	Quantity	Identification	Color	Description	Material
5	1	1	Flake		Unmodified	Laurel
5	1	1	Aluminum Strip			
5	1	1	Metal Wire			
5	2	1	Flake		Unmodified	Unknown
5	2	6.6g	Charcoal			
5	2	183.6g	Fire Cracked Rock		n=3	
5	3	1.5g	Charcoal			
5	3	31.7g	Fire Cracked Rock		n=2	
5	3		C^{14} Sample			
5	4	0.1g	Charcoal			
5	4	218.5g	Fire Cracked Rock		n=5	

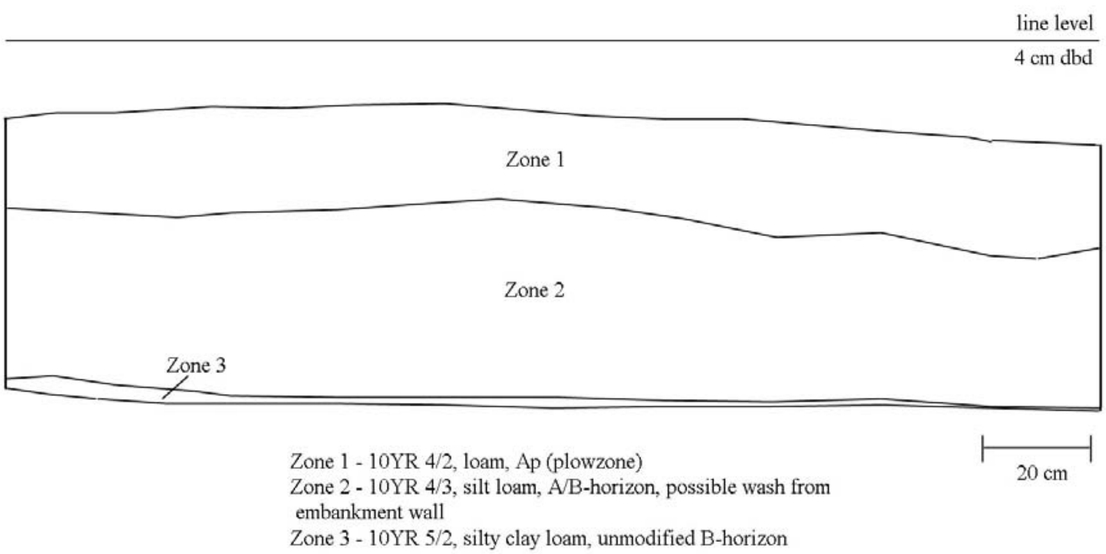
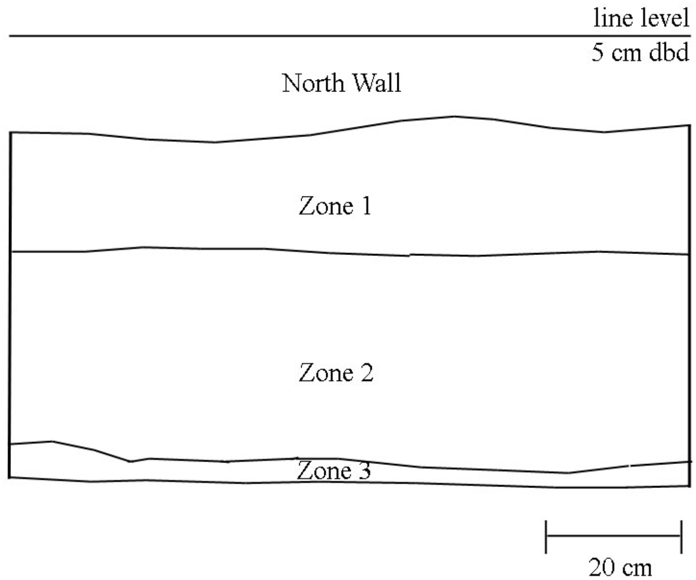


Figure 49. Unit 5 East wall.



Zone 1 - 10YR 4/2, loam, Ap (plowzone)
Zone 2 - 10YR 4/3, silt loam, A/B-horizon, possible wash from embankment wall
Zone 3 - 10YR 5/2, silty clay loam, unmodified B-horizon

Figure 50. Unit 5 North wall.

Unit 6

Unit 6 was located two meters north of Unit 4 on the northern slope of the embankment wall. The unit was 1 x 2 m in size and excavated to a depth of approximately 56 cm below the present ground surface. Table 17 provides a listing of the material recovered from Unit 6. The only prehistoric materials were two flakes and ten fire-cracked rocks. The stratigraphy revealed a minimum of two embankment fill episodes (Figures 51 & 52). An unmodified B-horizon was encountered at the base of the unit. Over this two distinctive soils were placed; Zone 3 first and then Zone 2. The location of the unit on the northern slope preserved Zone 2 where it may have been completely truncated by plowing in Unit 4. Smaller pockets of diverse soils, Zones 5 and 6, were also recorded. A carbon sample from Level 3 (Zone 2) was submitted for AMS dating. The resultant date was 2020 ± 40 BP or calibrated at 2-sigma 110 BC to AD 70 (Beta-211086).

Table 17 Material Recovered from Unit 6						
Unit	Level	Quantity	Identification	Color	Description	Material
6	1	1	Glass	Clear	Flat	
6	1	1	Aluminum			
6	1	425.0g	Fire Cracked Rock		n=5	
6	2	1	Flake		Unmodified	Laurel
6	2	2	Clay		Burned	
6	2	75.9g	Fire Cracked Rock		n=2	
6	3	0.78g	Soil		Burned	
6	3	99.1g	Fire Cracked Rock		n=3	
6	3		C^{14} Sample			

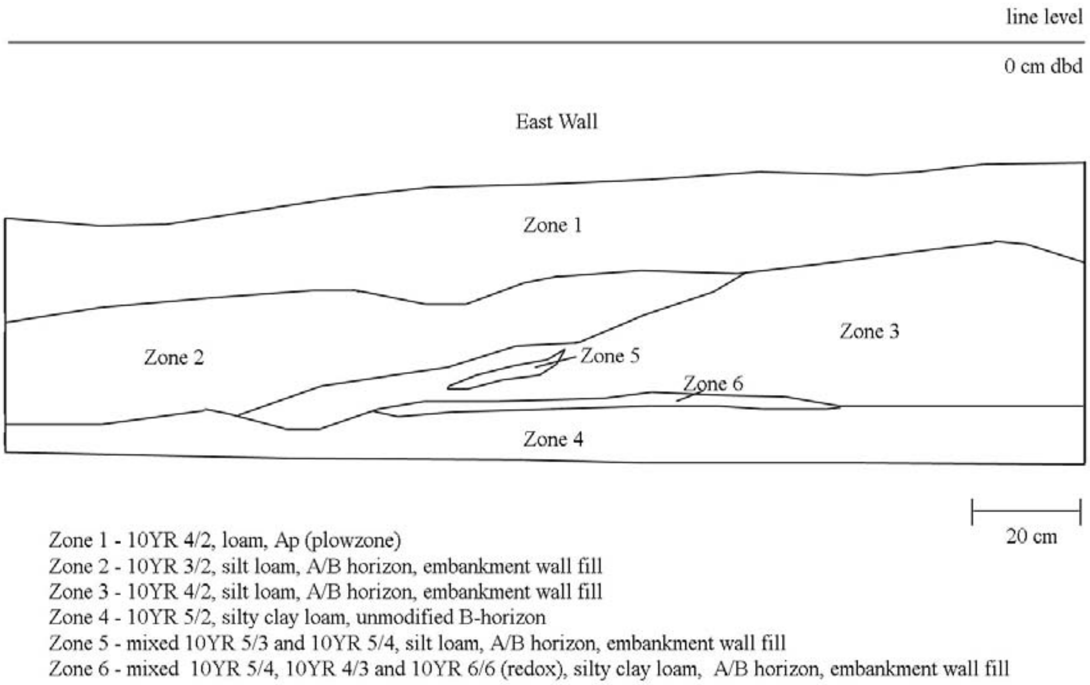
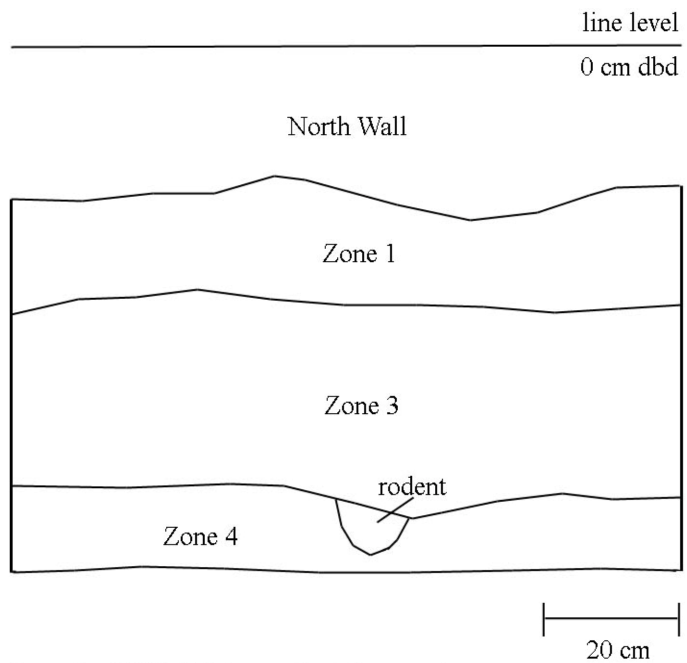


Figure 51. Unit 6 East wall.



Zone 1 - 10YR 4/2, loam, Ap (plowzone)
Zone 3 - 10YR 4/2, silt loam, A/B horizon, embankment wall fill
Zone 4 - 10YR 5/2, silty clay loam, unmodified B-horizon

Figure 52. Unit 6 North wall.

Unit 7

Unit 7 was located on the interior of the enclosure at the northeast corner. The unit was 1 x 2 m in size and placed over a magnetic anomaly. The unit was excavated to approximately 36 cm below the present ground surface. One biface, one flake and 3 fire-cracked rocks were recovered from the unit (Table 18). The biface was recovered at the plowzone-subsoil interface. It was manufactured from Laurel chert and is suggestive of Late Woodland technology. An odd soil formation was encountered at the plowzone-subsoil interface that appeared to be an iron concretion but also mixed with sand and clay. A much larger piece of decaying granite with feldspars and pyrite was encountered below this soil concretion in Level 2. The soil concretion may have been the result of weathering and plow disturbance of this granite rock. This unit had a natural or unmodified stratigraphy (Figure 53). At the base of the plowzone, an unmodified B-horizon was encountered. The magnetic anomaly was either missed or caused by the large granite rock encountered in the subsoil.

Table 18 Material Recovered from Unit 7						
Unit	Level	Quantity	Identification	Color	Description	Material
7	1	1	Flake		Unmodified	Laurel
7	1	1	Styrofoam			
7	1	1	Plastic Wrapper			
7	1	4	Plastic			
7	1	32.6g	Fire Cracked Rock		n=1	
7	2	1	Plastic Wrapper			
7	2	1	Plastic			
7	2	152.9g	Fire Cracked Rock		n=2	
7	2	7	Soil Concretion			
7	2	1	Biface		Stage 2	Laurel

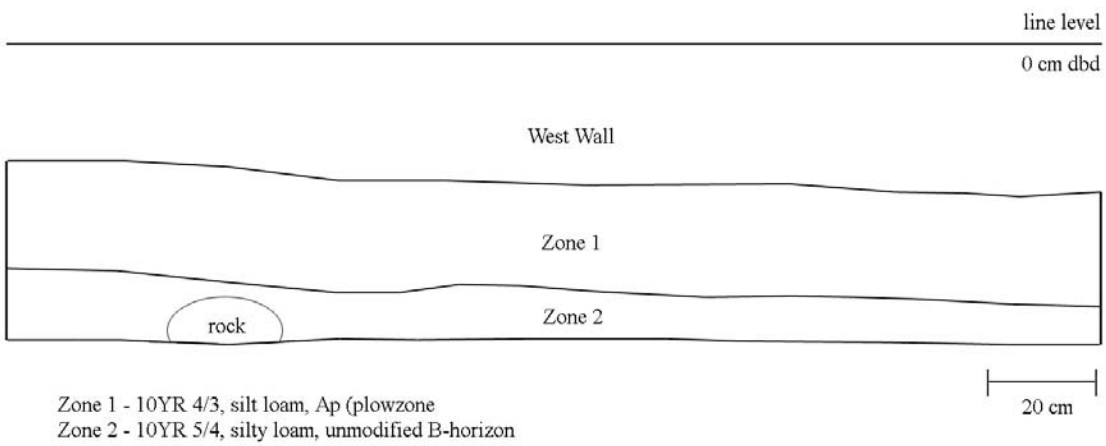


Figure 53. Unit 7 West wall.

Unit 8

Unit 8 was placed just to the interior of the northeast corner of the enclosure over a magnetic anomaly. The unit was 1 x 1 m in size and excavated to approximately 52 cm below the present ground surface. Wood charcoal and small pieces of wood were encountered at the base of the plowzone in a very dispersed pattern. This was likely related to a burned out tree and decaying root system and the source of the magnetic anomaly. Table 19 provides a listing of the material recovered from Unit 8. Only one fire-cracked rock could be related to the prehistoric era. This unit recovered more historic materials than any other unit. A plowzone was encountered at the top of the unit, followed by a B-horizon with the tree related charcoal (Figure 54). This second zone may have been affected by erosional wash from the embankment wall, but this was unclear due to the tree disturbance. The third zone, an unmodified B-horizon, was indicative of poorly drained soils. A drainage channel has been cut through the northeast corner of the embankment and aerial photographs show a darker area in the locality. The ponding of water or poorly drained soils were a likely reason for cutting a drainage channel.

Table 19 Material Recovered from Unit 8						
Unit	Level	Quantity	Identification	Color	Description	Material
8	1	1	Glass	Clear	Container	
8	1	1	Glass	Clear	Chimney/Lamp	
8	1	3	Glass	Clear	Flat	
8	1	1	Glass	Aqua	Bottle Top, Hand-Finished Lip	
8	1	1	Glass	Aqua	Container	
8	1	3	Glass	Amethyst	Container	
8	1	1	Field Tile			
8	1	1	Metal Frag		Unidentified	
8	1	2	Charcoal			
8	1	145.9g	Fire Cracked Rock		n=1	
8	3	1	Charcoal			

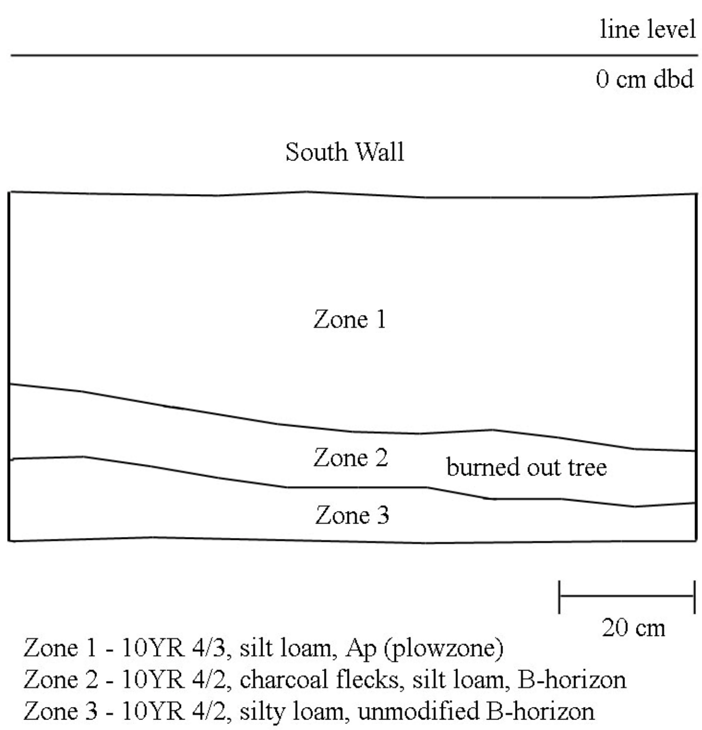


Figure 54. Unit 8 South wall.

Unit 9

Unit 9 was located on the eastern slope of the eastern embankment wall at the northeast corner of the enclosure. The unit was 1 x 2 m in size and excavated to a depth of approximately 52 cm below the present ground surface. Table 20 provides a listing of the material recovered from Unit 9. The only prehistoric materials were one flake and seven fire-cracked rocks. The stratigraphy revealed a minimum of two embankment fill episodes (Figures 55 & 56). An unmodified B-horizon was encountered at the base of the unit. Over this two distinctive soils were placed; Zone 3/4 first and then Zone 2. Zone 4 differed from Zone 3 only by the presence of charcoal. The location of the unit on the eastern slope preserved a portion of Zone 2 before it was truncated by plowing. A carbon sample from north wall in Zone 4 was submitted for AMS dating. The resultant date was 1980 ± 40 BP or calibrated at 2-sigma 50 BC to AD 100 (Beta-211086).

Table 20
Material Recovered from Unit 9

Unit	Level	Quantity	Identification	Color	Description	Material
9	1	1	Flake		Unmodified	Laurel
9	1	1	Glass	Clear	Container, embossed letters	
9	1	3	Glass	Clear		
9	1	1	Glass	Milk	Container	
9	1	3	Whiteware	Undecorated	Body	
9	1	5	Slag			
9	1	168.3g	Fire Cracked Rock		n=3	
9	2	0.148g	Charcoal			
9	2	476.7g	Fire Cracked Rock		n=2	
9	2	~1.0g	C^{14} Sample			
9	3	0.423g	Charcoal			
9	3	~1.0g	C^{14} Sample			
9	4	0.61g	Charcoal			
9	4	236.8g	Fire Cracked Rock		n=2	
9	4	~1.1g	C^{14} Sample			
9	4	0.1g	C^{14} Sample			
9	4	~4.2g	C^{14} Sample			
9	North Wall	~4.3g	C^{14} Sample			

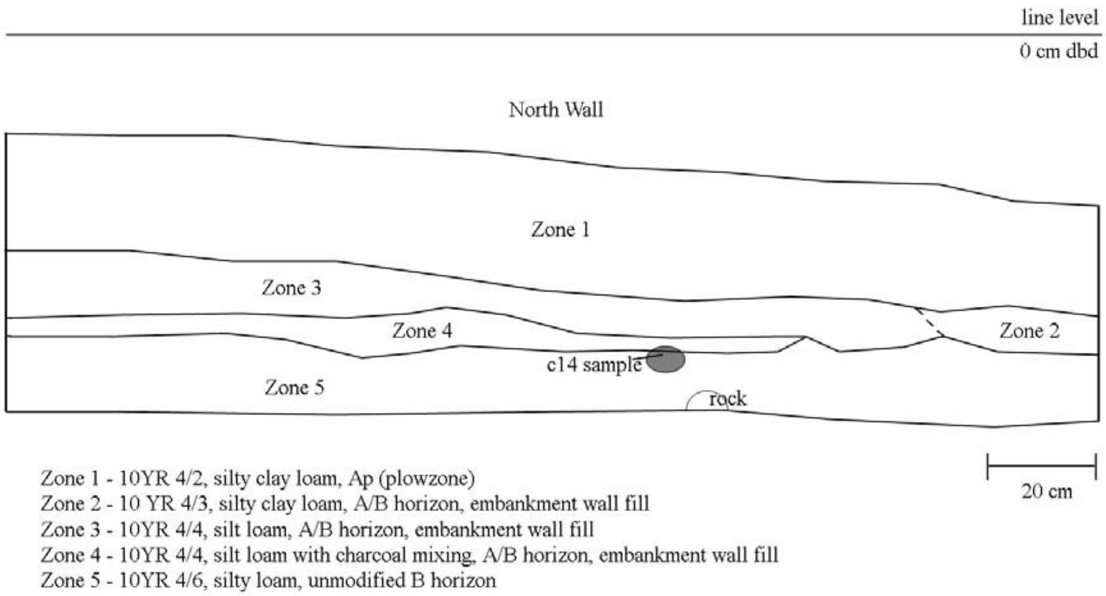


Figure 55. Unit 9 North wall.

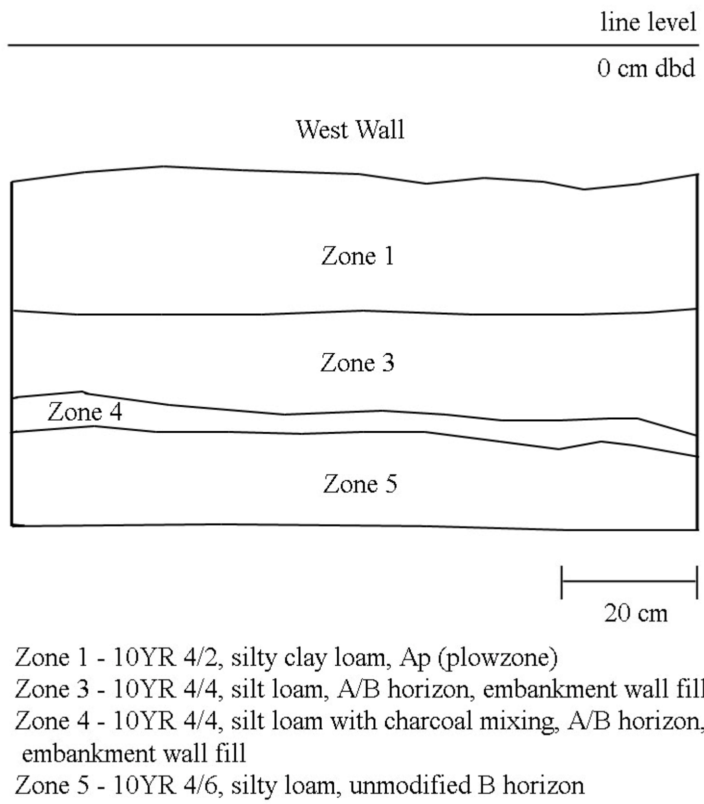


Figure 56. Unit 9 West wall.

Discussion

The goals of the excavations undertaken along the northern embankment wall were to collected data on the chronology and construction of the enclosure. These goals were met, and in addition, the excavations documented the level of disturbance caused by plowing, erosion and drainage cuts. Unfortunately, the magnetic anomalies that were selected for excavation were caused by tree burns and not cultural activities. The few units placed off the embankment to the interior of the enclosure did not reveal any interior activity areas.

Very few prehistoric artifacts were recovered and none could be assigned to the Middle Woodland period. However, the three carbon samples submitted for AMS dating returned calibrated ages between 110 BC and AD 220. The radiocarbon dates will be compared to regional data in the following section.

The information obtained from the excavation was most insightful concerning the construction of the embankment wall. The stratigraphy recorded from the units placed on the embankment revealed no buried A-horizons at the original ground surface. This indicated the area of the embankment wall had been prepared by removing the A-horizon prior to adding soil to form the wall. Removal of the A-horizon may have served as a footprint of where the wall was to be built. Or, the removal of the A-horizon may have served to level the ground surface prior to the wall construction. The northern wall is at the juncture between the till plain upland and the White River valley so leveling or evening the topography may have been required. Setzler (1931:35) indicates a buried A-horizon or "sod line" was encountered in his excavation of the southern embankment wall.

A minimum of two construction episodes were documented in the profiles. The profiles from units placed on the slope of the embankment provided the clearest data, since the deposits were not truncated by plowing. The soil textures and colors found in the embankment fill indicate that the soil used in the construction of the wall came from multiple sources. In comparison with the Randolph County soil survey (Neely 1987), these sources were locally available (see p. 7 this report). Darker grey colors and silty clay loams indicate sources of water saturated soils derived perhaps from near the White River and Sugar Creek or from wet prairies to the west of the enclosure. The silt loams and loams, both A and B-horizons, were likely derived from the Miami soils that formed from loess and glacial till that occur where the enclosure is located. Distinctive basket loading as one method of construction was indicated from the shape of some the distinctive soil pockets recorded in the unit profiles. The soil may have also been brushed or swept to help form the enclosure wall and not leave distinctive shapes.

The excavations were very limited and only occurred along the northern wall. Given the size and complexity of the Fudge enclosure, we would anticipate diverse but comparable results from other areas of the enclosure.

Radiocarbon Dating

Three AMS dates were derived from this project. These dates provided the first radiocarbon dates for the site and confirmed it's placement within the regional ceremonial landscape. The sample from Unit 2 was taken at the original ground surface and the resultant date was 1910 ± 40 BP, cal 2 sigma AD 20 to 220 (Beta-211085). A carbon sample from a secondary construction episode in Unit 6 resulted in a date of 2020 ± 40 BP or calibrated at 2-sigma to 110 BC to AD 70 (Beta-211086). The sample from Unit 9 was taken at the original ground surface and the resultant date was 1980 ± 40 BP or calibrated at 2-sigma to 50 BC to AD 100 (Beta-211086).

The three dates range between cal 110 BC and AD 220, representing over 300 radiocarbon years. Stratigraphically, it would appear the dates are out of order, since the date from Unit 6 was higher in the profile but provides the earliest date. However, the origin and context of the samples must be kept in mind. The samples from Units 2 and 9 collected at the original ground surface were in soil additions placed on the prepared B-horizon. All of the carbon samples collected were part of secondarily deposited soils that originated locally. How these soils were modified or the exact origin and primary context are unknown. Perhaps, using the overlap of these dates between cal 50 BC and AD 70 is a better reflection of the time frame that the northern embankment wall was constructed.

The three radiocarbon dates obtained during this project fit very well into the regional chronology of the other mound and enclosure sites in east central Indiana (Table 21) (Figure 57). The radiocarbon dates also compare with diagnostic artifacts recovered from Setzler's excavation of the mound. Discarding the dates that fall outside of the accepted range of Adena and Hopewell (ca. 500 BC to AD 400), a regional pattern emerges as the dates cluster between about cal 250 BC and AD 350. Actually, since most dates fall between 100 BC and AD 200, this may be the time of greatest fluorescence and expression of the Adena and Hopewell complexes in this region. The range of dates obtained from Fudge, cal 110 BC and AD 220, fit precisely in this active time.

The radiocarbon dates from east-central Indiana challenge the broader view of Adena being ancestral and chronologically separate from the Hopewell complex. Dates from this region show that the sites typically considered Hopewellian have the earliest dates in the region followed by the more typical Adena mounds. Utilizing radiocarbon data in conjunction with artifacts and landscape use, the Adena and Hopewell complexes are coeval in east-central Indiana (McCord and Cochran in press).

Table 21 Radiocarbon Dates from Eastern Indiana Earthworks					
Site	Sample Location	Conventional Age	Calibrated Age* (intercept date)	Sample No.	Reference
Fudge	Unit 2, deposit on original ground surface	1910 +/- 40 BP (AD 40)	AD 20 to 220 (AD90)	Beta-211085	
	Unit 6, building episode	2020 +/- 40 BP (70 BC)	110 BC to AD 70 (30 BC)	Beta-211086	
	Unit 9, deposit on original ground surface	1980 +/- 40 BP (30 BC)	50 BC to AD 100 (AD 30)	Beta-211087	
Anderson Complex	Great Mound post 3	2110 +/- 140 BP (60 BC)	365 to 265 BC 265 BC to AD 60 (114 BC)	M-2429	Vickery 1970
	Great Mound post 2	1720 +/- 130 BP (AD 230)	AD 146 to 446 (AD 341)	M-2428	Vickery 1970
	Great Mound post 2	2200 +/- 70 BP (250 BC)	373 to 164 BC (337, 324, 202 BC)	Beta-45955	McCord and Cochran 1996
	Great Mound log tomb	1910 +/- 80 BP (AD 40)	AD 19 to 223 (AD 88, 98, 115)	Beta-52612	McCord and Cochran 1996
	Great Mound embankment	2170 +/- 90 BP (160 BC)	369 to 58 BC (193 BC)	Beta-22129	Cochran 1988
	Fiddleback embankment	2090 +/- 90 BP (140 BC)	196 BC to AD 12 (90, 67 BC)	Beta-22130	Cochran 1988
	Fiddleback ditch	2070 +/- 150 BP (120 BC)	353 to 303 BC 208 BC to AD 84 (50 BC)	Beta-27169	Kolbe 1992
	Fiddleback mound - W	2070 +/- 70 BP (120 BC)	174 BC to AD 12 (50 BC)	Beta-27170	Kolbe 1992
	Fiddleback mound - E	2030 +/- 40 BP (80 BC)	155 BC to AD 60 (40 BC)	Beta-133452	Cochran and McCord 2001
	Circle Mound embankment	1955 +/- 75 BP (5 BC)	32 to 16 BC 9 BC to AD 130 (AD 69)	I-11, 848	Buehrig and Hicks 1982
	Circle Mound under s. mound	1880 +/- 60 BP (AD 70)	AD 75 to 231 (AD 130)	Beta-2416	Buehrig and Hicks 1982
	Circle Mound under s. mound	1870 +/- 60 BP (AD 80)	AD 134 to 261 (AD 235)	Beta-2417	Buehrig and Hicks 1982
	Circle Mound embankment	1560 +/- 80 BP (AD 390)	AD 419 to 606 (AD 538)	Beta-24115	Buehrig and Hicks 1982
New Castle	Mound 4 west side, bottom	1940 +/- 160 BP (AD 10)	102 BC to AD 249 (AD 76)	M-1852	Swartz 1976
	Mound 4 west side, top	1720 +/- 300 BP (AD 230)	2 BC to AD 647 (AD 341)	M-2045	Swartz 1976
	Mound 4 west side- burial area	1920 +/- 50 BP (AD 40)	5 BC to AD 230 (AD 85)	Beta-133449	Cochran and McCord 2001
	Mound 4 west side - charcoal lens	1760 +/-40 BP (AD 190)	AD 155 to 390 (AD 225)	Beta-133451	Cochran and McCord 2001
	Mound 4 east side -original ground surface	1980 +/- 50 BP (30 BC)	80 BC to AD 120 (AD 30)	Beta-133450	Cochran and McCord 2001

Table 21 (cont.) Radiocarbon Dates from Eastern Indiana Earthworks					
Site	Sample Location	Conventional Age	Calibrated Age* (intercept date)	Sample No.	Reference
	Mound 4 east side	1910 +/- 140 BP (AD 40)	41 BC to AD 253 (AD 88, 98, 115) AD 303 to 314	M-1851	Swartz 1976
	Earthwork 6 Unit 6-1	860 +/- 50 BP (AD 1090)	AD 1155 to 1235 (AD 1195)	Beta-127455	McCord 1999
	Earthwork 7 Unit 7-1	4070 +/- 60 BP (2120 BC)	2845 to 2820 BC 2670 to 2555 BC 2535 to 2490 BC (2585 BC)	Beta-127456	McCord 1999
Bertsch	posts in 180W20	1970 +/- 40 BP (20 BC)	50 BC to AD 115 (AD 45)	Beta-141813	McCord and Cochran 2000
White	fire area	1910 +/- 140 BP (AD 40)	41 BC to AD 253 (AD 88, 98, 115) AD 303 to 314	M-2017	Swartz 1973
	fire area	1920 +/- 140 BP (AD 30)	45 BC to AD 249 (AD 84)	M-2018	Swartz 1973
	primary mound 2	1860 +/- 200 BP (AD 90)	45 BC to AD 412 (AD 141)	M-2015	Swartz 1973
	primary mound 1	1740 +/- 140 BP (AD 210)	AD 129 to 439 (AD 264, 281, 329)	M-2016	Swartz 1973
	log tomb 1	1400 +/- 130 BP (AD 550)	AD 547 to 728 (AD 654) AD 732 to 772	M-2021	Swartz 1973
	timber	1490 +/- 130 BP (AD 460)	AD 427 to 665 (AD 600)	M-2019	Swartz 1973
	timber	1550 +/- 150 BP (AD 400)	AD 381 to 654 (AD 541)	M-2020	Swartz 1973
Windsor	near bottom	2020 +/- 70 BP (70 BC)	91 to 85 BC 68 BC to AD 72 (2 BC)	Beta-25224	Cochran 1992
	capping above rock	1960 +/- 40 BP (10 BC)	40 BC to AD 120 (AD 50)	Beta-211083	
	capping 1.5 m above rock	2090 +/- 40 BP (140 BC)	200 BC to 10 BC (100 BC)	Beta-211084	
Law Mound	1N1W - pottery	1990 +/- 40 BP (40 BC)	60 BC to AD 85 (AD 20)	Beta-140072	McCord and Cochran 2000
Hayes Arboretum	square 15W3	2050 +/- 40 BP (100 BC)	170 BC to AD 45 (50 BC)	Beta-141810	McCord and Cochran 2000
Waterworks	burial pit in 25W1	1820 +/- 60 BP (AD 130)	AD 65 to AD 365 (AD 225)	Beta-141811	McCord and Cochran 2000
Wolford	feature 5, 45W5	2010 +/- 50 BP (60 BC)	155 BC to AD 85 (5 BC)	Beta-141812	McCord and Cochran 2000
Chrysler Enclosure	bottom of ditch	1790 +/- 40 BP (AD 160)	AD 220 to 265 (AD 245) AD 290 to 320	Beta-110202	McCord 1998
* Calibrated by CALIB v. 3.0.3, Stuvier and Reimer 1993					

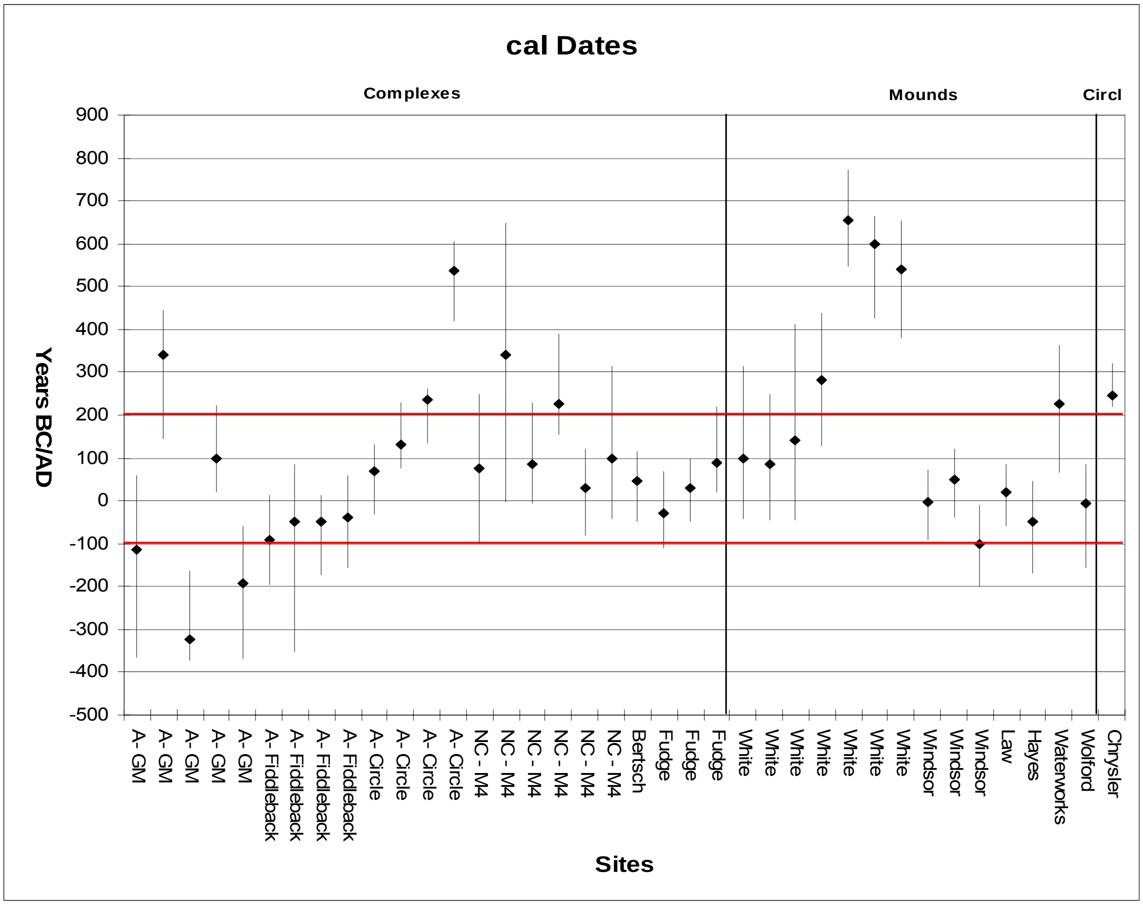


Figure 57. Radiocarbon dates from the region.

Summary

Information obtained during this project helped to define and clarify the nature of the Fudge site. Previous reviews of the Fudge site related that it had the potential to contain significant archaeological information concerning the regional Early/Middle Woodland ceremonial system (McCord and Cochran 1996, 2000). However, these claims were not fully tested until this project. A summary of the current investigations at the Fudge Site is presented in this section. Included is a review of the mapping, pedestrian survey, magnetometer survey and excavations.

Beginning with a review of the historic landuse, this project presented an overview of the alterations and transformations the site has undergone in the Historic period. By at least 1865, possibly earlier, historic land use began to change and degrade this ancient site. The site has been disturbed by agricultural uses, gravel and clay mining, fairground use, residential, communication and transportation activities. From the mapping activities, approximately 46% of the embankment walls were noted to be destroyed and the remaining walls have been reduced significantly in height. However, more of the site is preserved than is visible on the surface.

The magnetometer survey of the site defined the presence of subsurface anomalies relating to the excavated mound and the plowed-down western gateway extension. While these features are no longer visible they retain the potential to produce important information concerning the site construction and function.

The pedestrian survey of the Fudge enclosure and surrounding areas identified several new archaeological sites. The survey confirmed the absence of large amounts of habitation debris within the enclosure, supporting the notion of a Vacant Ceremonial Center. As a provision, we must consider the possibility of occupations within the enclosure for special events that may not leave material remains. The survey found only tentative examples of Middle Woodland occupation in the nearby area. Other potentially important resources were documented by the survey of site 12R328, a Late Archaic lithic scatter, northwest of the site. The old Randolph County Fairground (12R10 and 554) and a historic structure (12R578) have the potential to produce important information from the Historic era.

The excavations were limited to nine small test units placed along the northern embankment wall. The excavations recovered few artifacts but three radiocarbon dates were obtained from various locations in the embankment wall. The calibrated dates ranged between 110 BC and AD 220. The radiocarbon dates and the stratigraphy suggest multiple stages of construction. The original ground surface at the northern embankment wall was also prepared by removing the original ground surface. The embankment wall was most likely constructed from locally available soils that were deposited by baskets or sweeping.

In sum, the project confirmed that important archaeological information still exists within the Fudge site. While the site has been disturbed by various activities during the Historic era, a large portion of the site retains integrity. This project tested only a small portion of the site's potential. Future work could explore the western and southern embankment walls in terms of stratigraphy, construction and dating. The western gateway could also provide intriguing information on chronology and function of the site. The excavated mound also has the potential to provide information on subsurface features and construction of the mound.

DISCUSSION

The current project offered new insights concerning the region that were not conceived when the project was developed. This final section addresses the project research questions and offers further interpretations of the Fudge site and the regional earthworks. The information provided by this project and information collected from this region were used to redefine and propose the usage of the New Castle Phase for the east central Indiana earthworks.

Research Questions

1. What is the chronology of the Fudge site?
   a. When was the site constructed and how long was it used?
   b. Were the mound and embankment constructed at the same time?

Prior to this project, the Fudge site was assumed to be approximately 2000 years old based on the artifact styles Setzler (1931) recovered and from radiocarbon dates of other enclosures and mounds in the region (McCord and Cochran 1996, 2000). It was hoped that this project would provide samples appropriate for radiocarbon dating and the resultant dates would define the time of construction and perhaps the use of the site. The dates would then be compared to artifact styles recovered from the mound to determine the relationship between the two constructions.

The context of the samples obtained for radiocarbon dating determined how the research questions were answered. All of the samples recovered were from building episodes and should provide an estimate of the time the Fudge enclosure was used. It must be noted that the results actually date whatever activity produced the wood charcoal and these activities were not necessarily contemporary with the construction of the embankment wall. While the radiocarbon dates were obtained from secondary deposits, they fall within the expected time period of the enclosure construction and the context is felt to associate them with the enclosure wall construction.

The calibrated range of the dates obtained was between 110 BC and AD 220, spanning approximately 300 radiocarbon years. These dates fall in the same time range documented for other regional earthwork complexes and mounds (Figure 57). The overlap of the Fudge dates between 50 BC and AD 70 provides another way to examine the time period of enclosure use, spanning approximately 120 radiocarbon years. Either way these dates are examined, they can only be used to examine the time period the enclosure was constructed. Due to agricultural erosion, the upper portions of the embankment wall are missing. Use of the enclosure could have occurred several years beyond the time frame obtained by the three radiocarbon samples. In addition, we were unable to recover samples for radiocarbon dating on the original ground surface. Unfortunately, we still do not know when the construction of the embankment was initiated.

Previous interpretations of the site suggested the mound was an earlier Adena construction (Setzler 1931, Kellar and Swartz 1971), but the enclosure was a later Hopewell addition (Griffin 1971). No radiocarbon dates have been obtained from the mound, so an examination of whether the mound and enclosure were constructed during the same time frame had to rely on the artifacts recovered by Setzler (1931). The diagnostic point types include a Cresap and two Snyders points. Cresap points have been related to dates between 1000 and 500 BC (Justice 1987:187). This point style and other Late and Early Archaic styles appear to predate the mound construction. Snyders points are related to occur between 130 BC and AD 200 (Justice 1987:201-203). The sandstone tablet, biconcave gorget and expanded center bar gorget are related only to the Adena Complex and not to radiocarbon dates. The one ceramic sherd was identified as similar to regional styles dating between 150 BC and AD 100 (McCord and Cochran, in press). The dates associated with Snyders points and the ceramic sherd suggests the mound and enclosure were used during the same general period, 110 BC to AD 200. Unfortunately, the data do not provide a fine-grained chronology. It cannot be determined at this time if the mound was constructed first, or the enclosure, or if they were built at the same time. The overlap of time, though, suggests that they were in use at the same time.

2. What construction episodes can be defined?
   a. How was the embankment built?
   b. Are there undocumented features at the site?

Construction of the site was primarily derived from the excavation data. In addition, the magnetometer survey provided information that was not accessible through excavation.

The excavation of the units in the northern embankment wall helped to define different construction episodes and techniques used in embankment construction. The initial construction involved preparing the surface by removing the A-horizon. All of the units documented that soil was piled on an unmodified B-horizon. This preparation may have helped to create a "footprint" for the wall construction or helped in leveling a surface to begin the wall construction.

Several types of soil were utilized in the embankment wall construction. The contrast of soil zones recorded in some of the units suggested at least two phases of construction. The soil deposits were substantial in thickness and are, therefore, interpreted as separate episodes of construction rather than contemporary additions of contrasting soil. However, the interval between building episodes was not long, since A-horizon development was not documented.

The soils encountered during excavation and in the profiles of the unit walls indicate basket loading was one technique used in the wall construction. The inverted shape of baskets was noted during excavation, but not all soil deposits showed clear evidence of basket loading. The soil may have been loaded, but the individual baskets could not be distinguished due to homogenous soils or the soils could have been swept-up onto the wall.

The soil textures and colors found in the embankment fill indicate that the soil used in the construction of the wall came from multiple sources and that they were locally available. Darker grey colors and silty clay loams indicate sources of water saturated soils derived perhaps from near the White River and Sugar Creek or from the wet prairie Treaty soils to the west of the enclosure. The silt loams and loams, both A and B-horizons, were likely derived from the Miami soils that formed from loess and glacial till and that occur where the enclosure is located.

The magnetometer survey provided intriguing information concerning undocumented features at the site. The ditch and bank construction of the western gateway was reported to no longer be visible as early as 1882 (Phinney 1882). The magnetometer survey documented that the ditch structure does still exist below the plowzone. In addition, several discrete magnetic anomalies believed to be cultural in origin were revealed along the edge of the ditch. While the nature of these anomalies is unknown (ie. posts, pits, etc.), they do document the presence of previously unreported features at the site. They also suggest another undocumented component relating to the construction of the site.

During the course of this project, Setzler's (1931) information was again reexamined. A few new insights concerning the mound were inferred and relate to undocumented features.

The main impression concerns the post pattern Setzler (1931) documented on the original ground surface around the central burial pit. Setzler assumed the post pattern continued on the south-side of the tomb as the mirror reflection of the north side. If he was correct in this assumption, the post pattern suggests a structure 7.6 x 9.75 m (25' x 32') in size. Internal posts were not identified, so the structure may not have been roofed. Rectangular mortuary structures have been documented at sites in Ohio (eg. Greber 1983, 1997). No gap in the post pattern or entrance was noted in the northern part of the post structure, so if one did exist it was on the southern side.

In addition to the idea of a mortuary structure, another interesting revelation concerns the individuals in the central burial pit. Within the pit, an extended skeleton of an adult male was encountered accompanied by an isolated cranium placed over his abdomen (Setzler 1931:31). The extended skeleton in the burial pit was reportedly disarticulated due to disintegration of bark underlying the body. The cranium was "lying 6 inches higher than the rest of the body, on a solid pillar of earth" (Setzler 1931:31). All of the post cranial material was at the same lower level. The excavation photographs clearly show the isolated cranium placed over the abdomen of the extended individual was not in direct contact with the extended burial. A considerable amount of dirt separated the two. It appears that the isolated cranium was at approximately the same level as the cranium from the extended individual. There would appear to be more complexity to this burial than disarticulation caused by disintegration and an intentional placement of both crania at the same level.

The last insight concerns the organization of the mound. All of the caches and burials identified occurred within the confines of the rectangular structure. Because of this relationship, the posts may well define the first activity that occurred in the construction of the mound. It is unclear if the artifact caches and burial represented by Votive Offerings #1 and 2 or if the central burial occurred next. After the placement of the burials and artifacts most of the interior was then covered with a layer of bark and then ocher. Mounding of the soil then began. While not recognized as features, Setzler (1930:221) did indicate large areas of charcoal were found when the rest of the mound was excavated. Setzler (1931) reports only a few artifacts from the mound fill, so it is unclear how many soil cappings occurred over the post structure. An intensive review of the photographs from the excavation may help to reach an understanding of these discrepancies.

Each time the Fudge site is examined new information is revealed. Even though the Fudge site has been reanalyzed, the information has the potential to be recognized in new ways.

Construction Estimates

From the excavation data, a minimum of two construction phases were detected in the embankment wall. We were curious if the construction of the embankment wall was actually feasible in one episode. We then sought models to estimate the time it may have taken to build the Fudge enclosure. Using the same models applied to the Great Mound at the Anderson Complex (Cochran 1988), we calculated and evaluated an estimate of construction time.

This estimate was based on an embankment wall that is 6'tall, 25' wide at the base and has a perimeter of 4868' (1484 m). The embankment wall was reported up to 10' tall, but we were conservative in our estimate. Two methods were used to determine the amount of soil or cubic feet of dirt incorporated into the enclosure. The first method used a formula for ½ the volume of a cylinder ($V=\Pi \cdot r^2 \cdot h$). The second method used a calculus formula for determining slope:

> The equation used for determining the volume of the enclosure was created assuming a standard parabolic curve with the standard equation, $y = ax^2 + b$. The height of six feet was used as the y-intercept and therefore became "b" in the equation. Drawing a line down the middle of the mound would leave 12.5 feet on either side. The x-intercepts of 12.5 and -12.5 were used to determine "a", which was approximately 0.04. The standard parabolic curve opens upwards, so "a" had to become negative to create a curve that opens downwards, making "a" -0.04. The equation generated to determine the area of the enclosure was $y = -0.04x^2 + 6$. A derivative of the equation was taken to determine the area under the curve which, when multiplied by the perimeter, gives an approximation of the total volume of the embankment walls (Nicole Schneider, personal communication).

The estimates of cubic feet were then applied to two models used at the Great Mound (Cochran 1988). One was derived from information from the Norton Mound complex in Michigan (Griffin, Flanders and Titterington 1970:131-160). This model used a basket load that contain 0.5 ft^3 of soil and weighed 25 pounds as a standard measure. An estimate of 20 baskets per individual was the daily rate of work (Griffin, Flanders and Titterington 1970:131-160). Another model was derived from an experimental construction project of Overton Down (Ashbee and Cornwall 1961). This model used a rate of one person excavating 5 ft^3 of soil per hour using digging sticks and scapula shovels (Ashbee and Cornwall 1961). Table 22 provides the results of the models using the estimated size of the Fudge enclosure.

Table 22
Estimated Work Effort to Construct the Fudge Enclosure

	Ft3 per hour	Ft3 per day (8 hours)	Ft3 per day x 120 people	Ft3 of Fudge Enclosure	Person days
Norton Model	1.25	10	1200	237,704 (by slope)	198
				275,139 (by ½ volume)	229
Overton Model	5	40	4800	237, 704 (by slope)	50
				275,139 (by ½ volume)	57

Compared with the results of the two models applied to the Great Mound at Anderson, the information was not consistent. By the Norton model the Great Mound was estimated to have taken 367 days and 92 days by the Overton estimate (Cochran 1988:28). Since the Fudge enclosure is much larger than the Great Mound structure, we expected it to take much longer. We, therefore, rechecked data from both sites. It appears that the estimate of cubic feet of soil used in the construction of the Great Mound was inaccurate. The cubic footage was recalculated using a 6' tall embankment and 360' in diameter (1130' in perimeter). The estimates were calculated by the ½ volume and slope formulas used for the Fudge enclosure. Table 23 provides the results of the models using the estimated size of the Great Mound.

Table 23
Estimated Work Effort to Construct the Great Mound

	Ft3 per hour	Ft3 per day (8 hours)	Ft3 per day x 120 people	Ft3 of Great Mound	Person days
Norton Model	1.25	10	1200	55,178 (by slope)	45
				63867 (by ½ volume)	53
Overton Model	5	40	4800	55,178 (by slope)	11
				63867 (by ½ volume)	13

As Cochran (1988:28) pointed out, there is a considerable discrepancy between the two models. He considered the Norton estimate to be a maximum figure and the Overton estimate as too low since it involved the removal of chalk deposits not glacial clays, and considered the best figure to be somewhere between the two (Cochran 1988). As Cochran (1988) also pointed out, there is no data for predicting a reliable estimate for the population involved in the construction of either of the earthworks. However, drawing a population of 120 individuals from the east central Indiana region does not seem improbable.

The Norton model is the favored estimate for the Fudge enclosure. In light of the estimated work effort derived for the Fudge enclosure, the time involved suggests multiple build episodes. It seems unlikely that enclosure construction was sustained for 200 continuous days.

3. Is the enclosure a vacant or occupied center?
    a. Are there associated sites within or near the enclosure?

Very few artifacts were recovered from within the portions of the enclosure that were surveyed. The 16 prehistoric artifacts that were recovered were not diagnostic of the Middle Woodland period. The paucity of material suggests that the enclosure did not serve as a habitation area during the Middle Woodland period and supports the notion of a Vacant Ceremonial Center (Prufer 1964, Dancey and Pacheco 1997). Information in historical sources and from local collectors also documents little habitation debris within the enclosure. While habitation debris was not encountered in the enclosure we should not assume the enclosure was empty or devoid of activity. Rather, the activities conducted within the enclosure did not produce expected habitation debris, ie. residual material remains.

Most of the archaeological sites documented during the survey of nearby and adjacent areas were small in size and most were of unknown Prehistoric age. No definitive Middle Woodland artifacts were recovered from the surrounding areas surveyed. Sites 12R554 and 569 did have artifacts of Burlington chert suggesting a Middle Woodland occupation, but this evidence is somewhat tenuous. The gorget preform from site 12R576 may also relate to the Middle Woodland period.

A convincing Middle Woodland habitation within or near the Fudge enclosure remains elusive.

4. What activities occurred at the site?

It is believed that many kinds of activities occurred at the site. However, having empirical evidence to support these beliefs is at times lacking. Mortuary activities were clearly demonstrated at the site. The remains of 3 individual were recovered from Setzler's (1931) excavations of the mound (McCord and Cochran 2000). The observation of solar events has also been documented at the site (Cochran 1992). Remapping of the site did not change the orientation of the site enough to affect the interpretation of solar alignments. The sun rise and sun sets documented through the corners of the enclosure, the mound and gateways at the summer and winter solstices were confirmed (Figure 58). These observations may have been tied to a cyclical scheduling of ceremonies or events. The documentation of solar and lunar events in other Ohio Valley earthworks is increasing (e.g. Romain 2000). In a more general sense, the site had to have been a place of gathering. In simpliest terms, a labor force would have gathered to construct the embankment walls and the mound. Other activities could have included social gatherings, dances, singing, trade, celebrations, games, gambling and story telling. These activities could not be empirically documented, but are suggested by historic sources (Brown 1997, DeBoer 1997, Miller 2001). Of course, the category of "ceremonial activities" has long been associated with earthwork sites like Fudge (eg. Squier and Davis 1848, Webb and Snow 1945). The growth of cognitive archaeology has identified specific functions and roles of the "ceremonial activities". Ceremonies conducted for world renewal, creation, death and rebirth, rites of passage, reincorporation, production of ceremonial objects, feasting, renewing and creating kinship ties, and ancestor worship have been offered (Brown 1997, Carr 2005, DeBoer 1997, Hall 1979, Miller 2001, Romain 2000, Seeman 1979). The Fudge site has not been fully explored under these models, but one ritual use is explored below.

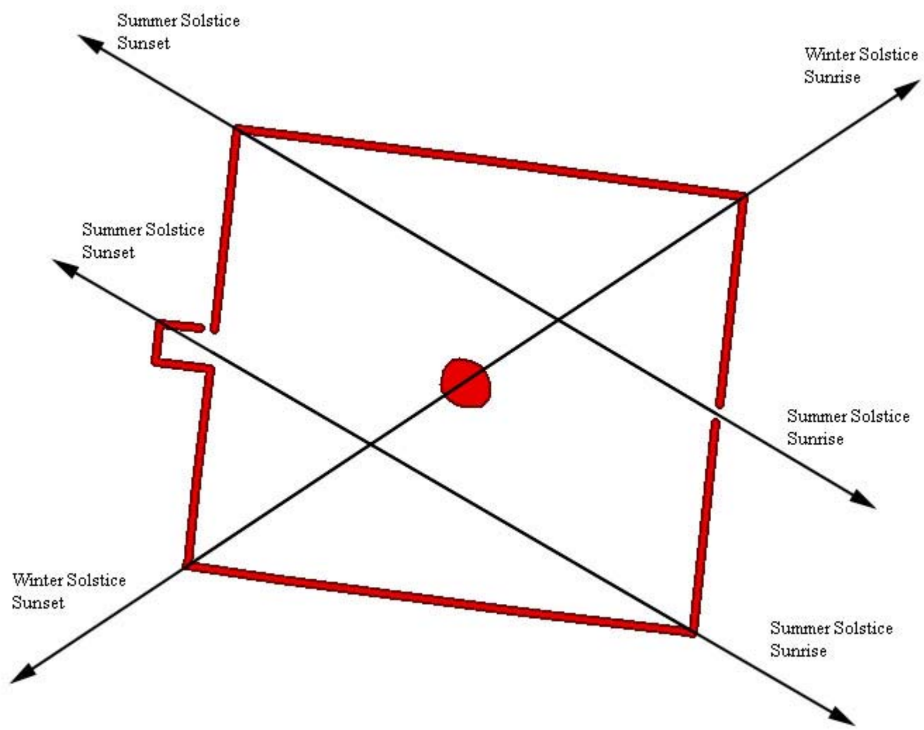


Figure 58. Solstice alignments.

Fudge Mound as a Ball Court – by Donald R. Cochran

While we recognize that enclosures were build to contain ritual activities and that mounds are the results of rituals, the nature of the rituals remain elusive except in the most obvious sense. Mortuary ritual was clearly represented by the interment of human remains and has clearly been the focus of archaeological interpretation (e.g. Brose & Greber 1979). Astronomical alignments certainly suggest cosmological associations and calendric scheduling of ritual (Byers 2004,Greber 1996, Romain 2000). However, activities that occurred within enclosures that either produced no material remains or, produced remains that were subsequently removed and deposited elsewhere, provide us with little evidence for identifying what occurred within enclosures. Reviewing the ethnographic literature can provide clues, possibilities and hypotheses for ritual uses of enclosures. While conducting background research into the function of rectangular enclosed spaces, a number of intriguing correlations between the attributes and use of ball courts and rectangular enclosures were noted.

For instance, in the southwestern United States and throughout Central America, enclosed rectangular space is associated with ball courts (Fox 1996, Whalen & Minnis 1996). Rectangular yards for chunkey were also used by Mississippian groups in the Southeastern US (Squire & Davis 120-122, Swanton 1979:682-684). In addition to the shape of the space, ball courts were ritually cleaned before each use with the sweepings deposited either outside the enclosure or onto the walls (Fox 1996: 489-491) (see also Miller 2001, Spector 1993). These discoveries led to an investigation of ball games in North America and the Eastern Woodlands in particular (Swanton 1979, Vennum 1994,). A number of interesting associations were discovered with at least some apparent relevance to Fudge Mound as outlined below.

- Ball games were universal throughout aboriginal North America which suggests its ancient roots (Swanton 1979, Vennum 1994).
- Ball games were ritually and ceremonially charged events (Radin 1923, Swanton 1979:675, Vennum 1994:28,)
- Ball games are associated with world renewal, healing, commemoration, first fruits and other ceremonies (Swanton 1979,Vennum 1994).
- Ball games are associated with particular events in the annual ceremonial round (Swanton 1979:681, Vennum 1994:27).
- Ball fields are placed adjacent to rivers, streams or lakes because of the ritual significance of water (Swanton 1979,Vennum 1994).
- Ball fields are aligned to the cardinal directions with two goals, one placed to the east and the other to the west (Swanton 1979:674-682,Vennum 1994).
- Ball fields are no less than ¼ mile long and most were from ¼ to ½ mile in length (Vennum 1994:238).
- In the Winnebago (Ho Chunk) game, play is initiated by elder men erecting a small mound in the center of the field where the ball is put into play (Radin 1923:72).

As Swanton (1979) and Vennum (1994) have noted, ball games (similar in most respects to La Crosse) are universal among historic Native American tribes. Regional differences in the numbers of goal posts and rackets occur, with southeastern people using two goal posts and two rackets while Great Lakes people tended to use one goal post and one racket. Otherwise, ball games were played everywhere across the Eastern US with surprising similarities between groups and regions.

The ceremonial significance of ball games in the Eastern Woodlands is clearly documented (Swanton 1979:674-682, Vennum 1994). Vennum (1994) notes the similarity between ball games and warfare ritual including purification, abstinence and invocation of spiritual assistance before, during and after a game. Feasting, dances, additional purification and a "cooling off" period followed a game. The outcome of a game is considered preordained by the spirits in accordance with the power of the religious leader who "controlled players and games at every turn" (Vennum 1994:28). "Games were organized as part of religious holidays and institutions or timed to coincide with particular changes of season or the position of heavenly bodies" (Vennum 1994:27). The origins of the ball game and many other sports are documented in mythologies. A widespread story concerns the first game that was played between the birds and the land animals, in which the birds won (Radin 1923:142, Swanton 1979, Vennum 1994). The thunder spirits or thunderbirds are commonly associated with ball games. The Eastern Cherokee identified the moon as the tutelary spirit of the game and anciently "played lacrosse only during a full moon" (Vennum 1994:31). Outside the Eastern Woodlands, the ritual and ceremonial significance of ball games is clearly documented in the construction of monumental architecture specifically for ball games, the correlation with world renewal ceremonies and the sacrificial nature associated with the outcome whereby players could be sacrificed to the appropriate gods (Fox 1996, Whalen & Minnis 1996).

In addition to the prevalence of world renewal ceremonies associated with ball games, the games also functioned in a variety of other ways. Ball games could be played to commemorate a well known ball player, or as a memorial for a death. Ball games were played as a healing ritual for a sick person, especially someone of note. Ball games also functioned to renew connections within a group and to serve as an outlet for tensions within a group. Games could also be played if someone dreamed of the game and was able to sponsor it (Vennum 1994:27-52).

Although ball games could be played throughout the year depending upon the reason for the game, as noted above they were scheduled into the annual ceremonial round in association with particular observances. Intertribal games were held in the spring (Kinietz 1940,Vennum 1994:227), and games were also held in association with the first fruits ceremonies of the late summer (Swanton 1979:681).

The locations for ball games were selected as large open areas adjacent to rivers, streams and lakes (Swanton 1979,Vennum 1994). Historically, ball fields were marked with two goals, one east and one west and the ceremonial nature of the game was demonstrated in the orientation of the fields to the cardinal directions. Ball fields were generally about ¼ mile in length although some fields were much larger. The center of the ball field is of considerable importance since play is started there. In addition, ball fields were laid out in relation to water because of the significance of water to ceremonial activities. Both players and equipment were taken to water before and after games for cleansing (Swanton 1979:675-682,Vennum 1994:238-239,.

Comparing the elements of the ball game to the Fudge site reveals some interesting correlations. First, the ceremonial nature of the Fudge enclosure is without question. The Fudge enclosure is situated so that the eastern wall was parallel to Sugar Creek and the north wall is parallel to the White River. The enclosure is aligned a few degrees east of north and the east-west gateways are aligned so that the sun would rise through the eastern gateway and set through the western gateway a few days before the spring and after the fall equinox. The orientation of the gateways closely parallels the recorded scheduling of ball games in the spring and at the first fruits ceremonies in late summer. The Fudge enclosure is very close to ¼ mile in length and the center is marked with an earth mound. Fudge has two gateways, one in the center of the east wall and one in the center of the west wall. In addition to the architectural similarities between the Fudge site and ball courts, the evidence for rebuilding stages in the embankment wall may relate to the kind of ritual cleaning documented for ball courts and dance grounds (Fox 1996, Miller 2001,Spector 1993). Our survey of the Fudge enclosure revealed that more artifacts were found on the embankment walls than in the center of the enclosure which suggests that the center was cleaned and the material deposited on the embankment walls.

While it is interesting to note the similarities between the ethnohistoric record of ball games and the Fudge site, there are of course problems in directly connecting historic Native American activities with sites of 2,000 years ago (Brown 1997:470). First, the ethnohistoric record documents the activities of societies with subsistence focused on cultivated crops. The people who constructed the Fudge enclosure were most likely engaged in some horticulture, but the focus of subsistence was still directed toward hunting and gathering. While earth renewal and first fruits ceremonies related to the spring and fall equinox are easily envisioned for the Fudge enclosure, we have no evidence for these activities at the site. In addition, although the antiquity of the ball game in the Eastern Woodlands is indicated by its universality, we are currently unable to directly link the Fudge site to ball games either through artifacts or feature contents or contexts.

We currently interpret the distribution and arrangement of enclosure complexes in east central Indiana to mean that each site represents the location of specific ceremonial activities that were carried out at a specific time in the regional ceremonial cycle. Clearly, the different configuration of earthworks within each site indicates that different activities were taking place. In addition, although our sample from each site is incomplete, it is also clear that each site contains evidence of unique activities. Although we actually know too little to even begin to propose what activities occurred at which sites, evidence linking the Fudge enclosure with the ball games prevalent throughout the Eastern Woodlands is a start toward more site specific interpretations.

5. How does the site relate to other earthworks in east central Indiana?

East-central Indiana contains a unique collection of earthworks. Three types of earthwork sites are recognized in the region: enclosure complexes, mounds and isolated enclosures (Cochran 1992). The Fudge site is identified as a complex due to the large size. Assuming that the arrangement of the various site types across the regional landscape is meaningful, plotting the distribution of the earthworks produces a map of the known ceremonial sites in the region (Figure 59). The clustering of enclosure complexes is not duplicated elsewhere in Indiana and a noticeable gap separates the east-central Indiana enclosures from those in Ohio (Figure 60). As previously recognized, the enclosure complex sites are relatively evenly spaced within the region and represent a landscape divided into five (Cochran 1992, 1996; Cochran and McCord 2001) or six parts (McCord and Cochran in press).

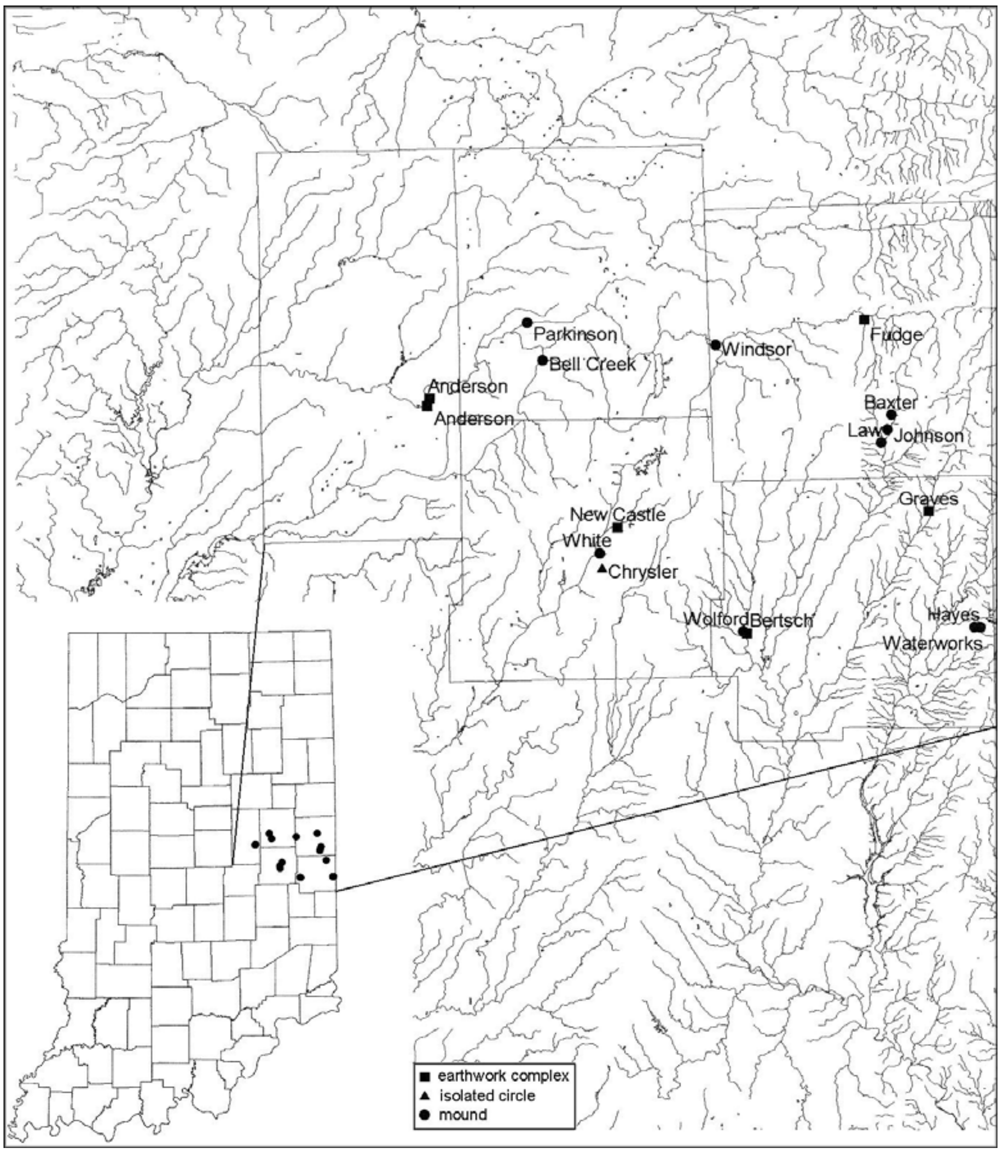


Figure 59. East central Indiana mounds and earthworks.

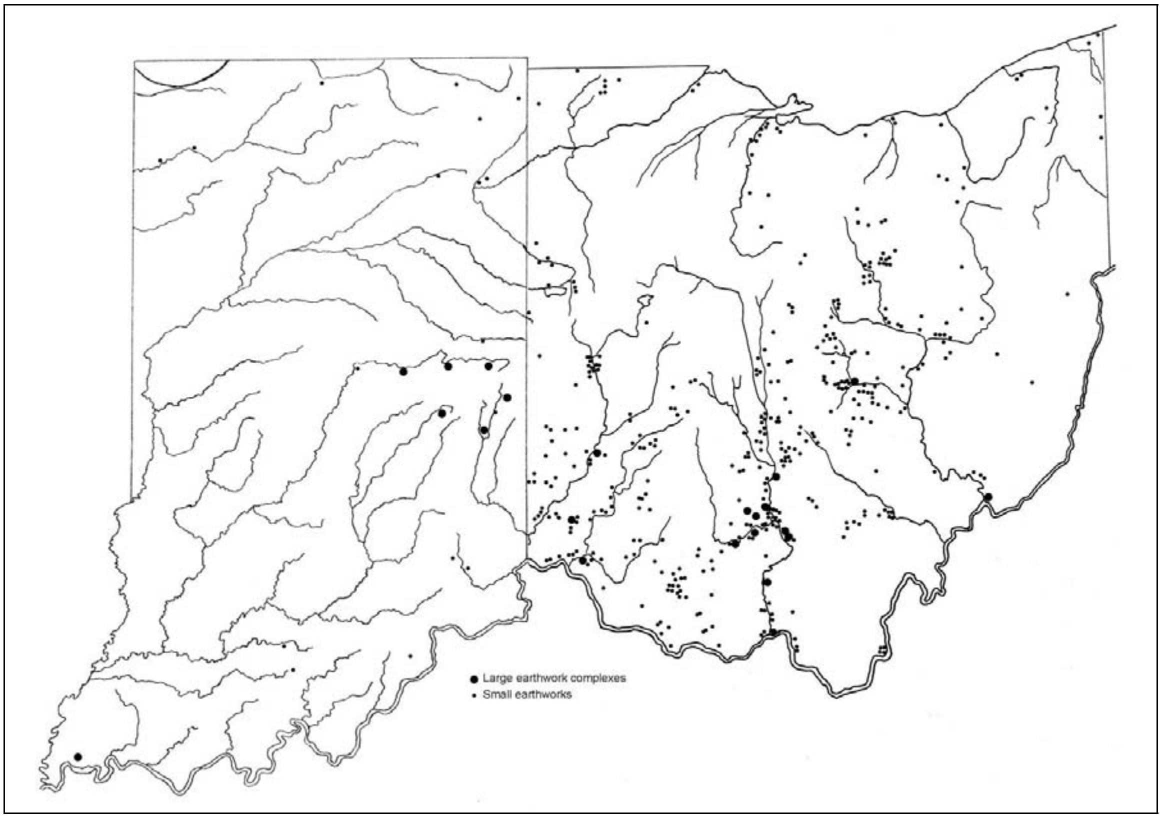


Figure 60. Distribution of earthworks in Indiana and Ohio.

Dividing the distribution map into hypothetical territories using thiessen polygons centered on the enclosure complexes reveals some interesting patterns in the arrangement of enclosure complexes and some mounds (Figure 61). First, there is an apparent northeast to southwest separation between rectangular and circular enclosure complex territories. Second, each enclosure complex territory includes a segment of a river valley while watershed divides appear to mark boundaries between territories. Isolated mounds occur on the boundaries between the rectangular complex territories but no mounds mark the boundaries between the circular enclosure complexes. Isolated enclosures and other mounds also occur within the territories although their placement is less obviously patterned (McCord and Cochran in press).

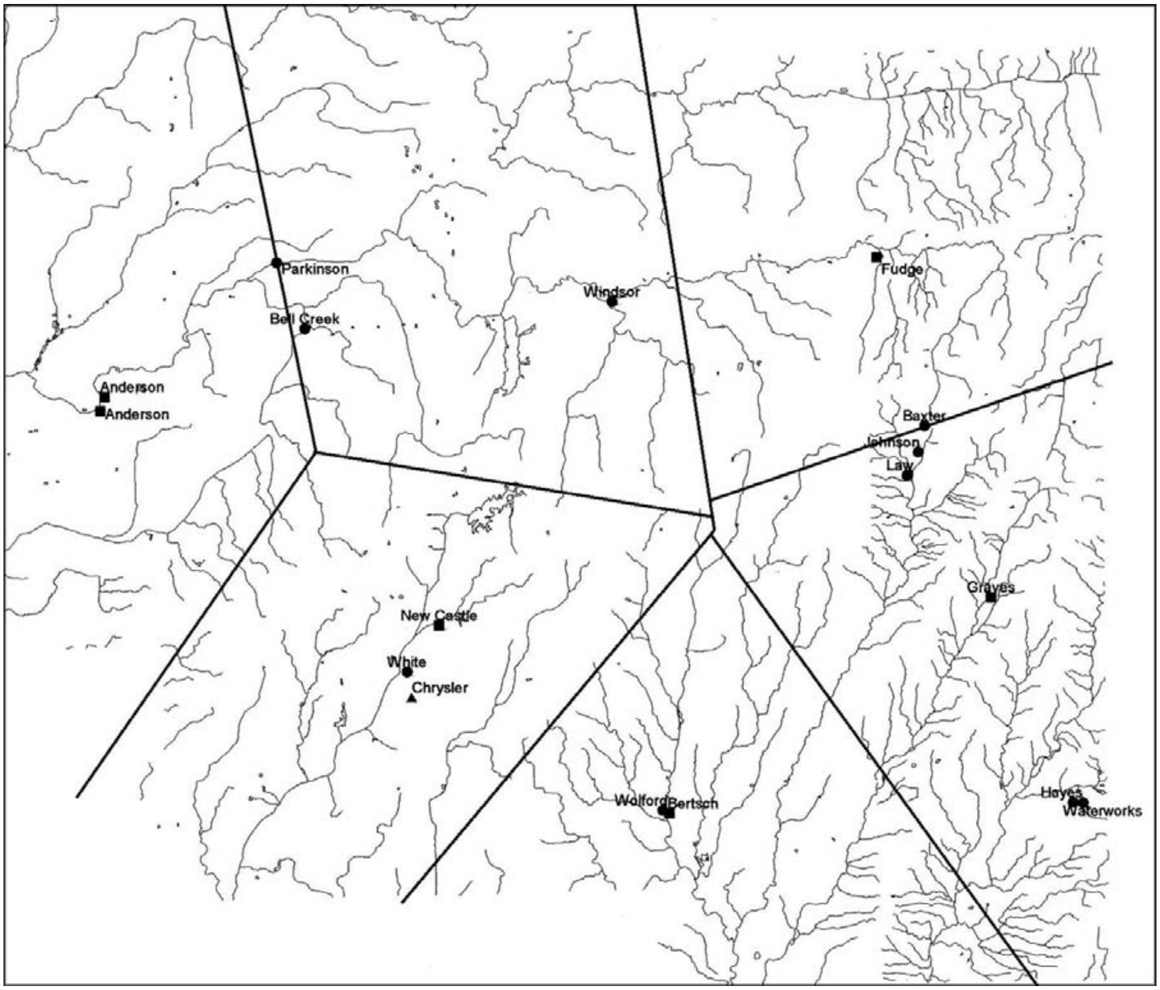


Figure 61. Thiessen polygon division of east central Indiana.

Given the homogeneous nature of the natural setting of east central Indiana, the earthwork locations do not appear to reflect environmental considerations. Most sites are situated adjacent to a river valley and all but one of the earthwork complexes are on the east edge of a river valley. Many of the earthworks are in prominent locations that offer a commanding view to the west across a river valley. No discernable associations between the placement of the enclosure complexes and such natural features as rock outcrops, springs, caves or other unique resources have been defined (Cochran 1999).

The regular placement of the earthworks shows that they represent elements in a constructed landscape (McCord and Cochran in press). The current radiocarbon chronology for the sites shows that the enclosure complexes have the earliest dates. While sampling error might be a problem, it appears that the constructed landscape began with the demarcation of the complexes. While the enclosure complex sites were in use, the isolated mounds representing other ritual activities were added to the constructed landscape. While the complexes were previously thought to represent a center to the territories demarcated by the theissen polygons (McCord and Cochran in press), this is not the current understanding.

The structure, size, and configuration of earthworks within the complexes and within the east central Indiana region are unique to each site. They share common ideas on shape and incorporate similar material remains that link them together. However, each site contains unique elements. For example, the New Castle site and the Anderson site have commonalities in containing small circular enclosures and one large circular enclosure with a central mound (Figure 62). However, the Anderson site contains rectangular forms as well. The panduriform or constricted waist forms of Mound 4 at New Castle and Fiddleback at Anderson contain different deposits on the central platform, but share New Castle Incised pottery. The Fudge site shares the rectangular shape with earthwork forms at Anderson, but the rectangular shapes at Anderson are of bank and ditch construction while Fudge was primarily built as a bank construction. At Fudge the western gateway enclosure is a bank and ditch construction. The sizes of the Anderson rectangular enclosures and Fudge are dramatically different as well. Other similarities and differences occur, but enough have been provided to demonstrate the ideas of congruency in shape or style but divergence in structure and form.

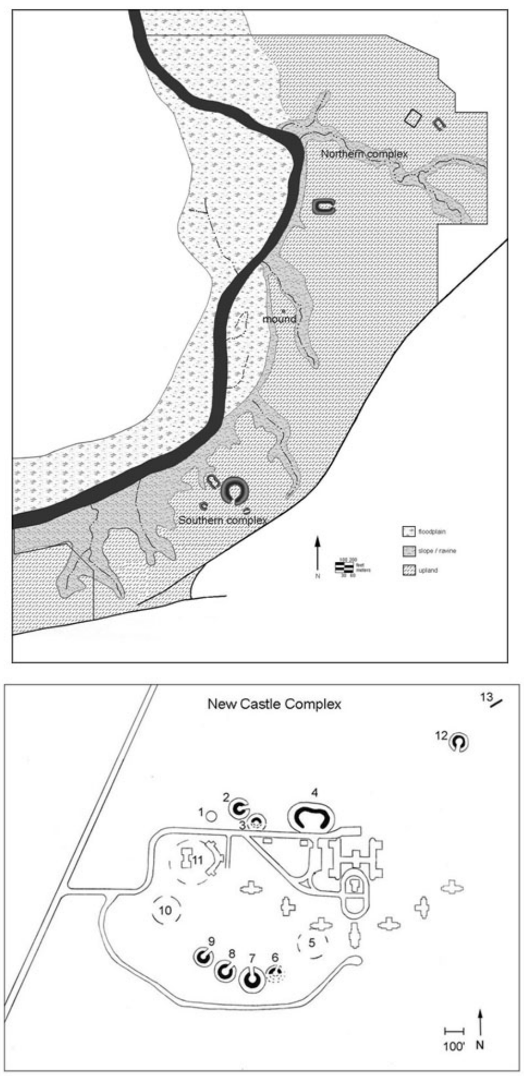


Figure 62. Layout of the Anderson site and New Castle site.

In recognizing the concept that each earthwork site in the region is unique, we came to the realize that each site represents a different component of the regional system. The earthwork complexes were not central locations for a specific territory. They were gathering areas for the region and each likely had a unique function within the regional system. A similar concept has been expressed by Carr's (2005:73-118) review of normative and partitive views of Hopewellian society. Normative views would suggest that single or multiple Hopewell ceremonial centers share a similar function, where a partitive perspective allows a society to construct "many and diverse kinds of ritual sites that vary in their function, in the segments of society that use them, in the roles played out at them, and thus in their size, form, content and structure" (Carr 2005:77).

The exact nature of the role the Fudge site played in the region requires further exploration. At a minimum the Fudge site was a major component in the east central Indiana landscape. The radiocarbon dates suggest a long term investment in the site. It was contemporary in construction with several other earthworks in the region. In a comparison of similar forms, Fudge may predate the construction of the Circle Mound (rectangular form) at the Anderson complex and represent the earliest rectangular form in the region. The results challenge the long held belief that circular earthwork forms predate rectangular forms and that similarity of construction equates to contemporaneity (Byers 2004, DeBoer 1997).

Revision of the New Castle Phase

In the broader archaeological literature, Hopewell has evolved and been studied under varying theoretical perspectives (Brose and Greber 1979, Carr and Case 2005, Pacheco 1996). At a local level the views of the regional mounds and earthworks in east central Indiana has also changed over time. Vickery (1970) was the first to propose a New Castle Phase for the area. He grouped the Anderson, New Castle, Spruce Run and tenatively Mound Camp sites in a single phase based on: "1) resemblances in ceramic attributes; 2) occurrence with a complex of geometric earthworks; and 3) geographical proximity" (Vickery 1970:147). In essence, Vickery (1970) believed the sites included in this phase represented a mixing of Adena and Hopewell complexes. Swartz (1976:59-61) did not elucidate the New Castle Phase, but did suggest the regional phase was coeval with a Middle Scioto Tradition. Given the vagueness of the phase definition, it has not been recently used.

Instead of adopting a Phase for the region, we have always struggled with the constructs of Adena and Hopewell and their relationship (Cochran 1992, Cochran 1996, Cochran and McCord 2001, McCord and Cochran 1996, McCord and Cochran 2000). There is nothing new in discussing the problems with this nomenclature. Numerous authors have exposed and disputed the many problems in using the labels Adena and Hopewell (Clay 2002, Greber 1991, Swartz 1971). In our work with the regional earthworks, our views on the region have evolved from seeing a continuity of Adena and Hopewell, not a mixing (Cochran 1992), to believing Adena and Hopewell were two different components of the same contemporaneous ceremonial system (Cochran 1996), and defining the relationship of Adena sites as representing smaller groups and Hopewell as the corporate group within the same system (McCord and Cochran 1996).

From all the information we have collected from the east central Indiana earthworks (Cochran 1988, Cochran 1992, Cochran 1996, Cochran and McCord 2001, Kolbe 1992, McCord and Cochran 1996, McCord and Cochran 2000), it is apparent that they are part of a regional network. The radiocarbon dating shows that the sites were in use between cal 250 BC and AD 350. The sites contained similar types of artifacts including ceramics and chipped stone tools as well as artifacts of exotic materials such as copper and mica. Given the similarities and geographic relationship between the sites, we can view them as representing a local population of related people. The different site types suggest that they served different purposes. Overall, the placement of earthworks in east central Indiana shows that the sites were organized in relation to other earthwork sites in the region. We can view the distribution of earthworks in east central Indiana as a map of a sacred landscape as defined by the people living in the area. The spacing of the sites across the landscape and the arrangement of earthworks in relation to astronomical alignments suggests some of the ideas held by the people, ideas about connections with the rest of the universe as well as life, death and rebirth (Cochran and McCord 2001:47-48).

Every time we try to discuss this region, we are hindered by the historical terminology of Adena and Hopewell and all the archaeological baggage they entail. Similarly utilizing the terms Early and Middle Woodland fails to truly characterize this region. In an attempt to clarify, not confuse the issue, we are reviving the New Castle Phase to define the east central Indiana earthwork phenomena. Cochran (1996:347) first suggested the New Castle Phase could be utilized if it were redefined and became more inclusive.

We have the opportunity and luxury of drawing on years of research in this region that Vickery (1970) did not. Our current view allows us to incorporate radiocarbon dates, artifacts, sites and ceremonialism to redefine the New Castle Phase. Currently, we do not have habitation data to incorporate into the phase other than a notion of a dispersed settlement pattern. Information from a New Castle Phase habitation site is deficient within the region.

The New Castle Phase Definition

Geographic Boundary

The New Castle Phase is defined as occurring within the upper reaches of the Upper White River Drainage in both the East and West forks and the upper reaches of the Whitewater Drainage (Figure 59). This area encompasses portions of Madison, Delaware, Randolph, Henry and Wayne counties and is based on the presence of similar sites. Neither the Spruce Run site in Delaware County, Ohio nor the Mound Camp site in Franklin County, Indiana are included as these sites are too geographically distance.

Also, the ceramics from these sites are similar to those from the New Castle Phase sites only in having incised line decoration.

Sites

The sites included in the New Castle Phase occur as enclosure complexes, mounds and isolated enclosures. The specific sites currently defined as belonging to the New Castle Phase include: the Anderson complex, the New Castle complex, the Bertsch complex, the Fudge site, the Graves site, Wolford Mound, Windsor Mound, Law Mound, the White site, Waterworks Mound, Hayes Arboretum Mound and the Chysler enclosure (Cochran 1988, Cochran 1992, Cochran 1996, Cochran and McCord 2001, Kolbe 1992, McCord and Cochran 1996, McCord and Cochran 2000). Other sites that likely belong to the phase include Johnson Mound, Baxter Mound, Bell Creek Mound and Parkinson Mound.

Chronology

The time span of the New Castle Phase is defined between cal 250 BC and AD 350 based on radiocarbon evidence (Figure 57). There are a few outlying dates beyond this range, but the majority of dates fall within this time frame. A more intense concentration of radiocarbon dates occurs between 100 BC and AD 200.

Artifacts

The artifacts recovered from the region vary by site but artifacts common to many sites include Adena, Robbins and Snyders points; lamellar bladelets; sandstone tablets; expanded center bar gorgets; biconcave gorgets; platform pipes; different forms of imitation bear canines; various copper artifacts including beads, awls, a panpipe, a breastplate, and strips; various shell forms including disk and barrel-shaped beads, freshwater pearls and conch shell dippers; and mica in forms of crescents or trimmed sheets. Unique artifacts sometimes occur within the sites as well, such as the limestone object recovered from Windsor Mound. The ceramics recovered from these sites appear to represent a regionally distinct group. The definition of a regional ceramic type (group) has been previously suggested (McCord and Cochran 2000:189). The ceramics have slightly sandy pastes that are variably mixed and tempered with crushed granitic rock. The rim form is straight to slightly everted. The rim is typically thickened at the top and has either a rounded or beveled lip. The ceramics do display some intra-site variability in terms of surface treatment and decoration. The New Castle Incised type (Swartz 1976) has been recognized at the Anderson and New Castle sites (Swartz 1976). Some of the rims recovered from Windsor Mound have small notches incised across the lip (McCord 1994). One vessel from the Law Mound had a brushed surface treatment. Ceramic types that are proposed are based on decoration. The New Castle Incised type has already been proposed for incised ceramics that have various patterns of incised lines including nested diamonds and line-filled rectangles (Swartz 1976). New Castle Plain would seem to be a logical type name for the plain sherds. New Castle Brushed could be utilized to describe the variation seen at the Law Mound.

Mortuary Practices

The phase definition relies heavily on ceremonialism and mortuary practices. Mortuary activities at these sites include individuals as primary and secondary interments. Extended inhumations, bundle burials and cremations have all been documented at the region and multiple burial forms often occur within the same site. Burials may occur in prepared tombs, submound structures or simply placed on the ground. Burials are only known from mound structures in the New Castle Phase. The burial reported from the outwash terrace near Strawtown (see p. 15, this report) is outside the geographic boundary of the New Castle Phase.

Ceremonial Landscape – by Donald R. Cochran

We have documented several features associated with the east central Indiana earthworks, and the investigations of the Fudge site have reinforced our interpretations of the chronological relationships, episodic construction and organization of earthworks within the regional landscape (Cochran and McCord 2001, McCord and Cochran in press). It is our view that the contents and distribution of the east central Indiana earthworks represent a cognitive map of the ceremonial system that produced them. The important elements of the ceremonial landscape of east central Indiana are summarized below.

- Mounds and enclosures were built and in use at the same time.
- Earthworks are intentionally spaced across the landscape.
- Enclosure complexes divide the region into 5 or 6 parts.
- The distribution of circular complexes and rectangular complexes divide the region into two parts.
- Earthwork complexes represent locations where unique events occurred within the regional ceremonial round.
- Mounds are primarily located midway between the rectangular complex sites.
- “Adena” and “Hopewell” artifacts represent parts of the same ceremonial system.
- Earthworks are organized in relation to astronomical events.

While we have previously documented these aspects of the regional ceremonial system and landscape, we have not previously discussed the relationship and symbolism of the circular and rectangular complexes. Exploring the relationships and meanings of these two aspects of the regional landscape have important implications for expanding our interpretations.

Recognition of the potential symbolic value of earthworks has a long history in the Ohio Valley (Romain 2000:168-169,Squire and Davis 1848:304). For the most part, earlier associations were related to widely held ideas of Native American religious symbolism related to the four directions or representations of the sun and moon (e.g.

Romain 2000: 169). Recently, competing interpretations of the symbolism associated with circular and rectangular enclosures have been presented (e.g. Byers 2004, DeBoer 1997,Romain 2000:163-200). For example, Romain (2000:167) uses ethnographic analogies and archaeoastronomy to hypothesized that large circular enclosures represent the earth while large rectangular enclosures represent the sky or heavens. Byers (2004), on the other hand, used the same sources of information to arrive at the opposite interpretation: rectangles represent the earth and circles represent the sun or heavens. A different approach is taken by DeBoer (1997). Following Faulkner's recognition that southeastern Native American houses alternated between circular winter houses and rectangular summer houses, DeBoer (1997:230) posits that "winter is to summer as circle is to rectangle". This analogy is related to a duality theme recognized in Hopewell materials by several investigators (Byers 1987, DeBoer 1997,Greber 1996).

In working with the east central Indiana earthworks, we independently arrived at a similar hypothesis that rectangles equal summer and circles equate to winter based on two lines of evidence. First, in attempting to determine a reason(s) for the regional organization of circular and rectangular enclosures, we noted the same pattern of shifting house types between rectangular summer houses and circular winter houses (DeBoer 1997) in the Great Lakes area (e.g. Ritzenthaler and Ritzenthaler 1983:57-60, Trigger1978). In addition, based on the astronomical alignments for the winter and summer solstices at Anderson Mounds (Cochran and McCord 2000), we noted that the sun sets in the south at the winter solstice and in the north at the summer solstice. In the region, circular enclosure complexes are organized south and west of the rectangular enclosures (see Figure 59). Thus, we reasoned, an association between sunset in the south at the winter solstice and the distribution of circular enclosures relates to sunset in the north at the summer solstice and the distribution of rectangular enclosures in the region. In addition to these two lines of evidence, the gateways of the Fudge enclosure were aligned to sunrise and sunset a few days before the spring equinox and a few days after the autumn equinox. In essence, the gateway alignments at Fudge bracket the summer season between the equinoxes. Why the gateway alignment is just slightly off of the equinox is not understood, but it conveyed some meaning to the builders and users of the enclosure.

Extending this line of reasoning, we can envision a regional ceremonial landscape divided between enclosure complexes representing summer and winter. We can hypothesize that ceremonies related to the summer season were held at the rectangular enclosures on the north end of Anderson, at Fudge and at Graves while winter ceremonies were conducted at Bertsch, New Castle and the circular complex at Anderson (e.g. DeBoer 1997). The two part division of the ceremonial landscape also suggests a dual division, such as a moiety, within the society that built and used the sites. Swanton (1979:663-665) presents intriguing information on moieties in the Southeastern US with apparent relevance to the New Castle Phase. For example, moieties "determined marriage relationships and usually added certain other functions, such as partnership in ball games, the ordering of mortuary ceremonies, and so on" (Swanton 1979:663). Although an extended investigation of the relevance of this idea to the New Castle Phase sites is beyond the scope of the present project, additional research is clearly warranted.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The Archaeological Resources Management Service (ARMS) at Ball State University conducted a FY2005 Historic Preservation Fund Grant to investigate the Fudge site. The project was inspired by a reanalysis and evaluation of Fudge site material undertaken in 1999 (McCord and Cochran 2000). This evaluation recognized that the site still contained tremendous potential for understanding the regional Early/Middle Woodland ceremonial/mortuary system and several recommendations for further work were made (McCord and Cochran 2000:76-77). The research questions and goals of this project were derived from those recommendations. This project involved a review of the archaeological setting and changes in landuse. The project incorporated pedestrian surveys of the enclosure and surrounding area, an instrument survey of portions of the site, limited test excavations along the northern embankment wall, completion of a National Register nomination, and public outreach. The main objective of the project was to further our understanding of Early/Middle Woodland ceremonial and settlement systems in eastern Indiana and the Ohio River valley through investigations of the Fudge site chronology, construction and function.

Previous reviews of environmental and archaeological data suggested, that the generally homogenous environment of till plain regions in Indiana, including Randolph County, would shape a dispersed prehistoric settlement pattern (Wepler and Cochran 1983:90, Cochran 1994:6) and the construction of the layout and placement of earthworks in the Middle Woodland ceremonial landscape of east central Indiana was not reliant on any observable, recurring pattern of natural features (Cochran 1999). A specific review Early and Middle Woodland information found the earthwork locations appeared to follow a congruent trend with habitation data focusing primarily on valley settings, specifically the valley/till plain edge, but also utilizing the till plain region. The ceremonial landscape was apparently conceived as a cognitive map of interconnected and interrelated places of unique importance to the people living in east central Indiana at the time the landscape was constructed.

A review of the historic landuse presented an overview of the alterations and transformations the Fudge site has undergone in the Historic period. The site has been disturbed by agricultural uses, gravel and clay mining, fairground use, residential, communication and transportation activities, but over half of the embankment walls were visible though they were reduced significantly in height.

The magnetometer survey of the site documented more the site is preserved than is visible on the surface. Subsurface anomalies relating to the excavated mound and the plowed-down western gateway extension were noted to have the potential to produce important information concerning the site construction and function.

The pedestrian surveys survey confirmed the absence large amounts of habitation debris within the enclosure and found only tentative examples of Middle Woodland occupation in the nearby area. Other potentially important resources documented by the survey included a Late Archaic lithic scatter (12R328), the old Randolph County Fairground (12R10 and 554) and a historic structure (12R578).

The excavations along the northern embankment wall recovered few artifacts but three radiocarbon dates were obtained from various locations in the embankment wall. The calibrated dates ranged between 110 BC to AD 220. The radiocarbon dates and the stratigraphy recorded suggest multiple stages of construction involving preparation of the original ground surface and construction of the northern embankment wall from locally available soils.

Further understanding of Early/Middle Woodland ceremonial and settlement systems were obtained through investigations of the Fudge site chronology, construction and function. From all the information we have collected from the east central Indiana earthworks (Cochran 1988, Cochran 1992, Cochran 1996, Cochran and McCord 2001, Kolbe 1992, McCord and Cochran 1996, McCord and Cochran 2000), it is apparent that they are part of a regional network. The radiocarbon dating shows that the sites were in use between cal 250 BC and AD 350. The sites contained similar types of artifacts including ceramics and chipped stone tools as well as artifacts of exotic materials such as copper and mica. The structure, size, and configuration of earthworks within the complexes and within the east central Indiana region are unique to each site. The different site types suggest that they served different purposes. They share common ideas on shape and incorporate similar material remains that link them together. The placement of earthworks in east central Indiana shows that the sites were organized in relation to other earthwork sites in the region and they represent elements in a constructed landscape. Overall, we can view the distribution of earthworks in east central Indiana as a map of a sacred landscape as defined by the people living in the area. It is believed that many kinds of activities occurred at the sites. Mortuary activities and the observation of solar events has been documented at numerous sites in the region. Other potential functions served by the mounds and earthworks may have include social gatherings, dances, singing, trade, celebrations, games, gambling and story telling. Ceremonies conducted for world renewal, creation, death and rebirth, rites of passage, reincorporation, production of ceremonial objects, feasting, renewing and creating kinship ties, and ancestor worship have been offered as some of the potential rituals conducted at the regional earthworks. The clear regional pattern in chronology, sites, artifacts, mortuary practices and ceremonialism has led to the redefinition of the New Castle Phase. Application of a phase definition for the region not only seems appropriate, but should help eliminate the cumbersome and misrepresentative usage of the Adena and Hopewell terms.

Recommendations

In sum, the project did confirm important archaeological information still exists within the Fudge site. While the site has been disturbed by various activities during the Historic era, a large portion of the site retains integrity. This project tested only a small portion of the site's potential. Future work could explore the western and southern embankment walls in terms of stratigraphy, construction and dating. The western gateway could also provide intriguing information on chronology and function of the site. The excavated mound also has the potential to provide information on subsurface features and construction of the mound.

The Fudge site is eligible for listing on the State and National Registers of Historic Places. The site has already yielded important information in Early and Middle Woodland prehistory. The Fudge site is one of only three sites in the New Castle Phase with a rectangular shape. It is unprecedented in size in the region and the State and the only site from the area to be depicted in Squier and Davis's (1848) *Ancient Monuments of the Mississippi Valley*. The rectangular structure without an associated circle and the placement of gateways along the middle of the wall also appears to be an unusual form of earthwork construction. The site has the potential to contain further information on the ceremonial landscape of east central Indiana. Fudge is crucial to understanding how the landscape was constructed and used. The sites within the New Castle Phase are believed to have different functions, but the mechanics of these different roles within the system are not fully understood at this time. The Fudge site contains intact, unexplored deposits that my further our understanding of the site, the New Castle Phase and Adena and Hopewell complexes in the Ohio River valley.

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Appendix A

Woodland Settlement in the Upper White River Drainage

Site Locations Confidential

Not for Public Disclosure

Appendix B

Artifact Definitions

Appendix B
Chipped Stone Artifact Classification

Core. A core is a nucleus of stone exhibiting one or more negative flake scars (Crabtree 1972:54). Objects categorized as cores may range from a simple nucleus with only one negative flake scar to specialized forms with multiple flake removals. Striking platforms may be prepared or unprepared. Cores can be subdivided into more specific types (cf. Monet-White 1963:6-7; Callahan 1979:41; Wepler and Cochran 1983:38-40).

Biface. An artifact with negative flake scars covering both surfaces either partially or wholly is herein termed a biface (Crabtree 1972:38; Tixier 1974:4). As used here, a biface has no modification for hafting and bifaces are viewed as stages in the manufacture of points. In order to avoid confusion, the terms "blank", "blade", and "preform" are not normally applied to bifaces. Blank and preform are general terms that can be applied to a number of manufacturing sequences (e.g., gorget blank or preform, celt blank or preform, etc.). Use of the term blade is restricted to a specific of type flake with parallel sides and a length that is two times greater than width, or a particular portion of a point: the blade element. In the latter case, the term is only used when discussing points. Callahan (1979) separates bifaces into stages or levels of reduction beginning with the selection of the raw material (Stage 1) and continuing through successive levels of refinement (Stages 2, 3, 4, etc.).

Stage 2 Bifaces. A stage 2 biface is defined as "that stage during which the core blank or spall is given an edge . . . or, where the edge is too sharp and low-angled,. . it is thickened so that roughly centered, circumferential edge-angles of between 55 degrees to 75 degrees result. Flake scars may cover less than half of the width of the biface, producing a hexagonal, irregular to thick lenticular cross-section" (Callahan 1979:36).

Stage 3 Bifaces. Stage 3 bifaces represent "that stage (primary thinning) during which a lenticular cross-section is obtained by means of striking so as to drive flakes from the edge to or slightly beyond the center of the biface, contacting or slightly undercutting similar flake scars taken from the opposite margin. . . . Aligned, centered edge-angles of between 40 and 60 degrees should result so that secondary thinning may be effected subsequently" (Callahan 1979:37).

Stage 4 Bifaces. Stage 4 bifaces represent "that stage (secondary thinning) in which a flattened cross-section is obtained by means of striking flakes so that they considerably undercut prior flake scars from the opposite margin and so that the width/thickness ratio is made to fall between roughly 4.00 and 5.00 or more. Aligned, centered edge-angles of between 25 and 45 degrees and surfaces without significant humps, hinges, step-fractures, or median convexity. . ." (Callahan 1979:37).

Biface Fragment. Biface fragments consist of various portions of bifaces broken either during manufacture or through use.

Flake. A flake is "any piece of stone removed from a larger mass by the application of force - either intentional, accidentally, or by nature" (Crabtree 1972:64).

Unmodified Flakes. Artifacts in this class have one or more positive or negative flake attributes (Watson 1956:17; Oakley 1957:16). Flake margins show no evidence of use or retouch.

Notch Flakes. A notch flake is "the result of pressure flaking to remove notches along the basal and/or lateral margins of a biface in order to create a hafting element" (Austin 1986:96). They are defined as having "a peculiar half-cone shape" (Waldorf 1984:35) that makes them distinctive. "The most recognizable and distinctive characteristic of the flake is the presence of a recessed, U-shaped platform. While most flakes exhibit a relatively straight, continuous margin at the juncture of the striking platform and dorsal flake surface, the notching flake is typified by a deep, semi-circular scallop which is the result of prior notching" (Austin 1986:96).

Block Flakes. Block flakes are sharp-edged, irregularly shaped pieces of isotropic stone that lack a striking platform, a positive or negative bulb of percussion, compression rings, or any other attribute associated with conchoidal fracture. Block flakes may occur naturally through frost cracking or uncontrolled heating (Watson 1956:19-21: Oakley 1956:9-11). They can also be produced during chipped stone reduction where the raw material has been exposed to either of the above processes or when the material breaks along internal planes of weakness. In an archaeological assemblage, block flakes would occur in greater percentages where early stages of reduction occurred.

Edge Modified Flakes. Edge modified flakes are unspecialized flake tools distinguished by regular edge wear or retouch. The former is most often recognized as a continuous row of small flakes removed along one flake edge. Flake margins can be modified during cultivation of a site, by lake shore erosion, spontaneous retouch during lithic reduction, and a variety of other natural and mechanical processes. Retouched flakes can represent one resharpening of a dulled flake margin to conservation of a flake through extensive resharpening. objects in this class are usually not morphologically distinct, and the class encompasses a wide range of diversity in size, shape, and construction of the retouched edge or edges. It is not normally possible to distinguish between prehistoric utilization and edge damage resulting from other causes without microscopic examination of all flake margins. For this classification, all flakes with regular edge modification were sorted into this class.

Blades. A blade is a specialized flake that has more-or-less parallel sides and is at least twice as long as it is wide. Thickness varies little along the length of the blade. Blades also have straight, parallel, or converging ridges on the dorsal surface (Movius et al. 1968:4; Crabtree 1972:42)

Gravers. A flake, blade or other artifact that exhibits one or more small sharp points (graver spurs) intentionally retouched from one or more margins of the artifact is classified as a graver

(Crabtree 1972:68: Nero 1957:300). The retouching that isolates the graver spur may be unifacial or bifacial.

Denticulate. Artifacts in this class are distinguished by a toothed or serrated edge created by the alternating removal of a series of flakes from the margin of a flake, biface or core (Crabtree 1972:58). Cores with unprepared platform edges and nonmarginal areas of applied force may exhibit "denticulate" edges but are not included in this class.

Endscraper. Endscrapers are a morphologically distinct unifacial tool form resulting from the concentration of retouch on one end of a flake or blade (Crabtree 1972:60; Movius et al. 1968:9).

Point. A point is "any bifacially flaked, bilaterally symmetrical, chipped stone artifact exhibiting a point of juncture on one (distal) end and some facility (notching, constriction, lateral grinding) for hafting on the opposite (proximal) end. Thus, *point* is a morphological defined class of chipped stone tool, and the term . . . does not convey any particular functional interpretation" (Ahler and McMillan 1976:165).

Point Fragments. Broken portions of points are sorted into this category. Hafting elements from broken points are, however, when distinctive, classified as points.

Perforator. "Bifacially chipped stone artifacts or artifact fragments with extremely narrow, parallel-sided blades and steep angled lateral edges are classified as perforators" (Ahler and McMillan 19766:179). Perforators are equivalent to artifacts frequently referred to as drills. Perforator is herewith preferred due to the more generalized suggestion of function as a piercing tool. Some artifacts in this class may represent exhausted cutting tools.

Bipolar Artifacts. This category includes those artifacts that are the result of bipolar flaking. Bipolar flaking involves resting a stone nucleus on an anvil and striking the nucleus with a hammerstone or billet (Flenniken 1982:32). The artifacts that result from bipolar flaking include bipolar cores (Hayden 1980:23), bipolar flakes (Kobuyashi 1975), and pieces esquillees (Hayden 1980:2-3). Bipolar cores exhibit opposing striking platforms of several types (Binford and Quimby 1964) and prominent negative flake scars. Bipolar flakes consist of the flakes detached during bipolar flaking. *Pieces esquilles* are similar to bipolar cores except that they exhibit opposing ridge striking platforms and lack prominent negative flake scars; pieces esquillee tend to be rectangular while bipolar cores may exhibit any number of forms. There is confusion in the archaeological literature in the use of the terms "bipolar core" and "*pieces esquillee*". Some investigators use them interchangeably while others designate all bipolar nuclei as *pieces esquillee* (Hayden 1980). For the purposes of this classification, all bipolar artifacts are grouped under the single heading "bipolar artifact".

Other Chipped Stone. Objects in this category include flakes and pieces of stone that have been chipped, pecked or ground although the reduction processes are incomplete and the final form of the artifacts involved are unknown.

Hammerstones. Items in this class are characterized by battering and/or flattening on at least one surface as a result of being used as a pounding or hammering tool.

Anvils. Any stone with evidence of pitting on one or more faces (usually flat) is classified as an anvil (Tixier 1974:3).

Fire-Cracked Rock. This class includes all nonchert lithics with irregular fractured surfaces that were not produced by percussion. Specimens may be discolored from direct contact with fire and pot-lid fractures may also be present (House and Smith 1975:76). Items in this class could have been produced through use in stone boiling, indirect cooking, use as hearth stones, or from steam generation in sweat lodges. Historically, some fire-cracked rock could have been incidentally produced when piles of brush and wood were burned during field clearing.

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Appendix C

Artifacts Recovered from Survey

Catalog #	No.	Identification	Color	Description	Material	Provenien
12R10.01	1	Flake		Unmodified	Laurel	Loci #1
12R10.02	7	Glass	Clear	Window		Loci #1
12R10.03	2	Glass	Amber	Container		Loci #1
12R10.04	1	Whiteware		Undecorated		Loci #1
12R10.05	1	Brick		Fragment		Loci #1
12R10.06	1	Flake		Unmodified	Laurel	Loci #7
12R10.07	1	Flake		Edge Modified	Laurel	Loci #8
12R10.08	1	Flake		Unmodified	HT Laurel	Loci #8
12R10.09	1	Flake		Unmodified	HT Laurel	Loci #9
12R10.10	1	Flake		Edge Modified	Laurel	Loci #11
12R10.11	3	Flake		Unmodified	Laurel	Loci #11
12R10.12	1	Other Chipped Stone				Loci #15
12R10.13	1	Glass Button	Milk			Loci #16
12R10.14	1	Flake		Unmodified	Flint Ridge	Loci #18
12R10.15	1	Flake		Unmodified	Wyandotte	Loci #19
12R10.16	1	Flake		Unmodified	Laurel	Loci #20
12R10.17	1	Flake		Unmodified	Laurel	Loci #21
12R10.18	1	Flake		Unmodified	Upper Mercer	Loci #23
12R10.19	1	Flake		Unmodified	Laurel	Loci #24
12R328.1	1	Axe		Fragment		
12R328.2	1	Flake		Edge Modified	Flint Ridge	
12R328.3	1	Flake		Edge Modified	Unknown	
12R328.4	1	Bipolar			HT Unknown	
12R328.5	2	Flake		Unmodified	Laurel	
12R328.6	2	Flake		Unmodified	HT Unknown	
12R554.01	1	Flake		Edge Modified	Wyandotte	Loci #2
12R554.02	1	Flake		Unmodified	HT Burlington	Loci #2
12R554.03	1	Flake		Unmodified	Laurel	Loci #3
12R554.04	1	Flake		Unmodified	Laurel	Loci #4
12R554.06	1	Flake		Unmodified	Unknown	Loci #5
12R554.07	1	Core			Laurel	Loci #6
12R554.08	1	Flake		Unmodified	Unknown	Loci #10
12R554.09	1	Glass	Amethyst	Bottle Top		Loci #13
12R554.10	1	Flake		Unmodified	Unknown	Loci #14
12R554.05	1	Flake		Unmodified	HT Unknown	Loci #4
12R555.1	2	Flake		Unmodified	Laurel	
12R555.2	1	Other Chipped Stone				
12R556.1	1	Flake		Unmodified	Laurel	
12R557.1	1	Flake		Unmodified	HT Laurel	
12R558.1	1	Big Sandy			Laurel	
12R559.1	1	Flake		Unmodified	Unknown	
12R560.1	1	Flake		Unmodified	Unknown	
12R561.1	1	Flake		Unmodified	Laurel	
12R562.1	1	Perferator		Fragment	Unknown	
12R563.1	1	Flake		Edge Modified	Unknown	
12R564.1	1	Unclassified Early Archaic			Unknown	
12R565.1	1	Kirk Corner Notched			Zaleski	
12R566.1	1	Flake		Edge Modified	Unknown	
12R567.1	1	Flake		Edge Modified	Unknown	
12R567.2	1	Flake		Unmodified	Flint Ridge	
12R568.1	1	Riverton			Laurel	
12R568.2	1	Biface		Fragment	Wyandotte	
12R568.3	1	Flake		Edge Modified	Unknown	
12R569.1	1	Flake		Unmodified	Burlington	
12R569.2	1	Flake		Unmodified	Unknown	
12R570.1	1	Whiteware	Red Transfer Print	Body		

12R570.2	2	Whiteware	Undecorated	Body		
12R571.1	1	Other Chipped Stone				
12R572.1	1	Biface		Stage 3	Laurel	
12R573.1	1	Anvil/ Hammerstone/Muller				
12R574.1	1	Flake		Edge Modified	Wyandotte	
12R575.1	1	Flake		Unmodified	Laurel	
12R576.1	1	Other Chipped Stone		Gorget Preform?	Slate	
12R577.1	1	Porcelain		Base		
12R577.2	1	Porcelain		Rim, Bead Edge		
12R577.3	2	Stoneware	Buff Paste	Gray salt glaze ext. Albany int.		
12R578.01	1	Flake		Unmodified	HD Unknown	
12R578.02	1	Porcelain	Undecorated	Rim, w/ circular hole		
12R578.03	1	Whiteware		Maker's Mark		
12R578.04	7	Whiteware	Blue Transfer Print	Hand Painted (red, green, yellow)		
12R578.05	1	Whiteware	Brown Annular Band	Rim		
12R578.06	1	Whiteware	Flow Blue	Rim, Shell Edge		
12R578.07	1	Whiteware	Green Line	Hand Painted		
12R578.08	3	Whiteware	Blue Sponge			
12R578.09	1	Whiteware	Flow Blue	Rim, Feather Edge		
12R578.10	1	Whiteware	Undecorated	Rim/Base		
12R578.11	4	Whiteware	Undecorated	Rim		
12R578.12	2	Whiteware	Undecorated	Base		
12R578.13	24	Whiteware	Undecorated	Body		
12R578.14	1	Stoneware	Buff Paste	Base, Blue-green salt glaze ext Gray salt glaze int		
12R578.15	1	Stoneware	Buff Paste	Body, Dark brown and brown salt glaze ext Albany glaze int		
12R578.16	1	Stoneware	Buff Paste	Gray glaze ext Dark gray glaze int		
12R578.17	1	Stoneware	Buff Paste	Body, Albany glaze ext Dark gray glaze int		
12R578.18	1	Stoneware	Buff Paste	Body, Clear glaze ext and int		
12R578.19	1	Stoneware	Gray Paste	Body, Albany glaze ext Red slip int		
12R578.20	4	Stoneware	Gray Paste	Body, Gray salt glaze ext Albany glaze int		
12R578.21	1	Stoneware	Gray Paste	Rim, Buff salt glaze ext Albany glaze int		
12R578.22	1	Stoneware	Gray Paste	Base, Buff salt glaze ext Unglazed int and base		
12R578.23	2	Stoneware		Body, Buff glaze ext Unglazed int, Buff slip		
12R578.24	1	Redware		Body, Yellow glaze ext and int		
12R578.25	9	Redware		Body, Salt glaze ext and int		

12R578.26	1	Redware		Body, Unglazed ext Brown salt glaze int		
12R578.27	1	Glass Button	Blue	4-hole		
12R578.28	1	Glass	Clear	Container, Lip-threaded		
12R578.29	4	Glass	Clear	Container, Lip-threaded		
12R578.30	1	Glass	Aqua	Lid		
12R578.31	3	Glass	Aqua	Container, Base		
12R578.32	6	Glass	Aqua	Container		
12R578.33	16	Glass	Aqua	Flat		
12R578.34	5	Glass	Amber	Container, Body		
12R578.35	2	Glass	Light green	Lid?		
12R578.36	2	Glass	Green	Container, Body		
12R578.37	1	Glass	Amethyst			
12R578.38	1	Glass	Milk			
12R578.39	1	Glass	Carnival			
12R578.40	1	Tooth		Deer		
12R578.41	1	Metal		Ring, 1" diameter		
12R578.42	4	Nails		Square		
12R578.43	3	Metal		Farm machinary frags		
12R578.44	1	Metal		Nut, 1⅜" wide, ½" thick		
12R578.45	7	Slate		Roofing		
12R578.46	1	Brick		Vitrified Surface		
12R578.47	1	Mussel Shell				
12R578.48	1	Brick		Sample of 50+ frags		
	217					

Catalog #	No.	Identification	Color	Description	Material	Provenienc
05.52.10.1	13	Chert Sample				w/in enclosur
05.52.11.1	1	Chert Sample				Hahn Field
05.52.12.1	1	Glass	Clear	Bottle Top		Howard Field
05.52.12.2	3	Glass	Clear	Container		Howard Field
05.52.12.3	1	Glass	Clear	Chimney		Howard Field
05.52.12.4	3	Glass	Aqua	Container, embossed letters/symbols		Howard Field
05.52.12.5	5	Glass	Aqua	Container		Howard Field
05.52.12.6	1	Glass	Amber	Bottle Top, Screw Top		Howard Field
05.52.12.7	6	Glass	Amber	Container		Howard Field
05.52.12.8	1	Whiteware	Green Transfer Print	Floral Pattern		Howard Field
05.52.12.9	4	Whiteware	Undecorated			Howard Field
05.52.12.10	4	Stoneware				Howard Field
05.52.12.11	1	Field Tile				Howard Field
05.52.12.12	2	Nail		Square		Howard Field
05.52.12.13	7	Clay Pigeon		Fragments		Howard Field
	38					

Appendix D

Site Summaries

Site Locations Confidential

Not for Public Disclosure

Appendix E

UTM Coordinates of Units

Appendix E UTM Coordinates of Units NAD 83			
E	N	Elev	Label
671079.728	4450116.63	327.658	unit1sw
671077.491	4450111.48	328.124	unit2sw
671077.781	4450103.86	328.3272	unit3sw
671006.409	4450113.31	328.6393	unit5sw
671007.508	4450113.17	328.6411	unit5se
671007.899	4450115.14	328.6611	unit5ne
671006.835	4450115.3	328.6635	unit5nw
671006.963	4450117.3	328.6448	unit4sw
671008.051	4450117.2	328.6867	unit4se
671008.447	4450119.08	328.6445	unit4ne
671007.603	4450119.27	328.6185	unit4nw
671007.749	4450121.27	328.5347	unit6sw
671008.714	4450120.91	328.5565	unit6se
671009.257	4450123.01	328.4204	unit6ne
671008.303	4450123.17	328.4379	unit6nw
671245.216	4450042.339	328.7748	swunit7
671246.278	4450042.348	328.7696	seunit7
671246.242	4450044.372	328.6834	neunit7
671245.214	4450044.358	328.7159	nwunit7
671270.964	4450053.862	328.6859	swunit9
671272.957	4450053.665	328.5392	seunit9
671273.087	4450054.704	328.5121	neunit9
671271.083	4450054.921	328.6745	nwunit9
671261.649	4450076.38	327.9914	swunit8
671261.63	4450077.386	327.9682	nwunit8
671262.664	4450077.408	327.9469	neunit8
671262.684	4450076.401	327.9958	seunit8

Appendix F

Phosphate Analysis

by
Janice Northam

Soil Phosphate Testing at Fudge Site

By Janice Northam

An important question addressed at the Fudge site during the 2005 investigation is whether the site was occupied or a vacant ceremonial center. Few artifacts have been found within the enclosure, both by collectors and during the 2005 reconnaissance survey. The lack of habitation artifacts leads one to ask what people were doing within the enclosure: were they occupying it for only special purposes, or at all?

Soil phosphate testing is one method for determining the presence of human occupation. From the soil samples gathered during the 2005 archaeological project at Fudge, information will be gleaned from the analysis of the phosphate levels in order to gain insight into areas of human occupation at the site. The effects of farming, pasturing, erosion, and other physical and chemical activity to the soils in the study area will also be explored to understand the affect they may have on the phosphate analysis in relation to human activity. A literature search will be completed to understand the process of this testing, and how it is best carried out for optimal results to the Fudge site.

Phosphate testing of soils is an important tool to predict locations of human activity. Even negative results for the presence of phosphate are important information as to locations where *no* human activity took place. Therefore, phosphate testing will be done under the supervision of the Natural Resources and Environmental Management Department at Ball State University on soil samples collected at Fudge site to better understand areas of human occupation at this important archaeological site. In addition, soil acidity/alkalinity (pH) testing will be done as recommended in the literature to be combined with phosphate tests. The results of these tests will contribute to the overall knowledge of the purpose of the site.

Review of Literature

Soils supply in one form or another, either directly or indirectly, most of the chemical nutrients needed to sustain life, both for vegetation and animal needs. Levels of nutrients, both micro and macro nutrient levels found in the soil are altered by human activities, and this is true of human occupations prior to the advent of agriculture. Macronutrient elements that are used by, and necessary for plants include nitrogen, phosphorus, potassium, calcium, magnesium and sulfur. Depletion of natural levels of these nutrients occurs as animals and humans remove and consume vegetation containing these elements (Rapp and Hill 1998: 194-195). However, significant amounts of some of these nutrients are returned to the soil in the form of human and animal waste (urine and feces), and by food processing waste. These include nitrogen, phosphorus, and calcium; of particular interest to this study is the re-deposition of phosphorus to the soil environment by human activity.

Paleosols are soils that are formed on a landscape some time in the past, and having been buried by natural processes have preserved intervals of non-natural forms of deposition on periods of "landscape stabilization and surfaces of human occupation (Rapp and Hill 1998: 34)." The focus of this study is the formation of "archaeosediments (Waters 1992: 32-33)," or anthrosols. These are soils that are altered depositionally or chemically by humans, soils changed in some way by man. The study of these soils in relation to surrounding natural soils yields important information for the archaeologist about prehistoric cultures, their settlement patterns, living arrangements, and relationships with their environment over time. More detailed data can be obtained regarding anthrosols by examining properties of soils below the plow zone (Rapp and Hill 1998: 177) and below other modern land use practices from an anthropological/archaeological perspective. Therefore, this review of literature will include soil science theory and its application to archaeology, specifically as it relates to soil phosphorus.

For archaeology, analysis of soil sediments can provide valuable information as to climatic and morphogenic paleoenvironments, developmental history of sites, proposed models of man-land relationships, and interpretation of site-specific human activities (Hassan 1978: 210-211). New questions are being asked of both the disciplines of geology and archaeology: "concern with the relationship between the geological setting of a region and settlement location, the nature of site-forming processes, the recognition of activity areas in archaeological sites, the role played by geological processes in distorting or preserving the archaeological record, and finally the dynamic relationship between man and the earth through time" (Hassan 1979: 267). As he points out, the emphasis has evolved to an anthropological dimension of the human past rather than merely a historical (or prehistorical) reconstruction of that past. Geological and environmental processes are, and have always been, an integral part of that study.

For the current study, the recognition of activity areas in an archaeological site, or the lack thereof, is important. The soils used in the construction of the Fudge site and the amount of time over which that construction took place had meaning for the people who constructed it. Radiocarbon dates obtained during the 2005 field season approximate the time period of use of the site at between ~50 B.C. to ~ A.D 90. Since very few artifacts have been found on this site, archaeologists have turned to soil analysis as one method in conjunction with several other methods to obviate clues as to the purpose this earthwork served to prehistoric mankind.

Soil phosphate testing began in the early 20th century to determine the availability of nutrients in the soil for plant use (Parnell 2001: 380. One of the earliest uses in archaeology was in 1911 in Egypt (Bethell 1989: 1, Herz 1998: 181). During the first half of the 20th century, the method continued to be refined in Europe (Herz, Bethell 1989) but acceptance in North American archaeology was slow. Continued observations and investigations continued into the latter half of the 20th Century with the work of Dauncey, Dietz, and Lutz (Alaska) and Solecki's analysis of burials where no visible artifacts or remains existed (Bethell 1989: 2).

Soil science continued to develop into the 1960's and Bethell (1989: 2) notes one of the most important developments was that of Cook and Heizer. Their understanding that archaeologically deposited phosphates should be considered not in isolation, but as part of a dynamic system of "deposition and fixation" of phosphates in the soils was a breakthrough for scientific research uniting archaeology and soil science. They also pioneered work with other elements in the soil in conjunction with phosphates, its behavior in the presence of these, and other organic elements such as plants and animal materials. Phosphate retention in the soil was further studied during this period by the British Museum during excavations of a famous ship burial at Suffolk. Improved field spot-testing was extended from Lorch's work by Gundlach in Germany during the 1960's as well.

In the 1970's saw soil phosphate analysis was combined with other archaeological techniques such as magnetometry, aerial photography, field survey and surface artifact concentrations. From these pre-excavation activities, phosphate testing of subsurface soil deposits became an integral part of predicting site stratigraphy, thus giving a "three dimensional" idea of site limits prior to digging (Bethell 1989: 3). Keeley's work in the 1980's (Bethell 1989: 4) has particular relevance to the present study. In particular, earthen enclosures which contained negative phosphate results. Keeley found that this was a result of a lack of phosphorus, rather that a methodological problem or failure. Her findings are important to the analysis of visible man-made changes to the earth that would *appear* to have had human remains present, and thus the presence of high phosphate levels. However, the archaeological story has a different ending than anticipated in such cases where the science does not support the assumption.

Soil and sediment studies in archaeology have focused on a few key indicators of preshistoric settlement and activity areas, such as soil analysis for presence of phosphates. Herz and Garrison note that it is a reliable indicator for anthropogenic soils (Herz 1998: 47). Phosphorus along with nitrogen and carbon are added to soils to a much higher degree in the presence of human occupation than naturally found in soils. As most authors note, this is due to the decomposition of organic matter, principally human and animal remains and excreta. Interestingly, Herz notes that phosphorus in desert and agricultural land, phosphorus in soil ranges from 0.01-0.2% in the uppermost 10 cm. of soil. In comparison, 100 people living in an area of one hectare will add 125 kg. of phosphorus to the soil annually, amounting to an annual increase of 0.5%-1.0% to the uppermost soil layers (Herz 1998: 181-182). Of the three elements, only phosphorus remains in the soil because it is fixed and insoluble, especially in clay soils and those rich in Calcium and Iron (Herz 1998: 182).

To further explore the nature of phosphorus in soil, soil science references have also been consulted. It is important to understand presence of phosphate as it naturally occurs to further understand its presence in relation to human activity. Three fractions of phosphorus have been detected in soils. These are 1) those associated with crops or plant growth, aluminum and iron phosphate, that are easily extractable; 2) phosphate that is more tightly bound, "occluded," associated with human activity; 3) natural geologic phosphate, or occluded calcium phosphate/apatite (Rapp and Hill 1998: 195; Clark 1996: 120).

One factor that influences availability in soils for plant use is the acidity or alkalinity of the soil, its pH. In alkaline soils, inorganic forms of calcium phosphate are formed in a pH soil atmosphere of pH 6 or above. This is due to the availability of (Ca) calcium ions to bond with phosphorus in the soil, as calcium is available in alkaline soil as a base. However, in more acidic soil solutions the available ions are in the form of aluminum and iron, Al and Fe. The available phosphorus bonds with these, forming aluminum phosphate or iron (ferrous) phosphate. These are held on surfaces of clay minerals in films. As Bethell (1989: 4-9) notes, phosphorus can be taken up by plants via roots as an important nutrient. When the plant dies, its organic material becomes "food" for organisms, and thus the phosphorus is taken into their bodies. These can further be taken up by plant roots or utilized by other microorganisms within the food chain. A portion of the organically derived P is returned into soil solution and becomes mineralized as calcium phosphate, iron or aluminum phosphate.

This latter portion is important in that the strong fixative powers of the clays within soils help bind, fix the phosphorus "in place" in the soil. Areas of high concentrations of human or animal excretion, waste, or burial practices alter the normal phosphorus cycle in that as humans and animals eat meat or plants as food, phosphorus is concentrated in their bodies. When areas of waste, such as refuse pits of pots used for cooking plants and animal parts, or where bones and carcasses are discarded, or where human burial takes place within the soil system, the signature of increased phosphorus in that area is markedly increased from the normal soil phosphorus. The background signature of phosphorus in the soil would contain percentages of organic, inorganic and residual phosphorus-containing compounds that can be taken into soil solution at a lower level amount. Thus presence of excess organic phosphorus (contained in all living things) would remain quite stable when re-deposited in the soil, and has been found to remain over archaeological time, and can be measured. This measurement is indicative of presence of human activity intervening in the normal soil cycles, as distinguished by elevated phosphorus levels.

According to Eidt (1984: 35) the best measure of phosphate elevations in soils containing prehistoric or historic settlement are measured in 'total' phosphorus rather than 'available' phosphorus. He also observes that leaching of phosphorus, as previously thought to be high, does not occur to any appreciable amount in most soils due to the rapid fixation of phosphorus with Calcium, Iron, and Aluminum (Eidt 1984: 27). Erosion can carry top soil amounts of phosphorus away with plants, plant debris, or fertilizer applications, but does not affect the lower zones of soil in maintaining phosphorus (Eidt 1984: 34). Also, Eidt importantly observes that there is little "horizontal migration tendency" to phosphates in soils as it "possesses the useful trait of remaining bound to the original deposition site, and thus accumulating over archaeological time 'in place'"(Eidt 1984: 26).

Another explanation of the process of phosphorus elevations in soils in the presence of human activity is offered by Herz and Garrison (1998: 182-193). In this explanation, phosphorus in the ionic state is "labile" and readily available for plant uptake via plant roots. Another term for **labile** phosphorus is '**available**' phosphorus. A **nonlabile** form of phosphorus is found in soils in the crystalline, or **inorganic**, form as the mineral apatite, or a calcium phosphate. It only becomes labile, or available, as the mineral weathers. Measurement of the two is important per these authors as there is equilibrium between the two forms of phosphorus: labile/organic or altered apatite and inorganic P in unweathered (fresher) apatite. In agricultural studies of phosphorus available for plant use and in studies of soils for archaeological inference, available phosphate is measured. (Eidt's (1984: 35) methods take issue with this, indicating that 'total' phosphorus should be measured.) Herz and Garrison note that the amount of labile (available) P is dependent on variables such as soil water, soil textures and structure, and extraction of different amounts of P from the soil by different plants. Although some of these factors are noted in archaeological reports, they are not essential to archaeological interpretation using soil phosphorus measurements. The available P can be derived from desiccated bone as one source, such as in burials, as it becomes both available through decomposition for plant uptake and microorganism use, and as it is adsorbed onto clay minerals. The principal control over P distribution for these authors is the pH of the soil. Alkalinity favors calcium phosphate formation, and acidity favors ferrous and aluminum phosphates. They note that calcium phosphate is water soluble and readily available source of phosphorus for plants. As the more permanent bonding occurs with calcium, apatite is formed and is not readily available to plants unless weathered. Bone burial may be represented by fluorapatite, a more insoluble phosphate mineral that remains stable in the soil even with weathering.

In acid soils, again these authors (Herz and Garrison 1998: 183) echo others in the characteristic of phosphorus to bond with iron and aluminum. This state makes the phosphorus not available, or "occluded" to use Eidt's language, which means that it is enclosed within calcium carbonate, iron oxides, and silica. When bound with Ca, Fe, and Al, it is less available, but not as much so as when occluded.

In further discussion of interpretation of soil phosphate testing and results, Herz and Garrison (1998: 184) note that *total* phosphate, both labile and non-labile, is important to archaeological analysis. In one study cited by Herz and Garrison, the available P in relation to total P ranged from 2-11% in one case to 1-3% in another. Therefore, they conclude that the total P is the best predictor of human activity in the prehistoric soil record as these small percentages may be overlooked as to their significance.

One of the easiest understood explanations for the archaeological presence of elevated phosphate levels is by Clark (1996: 120). As he explains the process, naturally derived phosphates (mainly form natural apatite or calcium phosphate) from 'nearly all rocks' or parent material, is taken up by living things. Living things then excrete the concentrations of phosphate back into the soil, either in the form of waste or of processing/discarding food stuffs such as meat and plant sources. As this re-deposit occurs in organic form, the phosphates bind very tightly with clay particles in the soil matrix and change further into more stable forms, thus remaining in the soil over long periods of geological time.

Some interesting data relating to phosphates in soils is applicable to implications for archaeology of various kinds of investigation, including the present study. Some of these are:

1. A total phosphate concentration of more than 2,000 parts per million indicates the presence of a burial. Also, wood burning may raise the amount of magnesium in soils, and these authors conclude that a high pH may be related to fire (Rapp and Hill 1998: 195). Solecki (1951: 255) found that where no osseous material remains, but phosphate levels are high, enough to indicate previous presence of burial, it may not be possible to determine if the elevation is due to human or animal bone. This author also notes that phosphate levels of red and yellow ocher (iron oxide) from a mound site presumed to contain burials was very high; ocher naturally is lacking in phosphate.
2. Eidt in 1977 found a close association between phosphate levels of growing modern vegetables and those grown in prehistoric soils (Clark 1996: 121).

3. Eidt (1977: 34) observes that certain types of prehistoric activity may not influence the phosphate in soils of an activity area, such as a flint knapping area. Also, topography may or may not influence site recognition as with slopes which would possibly promote erosion depending on prior land uses.
4. Eidt (1977: 41) observes the importance of information gained with systematic phosphate testing of a site where no artifactual evidence remains. This applies to burials where the soils and bone composition have led to disappearance of any evidence of human remains.
5. One observation by Provan in Norway (Bethell 1989: 3), based solely on phosphate evidence, was that of dietary change from one prehistoric period to another, by differences in phosphate levels at a site.
6. Archaeological sites covered by layers of alluvium can be discerned by phosphate analysis, and the variance in soil color left by phosphate variation (Keeley in Bethell 1989: 4).
7. Phosphate values may be related to intensity of use of an area as pertains to the age of the site. This may indicate higher population levels at different time periods, and/or seasonal use of an area (Lillios 1992: 504) as illustrated by the higher enrichment with P in older soils, older areas of occupation.
8. Hassan (1978: 210) observes that changes in phosphate levels over a site over time can indicate changing habitation patterns within a site. Again, he notes that this must be evaluated in relation to other methods of investigation for intra-site variability.
9. Cremation ashes are high in *available* phosphate, and may be found in soils that are mixed with ashes, having a grey, powdery appearance (Solccki 1951: 255) which could be mistaken by the untrained eye as gleyed, silty soil. It was also thought by this author in 1951 that an area of intensive occupation by humans could contain 50 times the proportion of phosphate as ordinary soil.
10. Parnell cites ethnographic data on space use and activity patterns to indicate such areas as sweeping (pushing organic materials to the [patio] peripheries, gardening, waste handling, storage, and food preparation, as well as rest/sleep areas, areas of heavy foot traffic (Parnell 2001: 380). However, he seems to rely heavily on the use of phosphate and other chemical testing to enhance artifactual evidence and conclusions. Extractable phosphate (presumed to mean available phosphate) in range >55 mg/kg were considered to be more detailed in their relevance to site structure than total phosphorus measurement (Parnell 2001: 385-386). Interestingly, this author finds that the suggestion of habitual sweeping patterns shown by elevated P levels move from one room to the next toward a common refuse area off an area designated as patio (Parnell 2001: 386).
11. Parnell also concludes that high artifact concentrations would logically coincide with chemical level analysis elevations because artifacts likely would not have been washed prior to discard. Therefore their last area of use would leave a signature of higher chemical elevations in certain locations (Parnell 2001: 396).
12. Parnell finds the use of extractable phosphate more revealing of detail than use of total phosphate extraction methods (Parnell 2001: 400). He also sees this being adapted to field methods that can be inexpensive and available on site, albeit somewhat subjective in reading of results.

13. Parnell noted that within a habitation area considered to be a house and patio structure, there was found to be elevated levels of phosphorus moving through the structure toward a midden area off the patio. This was interpreted to indicate sweeping of organic debris from the inside to the outside of the dwelling. Levels were elevated, but not as high as concentrated areas of food preparation.
14. Weymouth and Woods (1984: 21) found that burned wood resulting in ash can increase concentrations of calcium, potassium, magnesium, and phosphorus. Calcium and pH values can be affected by this and by building materials that include limestone. Also, (p. 22) they conclude that higher phosphate levels would be expected in historic over modern debris disturbances. This, associated with magnetometry anomalies can be interpreted as occupational boundaries. They were also able to demonstrate via magnetometry and phosphate testing the presence of an anomaly-free parade ground at the center of an area bordered by magnetic and artifactual evidence.
15. Intermediate levels or zones in vertical profile with differing levels of phosphorus can be interpreted as temporary abandonment of site, change in population size, change in subsistence base, or by change from annual to seasonal use of the site (Sjoberg 1976: 454)
16. William I. Woods (1977: 250) found that phosphate levels within a settlement site from a ceremonial area would contain phosphate results much closer to the level found in surrounding natural, uninhabited soils. He found that with samples from a ceremonial area contained some human interference, but was closer to naturally occurring soils in his study area.
17. Cavanagh, Hirst, and Litton (1988: 74) found that phosphorus concentrations were maintained over a larger area than artifact scatters/counts. This indicates that the latter may only represent a portion of a site's boundaries/use area. This confirms earlier conclusions by Craddock, Gurney, Pryor and Hughes (1985: 361) that artifactual remains "represent only a tiny fraction of the rubbish trodden into the ground or dumped into pits and ditches."
18. Topsoil levels of phosphorus (showing elevated levels) can accurately reflect phosphorus concentration beneath the topsoil (Craddock, et.al., 1985:362). Craddock and colleagues (1985: 368-369) also found that there is a general correlation of plough zone soil to underlying features, as discovered with phosphorus testing and concurrent use of magnetometry.
19. In relation to man-made banks, the mixed nature of the soils can be apparent as high readings of phosphorus are encountered in various areas of deeper levels of construction (Currie and Locock 1991: 85). Ash and charcoal mixed within soils tested gave high readings of phosphorus (Currie and Locock 1991: 87). They also used pH analysis to determine soil enhancements through different depths, as well as differences in soil sources used to construct an earthen wall.
20. At low pH, phosphorus reacts with, adsorbs with Al and Fe in soil, and with Ca from about pH 6.5 and above. pH increases with depth in most well-drained soils, thus potentially changing the cation bonding as pH changes (White 1978: 507).

Sjoberg notes that when arbitrary levels are taken in vertical excavation, soil samples are usually taken from arbitrary level designations, and can reveal a phosphorus profile of actual strata of occupation intervals (Sjoberg 1976: 454). She points out that information such as abandonment of sites for temporary periods, changes in subsistence base and population size, and seasonal/annual uses of a site can be gleaned from analyzing vertical data. Eidt has been cited in several references as having delineated through phosphate analysis the location of dwellings, gardens (with the addition of pollen analysis), work and storage areas within sites (Rapp and Hill 1998: 195).

Rapp and Hill (1998: 28), elaborating on the conclusions of Eidt, explain how different kinds of phosphate can be related to past human land use. Very soluble phosphates are associated with land use for crop production, i.e., vegetable cultivation. Small amounts of tightly bound iron, aluminum phosphate as well as apatite and calcium phosphate were also present. In forest areas, small amounts of apatite and calcium phosphate were present with equal portions of "easily soluble" iron and aluminum phosphates (Rapp and Hill 1998:28), presumably related to the more acid pH levels of forest soils. It was found that in abandoned residential sites of land use, the three types of phosphates were about the same, and inferences were made about differing land use by Eidt, as presented by these two authors. This combined with the work of Sjoberg can be valuable to overall interpretations of profiles through comparison from various units within a site as well.

Some factors that can influence the results of phosphate tests are noted by several authors. Proudfoot indicates the importance of understanding the underlying geology of a site as this may affect the natural phosphate levels in the soil. Drainage and erosion to soils is important to be aware of when analyzing phosphate levels as sandy or peaty soils tend to be the least satisfactory for analysis (Clark 1996: 120). Erosion can deplete phosphate levels in soils, especially within the upper soil zone in which human activity may have increased the phosphate levels. Leaching has been cited in the early literature as being a problem with accurate phosphate levels in acid soils, that levels were low because of leaching of soil phosphates. Lillios (1992: 500) indicates that pH only affects phosphates held in the available form, a small percentage of the total phosphates in a soil. Underlying parent materials can be a varying source of phosphate in soils (Clark 1996: 120), as well as soil histories (climatic and recent human modifications) and types of soils in an area.

Basically two methods have been developed and tested since the 1950's (Eidt 1984: 18). The field method described in the literature and by Eidt himself involves a visual scale of color change on litmus paper that subjectively evaluates the amount of phosphorus in a soil sample. The testing paper can even be preserved as part of the documentation of the site data. Another method is limited to the laboratory setting, use of chemicals and mechanical centrifuge and spectrometry to remove the subjectivity from the resultant data. An ignition method has also been used with determining total phosphorus, and has been described as easier and safer to carry out (Bethell 1989: 13).

To understand the meanings of the data that is obtained when testing for soil phosphate in relation to human activity, it is beneficial to test pH (acidity, neutrality, or alkalinity) of the soil samples as well. As previously mentioned this influences the form in which phosphate may be stored in the soil, as well as the presence/degree of preservation of osteological remains. For example, acid soils may tend to be less preservative, more an agent of decomposition, than neutral or alkaline soils. When these data are plotted against profiles of archaeological units, showing various soil zones and inclusions, inferences can be made of soil provenience in the absence of artifactual remains. This has been documented by Rapp and Hill (1998: 195), as well as by numerous other authors. With mound building in its various forms, it has often been the case that soil was carried by basketloads to the site for construction of the mound. This activity can often be seen in soil profiles; with the added information of pH and phosphate levels further distinctions of these soil differences can be made within the profile.

In conclusion, human activity over time accounts for one source of phosphorus accumulation in soil, along with plants and animals, and primary source material of rocks. Eidt notes that soil phosphorus from any of these sources occurs mostly in the phosphate form because of its affinity for oxygen (Eidt 1984: 27). Used more in Europe than in Britain or the United States, phosphate testing of soils to delimit archaeological sites and determine other information about them, has been used, having been borrowed from the soil sciences testing for plant nutrients in the soils. More recently the trend in archaeology has been toward preservation of sites rather than destruction of sites, via extensive excavation. Phosphate analysis has been used in conjunction with other methods, such as magnetometry, in systematic sampling to promote non-destructive study of prehistoric sites, and predictive modeling at historic sites.

Methods

The method for extracting phosphorus used for this study was the Bray P-I procedure. This method of testing for "adsorbed" phosphorus was first published in 1945 by Roger H. Bray and L. Touby Kurtz of the Illinois Agricultural Experimental Station (Knudsen/Beegle 1988: 12). It was originally recommended for the removal of acid soluble phosphorus forms, largely Al- and Fe-phosphates (USDA/NRCS Website). Since this test is used by soil scientists primarily for agricultural evaluations, information available regarding this procedure mainly deals with those types of results that can predict crop yield from phosphorus nutrient content of the soil. This test is said to coordinate well with yield response on most acid and neutral soils, can be used for soils containing small amounts (< 2%) of dolomite or calcium carbonate (Knudsen/Beegle 1988: 12) to which the phosphorus adsorbs. The authors caution that it should not be used on soils with large amounts of lime (calcareous soils with pH > 7.4) as the phosphorus may be precipitated during extraction and yielding very low test values. This method is used only for phosphorus, whereas other methods extract multiple macronutrients. It is recommended for use in North Central Region of the United States. One source references the upper limit of the test reporting to be 100 ppm. as the extracted phosphorus is measured by the intensity of blue color developed in the filtrate solution (University of Minnesota Website).

Since soil sampling was not initially planned for soil phosphate testing, samples were obtained only from the units and zone/levels exposed during excavation. Soil samples were taken from each vertical zone of excavated one-X-one meter units and two-X-one meter units during the summer field season of 2005. These are identified by landowner name from whose field they were taken, from excavation unit, and by zone, date and excavator's initials (**Table 2**). Soil samples were collected under clean conditions, without being contaminated by human hands, using standard archaeological technique for collection of soil samples within a unit. This includes use of clean trowel, sample removal from bottom-most level or zone first, and working upward to surface level, as is standard procedure within ARMS. This procedure is followed to prevent contamination of lower zones of soil from that of upper zones. If more than one sample is encountered in a zone (example: leached soil or lenses demonstrating more than one uniform soil in a zone), samples are collected for each separate soil. The samples have been stored in their original clean zip-seal plastic bags until time of analysis, at room temperature in the office of Ms. McCord in the ARMS lab.

On February 20, 2006, the drying of soil samples began, with completion occurring on February 24, 2006. Careful, accurate labeling of samples was maintained, and a clean environment for handling was provided, with samples being untouched by bare hands. Upon drying and cooling, the samples were placed in clean, freshly labeled zip-seal plastic bags to await transport to the soils lab for testing.

1. Oven-dried soil samples from the Fudge site excavations will be used for testing of phosphorous and pH.
2. 45 soil samples were oven-dried at approximately 100-110º F. for 8-12 hours, depending on sample size.
3. Soil samples were dried in aluminum foil “boats,” one use each to prevent cross-contamination of samples. This was standard drying procedure used in archaeology.
4. Samples were not touched by bare hands, to avoid contamination that would skew results.
5. After drying, samples were placed in fresh, clean zip-closure bags, labeled with project, site, unit, level or zone, date excavators’ initials, and bag number of sample where applicable.

On February 27, 2006, this author met with Mr. Dale Scheidler, Director of Research in the Natural Resources and Environmental Management Department at BSU to review the testing procedure for the Bray 1 Method of Phosphorus testing of soils. Soil pH will also be measured, as suggested in the literature, using the Fisher Scientific Accumet pH Meter #910. The machine was calibrated on each day of use prior to measuring pH of soil samples.

A total of 45 soil samples were obtained from archaeological work at the Fudge site during the 2005 season. These are listed in Table 1 with their Sample Number correlate that will be used for testing. Each sample was oven-dried at approximately 100**º F** for 8-12 hours. Samples were placed in aluminum foil “boats” using aseptic technique in order to not introduce contemporary contaminants. Munsell determination was completed for each sample in the ARMS lab by Beth McCord, Project Director and Principle Investigator to maintain consistency of sample description, with some assistance by the author. This was recorded in Table 1, along with texture determination for each sample. Soil samples were then divided in half, with one half remaining with project collection for curation. The remaining samples were placed in clean zip-closure plastic bags, labeled with site, unit, level or zone, feature if present, date and excavator initials. The latter group will be used for pH and phosphate testing.

The samples were then individually ground to a more uniform texture, removing any obvious pebbles and organic matter. This was done using a porcelain mortar and pestle, with thorough cleaning of equipment (three rinses with tap water, paper towel drying) between processing of samples to prevent cross contamination and biased results. The samples were then returned to their bags to await transfer to the NREM soils lab. After transport to NREM Soils Lab on March 8, 2006 the soil samples were prepared for Bray P 1 testing, and pH testing. The processes of pH testing and Bray P-1 testing was directed and overseen by Mr. Dale Scheidler at the direction of Dr. John Pichtel, both of the NREM Department, Ball State University. A code was devised to number each sample, 1 through 45, to facilitate testing and ordering of samples. With the assistance of Mr. Dale Scheidler of the NREM department, plastic vials with lids were acid washed with a 10% hydrochloric acid solution, rinsed in deionized water, and allowed to air dry. Each vial was labeled with masking tape and a number corresponding to each soil sample, 1 through 45. These are listed in **Table 2.**

On March 8, 2006, samples were prepared for Bray P 1 testing scheduled for afternoon of March 13, 2006. Using aseptic technique, 1 gram of soil was extracted from bag and weighed, using weighing paper and digital scales available in the NREM Soils Lab #7. Metal spatula was cleaned between each sample bag. Each one gram soil sample was placed in a lidded plastic vial labeled with its corresponding number. These were then placed in a holding rack to be used for phosphorus testing.

Again, using aseptic technique, 5 grams of soil was extracted from each bag of soil, using a digital scale calibrated in Soils Lab #7 on the day of use. These samples were placed in a beaker for pH testing. 10 ml. of deionized water was then added to the beaker, and stirred for 5 minutes. Clean pH meter probe was seated in the beaker and in contact with the soil solution. This was read after 5 minutes, and recorded on data sheet corresponding to sample number. Beakers were cleaned using 3 rinses of clean tap water, then thoroughly dried with paper toweling. The pH meter probe and glass stirring rod were cleaned between uses with deionized water, and blotted dry with KemWipes. On March 8, 2006, twenty of the 45 samples were tested for pH. The remaining 25 were completed for pH on March 9, 2006. Recalibration of the pH meter and digital scale was again done prior to use on 3/9/06.

pH Testing

(This procedure was taken from Lab. Exercise #6 of NREM 221/521 Soil Resources Laboratory Manual, authored by Dr. H. Brown and Dr. John Pichtel, Spring 2006, pp.135-136; It was modified in amounts to better fit the amount of soil in each sample.)

Equipment:
5 grams of soil
50 ml. plastic beaker, initially acid washed;
Deionized water, pH of 6.13
Glass rod for stirring
Standardized digital pH meter, calibrated 3/8/06 @ 0930.
(Fisher Scientific Accumet pH Meter #910)

Procedure:
1. 5 g. of soil is placed in 50 ml. beaker

2. Deionized water is added to make 10 ml. total solution of soil and water.
3. Solution is stirred for 5 minutes with glass rod. It then is left to stand for 5 minutes.
4. pH result is then read using standardized pH meter with glass electrode.
5. pH measurement is recorded on data recording sheet(**Table 2)** for each of the 45 soil samples.

Phosphate testing

(The Bray P 1 test for soil phosphate was the procedure used for testing as recommended and furnished by the NREM Department, Ball State University, "Recommended Phosphorus Tests," authored by D. Knudsen and D. Beegle, from North Central Regional Publication #221, pp. 12-14.)

Equipment:

Soil samples previously prepared, using one gram of each soil sample in plastic lidded vial.
IEC International Centrifuge Model UV
Milton Roy Company Spectronic 20 D spectrometer; absorbancy units were calculated.

Extraction solution: This was prepared by Mr. Scheidler prior to lab session.
- 125 ml. of 1.0 Molar Hydrochloric Acid.
- 5.55 g. of Ammonium Fluoride
- Deionized Water to final volume of 5.0 liters
- pH 2.60—Adjust with acid or base as needed.

Acid Molybdate Stock Solution
- 15 g. Ammonium Molybdate
- 0.3638 g. Antimony Potassium Tartrate
- 175 ml. concentrated Sulfuric Acid
- Deionized Water to final volume of 250 ml.

Working solution: Prepared day of testing (3/13/06) by Mr. Scheidler.
- 15 ml. of Acid Molybdate Stock Solution added to 500 ml. of Deionized Water
- 0.8 g. of Ascorbic Acid dissolved in 6 ml. of Deionized Water.
- Add to Deionized Water to final volume of 600 ml.

Glass test tubes
Glass tubes specific to spectrometer
Phosphate standards mixtures of .2 ppm, .5 ppm, 1.0 ppm, 2.0 ppm, 3.0 ppm, 4.0 ppm, and 5.0 ppm. However, the 2.0 ppm standard did not react/turn blue, and was therefore not counted with values for results.
Glass pipettes, 2 ml. measures

Procedure:

1. Soil samples (1 gram of soil) were diluted with 10 ml. of extracting solution to each vial. These were shaken at low speed in automatic shaker for 5 minutes, then placed in centrifuge at a speed of 25 (x100) R.P.M.'s for 5 minutes after gradually reaching specified speed. Samples were carefully placed in vial racks, taking care not to allow soil pellet and extractant solution to re-mix. These two parts were visibly separated

after centrifuging, with the solution at top clear, and the soil pellet visible at the bottom of the tube.

2. 2 ml. of extractant was measured with pipette, and placed in clean, dry glass test tube. Each test tube was numbered 1 through 45 to correspond to soil sample numbers.
3. 8 ml. of working solution was then added to each test tube, and allowed to stand for 10 minutes. This allowed for blue color to derive, indicating Phosphorus presence in each sample.
4. Standards were checked in the spectrometer for their values in **absorbancy units** to be compared to actual soil Phosphorus samples.

5. **Standards Table 1** is as follows:

Standard:	Absorbance Units:
.2 P solution	.040
.5 P solution	.111
1.0 P solution	.172
2.0 P solution	Non-reactive/no color (Skipped)
3.0 P solution	.506
4.0 P solution	.676
5.0 P solution	.875

6. Each vial of soil sample P extractant was placed in the digital spectrometer and numerical values were recorded for each of the 45 samples. These were recorded in absorbancy units, compared with a standard curve of known P concentration and transmittance units (above). Values are recorded in **Table 2.**
7. Absorbancy Units of Phosphorus concentration in filtrate was converted to concentration in soil samples, ppm of available P. This was done via plotting against Standards scale. This number was converted using the procedure used for Bray P 1 testing:
   ppm P in soil = ppm P in filtrate (1 gram of soil) x 10 (ml. of solution); this gives a final value of mg (available) P per kg soil. This is reported in **Table 2.**
   Results were reported on **Table 2** for each archaeological unit represented in this study. An X-Y graph (figure 1) was used to obtain a linear progression of the Standards (x) vs. absorbancy units (y). From this data, a value was obtained for P in the soil samples.

Results

Numerical results for pH and Phosphorus are given in **Table 2.**
These results were then transcribed onto profile drawings of the walls of the nine units excavated at the Fudge site enclosure. The units were also placed in relationship to one another geographically as they lay topographically in the field.

Interpretations and Summary of Results

Units 1, 2, 3, and 4, 5, 6 were placed in the Ashley property horse pasture along the north enclosure wall. This field was formerly in cultivation.

Units 1, 2, and 3 are considered together as they were aligned N-S across the north side of the enclosure wall, with Unit 1 being the northern-most, and Unit 3 being the southern-most. As predicted based on the literature, the pH value got higher, more alkaline, as each zone progressed downward toward bedrock or parent material in the West Wall profiles. This would be expected in this region with a heavy limestone bedrock component or calcium-rich glacial till parent material.

However, there were pockets that did not follow this pattern. For example, Unit 2 West Wall "burned out tree" and East Wall Zone 2a both have higher phosphate levels than any zones adjacent to them. Burned organic material will carry a higher phosphate level than its surrounding soil. In this instance, the burned out tree area can account for the higher phosphate level in the East and West Walls for these two areas. Pocket 3/Zone 5 in the West Wall profile is a mixed pocket of soil differing in texture and color from its surroundings. This could possibly be explained as part of the mound-building activity, with soil being carried from a different location and placed on the embankment wall during construction.

Also in this unit (2), the area of Zone 2a is higher in phosphate with a pH not significantly higher than its surroundings. This could be explained by it being from the opposite side of the unit and containing some of the phosphate from the "burned out tree." The pH is almost identical to that found from the "tree" sample, and the phosphate level is 11.15 (2a) compared to 13.1 (tree). These, it would seem, are comparable phosphate levels from a horizontal position within the soil of this unit.

In the North Wall profile of Unit 2, it is noted that Pocket 2 is slightly different in pH, and similar to the pH in Zone 2, South Wall. Since its phosphate level is also different, this may represent another episode of embankment construction, with soil of different acidity/alkalinity and phosphate level being obtained elsewhere and deposited within the embankment.

In Unit 1, it is interesting to note that the pocket of soil labeled Zone 3 is distinctly different in color (mixed, gleyed) from its surrounding soil in profile. It may be concluded that this is also from a different area, being brought in for wall construction.

Unit 3, located to the interior of the embankment, progressively increases in pH with depth as would be expected. The phosphate levels increase as well. Since the B horizon is depressional, there may be a greater accumulation of organic material in this area that causes the phosphate level to elevate to 11.25. It should also be noted that these three units were placed roughly parallel to a noticeable "dip" in the embankment wall, the result of a drainage channel cut through the embankment to drain a depression on the interior. Erosion, or some percolation of phosphate with water to this B Horizon, maintained it in situ. Besides the depressional area, this unit could possibly represent the artifact-free inner aspect of the enclosure.

The testing of Zone 4 in Unit 2 and Unit 3 revealed almost identical B Horizon value for pH and phosphate. Although the process cannot currently be identified, it is possible that these two surfaces were similarly prepared prior to the construction of the embankment. Unit 1, the northern-most unit, is much lower in values, but this could also be due to some erosional processes.

In evaluating the results for Units 4 and 5, the two units toward the interior of the embankment in the segment of Units 4, 5, and 6, the West Walls of these units vary little. The pH levels are slightly more alkaline in Unit 5 than those in Unit 4, but the phosphate levels are rather low in all the Zones of these two units. It would appear that they are not modified by construction with soils brought from elsewhere. One could assume that these profiles are relatively natural, or that this is a wide segment of the embankment wall with natural Zones or Horizons in profile. If the enclosure was cleaned during episodes of use and the sweepings piled onto the existing wall, this profile could be the result. As soil erodes to the inside of the embankment when not in use, and then is pushed back onto the wall, neither the pH nor the phosphate level would be expected to change significantly. This pattern is seen in the results from the North Wall of Unit 6 as well. The pH and the phosphate levels are in the same relative range.

However, in Unit 6, East Wall we see that Zone 5 and Zone 6 are higher in pH and phosphate levels lower than adjacent Zones. Again this could illustrate mound construction areas. The Munsell values show these areas to be mixed soils, unlike the more consistent values for surrounding soil. The redoxy characteristic of the Zone 6 could account further for the very low phosphate level of 1.35 as the phosphorus would be attracted to the iron in the soil, even though the pH (6.40) is very near neutral. Zone 3 on the North Wall reveals an acid pH, under which the phosphate would be adsorbed with the Fe, and Al if present. Interestingly, Zone 6 may be an illustration of the dynamic processes of soils under various acidity/alkalinity, and what changes the macronutrient phosphorus undergoes under mixing and changing conditions due to humans.

Units 7 and 9 are located within a lawn, where the landowner hosts a yearly car show each summer. This area was once under cultivation, but has in pasture for several years. The higher phosphate in conjunction with more acidic pH in the Ap and A/B Horizon may be due to lawn fertilization/maintenance products used by the owner. It is mowed regularly as well. It is possible, too that the car show produces emissions that affect the pH of the soil in the Horizons of these two units. The texture and color of soil is also very similar.

Also, it is noted that the West Wall of Unit 9 differs from the profile of the West Wall of Unit 7, illustrating the evidence of embankment wall construction. Zone 4 in Unit 9 is narrower when compared to the natural horizons in this profile. It's pH and P values do not differ greatly from Zone 3 above, and Zone 5 below. This may suggest embankment wall fill from nearby such as within the enclosure. If samples were available for the West Wall of Unit 9, this could possibly confirm this observation. Zone 2 of the North Wall is slightly different enough to suggest another source (outside the embankment, or sloughing toward the outside from an earlier episode) of soil. These are all in the more acid range, however, and it is not clear how these slight variances in acid pH would affect the interpretation.

Unit 8 is located in another horse pasture. The phosphate levels are not significantly different from one another to make any assumptions about them. It is interesting to note that the "burned out tree" in the wall of this unit does not make as great a difference in the values for Zone 2 in the South Wall of Unit 8 as was noted earlier. It would seem that the level of organic material in that zone would cause the phosphate level to be higher, but such is not the case. It is not known whether age and further decomposition would affect the values expected for this. That would be an avenue to further explore in the literature of similar studies.

The procedures were followed very carefully in this study although sources of skewed data or erroneous results were present. One possible source of error is that the soils were dried in an oven rather than air-dried because of the number of soil samples to process and the limited time to complete the study. Another possible source of error was that these samples were all dried in aluminum foil "boats," which could affect the affinity for phosphorus to the aluminum under certain more acid soils. However, *all samples* were treated in the same manner, so it could be assumed that consistent presence of any error would be a constant rather than a source of varying or erroneous results.

Conclusion:

In this study, the Bray I test for phosphate in soil modified by human activity when used in conjunction with pH testing for soil sample alkalinity and acidity provides support for the episodic construction of the embankment walls at the Fudge site. The building episodes were sequential, and some soils were taken from areas away from the embankment walls. It appears that part of the embankment wall construction consisted of larger amounts of soil deposited onto earlier levels of soil. From this, it appears that a case could be made for the episodic clearing of the surface of the interior of the enclosure which contributed to the construction of the embankment walls. However, confirmation of this hypothesis would require testing of other portions of the embankment walls as well as within the enclosure.

From the phosphate tests conducted during this project, neither the time interval involved in the construction of the embankment walls, nor the frequency of the building episodes within the total span of the embankment's use could be determined. The lack of high phosphate levels at the Fudge site speaks to the *lack* of organic remains within and adjacent to the embankment wall, at least in the units excavated during this project. This fact supports the notion of a non-inhabited space within this enclosure, at least as represented in the embankment walls. It would be interesting to learn if similar enclosure sites in the Americas have been similarly tested with comparative results.

Finally, from the review of literature, there is not a great body of data to compare to this study. It does seem, however, that the results of the phosphate tests are fairly miniscule in comparison to some cited in the literature. This may also be due to variation in resultant values due to variation in method of testing. This would need to be further explored to gain more insight into how these findings compare to others done previously. Further conclusions regarding this site must await further testing of the background, or natural unmodified soils, for comparison to the results presented here.

Table 2

Soil Sample	Texture	Munsell	Numerical representation of sample	pH	P Absorbancy Units	P ppm in liquid	P Mg/Kg soil
Ashley Unit 1-Zone 1-(top) West Wall 7/7/2005 (jn/lh) 1m x 1m	loam, Ap (plowzone)	10 YR 4/2	1	5.8	.095	0.475	4.75
Ashley Unit 1-Zone 1-North Wall 7/7/05 (jn/lh) 1m x 1m	loam, Ap (plowzone)	10 YR 4/2	2	6.14	.093	0.465	4.65
Ashley Unit 1-Zone 2 (middle)-West Wall-7/7/05 (jn/lh) 1m x 1m	silt loam, A/B Horizon, embankment wall fill	10 YR 3/2	3	6.14	.065	0.325	3.25
Ashley Unit 1-Zone 2 (bottom)-North Wall-7/7/05 (jn/lh) 1m x 1m	silt loam, A/B Horizon, embankment wall fill.	10 YR 3/2	4	6.22	.047	0.235	2.35
Ashley Unit 1-Zone 3-Lowest lens-West Wall-7/7/05 (jn/lh) 1m x 1m	silty clay loam, B Horizon, embankment wall fill	10 YR 5/3 and 10 YR 6/2 Gleyed	5	6.27	.094	0.47	4.70
Ashley Unit 1-Zone 4-West Wall-7/7/05 (jn/lh) 1m x 1m	silty clay loam, Ab (original ground surface)	10 YR 3/2	6	6.40	.051	.255	2.55
Ashley Unit 2-Zone 1-South Wall-7/5/05 (bkm) 1m x 1m	loam Ap (plowzone)	10 YR 4/3	7	5.19	.087	0.435	4.35
Ashley Unit 2-Zone 2-South Wall-7/5/05 (bkm) 1m x 1m	loam, A/B Horizon, embankment wall fill	10 YR 4/3 10 YR 5/4 mixed	8	5.55	.094	.47	4.7
Ashley Unit 2-Zone 2a-East	Silt Loam	7.5 YR 4/2	9	5.55	.223	1.115	11.15

Wall-7/5/05 (bkm) 1m x 1m							
Ashley Unit 2-Zone 2b-West Wall-7/5/05 (bkm) 1m x 1m	loam, A/B Horizon, embankment wall fill	10 YR 4/3 10 YR 3/1 5 YR 4/4 mixed	10	5.89	.129	.645	6.45
Ashley Unit 2-Zone 3-South Wall-7/5/05 (bkm) 1m x 1m	silty clay loam, A/B Horizon, embankment wall fill	10 YR 4/3, 10 YR 3/1, 5 YR 4/4 (redox)	11	5.67	.131	.655	6.55
Ashley Unit 2-Zone 4-South Wall-7/5/05 (bkm) 1m x 1m	silty clay loam, unmodified B Horizon	10 YR 3/2	12	6.12	.207	1.035	10.35
Ashley Unit 2-Pocket 1-East Wall-7/5/05 (bkm) 1m x 1m	silt loam	7.5 YR 3/2	13	5.88	.241	1.205	12.05
Ashley Unit 2-Pocket 2-North Wall-7/5/05 (bkm) 1m x 1m	Silty clay loam	7.5 YR 3/3	14	6.02	.167	.835	8.35
Ashley Unit 2-Pocket 3-West Wall-7/5/05 (bkm) 1m x 1m (Zone 5 on profile)	Silt loam	10 YR 3/4	15	5.80	.154	.77	7.70
Ashley Unit 2-Tree-West Wall-7/5/05 (bkm) 1m x 1m	burned out tree		16	5.54	.262	1.31	13.1
Ashley Unit 3-Level A/Zone 1-7/6/05 (bk/dp) 1m x 1m	loam, Ap (plowzone)	10 YR 4/2	17	5.72	.097	.485	4.85
Ashley Unit 3-Level B/Zone 2-7/6/05 (bk/dp) 1m x 1m	loam, A/B Horizon Possible wash	10 YR 3/2	18	5.77	.124	.62	6.2
Ashley Unit 3-Level C/Zone 3-7/6/05 (bk/dp) 1m x 1m	silty clay loam B Horizon, depressional	10 YR 3/1	19	6.11	.225	1.125	11.25
Ashley Unit 4-Zone 1-West	loam,	10 YR 4/2	20	5.83	.096	.48	4.90

Wall-7/22/05 (bk) 2m x 1m	Ap (plowzone)						
Ashley Unit 4-Zone 2-West Wall-7/22/05 (bk) 2m x 1m	silty clay loam, A/B Horizon, embankment wall fill	10 YR 3/2	21	5.12	.069	.345	3.45
Ashley Unit 4-Zone 3-West Wall-7/22/05 (bk) 2m x 1m	silty clay loam, unmodified B Horizon	10 YR 5/2	22	5.15	.079	.395	3.95
Ashley Unit 4-Zone 4-East Wall-7/22/05 (bk) 2m x 1m	silty clay loam	10 YR 3/2	23	5.45	.057	.285	2.85
Ashley Unit 4-Feature 2-7/7/05 (bk/cg) [visible carbon in sample] 2m x 1m	silty clay loam	7.5 YR 3/2	24	5.41	.075	.375	3.75
Ashley Unit 5-Zone 1-West Wall-7/22/05 (jn) 2m x 1m	loam, Ap (plowzone)	10 YR 4/2	25	6.32	.058	.29	2.9
Ashley Unit 5-Zone 2-West Wall-7/22/05 (jn) 2m x 1m	silt loam, A/B Horizon, possible wash from embankment wall	10 YR 4/3	26	6.44	.051	.255	2.55
Ashley Unit 5-Zone 3-West Wall-7/22/05 (jn) 2m x 1m	silty clay loam, unmodified B-Horizon	10 YR 5/2	27	6.38	.039	.195	1.95
Ashley Unit 6-Zone 1-North Wall-7/21/05 (drc/bkm) 2m x1m	loam, Ap (plowzone)	10 YR 4/2	28	5.52	.081	.405	4.05
Ashley Unit 6-Zone 2-West Wall-7/21/05 (drc/bkm) 2m x 1m	silt loam, A/B Horizon, embankment wall fill	10 YR 3/2	29	7.30	.025	.125	1.25
Ashley Unit 6-Zone 3-North	silt loam,	10 YR 4/2	30	4.84	.086	.43	4.3

Wall-7/21/05 (drc/bkm) 2m x 1m	A/B Horizon, embankment wall fill						
Ashley Unit 6-Zone 4-North Wall-7/21/05 (drc/bkm) 2m x 1m	silty clay loam, unmodified B-Horizon	10 YR 5/2	31	5.03	.071	.355	3.55
Ashley Unit 6-Zone 5-East Wall-7/21/05 (drc/bkm) 2m x 1m	silt loam, A/B Horizon, embankment wall fill	10 YR 5/3 10 YR 5/4 mixed	32	6.48	.033	.165	1.65
Ashley Unit 6-Zone 6-East Wall-7/21/05 (drc/bkm) 2m x 1m	silty clay loam, A/B Horizon, embankment wall fill	mixed 10 YR 5/4 10 YR 4/3 10 YR 6/6 (redox)	33	6.40	.027	.135	1.35
Ashley Unit 6-Zone 7-West Wall-7/21/05 (drc/bkm) 2m x 1m	silt loam, A/B Horizon, embankment wall fill	mixed 10 YR 5/3 10 YR 5/4	34	5.98	.068	.34	3.40
12 R 10 Fisher Unit 7-West Wall- Ap Zone 1-10/13/05 (bkm/jn) 2m x 1m	silt loam, Ap Horizon (plowzone)	10 YR 4/3	35	5.33	.072	.36	3.6
12 R 10 Fisher Unit 7-West Wall-(Level 1)-10/12/05 (bkm/jn) 2m x 1m	Silt loam, Ap Horizon (plowzone)	10 YR 4/3	36	5.46	.103	.515	5.15
12 R 10 Fisher Unit 7-B Horizon- Zone 2-10/13/05 (bkm/jn) 2m x 1m	silty loam, unmodified B-Horizon	10 YR 5/4	37	5.86	.023	.115	1.15
12 R 10 Fisher Unit 8-Ap Horizon- South Wall-10/14/05 (bk/jm)	silt loam, Ap (plowzone)	10 YR 4/3	38	5.40	.154	.77	7.7

1m x 1m							
12 R 10 Fisher Unit 8-Zone 2-Charcoal-10/14/05 (visible charcoal in sample) (bk/jm) 1m x 1m	silt loam, B-Horizon, charcoal flecks	10 YR 4/2	39	5.79	.163	.815	8.15
12 R 10 Fisher Unit 8-Zone 3-Sub-10/14/05 (bk/jm) 1m x 1m	silt loam, unmodified B-Horizon	10 YR 4/2	40	6.05	.174	.87	8.7
12 R 10 Fisher Unit 9-Zone 1-Ap-10/19/05 2m x 1m	silty clay loam, Ap (plowzone)	10 YR 4/2	41	5.13	.165	.825	8.25
12 R 10 Fisher Unit 9-Zone 2-10/19/05 2m x 1m	silty clay loam, A/B Horizon, embankment wall fill	10 YR 4/3	42	5.31	.109	.545	5.45
12 R 10 Fisher Unit 9-Zone 3-10/19/05 2m x1 m	silty loam, A/B Horizon, embankment wall fill	10 YR 4/4	43	4.90	.195	.975	9.75
12 R 10 Fisher Unit 9-Zone 4-Charcoal Zone-10/19/05 (visible charcoal in sample) 2m x 1m	silty loam with charcoal mixing, A/B Horizon, embankment wall fill	10 YR 4/4	44	5.10	.144	.72	7.2
12 R 10 fisher Unit 9-Zone 5-Natural-10/19/05 2m x 1m	silty loam, unmodified B-Horizon	10 YR 4/6	45	5.20	.131	.655	6.55

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