GUIDEBOOK NO. 11

GEOLOGICAL ASPECTS OF KEY ARCHAEOLOGICAL SITES IN NORTHERN KENTUCKY AND SOUTHERN OHIO

edited by

Timothy S. Dalbey

originally prepared for the 1992 Annual Meeting of the Geological Society of America

Columbus
2007

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Guidebook originally prepared for Field Trip 6 for the Annual Meeting of the Geological Society of America, Cincinnati, Ohio, October 26-29, 1992

Columbus
2007

CINCINNATI

OHIO DEPARTMENT OF
NATURAL RESOURCES
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DEDICATION

At the Geological Society of America meeting in Dallas, Texas, in November 1990, Jonathan Davis was elected as the Archaeological Geology Division Officer in charge of the field trip for the Cincinnati meeting. Jonathan and I briefly discussed some of the interesting sites that could be visited on the field trip. He requested that I send him an itinerary and literature on the sites as soon as possible, as he hurried down the hallway to catch a plane home. I sent Jonathan the information he requested on December 18, 1990. Unfortunately, Jonathan was tragically killed in an automobile accident a week before the information arrived. The field trip and guidebook are dedicated to Jonathan Davis.

Timothy S. Dalbey, editor

Typesetting and layout, and revision of some figures by Lisa Van Doren
Cartographic assistance by Edward V. Kuehnle and Robert L. Stewart

Cover illustration: Reconstruction of Hopewell ceremonialism. Photo courtesy of the National Park Service, Hopewell Culture National Historical Park.

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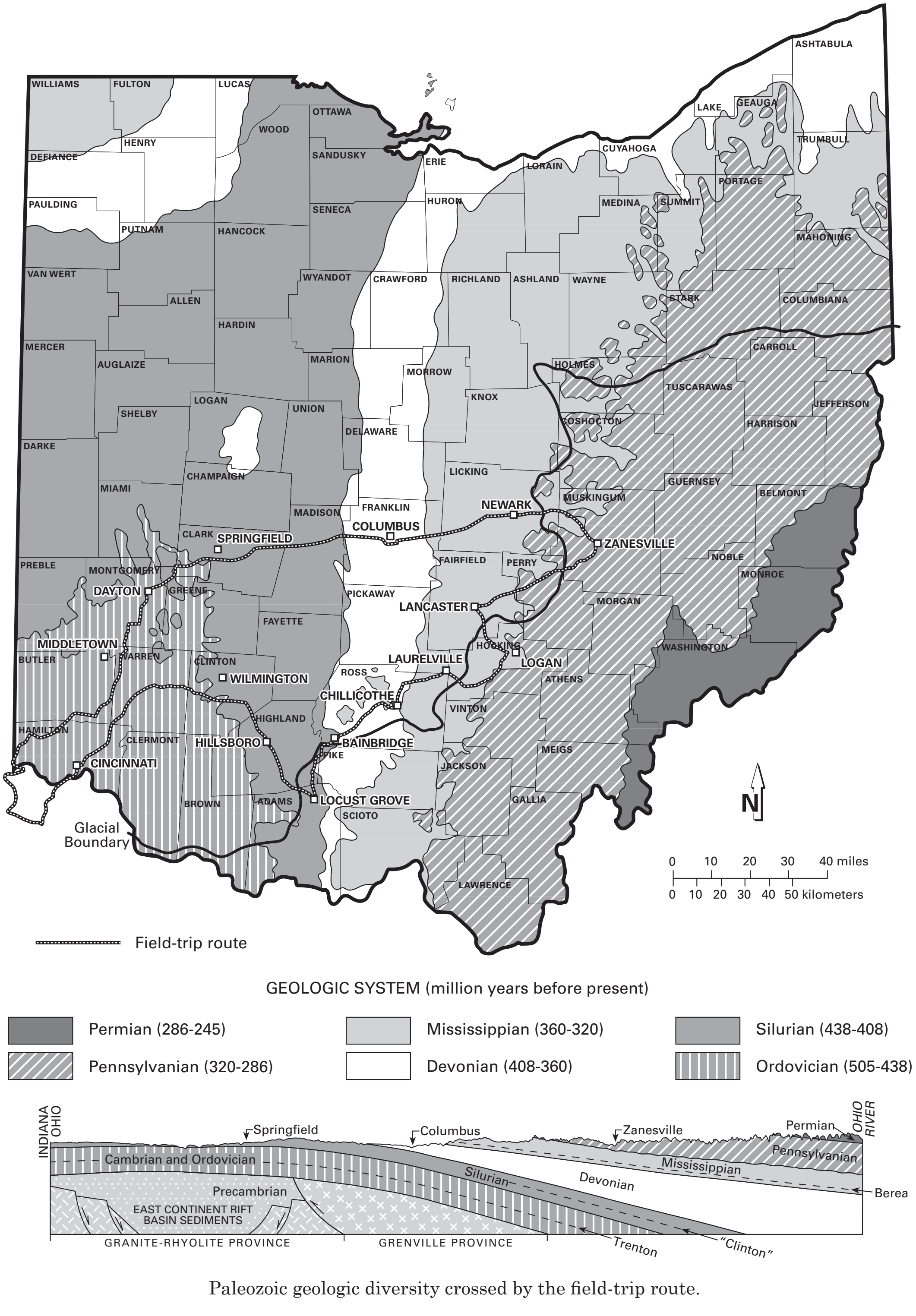
EDITOR'S NOTE

This guidebook originally was produced for use on a two-day field trip held in conjunction with the 1992 Annual Meeting of the Geological Society of America in Cincinnati, Ohio. At that time, because of time constraints, a printer's proof was used to make only enough copies of the guidebook to distribute to field-trip participants. The intention was to produce a final printed version for general distribution after the meeting. Now, 15 years later, the Division of Geological Survey has finally fulfilled that intention. We regret that it has taken so long to publish this guidebook.

All chapters were reviewed for currency, but no major revisions were attempted. The text and figures were edited more thoroughly than they were for the 1992 version. Some authors have made alterations in their respective chapters. Several authors have since moved on to other posts, and current personnel at the archaeological sites reviewed the site descriptions. Some additional citations of pertinent publications have been added, but no comprehensive literature search for recent publications was undertaken. An additional reading list has been added at the end of this guide (p. 119).



Paleozoic geologic diversity crossed by the field-trip route.

GEOLOGICAL ASPECTS OF KEY ARCHAEOLOGICAL SITES IN NORTHERN KENTUCKY AND SOUTHERN OHIO

by
Timothy S. Dalbey

INTRODUCTION

The Geological Society of America (GSA) national meeting was held in Cincinnati in 1961, 1981, and 1992. This guidebook was prepared for a field trip in conjunction with the 1992 meeting.

At the 1961 meeting, an excellent field-trip guidebook (Geological Society of America, 1961) covered many of the geological aspects of southern Ohio and specifically the Cincinnati area. Since 1961, many new road cuts have been created, such as those along Interstates 71, 74, and 275. These new road cuts have exposed fresh Ordovician fossil deposits, especially on the northern Kentucky side of the metropolitan area.

There was no archaeology field trip at the 1961 GSA meeting. In 1961, anthropology was taught as a subdiscipline of the Sociology Department at the University of Cincinnati, and no archaeology was associated with the department. Archaeology was active in the University of Cincinnati Classics Department, which sponsored excavations in the Mediterranean. George Barbour of the Geology Department worked in the Old World. The local archaeology was done primarily by Charles Oehler of the Cincinnati Museum of Natural History and, through the 1960's, by Raymond Baby and Martha Potter Otto of the Ohio Historical Society, based in Columbus, Ohio.

At the 1981 GSA meeting, Stein and others (1981) led a geoarchaeology field trip to the Green River and Mammoth Cave National Park in Kentucky, 300 km (185 miles) southwest of Cincinnati. The Green River portion of the trip stopped at key Pleistocene and Holocene locations depicting the evolution of the river. A stop also was made at the important Carlston Annis Mound archaeological site. Site formation processes, stratigraphy, and taphonomy were discussed, as well as the geological context of the changing fluvial history of the Green River at the site. The other portion of the field trip was devoted to the prehistoric remains within the geologic context of Mammoth Cave. The atmospheric conditions in the cave were favorable for the preservation of perishable goods and by-products of the prehistoric inhabitants. The prehistoric plant remains that have been recovered provide valuable evidence of plant use, diet, and subsistence in this part of Kentucky.

The goal of the 1992 GSA field trip was to provide a general overview of the bedrock geology and geomorphology of southwestern Ohio and visit key archaeological sites spanning most time periods from the Late Glacial to Paleoindian to the Fort Ancient culture. Many of the locations visited on this field trip (fig. 1) were chosen by the prehistoric inhabitants because of their unique geologic context. Many different physiographic areas are represented, ranging from the Kentucky Bluegrass Region to the Ohio Till Plains and the Unglaciated Allegheny Plateau of southeastern Ohio (fig. 2). Unfortunately, as with any field trip of this nature, many other excellent sites or sections were passed over because of time limitations. Two optional stops were included—the Ohio Historical Center in Columbus and Fort Hill in Highland County. The two-day field trip was about 800 km (500 miles) long; the overnight stop was at Dillon State Park.

Between the early 1960's and the early 1990's, much archaeological work was done in southern Ohio. This guidebook describes some of that research, as well as some of the sites that have not been researched since the turn of the century or that have been destroyed. Most sections of the guidebook were written by an investigator who has done research at the site he or she describes. The brief stop descriptions below list the expertise of the individual authors and their contributions to the guidebook:

STOP 1.—Big Bone Lick, Kentucky, by Kenneth B. Tankersley, formerly of the Illinois State Museum, now at Northern Kentucky University, Department of Sociology, Anthropology & Philosophy, Highland Heights, KY 41099. Ken has been involved in numerous geoarchaeology research projects in his career and has spent several field seasons at Big Bone Lick working out the stratigraphy of the site. He plans to return to excavate the Late Prehistoric bison beds at the lick.

STOP 2.—Shawnee Lookout Archaeological District, southwest Ohio, by Timothy S. Dalbey, formerly with the U.S. Army Corps of Engineers in Fort Worth, Texas, presently at Southern Methodist University, Department of Anthropology, Dallas, TX (home address: 2719 Santa Cruz Drive, Dallas, TX 75227-9341). Tim worked at Shawnee Lookout on the Headquarters site and directed archaeological work at the Late Archaic DuPont site and conducted research on several aspects, such as freshwater molluscan fauna, chert resources, and glacial geomorphology.

STOP 3 (drive-by).—Miamisburg Mound by Timothy S. Dalbey.

STOP 4.—SunWatch archaeological site, by Christopher A. Turnbow, formerly Associate Director at SunWatch National Historic Landmark, now in Albuquerque, New Mexico. During his tenure at the site, Chris conducted excavations and researched Fort Ancient house construction and experimental archaeology. Sandra Lee Yee, current Site Manager for SunWatch Indian Village and Assistant Curator of Anthropology for the Dayton Society of Natural History, reviewed and revised the site description.

STOP 5 (optional).—Ohio Historical Center, by Martha Potter Otto, Ohio Historical Society, 1982 Velma Avenue (I-71 and 17th Avenue), Columbus, OH 43211. Martha is a senior staff member of the Ohio Historical Center and is involved with all aspects of the museum from curation and collections to administration and field research on all aspects of Ohio archaeology, especially Hopewell and Adena.

STOP 6.—Prehistoric features of Licking County, Ohio, by Bradley T. Lepper, Ohio Historical Society, 1982 Velma Avenue (I-71 and 17th Avenue), Columbus, OH 43211, and Tod L. Frolking, Department of Geology and Geography, Denison

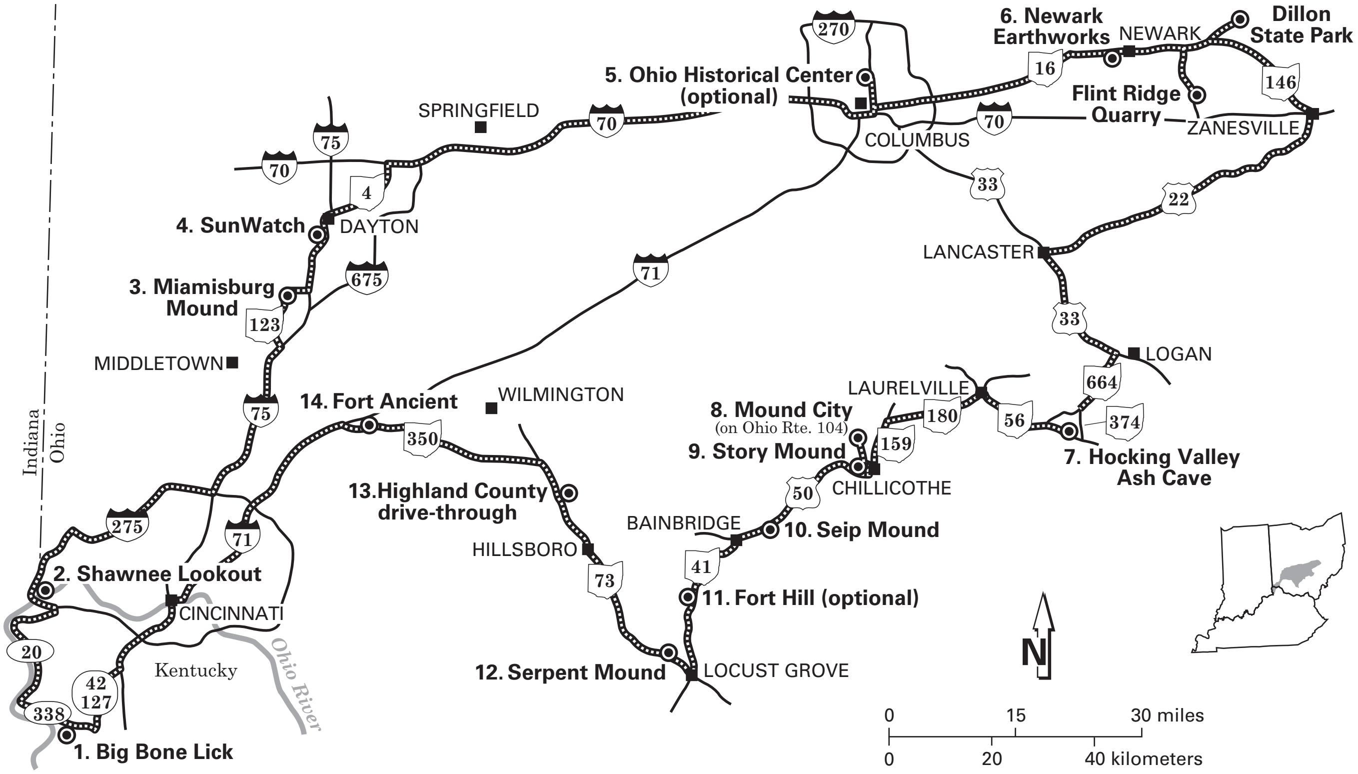


FIGURE 1.—Map of field-trip stops.

University, Granville, OH 43023. This stop includes five locations: the Burning Tree Golf Course, a *circa* 1990 mastodon excavation; the Flint Ridge prehistoric quarries; Newark Earthworks Great Circle; Newark Earthworks Observatory Circle and Octagon; and the Licking County Archaeology and Landmark Society Research and Education Center. The authors have conducted excavations at the multicomponent Munson Springs site, applied a multidisciplinary study to the Late Pleistocene Burning Tree mastodon site, and, using remote-sensing techniques, have attempted to trace a set of parallel earthen walls from the Octagon at the Newark Earthworks to Chillicothe.

STOP 7.—Hocking Valley—Ash Cave, by Timothy S. Dalbey. This area has not seen much recent archaeological research directly; however, the author was involved with the dating of carbonized plant remains from Ash Cave during his tenure at the Southern Methodist University Radiocarbon Laboratory. The Mississippian sandstones forming the Hocking Valley provide excellent examples of stratigraphy and sedimentation.

STOP 8.—Mound City Group, by Robert Petersen, formerly at Hopewell Culture National Historical Park, presently at the Dayton Aviation Heritage National Historic Park, P.O. Box 9280, Dayton, OH 45409, and Timothy S. Dalbey. During his tenure, Petersen operated the visitor center, developed educational programs for the National Park Service, and served as curator of collections. Bradley T. Lepper reviewed the stop description for currency.

STOP 9.—Story Mound, by Timothy S. Dalbey. Enclosed within the modern urban setting of Chillicothe and situated on the floodplain below the historic Adena mansion, this mound is in many ways similar to the original Adena Mound, which was destroyed.

STOP 10.—Seip Mound, by Martha Potter Otto. She describes some of the mortuary practices of the Hopewell and ritual aspects of the specialized workshop areas revealed by excavations at this large Hopewell earthwork.

STOP 11 (optional).—Fort Hill, by Martha Potter Otto. She describes the construction of the "fort" and the ongoing research at this mostly unstudied Hopewell earthwork.

STOP 12.—Serpent Mound, by Martha Potter Otto and Timothy S. Dalbey. Serpent Mound is one of the first areas set aside by the Ohio Historical Society strictly because the site is unique and because of the early efforts of Frederic Ward Putnam. This stop is one of the few known sites where a village, mound, and effigy mound are all Adena related.

STOP 13 (drive through).—Bedrock and glacial geology features between Chillicothe and Fort Ancient, with an emphasis on Highland County, Ohio, by Timothy S. Dalbey.

STOP 14.—Fort Ancient, by Jack Blosser, Ohio Historical Society, Fort Ancient State Memorial, 6123 Ohio Route 350, Oregonia, OH 45054. Jack is responsible for six other properties owned by the Ohio Historical Society, as well as educational programs at Fort Ancient, in addition to his own research into Hopewell village craft specialization and astronomical aspects of the fort design.

FIGURE 2.—Physiography of Ohio (from Bier, 1967) with field-trip route superimposed.

NOTES

The figures and tables in the introductory articles are numbered consecutively; the figures and tables for the stop descriptions are numbered separately for each stop—figures 1-1, 1-2, etc. for Stop 1, figures 2-1, 2-2 etc. for Stop 2, and so on. The references for the introductory articles and the stop descriptions are listed at the end of each article or stop description.

Measurements in this guidebook are in metric units. For road distances, English equivalents are given in parentheses. A conversion table is provided below.

Multiply metric unit	*by*	*to get English unit*
millimeter (mm)	0.039	inch
centimeter (cm)	0.39	inch
meter	3.28	foot
kilometer (km)	0.62	mile
square centimeter (cm^2)	0.155	square inch
square meter	10.76	square foot
square kilometer (km^2)	0.39	square meter
hectare	2.47	acre
cubic meter	35.31	cubic foot
liter	1.06	quart
gram (g)	0.035	ounce (avoirdupois)
kilogram (kg)	2.205	pound (avoirdupois)

The following definitions are considered standard reporting practices by dating laboratories and the journal Radiocarbon:

- ^{14}C refers to the dating technique of measuring the radioactive decay of the ^{14}C isotope. The half-life of this isotope is 5,730 ±40 years. This technique is commonly referred to as radiocarbon dating.
- B.P. refers to before present; the present is considered 1950. Any B.P. date should be subtracted from the year 1950.

ACKNOWLEDGMENTS

This field trip would not have been possible without the help and cooperation of Thomas M. Berg and Robert G. Van Horn of the Ohio Department of Natural Resources, Division of Geological Survey. I thank all the contributing authors for their generous contributions to the guidebook and hosting the tour at their respective sites during the 1992 field trip. Carol Naab prepared the original manuscript. I thank Rodney Riggs and Beverly Mitchum for enlightening me about Mexico Bottom (Indiana). I am very grateful for the assistance and patience of my wife, Barbara, who helped me with every aspect of the project.

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Bier, J. A., 1967, Ohio landform map: Ohio Division of Geological Survey.

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Stein, J. K., Watson, P. J., and White, W. B., 1981, Geoarchaeology of the Flint Mammoth Cave system and the Green River, western Kentucky, *in* Roberts, T. G., ed., GSA Cincinnati '81 Field Trip Guidebooks, v. III: Washington, D.C., American Geological Institute, p. 507-542.

ANCIENT RIVERS, GLACIERS, FLOODS, AND GRAVEL BARS— THE DERIVATION OF PALEOZOIC CHERT AT CINCINNATI

by
Timothy S. Dalbey

The bedrock around Cincinnati is of Ordovician age and does not contain chert. In order to understand the derivation of chert used by prehistoric cultures, it is important to comprehend the geologic setting in the Greater Cincinnati area. In this section, we will consider the problem from a geological perspective involving two sites along the Ohio River. The DuPont site is middle Late Archaic (4,700-3,700 years B.P.) and is located at the confluence of three rivers—the Whitewater, the Great Miami, and the Ohio—in Hamilton County, Ohio, at the Ohio-Indiana-Kentucky boundary (figs. 3, 11; also see fig. 2-1, Stop 2). The Ferris site is Early Archaic (*circa* 8,550-7,000 years B.P.) and is located along the Ohio River in Clermont County, Ohio, about 80 km (50 miles) east of the DuPont site (figs. 3, 11).

CHERT STUDY IN THE CINCINNATI AREA

Five partially excavated features from the DuPont site yielded 3,426 chert debitage artifacts (Featherstone, 1977). An extensive surface collection of the Ferris site (Theler and Dalbey, 1974) yielded 3,243 chert tools (n = 366) and debitage (n = 2,877). The types of chert represented by the artifacts at the two sites varied considerably in color (chemical elements), crystal inclusions, fossil inclusions, texture, and silica content (reflecting flaking properties). Many of the cherts did not compare with the eight classic chert types described by Stout and Schoenlaub (1945). Therefore, many of the cherts represented at the two sites must have been derived from river gravel bars or quarried from unknown chert-bearing formations within a wide radius of the Cincinnati area.

Three major geologic aspects may account for chert variability and availability in rivers draining the nonchert-bearing Ordovician bedrock in the Greater Cincinnati area: (1) Paleozoic bedrock geology and tectonics resulted in the Cincinnati Arch and the Jessamine Dome to the south; (2) Paleozoic bedrock underwent a long period of erosion through the Mesozoic and the Cenozoic, and the drainage pattern was different than that of the present; (3) Quaternary glaciations transformed the landscape, changed drainage systems, and created the modern geomorphology and topography.

Over the years, I collected chert from a variety of geologic formations, glacial features, and river gravel bars within a large area surrounding Cincinnati. I consulted the geological

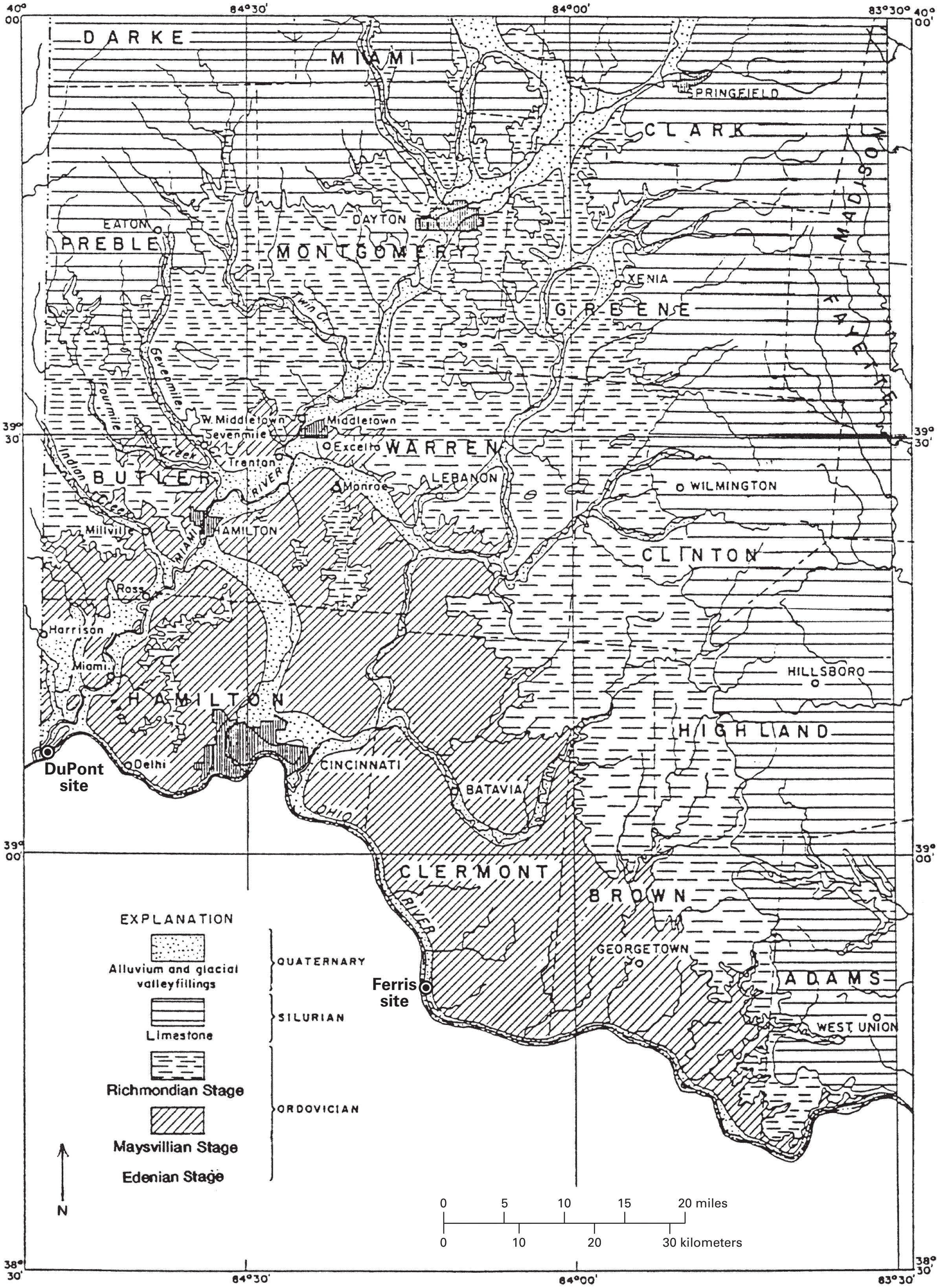


FIGURE 3.—Generalized bedrock geology of southwestern Ohio and locations of the DuPont and Ferris sites discussed in the text (modified from Spieker and Durrell, 1961, fig. 2).

and archaeological literature covering more than five states (Price, 1921; Olafson, 1964; Hastings, 1965, 1971; Murphy and Blank, 1970; Carskadden, 1971; Converse, 1972; Morton and Carskadden, 1972; Murphy, 1972; Carskadden and Donaldson, 1973; Vickery, 1974; Theler, 1978). I visited outcrops described in the literature (McFarlan and Walker, 1956; Huddle and others, 1963; McGrain and Dever, 1967; Nicoll and Rexroad, 1968; Shaver and others, 1970; Schwalb, 1975; DeLong, 1972; Gray, 1972) in an attempt to sample as much chert variability as possible along an outcrop. In some instances, the chert deposits were difficult to locate, such as those at Kentucky Flint Ridge in Breathitt County, Kentucky. Here, the chert formed a mountain cap rock over a coal seam, and the entire chert deposit had been dynamited away during strip mining. Huge chert slabs were found at the bottom of the mountain ravines covered by strip-mining-spoil debris. In some instances, chert-bearing formations spread through many counties, and the total variability of some cherts is not known. In other instances, the literature sources were dated or in the process of changing from new research. Therefore, many of the terms used for the cherts reflect geologic groups/formations/members that need to be updated (Ettensohn, 1992).

Once chert locations were identified, I could generate geologic maps and plots of chert-bearing bedrock formations. Then, I superimposed post-Paleozoic drainages over the geologic maps to see which drainages flowed through chert-bearing areas and were capable of carrying chert downstream. In some instances, gravel bars in various reaches of some rivers were checked for the types of chert. Many of the major tributaries of the Ohio River and the Ohio River itself are inundated by a system of locks and dams. The modern Ohio River is a system of 26 lakes that have a maintained pool depth of 8 meters, submerging gravel bars in the Ohio River and mouths of tributaries. On occasion in drought years, the gravel bars are exposed at the mouths of major tributaries, allowing chert to be collected from the gravel bars. Ultimately, plots of chert varieties from gravel bars up a particular river could prove very informative. Bedrock geologic maps (see figs. 9-13) plot the locations where chert was collected; these maps represent only a beginning.

Chert variability at a site reflects the various geologic processes that have created the existing topography where chert can be exploited. Chert bedrock quarries are indeed natural occurrences, but the exploitation of certain chert deposits is a culturally selective process. Once the derived natural chert variability and availability are known, culturally selected bedrock quarries may be easier to identify and locate.

AREAS OF ORDOVICIAN PALEOZOIC BEDROCK WITHOUT CHERT

The fossiliferous shale and limestone strata in the Cincinnati area represent the "type section" for the Upper Ordovician Cincinnatian Series, some 450 million years ago (fig. 4). These highly fossiliferous marine strata were deposited on an epicontinental sea floor that covered most of North America at the time (fig. 5). The rocks show ripple marks, channel fillings, and reworked shell "hash" zones, reflecting wave action and currents commonly found today in ocean water less than 198 meters deep. Exposed sections to the east and south near Cynthiana, Kentucky, are older Ordovician strata thought to be transitional to the Upper Ordovician (fig. 6).

Ray (1974) provided a broad perspective on the physiography of the Ordovician. The Inner Bluegrass area (fig. 7) consists of limestones and shales of Middle Ordovician age exposed near the center of the Jessamine Dome around Lexington, Kentucky, about 130 km (80 miles) south of Cincinnati. The Unglaciated Outer Bluegrass surrounds the Inner Bluegrass, extending east, south, and west to boundary escarpments of the region. It consists of successive concentric bedrock zones of outward-dipping formations of Late Ordovician, Silurian, Devonian, and Mississippian age. Thus, chert-bearing formations in Silurian through Mississippian rocks can be more than 100 km (62 miles) apart on opposite sides of the dome. Major streams are entrenched many meters below the upland surface. A mature topography of steep-sided, narrow, rocky, leached, clay-capped ridges having elongate spurs is the result of deep incision and headward erosion of tributaries.

To the north of the Unglaciated Outer Bluegrass is the Glaciated Outer Bluegrass, which includes the Cincinnati area. The pre-Quaternary topography was similar to the Unglaciated Outer Bluegrass, but Quaternary glaciation filled in valleys and planed off areas, particularly north of the Wisconsinan glacial boundary.

PALEOZOIC OF INDIANA AND KENTUCKY

Surrounding the Ordovician in the tri-state area is an almost continuous belt of Silurian rocks; the widest exposure is on the east and west flanks of the Cincinnati Arch/Jessamine Dome south of the Wisconsinan glacial boundary. The Brassfield and Laurel Limestones occur on the west flank in Indiana; the Brassfield also occurs on the east flank in Ohio. The Silurian belt narrows to the south in Kentucky around the Ordovician Bluegrass plateau. A well-developed cuesta was formed along the western erosion-resistant Silurian formations and created a north-south drainage divide at Madison, Indiana. The Silurian divide is known as the Laughery Escarpment and separates the drainage of the Dearborn Upland to the east into the present-day Whitewater River, which drains the Brassfield Limestone, containing white-gray fossiliferous cherts, and the Laurel Limestone, containing pink-gray cherts (figs. 8, 9).

To the west of the Laughery Escarpment, Silurian beds dip west, where deep incision by streams into easily eroded limestones, siltstones, and shales of Devonian and Mississippian age created the Scottsburg Lowland. The west boundary of the lowland is formed by the Knobstone-Muldraugh Hill Escarpment, which forms a concentric ring at the outer boundary of the Bluegrass region. The Knobstone-Muldraugh Hill Escarpment is formed by resistant limestone of Mississippian age capping sandstones, siltstones, and shales.

The concentric ring continues from the west side of the Outer Bluegrass around to the south, where the escarpment is known as Muldraugh Hills. Here, the escarpment has been eroded to form knoblike hills that outline the Bluegrass region. The knobs consist of Devonian limestones that contain nodules of Boyle chert. The Devonian is capped by resistant

Mississippian limestones that contain chert in the Paoli and Haney limestones.

The Mississippian is divided into two parts: the Dripping Springs Escarpment to the west and the outer broad, karstic Mississippian Plateau to the east, consisting of extensive St. Louis and Ste. Genevieve limestones and localized occurrences of nodular and bedded chert (fig. 10). The Mississippian limestones in Kentucky (and elsewhere) represent the last widespread carbonate-producing epeiric sea in North America.

To the east and southeast in Kentucky, a higher plateau consists of early Pennsylvanian-age shales, cherts, siltstones, sandstones, and coal beds in a dissected upland of rough ridges and V-shaped valleys (Rice and others, 1979). The plateau forms a resistant border known as the Pottsville Escarpment, which contains bedded Kentucky Flint Ridge cherts. Four rivers begin in the area; drainage relief is as much as 700 meters. The headwaters of the modern Licking River begin in the mountains (1,067 meters above sea level) and drain the Pottsville Escarpment, including the chert-bearing Mississippian bedrock. Thus, as the Licking River flows northward to Cincinnati, it carries Paoli, Haney, St. Louis, Ste. Genevieve, and Kentucky Flint Ridge cherts to the Ohio River at Cincinnati.

PALEOZOIC OF OHIO

The Silurian section in Ohio also forms a concentric ring to the north around the Cincinnati Arch (fig. 11, frontispiece on p. viii). In the unglaciated areas to the east, Silurian limestones form resistant escarpments such as the Manchester Divide. Brassfield limestone containing poor-grade chert nodules lies unconformably over the Ordovician. Above the Brassfield, shales are interspersed with more massive Bisher-West Union limestones containing good quality chert. The steep hills incised into Silurian bedrock are capped by resistant Niagaran limestone. To the north, large blocks of Silurian Brassfield bedrock were dislodged and pushed southward by Quaternary glaciers. Some localized chert nodules and lenses occur mostly to the north in Cedarville-Guelph limestones and dolomites.

Massive dolomitic limestones of Devonian age occur in a narrow band in Ohio. These limestones are commonly quarried for use in the building industry. The Middle Devonian Columbus Limestone contains sparse and sporadic chert zones. The Middle Devonian Delaware Limestone contains sporadic dark-brown chert nodules. The more widespread Upper Devonian Ohio Shale makes a subtle transition to the Lower Mississippian Bedford Shale. The Lower Mississippian represents a riverine deltaic system of sands and shales that once extended south from the craton and formed the Berea Sandstone (see Stop 7, Hocking Valley). The Berea Sandstone is a resistant formation capping hilltops in the unglaciated areas of south-central Ohio (see Stop 11, Fort Hill).

Farther east, across the Scioto River valley, massive Middle Mississippian sandstones form the Allegheny Plateau. The sandstones (Cuyahoga and Logan Formations) represent a series of deltas deposited along a north-south-trending shoreline and represent the first stage, or front, of a long sequence of terrestrial deposition resulting from uplift and erosion of mountains to the east throughout the rest of the Carboniferous (see Stop 7). The Black Hand Sandstone Member of the Cuyahoga Formation is a resistant cliff-forming unit that represents a remnant delta composed almost entirely of quartz sand. The quartz-rich deltaic sands were not uniformly deposited; other delta facies consisting of less consolidated sediments have been deeply incised, creating deep gorges. No chert is known to occur in these Mississippian deposits.

The end of the Mississippian is marked by an unconformity; the overlying Lower Pennsylvanian Pottsville Group consists of conglomerates, sandstones, shales, coals, and marine limestones. Boggs and Mercer cherts form resistant layers commonly interspersed with coal and shale. The Pottsville Group was deposited unevenly over a deeply dissected Mississippian surface. It crops out in sporadic locations and consists of varying lithologies and thicknesses (Collins, 1979).

The Allegheny Group of Pennsylvanian age is noted for freshwater limestone strata interspersed with marine sedimentary deposits similar to the Pottsville. The limestones in the Allegheny Group yield the most numerous types of chert. The lithologic variability reflects facies changes over time. The various chert varieties are known as Zaleski, Plum Run, Vanport (Ohio Flint Ridge), and Coshocton. Over 32 named beds represent alternating marine and freshwater environments characteristic of a coastal estuary with a lush vegetation. The Lower and Middle Kittanning coals are of major economic importance.

The Pennsylvanian-age Conemaugh Group represents an even longer sequence than the Allegheny Group. This sequence is mostly devoid of coal. Freshwater limestones and red beds increase toward the top of the sequence. Two chert varieties are present in the Ohio Conemaugh: Brush Creek chert was collected low in the section in freshwater limestones; Meigs chert is a bit higher in the section but was not collected and is not shown on figure 11. The Monongahela Group, the uppermost Pennsylvanian sequence of alternating coals and limestones, was not collected, although a couple of chert varieties have been informally discussed (Morton and Carskadden, 1972; Carskadden and Donaldson, 1973) in the area of Ohio that is drained by the Muskingum River.

PALEOZOIC OF WEST VIRGINIA AND PENNSYLVANIA

In West Virginia, the Big Sandy, Kanawha, and Hughes Rivers drain the Pennsylvanian Kanawha Series, which is rich in black chert (fig. 12). The New River flows north from North Carolina across easternmost Tennessee through chert-bearing Mississippian and Pennsylvanian formations of the Clinch Mountain Belt (Milici and others, 1979) and into the Kanawha River at Charleston. The combined rivers then flow a short distance over a steep gradient into the Ohio River. Gravel bars at the confluence of the New River and the Kanawha River have not been collected, but it would be very interesting to see the content of the gravel bars that have been deposited all the way from North Carolina. The other chert-bearing deposit in West Virginia is the Permian-age Dunkard Series (Arkle and others, 1979). This chert is

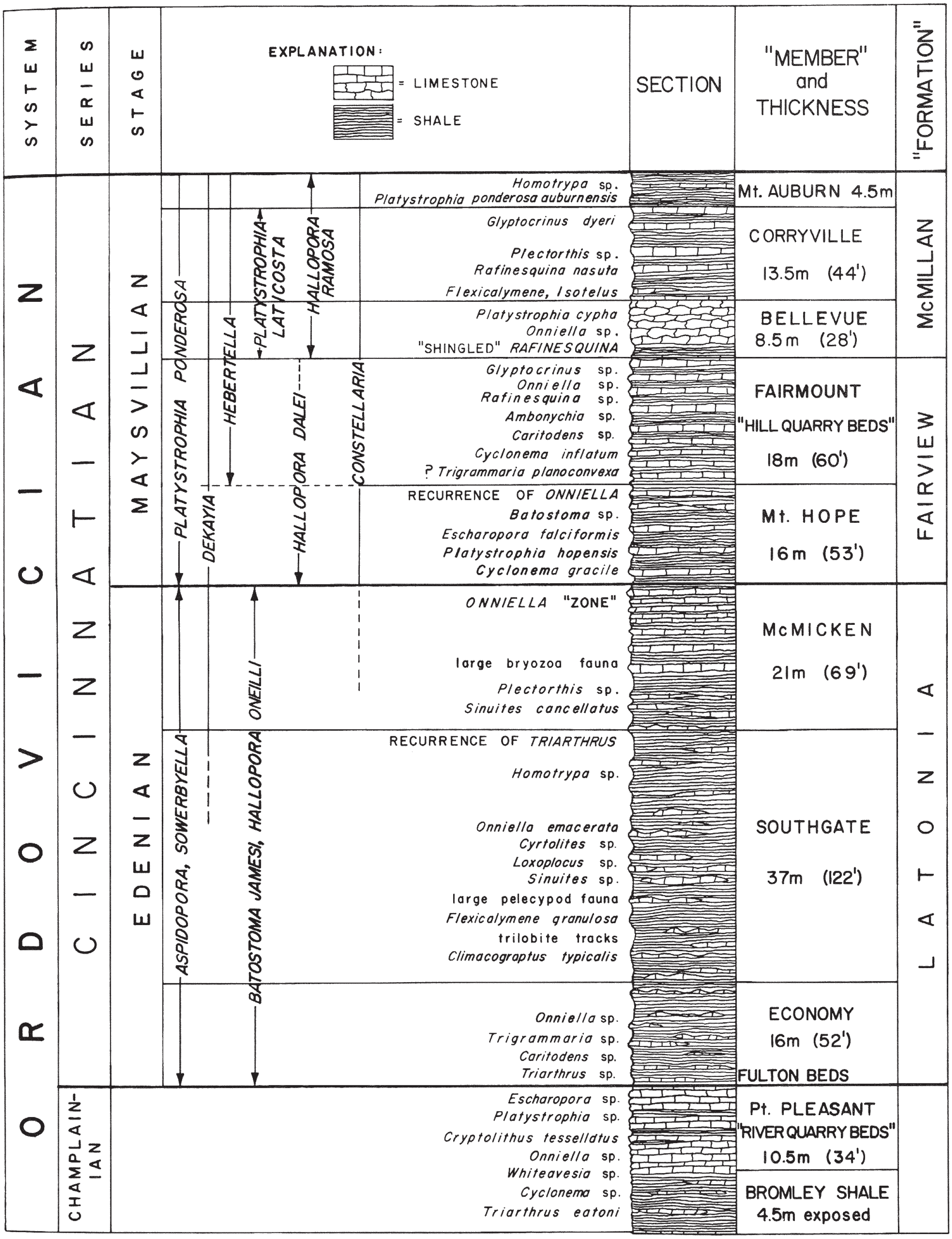
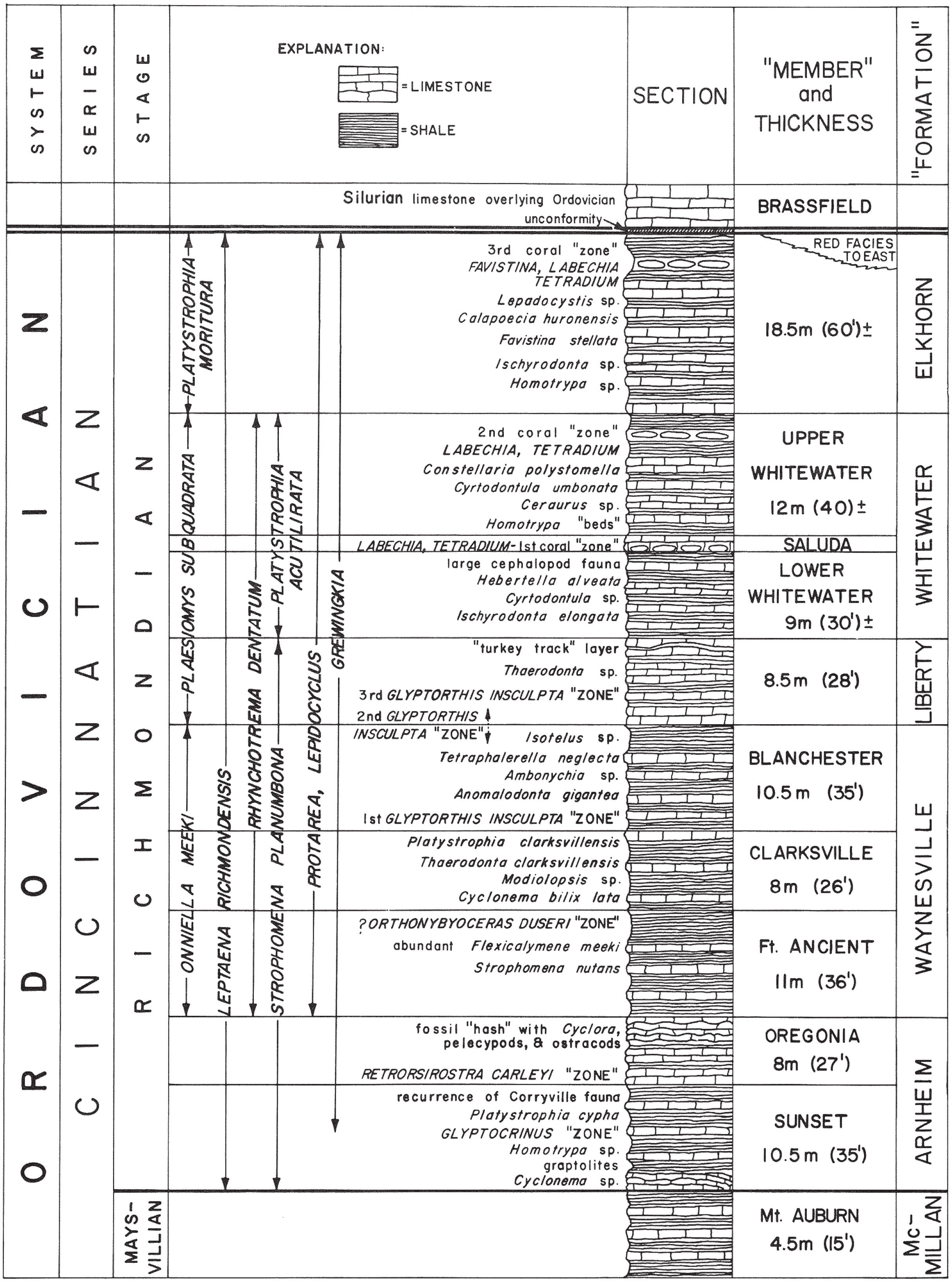


FIGURE 4.—Biochronostratigraphic (Edenian to Richmondian) and biolithogeographic (south to north) units represented by and Pope, 1961, fig. 3).



fossils of the Cincinnatian series of the Upper Ordovician (from Davis and Cuffey, 1998, p. 21-22; revised from Caster, Dalvé,

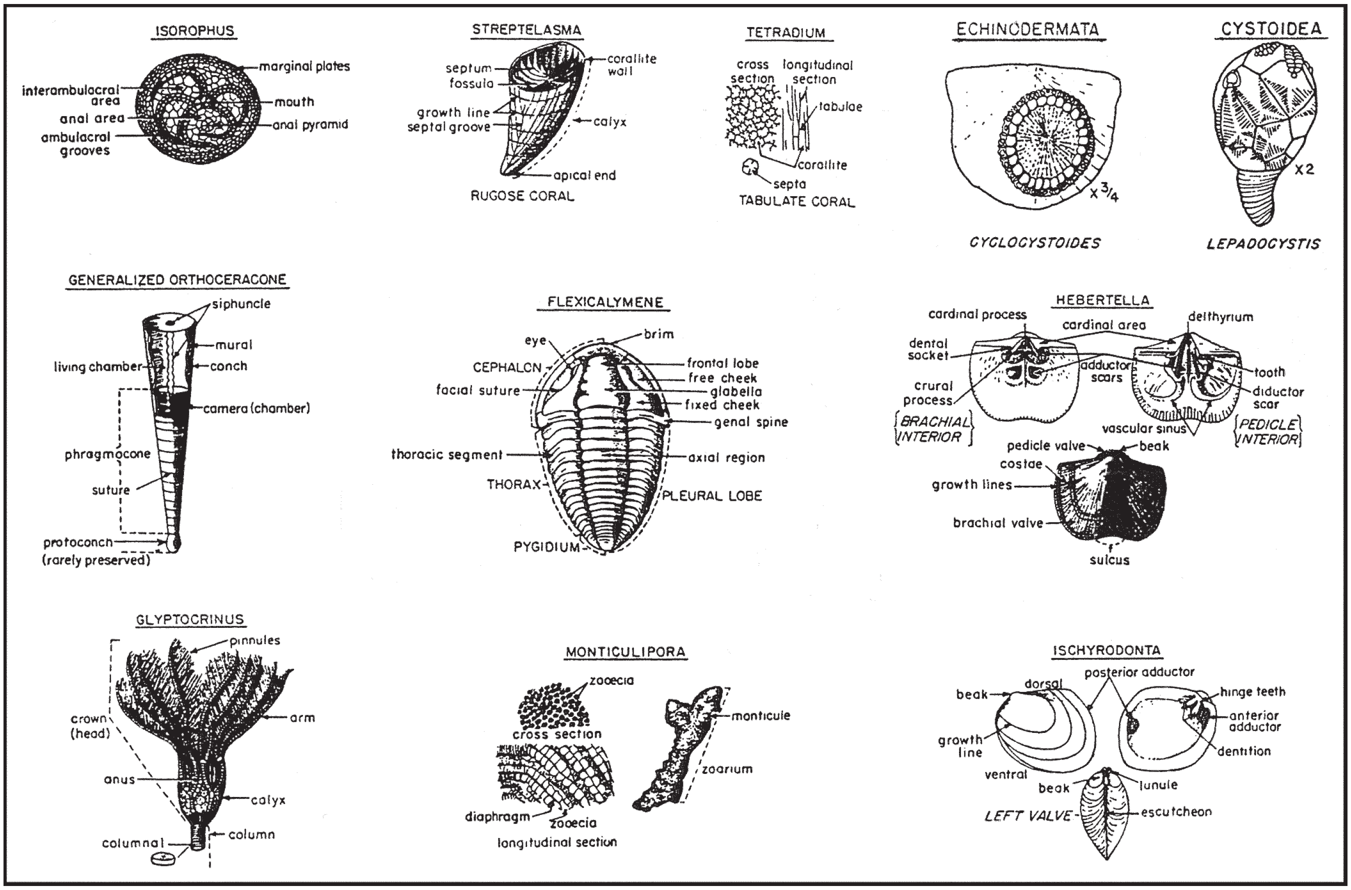


FIGURE 5.—Morphology of rare and important Cincinnatian type fossils (from Caster, Dalvé, and Pope, 1961, fig. 5).

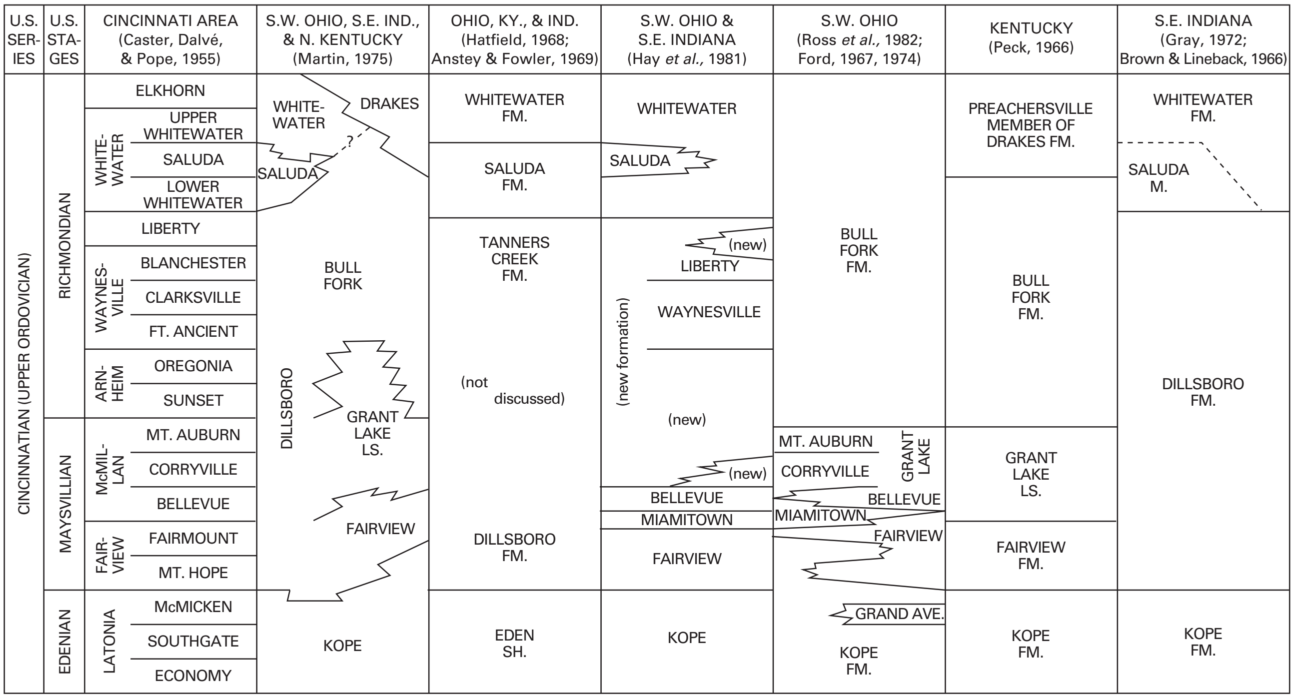


FIGURE 6.—Stratigraphic nomenclature of Cincinnatian rocks in the tri-state area (Ohio-Kentucky-Indiana) (from Davis, 1985, with permission).

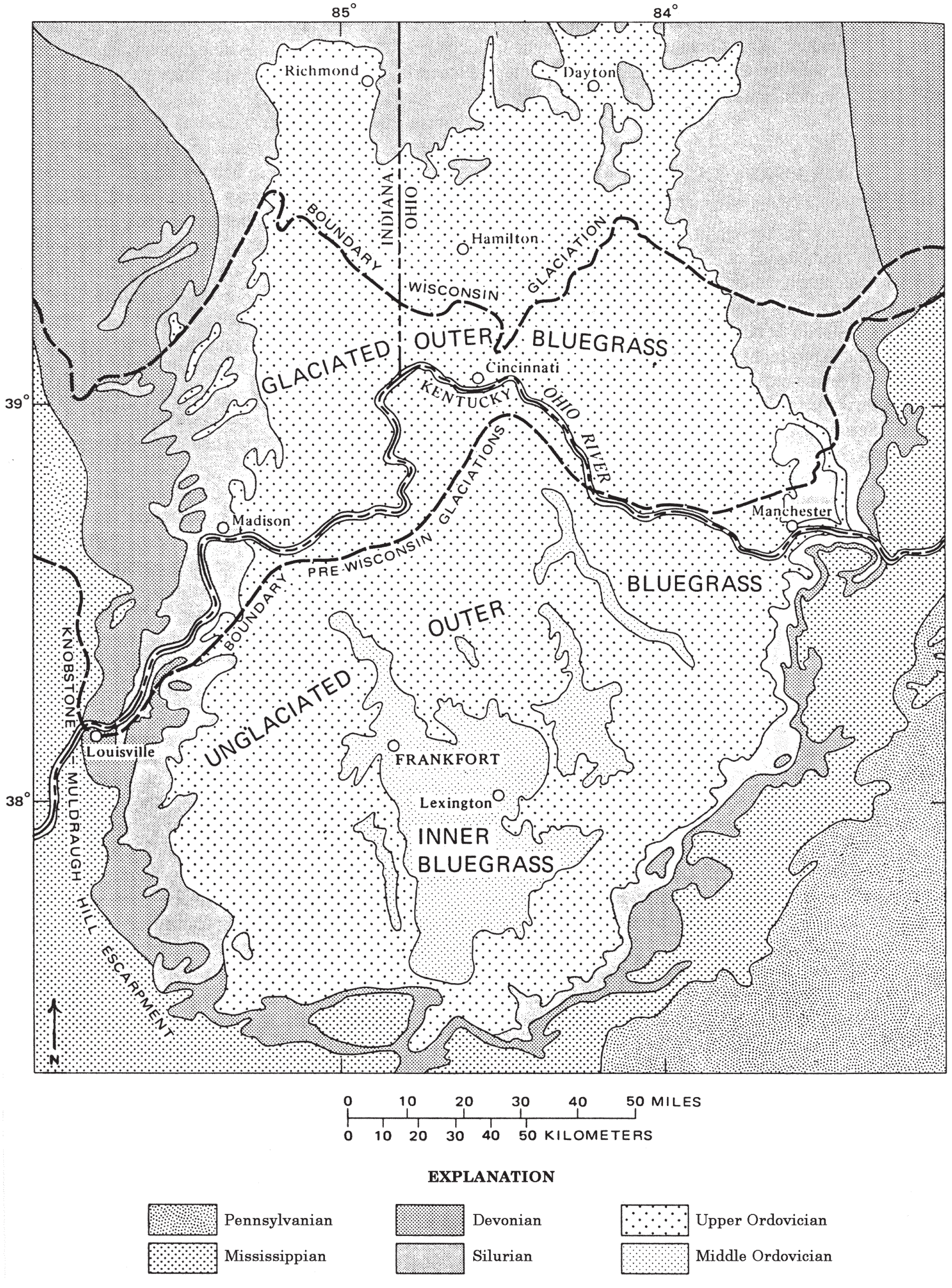


FIGURE 7.—Generalized physiographic map of the Bluegrass region of Ohio, Indiana, and Kentucky (from Ray, 1974, fig. 4).

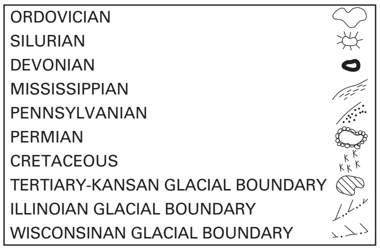
referred to as Hughes River chert in the northern part of West Virginia.

Cherts from southwestern Pennsylvania were not collected; however, discussions with people interested in chert in West Virginia described a red "jasper" they had located in Pennsylvania. The chert supposedly occurs east of Pittsburgh in the Mississippian red beds of the Mauch Chunk Formation, which is drained by the Monongahela River (fig. 13). A fine-grained red quartzite is common in gravel bars of the New River near the town of Del Rio, easternmost Tennessee. It is possible that this quartzite may be carried downstream and deposited in the Kanawha River and eventually make its way to the Ohio River. At some archaeological sites in the Cincinnati area, artifacts have been found that are made from a red material that could be from either Del Rio, Tennessee, or from the Mauch Chunk Formation, or perhaps from a chert-bearing locality that is unknown.

TEAYS EROSION

There is no Mesozoic or Cenozoic bedrock in the Cincinnati region. It is generally accepted that since Late Paleozoic time the area has been above sea level and subjected to subaerial erosion. Therefore, the post-Paleozoic history of the area is inferred from the geomorphology and begins with the oldest landforms and unconsolidated deposits. The oldest features are high-elevation rolling uplands covered with alluvial sands and gravels. The upland flats, ridge crests, and isolated hilltops have 30 to 60 meters of relief. The Cincinnati area and the Inner Bluegrass farther south, which is presently at elevations of 274 to 305 meters above sea level, underwent uplift at the end of the Paleozoic, and any post-Ordovician strata were eroded away. According to Ray (1974), by late Miocene the Inner Bluegrass surface of gently rolling, low relief may have been only 100 meters above sea level. The regional uplift history is not entirely known.

Regional uplift either at the end of the Miocene or in the early Pliocene rejuvenated stream erosion. Stream entrenchment of upland surfaces on the Allegheny Plateau left broad valley floors bounded by high, steep walls to the east. At Parker, Pennsylvania, a broad, perched, high valley ("strath") was defined as the post-Miocene stage below the uplifted Lexington paleosurface. The Parker Strath has been identified as a regional feature and is considered the first eroded valley surface below the original plain (fig. 14); it is considered to be Pliocene. Hence, the major rivers of the Pliocene, such as the Old Kentucky and the Old Licking Rivers, flowed north across Ordovician bedrock and cut valleys 30 to 60 meters below the surface. The Parker Strath can be seen along the Great Miami River between Stop 2 (Shawnee Lookout) and Stop 3 (Miamisburg Mound).



Geologic Stratigraphy: "Chert" and "Flint" Variety

State	System	Series / Group	Formation	Member	Ref. No.
Pennsylvania	Pennsylvanian			Pa. jasper	26
West Virginia	Permian			Hughes River	25
	Pennsylvanian	Kanawha Series		Kanawha Black	24
Kentucky	Pennsylvanian	Pottsville Series	Breathitt	Kentucky Flint Ridge	23
	Mississippian	Stephensport	Hardinsburg	Haney	20
		Blue River Chester Series	Paoli		19
			Ste. Genevieve	Dover	18,22
		Blue River Meramec Series		Christian Co.	17,21
			St. Louis		
	Devonian		Casey	Boyle	16
	Silurian	Salamonie			13
		Clinton	Brassfield		1
Indiana	Mississippian	Blue River	St. Louis	Harrison Co.	15
	Silurian	Salamonie		Indiana Green	14
				Laurel	13
		Clinton	Brassfield		1
Ohio	Pennsylvanian	Conemaugh		Brush Creek	12
		Allegheny Series		Vanport	11
				Oh. Flint Ridge	11a
				Plum Run	11b
				Zaleski	10
		Pottsville Series		Upper Mercer	9
				Lower Mercer	8
				Boggs	7
	Mississippian		Maxville		6
	Devonian		Delaware		5
			Columbus	Eversole	4
	Silurian	Niagaran	Cedarville-Guelph	Logan Co.	3
			Bisher-Lilley		2
		Clinton	Brassfield		1
	Ordovician	Cincinnatian	— no	chert —	

FIGURE 8.—Stratigraphic relationship of chert-bearing deposits in five states within the Ohio River catchment above the DuPont site and explanation of symbols for figs. 9-13. "Reference no." refers to numbered locations on figs. 9-13.

The upper Ohio River drainage of today, above New Martinsville, West Virginia, flowed to the north as part of an ancestral St. Lawrence River. The drainage west of New Martinsville flowed from North Carolina northwestward through the Teazes (Teays) valley, a broad now-abandoned valley in West Virginia entrenched below the upland surface and equivalent to the Parker Strath. The ancient river flowed north into south-central Ohio, creating the broad valley through which the present-day Scioto River flows. At Chillicothe, the broad valley is buried by glacial deposits. According to Teller (1973), deep drilling and well-log studies have shown that the valley continues northwestward across Ohio and Indiana and joins the buried Mahomet valley of central Illinois. The combined river, called the Teays-Mahomet, was the major stream of the north-central states and a tributary of the ancient Mississippi River (Melhorn and Kempton, 1991).

The literature on the Teays-age drainage is filled with various names for rivers (table 1). According to Ray (1974), it is generally agreed that there was a Teays-age drainage

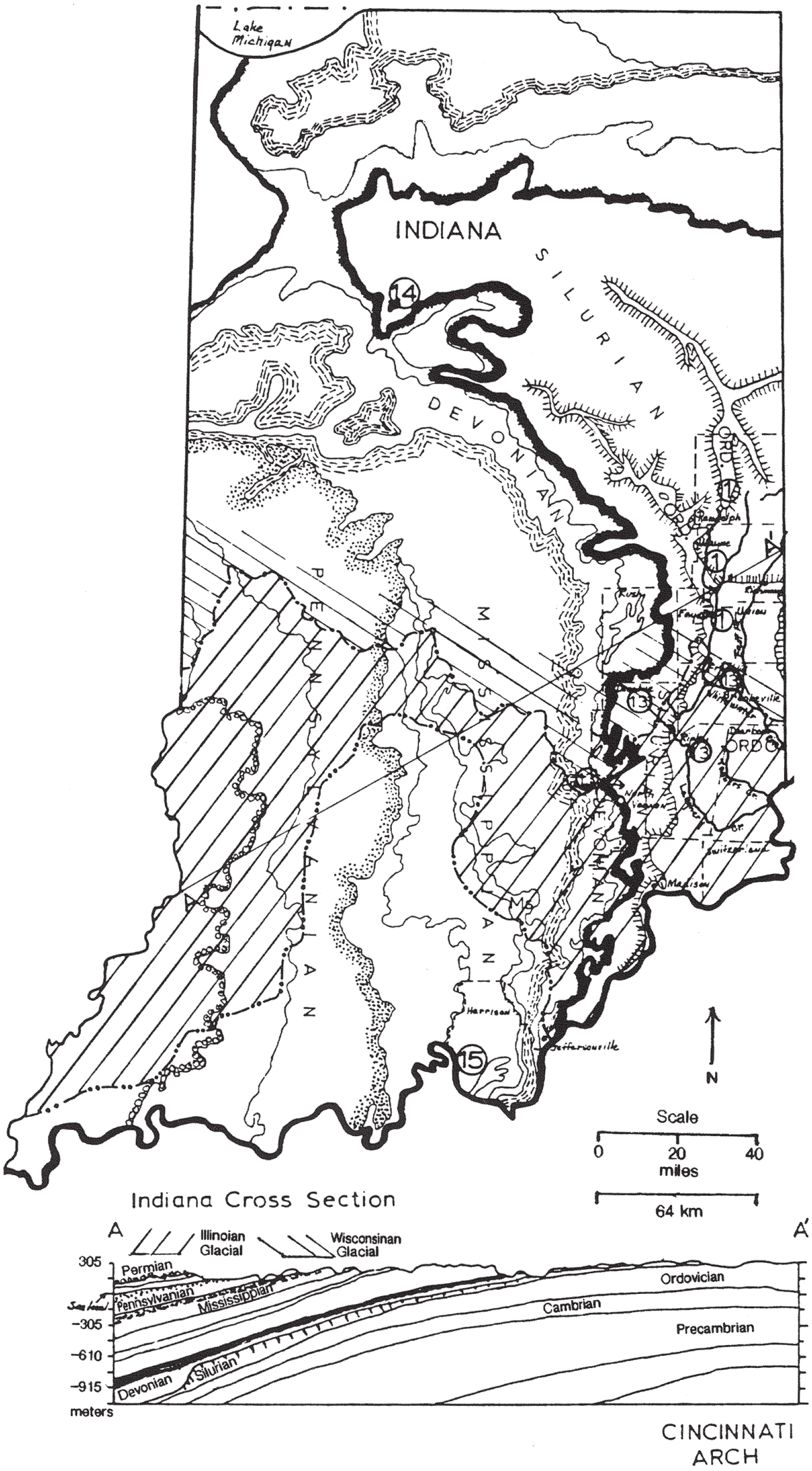


FIGURE 9.—Geologic map of Indiana and chert locations (numbers in circles) within the catchment of the DuPont site (modified from Purcell, 1970). See fig. 8 for map-symbol explanation and chert identifications.

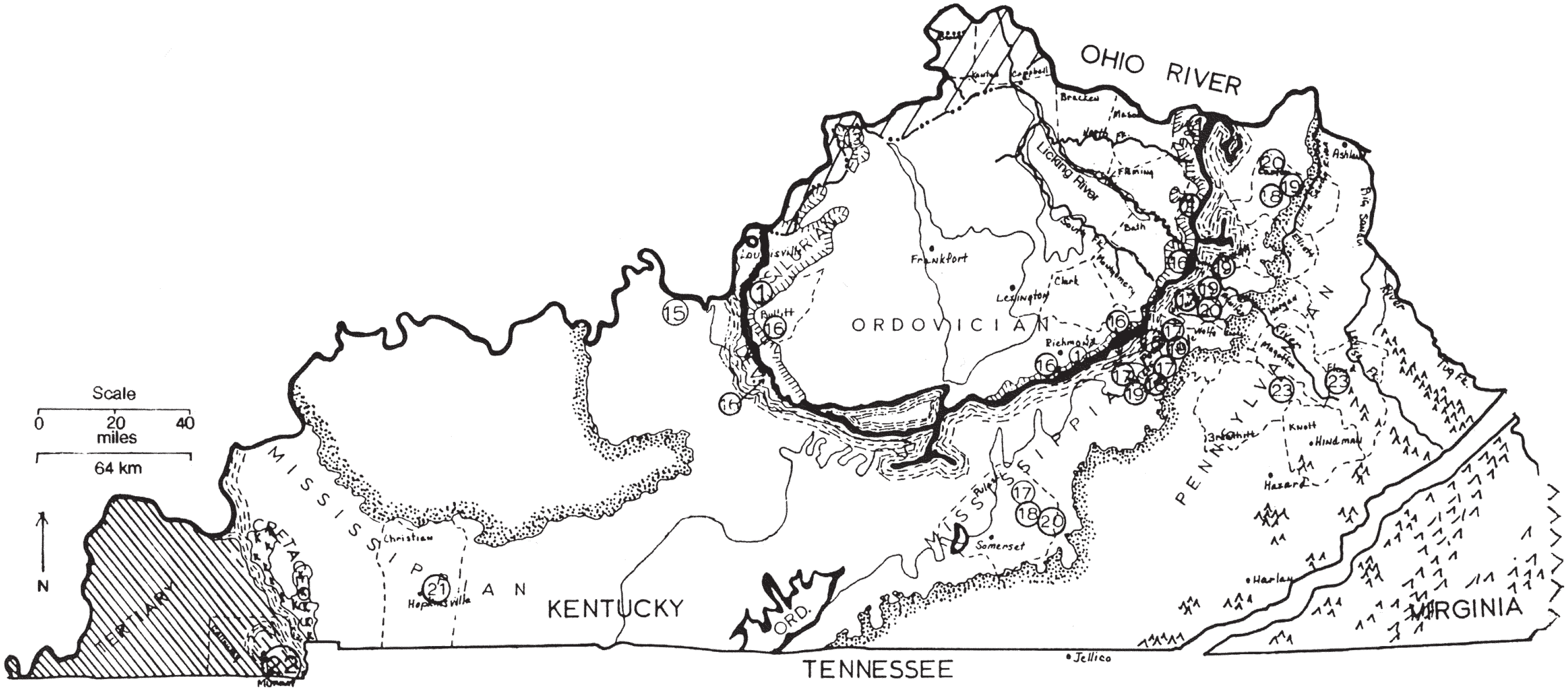


FIGURE 10.—Geologic map of Kentucky, chert locations (numbers in circles) within the catchment of the Ohio River at the DuPont site, and well-known chert locations outside the catchment. See fig. 8 for map-symbol explanation and chert identifications.

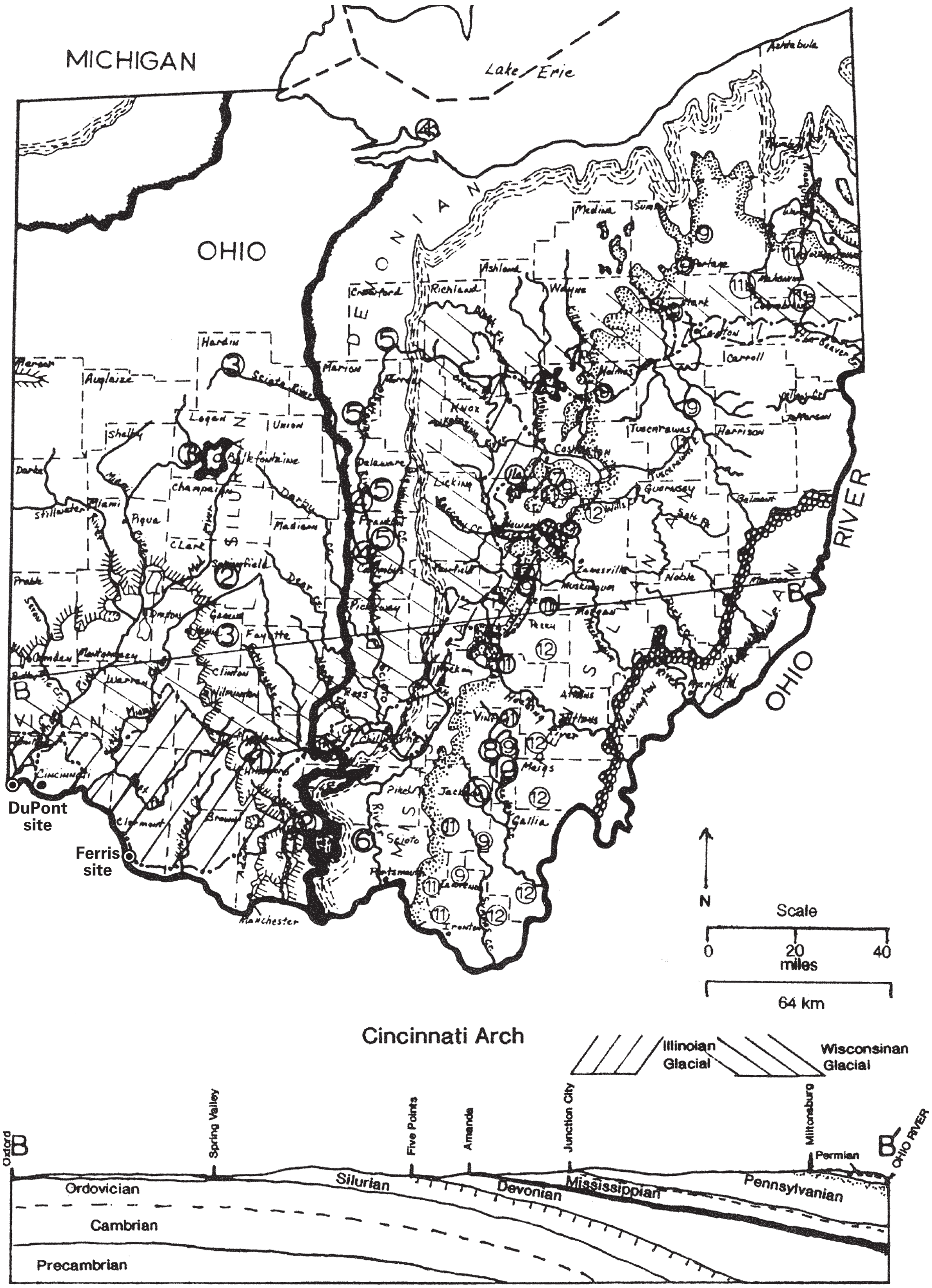


FIGURE 11.—Geologic map of Ohio, chert locations (numbers in circles) in the Ohio River catchment drainage, and a cross section of the Cincinnati Arch. See fig. 8 for map-symbol explanation and chert identifications.

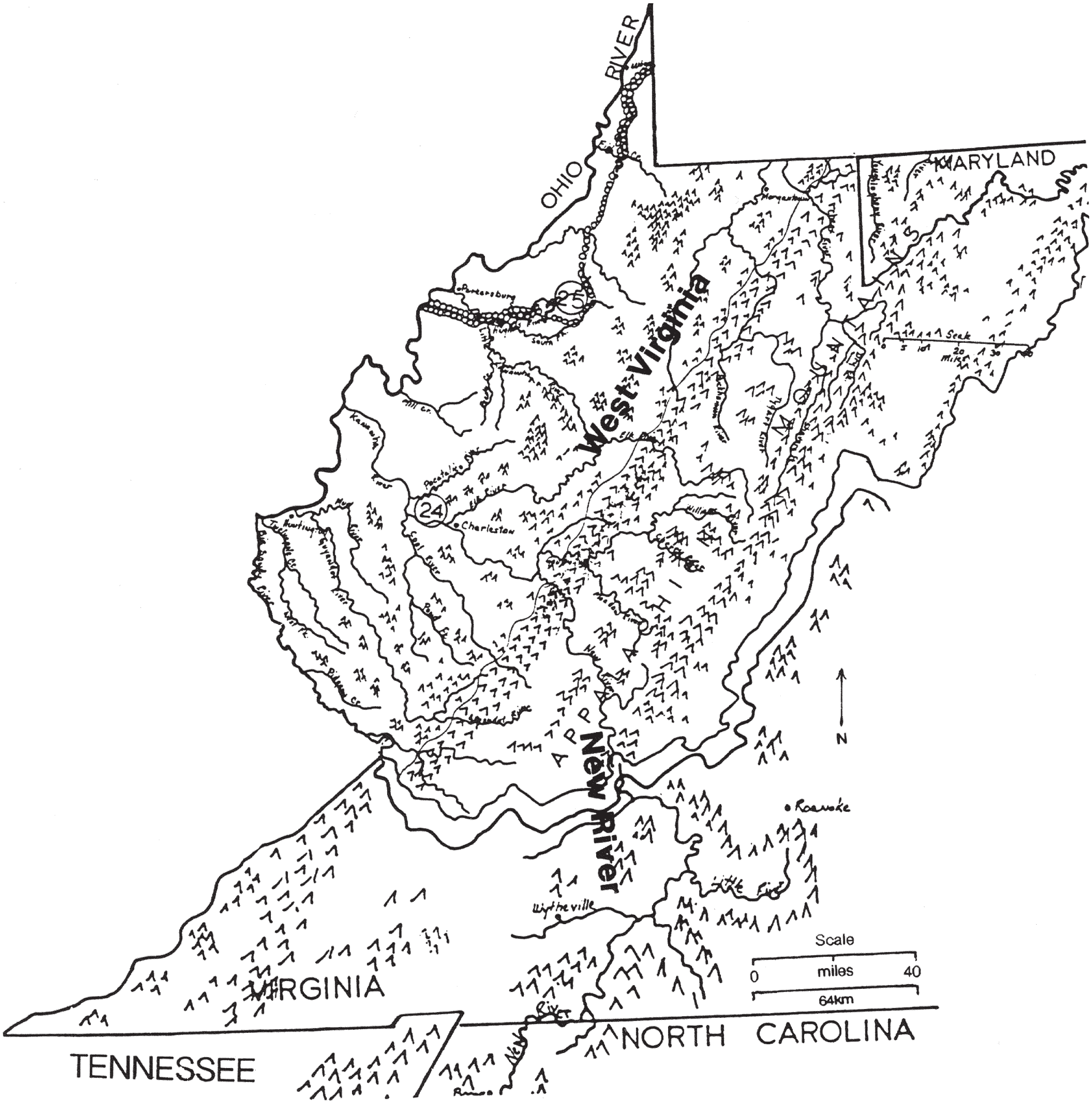


FIGURE 12.—Ohio River catchment drainage and chert locations (numbers in circles) in West Virginia, including area of drainage from North Carolina, Tennessee, and Virginia that is in the Ohio River catchment. Area of Permian outcrop indicated by line of circles. See fig. 8 for chert identifications.

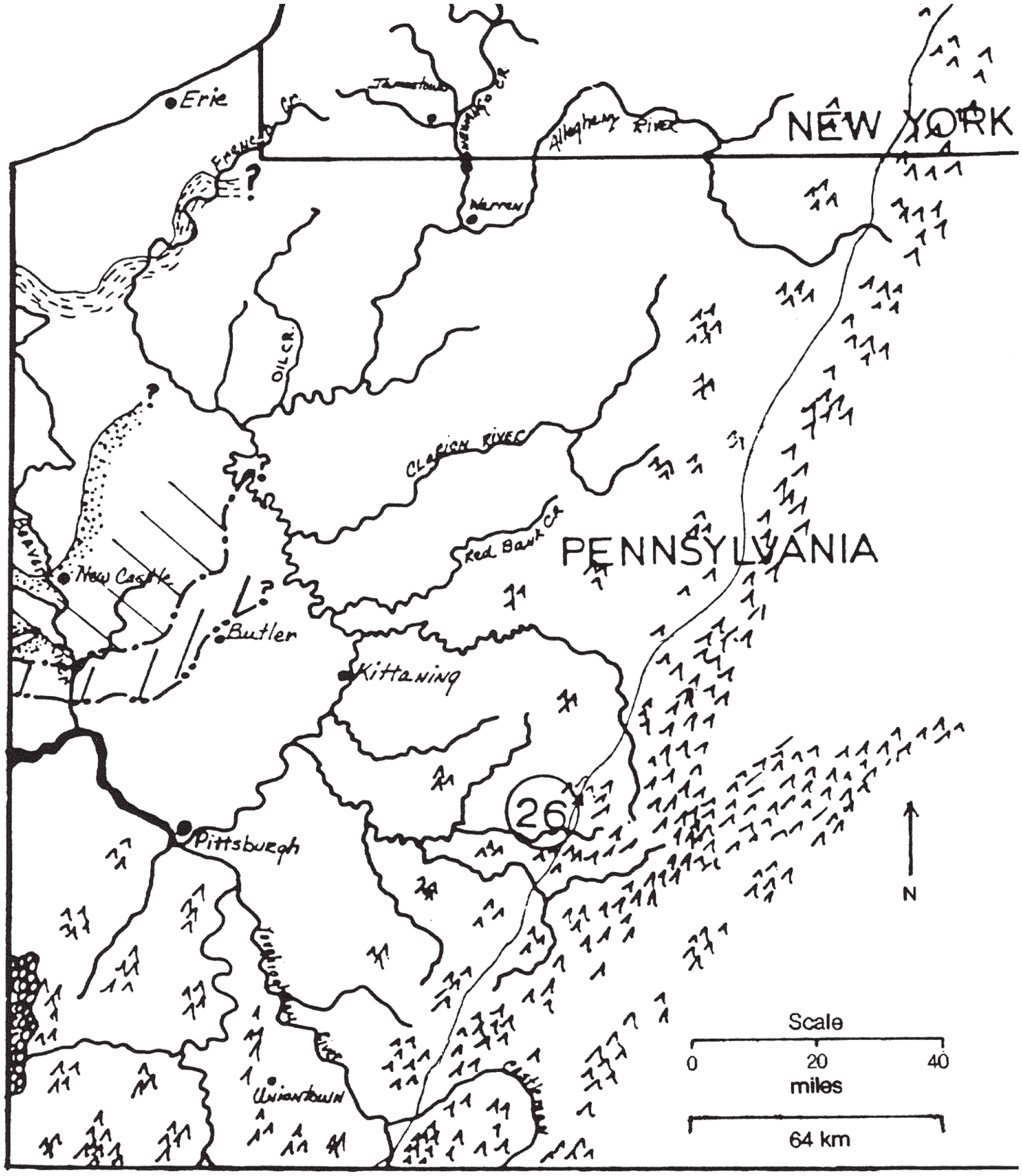


FIGURE 13.—Western Pennsylvania and New York drainage within the Ohio River catchment and chert locality (number in circle). See fig. 8 for map-symbol explanation and chert identifications.

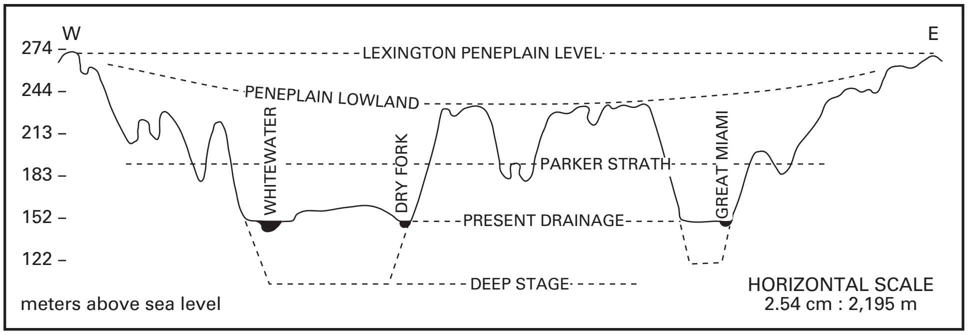


FIGURE 14.—Cross section of the Great Miami River near Hooven, Ohio, north of Stop 2, showing pre-Teays valley at 224 meters, Teays incision and Parker Strath at 195 meters, and present drainage at 152 meters. Deep Stage drainage is outlined. From Ettensohn (1974, fig. 10).

TABLE 1.—*Summary of names used for preglacial (Teays-age) rivers in northern Kentucky, southwestern Ohio, and southeastern Indiana*[1]

Name of preglacial river	Geographic extent	Initial reference
Old Limestone	In and adjacent to present Ohio River valley from Maysville to eastern Cincinnati, then north and west through Norwood Trough to present Mill Creek valley; original reference did not extend river north of Cincinnati	Fowke (1898)
Manchester	Same as Old Limestone except headwaters extended to Manchester	Fowke (1924, p. 86)
Norwood	Same as Manchester	Stout and others (1943)
Old Licking	Coincident with present Licking River valley from headwaters to Butler, Kentucky, then across uplands to junction with Manchester River 15 miles southeast of Cincinnati; original reference extended river entire length of present Licking River and north through Mill Creek valley to Hamilton	Fowke (1898)
Old Laughery	Roughly coincident with Laughery Creek (south and west of Lawrenceburg, Indiana) and then within and adjacent to the present Great Miami River valley north as far as Hamilton	Fowke (1898)
Old Kentucky	Same as Old Laughery between Lawrenceburg and Hamilton, but its headwaters were extended south and west along present Ohio River valley to Carrollton, Kentucky, and then up the Kentucky River valley	Fowke (1900)
Cincinnati	Roughly same as Old Kentucky but flowed in opposite direction	Tight (1903, pl. 1)
Hamilton	Headed near Hamilton and flowed west and a little south into eastern Indiana	Stout and others (1943)
Eagle	Same as Old Kentucky from near Patriot, Kentucky, to Hamilton; south of Patriot it extended across uplands into headwaters of present Eagle Creek. The name Eagle River should be retained only for that portion south of the junction with the Old Kentucky near Patriot	Durrell (1961)
The names that Teller recommended to be retained are italicized.		

[1]From Teller, 1973, table 1.

[2]Names in *italics* are those Teller recommended be retained.

divide of resistant Silurian limestone at Manchester, Ohio, that bounded the west side of the main Teays northward flow, creating the present Scioto River valley (fig. 15).

On the west side of the Manchester Divide the Manchester River flowed west along a path similar to the present Ohio River. The Old Licking River flowed north from Pottsville formations in the southeastern Kentucky mountains in much the present-day course of the river and joined the Manchester River 24 km (15 miles) southeast of Cincinnati (fig. 15). The combined rivers (called the Manchester) flowed north from the Fort Thomas Divide up the present Little Miami River valley in eastern Cincinnati. The Manchester River then turned west through the Norwood Trough and met the northeast-flowing Old Kentucky River south of Hamilton, Ohio. Durrell (1961) reported that Teays-age Old Licking River alluvium south of Claryville, Kentucky, contains subrounded Mississippian cherts as the most abundant cobble and pebble components. Swadley (1971) and Teller (1973) discussed Teays alluvial gravel deposits consisting of pebbles, cobbles, and blocks, mostly of brown chert (Paoli) derived from Pennsylvanian and Mississippian bedrock in the old Old Kentucky River and Old Licking River alluvium.

Another divide created by resistant Silurian limestones occurs on the west side of the Cincinnati Arch at Madison, Indiana. Drainage on the east side of the divide flowed northeast from central Kentucky along a course similar to

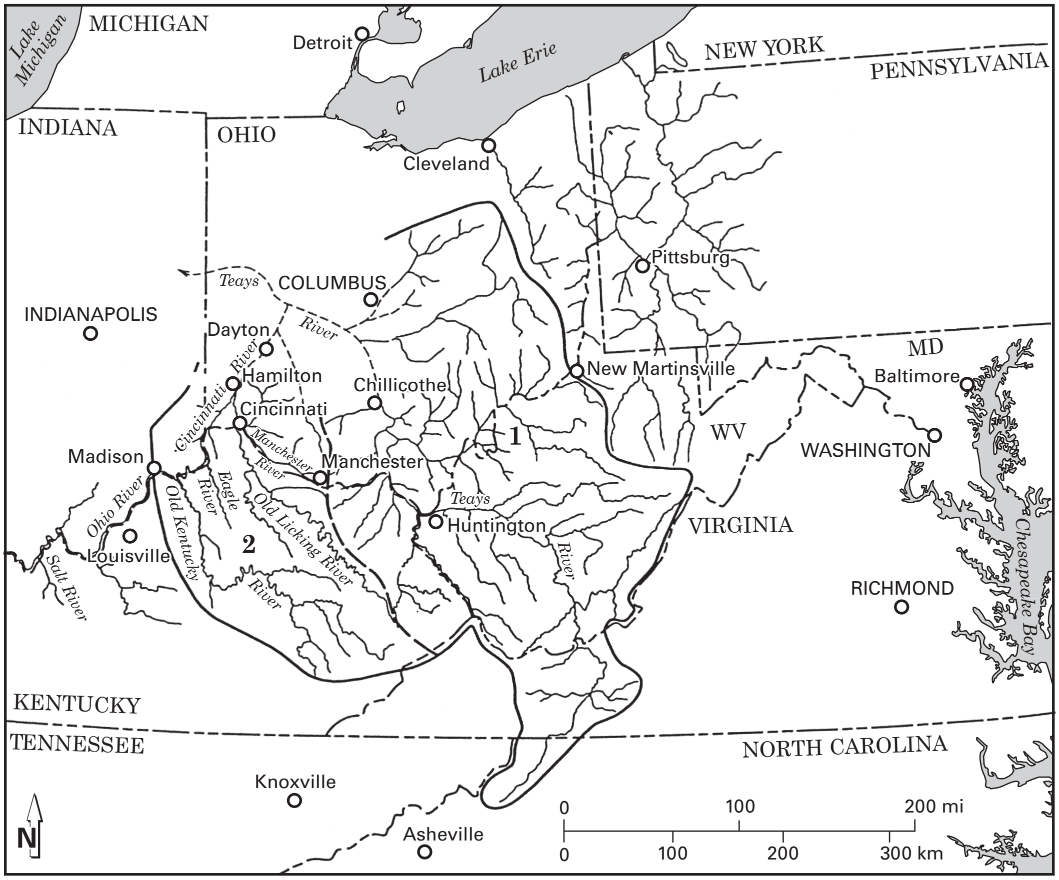


FIGURE 15.—Preglacial drainage of the upper Teays River. **1**, drainage of the main Teays River. **2**, drainage basin of Cincinnati River, a western tributary of the Teays River within the Ohio River catchment at DuPont (modified from Ray, 1974, fig. 5).

that of the present Ohio River, then north up the course of the present Great Miami River valley to Hamilton, where it joined the Manchester River. The westernmost river of this drainage was the Old Kentucky River, which followed a path similar to that of the present-day Kentucky River to Carrollton, Kentucky, then turned northeast to flow up the course of the present-day Great Miami River (fig. 15; also see fig. 2-1, Stop 2—the wide valley in this figure was initially created by the Old Kentucky River). The Old Kentucky River was met by the Eagle River at the present town of Patriot, Kentucky (fig. 15). Big Bone Creek (Stop 1) was part of the Eagle River drainage.

The Teays-age perched valleys of the Parker Strath in Kentucky and southwestern Ohio occur at approximately 182-213 meters above sea level. The three Kentucky rivers described above contributed alluvial deposits in their respective valleys, and chert was one of the major alluvial components. Therefore, the uplands across the Ohio River from the DuPont site would be potential chert resource areas; however, these upland alluvial deposits would be from the Eagle River, which drained mostly Ordovician bedrock. The uplands to the southwest would have more potential, as they fall into the Old Kentucky drainage that crossed numerous chert-bearing formations. However, at the time this was written in 1992, these potential locations had not been surveyed or collected. The Manchester River on the east side was less likely to have alluvial gravels containing chert in the higher valleys, although the upland alluvium has not been extensively surveyed.

QUATERNARY

Kansan glaciation

There is no substantiated evidence for the presence of Nebraskan glacial deposits east of the Madison, Indiana, divide. The only evidence for Kansan glaciation in Ohio is in the extreme southwestern corner and extending into adjacent northern Kentucky and southeastern Indiana (see fig. 16). During the first Kansan glacial advance into central Ohio and Indiana, the Teays drainage was dammed, and impounded waters filled valleys, creating numerous lakes in the Old Licking and Manchester River valleys. The Old Kentucky River may have been captured by the Old Ohio River west of the Madison divide prior to glaciation or after the first glacial advance into the area. Although Kansan till

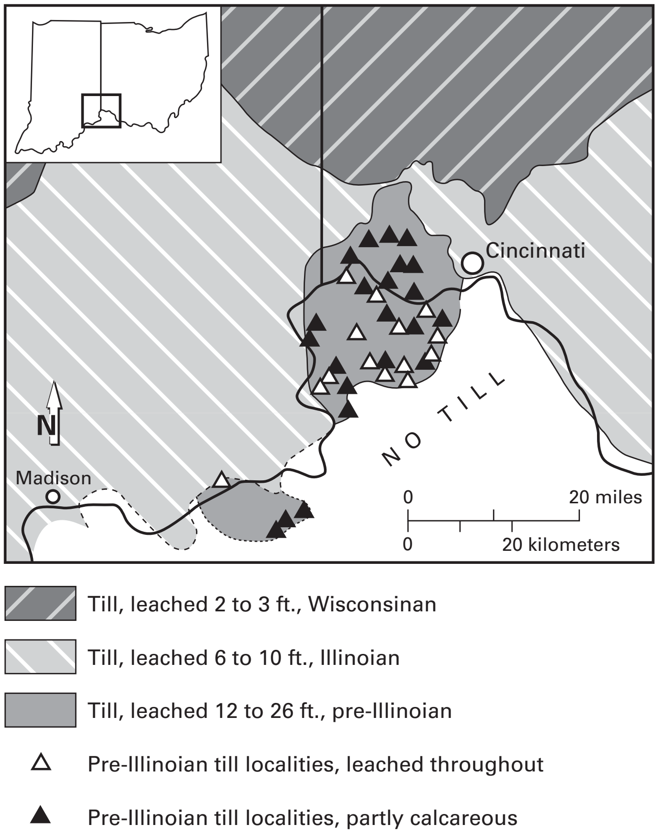


FIGURE 16.—Extent of various tills and depths of carbonate leaching (modified from Teller, 1973, fig. 3). Pre-Illinoian till in this figure is Kansan.

In many places within the Old Kentucky and Manchester River valleys, deeply leached glaciofluvial outwash overlies preglacial alluvium or bedrock. In other places adjacent to the old valleys, till overlies extensive laminated varvelike clays and silty clays such as the Claryville clays (Durrell, 1961), which were deposited as glaciolacustrine lake sediments. Lacustrine clays are absent in the Old Kentucky River uplands, suggesting a western outlet had been established during the Kansan. Kansan till deposits have not been dated, and further research is needed, for this glacial period changed the drainage patterns for most of the northeastern United States.

Yarmouth Interglacial

As the Kansan ice retreated north to Hamilton, Ohio, a westward outlet spillway was created across the Fort Thomas Divide and the Anderson Divide for the Old Licking and Manchester Rivers (see fig. 18). There was probably more than one glacial stage during the Kansan glaciation, and meltwaters spilling over the divides deeply eroded narrow, V-shaped valleys, creating a westward flow. Once the ice is present in northern Kentucky, lake clays are not substantial in the Old Kentucky River valley compared to the Old Licking and Manchester River valleys. This distribution suggests that the western area had an outlet channel to the west early in the glacial history of the area.

To the east, dammed river waters rose to levels where the lowest divides provided overflow spillways. These spillways were eroded gradually, reducing the lake levels. At Cincinnati, the Manchester and Old Licking River valleys were dammed as water overflowed west across the northern Kentucky uplands into the Kentucky River basin through shallow spillways.

Kansan till (pre-Illinoian of Teller, 1973) is found in a discontinuous, uneven cover on the uplands in northern Kentucky and southwestern Ohio (fig. 16). Carbonate leaching is the deepest of all Quaternary tills, reaching depths of 3.7 to 7.9 meters (Teller, 1973; Ettensohn, 1974). In some areas the till is thin enough to be leached completely. In southeastern Indiana, Gooding (1966) described Kansan till below Illinoian till as red, noncalcareous silts and clays, which contained abundant Silurian Laurel limestone cherts in the till fabric at the Handley, Townsend, and Osgood stratigraphic sections (fig. 17). Huge boulders in northern Kentucky were deposited as the first Kansan glacier pushed into the area (Teller, 1973).

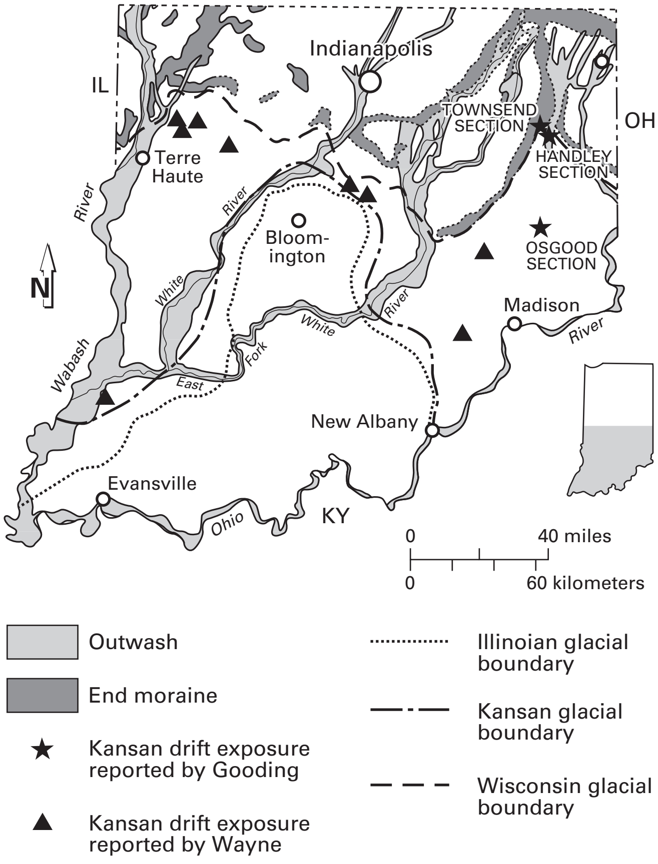


FIGURE 17.—Boundaries of the Kansan, Illinoian, and Wisconsinan glaciations in southern Indiana (modified from Gooding, 1966, fig. 1). Key till sections at Osgood, Handley, and Townsend contain Silurian-age Brassfield and Laurel cherts.

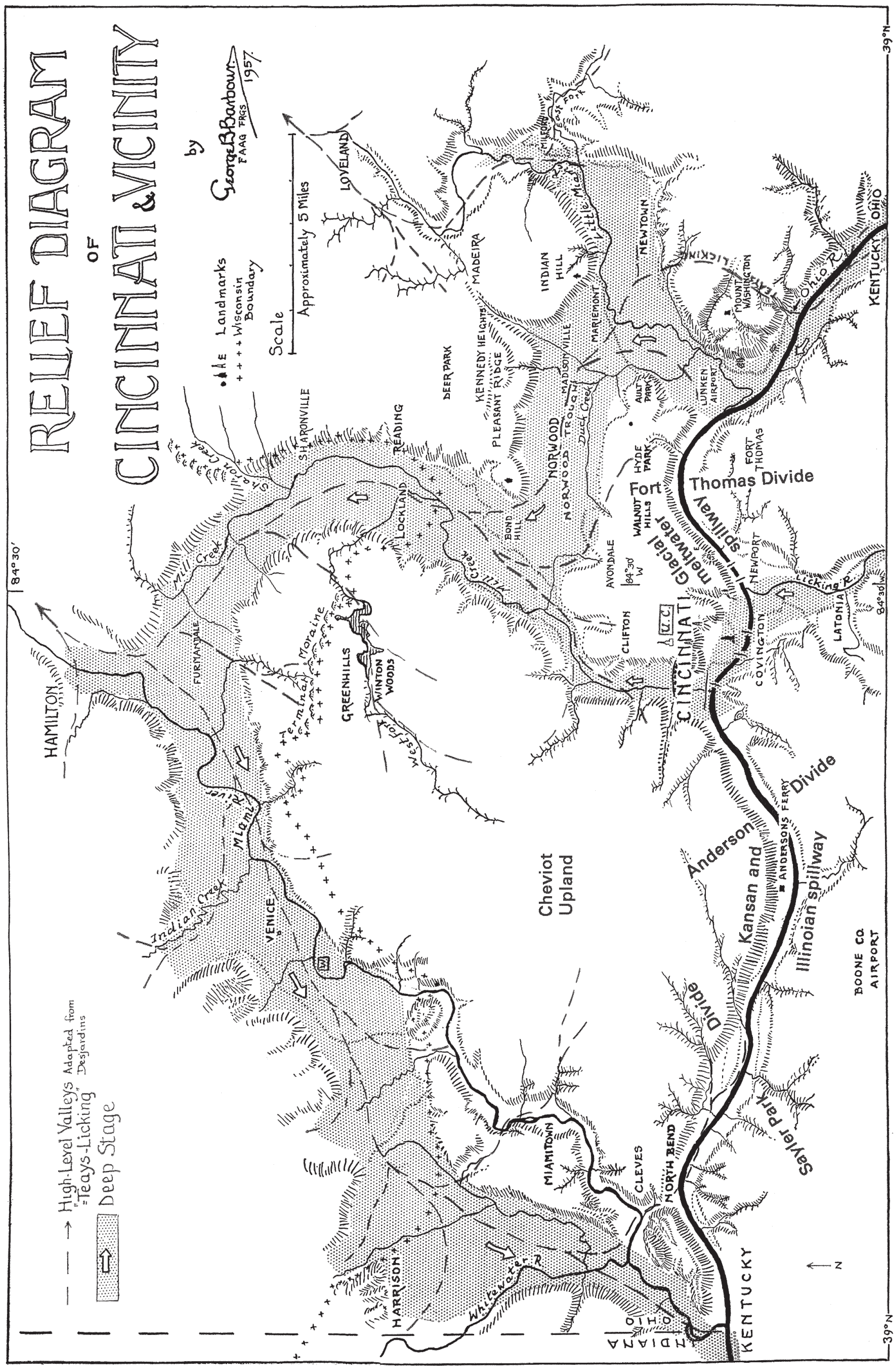


FIGURE 18.—Yarmouthian Deep Stage drainage in Cincinnati and beginning erosion of the Anderson and Fort Thomas Divides (modified from Ohio Academy of Science Field Conference, 1961).

retreated to the north, the spillways were abandoned, and the old preglacial channel was reopened. By that time, the Teays tributaries east of Cincinnati were integrated into a single westward-flowing new Ohio River, and postglacial drainage was established, as shown in figure 18. The new Ohio River extended from Pittsburgh to southern Illinois, and many segments of the former Teays valley remnants were filled with alluvium. Proglacial lake clays that were deposited in the old valleys were abandoned, and segments are preserved today. The first post-Teays rivers in the Cincinnati area east of the Anderson Divide flowed mostly in the old Teays drainage. West of the divide, the new Ohio River closely followed the old Teays channel and in a few areas actually flowed in the old channel. Once the new Ohio River was established, it incised valleys 75 meters below the Teays valley-bottom levels to elevations as low as 107 meters above sea level. This entrenchment is referred to as the "Deep Stage" drainage prior to Illinoian glaciation (fig. 18).

Yarmouth Interglacial deposits were identified at the Handley, Townsend, and Osgood stratigraphic sections in southeastern Indiana (see fig. 17) described by Kapp and Gooding (1974). Pollen and soil studies from the sections enabled them to reconstruct a series of forest successions. The post-Kansan glacial period is characterized, mostly on the basis of pollen, as being wet and cool; arboreal pollen consists of high percentages of ironwood (*Ostrya-Carpinus*), basswood (*Tilia*), hazel (*Corylus*), aspen and cottonwood (*Populus*), birch (*Betula*), and pine (*Pinus*). Oak (*Quercus*) was constant through the section at about 25 percent. Toward the upper part of the section, ironwood declines, and elm (*Ulmus*), beech (*Fagus*), hackberry (*Celtis*), and hickory (*Carya*) increase, indicating a more temperate climate.

Illinoian glaciation

Teller (1973) described four Illinoian tills that he identified only 80 km (50 miles) northwest of Cincinnati. Meltwaters from these glaciers probably contributed to the extensive Deep Stage erosion of rivers in the Cincinnati area. Abandonment of the Cincinnati-Hamilton-Lawrenceburg portion of the new Ohio River resulted from one or two Illinoian glacial invasions of the area. The first invasion of ice blocked the new Ohio River south of Hamilton, forcing a breach of the Anderson Divide and the Sayler Park Divide west of Cincinnati (fig. 18). The glacier crossed the Norwood Trough and again forced the river over the Fort Thomas Divide west of the Manchester-Old Licking River in the vicinity of Lunken Airport east of downtown Cincinnati. These spillways had once been temporary overflow channels during earlier damming. Illinoian glaciers were the most extensive in Ohio, Indiana, and Kentucky, reaching as far south as 38° N. latitude in Kentucky. To the east, a lobe of the Illinoian glacier advanced as far south as Chillicothe and turned southwest to Cincinnati (fig. 19; also see Stop 13, Cuba Moraine drive-through). To the west, another lobe advanced along the Ohio-Indiana border in western Hamilton County. The Cheviot Upland (fig. 18) was in an interlobate zone and was not glaciated during the Illinoian.

As the new Ohio River was dammed by the ice, lakes formed as far east as Portsmouth, Ohio, and along the Licking River to the south. As these lakes rose during later advances, more cutting of the new spillway divides created the present course of the Ohio River. To the west, the Great Miami River was forced out of its old channel as the western glacial lobe pushed southwest around the Cheviot Upland into southeastern Indiana (Gooding, 1963; Teller, 1973). Most of the unglaciated hilltops in the Cincinnati area are covered with Illinoian loess. Illinoian till was deposited in valleys and on hilltops in the paths of the glacier. The tills are leached of carbonates to depths of 1.8 to 3.1 meters (Teller, 1973).

There have been few attempts to date the Illinoian glacial deposits in Ohio. Wood and other organic deposits have been reported from Illinoian tills, but are beyond radiocarbon dating capabilities. The varvelike lake-clay deposits in dammed rivers would seem to make a good paleomagnetic dating source. Optical Stimulated Luminescence (OSL) or thermoluminescence of Illinoian outwash sands (Berger and others, 1992) also might provide a good source for dating. The Illinoian glaciation consisted of several major glacial events and may span 117,000 years from 245,000 to 128,000 years ago, spanning Isotope Stages 6 through 8 (Imbrie and others, 1984). The best one could hope for is a section of Wisconsinan glacial deposits over a Sangamon soil, over several Illinoian glacial deposits, over a Yarmouth Interglacial soil, over a Kansan glacial deposit.

Sangamon Interglacial

Kapp and Gooding (1974) described 2 meters of Sangamon soil profile in the Whitewater River valley in southeastern Indiana. Pollen spectra from the soil profile indicate six vegetational periods occurred during the Sangamon in southeastern Indiana. The Sangamon soil profile was leached of carbonates below a depth of 1.5 meters. The soil is a humic gley that fills depressions on an Illinoian surface with leaf litter, moss polsters, and wood fragments. The soil is developed in many places on Illinoian loess.

The pollen profiles of Kapp and Gooding (1974) indicate the early Sangamon was dominated by pine and spruce (*Picea*), with spruce declining. Toward the middle of the Sangamon Interglacial, pine declined; hardwoods increased, along with shrubs; and for the first time there is notable representation of Compositae and Gramineae. Oak- and hickory-dominated forests contained less numerous hardwoods such as beech (*Fagus*), maple (*Acer*), ash (*Fraxinus*), walnut (*Juglans*), sweetgum (*Liquidambar*), tulip poplar (*Liriodendron*), hemlock (*Tsuga*), larch (*Larix*), ironwood, and elm. In the upper zones, hardwoods gave way abruptly to subboreal conifers, due possibly to an abrupt climate change. The Sangamon Interglacial does not appear to be nearly as long as the Yarmouth Interglacial. Very few radiometric determinations have been made on Sangamon soils in this particular area; however, many other areas in the United States and the world have been dated and correlate with the Eem of Europe and Isotope Stage 5 of the marine $\delta^{18}O$ record. The Sangamon Interglacial dates from approximately 128,000 to 70,000 years ago (Imbrie and others, 1984).

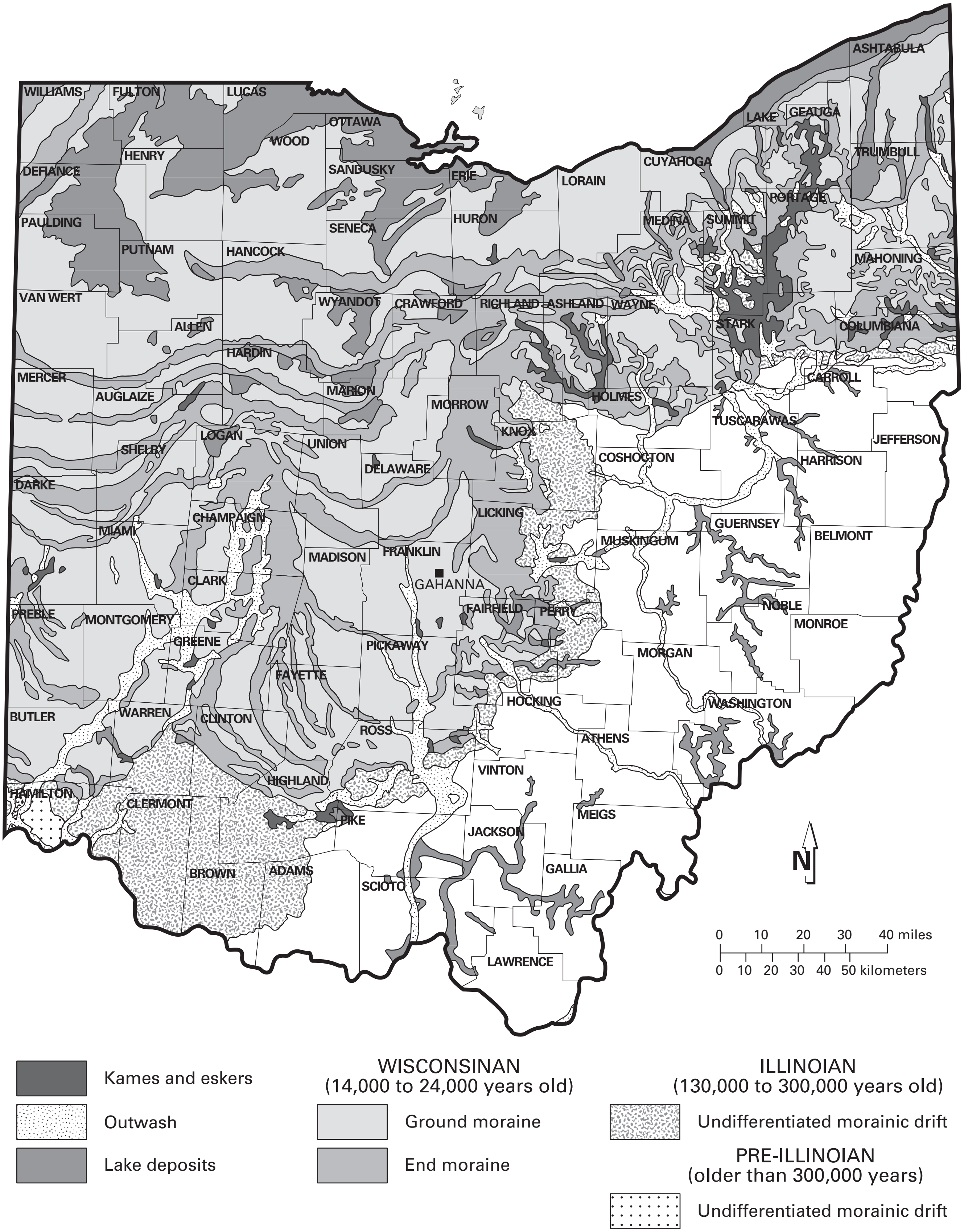


FIGURE 19.—Generalized map of the glacial deposits of Ohio.

Wisconsinan glaciation

The first Early Wisconsinan ice advanced into the St. Lawrence basin and then retreated about 65,000 years B.P. The second Early Wisconsinan advance reached as far south as Gahanna, in central Ohio, and then retreated by 55,000 years B.P. (figs. 19 and 20). Early Wisconsinan stades were more extensive in New York and Pennsylvania than to the west; late Wisconsinan stades were more extensive in the west (Dreimanis and Goldthwait, 1973). The middle Wisconsinan was dominated mostly by an interstade, which in southern Ohio lasted from 53,000 to 23,000 years B.P. During this period, glaciers advanced and retreated into the Lake Erie basin but did not reach farther south than the north side of Cleveland, Ohio.

Generally, the late Wisconsinan is known as the “Main” or “Last Glacial Maximum” (LGM) in this region, or by the Michigan Lobe time-stratigraphic terms of Woodfordian, Twocreekan, and Valderan. Many localized sequences have been well defined (fig. 21). The late Wisconsinan lasted from 23,000 to 10,000 years B.P. and represents the maximum advance of the Wisconsinan glacier. The late Wisconsinan Huron Lobe advanced into Ohio 23,000 years B.P., plowing down trees in its path. Immature fallen spruce timbers recovered from till deposits near Oxford, Ohio, were bent into U shapes, retained their bark, and the wood was still in fresh condition (Goldthwait, 1959). Numerous ^{14}C determinations were run on various wood samples prior to 1970 (Dreimanis and Goldthwait, 1973), and it is not always clear what type of wood sample was run. Today it would be interesting to run ^{14}C ages on the cellulose fraction of freshly exposed logs buried in the late Wisconsinan till.

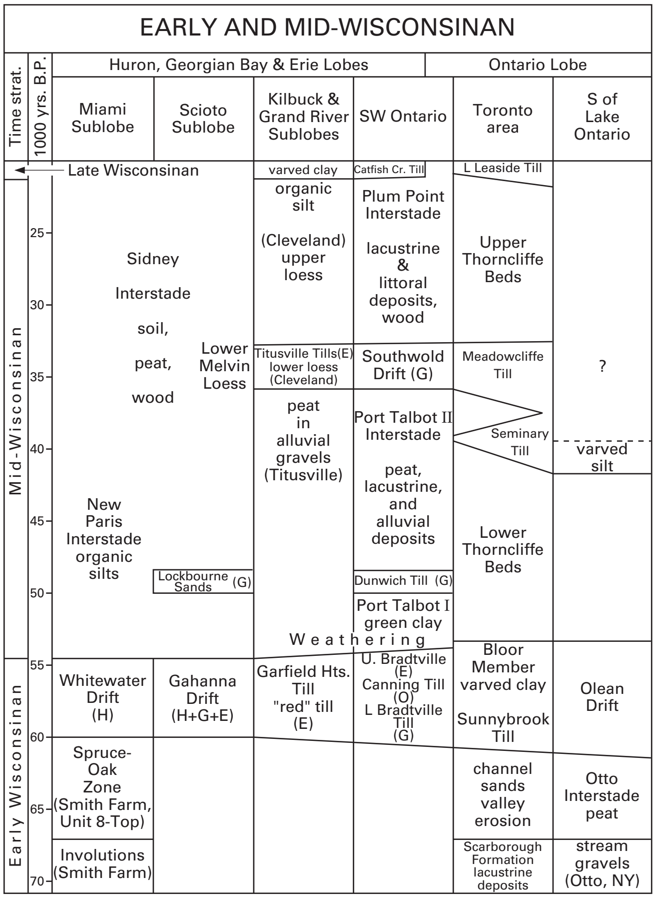


FIGURE 20.—Correlation of early and middle Wisconsinan units by sublobes across Indiana, Ohio, western Pennsylvania, and southern Ontario (modified from Dreimanis and Goldthwait, 1973, fig. 4). Letters in parentheses indicate probable lobes: E, Erie; G, Georgian Bay; H, Huron; O, Ontario.

Sublobes of the Huron Lobe advanced at different times and at different rates, resulting in complicated criss-crossing and overlapping of end-moraine crests (fig. 22). The Scioto Sublobe reached its maximum southern advance by 21,500 years B.P. (figs. 19 and 22; also see Stop 13, Cuba Moraine drive-through). The Miami Sublobe reached its maximum southern extent by 19,000 B.P. and deposited the Hartwell Moraine in northern Greater Cincinnati (fig. 22). The maximum was followed by the minor Connersville Interstade in the Whitewater River basin from 19,000 to 21,000 years B.P. (Wayne, 1956). To the east, an advance of the Scioto Sublobe overran the Hartwell Moraine 18,000 to 18,500 years B.P., resulting in the Cuba Moraine and the Caesar Till (figs. 19, 21). As glacial lobes retreated after 18,000 years B.P., meltwaters deposited the Kennard Outwash (Dreimanis and Goldthwait, 1973) down the Little and Great Miami River valleys. During this period the Big Bone Lick fauna (see Stop 1) listed in table 2 was deposited. By 17,200 years B.P. another advance of the glaciers deposited the Reesville Moraine (Scioto Sublobe) and the Farmersville Moraine (Miami Sublobe) and the related Darby Till (fig. 21).

By 15,500 years B.P., the Erie Lobe had retreated to Niagara Falls and the Huron Lobe retreated as far north as Ontario (Dreimanis and Goldthwait, 1973). The Erie Interstade is marked by minor tills and extensive lacustrine silt and clay deposited in the Huron and Erie basins between 15,000 and 16,500 years B.P. In a very short period of time another advance occurred, resulting in deposition of the Hiram Till north of Columbus and Piqua, Ohio. Again, the glacier melted and retreated north to Ontario, and the Cary-Port Huron Interstade developed for about 600 years (*circa* 13,000 to 13,800 years B.P.).

The last glacial advance about 13,000 years B.P. did not reach Ohio. During this advance, a series of glacial lakes formed in northern Ohio. The highest lakes were Glacial Lakes Maumee and Whittlesey. Several lower lake phases followed in the Erie and Huron basins as eastern outlets were opened by glacial retreat. The fauna from Welsh Cave (table 2) dates from about 12,900 B.P., when north-central Kentucky was a warming steppe forest with open grasslands. No strong evidence has been found for Twocreekan (11,500 years B.P.) or Valderan (9,500 years B.P.) glacial advances in Ohio.

Pollen studies by Shane (1987) indicate the recurrence of spruce, loss of deciduous trees, and an expansion of firs on the till plains and the Allegheny Plateau across Ohio and Indiana between 10,500 and 11,000 years B.P. This cool event probably corresponds to the Twocreekan glacial

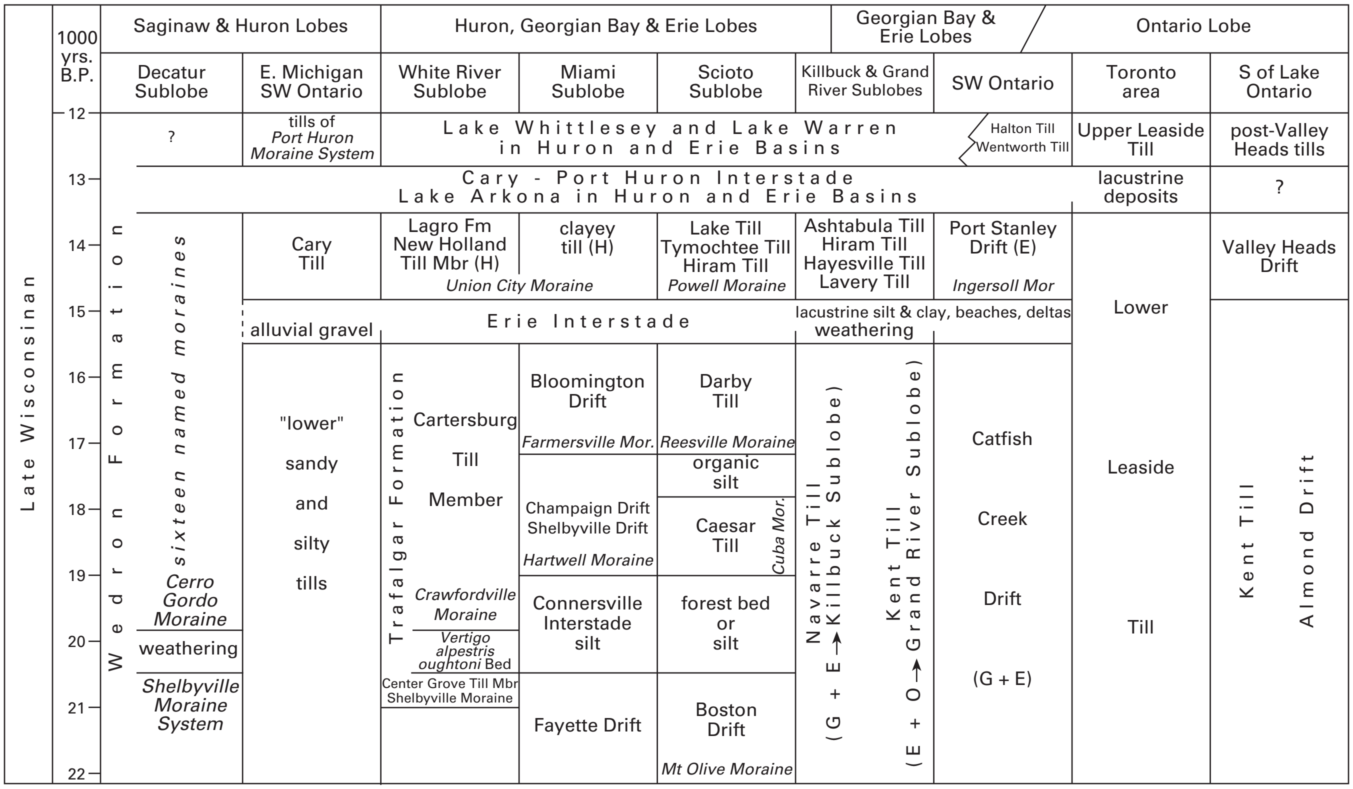


FIGURE 21.—Correlation of late Wisconsinan stade and interstade deposits, end moraines, and proglacial lakes by sublobes from eastern Michigan to western Pennsylvania and Ontario (modified from Dreimanis and Goldthwait, 1973, fig. 7).

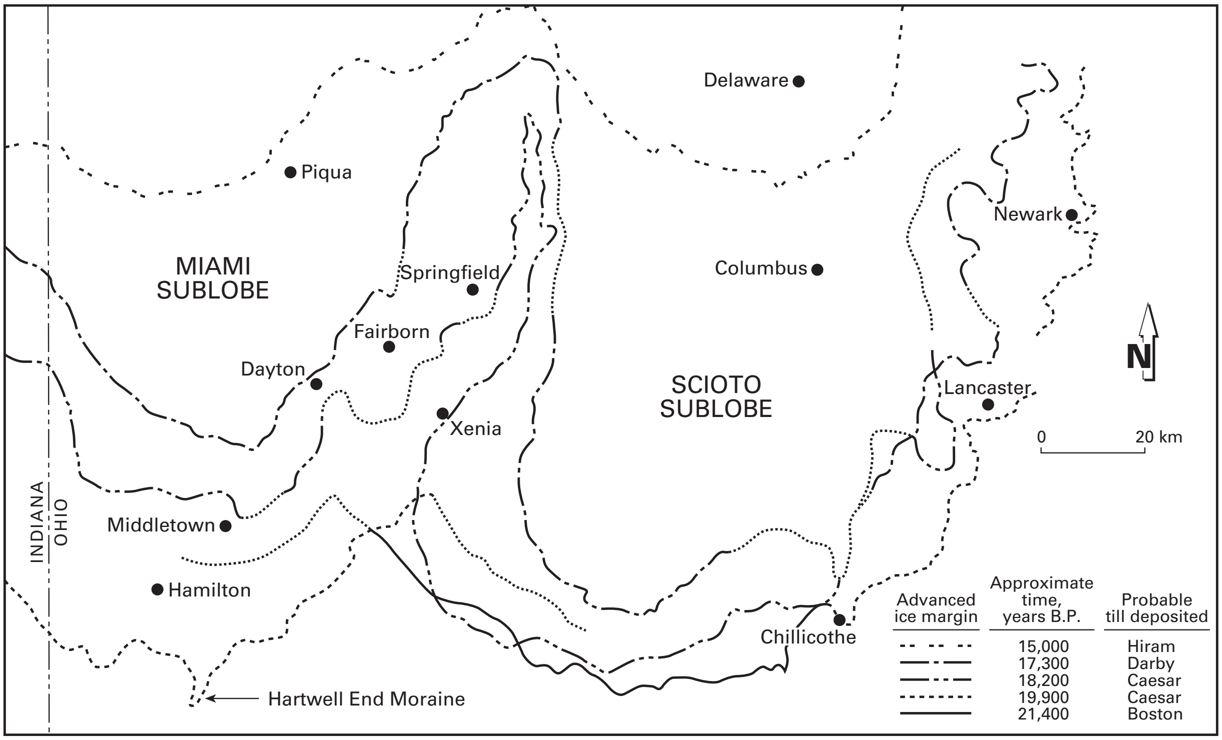


FIGURE 22.—Late Wisconsinan ice-limit boundaries of the Miami and Scioto Sublobes based on ^{14}C dates from wood in till of end moraines (modified from Dreimanis and Goldthwait, 1973, fig. 8).

TABLE 2.—*Some of the Late Pleistocene mammalian fauna in northern Kentucky*[1]

Order Species	Common name
Insectivora	
Sorex cinerus (W)[2]	masked long-tailed shrew
Microsorex hoyi (W)	shrew
Scalopus aquaticus (W)	eastern mole
Blarina brevicauda (W)	short-tailed shrew
Chiroptera	
Myotis sp. (W)	brown bat
Pipistrellus subflavus (W)	pipistrel bat
Edentata	
Megalonyx jeffersoni (B, x)	ground sloth (large)
Glossotherium harlani (B, x)	ground sloth
Lagomorpha	
Sylvilagus sp. (W)	cottontail rabbit
Lepus americanus (W)	hare
Rodentia	
Spermophilus tridecemlineatus (W)	thirteen-lined ground squirrel
Tamiasciurus hudsonicus (W)	red squirrel
Geomys sp. (W)	pocket gopher
Peromycus sp. (W)	white-footed mouse
Cleithryonomys gapperi (W)	red-back vole
Phenacomys intermedius (W)	caviomorphlike rodent
Microtus pennsylvanicus (W)	vole
Microtus xanthognathus (W)	yellow-cheeked vole
Microtus sp. (W)	vole
Erethizon dorsatum (W)	porcupine
Carnivora	
Canis dirus (W, x*)	dire wolf
Ursus americanus (B)	black bear
Ursus arctos (W)	short-faced bear
Mustela nivalis (W)	weasel and mink
Taxidea taxus (W)	badger
Proboscidea	
Mammut americanum (B, x)	mastodon
Mammuthus columbi (B, x)	Columbian mammoth
Mammuthus primigenius (B, x)	wooly mammoth
Mammuthus sp. (W, x)	mammoth
Perissodactyla	
Equus complicatus (B, x*)	horse
Equus sp. (W, x)	horse
Tapirus haysii (B, x*)	tapir
Artiodactyla	
Platygonus compressus (W, x)	flat-headed peccary
Cervalces scotti (B, x)	elkmoose (stagmoose)
Rangifer tarandus (B)	caribou (reindeer)
Bison bison antiquus (B, x*)	bison
Bootherium bombifrons (B, x)	woodland muskox

[1] From Lundelius and others (1983).

[2] Explanation of notations in parentheses: W, Welsh Cave, Woodford County, Kentucky, 12,950 ± 550 years B.P. (date derived on collagen of *Platygonus*, 31 individuals). *Canis dirus* and associated fauna indicative of boreal forest/steppe. B, Big Bone Lick, Boone County, Kentucky, 17,200 ± 600 years B.P. This site was the fiirst North American locality of *Bootherium bombifrons, Cervalces scotti, Bison bison antiquus, and Glossotherium harlani* (x, extinct species. x*, extinct subspecies).

advance, which has been well dated from 11,500 to 11,750 years B.P.

By 9,000 years B.P., diverse deciduous forests extended across the region. After 8,000 years B.P., warming and drying led to the prairie expansion in the northern Midwest. Today, the general vegetation in southwestern Ohio consists of western mesophytic forests in the Cincinnati area, beech-maple forests to the north on the till plains in the Dayton, Ohio, area, and mixed mesophytic forests in the unglaciated southeast and south-central area around the Hocking Valley (Watts, 1983). Table 3 lists trees and shrubs that are indicative of different geologic settings.

The area that is now downtown Cincinnati was not covered by the Wisconsinan glacier. However, remnants of the Wisconsinan glaciers are evidenced in outwash sluiceways such as the Little Miami and Great Miami Rivers. Glaciofluvial outwash poured down these valleys, aggrading them to elevations of 165 meters above sea level. The outwash aggradation is equivalent to the melting of the LGM at its southern extent and is referred to as the Tazewell terrace, which formed 16,000-18,000 years B.P. (Ray, 1974; Dalbey, 1976). The Tazewell terrace is now preserved as terrace remnants, which are actively mined for sand and gravel. Valleys that were tributary to the main glaciofluvial channels (Scioto, Ohio, Mill Creek, and the two Miami Rivers) were cut off and ponded by the aggradation, and extensive lakes were formed. Big Bone Creek was backed up by the outwash, and erosional terrace remnants of lacustrine clay and silt occur along valley walls. The Tazewell terrace developed a paleosol during the Erie Interstade at 15,500 years B.P., and old tributaries downcut through the outwash.

Another weak terrace, primarily along the Great Miami River and the Scioto River, lies about 5 meters below the Tazewell terrace. This terrace corresponds to the melting of the last major readvance of the glacier after 15,000 years B.P. (Reesville Moraine). Meltwaters flowed in the upper reaches of the major tributaries to the Ohio River valley. These meltwaters incised the river valleys, creating the channels of the modern rivers. The Great Miami and the Scioto Rivers retain alluvial terraces of this outwash event, referred to as the Cary terraces (Ray, 1974).

The post-Paleozoic history of the Ohio River valley incision at Cincinnati can be summed up by a simplified cross-section model (fig. 23) devised by Durrell (1977). Teays drainage flowed north and was cut off and altered by the first glacial advance. Chert occurs in abandoned Teays alluvial valleys in the uplands. Many of the old river valleys have layers of alluvium from proglacial lakes covering Teays River alluvium. Thus the chert-bearing Teays upland alluvium commonly is not accessible because it is buried, but some modern streams drain stretches of the Teays alluvium where chert is available in specific locations.

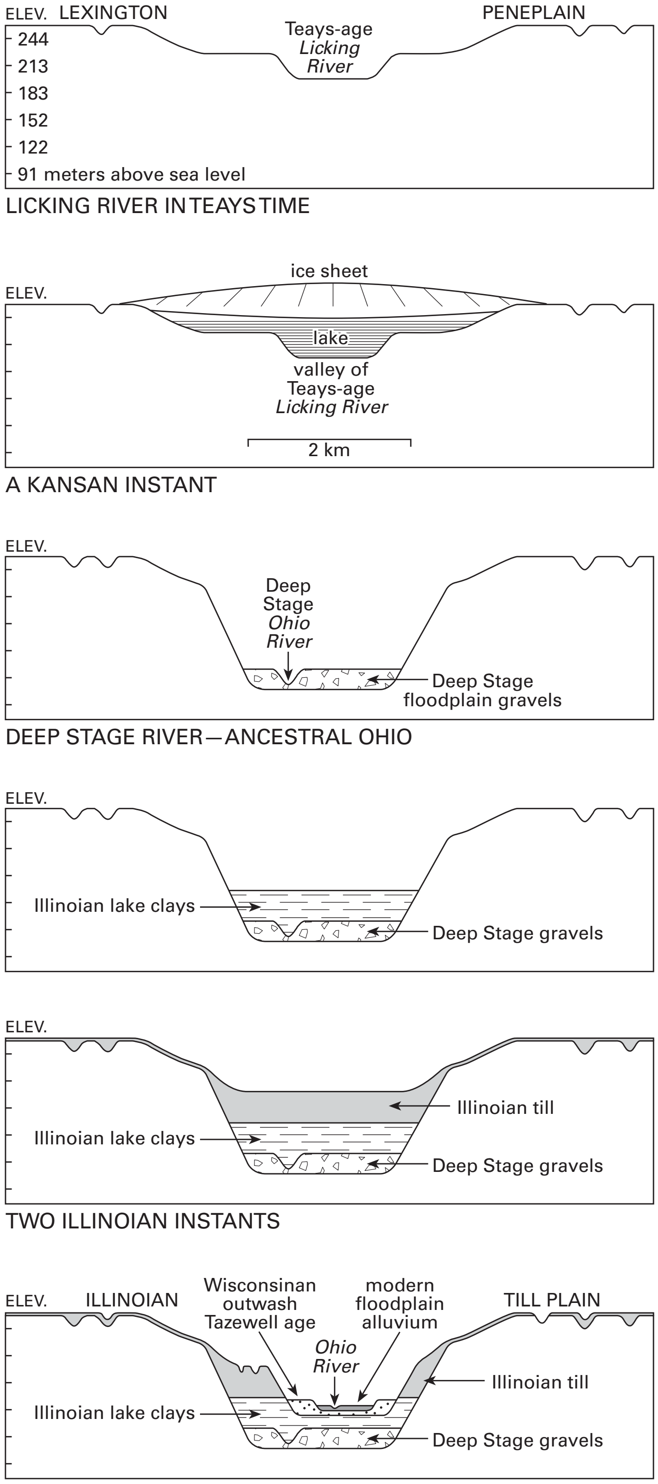
During the glacial stages, the river valleys in south-central and southwestern Ohio were recycled. Northward flows were cut off, lakes formed, divides were breached as spillways, new flow regimes were started and abandoned to the old preglacial drainage, and the cycle repeated with each glacial advance. Each time, enough change occurred to establish the modern system. The modern drainage south of the Ohio River, for the most part, still captures the

TABLE 3.—*Some plants*[1] *useful in mapping glacial geology and their geologic setting*

Bedrock
limestone
red cedar (*Juniperus virginiana*) except in southwestern Ohio
chinquapin oak (*Quercus muehlenbergii*)
redbud (*Cercis canadensis*)
sandstone
chestnut oak (*Quercus montana*)
sourwood (*Oxydendrum arboreum*)
scrub pine (*Pinus virginiana*)
pitch pine (*Pinus rigida*)
blueberry (*Vaccinium*)
floodplain
sycamore (*Platanus occidentalis*)
black willow (*Salix nigra*)
cottonwood (*Populus deltoides*)
American and cork elms (*Ulmus americana* and *Ulmus thomasi*)
red maple (*Acer rubrum*)
box elder (*Acer negundo*)
Clay till uplands
very poorly drained to swampy
black willow (*Salix nigra*)
American elm (*Ulmus americana*)
red maple (*Acer rubrum*)
swamp white oak (*Quercus bicolor*)
bitternut hickory (*Carya cordiformis*)
moderately well drained
white ash (*Fraxinus americana*)
American elm (*Ulmus americana*)
well drained
sugar maple (*Acer saccharum*)
American beech (*Fagus grandifolia*)
red oak (*Quercus borealis*)
Sandy till uplands
white oak (*Quercus alba*)
black oak (*Quercus velutina*)
red oak (*Quercus borealis*)

[1] Assembled from Braun (1951).

northward drainage from Kentucky, West Virginia, and the surrounding areas established in Teays time. The southwest-flowing streams above Pittsburgh did not contribute to the Ohio River system until the Kansan glacial stage. All the streams in southern Ohio reversed their direction as a result of glaciation and flowed south, draining tills, except the unglaciated Allegheny Plateau in the southeast. Since the end of the Cary Interstade about 13,000 years B.P., the modern drainage north of the Ohio River above the DuPont site has been established. Today, the Ohio River catchment basin above the DuPont site drains an area of more than 400,000 km^2 and parts of nine states (fig. 24).


LICKING RIVER IN TEAYS TIME

A KANSAN INSTANT

DEEP STAGE RIVER—ANCESTRAL OHIO

TWO ILLINOIAN INSTANTS

WISCONSINAN AND BEYOND

FIGURE 23.—Cross-sectional model of post-Paleozoic sequential geomorphology in the Cincinnati area (modified from Durrell, 1977, figs. 2, 5, 6, 8, 10, and 11).

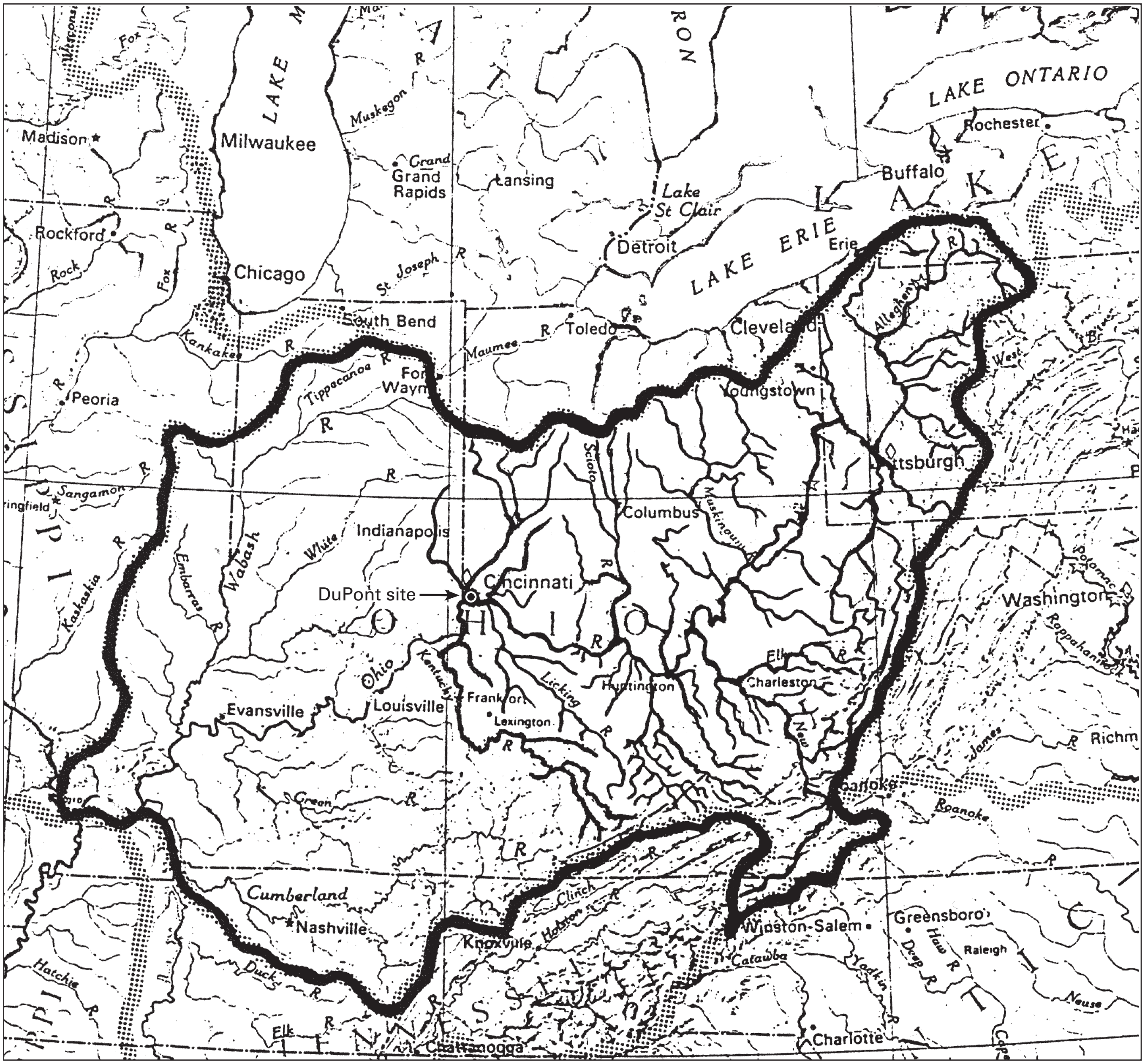


FIGURE 24.—Modern drainage catchment of the DuPont site, including areas of potential chert-bearing Paleozoic bedrock, Teays drainage with chert, and till with chert.

POST-PLEISTOCENE/HOLOCENE

The prehistoric Stone Age inhabitants of Ohio were the “first geologists” in the state. One of their primary interests was good-quality workable chert. They were the first to quarry raw materials such as chert and, at a later date, Ohio pipestone for economic benefit. Their lapidary work is unique in North American prehistory. For example, banded slates were commonly used for gorgets and birdstones; limestone was used for a variety of tools such as roller pestles, hoes, and net sinkers; quartzite was used for mortars; sandstone was used for abraders; igneous and metamorphic rocks were used for axes, hammers, choppers, adzes, celts, and scraper planes, all indicating that harder stone materials were used for heavy-duty tasks. The most developed use of stone raw materials was during the Hopewell period, when exotic raw materials from outside the area were either traded or independently obtained. This brief list only touches on a few aspects of the ability of prehistoric inhabitants to use stone to their advantage.

The prehistoric inhabitants living where Cincinnati is located today had three potential sources from which to obtain chert raw material for stone tools: (1) exposed Paleozoic bedrock outcrops, (2) stream gravels, and (3) glacial features. From the preceding discussion, we know nodular or bedded cherts do not crop out in the Ordovician bedrock in the Cincinnati area, eliminating this source. The second source, stream gravels, were the most common source of chert. Stream gravels have the most potential because of the large drainage area, the long duration of southern streams flowing into the area, and the recycling of the old northern drainage by glaciers. Streams in the drainage can be characterized as having three general gradients of flow. The upper reaches in the mountains have steep gradients, fast flow, and bedloads of brecciated boulders and cobbles. The middle reaches of streams across the Bluegrass Plateau and the Till Plains have an intermediate gradient and flow regime and a bedload consisting of sand and large cobble (>64 mm) substrates. The lower reaches near the mouths of tributaries have lower gradients and flow and substrates consisting of silts and sands in pools and runs; cobble and gravel bars are common on meanders and riffles. Ohio River floods are different since the locks and dams were constructed. Modern floods are very clay and silt rich; large debris is restricted between dams. Floods in prehistory were able to carry a much heavier stream load.

Glacial features such as kames, eskers, end moraines, tills, and glaciofluvial outwash terraces consist of heterogeneous raw materials of various size fractions. Direct exploitation of raw materials in glacial features is unknown. However, inhabitants in central Ohio during the Glacial Kame period commonly used kames to bury their dead. The glacial features contributed raw materials as stream erosion cut through the features, incorporating glacial raw materials to the stream bed.

At the Ferris site along the Ohio River, gravel bars in the Ohio River were the primary available chert sources, along with a few high-gradient creeks from adjacent uplands draining nearby Illinoian tills. At the DuPont site, the Whitewater River and the Great Miami River join less than 2 km (1.2 miles) to the north and flow into the Ohio River below the site. Therefore, gravel bars in the Ohio River containing eastern cherts from upstream would be available, as well as cherts in gravel bars along the combined Whitewater and Great Miami Rivers.

Gooding (1966) and Kapp and Gooding (1974) described several sections of Kansan and Illinoian drift containing abundant chert cobbles from the Silurian Laurel and Brassfield Limestones in southeastern Indiana. For several million years during the Teays age, Silurian outcrops weathered extensively, and surfaces were probably covered with loose bedrock. The first glacial advance into the area would have crushed and pushed loose weathered surface rocks ahead of the glacier. Teller (1972) suggested tills rich in Laurel chert occur within short distances from bedrock sources (fig. 25). Some of the chert in Kansan till retains a coating of reddish-brown clay indicative of the weathered surface where they originated. The present Whitewater River drainage was a glacial meltwater channel during the Shelbyville (LGM) stade in southeastern Indiana. As a meltwater channel, the Whitewater River eroded tills of three separate glaciers in southeastern Indiana, depositing Laurel and Brassfield cherts along with other glacial boulders and cobbles forming the stream bed. The modern Whitewater River is known for whitewater canoeing through the rocky substrate.

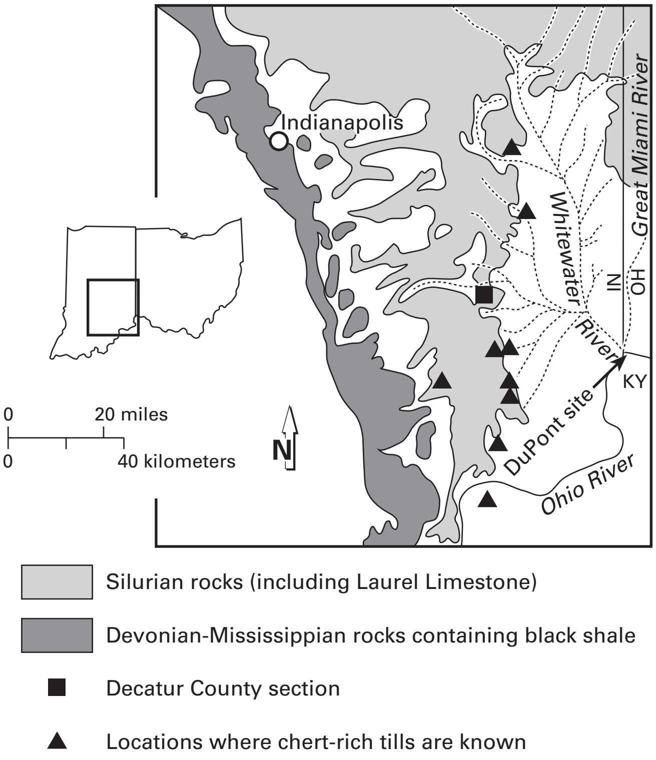
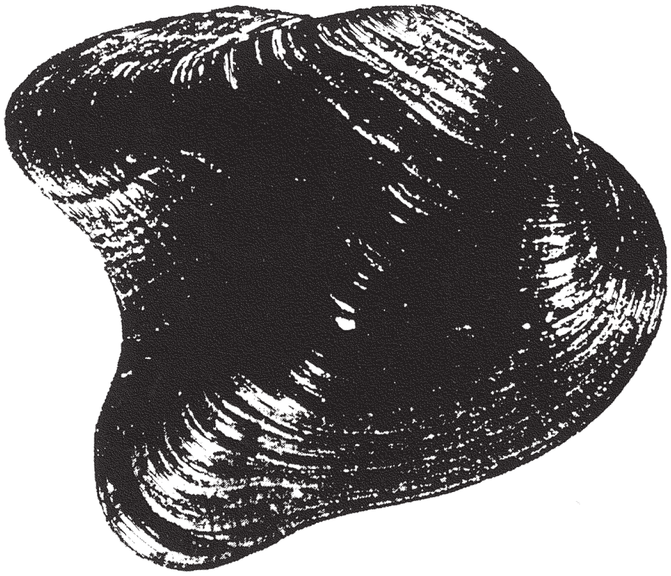


FIGURE 25.—Chert locations in Silurian limestone outcrops drained by the Whitewater River in southeastern Indiana (modified from Teller, 1972, fig. 2). Areas of Kansan and Illinoian till containing Laurel cherts also are drained by the Whitewater River. The Whitewater and Great Miami Rivers aggraded during the Tazewell drainage, depositing predominantly Laurel cherts in Great Miami River gravel bars.

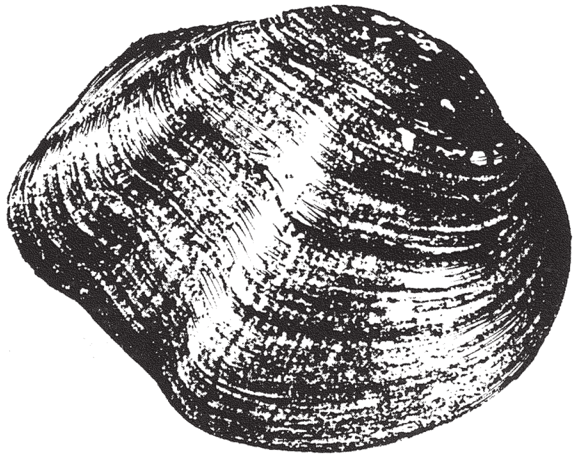
The Great Miami River was the main outlet channel in southwestern Ohio for the Wisconsinan (LGM) Miami Sublobe. South of the Wisconsinan end moraines, the meltwaters primarily eroded Illinoian tills that contained Silurian-age Bisher and Cedarville-Guelph cherts and Devonian-age Columbus cherts north of the area and reworked glaciofluvial outwash deposits of lesser known origin (Lake Huron area).

As mentioned above, the Ohio River in the vicinity of the DuPont site once had large gravel bars. Molluscan naiad fauna recovered from 35 earthern features at DuPont (Dalbey, 1977a, 1977b, 1977c) indicate the existence of riffles, which are created by a rocky cobble-gravel substrate. Extinct large river Naiades such as *Epioblasma* sp. (fig. 26) required a habitat of fast-flowing oxygenated water created by riffles and a cobble to gravel nonshifting substrate (La Rocque, 1967; Stansbery, 1971, 1975). Thirty-five percent of the identifiable Naiades (n = 198) excavated at DuPont required riffle habitats. The higher, artificially created pool levels created by the dams and the high silt and clay content of the water has caused the extinction or near extinction of 22 species of Naiades in the Ohio River at Cincinnati.

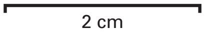
The Licking River in Kentucky flows north to the Ohio River, downcutting through Paleozoic bedrock containing

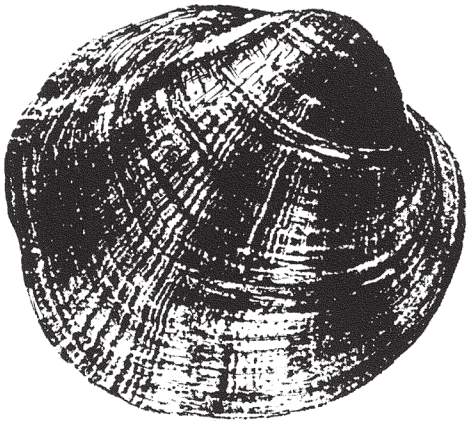


Epioblasma flexuosa (Rafinesque, 1820). OSUM 10369.2, female, "Ohio river," 18?, length = 70 mm, from Henry Moores Collection.

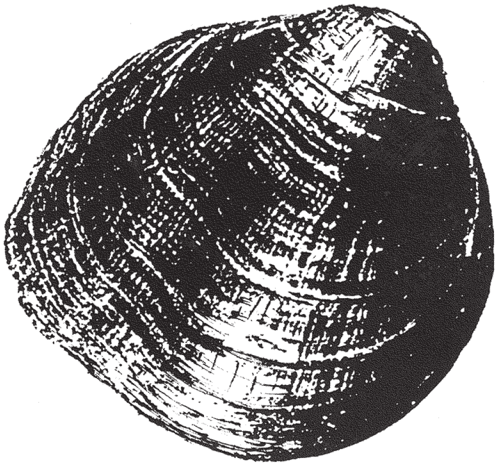


Epioblasma flexuosa (Rafinesque, 1820). OSUM 10369.1, male, "Ohio river," 18?, length = 58 mm, from Henry Moores Collection.





Epioblasma personata (Say, 1829). OSUM 10370.1, female, "Ohio river," 18?, length = 46 mm, from Henry Moores Collection.



Epioblasma personata (Say, 1829). OSUM 10379.1, male, "Ohio riv. Cinti.," 18?, length = 40 mm, from Henry Moores Collection.

FIGURE 26.—Extinct Ohio River Naiades collected in the 1800's that required a riffle habitat created by gravel bars oxygenating river water (modified from Stansbery, 1971, figs. 5, 6, 11, and 12).

Kentucky Flint Ridge, Haney, Paoli, and Ste. Genevieve cherts. The source area for the Paoli chert is closest, within 120 km (75 miles) of the Ohio River. Therefore, Paoli chert would be common in gravel bars at Cincinnati and could possibly work down to gravel bars near DuPont. Cherts from central Ohio, eastern Kentucky, and West Virginia also could be carried this far downstream by floodwaters, but their frequency would be very low. Swadley (1971) and Teller (1973) described Teays-age river gravels in upland valleys at elevations of 182 meters above sea level that contain light-tan and brown cherts in northern Kentucky south of the DuPont site.

Thus, the DuPont site was located where nearby Laurel and Brassfield cherts from Indiana would be deposited in the Whitewater River. Bisher, Cedarville-Guelph, and Columbus cherts would be available in the Great Miami River, and all these cherts would be available below the confluence of the two rivers. Paoli chert was available in Teays valleys in the uplands of Kentucky across the Ohio River from the site. Paoli, Haney, and Kentucky Flint Ridge cherts would be abundantly available along the Ohio River for 30 km (19 miles) to the mouth of the Licking River. Other eastern cherts such as Zaleski and Upper Mercer also would be available in the Ohio River in greatly reduced amounts.

The Ferris site was located where eastern and southern cherts were available on gravel bars in the Ohio River. Brassfield and Bisher cherts crop out about 40 km (25 miles) north and east of the site. Kentucky cherts (Ste. Genevieve, Paoli, Haney, and Kentucky Flint Ridge) would be available in limited quantity, fed to the Ohio River by the Big Sandy River to the east. The cherts listed above would be available in the uplands 30 km (19 miles) to the southwest in Old Licking River Teays-age deposits and in the Holocene Licking River gravels at Cincinnati and upstream into Kentucky.

ARCHAEOLOGY

Featherstone (1977) located an elongated gravel bar in the Great Miami River below the confluence with the Whitewater River (fig. 27) about 2 km (1.2 miles) north of the DuPont site. The gravel bar (fig. 28) measured 200 meters long by 65 meters wide and had an area of 13,000 square meters. Two 1-square-meter grids were laid out along the center axis of the gravel bar on its upstream and downstream areas. All cobble-size rocks (64 to 256 mm) were collected from the surface in the two 1-square-meter grids, totaling 188 cobbles. Chert composed 8 percent (n = 15) of the cobble-size sample (table 4). The chert types in the gravel bar consisted of Laurel (40 percent, n = 6), Brassfield (13 percent, n = 2), Cedarville-Guelph (13 percent, n = 2), Bisher (7 percent, n = 1), and unknown glacially derived cherts (27 percent, n = 4). This sample indicates that a gravel bar of this size has the potential of yielding 97,500 chert cobbles; 39,000 of the chert cobbles would potentially be Laurel chert. The density and spatial pattern of chert across a gravel bar will vary, but these data do point out the high yield potential of gravel bars for supplying the many varieties of stone, and certainly chert, used by the prehistoric inhabitants of the area.

Chert debitage from two of the partially excavated features (Features AA and B) at DuPont were analyzed for raw material type (see Stop 2, fig. 2-7, for a brief description of the features). These two features represent one of the earliest occupations at the site (Feature B) and one of the latest occupations at the site (Feature AA), separated by 360 years (Brandau and Noakes, 1978). Laurel chert was commonly used throughout the entire Late Archaic occupation of DuPont (table 5). The Great Miami River and Whitewater River cherts compose over 70 percent of the identifiable cherts used at DuPont. The large unidentified chert category (20 percent) reflects unknown glacially derived cherts and other cherts within the drainage net that have not been identified. In Feature AA it appears that 10 percent of the cherts are Kentucky types, reflecting exploitation of the Ohio River. The large number of Great Miami River chert types clearly indicates that gravel bars along the river were exploited for chert and other stone raw materials near the site.

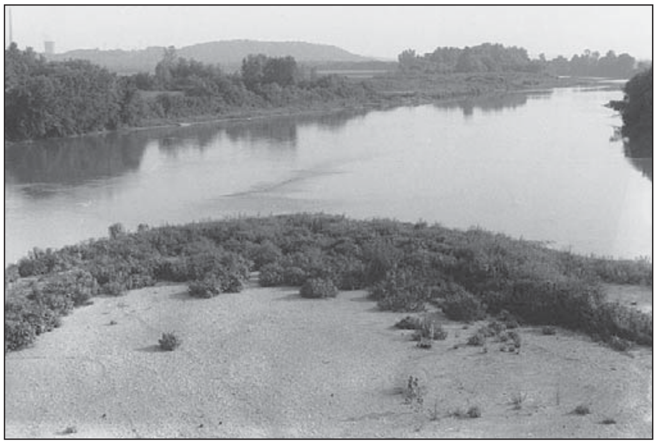


FIGURE 27.—Confluence of the Whitewater River (right) and the Great Miami River (left). View looking southwest to the hilltop promontory on which Miami Fort and the Shawnee Lookout Archaeological District (see Stop 2) are located. The DuPont site is at the toe of the hill.

FIGURE 28.—Gravel bar on the Great Miami River below the confluence with the Whitewater River sampled by Featherstone (see text).

TABLE 4.—*Cobble-size rock types in a Great Miami River gravel bar*

Rock type	Number	Percentage
dolomite	88	47
limestone	47	25
chert	15	8
quartzite, quartz	11	6
sandstone, siltstone	9	5
granodiorite, gabbro, gneiss, and other igneous-metamorphic rocks	8	4
Huronian tillite	2	1
uncertain	8	4
Total	188	100

TABLE 5.—*DuPont site, feature debitage chert types*

Chert type	Feature AA		Feature B	
	n	Percentage	n	Percentage
Laurel	1,433	52	311	47
Brassfield	138	5	46	7
Bisher	220	8	13	2
Cedarville-Guelph/ Columbus	165	6	112	17
Delaware	14	0.5	20	3
Paoli	96	3.5	3	0.5
Kentucky Flint Ridge	96	3.5	3	0.5
Upper Mercer	28	1	0	0
Haney	tr[1]	tr	0	0
St. Louis	tr	tr	0	0
Brush Creek	tr	tr	0	0
Kanawha Black	tr	tr	7	1
Zaleski	tr	tr	0	0
unidentified	551	20	146	22
Total	2,741	99.5	661	100

[1] tr = trace, 15 or fewer flakes.

The Ferris site represents a single-component Early Archaic site. The chert types for debitage and tools from the intensive surface collection are presented in table 6.

TABLE 6.—*Ferris site, debitage and tool chert types*

Chert type	Debitage		Tools	
	n	Percentage	n	Percentage
local pebble chert	984	34.2	96	26.2
Brassfield	126	4.4	36	9.8
Paoli	500	17.4	68	18.6
Kentucky Flint Ridge	390	13.6	29	7.9
Boyle	317	11.0	48	13.1
Haney	39	1.4	9	2.5
St. Louis	8	0.3	4	1.1
Ste. Genevieve			3	0.8
Harrison County (Indiana)			1	0.3
Laurel	4	0.1	1	0.3
Cedarville-Guelph	2	<0.1		
Zaleski	89	3.1	21	5.7
Brush Creek	3	0.1		
Ohio Flint Ridge	3	0.1	1	0.3
Kanawha	3	0.1	2	0.6
unidentified	409	14.2	47	12.8
Total	2,877	100	366	100

The Ferris chert assemblage, when compared to the DuPont chert assemblage, does not appear to be as localized. The Kentucky cherts represent about 44 percent of both the debitage and the tools. Local pebble cherts occur in nearby Illinoian tills and local creeks, and probably the Ohio River as well. No gravel bars have been accessible on the Ohio River in this area for years. It is possible that the Kentucky cherts occurred in gravel bars along the Ohio River near the site. The Big Sandy River about 100 km (62 miles) to the east drains areas of Ste. Genevieve, Paoli, Haney, and Kentucky Flint Ridge chert bedrock (figs. 8, 10). However, the occurrence of Boyle, Harrison County (Indiana), Laurel, and Cedarville-Guelph cherts clearly indicates a wide-ranging area from the Licking River in Kentucky to the Great Miami River (figs. 8-11). The Harrison County tool does not necessarily indicate that the range of these people extended to south-central Indiana. However, the high amount of Boyle chert and other Kentucky varieties may indicate that these people had their origin along the central Licking River valley. The varieties of chert from downstream on the Ohio River also reflect their total range of exploitation.

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PREHISTORIC ARCHAEOLOGY

by
Timothy S. Dalbey

This discussion highlights some aspects of archaeology in southern Ohio. The chronology in table 7 is fairly well established back in time to the middle of the Late Archaic; the older dates are not well established.

PALEOINDIAN (*circa* 14,000-8,550 years B.P.)

Paleoindian projectile points (fig. 29) have been found at a number of localities in southern Ohio, but an unmixed Paleoindian assemblage is extremely rare. One of the most prolific Late Pleistocene faunal sites in the Cincinnati area is Big Bone Lick in northern Kentucky (see Stop 1), but Paleoindian assemblages have been elusive at the lick. The Burning Tree mastodon find in Licking County, Ohio, indicates that Paleoindians may have redistributed body parts (see Stop 6). No other Paleoindian remains have been associated with Late Pleistocene megafauna in Ohio.

Recent work at three other Ohio sites shows promise for elucidating more about Paleoindian lifeways. The Noble's Pond site (Stark County) has yielded a large chert artifact assemblage which is being analyzed but has not been sufficiently dated (Mark Seeman, oral communication, 1990). The Munson Springs site (Licking County) has yielded a lanceolate point and other lithic artifacts below an Early Archaic component (Frolking and Lepper, 1990; Lepper and Gill, 1991; Reustle, 1993). The Paleo-Crossing site (Medina County), located on a ridge overlooking a bog, has yielded fluted projectile points, two earthen pit features having a radiocarbon date of 13,120 years B.P., and three post molds of possibly the oldest structure in North America.

TABLE 7.—*Archaeological chronology for southern Ohio*

Culture		Years B.P.
Late Prehistoric (Fort Ancient)		1,000 to historic
Late Woodland (Newtown)		1,500 to 1,000
Middle Woodland (Hopewell)		2,150 to 1,500
Early Woodland (Adena)		2,950 to 2,150
Late Archaic	(late) Central	3,700 to 2,950
	(middle) Ohio Valley	4,700 to 3,700
	(early) Archaic	5,950 to 4,700
Middle Archaic		7,450 to 5,950
Early Archaic		8,550 to 7,450
Paleoindian	(Plano)	10,000 to 8,550
	(Clovis)	14,000 to 10,000

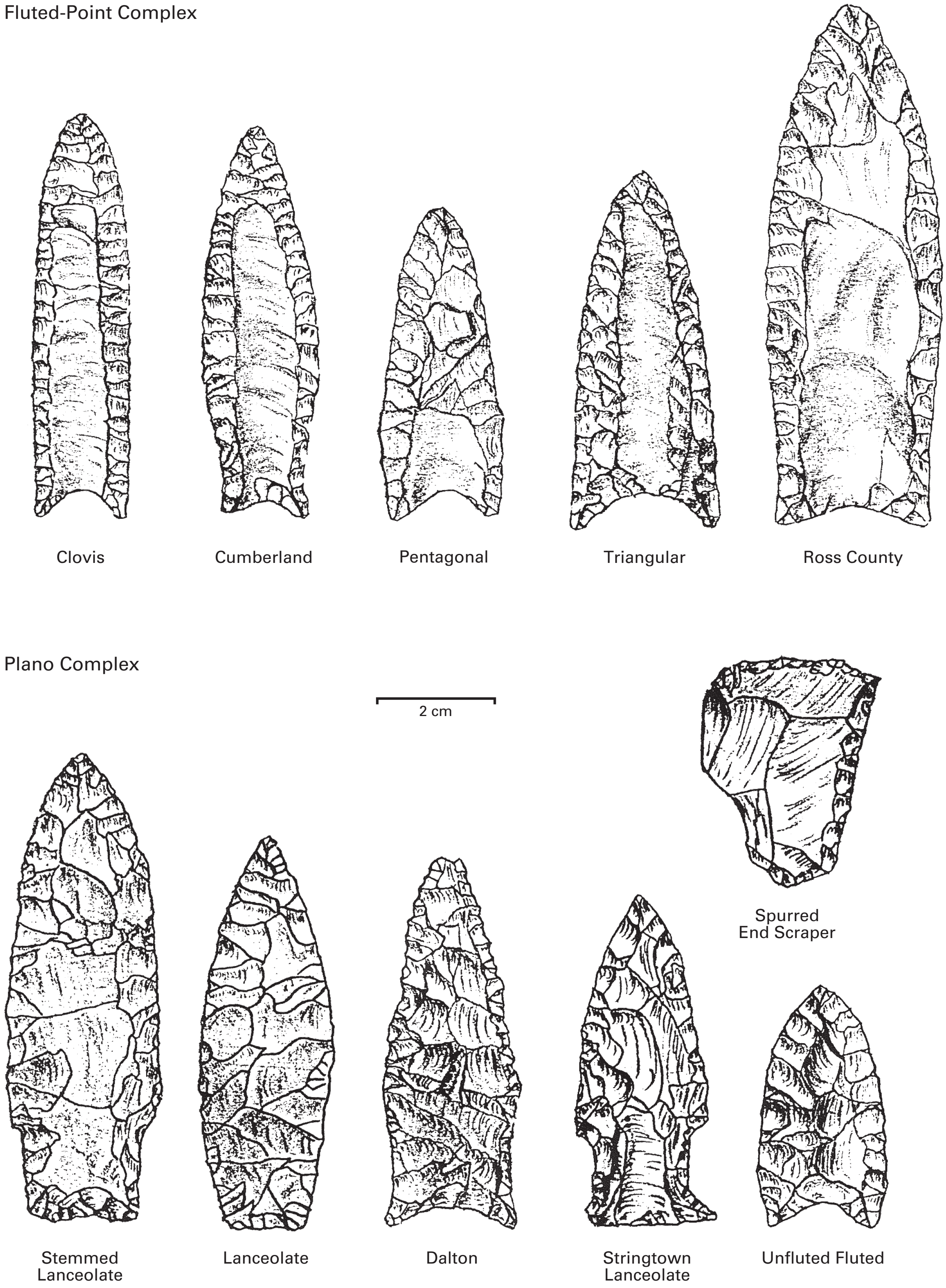


FIGURE 29.—Paleoindian projectile point types.

Most of the Paleoindian locations in the Cincinnati area reflect surface-collected localities (Starr, 1960; Fischer, 1968). Prufer and Baby (1963) divide the Paleoindian period into the earlier Fluted-Point Complex (Clovis) and the later Plano Complex (unfluted lanceolate). They examined 490 Paleoindian projectile points from museum collections and local collectors, then plotted a statewide frequency plot of points by county. Later, Seeman and Prufer (1982) added 566 Paleoindian projectile points to the count, bringing the total in the state to 1,056, which they claimed represented a more accurate interpretation of the Ohio Paleoindian projectile-point distribution. Lepper (1983, 1985) provided some cogent arguments about distributional data of the type presented by Seeman and Prufer (1982, 1984).

Two other promising Paleoindian sites are the Welling site (Prufer and Wright, 1970) in east-central Ohio (Coshocton County) and the Sandy Springs site (Cunningham, 1973) in southwestern Ohio (Adams County). A total of 54 fluted points has been recovered from the excavations at the Welling site. The Sandy Springs site has produced 72 fluted points from a sand-exposed, paleo-eroded surface along the Ohio River. No Paleoindian sites have been excavated in Ohio that have an extremely well dated Clovis sequence or a Clovis sequence stratified below a Plano component.

EARLY ARCHAIC (*circa* 8,550-7,450 years B.P.)

Perhaps less is known about Early Archaic people than about Paleoindians in southern Ohio. Very little survey work is available on Early Archaic sites. Most known sites are identified by surface collections of projectile points excavated at known archaeological sites in other states (fig. 30). One small intensive survey of available exposed plowed surfaces in a 31-square-kilometer area in Clermont County, east of Cincinnati, yielded a total of 15 Early Archaic sites (Theler, 1978a). Within the surveyed area, the Ferris site (33Ct31) represented a single-component Early Archaic site that was minimally tested and intensively surface collected (Theler and Dalbey, 1974). Of the 57 diagnostic projectile points from the surface of the site, 55 were Kirk-Palmer types, one was a Thebes point, and one was a Dalton point. Other tools include unifacial steep-edged endscrapers (23), crescent-shaped knives, perforators, drills, sidescrapers, ovate and rectangular knives, spokeshaves, gravers, choppers, hammerstones, manos, pitted stones, and bifacially flaked adzes. This tool inventory suggests seasonal exploitation of animals and plants combined with processing, grinding, and, probably, woodworking. Further analysis of chert tool and debitage raw material at the Ferris site indicates that a large proportion (18 percent, n = 91) of the raw material came from the south (>50 km) in Kentucky or from the west (about 48 km) from the Licking River at Cincinnati (see figs. 10, 11). This finding suggests the Early Archaic people exploited the Ohio River valley intensively; they may have been highly mobile and had a seasonal strategy settlement system.

MIDDLE ARCHAIC (*circa* 7,450-5,950 years B.P.)

Middle Archaic sites may be even less known than the Early Archaic and probably represent the fewest number of sites in Ohio. Most sites are identified by surface collections and diagnostic points (figs. 31, 32) from excavated sites in West Virginia and Tennessee. A Middle Archaic component yielding LeCroy projectile points was found at a depth of 3 to 4 meters along the Ohio River at Mexico Bottoms near the town of Patriot, Switzerland County, Indiana (McHugh and others, 1984)(see fig. 1-1, Stop 1). This discovery suggests that many of the early archaeological sites along the Ohio River are deeply buried and will be found only through subsurface investigations. Theler's Clermont County survey (1978a) yielded only nine Middle Archaic sites. The few known Middle Archaic sites in Ohio may be indicative of a larger trend of fewer Middle Archaic sites throughout the Ohio River drainage. This trend may reflect a population decline of the area or some other explanation, but nevertheless this period of archaeology needs further research.

LATE ARCHAIC (*circa* 5,950-2,950 years B.P.)

In extreme southwestern Ohio, Late Archaic sites are the most common, and many sites have been excavated, although few have been published. The numerous sites have provided the basis for dividing the Late Archaic into early, middle, and late periods. Very few early Late Archaic sites have been excavated, although many middle Late Archaic sites have been. Vickery (1976) defined a late Late Archaic manifestation preceded by a transitional period from middle to late Late Archaic. One of the key indicators of the middle Late Archaic sites is McWhinney projectile points (fig. 33). Middle Late Archaic settlement was focused along the Ohio River floodplains and terraces. Site size ranges from small, 0.5 hectare (<1 acre) extraction or special-purpose camps to large seasonal camps; enormous sites of over 12 hectares are located at the confluences of some major rivers. These large camps no doubt reflect repeated occupations and, perhaps, lengthy periods of occupancy at the site (see Stop 2).

River exploitation was very important during the middle Late Archaic; sites have yielded freshwater molluscan remains, fish bones, fish hooks, net sinkers, aquatic turtle and waterfowl remains, and chert from gravel bars. It was during the late Late Archaic that river craft were used to navigate rivers in northern Ohio (Brose and Greber, 1982) and probably the Ohio River as well. Seasonal fruits and nuts were very important; large quantities of walnut, hickory, butternut, and acorn were gathered. No cultivated plant remains have been identified.

Large and numerous earthen features also characterize the middle and, to some degree, the late Late Archaic. Some features represent nut-roasting pits, earth ovens that became stratified with reuse, "Dakota"-type earth ovens having subsurface vents, and storage pits that become filled with refuse. House patterns are unknown, but a type of windscreen is suggested by post-hole patterns around a large earth oven or drying-smoking racks. The large earth ovens were central to everyday life at the large camps. Many tools recovered from around the periphery of the earth-oven pits suggest that many daily activities of the family took place around the ovens. At the DuPont site (see Stop 2), caches of tool kits were found together, such as a small (160 mm) $^3/_4$ grooved axe, a chert knife, and a hammerstone

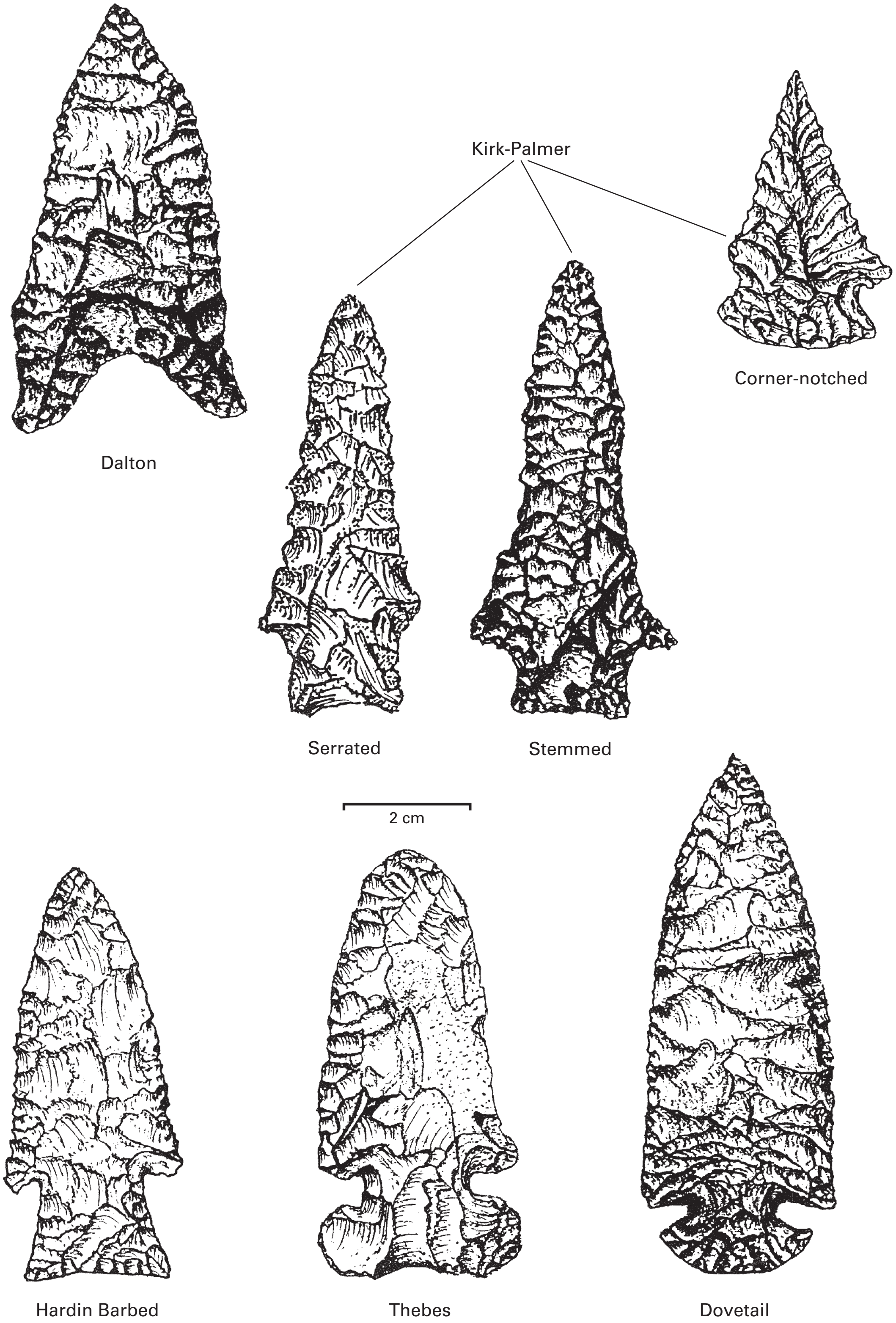


FIGURE 30.—Early Archaic projectile point types.

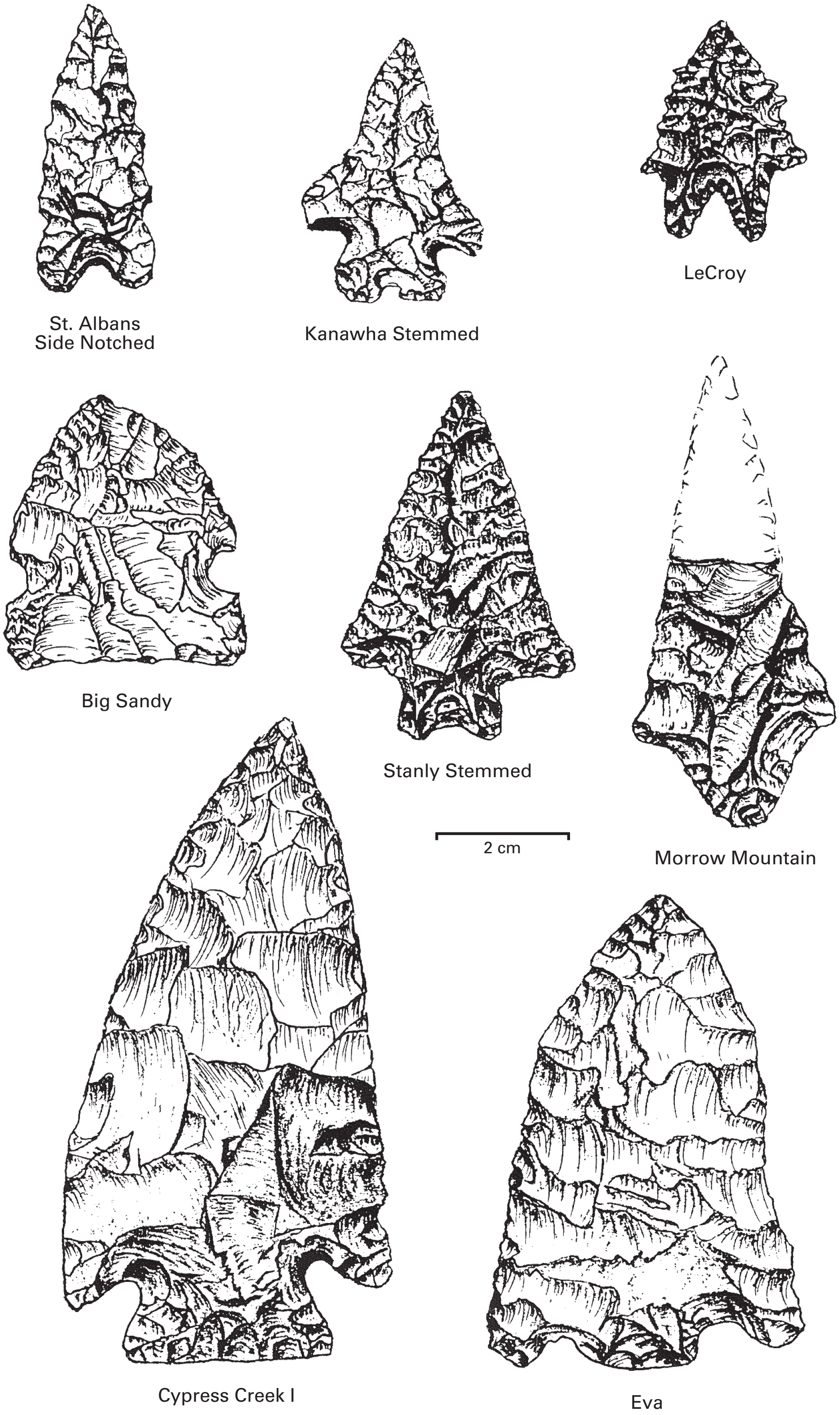
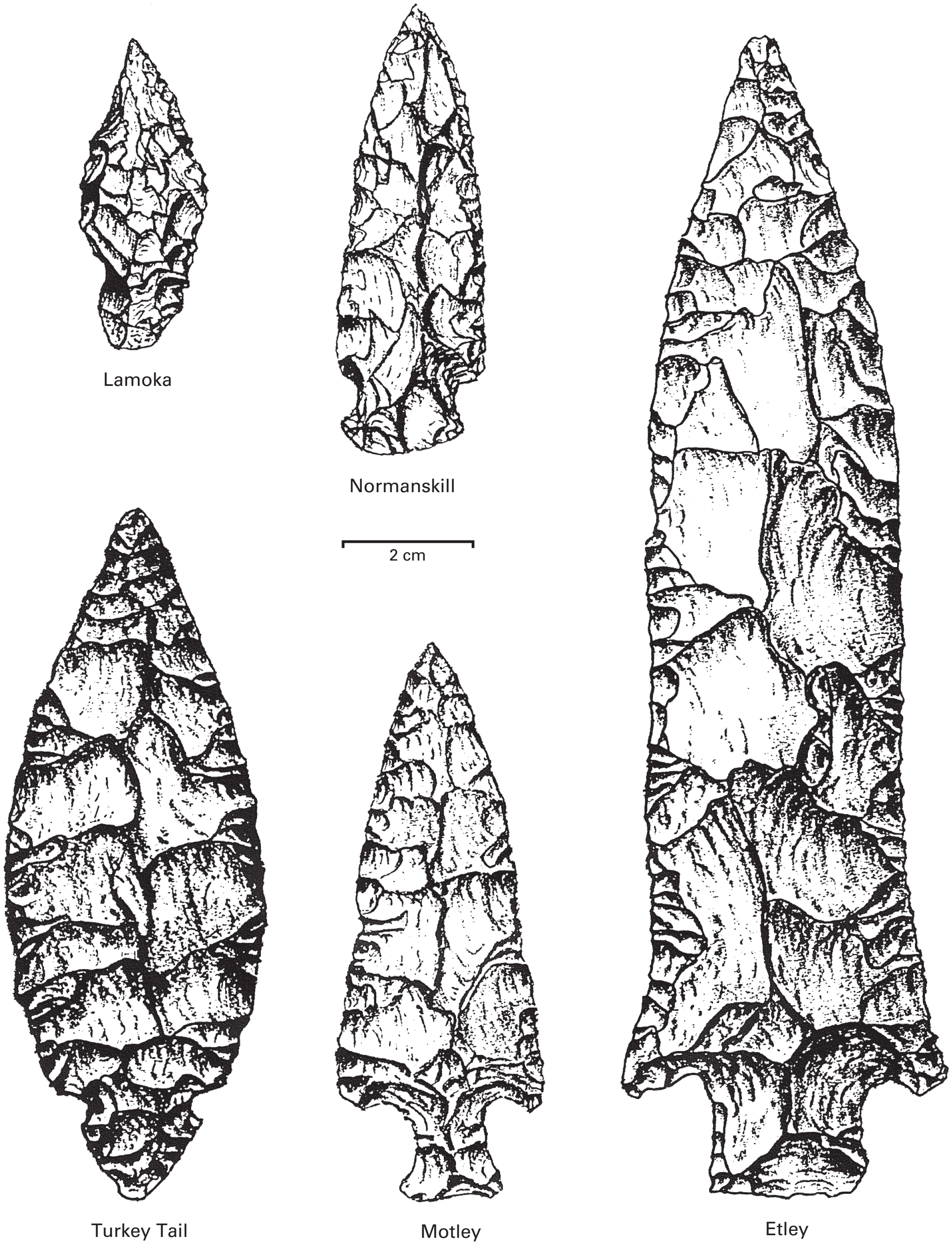


FIGURE 31.—Middle Archaic projectile point types.



Lamoka

Normanskill

Turkey Tail

Motley

Etley

FIGURE 32.—Middle Archaic projectile point types.

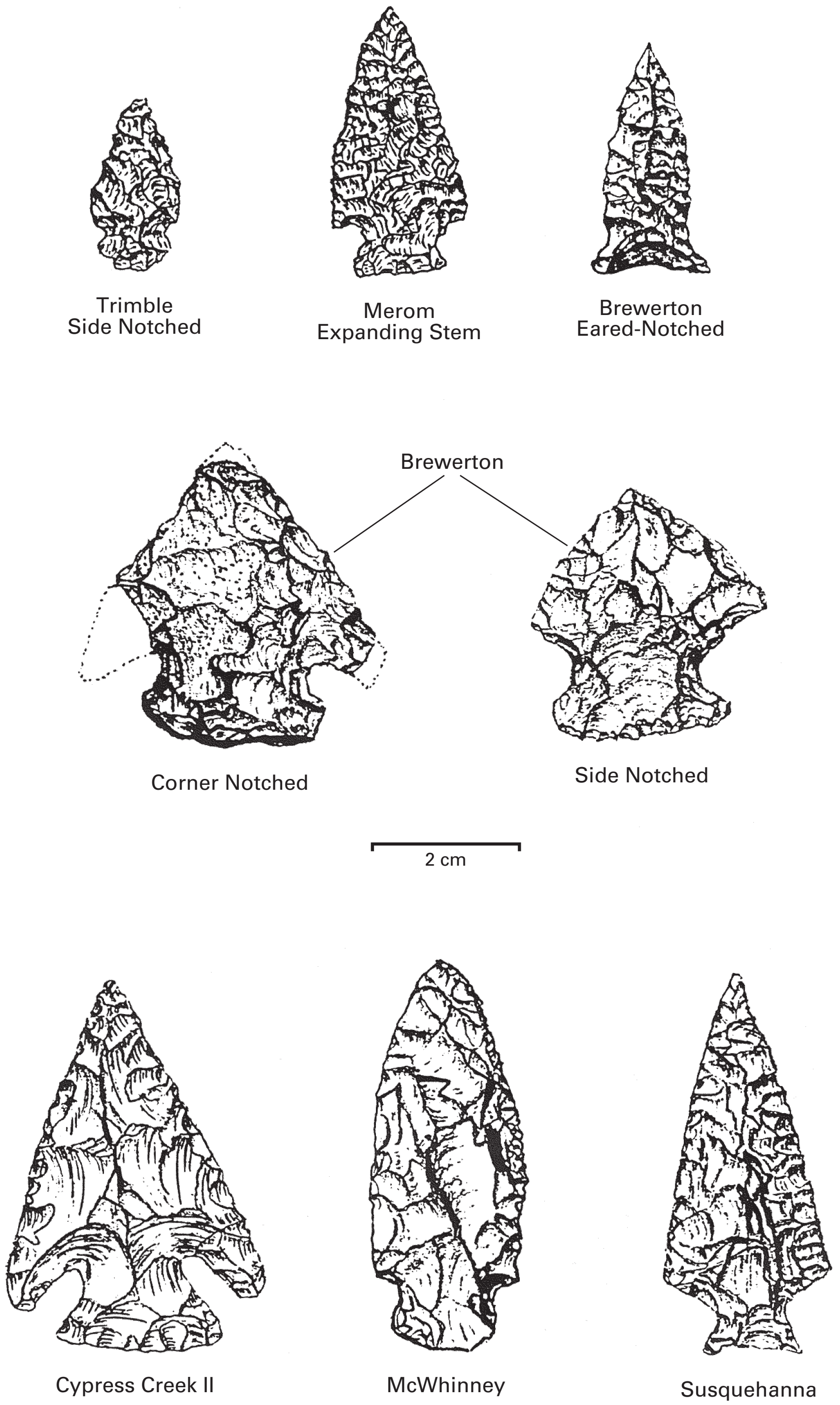


FIGURE 33.—Late Archaic projectile point types.

lying together on one side of an earth oven and a limestone roller pestle, pitted stone, scrapers, and a hammerstone on the other side. The earth ovens are up to 1.3 meters deep and have a volume of 3 cubic meters.

Mortuary practices included covering body parts with red ochre and placing utilitarian tools with the deceased in shallow oval pits. Bone beads were worn as clothing ornaments as well as shell necklaces, which commonly have a central perforated canine tooth or cannel-coal bead. Burials typically were placed on cut-away platforms on the sides of earth ovens. Some individuals had several projectile points lodged in the skeleton, indicating conflict. The atlatl was used, commonly made with a deer-antler handle connected to a wood shaft with a hook on the end made of antler or bone. Dog remains also have been recovered from earth ovens and appear to be the size of a beagle. Hide working and tanning can be inferred by whole deer-skull (antlers removed) remains recovered from earth-oven pits where the skull contents historically were used in the tanning process. Bone weaving shuttles, awls, and needles suggest basketry and garment weaving.

The Late Archaic sites are very complex and probably represent an increased population density along the Ohio River. The middle Late Archaic sites are contemporaneous with the Green River Archaic (Indian Knoll) sites, but it has not been established that they are related to the Green River Archaic people, as some have suggested. The Late Archaic people are probably the population base that the later Woodland cultures were derived from, although earlier Woodland skeletal groups have not been compared to Late Archaic skeletal populations.

EARLY WOODLAND/ADENA
(*circa* 2,950-2,150 years B.P.)

In southern Ohio, the best known aspect of the Early Woodland period is the Adena culture (Potter, 1968). Much has been written about the Adena culture (see Stop 9); however, the Adena is mostly identified as a burial complex within the larger Early Woodland Complex (Otto, 1979). The Early Woodland period in Ohio marks the beginning of the use of pottery, which is commonly called Fayette and Marion. During this time, native plants such as sunflower and sumpweed were cultivated in garden plots in southern sites. In Kentucky, squash and gourd have been found as early as 2,570 to 2,350 years B.P. Burial ceremonialism that began in the Late Archaic became more elaborate in terms of grave preparation as well as in grave goods, culminating in the construction of mounds and earthworks. Mounds become more common after 2,350 years B.P. throughout the eastern United States. Large caches of large ceremonial spears, Robbins Stemmed projectile points of exotic raw materials, and hammered copper ore occur in mounds in Ohio and westward to Illinois.

Once mound building began to flourish late in the period, specific items made during this period began to change significantly, such as cylindrical pipes made of Ohio pipestone; these pipes were exchanged as far as Illinois and New York. The slate gorget of earlier Late Archaic culture persisted during this time. Birdstones and boatstones replaced bannerstones of the Late Archaic. The $^3/_4$ grooved axe and celt were the primary wood-cutting tools. Permanent houses ranged from small single-family structures to large round structures that could house more than 30 people. There are groups of 10 or more of these structures on Adena sites. Fayette Thick pottery changed to Adena Plain and Montgomery Incised. Projectile-point styles changed to Adena Ovate Base and Robbins Stemmed (fig. 34).

During the Adena period, burials were interred in many different ways, such as flexed, bundled, redeposited, cremated, or extended in log tomb crypts, and were placed on mound floors or on platforms in mounds. Circular earthen enclosures around mounds were more the exception and are probably late Adena. Very large mounds were constructed, such as the Miamisburg Mound (see Stop 3), which is considered to be Adena and is one of the largest mounds in the United States. Child burials commonly contained some of the most elaborate grave goods in a mound. Cranial deformation and trephination also were practiced during this period.

Ironically, most of what we know as Adena comes from burial-mound excavations. Very few commoners' burials, that is nonmound burials, have been found that belong to the Adena time period. Very few Adena villages have been located and excavated. Serpent Mound, considered by many archaeologists to be an Adena monument (see Stop 12), along with a conical mound and a village site, is one of the rare sites with potentially all aspects of Adena life; however, recent excavations at the site have only elucidated aspects of the Fort Ancient occupation.

MIDDLE WOODLAND/HOPEWELL
(*circa* 2,150-1,500 years B.P.)

It can be argued that Adena is early Hopewell, and Hopewell represents an elaboration of the burial ceremonialism that began in Adena (Otto, 1979). In southern Ohio the most dramatic Middle Woodland aspect is Hopewell. Middle Woodland non-Hopewell sites in southern Ohio are rarely excavated but do occur and are identified by diagnostic points (fig. 34). Researchers must consider these sites in order to fully understand Middle Woodland economy (see Stop 2). Much has been written about the Hopewell culture (see Brose and Greber, 1979), but very little about the Hopewell economy. For the most part, large ceremonial centers consisting of earthworks and mounds have been the focus of excavations. For over 100 years, there has been a fascination with excavating mounds by archaeologists. However, mounds can be huge, expensive, time consuming, and limited in the amount of information they reveal. In the past few decades, more mounds have been destroyed by development than could ever be excavated; at a very conservative estimate, more than 5,000 mounds have been destroyed. As a result, most of what is known about Hopewell has been developed from earthwork and mound excavations. These excavations have revealed an enormous amount of information about mortuary practices and, to some degree, ceremonialism, status, craft specialization, and exchange systems such as the "Hopewell Interaction Sphere" (see Stop 8). Cultural change can be demonstrated through changing mortuary practices and various construction phases of

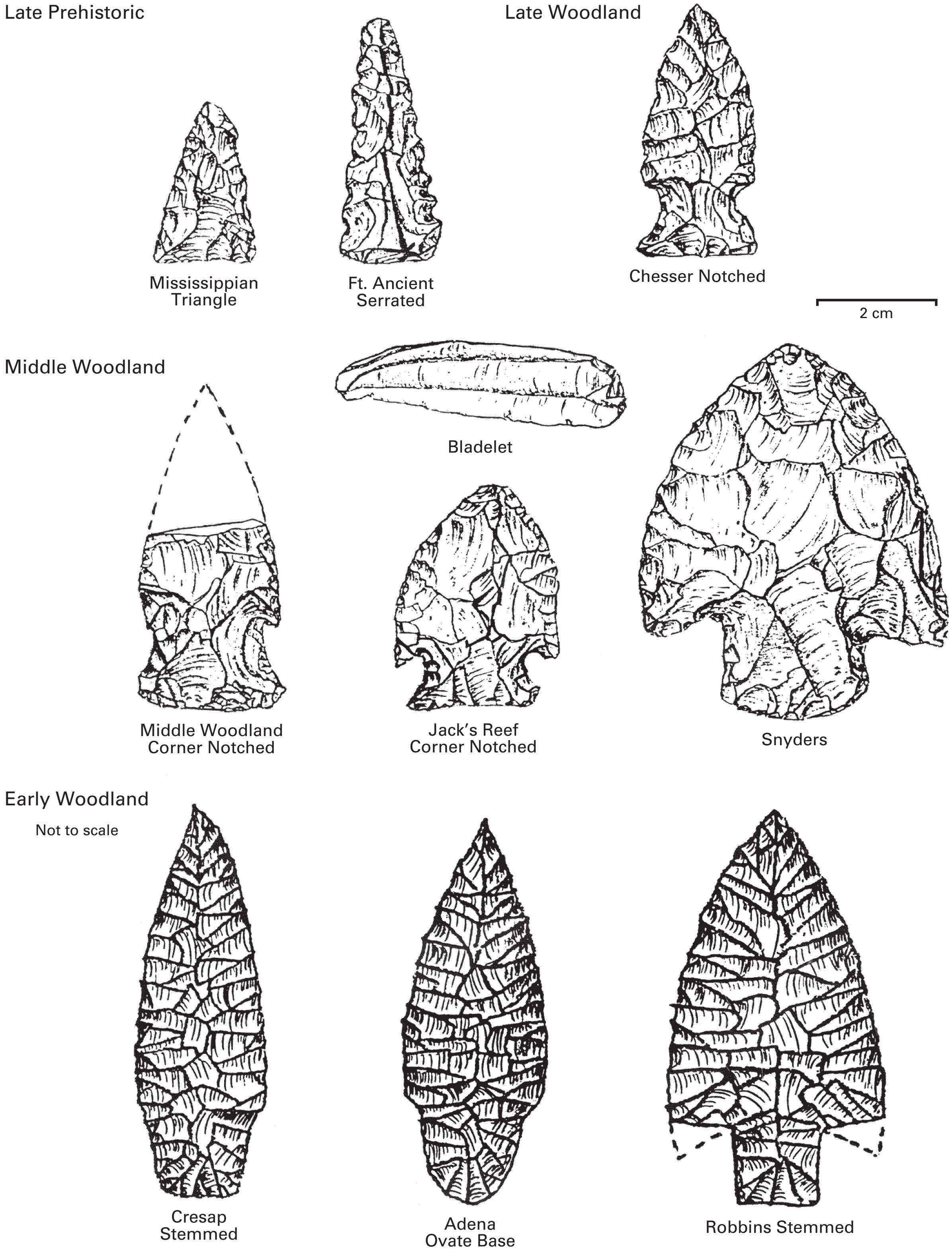


FIGURE 34.—Woodland and Late Prehistoric projectile point types.

the ceremonial centers, which must reflect cultural change in the society at large. Many of the burial practices were started in the Adena; however, cremations and ceremonies in charnel houses capped by a large earthen mound became more common by 1,700 years B.P.

Craft specialization during the Hopewell period is one of the most spectacular aspects of this culture. Many artisans worked in stone, creating beautiful pipes, effigies, mica carvings, ceremonial chert blades, earspools, medallions, copper breastplates, bead work, and bone carvings, to name just a few. Many types of weaves were used to make clothing, which was dyed with geometric designs. Pottery, on the whole, was not as elaborate, although Hopewell pottery was incised with a variety of designs, including Shoveler Duck designs. Other animistic designs were common in ceremonial burial contexts.

Archaeologists have investigated earthwork alignments to see whether there is an archaeoastronomical relationship with solar seasonal cycles (see Stop 14). However, beyond such alignments, we do not have a clue about why the earthworks were planned the way they were. Some have argued that the Hopewell cultural system was based on the work of a society on the level of a tribe that had a powerful leader but that may not have been a chiefdom or a state. Such arguments generally rest upon whether or not a society has agriculture, such that production could be administered by a polity and redistributed among the society by this central authority.

Agriculture has not been well demonstrated in Hopewell culture, although they did cultivate a variety of plants, including squash, sunflower, goosefoot, and lamb's quarter. This observation may be primarily due to the lack of village sites excavated (see Stop 7). The amount of work that went into constructing the huge Hopewell earthworks strongly suggests there was some motivating factor beyond a powerful local tribal leader. It is further demonstrated when one looks at the eastern United States as a whole and the similarities of the types of changes that took place in various areas.

The earthworks have changed with time and need to be extensively dated. Most "fort"-type Hopewell earthworks (see Stops 2, 11, and 14) were constructed on promontories at the same time that the large ceremonial centers were built in the river valleys. Graded ways leading from the river banks to the "forts" suggest that large contingencies from within the social order paid visits to the centers for ceremonies. Travel up and down the rivers was probably an important means of communication and transportation that has had little research.

Most of the large Hopewell excavations were done before modern scientific techniques were discovered. There has been good recent work at Fort Ancient, Stubbs, and Newark. The large amount of knowledge that has been compiled on the Hopewell is a tribute to the work and dedication of those who have studied the Hopewell.

LATE WOODLAND/NEWTOWN
(*circa* 1,500-1,000 years B.P.)

The Late Woodland period is marked by a dramatic change in burial ceremonialism. The large earthwork complexes disappear, as well as the large mounds. Late Woodland mounds are low profile and contain only a few individuals. The burials are extended, in many cases encased in a stone "box" grave, which gave rise to the name "Stone Mound" culture in the older literature. Burials contain less exotic grave goods, cremations are not common, and pottery vessels are commonly associated with graves. The mounds generally are located on hilltops not too far from a village site. The lack of spectacular mounds and earthworks in the Late Woodland period caused speculation that this was a time of cultural decline. It could be argued that this is one of the most dynamic periods in Ohio prehistory to study because of the dramatic cultural change that took place after the Hopewell.

As in the Middle Woodland period, hunting, gathering, and fishing were the primary means of subsistence. A dramatic change was the growing of corn, squash, and maygrass in small garden plots (Featherstone, 1977). Small triangular arrow points and Chesser corner-notched projectile points are diagnostic for the Late Woodland period (fig. 34). Hunting activities became more efficient, and the use of the bow and arrow occurs for the first time. At Sand Ridge (discussed below), remains of white-tailed deer and wild turkey are the most numerous in the Late Woodland levels (Theler, 1978b). All areas were exploited, and many upland sites have been located in surveys. Late Woodland pottery was cord marked, as in the Middle Woodland, except there is an elaboration of cording techniques. Limestone and grit temper was still used; however, there was a greater emphasis on ceramics.

Two Late Woodland sites in the Greater Cincinnati area are the Turpin and Sand Ridge sites, along the Little Miami River near its confluence with the Ohio River in Hamilton County, Ohio. The Turpin site is on a broad floodplain, and Sand Ridge is on a Pleistocene terrace (Dalbey, 1976a) about 2 km (1.2 miles) downstream. Turpin was excavated before the turn of the century, but the only extensive modern-era excavations were conducted by Oehler (1973). He excavated a Fort Ancient (Late Prehistoric) earthen platform mound with a raised center and an associated village stratified over a Late Woodland village with an associated low-profile stone mound. It was at Turpin that a component was defined as prior to Fort Ancient, and it was demonstrated that it was definitely not Hopewell. Griffin (1952) recognized this component as the Late Woodland Newtown Phase on the basis of the ceramics. Riggs (1986) conducted additional excavations at Turpin for radiocarbon dating and chronological control for his ceramic analysis of both Late Woodland and Fort Ancient ceramics. The Late Woodland levels yielded mean (n = 2 each) uncorrected uncalibrated dates of 1,390 years B.P. for the lower levels and a mean of 1,148 years B.P. for the upper levels. Radiocarbon dates for the Fort Ancient phase at Turpin had a mean (n = 3) date of 783 years B.P. The ceramic analysis showed typical Late Woodland cord-marked undecorated vessels dominated the Newtown Phase.

The Sand Ridge site (Dalbey, 1976b; Featherstone, 1977; Theler, 1978b) produced radiocarbon dates comparable to Turpin; the mean (n = 2) uncorrected uncalibrated age was 1,415 years B.P. for the lower levels, and the mean (n = 3) age for the upper levels was 1,148 years B.P. The Sand Ridge sequence provided an enormous amount of Newtown ceramics (>20,000 Late Woodland sherds from a 1-meter-thick, 4-square-meter unit) that are characterized by extensive and elaborate cord-marked (predominant) and plain ware having little decoration except for a few punctates along the rim.

The Late Woodland culture is now recognized all along the Ohio River as far east as West Virginia (Shott, 1992). The Newtown Phase is now recognized in a larger area to the south in north-central Kentucky and southeastern Indiana. The Late Woodland elaborate effigy mounds of Wisconsin never materialized in southwestern Ohio.

LATE PREHISTORIC/FORT ANCIENT
(*circa* 1,000 years B.P. to historic)

Griffin (1943) analyzed the ceramics from many of the early excavations; he defined the Madisonville Focus primarily on the basis of ceramics from Turpin, Sand Ridge, and Madisonville, which was about 1 km (0.6 mile) west of Turpin. At Madisonville, about 150 extended burials were placed in among features in a haphazard pattern. The site yielded cord-marked, shell-tempered ceramics which, when compared to the surrounding sites, were placed together in the Madisonville Focus. A Fort Ancient platform mound that had a central higher mound was excavated at Turpin and indicated a higher status of those individuals in the mound than other burials placed in the midden.

However, Griffin (1943) noted that some of the sherds at these sites were similar to the Anderson Focus, which he defined from the Anderson village site along the Little Miami River 48 km (30 miles) upstream from the sites in Hamilton County. The Anderson site, at the base of the promontory below the Hopewell earthwork at Fort Ancient, was oval, about 1 hectare, and had a timber pallisaded wall surrounding the site. Outside the walls, corn, beans, and squash were grown in garden plots. Houses were square, outlined by timber posts set in a trench. The material culture was simple without any of the really elaborate items that were common in the Hopewell culture. Freshwater mollusks were used extensively for hoes, scoops, beads, ornaments, and temper for ceramics. Small triangular and serrated triangular projectile points are diagnostic of the Fort Ancient culture (fig. 34). A cemetery was excavated within the south walls at Fort Ancient (see Stop 14).

Riggs (1986) was able to demonstrate the co-occurrence of primarily Late Woodland Newtown Phase ceramics with early Anderson Focus shell-tempered undecorated ceramics at Turpin. The shell tempering quickly replaced the mostly grit-tempered Newtown ceramics, although the vessel and rim forms remained similar. Later Anderson Focus vessels have curvilinear (guilloche), rectilinear, and oblique incised designs. The shell-tempered ceramics at Sand Ridge were more characteristic of the later Anderson. The lower Little Miami River sites have a mean (n = 3) date of 783 years B.P. Thus, based on ceramics, they compare favorably to Anderson village and the cemetery at Fort Ancient, and not with the Madisonville Focus.

The vessels from the Madisonville Focus have mostly flared rims, four applied thin strap handles over a smooth rim, and a cord-marked or plain body. Further analysis of the ceramics from the Madisonville site may detect earlier Anderson Focus vessels. The Madisonville Focus is late and may have been occupied into the historic contact period. During the early excavations, a shell-tempered chalice resembling a wine goblet was recovered from the Madisonville site. The earliest Europeans known in the area were the French about 1750, and people living at Madisonville may have come into contact with them. The Madisonville Focus remains poorly dated and may begin as late as 550 years B.P. to historic time.

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STOP 1: BIG BONE LICK, KENTUCKY--LATE PLEISTOCENE ARCHAEOLOGY

by
Kenneth B. Tankersley

Big Bone Lick is situated at the confluence of Big Bone Creek and Gum Branch, in Boone County, Kentucky (fig. 1-1). The site, which is managed as a state park, is 35 km (22 miles) southwest of Covington, Kentucky, on Kentucky Rte. 338, west of U.S. Rtes. 127/42. The site includes a museum and a Discovery Trail.

Big Bone Lick is one of the largest and most reliable salt springs (salines) in eastern North America. The natural brine that occurs at this locale originates hundreds of feet below the surface in the porous Ordovician-age limestone. The brine reaches the surface through fault planes and bedrock fractures under high hydrostatic pressure (Stout, Lamborn, and Schaaf, 1932, p. 15). Consequently, the flow of salt water has not been affected by climatic conditions or surface moisture. In other words, we can safely assume that these springs were active during the late Pleistocene.

During the late Pleistocene, Big Bone Lick was a slack-water environment maintained by seasonal flooding, silty lacustrine deposits, and the recharge of numerous saline springs. This environment attracted large herbivores such as muskox, caribou, ground sloth, horse, mammoth, mastodon, and bison. By about A.D. 1700, a new stream channel eroded and exposed the late Pleistocene fossil-bearing deposits. Indians collected the recently exposed vertebrate fossils during bison hunts and salt production (Jillson, 1936; Tankersley, 1986).

Historically, the lick was the site of a salt works, health spa, and inn. It is best known, however, for the academic interests of famous naturalists including Benjamin Franklin, Thomas Jefferson, George Cuvier, and Charles Lyell (Jillson, 1936).

A number of significant early Paleoindian artifacts has been documented at Big Bone Lick (fig. 1-2). The typological diversity of these artifacts suggests that they represent redundant Paleoindian occupations (Tankersley, 1989). Artifacts occur in areas where topographic features or resources attracted and concentrated game, such as ponded or slow-moving water, stream confluences, shallow river crossings, major game trails, and mineral springs (Tankersley, 1990a).

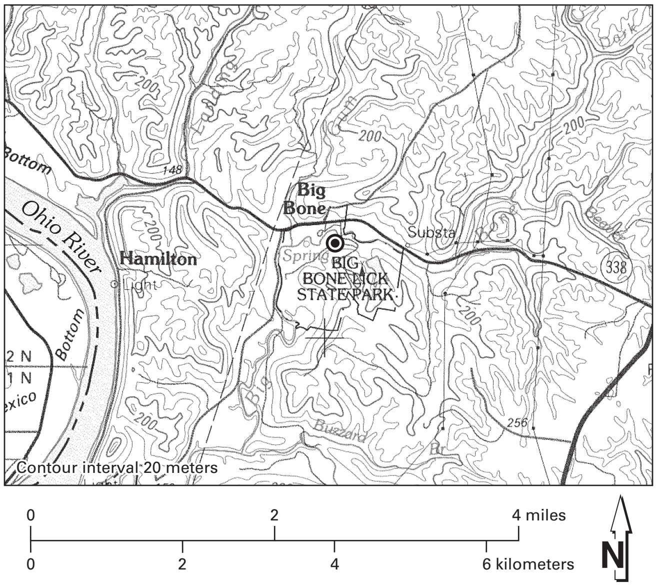

FIGURE 1-1.—The topographic setting of Big Bone Lick, Kentucky.

HISTORICAL RESEARCH

The search for the remains or traces of the earliest inhabitants of eastern North America is as old as American archaeology itself. Most of the early investigations, whether deliberately or by happenstance, centered around Big Bone Lick (Tankersley, 1990b). Thomas Jefferson, often referred

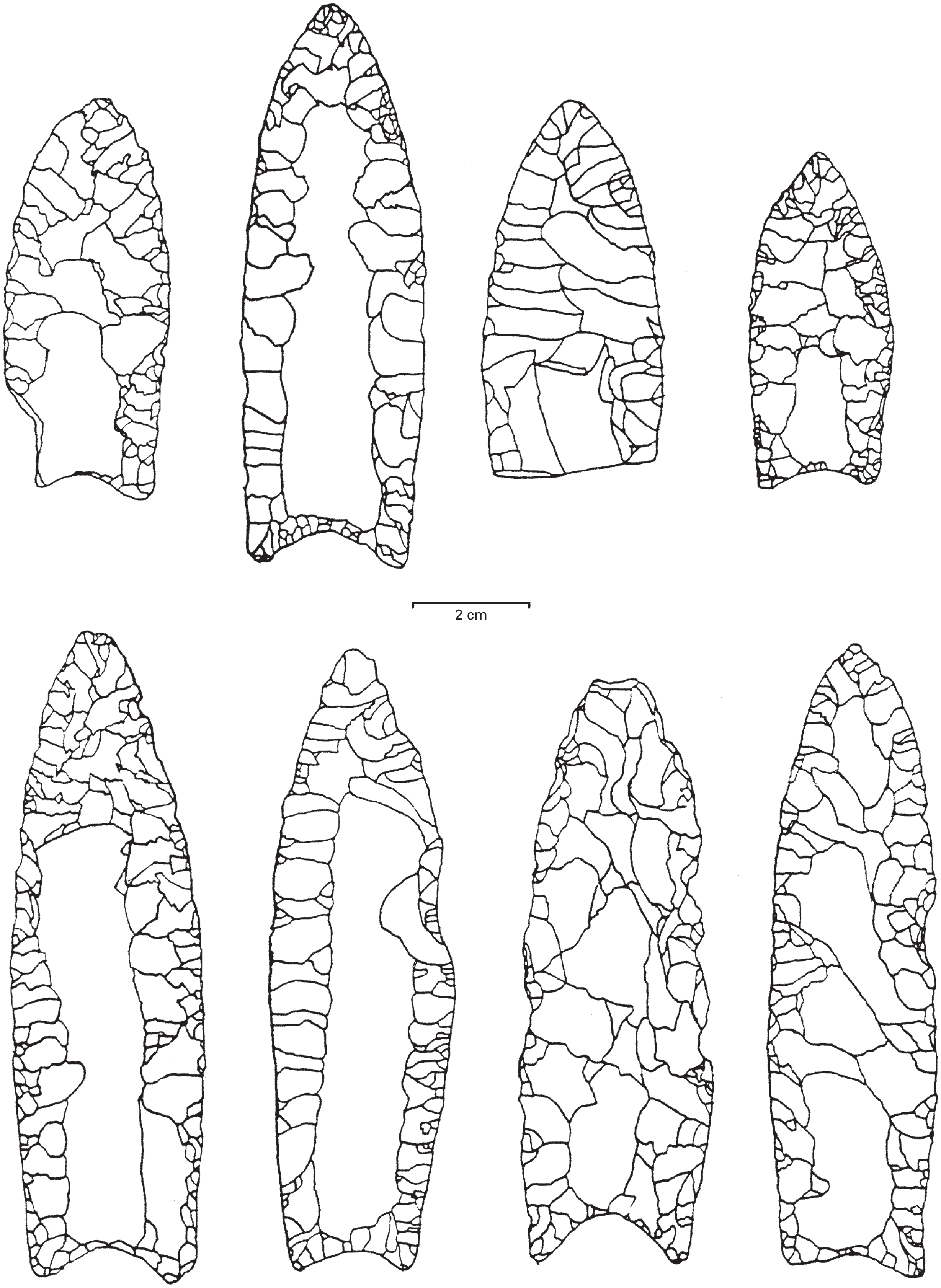

FIGURE 1-2.—Fluted points recovered from Big Bone Lick between 1800 and 1991.

to as the father of American archaeology (Willey and Sabloff, 1982), was one of the first people to seriously speculate on the origins and antiquity of the North American Indians. Jefferson postulated an Asiatic origin for these people and that they were contemporaneous with mastodon, although he did not believe in a great length of time for either the peopling of North America or their association with mastodons. Jefferson's reasoning was based in part on a Delaware Indian oral tradition that explained the accumulation of large bones at Big Bone Lick (Jefferson, 1801, p. 79-80):

> *In ancient times a herd of these tremendous animals came to the Big-bone licks . . . the Great Man above . . . hurled his bolts among them till the whole were slaughtered, except the big bull, who presenting his forehead to the shafts, shook them off as they fell; but missing one at length, it wounded him in the side; whereon, springing round, he bounded over the Ohio, over the Wabash, the Illinois, and finally over the great lakes, where he is living at this day.*

Jefferson was so enthusiastic about the "recentness" of the megafauna, implied in the Delaware folklore, that he instructed Meriwether Lewis and William Clark in 1803 to search for these animals during their exploration of the Louisiana Territory (Schultz and others, 1967). After an unsuccessful attempt by Lewis and Clark to collect these species on the western frontier, Jefferson had George Rogers Clark make a collection of mastodon remains from Big Bone Lick. Because Clark's instructions specified the recovery of paleontological material, artifacts that may have been encountered during the dig were not collected or recorded. Jefferson displayed the resulting fossil collection at the White House during his presidential terms (Jillson, 1936).

Suggestions of contemporaneity between people and megafauna are not unique in the oral traditions of North American Indians. Indeed, ethnologists argue that some of this folklore represents a "dim but actual tradition at the time when mammoths [and mastodons] lived in North America" (Strong, 1934, p. 87). Interestingly, the oral tradition of the Delaware, recorded firsthand by Jefferson, parallels two archaeological and paleoecological positions about the late Pleistocene fauna. First, the progenitors of North American Indians preyed on these species. And second, the direction of megafaunal retreat from Kentucky was northward.

By the end of the eighteenth century, it was well advertised in Europe that complete mammoth and mastodon skeletons were both popular and valuable items for collection. William Goforth, a medical doctor and resident of Big Bone Lick, acknowledged the European elephant fancy and the lick's potential production of "wagon loads" of mammoth and mastodon fossils. Although fully articulated specimens had never been recovered, Goforth became obsessed with the notion that the fossil-bearing deposits of Big Bone Lick would one day bring him fame and fortune.

Goforth excavated extensively around the saline springs and seeps of Big Bone Lick between 1803 and 1807 (Jillson, 1936). Although he failed to find an articulated mammoth, he did recover an extensive collection of mastodon bones and teeth, as well as three fluted projectile points (Tankersley, 1985). Unfortunately, the significance of the artifacts was not recognized at that time, but it is possible that they were associated with the mastodon remains. Similar historical accounts of the recovery of mastodon remains with fluted points have been noted for the Boaz site in Wisconsin (Palmer and Stoltman, 1976) and the Kimmswick site in Missouri (Graham and others, 1981). At the Kimmswick site, the association of mastodons with fluted points was subsequently verified (Graham and Kay, 1988).

Immediately prior to the Civil War, some investigations began to suggest a great antiquity for the settlement of North America (Meltzer, 1985). With Boucher de Perthes's unequivocal evidence of an ancient Paleolithic occupation in France and the growing acceptance of Charles Darwin's concept of evolution, the search began for sites of comparable antiquity in America (Willey and Sabloff, 1982). In 1862, George Gibbs published *Instructions for archaeological investigations in the United States*, which alluded to the possibility, if not the probability, that Paleolithic materials could be found in Pleistocene strata.

Nathaniel Shaler, then Kentucky state geologist, was aware of the possibilities for an "American Paleolithic" and the apparent ancientness of the bone beds at Big Bone Lick. Having read Gibbs's paper, Shaler set out during the summer of 1868 to find, among other things, definite evidence of contemporaneity between the ancestors of the North American Indians and the mastodon at Big Bone Lick. Unfortunately, by 1868 most of the mastodon remains had been pillaged by fossil collectors, treasure hunters, and curiosity seekers; all that remained in the stratified deposits nearest to the springs was masses of early Historic bison skeletons (Tankersley, 1986). It is therefore understandable that Shaler's excavations failed to confirm a Paleoindian occupation at the site. Carr and Shaler (1876) warned that the failure of the 1868 excavations to confirm an early occupation did not preclude the possibility that it may have at one time existed.

In 1876, C. C. Abbott announced the discovery of Paleolithic artifacts in gravels of Pleistocene age near Trenton, New Jersey. Frederic Putnam made a similar discovery at the Madisonville site in southwestern Ohio (Moorehead, 1892), less than 40 km (25 miles) from Big Bone Lick.

By the late 1890's, however, the concept of an American Paleolithic was critically scrutinized. Virtually all claims of antiquity were refuted by the archaeologists of the newly formed Bureau of American Ethnology (BAE). The BAE's position was that Paleolithic artifacts, comparable to those found in western Europe, were absent in North America (Meltzer, 1985). In addition to the BAE's refutation of Paleolithic artifacts, Ales Hrdlicka systematically demonstrated that all of the human skeletal material found in the New World was anatomically modern. Thus, the deliberate exploration of Paleolithic manifestations at Big Bone Lick came to a standstill.

Nevertheless, another fluted projectile point was found by a local collector during the 1890's, in possible association with mastodon remains. Unfortunately, the significance of the discovery was overlooked for more than 60 years (Haynes, 1966).

SYSTEMATIC INVESTIGATIONS

During the late 1950's, C. Bertrand Schultz, a vertebrate paleontologist who had been involved in the excavation of numerous Paleoindian bison-kill sites on the Plains, took an interest in Big Bone Lick. He was intrigued by the reported co-occurrence of several species of bison (for example, *Bison latifrons*, *B. antiquus*, and *B. bison*) and their possible contemporaneity with the prehistoric peoples of the area (Schultz and others, 1967).

In 1959, Schultz met with Ellis Crawford and J. D. Moore to discuss the possibility of conducting an excavation at the lick. Ellis Crawford lived in the area and had been archaeologically trained by William S. Webb during the WPA days. J. D. Moore was an avocational archaeologist/paleontologist and a local authority on Big Bone Lick history. Interestingly, both men had independently recovered Clovis points from the immediate vicinity of the late Pleistocene fossil-bearing deposits (Tankersley, 1985). After talking to these individuals and examining the site, Schultz was convinced that the lick presented a great opportunity to resolve a number of paleontological, geological, and archaeological issues, not the least of which were the temporal position and subsistence strategies of early Paleoindians in the eastern United States.

Multidisciplinary excavations were conducted under the auspices of the University of Nebraska between 1962 and 1966 (Schultz and others, 1963). Schultz was the principal investigator, and Ellis Crawford directed the archaeological investigations. L. G. Tanner supervised the paleontological field work, and L. L. Ray and Frank C. Whitmore conducted the geological analyses. The University of Nebraska efforts exposed the remains of numerous extinct species and cultural material in late Pleistocene strata, but the deposits appeared to represent reworked alluvium. In other words, their excavations failed to identify a direct association between the fossil remains of the extinct Pleistocene species and Paleoindian cultural material.

In 1980, I was intrigued by the fact that Clovis artifacts had been collected at the lick for more than 180 years (Tankersley, 1985). The possibility that stratified Clovis deposits may be present was suggested by the fact that the University of Nebraska's efforts had recovered flaked stone in certain areas of the bone bed (Schultz and others, 1967). I was also fascinated by the way Big Bone Creek had exposed a wide variety of terrace and floodplain sediments. I felt that much of the lick's depositional history, and its associated archaeology, could be identified in profiled sections excavated along the length of the stream.

In 1981, I excavated eight test units along Big Bone Creek and Gum Branch. Although each excavation displayed a different temporal and textural sequence, a common depositional pattern was evident. The floodplain deposits of Big Bone Lick formed as a result of lateral accretion. The late Pleistocene, Holocene, and modern strata are horizontally juxtaposed (fig. 1-3). This sedimentation pattern is identical to that found in the neighboring Ohio River valley (Gray, 1984) and in the area of the Kimmswick site in Missouri (Saunders, 1988).

Archaeologically, the test excavations demonstrated that heavily patinated retouch flakes occur in direct association with spirally fractured late Pleistocene large-mammal long bones. Unfortunately, the context is secondary. While it may be argued that the cultural and faunal material is contemporary, an in situ association has not been confirmed. A radiocarbon date of 10,600 ± 259 years B.P. (W-1358) was obtained on a wood sample from this alluvium in association with the remains of ground sloth, mammoth, mastodon, and horse. This assemblage, however, likely represents a mixture of early and late Woodfordian fauna.

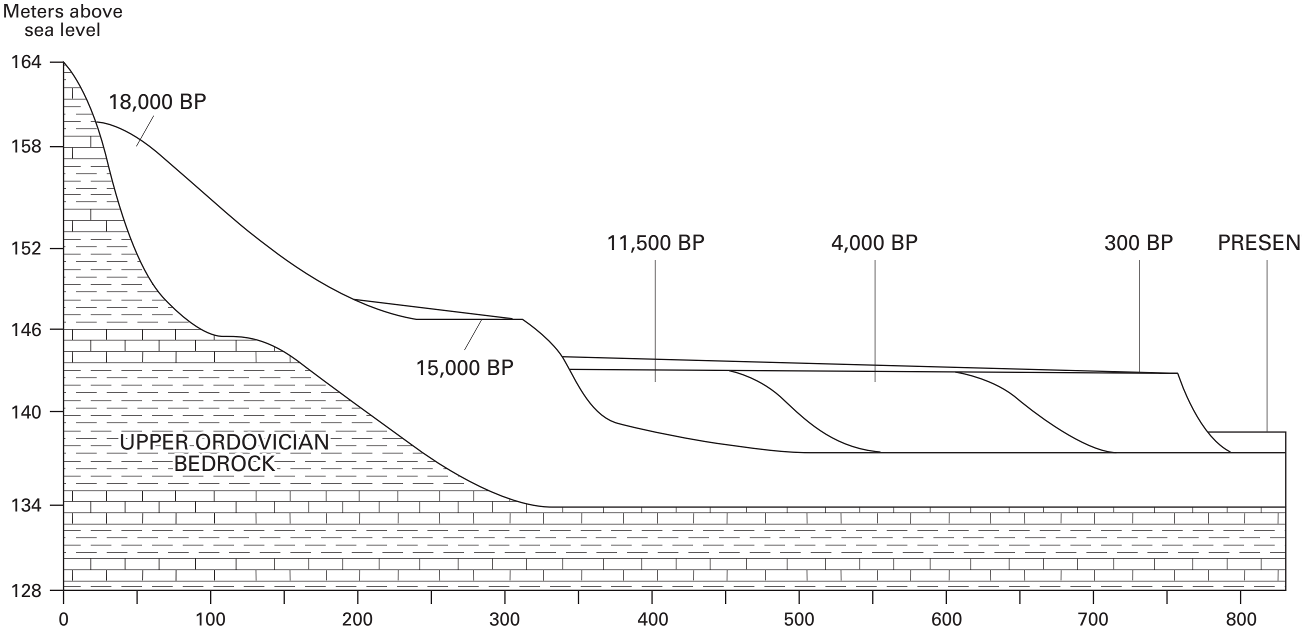

FIGURE 1-3.—A diagrammatic cross section of the bedrock and surficial geology of Big Bone Lick (PRESENT = creek).

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STOP 2: SHAWNEE LOOKOUT ARCHAEOLOGICAL DISTRICT, SOUTHWEST OHIO—SOME KEY SITES

by
Timothy S. Dalbey

Shawnee Lookout Archaeological District—locally known as the "Point"—is in southwestern Hamilton County, Ohio, in the southwestern corner of Ohio at the Ohio-Indiana-Kentucky state line (fig. 2-1). Archaeological interest in Shawnee Lookout Archaeological District dates back to 1795 when the Reverend James Smith traveled through the Ohio River region and wrote an account of Indian fortifications near the mouth of the Great Miami River (Morrow, 1907). William Henry Harrison's home was within the district, and he and Thomas Jefferson walked the hilltop "fort" area behind Harrison's house when Jefferson visited Harrison. In a paper delivered to the Historical and Philosophical Society of Ohio, Harrison (1838) postulated the "forts" were used to fend off invasions. Squier and Davis (1848) used Harrison's map of the "fort" (fig. 2-2) in their atlas of prehistoric monuments of the Mississippi Valley. Morrison (1878) described a hilltop "fort" (fig. 2-3) in Dearborn County, Indiana, directly across the Great Miami River valley from the "fort" at the Point and compared the two sites. Warren K. Moorehead made test excavations at the fort in 1890. Interest in the area diminished until Starr (1960, 1963) published a survey of Hamilton County and described several sites at the Point, including Miami Fort. The first modern-era surveys and excavations at the Point were carried out by Fischer (1965, 1966, 1968, 1969, 1970) at Miami Fort and other sites and mounds near the enclosure. Another "fort" was reported by the Ohio-Kentucky-Indiana Regional Planning Authority (1969) on a hilltop in Boone County, Kentucky (fig. 2-1). It is unknown how many hilltop enclosures once existed, but there were many more reported up the two Miami Rivers (see Stop 8, Mound City, and Stop 14, Fort Ancient, in this guidebook).

Shawnee Lookout Archaeological District (fig. 2-4) incorporates about 807 hectares bounded on the south by the Ohio River, on the west and north by the Great Miami River, and on the east by Dugan Gap Road. Shawnee Lookout Park is

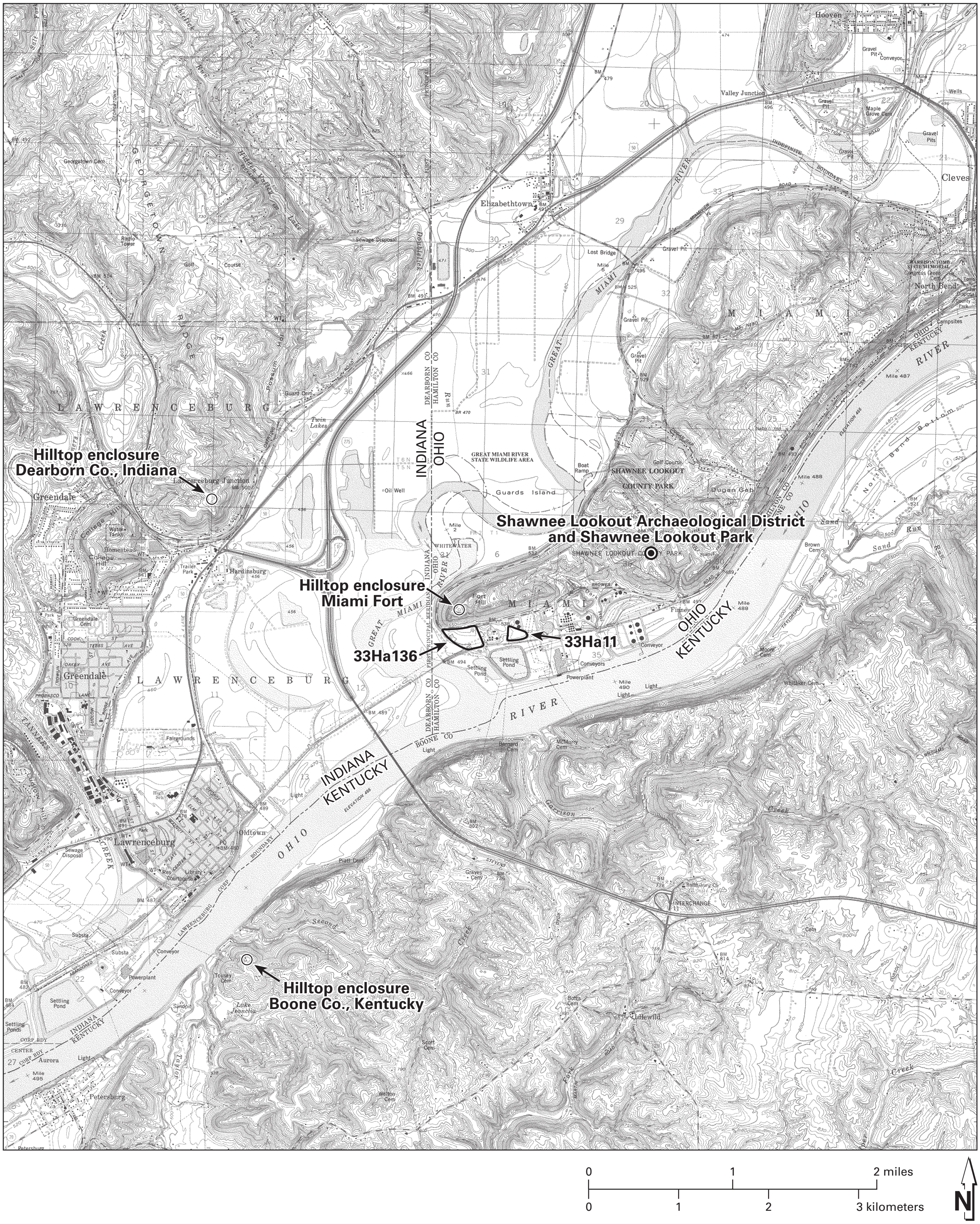

FIGURE 2-1.—Shawnee Lookout Archaeological District and locations of major hilltop enclosures. Topographic base from U.S. Geological Survey Hooven, Ohio–Indian–Kentucky and Lawrenceburg, Kentucky–Indiana–Ohio 7.5-minute quadrangles.

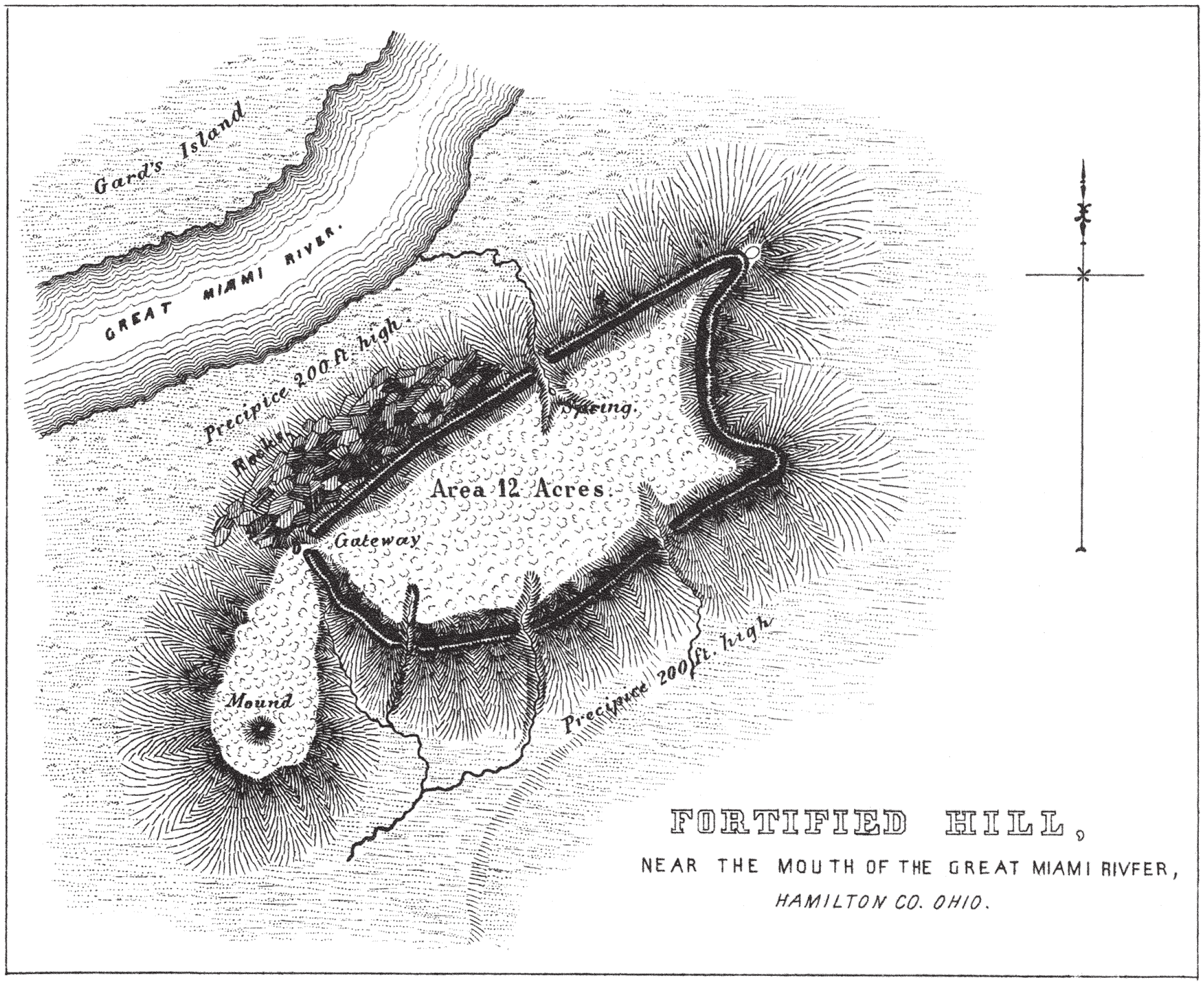

FIGURE 2-2.—Miami Fort (modified from Squier and Davis, 1848, Plate IX, no. 2).

a 408-hectare recreational park within the District and is owned by the Hamilton County Park Board. The park land was donated to the county in 1966 by the Cincinnati Gas and Electric Company (CG&E). The area was recognized and nominated as an Archaeological District in 1971 and attained District status in 1974. At that time, the District included 46 sites (one per 17 hectares); 34 within the park and another 12 in the surrounding area. The sites consist of one hilltop earthwork enclosure, one prehistoric cemetery, two historic sites (Fort Finney, established *circa* 1790, and President William Henry Harrison's home), 15 mounds, and 27 camp/village sites, representing all time periods.

GEOLOGY

Shawnee Lookout Archaeological District lies on a southwest-northeast-trending promontory overlooking the confluence of the Ohio and Great Miami Rivers to the southwest and the confluence of the Great Miami and Whitewater Rivers to the north. The mouth of the Great Miami River valley is 4.3 km (2.7 miles) wide, and the Ohio River is 1 km (0.6 mile) wide at the confluence, at an elevation of 146 meters above sea level. The bedrock at the point is fossiliferous limestones and shales of the Kope and Fairview Formations (Cincinnatian Series, Upper Ordovician), over 450 million years old. These Ordovician rocks probably were covered by later Paleozoic deposits, but they have been removed by post-Ordovician erosion.

Over 2 million years ago the Eagle River (see fig. 15) flowed north from Carrollton, Kentucky, roughly paralleling in part the present Ohio River course, past the Point at an elevation of 232 meters above sea level. The Eagle River was a north-flowing tributary of the Teays River system, which had its headwaters in North Carolina. During the Teays-age drainage, the relief of the hills and valleys ranged from 232 to 260 meters above sea level.

Approximately 0.4 million years ago, the Kansan glacier advanced from the northwest and reached the Cincinnati and northern Kentucky areas. The glacier dammed southeast-northwest-flowing streams, creating extensive lakes;

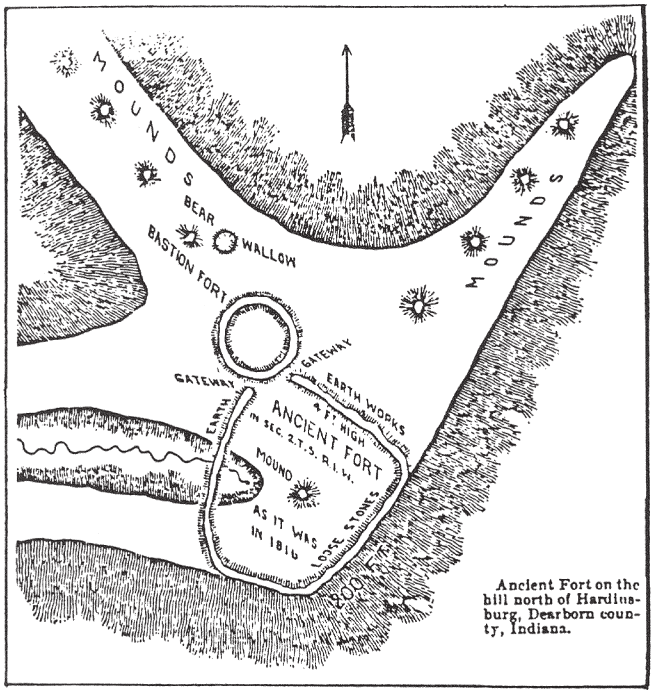

FIGURE 2-3.—Hilltop enclosure, Dearborn County, Indiana (from Morrison, 1878, Plate H).

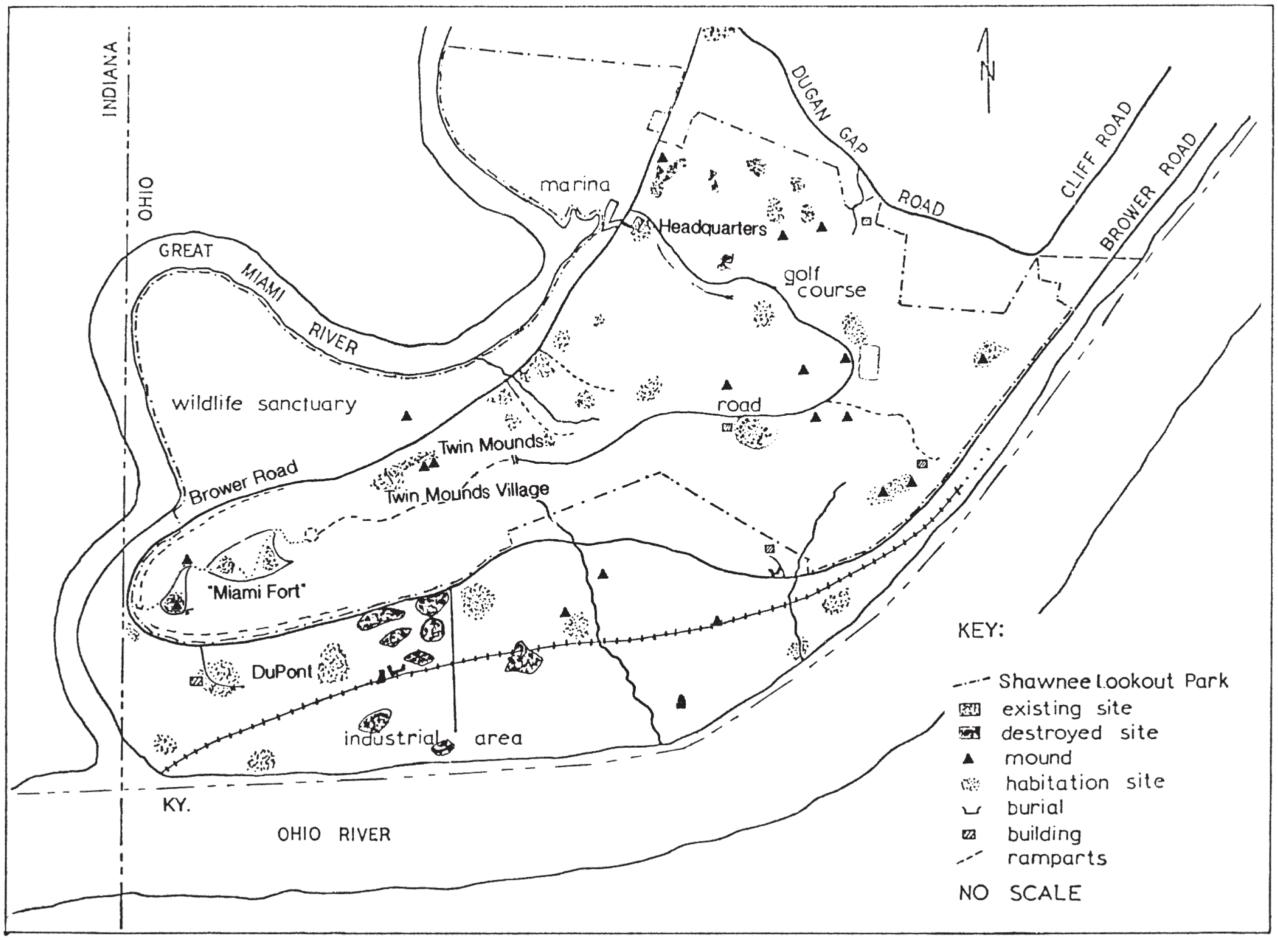

FIGURE 2-4.—Map of archaeological sites within the Shawnee Lookout Archaeological District in 1974.

the Madison, Indiana, divide was breached, creating a westward flow. Kansan glacial deposits have been reported in northern Kentucky and in Cincinnati, but are not known at the Point. However, the soil cover at the Point is thin Kansan loess covered by 3 to 4 meters of Illinoian loess. The Anderson Divide 10 km (6 miles) (see fig. 18) to the east diverted ice northeast and west of the Point in Indiana. The Eagle River no longer flowed north past the Point as the Madison Divide was breached and a southwestern flow was created. Kansan meltwaters flowed from eastern Cincinnati north to Hamilton, then south to Harrison and Lawrenceburg, Indiana, and on to the Louisville area. The overloaded rivers widened valleys and eroded deep, wide channels as much as 46 meters lower than the valleys today, to elevations of 100 meters above sea level recorded at the Miami Fort Power Station. Extreme erosion and incision in the valleys (Deep Stage drainage) during the Yarmouth Interglacial created in part the broad Great Miami River valley.

About 240,000 to 130,000 years ago, the Illinoian glacier advanced over southeastern Indiana and the Great Miami River valley. The glacial ice was diverted around the Point by the Anderson Divide. The eastern portion of Cincinnati was glaciated, as was northern Kentucky. The ice dammed the Deep Stage drainage, forming a lake extending eastward as far as Portsmouth, Ohio. As the proglacial lake levels became higher, the Anderson Divide as well as divides at Bellevue, Kentucky, and Sayler Park, Ohio, were breached. The resultant westward spillway between the Little Miami River to the Great Miami River created the present Ohio River channel through Cincinnati. During the Illinoian glaciation, the Deep Stage valleys were filled with glaciofluvial outwash, which aggraded the valleys 85 meters to elevations of 185 meters above sea level. As the glacier melted, most of the Cincinnati area was blanketed by till and loess. Most of the drainage on the Point was established about 130,000 years ago.

During the Sangamon Interglacial, new youthful streams in Ohio flowed south to the present Ohio River over aggraded river valleys. Many of the major present-day southward-flowing streams follow the outwash channels created by Illinoian meltwaters. The Whitewater River and the Great Miami River from Venice (Butler County), Ohio, to the Ohio River are examples of outwash channels in an interlobate zone. The terrace along the Ohio River below the Point consists of Illinoian loess and outwash gravels 3.5 meters below the surface.

The Hartwell terminal moraine (see fig. 13-2, Stop 13) represents the maximum advance of Wisconsinan ice into the northern part of Cincinnati by 19,000 years ago. When the Wisconsinan ice melted, the valleys of the Whitewater and Great Miami Rivers were once again aggraded with glaciofluvial outwash deposits. The valleys are filled with as much as 50 meters of outwash sand and gravel. Many of the outwash deposits are mined for sand and gravel, and a number of mammoth tusks have been uncovered.

VEGETATION

Braun (1916, 1928, 1934, 1936) was one of the first to notice the relationship of different plant assemblages with differing localized physiographic conditions in the Cincinnati area. On the basis of the varied geology of the area, Braun recorded the variability among plant communities that grew on Wisconsinan till plains, Illinoian till plains, Kansan till plains, and unglaciated Teays-age areas. Braun (1951) placed southwestern Ohio in the Western Mesophytic Forest, characterized by a mosaic of climax vegetation types. The dissected topography around the Point ranges in elevation from 146 to 260 meters above sea level. Low-lying (146-149 meters above sea level) floodplains along the Ohio River support willows, cottonwoods, white elms, silver maples, box elders, and sycamore trees and a variety of wetland species such as cattails, bulrush, arrowhead, sorrels, nettles, and plantains. Higher level floodplains in the Great Miami River (149-151 meters above sea level), which are not regularly flooded but are well drained, support a mixed swamp forest of white elm, sugar maple, black cherry, black ash, butternut, hickory, red ash, and red and white oaks. Poorly drained high floodplains (oxbows and meanders in till) support a swamp forest of pin oak, swamp white oak, shellbark hickory, and red maple. Slopes on the floodplain terraces support red elm, black cherry, hackberry, scarlet thorn, honey locust, box elder, and sugar maple.

Terraces (151-168 meters above sea level) paralleling the river valleys support predominantly a beech-maple forest in which beech is as much as 50 percent of the canopy. Other trees include sugar maple, tuliptree, black walnut, black cherry, white walnut, basswood, and white ash.

Limestone hillside slopes (168-213 meters above sea level) vary according to edaphic conditions and direction the slope is facing. South and west slopes on river bluffs support an oak-ash-maple forest made up of red oak, white ash, blue ash, Chinquapin oak, and sugar maple, with minor amounts of red elm, hackberry, black walnut, hawthorn, honey locust, sumac, red elm, grape, and blackberry thickets as lower plant cover in more open areas. The north and east slopes are a mixed forest dominated by sugar maple, basswood, butternut, hickory, shagbark hickory, black walnut, black cherry, white oak, beech, and hackberry, and pawpaw and grape in the understory. Clearings on these slopes have sassafras, honey locust, and hawthorns.

Uplands (213-260 meters above sea level) consist of about 50 percent beech-maple forests and an extension of the oak-ash-maple forest in divides. The uplands at the Point are covered with loess; however, in Indiana the uplands are covered with Illinoian till. North of the Hartwell Moraine the topography is flat and covered with Wisconsinan till.

ARCHAEOLOGY

There have been three periods of major modern archaeological excavation in the District: (1) Fischer from 1965 to 1970, (2) Lee and Vickery in 1972, and (3) Dalbey and Vickery from 1974 to 1975. Fischer (1965, 1966) conducted field schools and excavated in and around Miami Fort. Two small test units at the west end of the enclosure recovered Middle Woodland occupational debris from a midden layer 46 cm deep with two limestone-slab hearths.

Excavations at the east end of the enclosure revealed a stratified midden 61 cm deep; the top layer was contemporaneous with the building of the enclosure. The lower 21 cm of the midden contained Marion Thick ceramics characteristic of Early Woodland and most likely Adena. Although there was no stratigraphic break, the upper 40 cm contained Middle Woodland occupational debris and features. In three seasons, Fischer excavated over 221 square meters, recovering occupational midden debris, three limestone slab hearths, and two deep storage pits, in an unsuccessful attempt to find a house structure.

The Miami Fort enclosure (fig. 2-2) is 351 meters northeast-southwest by 171 meters northwest-southeast, enclosing an area over 60,000 square meters. The embankments are 3 to 4 meters high on the east side and 2 meters high on the west; borrow depressions along the interior walls converge to a point at the southwest end. There are two entranceways on the east end, two other natural drainage openings in the wall, and other natural drainage openings at the west end. A trench was excavated into the embankment at the west end. The embankment was about 3 meters high and constructed of culturally sterile soil from an inside borrow. The embankment had slumped, or the wall would have been 1.5 meters higher, and originally was capped with limestone slabs, which were found in the slumped soil. Wooden logs had been placed horizontally along the base of the inside wall. Another excavation, north along the west wall near a ravine opening, revealed bedrock 1.9 meters below the surface. In this area, patches of fire-hardened clay and dark organic stains to bedrock indicate three stumps were burned out, or a wooden structure was constructed of wood and daub at the natural opening to the enclosure. A charcoal sample from the base of the embankment was radiocarbon dated to 1,680 years B.P. (A.D. 270), placing the enclosure in the Middle Woodland period.

Two mounds lie west of the west wall. The mound farthest from the west wall was found to be looted through the center from the top down to the base and through occupational site debris to sterile subsoil. The mound is about 27 meters in diameter and 1.8 meters high. A 4.5-meter trench excavated from the periphery to the center revealed that the mound was built in two phases. A primary mound of sterile soil probably covered a central grave (because the center was looted) or graves. A second building phase used village midden debris to enlarge the mound. Six burials were excavated within the outer or later phase, consisting of two extended adults and four other individuals not well preserved; however, one of the burials was indentified as a juvenile with a copper bracelet. All belonged to the Middle Woodland period based on the cord-marked ceramics in the mound fill. Excavations into the midden deposits below the mound revealed three hearths, one storage pit containing 23 quarried chert cores, and Middle Woodland ceramics. An Early Woodland component may also be represented.

The mound closest to the west wall is about 1.1 meters high and oval shaped, 15 meters by 9 meters. An excavated 2-meter trench to the center of the mound revealed no trace of human interment. A layer of limestone slabs about 30 cm below the base of the mound formed a pavement, but investigations were stopped and the function of this mound is unknown.

After Shawnee Lookout Park was established in 1966, Fischer (1968) conducted an archaeology survey of the park land as part of a developmental plan for the park. Twenty sites were located within the park and were to have been noted along park trails; interpretative centers were to be placed at key locations. Today, 46 sites are listed in the National Register of Historic Places as the Shawnee Lookout Archaeological District, which incorporates the area shown in fig. 2-4 and listed in table 2-1. The sites within the park are fairly secure from any more destruction; however, at least eight sites within the district have been destroyed. The sites on the outer rim of Brower Road are in the most jeopardy and probably will eventually be destroyed by industrial development.

Fischer (1969) shifted his field investigations northeastward about 1 km (0.6 mile) to the Twin Mounds (33HA105) and Twin Mounds Village (33HA24). His first endeavor was to excavate Twin Mounds, but during the winter of 1965-66 both mounds were looted down through the center. One mound was 3 meters high and 21 meters in diameter, and the other mound was 2.5 meters high and 21 meters in diameter; both had a common base. Fischer abandoned his plan to excavate the mounds and instead concentrated on Twin Mounds Village for the next two field seasons. Later, Lee and Vickery (1972) reported that a copper breastplate and a celt, both wrapped in cloth, perforated bear canine teeth, freshwater pearl and marine shell beads, fragments of Ohio pipestone, and Middle Woodland pottery were looted from a cremation in one of the Twin Mounds. These types of burial items strongly suggest the mounds were associated with the Hopewell culture.

The excavations at Twin Mounds Village revealed two sites, a Late Archaic site on an eastern knoll and a Middle Woodland village on a western knoll. The Late Archaic site was excavated in five 1.5- x 3-meter units, revealing 12 features and two burials.

More effort was placed on the western knoll, which is about 480 meters east of the enclosure. The site is roughly oval, 97 meters east-west by 55 meters north-south (fig. 2-5). A total of 450 kg of fire-cracked rock, 10,000 animal bones, 25,000 chert artifacts (18 kg), and over 3,000 pot sherds (17 kg) were recovered from an arc of refuse midden 61 cm deep around the site periphery; the central area was relatively cleared of debris. Harrison County, Indiana, and Ohio Flint Ridge chert are predominant among the nonlocal cherts worked at the site. Cord-marked ceramics make up 51 percent of the ceramics and plain sherds the rest. Several activity areas were delineated on the site periphery (fig. 2-5): a butchery area on the south side of the site; an organic refuse area containing a relatively large amount of maize (see Lee and Vickery, 1972, p. 6); a habitation area in the central part of the site, which was kept cleared of refuse; and chert workshop areas on the east.

A structure, which Fischer (1970) considered a house, was found in the central area. The structure was defined by a roughly oval pattern of 55 postmolds (fig. 2-6). The north and west walls were straight and the south and east walls curved. About 36 posts averaging 15 cm in diameter placed on the average 37 cm deep supported walls of daub and probably thatch. Structurally, more crucial support posts were somewhat larger in diameter and placed deeper in the ground. An inner straight west wall consisting of nine posts was built parallel to the outer wall, suggesting that at some

TABLE 2-1.—*List of sites included in the Shawnee Lookout Archaeological District in 1974*

Site	Type	Culture	Comment
1 Miami Fort 33HA62	hilltop enclosure	Hopewell	earthen walls 4-5 meters high, area within walls 350 meters E-W by 171 meters N-S
2 village	habitation	Woodland	extensive site
3 Dupont site 33HA11	habitation	Archaic	unstratified site partially destroyed by industrial expansion
4 village	habitation	Woodland	on second terrace, two burials removed
5 Twin Mound Village 33HA24	habitation	Woodland	extensive site, partially excavated by UC in 1969-70
6 Columbia Park Village VI	habitation	multicomponent	on second terrace
7 Columbia Park Village VII	habitation	Fort Ancient	fire pits and burials removed in 1942
8 Columbia Park Village VIII	habitation	?	on second terrace
9 Columbia Park Village IX	habitation	multicomponent	
10 Columbia Park Village X	habitation	multicomponent	
11 Stoveking Village	habitation	Woodland Fort Ancient	extensive site with midden, 72 by 36 meters
12 Lynch site	habitation	multicomponent	Paleoindian through Fort Ancient
13 East Village, Miami Fort	habitation	Hopewell	inside east wall of fort
14 West Village, Miami Fort	habitation	Hopewell	inside west wall of fort
15 village	habitation	Hopewell	outside west wall of fort, mound built on village
16 village	habitation	Archaic and Woodland	near Lynch site
17 Headquarters site 33HA65	habitation	Woodland	burials removed by UC in 1971
18 village	habitation	Fort Ancient	on second terrace
19 village	habitation	Woodland	near Headquarters site
20 Lynch Camp II	habitation	Archaic	near Lynch site
21 Lynch Field site	habitation	?	across ravine from Lynch site
22 Lynch Mound	habitation	Archaic	erosional remnant, not mound
23 Tobacco Field site	habitation	Woodland	associated with mound
24 Bean Field site	habitation	Archaic and Woodland	may be associated with mound
25 village	habitation	Archaic and Woodland	near proposed cabin
26 Chopping Station	habitation and manufacturing	?	crude flake tools manufactured of tools
27 villages	habitation	Archaic and Woodland	in proposed golf course
28 Columbia Park Mound I	burial mound	Hopewell	tested by UC in 1966, 1.8 by 27 meters
29 Columbia Park Mound VII	burial mound	Woodland	1.1 by 15 meters
30 Stone Mound	burial mound	Woodland	9 by 15 meters, may be structural feature of village
31 Twin Mound A Columbia Park Mound 33HA105	burial mound	Woodland	4 by 24 meters
32 Twin Mound B Columbia Park Mound II	burial mound	Woodland	2.7 by 21 meters, contiguous with Twin Mound A
33 Brower Mound A	burial mound	Hopewell	3.6 by 26 meters
34 Brower Mound B	burial mound	Hopewell	1 by 18 meters
35 mound	burial mound	Hopewell	1.8 by 21 meters, associated with village
36 mound	?	Woodland	0.5 by 9 meters
37 mound	?	Woodland	0.5 by 9 meters
38 mound	burial mound	Hopewell	2.4 by 21 meters
39 mound	burial mound	Woodland	top bulldozed off on second terrace
40 Ackerman Mound	?	?	may be burial or structural feature
41 mound	burial mound	Woodland	2.1 by 24 meters, in proposed golf course
42 Stone Mound	burial mound	Woodland	in wildlife sanctuary on Brower Road
43 cemetery	prehistoric cemetery	Woodland	near Miami Fort
44 camp	military camp	historic	on second terrace above Ohio River
45 Fort Finney	military stockade	historic	built in late 1700's for negotiating with Indians
46 ramparts	embankments	Woodland	possible additional walls on steep slopes

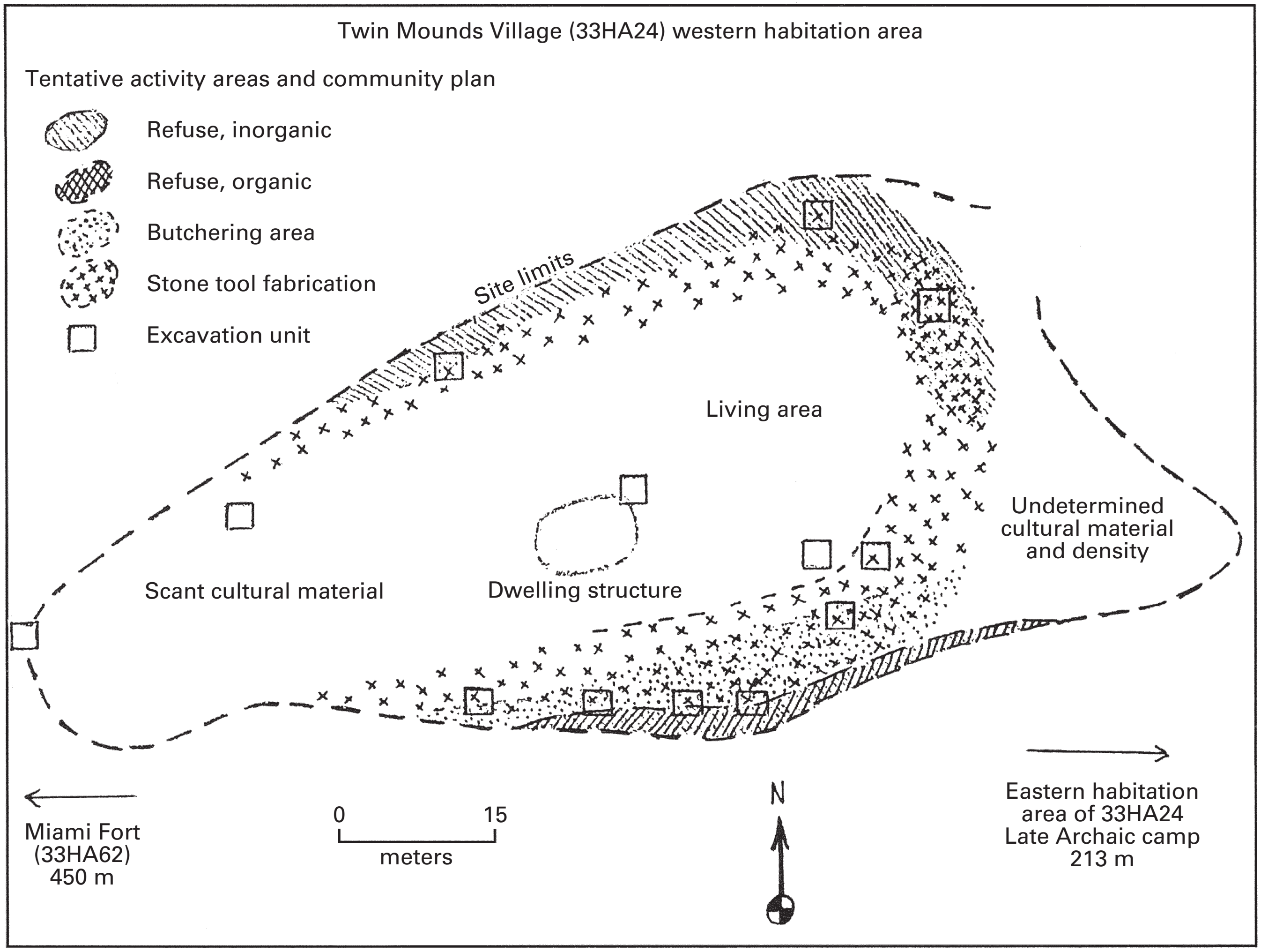

FIGURE 2-5.—Archaeological site map of Twin Mounds Village, west habitation Middle Woodland village and activity areas (modified from Fischer, 1970, fig. 3).

point the outer wall weakened and needed more support. The posts of the inner wall were on the average larger (19 cm in diameter) and placed only 31 cm deep. A couple of partitions within the structure and one on the outside southeast corner also were constructed. Entrances to the structure were located on all sides except the north. The floor plan of the structure covers about 274 square meters. A total of 12 features was found that probably related to activities around and in the structure. No other features were located outside of this area in the central portion of the site. Six features were defined as hearths. Feature 70-1 was 13 cm deep and contained charcoal, fire-cracked rock, Harrison County chert blades, an unfinished celt or adze, and a 24-cm-long stick. Feature 69-9 was 35 cm deep and had a cut mica mirror (10 by 10 cm), turtle carapace bowl, bone awls, a bone needle, mica flake debris, and pot sherds. There was no living floor found within the structure, or any other part of the site. The high charcoal content in the postmolds suggests the entire structure burned down after the second west wall was in place. No other structures were found in the central area, and the large size of the structure may cast some doubt on the function of the structure as a dwelling; however, further excavations may detect other structures.

Lee (1972) analyzed the material excavated by Fischer from the Twin Mounds east knoll. The site was predominantly Late Archaic, consisting of 12 features filled with refuse and a total of seven burials in flexed positions. Of the two burials excavated by Fischer, one was a juvenile with three bone fish hooks and a bone needle, the other was an adult with no grave items. Both burials were interred with their heads oriented eastward, one facing south, the other facing up. Lee (1972) compared the site to other Late Archaic sites up the Great Miami River drainage and a site up the Ohio River east of Cincinnati. Based entirely on an artifact trait list compiled from four Late Archaic sites and the bifacial tools from these sites, Lee (1972, p. 27-30) concluded these sites were all related and differed from the Green River Late Archaic sites (Indian Knoll).

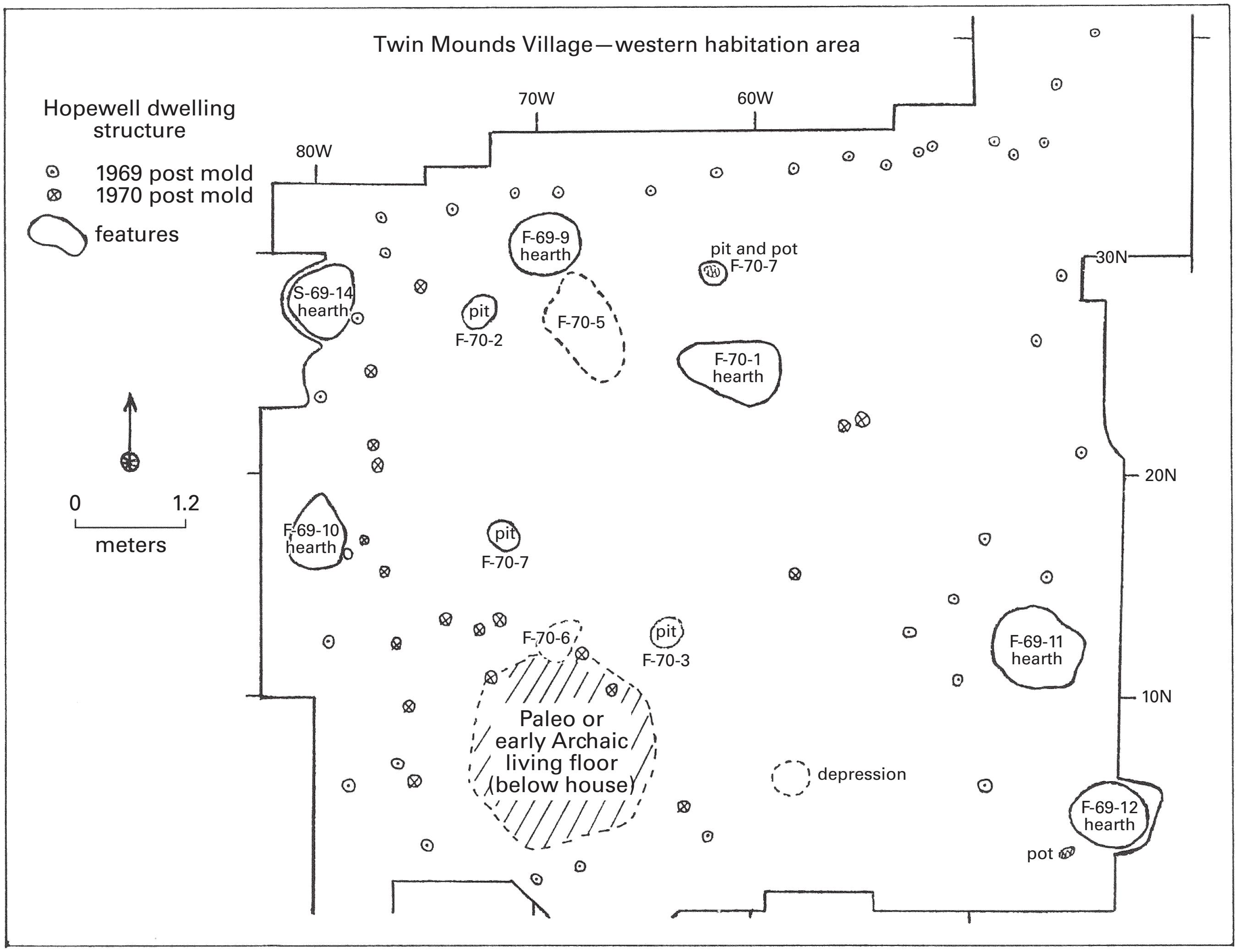

FIGURE 2-6.—Plan map of Middle Woodland-Hopewell structure in west habitation site of Twin Mounds Village (modified from Fischer, 1970, fig. 4).

Lee and Vickery (1972) excavated the area where the park ranger headquarters building is located today. The Headquarters site (33HA65) revealed a Middle Woodland village. Three burials were uncovered: two extended females buried in midden deposits and one questionable female buried extended in a grave pit below the midden. Cord-marked pottery sherds make up 88 percent of the ceramics. The significance of the Headquarters site is that the burials represent one of the few instances of commoners' graves without the elaborate grave items typical of Hopewell mortuaries associated with earthworks. Another significant feature is that one of the females was buried with a prepared flint core resting in one of her hands and was covered with limestone slabs. A cache of possibly bone-working tools was recovered along with a couple kernels of maize. In comparison to the Twin Mounds west-knoll Hopewell site, the Headquarters site may be more typical of a village habitation site. The Twin Mounds west-knoll site, which has more typical Hopewell items, may represent a ceremonial site or ceremonial workshop adjacent to the enclosure where socioreligious gatherings took place. Unfortunately, none of the sites were radiocarbon dated, except the enclosure wall.

During 1974 and 1975, Dalbey, then later Vickery and Dalbey, excavated south of Brower Road below Miami Fort, along the Ohio River (Dalbey, 1977b). Excavations for four electric-power-line tower footers on the CG&E property detected a prehistoric camp site. The site borders the E.I. DuPont de Nemours property, where a large, mostly Late Archaic site known as the DuPont site (James Keller, letter to Raymond Baby, Ohio Historical Society, 1956) was destroyed when the plant was built in 1955. The site on the CG&E property is part of the same site, which had been preserved by fill that was dumped over the site while leveling an area for a CG&E employee parking lot (fig. 2-7). The fill was rich in artifacts (Dalbey, 1976), including two Clovis points, and was once part of the site, which obviously had a Paleoindian component.

Dalbey (1976), as a consulting archaeologist to CG&E for the tower footer excavations through Shawnee Lookout

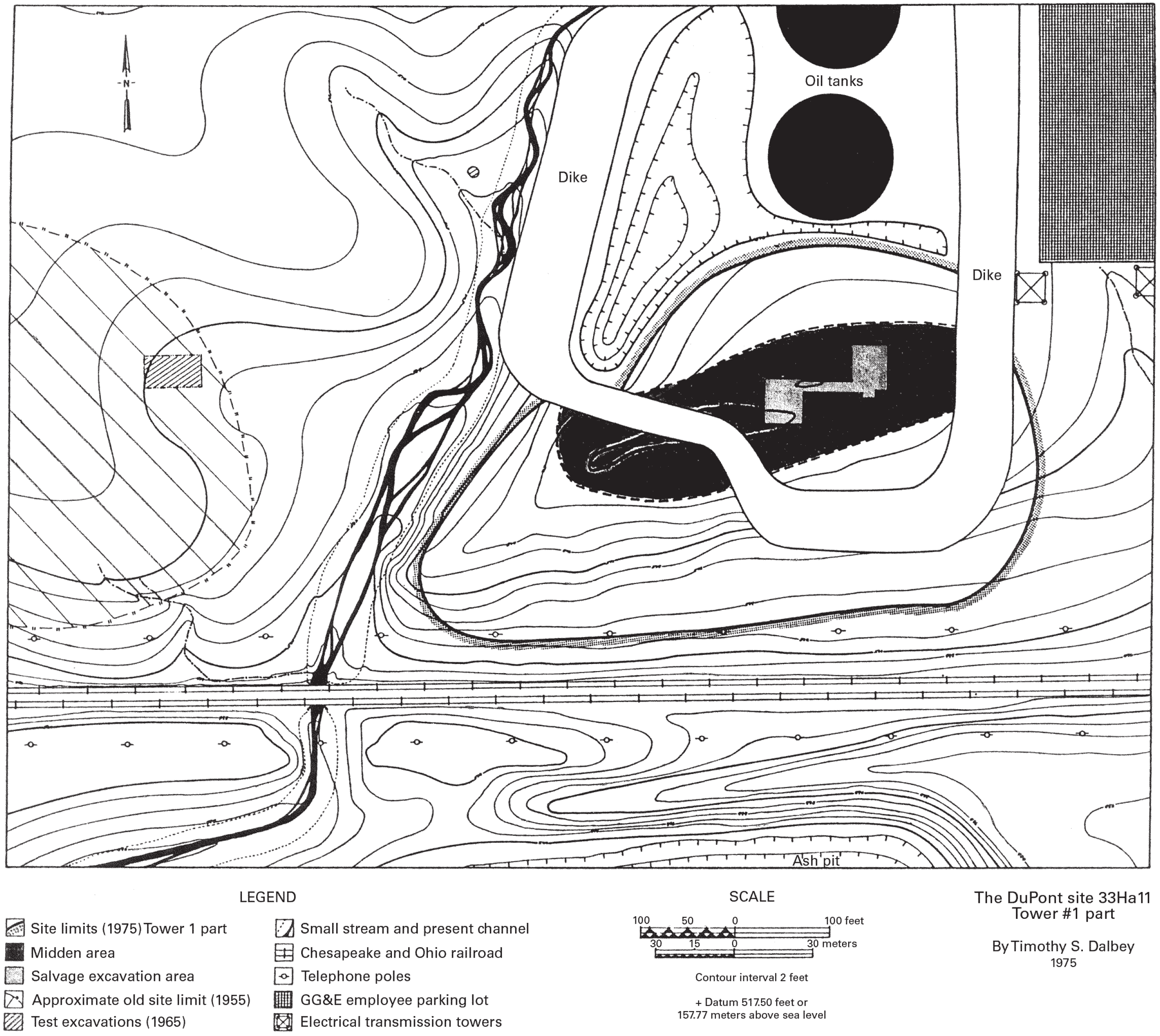

FIGURE 2-7.—Map of the DuPont site after fill was removed showing oil tanks, dike, and parking lot (modified from Dalbey, 1977b).

Park, conducted salvage excavations at the Tower No. 1 site on the CG&E property. While archaeologists were conducting salvage excavations for the tower footers, CG&E began excavation of the site area for an earthen containment dike around two oil storage tanks that were under construction north of the site. Due to the presence of archaeologists at the site, the excavation was stopped; and in coordination with CG&E, removal of the parking-lot fill exposed the original site surface and a remnant of the larger site was preserved. A small stream channel dividing the DuPont and the CG&E properties also was revealed. Dalbey (1977b) later learned that the entire area of the upper and lower terraces, consisting of over 32 hectares, was mostly a continuous site whose major component was Late Archaic (fig. 2-8). Salvage excavations stopped in April 1975, and a field school was conducted at the site in the summer of 1975.

An area of approximately 0.8 hectare was not disturbed by CG&E. An extensive midden area covers the center of this remaining site. An area of 1,341 square meters was delineated for excavation, although only 885 square meters was excavated. The unstratified midden was 46 cm deep on the east to central portion of the site, thinning to 15 cm deep on the west. As the midden was removed, large circular limestone features were uncovered at various levels in the midden. The different levels indicated a cultural stratigraphy; lower features were the earliest and intrusive features later.

A total of 62 features were excavated or detected, but there was no clear patterning (fig. 2-9). The features consisted of shallow storage pits filled with refuse, refuse pits, hearths, shallow earth ovens, stratified earth ovens, "Dakota"-type ovens having vents from the bottom to the surface, and wind breaks—screens around a few earth ovens. The feature depths ranged from 37 cm to 110 cm, and the feature volume ranged from less than 1 cubic meter to over 3 cubic meters, such as Feature VV, the large stratified earth oven, illustrated in figure 2-10. Five features were analyzed in detail, and four were ^{14}C dated. The five features yielded over 6,000 animal bones (Stine, 1977); 10,000 chert artifacts (B.C. Featherstone, 1977); 1,800 naiads (Dalbey, 1977a); 1,100 other gastropods (Theler, 1977); over 1,000 non-nut mast plant remains, of which 232 could be identified (B. J. Featherstone, 1977); over 400 tools; and 270 kg of fire-cracked rock. Flotation-processed soil from four features (AA, VV, ZZ, and B Nut Pit) yielded 12 grams of charcoal, 759 grams of various nut shells, including acorn, and 304 grams of seeds. No cultigens were found in the 9 liter-size flotation-processed samples. The list of plant remains recovered from flotation (table 2-2) reflects the large variety of vegetation that was exploited during the Late Archaic period almost 5,000 years ago.

The 400 tools recovered from the features were either broken and discarded into the features or were lying on the edges around the features, indicating a multiplicity of activities. McWhinney (Vickery, 1972) knives and projectile points, Archaic corner notched, and an untyped straight-stemmed ovate-base biface were the most numerous manufactured chert tools; other tools of various raw materials include bell pestles, roller pestles, lower grindstones, manos, hammerstones, $^{3}/_{4}$ grooved axes, scraper planes, drills, end and side scrapers, cupstones, pitted stones, gouges, and abraders. Tool caches of antlers and cores make up some of the stone-working tool kits. Bone utility tools include weaving shuttles, needles, awls, gouges, beamers, fish hooks, turtle carapace cups, bone beads, and deer antler tine flakers.

The typological consistency of tool types recovered from the features and the ^{14}C dates suggest that this was a favored location for over 500 years. The large stratified earth ovens such as Features AA and VV probably indicate longer than seasonal occupations of the site. Fish bone remains, bone fish-net sinkers, and naiad shells clearly indicate riverine exploitation. Derived chert in river gravel bars was the source for lithic raw materials for tool manufacture.

A total of 31 burials were detected, seven placed on prepared earthen platforms associated with earth-oven features. The majority of individuals were interred in a flexed position with some exceptions: one sitting burial, one semi-flexed, one extended, and two redeposited burials. Many of the burials had associated unused tools such as limestone roller pestles, $^{3}/_{4}$ grooved axe, weaving shuttles, and other utilitarian tools, which may have had some indication of their role or craft in the community.

Four male individuals had red ochre placed within the burial after death. Alongside one burial was a pouch that contained a large amount of red ochre and a bone flute; the individual was covered with yellow ochre on the back and red ochre on the front, and there were goose-bone beads along the base of where clothing would have been, perhaps indicating that this individual was a shaman. Another male individual had a turtle carapace cup filled with red ochre and a drill placed alongside the burial. He had a necklace of shell with a cannel coal center and an atlatl slung over his shoulder. This individual was killed—four McWhinney points were found within the skeleton, two of them severing parts of vertebrae. One other male individual was found with two projectile points that probably caused his death. This evidence of violence may indicate warfare; however, the four McWhinney points in the one individual are typical of the group living at the site. McWhinney points also are common throughout the Ohio River valley area and up the Great Miami River. These deaths may indicate friction between groups in the region and territoriality. If this premise is correct, the usual model of a typical egalitarian hunter-gatherer-collector band 4,000 to 5,000 years ago is more dynamic and complicated than realized.

The last remaining area owned by CG&E that was relatively undisturbed lies at the west portion of the terrace, west of the DuPont site, overlooking the confluence of the rivers (fig. 2-11; see also 33Ha136, fig. 2-1). Many collectors refer to this area as the "bird point site," and collections from this area reflect a late Late Archaic component. This area has long been looted by collectors and pothunters. However, by 1985, CG&E had bulldozed the barn and the area around the barn into a huge pile, probably to be used for fill dirt. The extent of damage to this portion of the site is unknown at this time, but if the damage is total, it would destroy the last remnants of a huge 32-hectare area that we know nothing about. This area was the last remnant of complex site situations at confluences to the Ohio River which were main focal points in the settlement patterns of prehistoric groups in the area.

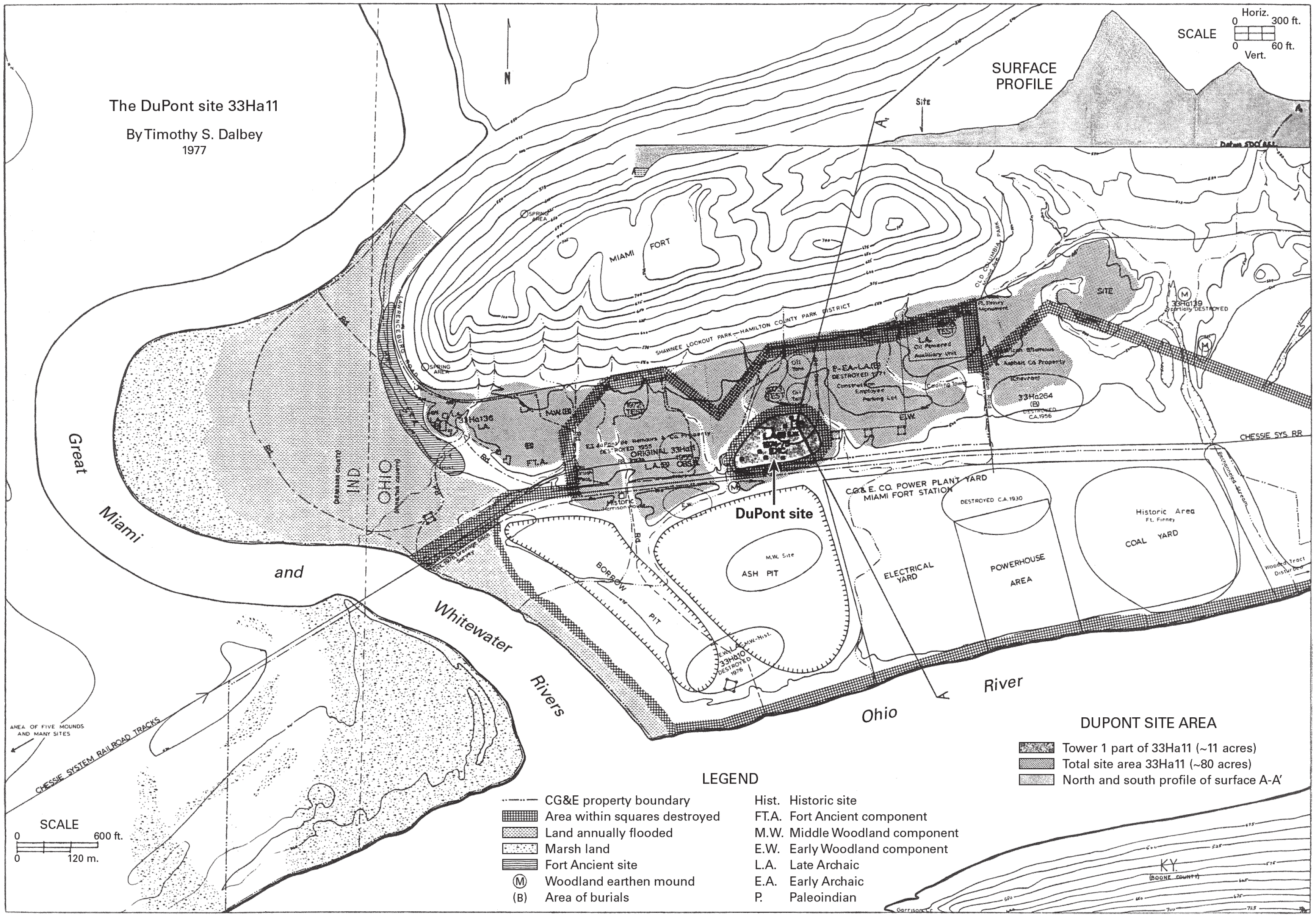

FIGURE 2-8.—Map of the 32ha along the terraces of the Ohio River showing the destroyed areas, the DuPont remnant excavated, and the other remaining areas up to 1985 (modified from Dalbey, 1977b).

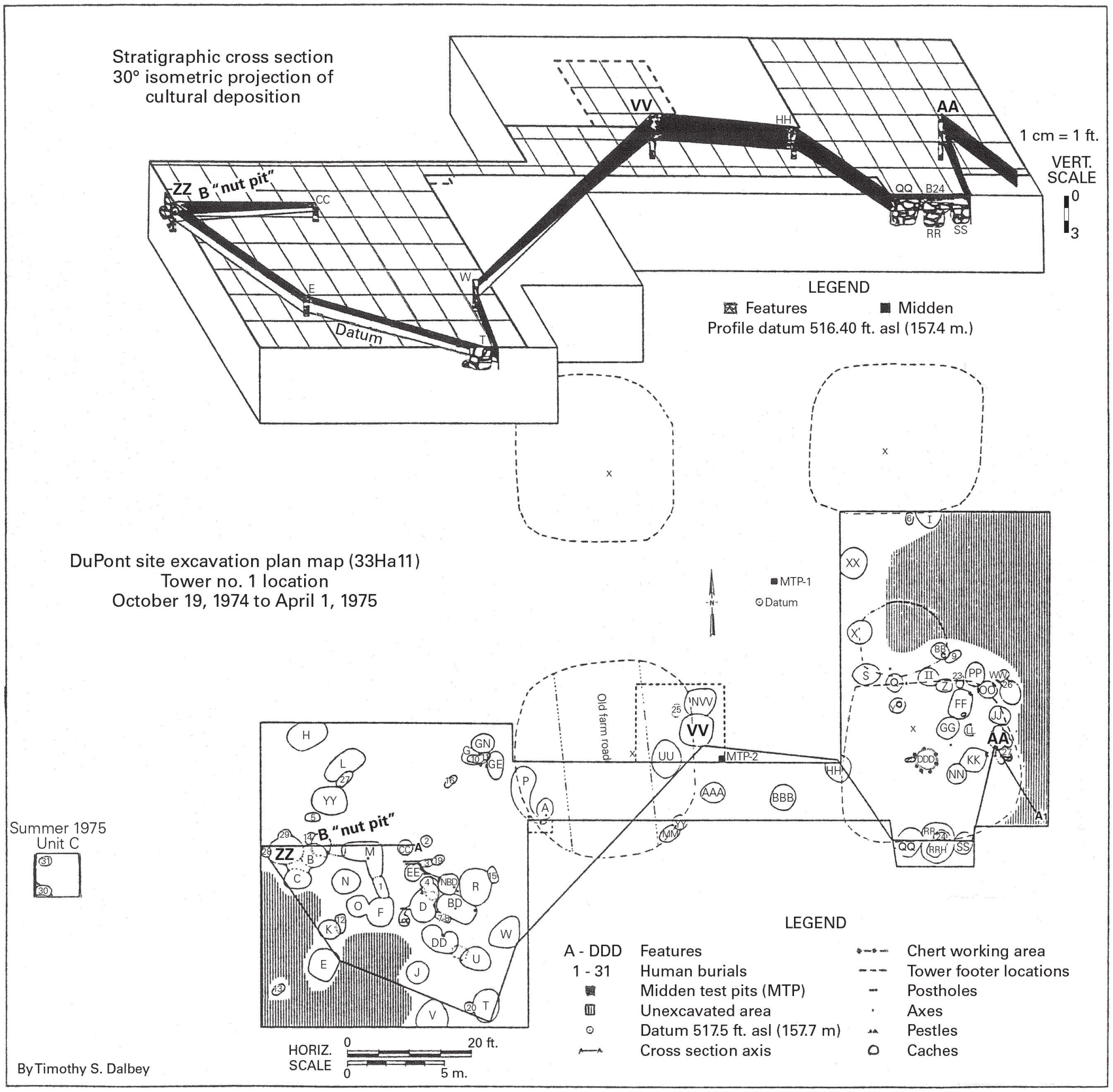

FIGURE 2-9.—Plan map of features and burials within the DuPont site remnant and an isometric projection of the midden plotted by key features (modified from Dalbey, 1977b).

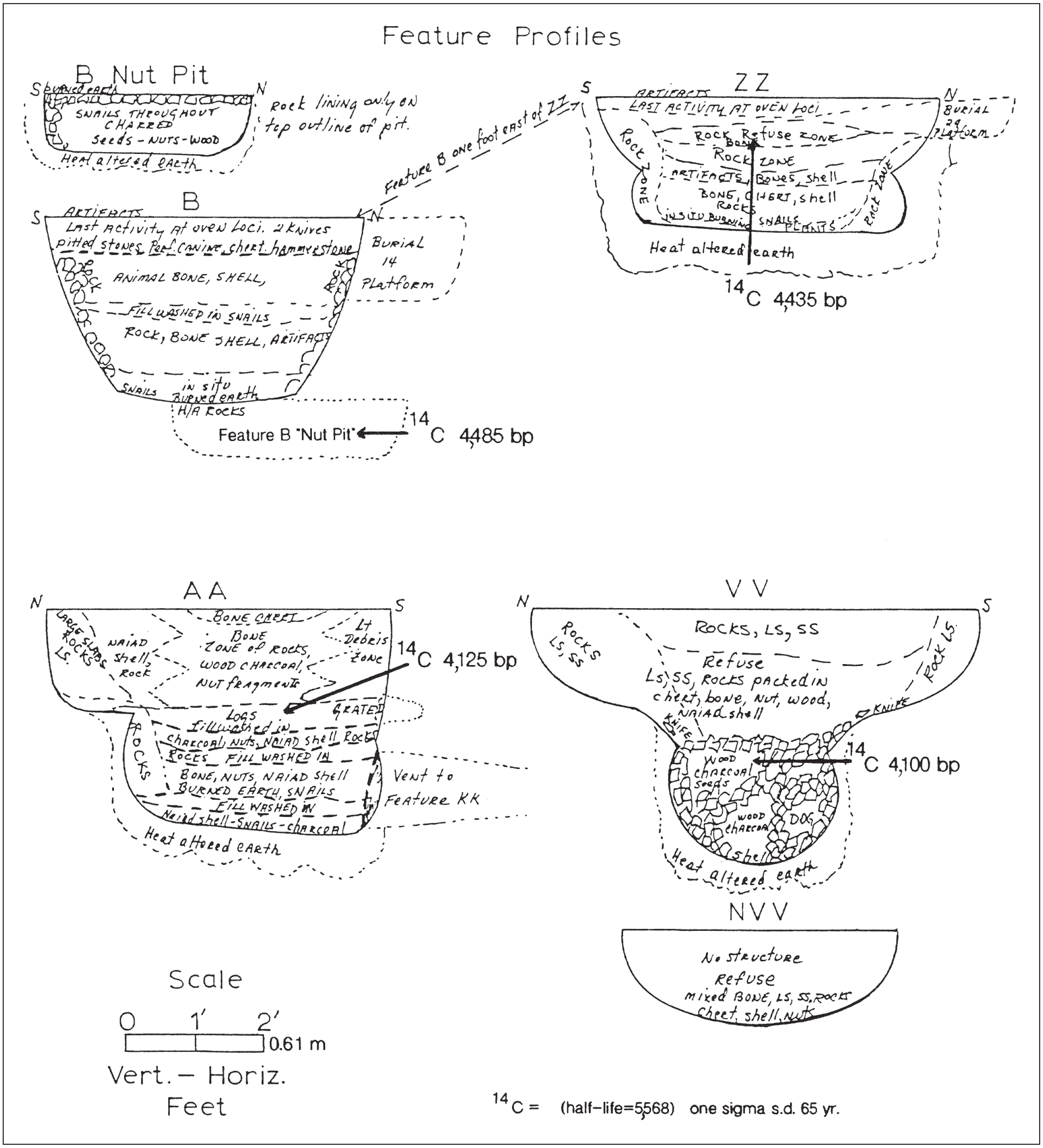

FIGURE 2-10.—Profiles of analyzed features at the DuPont site (CG&E property) and ^{14}C dates (from Dalbey, 1977b).

TABLE 2-2.—*List of identifiable plant remains recovered from features at the DuPont site*[1]

Category	Type	Occurrence
nutshell	black walnut	moist habitats; oak-ash-maple association of slopes, and mixed mesophytic association of slopes, terraces, and uplands
	white walnut	moist habitats; mixed mesophytic associations of slopes, terraces, and uplands
	hickory spp.	wet to dry habitats; all forest associations
	acorn (oak) spp.	wet to dry habitats; all forest associations
	hazelnut spp.	wet and dry habitats; oak-ash-maple association; also disturbed areas
grain seed	chenopods, amaranths, and polygonums	damp, disturbed habitats; shores of streams and disturbed areas of floodplains, terraces, and uplands
	composites, grass seed	all forest associations
fleshy fruits	pawpaw	moist habitats; mixed mesophytic association of slopes
	black cherry	moist habitat; oak-ash-maple association, mixed mesophytic association of slopes, terraces, and uplands, and floodplain bluff association
	blackberry spp.	wet, dry, and disturbed habitats; swamp forest association and clearings of oak-ash-maple association
	plum spp.	damp habitat; streamside association
	sumac spp.	dry and disturbed habitats; clearings of oak-ash-maple association and areas of slumping
	elderberry spp.	moist habitat; mixed mesophytic association of slopes and floodplain association
	blueberry spp.	wet and dry acidic and disturbed habitats; sandy parts of oak-ash-maple association
	viburnum spp.	wet and dry habitats; swamp forest association and slope areas
	grape spp., honey locust, hackberry, hawthorn spp.	disturbed habitats
miscellaneous	bedstraw spp.	moist and disturbed habitats; clearings of oak-ash-maple association and floodplain association
	wild bean	moist to dry habitats
	sedge spp.	wet to dry habitats; all associations
	pin cherry	dry and sandy habitats; oak-ash-maple association on sandy parts

[1] From B. J. Featherstone (1977).

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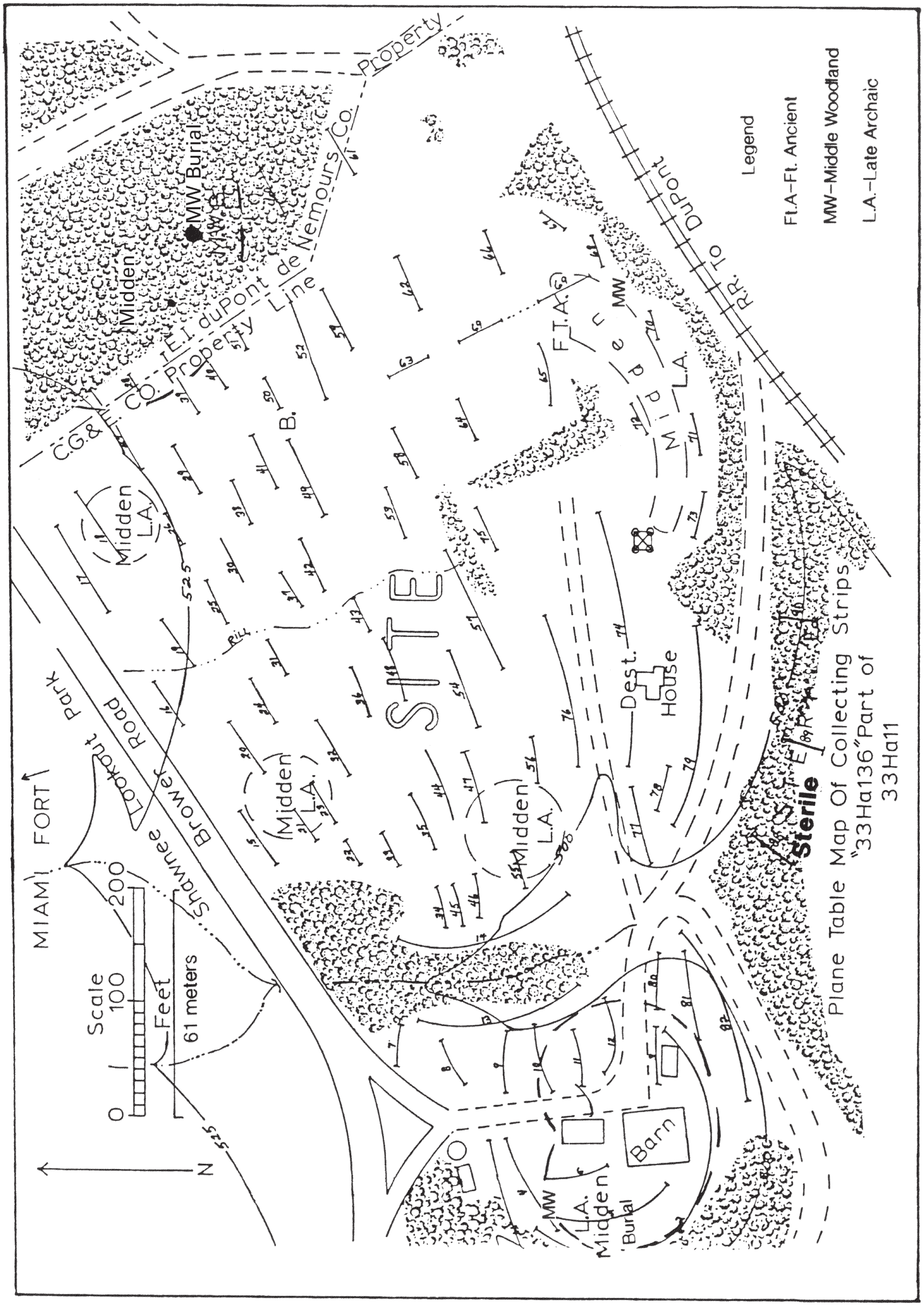

FIGURE 2-11.—Survey map of archaeological sensitive areas (on CG&E property) west of the DuPont plant that have been destroyed (from Dalbey, 1977b).

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STOP 3: MIAMISBURG MOUND DRIVE-BY

by
Timothy S. Dalbey

The Miamisburg Mound (figs. 3-1, 3-2) sits on a 30-meter bluff along the Great Miami River on Mound Avenue in Miamisburg, Montgomery County, Ohio. The Miamisburg Mound is the largest Indian burial mound in Ohio and the second-largest burial mound in the eastern U.S. Only the Grave Creek Mound in Moundsville, West Virginia, is larger. The mound measures almost 21 meters high, has a basal perimeter of 267 meters, covers over 0.4 hectare, and contains approximately 36,812 cubic meters of soil.

Local residents excavated into the top of the mound as early as 1869. They excavated an 11-meter shaft down through the center and then two shafts outward from this depth. Burials were found at 2.4 meters and 11 meters deep along the layers of ash and rock. The local residents labeled the mound as Adena. However, the mound and the areas around the mound have never been scientifically investigated (Fowke, 1902; Converse, 1972; Woodward and McDonald, 1986).

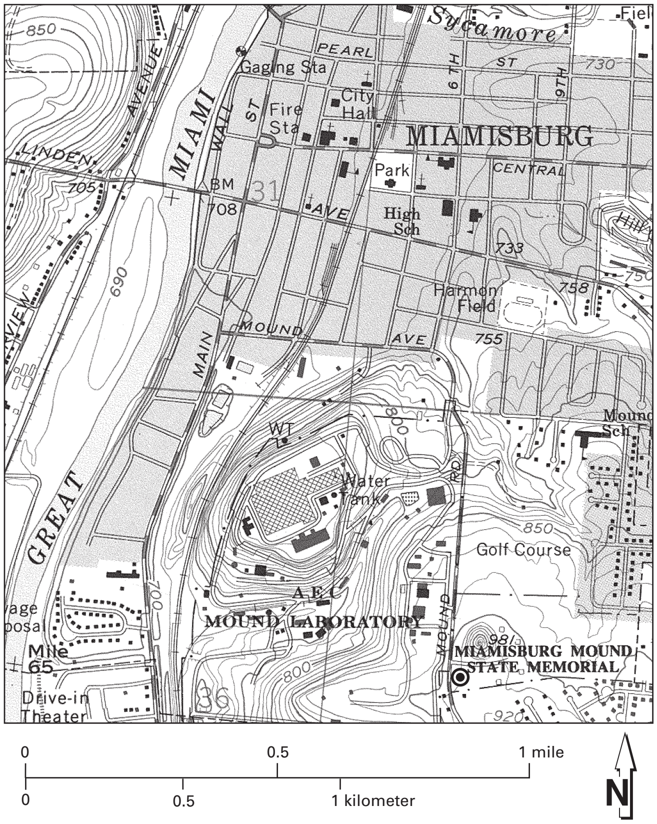

FIGURE 3-1.—Portion of U.S. Geological Survey Miamisburg, Ohio, 7.5-minute map showing location of Miamisburg Mound.

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FIGURE 3-2.—Miamisburg Mound.

STOP 4: SUNWATCH ARCHAEOLOGICAL SITE—VENTURING BACK IN TIME

by
Christopher A. Turnbow
with revisions by Sandra Yee

SunWatch Indian Village, a National Historic Landmark, represents the remains of a Fort Ancient settlement of the A.D. 1200's located in present-day Dayton, Ohio (fig. 4-1). The site (originally named the Incinerator site) was first investigated and reported in the 1960's by amateur archaeologists John Allman (1968) and Charles Smith (1968). Plans to construct a sewage treatment plant on the location led the Dayton Society of Natural History to commence emergency salvage excavations at SunWatch in 1971. This work exposed a stockaded village that had only a single occupation of less than 20 years and a well-preserved artifact assemblage that included such fragile items as crawdad pincers, fish scales, turkey eggshell, and uncarbonized wood. Because of its importance, the site was placed on the National Register of Historic Places in 1974 and, with the cooperation of the city of Dayton, was saved from destruction. SunWatch was preserved within the SunWatch Archaeological Park in 1988 and has since been identified as a National Historic Landmark because of its contribution to prehistoric cultural history. SunWatch is located at 2301 West River Rd., off Interstate 75 just south of downtown Dayton.

ENVIRONMENTAL SETTING AND DESCRIPTION

SunWatch is located on a level first terrace of the Great Miami River about 8 km (5 miles) south of downtown Dayton.

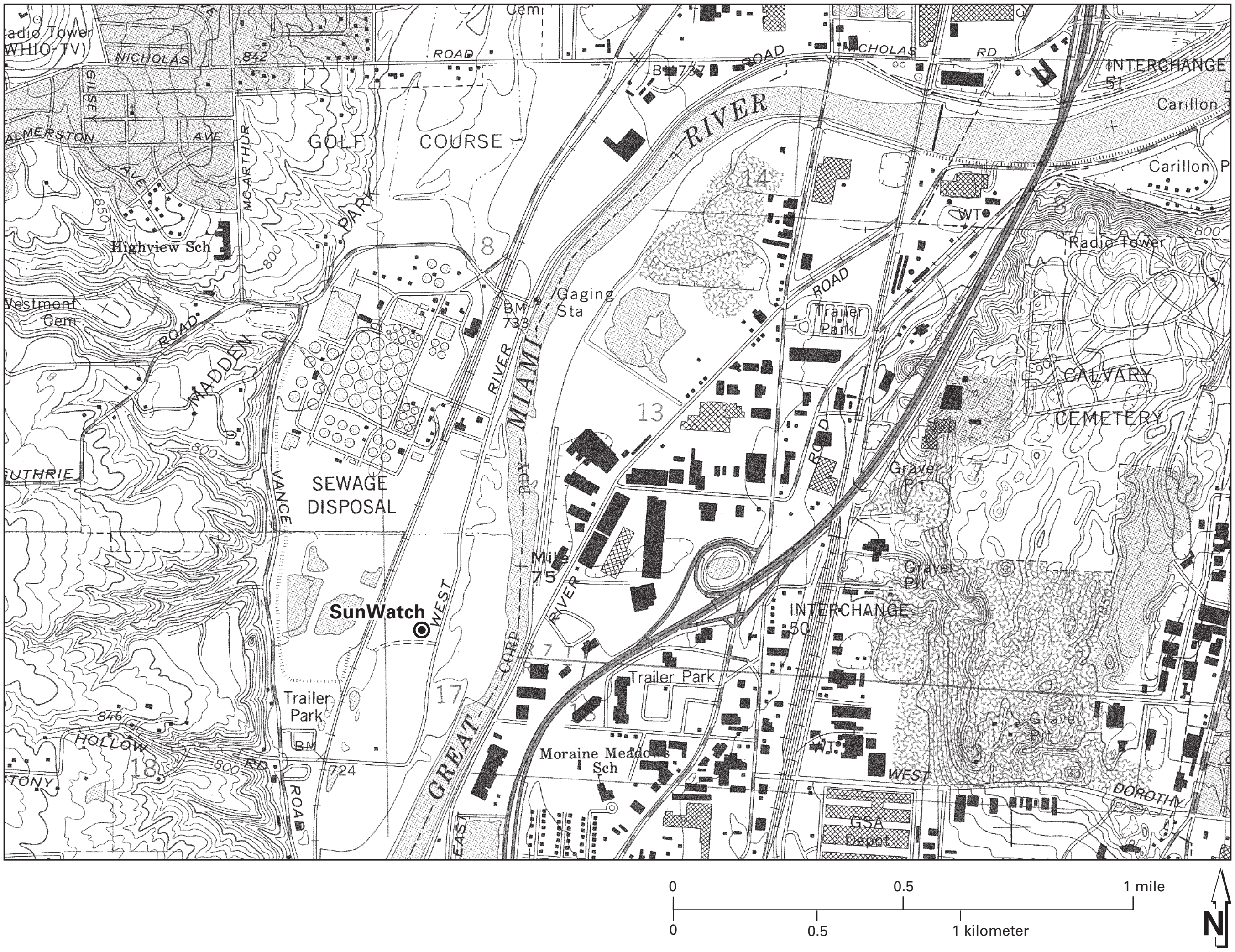

FIGURE 4-1.—Portion of U.S. Geological Survey Dayton South, Ohio, 7.5-minute topographic quadrangle showing the location of SunWatch Indian Village.

Dredging and channelization of the river in the early 1900's rerouted the river into its present position approximately 200 meters east of the site. During the Late Prehistoric period, the Great Miami River probably had swift currents and extensive riffles and was likely much closer to the site. Soils in the immediate area are highly productive, neutral, well-drained silt loams. The site is underlain by glacial outwash gravels and sands that provided good drainage. Archaeological and historical data suggest that edaphic conditions once existed that supported patches of prairies, woodlands, and marsh riverine habitats near the site during its occupation by prehistoric Native Americans, including Fort Ancient people.

Archaeological components identified at SunWatch include numerous Paleoindian, Archaic, and Woodland period campsites as well as a historic A.D. 1930's farmstead; however, the most intensive occupation was an Anderson-phase Fort Ancient village. Fort Ancient societies inhabited the central Ohio Valley from A.D. 950 to the late 1600's and are characterized as sedentary farmers who relied heavily on the production of corn, beans, and squash. This stable food base allowed them to establish permanent villages throughout the region. It seems clear that Fort Ancient technology and ideology underwent change in response to influences from the more complex contemporaneous Late Prehistoric societies to the west and south (Griffin, 1943; Prufer and Shane, 1970; Essenpreis, 1978). However, unlike the contemporaneous cultures, Fort Ancient populations are thought to have maintained a more or less egalitarian social organization and self-sufficient, autonomous villages.

The village at SunWatch is assigned to the Anderson phase because of the presence of diagnostic Anderson cord-marked and Anderson shell-tempered ceramic types (Griffin, 1943, 1978). Dating between A.D. 950 and the 1400's, the phase is known from village sites scattered within the middle drainages of the Great Miami and Little Miami Rivers.

The SunWatch village site covers approximately 1.2 hectares on the terrace edge. Excavations since 1971 have exposed around 60 percent of this settlement. Further excavations are on hold, as scientific methods are advancing so rapidly in the areas of remote sensing of sites that more will certainly be discovered in the future than can now be found and interpreted.

Almost all cultural materials have been found within the upper 35 cm of the stratigraphic column. Flood-deposited silt loam up to 25 cm thick is believed to have accumulated on top of the prehistoric cultural layers some time after the A.D. 1200's, but modern plowing has destroyed all but a few thin remnants of the prehistoric occupational surfaces. Excavations have concentrated on the cultural pits, burials, and postmolds that penetrate into the sterile clay loams and gravels below the plow zone.

The age of SunWatch village is based on 13 determinations from five different radiocarbon labs. Tree-ring calibration of the ^{14}C ages using Stuiver and Becker's table (1986) suggests the site was occupied in the early to mid A.D. 1200's. The SunWatch village was constructed in a rigidly planned pattern; a central plaza is surrounded by concentric zones of burials, domestic work area, structures, and stockades (fig. 4-2).

STOCKADES

Excavations have exposed at least three stockade alignments that surrounded the village. The outermost stockade enclosed an oval area approximately 128 meters north-south by slightly less east-west. It is estimated that over 1,300 posts were used to build each fence. Analysis of charcoal recovered from the stockade postholes revealed branches from several different types of trees were used in the fence rows (Wagner, 1988, p. 81). Posthole diameters were generally 6-12 cm and had similar depths. The average spacing of 35 cm between postholes in the alignments suggests the fences were wattled with branches or filled in some other fashion.

Experimental reconstruction of a portion of the stockade has confirmed that such fences rot at their bases and generally fall down in five to six years. On the basis of this information, the occurrence of three stockades at SunWatch suggests they were in use at different times. It is assumed that each new stockade enclosed a larger area within the village in order to accommodate new house construction and other activities associated with population increases within the community.

STRUCTURES

To the interior of the stockade was a residential zone consisting of single or in some cases double rows of structures. Eighteen of these rectangular, square, or trapezoidal buildings have been identified from the excavations, but a total of 25 to 30 may have existed in the village. These patterns range in size from 5.0 by 5.7 meters (29 square meters) to 6.7 by 9.1 meters (61 square meters). The structures were built of individually set posts, generally of hickory or oak. Clay daub recovered from the site suggests that some of these buildings were constructed by plastering over a wattled wall of prairie grass and small twigs. The arrangement and size of the interior postholes suggest a ridgepole roof design. The roofs may have been covered with grass thatch or bark. Postmolds defining these structures suggest a single central room that had benches set to the interior of the house walls. Hearths, commonly with clay liners, were present near the center of most buildings.

Most houses were probably occupied by single nuclear families consisting of parents, children, and, perhaps, unmarried or widowed relatives. On the basis of the amount of roofed-over floor space within each structure, the smallest dwellings may have contained 6 to 10 people, and the largest building could have housed a maximum of 18 individuals. Judging from these figures, the population estimate for SunWatch at its peak was approximately 250 people. This figure is close to a population estimate of 233 people based on the crude mortality rate determined from the burials.

DOMESTIC WORK AREA

Because of the dark, smoky conditions inside the dwellings, household chores commonly were done outside in a 10-meter-wide band between the structure zone and the burial zone (fig. 4-2). Excavations in this domestic work area have noted dense concentrations of tools, charcoal,

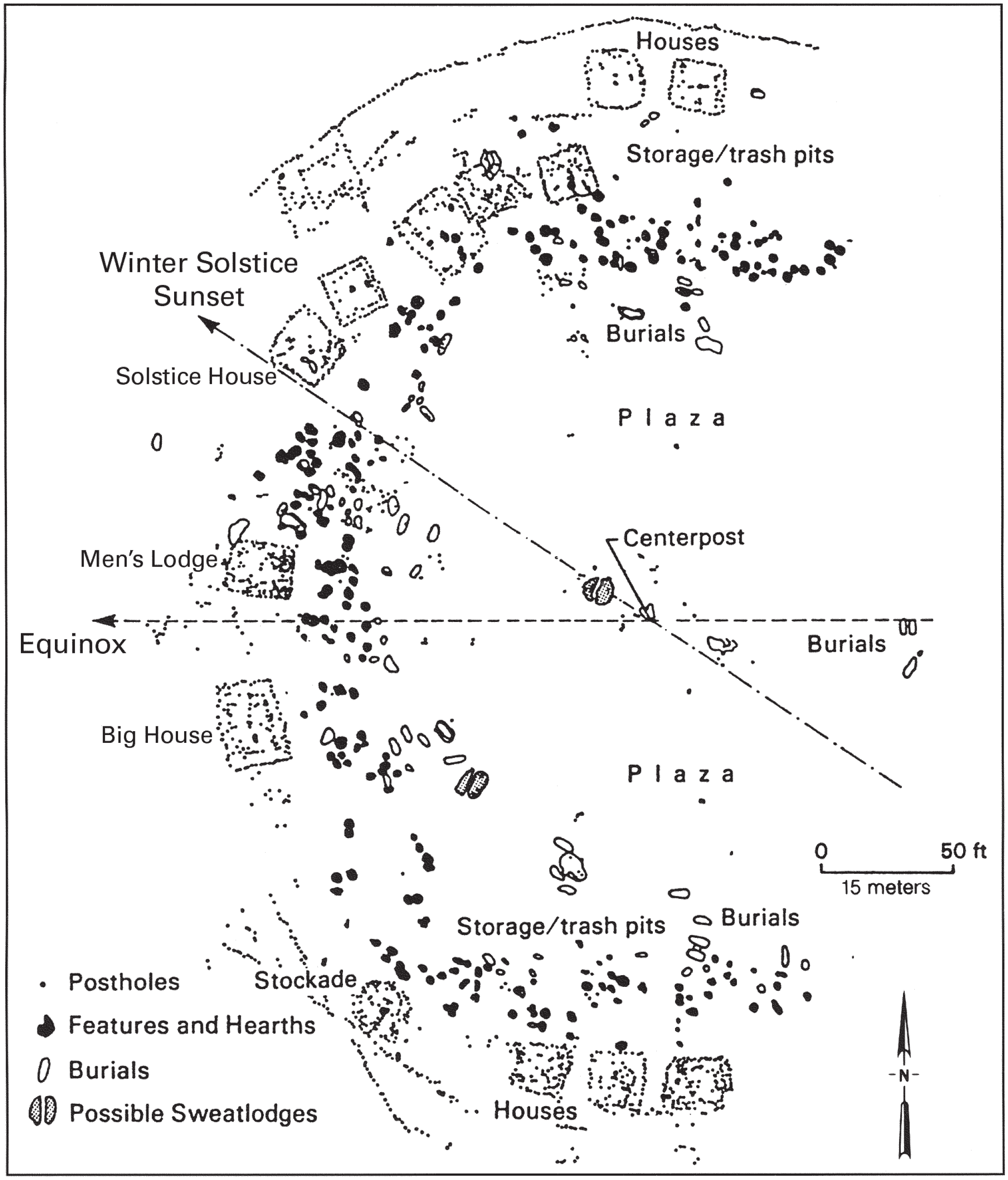

FIGURE 4-2.—Map of the SunWatch site showing village arrangement as known in 1986 (modified from Wagner, 1990).

and food refuse, as well as most of the over 300 pit features discovered in the village.

Pit features range from shallow basins to deep, straight-sided pits to irregular forms, but most are bell shaped and average about a meter in diameter and depth (Nass, 1987, p. 152). The deeper pits were dug into well-drained gravel deposits. Remains of grass liners found in several of them suggest that they originally functioned for storage of corn and other crops (Wagner, 1988, p. 83). Historical references noted that such pits were used to store or conceal surplus foods through the winter season.

As the storage pits were emptied of their original contents, they began to mildew and collapse and were rapidly refilled with household or village trash. Excavation of these pits produces large quantities of pottery, chipped stone, and well-preserved faunal and floral remains. Analysis of these materials provides a great deal of information on the lifeways of the SunWatch villagers and the environment in which they lived.

BURIAL ZONE

When a death occurred in SunWatch village, the individual commonly was buried within a narrow 4-meter-wide band around the edge of the central plaza. Graves were commonly rectangular, and the interments were extended or semi-flexed with their legs slightly bent. About 60 percent of the graves were covered with limestone slabs. Heilman and Hoefer (1981, p. 161) suggested that burials positioned nearest to the plaza and associated with limestone slab covers are the highest status individuals. The limestone slabs were quarried from a nearby outcrop and range in size from approximately 10 to 30 cm across.

Nonperishable grave goods were found in about 30 percent of the burials. Shell ornaments, including marine *Marginella* beads and drilled lightning whelks from the Gulf of Mexico, were used for necklaces, bracelets, and earrings. Wolf and bobcat incisors were drilled or scored for suspension. Shell beads, bone hair pins, lightning whelks, and wolf jaws were incorporated into headdresses. Bone tools, pipes, projectile points, and possible charms also were added to a few graves.

The human remains recovered from the site indicate life was difficult for the villagers. It is estimated that around half of the children died before the age of six. Robbins (1977, p. 22) proposed that infanticide and intentional abortion may have been practiced. For those who survived to adulthood, the average life expectancy was 36 years for men and 28 years for women.

CENTRAL PLAZA

In the center of the village was an oval plaza 65.9 meters north-south and 51.8 meters east-west. Kept clean of trash and pits, it probably served as a civic area for rituals, dancing, games, and other community activities. The only cultural features associated with the plaza are postholes and a wolf/dog burial.

In the center of the plaza, the Fort Ancient people erected a large pole of eastern red cedar that was 0.61 meter in diameter at its base. Placed into a ramped posthole 1.2 meters deep, the pole may have stood over 12.2 meters in height and would have dominated the settlement. Four other posts were placed in a parallelogram pattern around the center pole. Four smaller posts were erected in a measured straight line running NNE by SSW, 9.1 meters northwest of the center post (figs. 4-2, 4-3).

ASTRONOMICAL ALIGNMENTS

The arrangement of the center post in relation to other posts in the central plaza led Heilman and Hoefer (1981) to examine their use for calendric alignments, as in the highly celebrated “American Woodhenge” discovered in the Mississippi Valley (Wittry, 1973). They proposed that the inhabitants of SunWatch were “watchers of the sky” who scheduled events and rituals based on astronomical alignments from the center pole. Later analysis by Goss (1988) added further support to the theory.

Three alignments have been suggested from the research. Each works under the premise that the center pole acted as a frontsight that aligns to a specific backsight elsewhere in the village during sunrise on a significant date.

Twice each year the center pole, working in tandem with smaller posts that form the parallelogram around it, lines up with the off-centered hearth of the Big House, the largest structure excavated thus far in the village (fig. 4-3). This building is interpreted as a council or headman’s house and is located just south of the ceremonial structure known as the Men’s Lodge. Calculations placed the alignments on April 29 and August 14. These dates correspond closely to historically known corn planting and green corn harvest times of Native American populations in eastern North America.

The other alignment thought to be recognized from the center pole marks the winter solstice (fig. 4-2, 4-3). The best indication of the solstice alignment is the four posts northwest of the center pole that are set in a symmetrical line perpendicular to the winter solstice sunrise line (Goss, 1988, p. 326). These posts are thought to have served much like a gunsight, in which the shadow of the center pole appears between the two middle posts during winter solstice sunrise. The backsight of this line is a hearth in structure HII-87 (Solstice House in fig. 4-3) on the northwest side of the village (Heilman, Anderson, and Turnbow, 1990, p. 19).

THE CEREMONIAL AND POLITICAL WEST SIDE

Examination of the village suggests that the western portion, located between the winter solstice and the planting-harvest alignments, deviates from the general community pattern. Two structures found in this area are unique in character and are associated with unusual assemblages of features and artifacts.

The Men’s Lodge (HII-78) ceremonial structure is west of the center pole. It had two distinctive design features—a slightly subterranean floor and large, deeply set posts that suggest a taller, more massive framework than other structures in the village. Furthermore, eastern red cedar was a primary wood used in the construction of only this building. Cedar has sacred and religious importance to historic Indian populations in eastern North America.

Excavations of the floor and trash pits around the Men’s Lodge have revealed large concentrations of chipped stone debitage and tools, suggesting a male-dominated activity area. The skeletal remains of woodpeckers, owls, hawks, blackbirds, and songbirds were likewise recovered in dense quantities around this building, leading to the theory that the feathers of these beautiful birds were being used for ornamentation. Finally, two dogs buried together in front of the building possibly were killed as a ritual offering.

The Big House (HI-71), measuring 6.7 by 9.1 meters, is the largest structure found thus far at SunWatch. Its off-center fire hearth is theorized to have functioned as the backsight for the corn planting and harvest astronomical alignments. Because of its large size, the building may have served as a council house for the community leaders. Alternatively, the

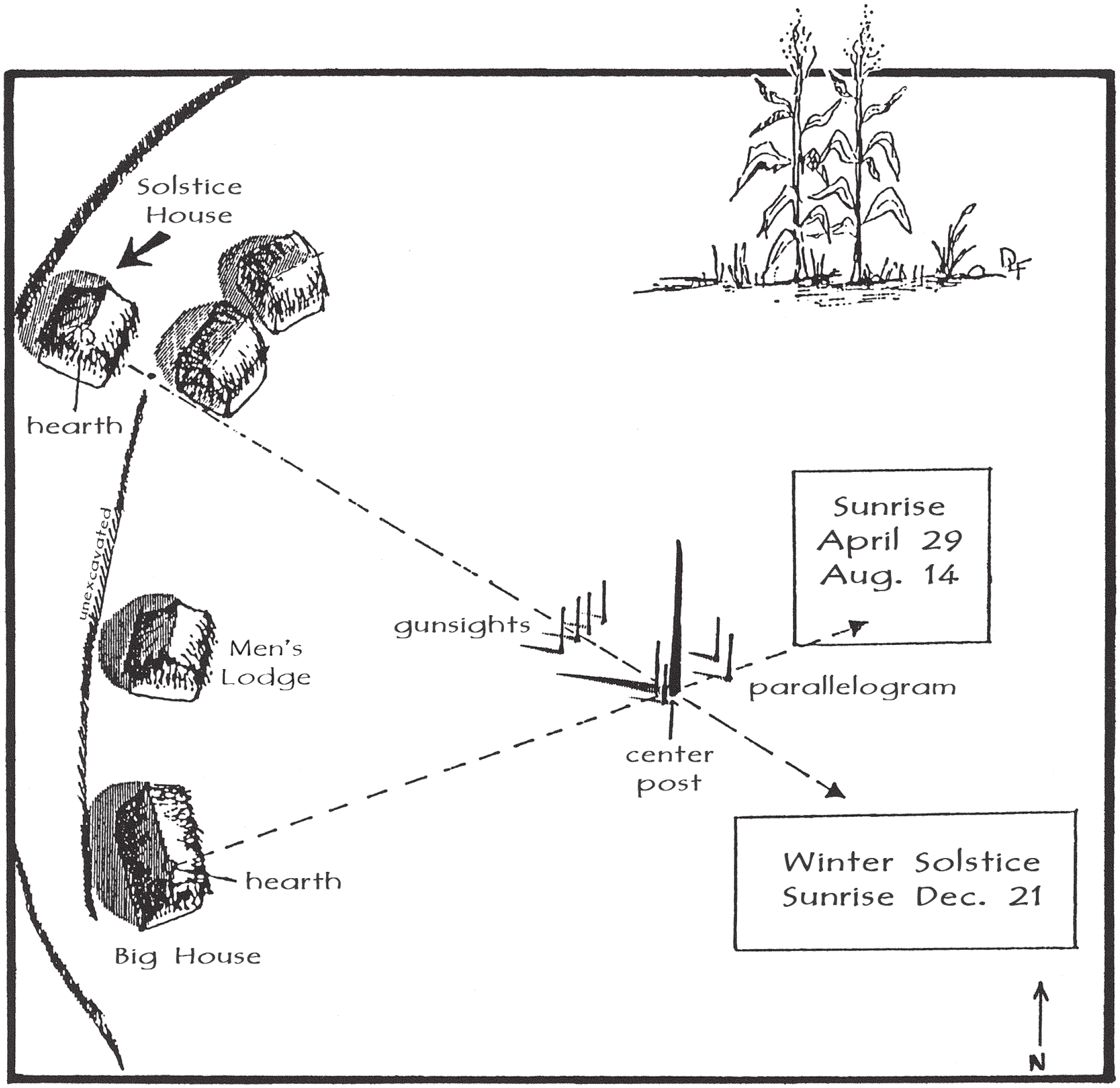

FIGURE 4-3.—SunWatch astronomical alignments for solstice and planting/harvesting dates.

presence of domestic storage pits and trash deposits in front of the structure could indicate that the village headman may have lived there in a pattern similar to that noted for the historic Huron of the eastern Great Lakes (Trigger, 1969, p. 73). The Huron built the village leader's home large enough to accommodate councils.

Regardless of the function of the Big House, more exotic material has been recovered in the area of the Big House and the Men's Lodge than anywhere else in the village. In particular, four pits contained layers of burnt maize in association with tools, exotic goods, and a pipe. These findings may represent the residue of a ritual harvest observance similar to the historically known Green Corn or Busk Ceremony.

SOCIAL ORGANIZATION

Besides the obvious concentric arrangement of the village and the presence of public and religious structures on the west side, spatial patterning within the settlement suggests that the community was organized into pie-shaped wedges that could represent distinct social divisions such as clans or other lineages. Structures were built in tightly spaced rows that appear to have been clustered in their arrangement. The approximate 2-meter distance between houses may represent the acceptable spacing for dwellings of close relatives.

Analysis of the trash-disposal patterns and artifact assemblages also revealed that there are distinct zones in which cross-feature refits of broken ceramics occurred. In these zones, parts of the same ceramic pot may be found in more than one trash pit, but always within the same zone. These ceramic zones correspond to the house clusters and a similar distribution of congenital skeletal anomalies and pathologies among human skeletal remains (Knick, 1977). On the basis of these data, Heilman (1988, p. 251) proposed that SunWatch had a matrilocal residence in which groups of related women lived in the housing clusters around the village. Familial relation implied by the similar skeletal anomalies was reinforced by trash distribution of the female artifact assembly of ceramics.

ABANDONMENT

After approximately 15 to 20 years, SunWatch was abandoned by the inhabitants. The decision to move was likely the result of many factors—the depletion of resources such as firewood, the deterioration of the houses and other structures, sanitation problems, declining soil fertility, and insect damage in the fields. A fire that swept through the northeastern section of the village may have hastened the abandonment.

SUMMARY

Like a great history book, SunWatch holds the record of customs and lifeways of the Fort Ancient people, who left no written account of their existence. Long-term multidisciplinary investigations have contributed significantly to our understanding of their culture. The results of this work are presented to the public at SunWatch Indian Village, an education and research center opened in 1988. Visitors to the park are introduced to the scholarly investigations of the site and to the Fort Ancient culture that constructed the village. Experimental reconstructions of SunWatch houses, stockades, and activities, begun in the 1980's, provide archaeologists with much-needed information on maintenance, function, and longevity of such structures, while giving the public a unique sense of stepping back in time as they explore the dark smoke houses, peer into the trash pits, watch a demonstration of village crafts, or get involved in a variety of hands-on experiences.

Future research will focus on the massive collections recovered from the previous excavations. Plans call for the preservation of the remaining undisturbed portions of the site; however, some limited excavations will be permitted in order to address research issues as they arise.

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STOP 5 (OPTIONAL): OHIO HISTORICAL CENTER

by
Martha Potter Otto

The Ohio Historical Center, at I-71 and 17th Avenue in Columbus, Ohio, is the administrative/research/exhibit hub for the Ohio Historical Society, Inc. (fig. 5-1). The center houses about 3,000 square meters of educational exhibits, curatorial offices, administrative offices, educational services, an extensive library of books and manuscripts, the state archives, and the Ohio Historic Preservation Office.

Permanent exhibits include "The First Ohioans," which deals with the American Indian cultures that have inhabited the area from the Paleoindian hunters 14,000 years ago to the present day, and "Ohio—Two Centuries of Change," which begins with the early settlement by Euro-Americans through statehood to the present era. The "Nature of Ohio" exhibit showcases the interaction of man and nature in five major areas of Ohio's natural history: geology, flora, fauna, geography, and climate.

The Ohio Historical Society, Inc., was founded in 1885 as the Ohio Archaeological and Historical Society to preserve and interpret Ohio history, archaeology, and natural history. Although it is a private organization, the Society's primary responsibilities are prescribed in state law; a portion of its budget is provided by the State of Ohio to carry out those activities.

One of the Society's primary responsibilities is the maintenance of 60 important historical and archaeological sites and natural areas throughout Ohio. Most of these sites are open to the public and are interpreted with the aid of informational signs, site museums, and restorations. Ohio is unique and fortunate to have so many sites preserved through a park system. Serpent Mound State Memorial (Stop 12) had an interesting beginning. Frederic W. Putnam from Harvard University and the Peabody Museum (the museum was only 17 years old at the time) traveled to Serpent Mound for the first time in 1883 and took a keen interest in the mound. Putnam was well aware the mound was in jeopardy from agricultural destruction. For the next two years, Putnam sought monetary aid for the preservation of the mound from prominent ladies in Boston. In June 1886, Putnam secured 60 acres for $6,000 for the Peabody Museum. A few acres were added in the next year and the site became known as Serpent Mound Park. Putnam proceeded to work at the site for three years and was active in encouraging Ohio legislative affairs about preservation (Putnam, 1890). The State of Ohio passed legislation on March 27, 1888, that exempted park lands from taxation as an incentive to preserve archaeological sites and create parks as a means to preserve such sites:

> AN ACT SUPPLEMENTARY TO SECTION 2732
> OF THE REVISED STATUTES OF OHIO
>
> SECTION 1. Be it enacted by the General Assembly of the State of Ohio, that all lands in the State of Ohio on which are situated any prehistoric earthworks, and which have been or may hereafter be purchased by any person, association, or company for the purpose of the preservation of said earthworks, and are not held for profit, but are or shall be dedicated to public uses as prehistoric parks, shall be exempt from taxation . . . (Putnam, 1890, p. 115).

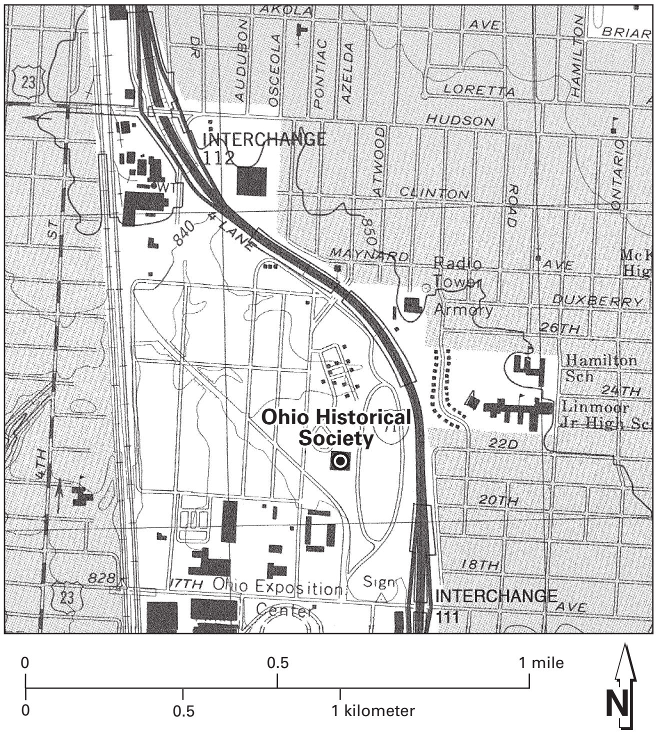

FIGURE 5-1.—Portion of the U.S. Geological Survey Northeast Columbus and Southeast Columbus, Ohio, 7.5-minute topographic quadrangles showing the location of the Ohio Historical Center.

This was the first law for the protection of archaeological monuments in the United States.

The following archaeological properties administered by the Ohio Historical Society are described in this guidebook: Moundbuilders State Memorial (Newark Earthworks) and Flint Ridge State Memorial (Stop 6), Seip Mound State Memorial (Stop 10), Fort Hill State Memorial (Stop 11), Serpent Mound State Memorial (Stop 12), and Fort Ancient State Memorial (Stop 14). Information on these and other OHS sites can be found on the OHS Web site: <http://www.ohiohistory.org>.

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STOP 6: MOUNDS, MINES, AND MASTODONS: THE PREHISTORY OF LICKING COUNTY, OHIO

by
Bradley T. Lepper
and Tod A. Frolking

This stop includes five locations (fig. 6-1). Stop 6A is the site of the 1989 Burning Tree mastodon discovery, which has been studied by a team of multidisciplinary researchers. Stop 6B is the Flint Ridge aboriginal quarries. Stops 6C and 6D are at the Newark Earthworks complex; Stop 6C is the Great Circle, and Stop 6D is the Observatory Circle and Octagon. Stop 6E is the laboratory facilities at the now-defunct Research and Education Center of the Licking County Archaeology and Landmark Society, where the Burning Tree mastodon remains were curated.

EDITOR'S NOTE: Stops 6A and 6E were part of the 1992 Geological Society of America field trip and are described here. However, the Burning Tree mastodon skeleton was purchased by a museum in Japan in 1993 and the lab facilities of the Licking County Archaeology and Landmark Society are no longer operational.

STOP 6A, BURNING TREE GOLF COURSE

The Burning Tree mastodon (*Mammut americanum*) is a nearly complete skeleton uncovered in December 1989, during drag-line excavations of a small pond for expansion of the Burning Tree Golf Course. The golf course is on Ridgely Tract Rd., east of Ohio Rte. 79 south of Newark. The skeleton occurred within fibric and humic peat in a small wetland of an undulating late Wisconsinan moraine. Regional paleoenvironmental reconstructions suggest that glacial ice was largely gone from the area by about 17,000 years B.P. (Mickelson and others, 1983). Sediment cores taken close to the mastodon's location contained 3+ meters of largely autochthonous peat and gyttja overlying calcareous clastic basal sediments over clay-rich till. An abundance of macrofossils of shallow-water aquatic organisms indicates a peat-ringed open-water environment at the time of the mastodon's demise. Twigs and fine organics from the presumed gut contents of the mastodon yielded ^{14}C dates of 11,660 ± 120 years B.P. and 11,450 ±70 years B.P. Spruce, fir, and pine dominate the pollen profile, which is characteristic for the late-glacial to early postglacial forests of the southern ice margin.

The very low hydraulic conductivities of both the peat and the till created pristine environmental conditions for the preservation of bone and biologically distinct gut re-

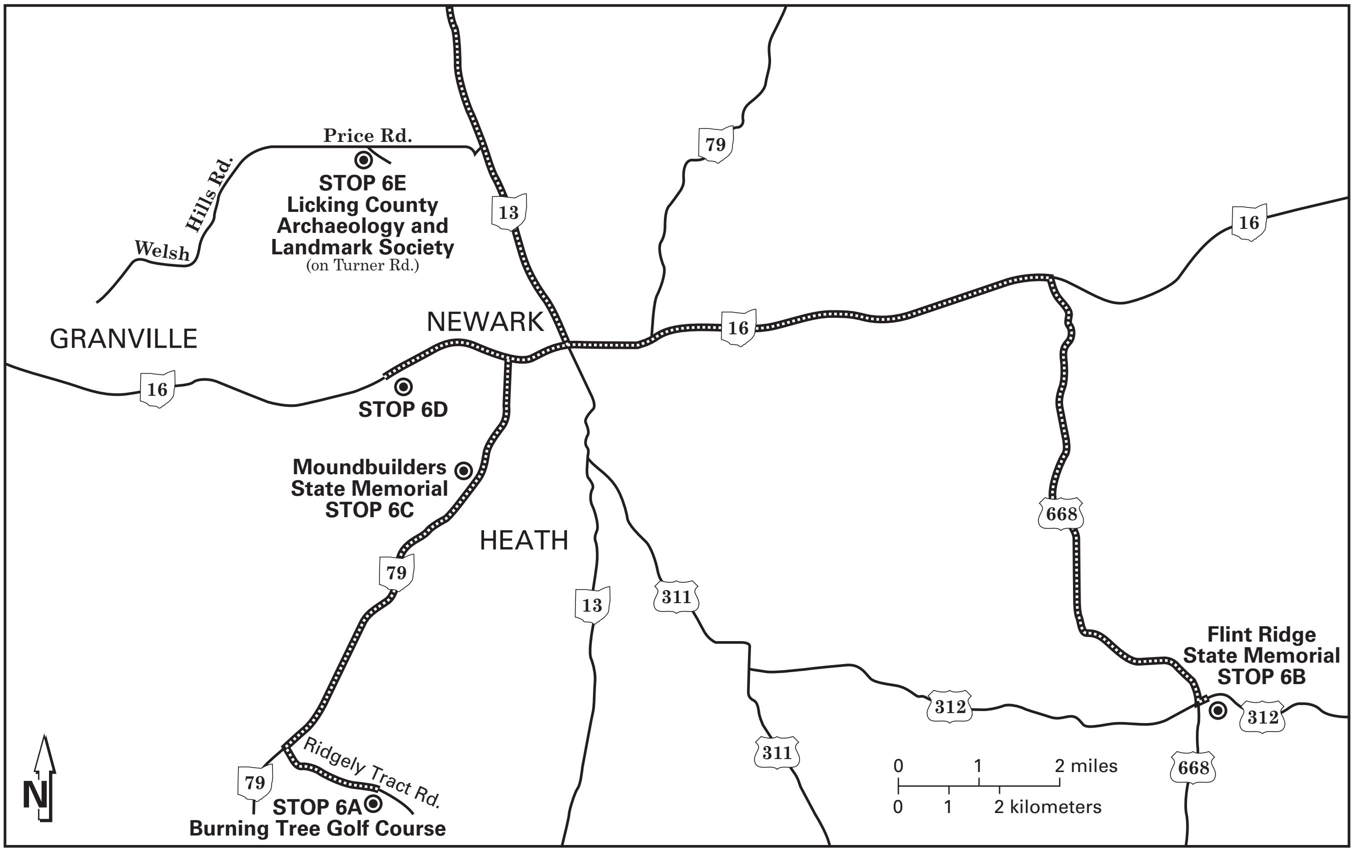

FIGURE 6-1.—Map of the five locations of interest in Licking County.

mains. They indicate a stable anaerobic bog environment that had minimal ground-water flux through the peat. Low iron-to-manganese ratios, bands of ferrous sulfide, and high carotenoid levels within the organic sediments indicate a strongly anaerobic environment throughout the period of basin filling. Historic plowing, tilling, and modification of the wetland outlet, coupled with extensive landscaping and damming during golf course development, prevent a reliable reconstruction of the presettlement vegetation and hydrologic conditions of the wetland.

Despite the relative completeness of the skeleton, several factors indicate the site is an artificial accumulation of bones: the skeleton's state of disarticulation, the patterns of bone distribution within the site, the presence and patterning of apparent cutmarks on several bones, and the presence of fine parallel striations (drag marks) on the last three right ribs. These patterns indicate that a fresh carcass was encountered by Paleoindians at a nearby location, partly disarticulated, and then transported to the lacustrine setting in which it was recovered. Seeds within the gut remains indicate that the animal died in middle to late autumn; this theory is corroborated by an analysis of incremental laminations of the tusk. Therefore, the site is interpreted as an unrecovered autumn/winter meat cache (Fisher and others, 1994).

Special significance is attached to the Burning Tree mastodon because living enteric bacteria (*Enterobacter cloaeca*) were isolated from the gut contents. This is the first documented discovery of ancient coliform bacteria in association with an extinct species of megafauna (Lepper and others, 1991). The original Burning Tree mastodon skeleton was purchased by a museum in Japan, but casts are still available.

STOP 6B, FLINT RIDGE

Flint Ridge is a distinctively flat-topped, east-west-trending ridge in eastern Licking and western Muskingum Counties. The ridge is capped by a sheetlike body of massive Vanport flint (fig. 6-2), which is a local facies of the Lower Allegheny Vanport limestone, of Pennsylvanian age (Carlson, 1987). Due to its resistance, the crest of Flint Ridge stands 20 to 35 meters higher than surrounding ridges. According to Forsyth (1966), the crest of Flint Ridge was not covered by the Illinoian ice sheet that covered the somewhat lower terrain to the north, west, and south. Flint Ridge State Memorial is at the junction of Licking County Rds. 668 (Brownsville Rd.) and 312 (Flint Ridge Rd.). The entrance is at an elevation of 362 meters and lies in line with the eastern limit of Illinoian ice in east-central Licking County. The museum at Flint Ridge State Memorial is built over a prehistoric flint quarry.

The body of flint is about 13 km (8 miles) long (east-west) by a maximum of 5 km (3 miles) wide at the eastern end of the ridge (Carlson, 1987). The flint is nearly continuous and has an average thickness of 1.2 meters. The massive flint ranges from white to light brown to blue gray. Prehistoric Native American quarries occur in areas of high flint purity (commonly blue-gray flint). Two samples contained 96.4 and 98.9 percent SiO_2 (Stout and Schoenlaub, 1945). The massive flint contains silicified fusulinids, but lacks the sponge spicules found in the more porous flint in the area.

Flint Ridge flint has been used for the manufacture of stone tools for over 10,000 years, and extensive portions of Flint Ridge are pockmarked with flint quarries (fig. 6-3). The Hopewell occupants of Ohio (*circa* 100 B.C. to A.D. 500), in particular, intensively exploited this high-quality and multicolored flint. There are anecdotal reports of the recovery of Vanport flint artifacts from Middle Woodland sites across eastern North America.

Exhaustive archaeological explorations were undertaken at Flint Ridge by W. C. Mills (1921). Beginning in the late 1980's, Richard Yerkes of The Ohio State University and his students added considerably to our knowledge of the prehistoric use of the quarries and workshops at this site in their search for habitation sites and additional flint quarry pits (Yerkes, 1995). Excavations to date have concentrated on the grass-covered area south of Flint Ridge Road and east of the eastern park road.

Yerkes recovered a total of 88,325 pieces of chipped stone from 16 1- by 1-meter test units. Almost all of this material is undiagnostic chipping debris, but five identifiable projectile points were recovered. These points include forms assignable to the Early Archaic (8,000 B.C. to 5,000 B.C.) and Middle Woodland (100 B.C. to A.D. 500) cultural periods.

STOP 6C, THE NEWARK EARTHWORKS, GREAT CIRCLE

The Great Circle is preserved in Moundbuilders State Memorial, on the west side of Ohio Rte. 79 on the south side of Newark (fig. 6-1). It is part of the Newark Earthworks complex, the largest set of geometric earthworks in the world (fig. 6-4; also see fig. 8-3). The Great Circle is "one of the best preserved ancient monuments of our country" (Thomas, 1894, p. 461). It is 366 meters in diameter and has walls about 5 meters high and an interior ditch about 3 meters deep. This giant enclosure was preserved as the Licking County Fairgrounds from 1854 until about 1933, when the Ohio Historical Society acquired the property.

This enormous constellation of earthen enclosures lies on a flat, late Wisconsinan, high outwash terrace (Vanatta Terrace) in the broad valley at the junction of Raccoon Creek and North and South Forks of the Licking River. The breadth of the present valley confluence reflects a long fluvial history. This location was the confluence of the ancestral west-flowing Cambridge and south-flowing Groveport-Utica Rivers (Mickelson and others, 1983). Approximately 100 meters of glacially derived sediments fill the valley at this confluence.

The high Vanatta Terrace is composed principally of outwash sands and gravels mantled by silt, presumably loess, which was deposited following stream incision and terrace formation. At the Great Circle, the silt cap is typically 50-60 cm thick. The modern soils are well drained, but subsurface clay accumulations are present in the silt/gravel transitional zone. The construction materials available to the Hopewell moundbuilders were the silt loam surface material, outwash sands and gravels, and irregular beds of gray silts (lacustrine?) and clay-rich tills in the valley fill.

The surrounding hills are composed of shales, siltstones, and sandstones of the Lower Mississippian Cuyahoga and

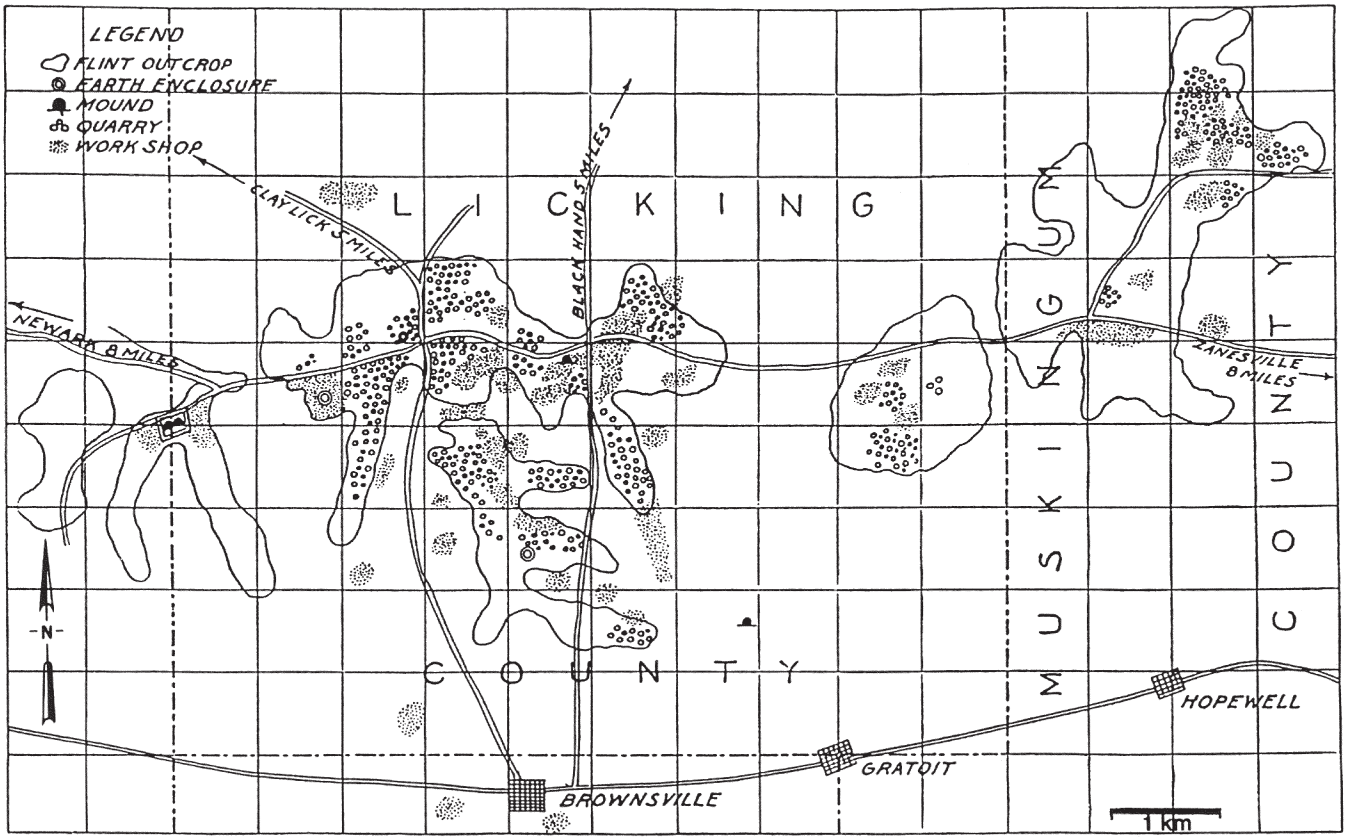

FIGURE 6-2.—Map of prehistoric chert quarries and other prehistoric sites at Flint Ridge, Licking and Muskingum Counties, Ohio (from Holmes, 1919, fig. 56).

Logan Formations. Numerous springs issue from the valley sides near the level of the terrace-hillslope junction. These springs are formed by locally perched water tables along shale and siltstone beds within the transitional zone of the Black Hand Sandstone Member and the upper Raccoon Shale Member of the Cuyahoga Formation. The combination of stable, well-drained outwash surfaces, abundant water resources from both springs and streams, and plentiful flint from nearby Flint Ridge made this location ideal for large gatherings and the construction of extensive earthworks.

Because of its complexity and impressive size, the Newark Earthworks often figures prominently as an illustration in popular summaries of Hopewell culture, but, paradoxically, relatively little archaeological research has been undertaken here. Scientific explorations began in 1820 with the publication of Caleb Atwater's map of the site. Subsequent surveys have added to our appreciation of the full extent and structure of the mounds and earthworks (Lepper, 1998a).

In 1926, Emerson Greenman conducted excavations into Eagle Mound, the cluster of low mounds at the center of the Great Circle. His unpublished field notes indicate that Eagle Mound overlies the remains of a large structure that has a central clay-lined depression, perhaps a charnel house and crematory basin.

From October 1977 through January 1980, a series of archaeological investigations were undertaken along the then-proposed corridor of the Ohio Route 79 Newark expressway. Salvage excavations in one area yielded evidence for an apparently small Middle Woodland settlement situated just outside the semicircular earthen wall that surrounded the cluster of burial mounds in the northeastern quadrant of the earthworks. This occupation has been dated to 1,845 ± 60 years B.P. (A.D. 105) (Lepper, 1998b).

STOP 6D, THE NEWARK EARTHWORKS, OBSERVATORY CIRCLE AND OCTAGON

The Observatory Circle and Octagon (fig. 6-4) are among the most spectacular remnants of Hopewell architecture in eastern North America. The circular enclosure is 320 meters in diameter and has walls 1.5 to 2.5 meters high. It is connected by parallel walls to an octagonal enclosure; each of the eight sides is approximately 186 meters long and 1.5 meters high, the octagon, by itself, enclosed 18 hectares. At one time an Ohio National Guard encampment, the site currently is leased from the Ohio Historical Society by the private Moundbuilders Country Club. The site is on 33rd St. south of Raccoon Creek in Newark.

Archaeoastronomical studies have established that the main axis of the site is aligned to the northernmost rise of the moon (Hively and Horn, 1982). Other lunar rise and set points are incorporated in the structure of the Octagon,

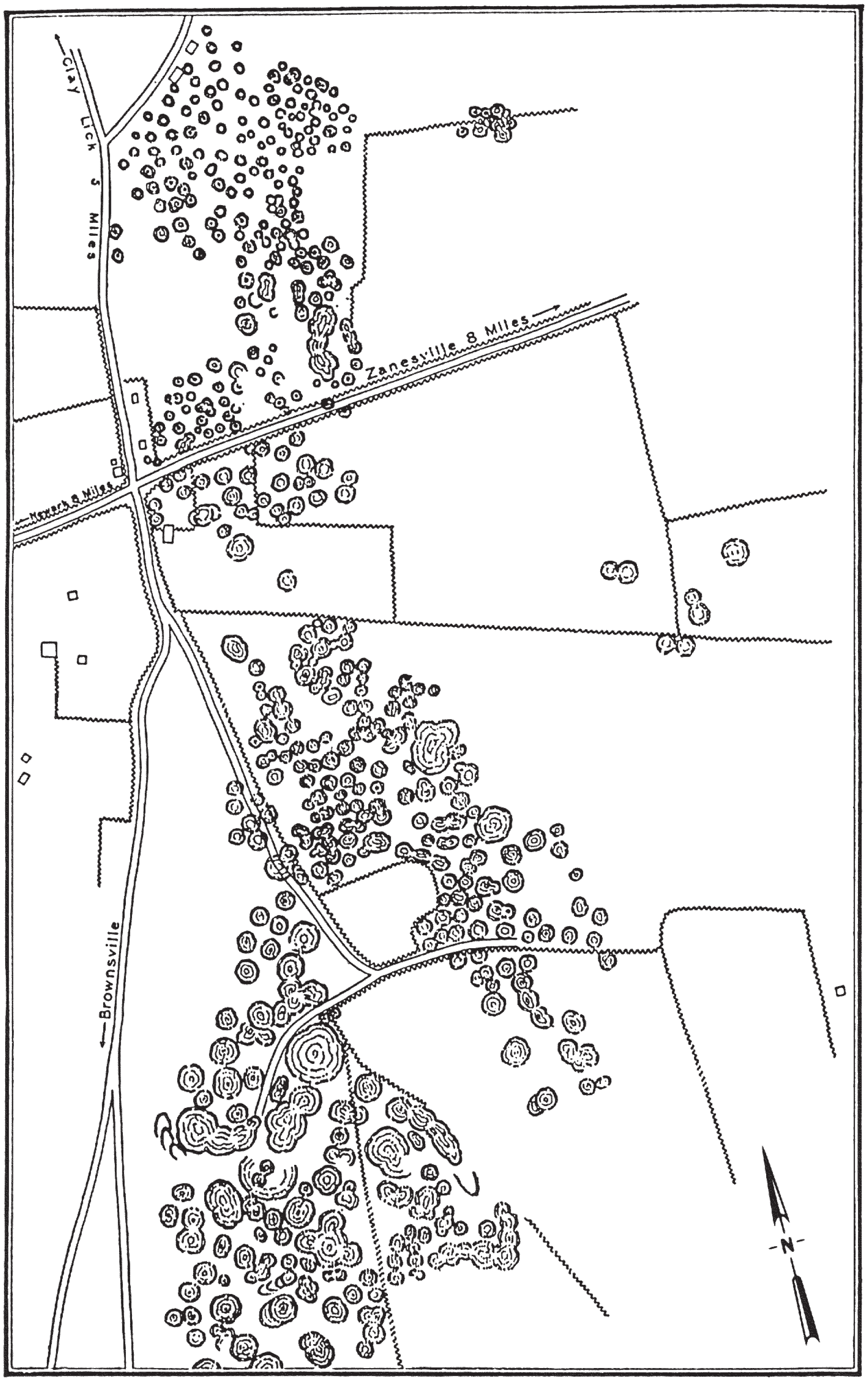

FIGURE 6-3.—Detail map of a portion of Flint Ridge quarries showing the distribution of pittings, Licking County, Ohio (from Holmes, 1919, fig. 57).

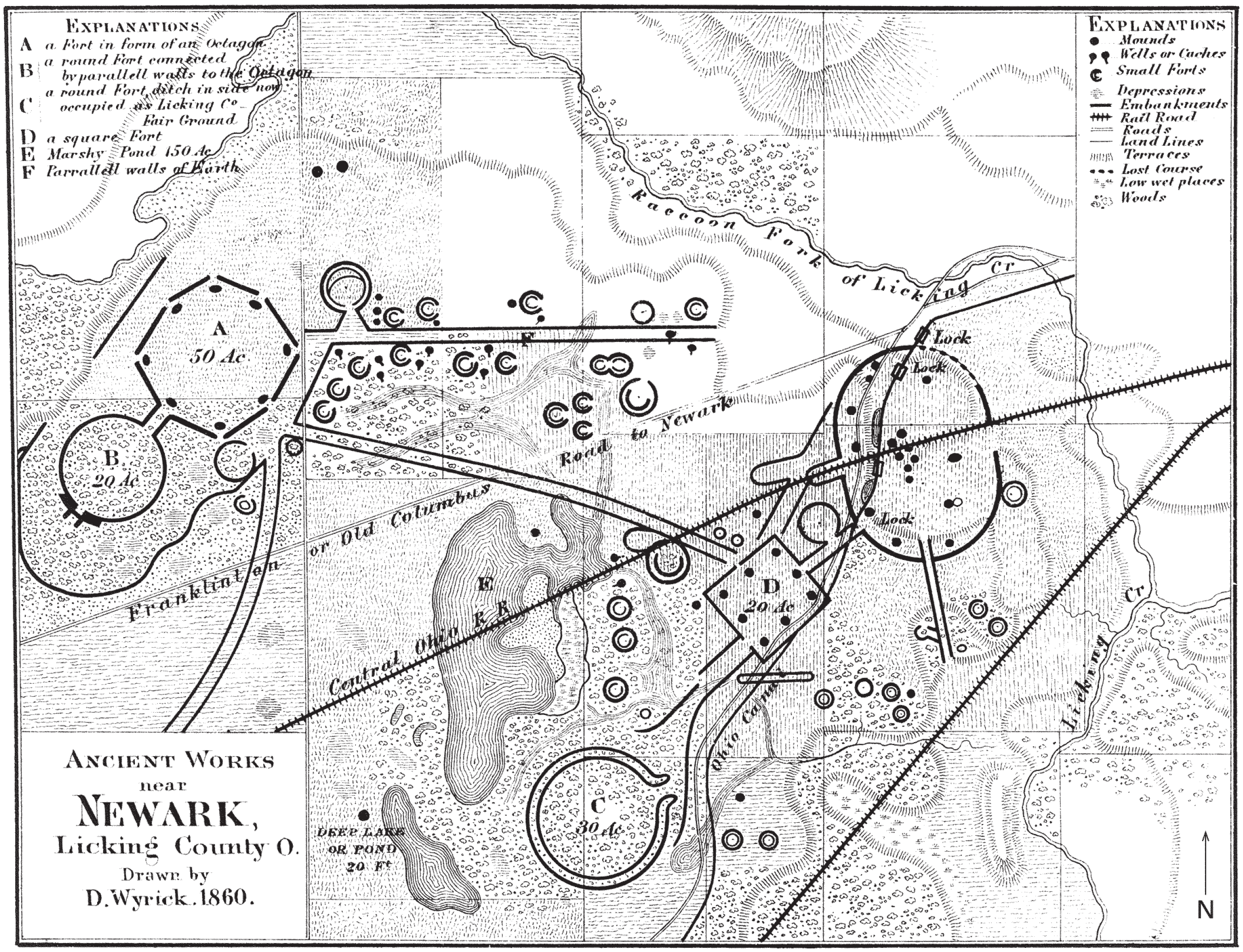

FIGURE 6-4.—Map of ancient earthworks near Newark, Licking County, Ohio (modified from Beers, 1866, p. 37).

suggesting that these earthworks may have been built as a lunar observatory.

It likely is not fortuitous that the largest of the Hopewell ceremonial centers is situated in proximity to Flint Ridge. The rainbow-colored flint from the Flint Ridge quarries figured prominently in the exchange network of the Hopewell, and it is logical to infer that the Newark Earthworks served as a major center in the so-called Hopewell Interaction Sphere.

STOP 6E, L.C.A.L.S. RESEARCH AND EDUCATION CENTER

The Licking County Archaeology and Landmark Society (L.C.A.L.S.) was a local organization committed to advancing archaeological research, education, and preservation in the central Ohio area. L.C.A.L.S. led the effort to recover the Burning Tree mastodon, and much of the skeleton was curated at the laboratory facilities of its Research and Education Center. The center formerly was located on Turner Rd. just south of the junction with Price Rd. (County Rd. 119) in Newark (fig. 6-1).

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STOP 7: HOCKING VALLEY--ASH CAVE

by
Timothy S. Dalbey

Autumn is one of the best times of the year to visit Hocking Hills State Park and Hocking State Forest. The autumn tree colors are beautiful, and, as we walk into the gorges, please notice the ferns that are native to these gorges and unique in Ohio.

The Hocking Hills State Park region (fig. 7-1) in southeastern Ohio lies within the larger Hocking State Forest and is part of the unglaciated Appalachian Plateaus. The Hocking River drains the eastern part of Hocking County and was part of the old preglacial Teays-age drainage system. Hocking Hills State Park was established in 1924 when the state purchased 59 hectares around Old Man's Cave; the park now encompasses over 4,000 hectares. The state park is made up of six areas: Ash Cave, Cantwell Cliffs, Cedar Falls, Conkle's Hollow, Old Man's Cave, and Rock House. These scenic areas were formed by nearly 200 million years of erosion, which created steep gorges in erosion-resistant Lower Mississippian rocks of the Black Hand Sandstone Member of the Cuyahoga Formation. The first stop in Hocking Valley will be Ash Cave.

Hall (1952) described the geology of the Hocking Hills area, and DeLong (1968) mapped the area in detail. Hansen (1975) summarized the bedrock and Pleistocene geology of the region.

GENERAL GEOLOGY

Mississippian rocks in Ohio form a northwestward-thickening clastic sequence of shale-siltstone-sandstone-conglomerate that has been differentially eroded; exposures of 305 meters are reported in Vinton County, south of Hocking County. The rocks dip gently to the southeast and east in the southern part of the state (Collins, 1979).

The Lower Mississippian (Kinderhookian Series) bedrock in central Ohio (fig. 7-2) has been described by many researchers using various lithostratigraphic concepts (Orton, 1882; Prosser, 1904; Hyde, 1953; Pepper and others, 1954; Collins, 1979). The Bedford Shale, Berea Sandstone, and Sunbury Shale crop out in the northeastern part of the state and southward through the central part of the state, west of the Hocking Valley (Potter and others, 1983) along the Scioto River drainage. Between Hocking Hills State Park and the next stop in Chillicothe, the field-trip route passes through these Lower Mississippian rocks. These rocks are

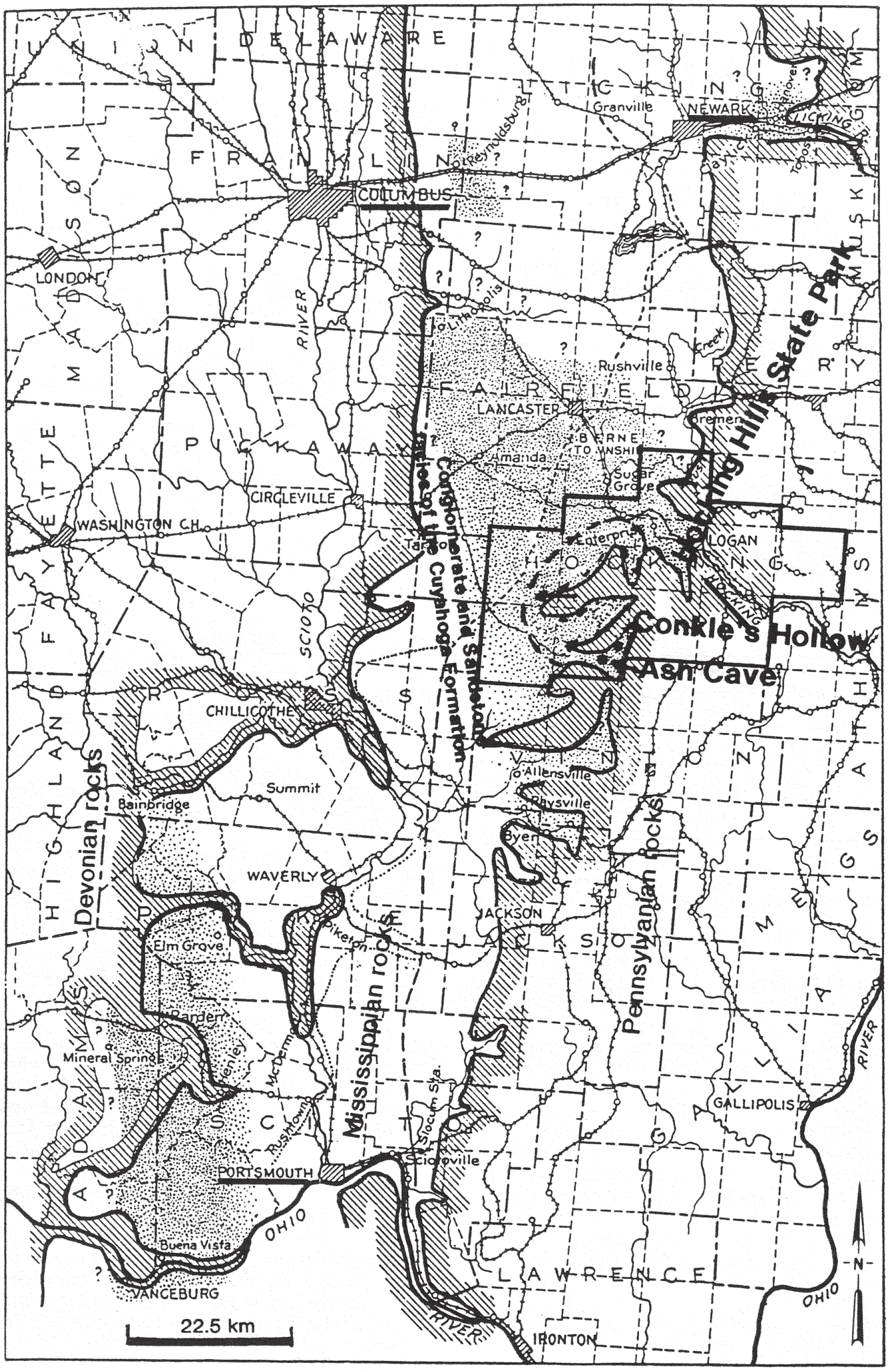

FIGURE 7-1.—Hocking Hills State Park within the Mississippian bedrock of south-central Ohio (adapted from Hyde, 1953, fig. 1).

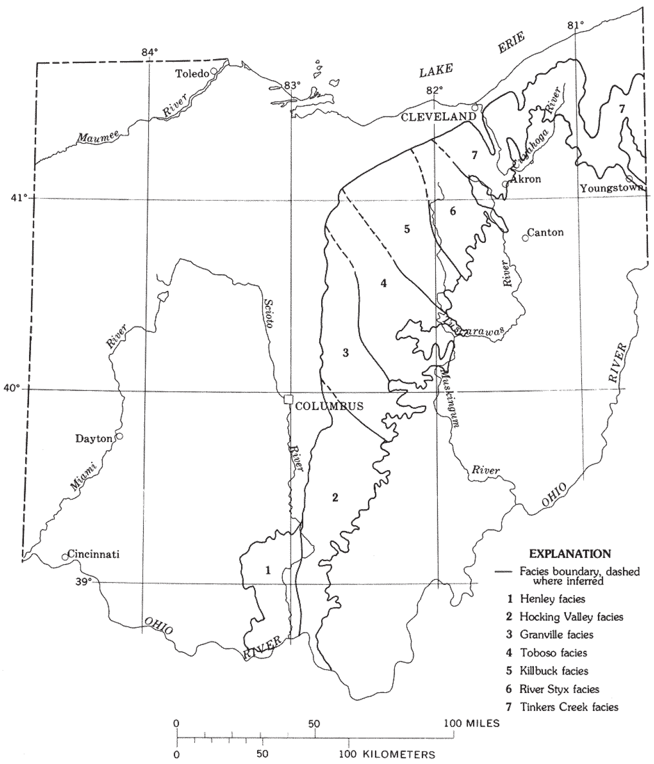

FIGURE 7-2.—Lithofacies of the Lower Mississippian Cuyahoga Formation defined by Hyde (1915) and Holden (1942) (from Collins, 1979, fig. 4).

in the subsurface in the Hocking Valley and are overlain by the Cuyahoga Formation (de Witt, 1970). Farther east, the Logan Formation crops out (fig.7-3).

According to Potter and others (1983), the Bedford Shale and Berea Sandstone represent fluvial deltas made up of distributary channel fills, lunate sand bars, marsh-bog deposits, coastal barriers, delta fronts, and prodelta marine clays interbedded with sands and silts. South of Ohio in Kentucky, massive limestones that span the Mississippian were formed in deeper offshore ocean waters (see Rice and others, 1979).

Basal Mississippian rocks exposed at the surface in Ohio are underlain by the Devonian-age brown-black fissile Ohio Shale. A spectacular view of this shale can be observed by looking southeast from on top of Seip Mound (see Stop 10, fig. 10-1) toward the west base of the 100 meter cliff face exposure of Copperas Mountain. There is little evidence for a major unconformity at the contact zone. In the northern part of the state the contact is indistinct and has led to misinterpretation. The contact between the Mississippian and the Pennsylvanian is disconformable owing to post-Mississippian erosion. Pennsylvanian rocks in the southeastern part of the state were derived from sediments originating from highlands and mountains to the east (see Edmunds and others, 1979).

The Berea Sandstone has been quarried for building stone for over a century in northern Ohio and is a significant producer of oil and gas in eastern Ohio. The Buena Vista and Black Hand Sandstone Members of the Cuyahoga Formation also have been extensively quarried.

HOCKING VALLEY GEOLOGY

One of the most extensive efforts to record and correlate the geology of Hocking County was that of Hyde (1953). Using the depositional facies concept to describe the lithologic variability, Hyde (1953) divided the Cuyahoga Formation into five geographically distinct depositional facies (fig. 7-2). The Hocking Hills State Park area lie in Hyde's Hocking Valley conglomerate facies, which has a maximum thickness of over 100 meters. Within this facies, Hyde identified four members, in ascending order: Lithopolis Member (now known as the Buena Vista Sandstone Member), Portsmouth Shale (now known as the Fairfield Member), Black Hand Member, and the Berne Member (now considered to be the basal member of the Logan Formation) (fig. 7-3).

The bedrock in most of the Hocking Hills State Park area is the Black Hand Sandstone Member. The name was derived from an Indian rock painting of a black hand on a sandstone promontory along the Licking River in Licking County. The hand is thought to have been a directional marker for the flint quarries at Flint Ridge (Stop 6). The hand was accidentally destroyed during construction of the Ohio and Erie Canal (Hannibal, 1998).

The Black Hand Member is a massive, well-sorted, medium- to coarse-grained sandstone ranging in thickness from 25 to over 75 meters; cross-bedding and thin lenses of conglomerate are conspicuous (Hansen, 1975). Its iron oxide cement makes the Black Hand Member resistant to weathering; it forms cliffs more than 30 meters high. Some zones in the Black Hand are less resistant to erosion, so that recesses and rock shelters develop. Throughout the deposit, northward-inclined bedding planes have angles of 10° to 20°. The top 3-7 meters are horizontal topset beds overlying inclined foreset beds of a delta. Black Hand sandstone is about 97 percent quartz sand (SiO_2); kaolinite and traces of 16 other minerals make up the rest. The kaolinite is considered to be the weathered replacement of feldspars that once occurred in the sands.

An erosional disconformity occurs between the Fairfield Shale Member and the Black Hand Sandstone Member. Overlying the Black Hand Member is the Berne Conglomerate Member, consisting of pebble beds, coarse sands, and some shales; the maximum thickness of the Berne Member is 6 meters. The Berne is considered to be a lag deposit that resulted from the reworking of the upper portions of earlier deposits by wave action (Hyde, 1953)(fig. 7-3).

During the Pennsylvanian Period, the area east of the Hocking Valley was a swampy, densely vegetated coastal plain (Edmunds and others, 1979). The organic-rich deposits became oil, gas, and coal deposits. Coal was mined in Hocking County as early as 1840 and as recently as the mid-1990's; cumulative coal production from Hocking County is over 85 million tons (Crowell, 1995).

Over 200 million years ago, the region was uplifted and tilted westward, creating extensive erosion of the Pennsylvanian deposits. This erosion continued during the period of Teays-age drainage to the northwest. The final major

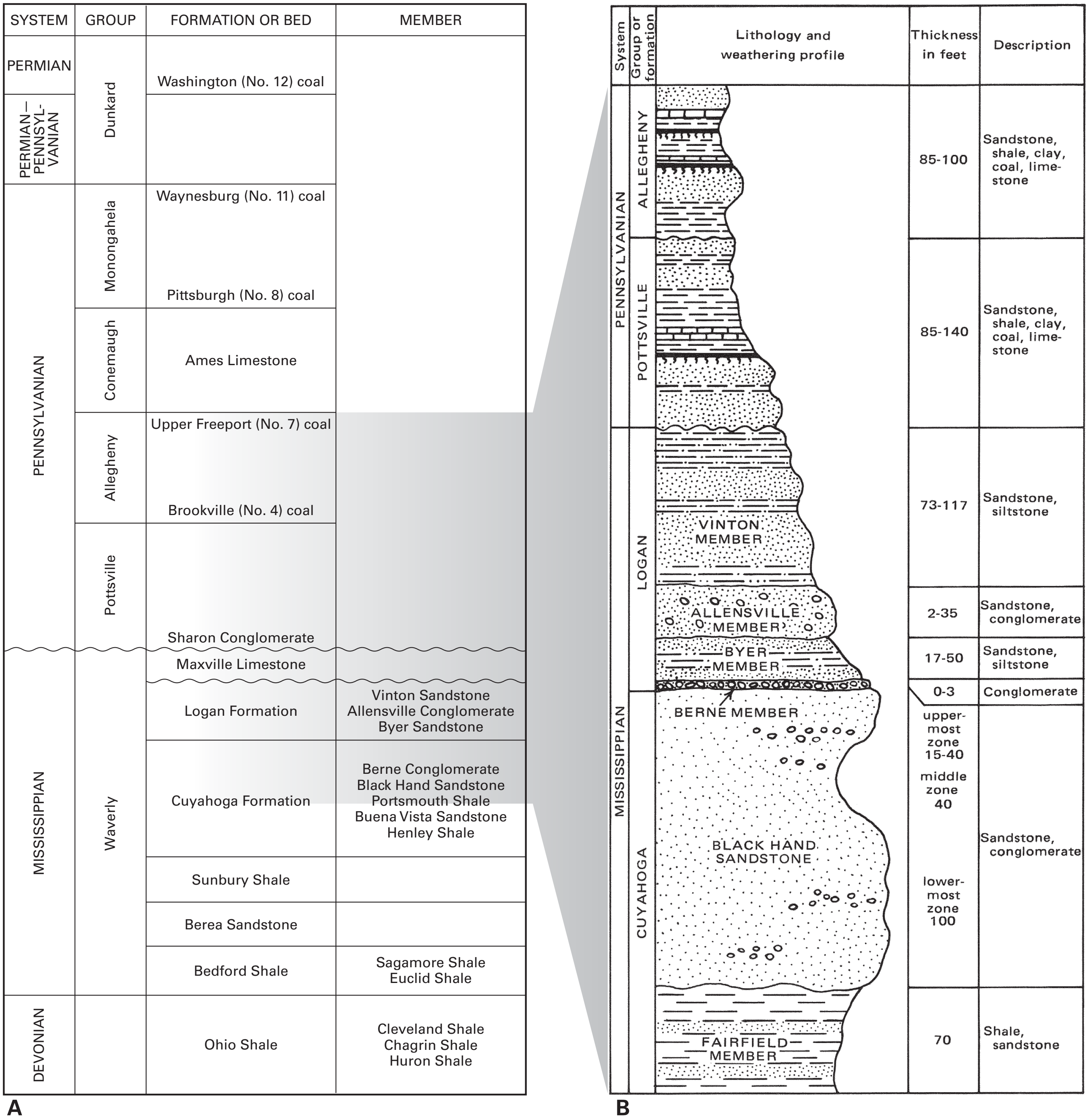

FIGURE 7-3.—**A**, Generalized carboniferous chronostratigraphy in Ohio (modified from Collins, 1979, fig. 3). **B**, Columnar section of rocks exposed in the Hocking Hills State Park region (from Hansen, 1975, fig. 4).

erosional impact in the area occurred during the Ice Age. High winds and glacial meltwaters poured through the valley, intensifying erosion. The last Wisconsinan glacial pulse advanced to within about 10 kilometers (6 miles) of the hills 20,000 years ago. Meltwaters created lakes in a number of valleys as ice dammed outlet channels (Hansen, 1975).

ARCHAEOLOGY OF ASH CAVE

Ash Cave is located just north of Ohio Route 56 in south-central Hocking County (fig. 7-4). The parking area for Ash Cave is on the north side of Ohio Route 56, 0.6 km (0.4 mile) west of its junction with Ohio Route 374 (fig. 7-5). The Black Hand sandstone in the Ash Cave area exhibits fine examples of deltaic foreset bedding, honeycomb weathering, solution hollows of weaker sediments, and oxidation of the iron oxide cement, forming limonite and hematite interspersed with lichen cover. Ash Cave itself is a large rock shelter formed by water erosion of weaker zones in the Black Hand sandstone. The reentrant is about 30 meters deep and more than 150 meters long.

Horvath's (1986) photographic essay of the Hocking Hills includes brief descriptions of the geology. The archaeology of Ash Cave was done in 1876; however, some interesting research was done in the 1980's.

E. B. Andrews from the Peabody Museum at Harvard University carried out archaeological excavations in Ash Cave in 1876. His excavations (Andrews, 1877) uncovered a refuse layer of pottery, corncobs, sticks, debitage, faunal remains, projectile points, and coarse grass stalks on top of a pile of ashes that covered an area of 205 cubic meters. The large pile of ashes gave the cave its name. One burial was located near the back of the cave near the bottom of the ash layer. One ^{14}C determination later produced a Late Woodland date of 1170 ± 200 years B.P. (A.D. 780).

Fritz and Smith (1988), in a study of early Native American cultigens from sites east of the Mississippi River, had the clever idea of searching through old collections curated by museums for cultigens. They were particularly interested in plant remains recovered from dry rock shelters or caves that were excavated before or shortly after the turn of the century. Their biggest problem when they went through the collections was the reliability of the context, and therefore they were highly selective, being careful to select only plant samples that had adequate field notes and documentation. Many of the early excavations recovered plant remains but were undated.

Another approach in their study was to apply accelerator dating to the old plant samples, which would not deplete much of the sample. Chenopod collections from 11 rock shelters from five states were selected for morphological analysis and accelerator dating. Four of the rock shelters had an unidentified pale-colored fruit, and eight contained thin testa of *Chenopodium berlandieri* (Fritz and Smith, 1988).

At the Peabody Museum they found a small glass bottle containing 8.7 grams of *Chenopodium* seeds that the museum had curated for 111 years from Ash Cave. This small bottle was all that was left of a 16-liter sample of seeds Andrews had excavated in 1876 from a storage pit at the bottom of the huge ash deposit. Fritz and Smith found very few diagnostic artifacts associated with the Ash Cave collection and other rockshelters that were evidently excavated in the Hocking Hills area. Fritz and Smith (1988) considered Andrews's 1877 report on the plant remains from Ash Cave to be the first archaeobotanical report on plant remains in the eastern United States. The 8.7 grams in the small glass bottle contained about 25,000 thin testa seeds of a domesticated *Chenopodium*. They submitted a small sample of 0.025 gram for accelerator dating and received a determination of 1,720 ± 100 years B.P. (A.D. 230). This date places the domesticated *Chenopodium* well within the Middle Woodland. This finding is one of the most significant in Middle Woodland archaeology and reopens the debate about domestication in the Middle Woodland (Smith, 1985). This new finding needs to be expanded by further research on the collections from Hocking Valley and should open up new excavations in Hocking Valley rock shelters.

FIGURE 7-4.—Ash Cave.

In the last few years, curation has become a controversial subject and is now considered an important part of every archaeological undertaking. Many museums and government agencies had to inventory their collections as a result of laws passed since 1990. This type of research endeavor stands out as an excellent example of the value of museum collections and the application of new technology.

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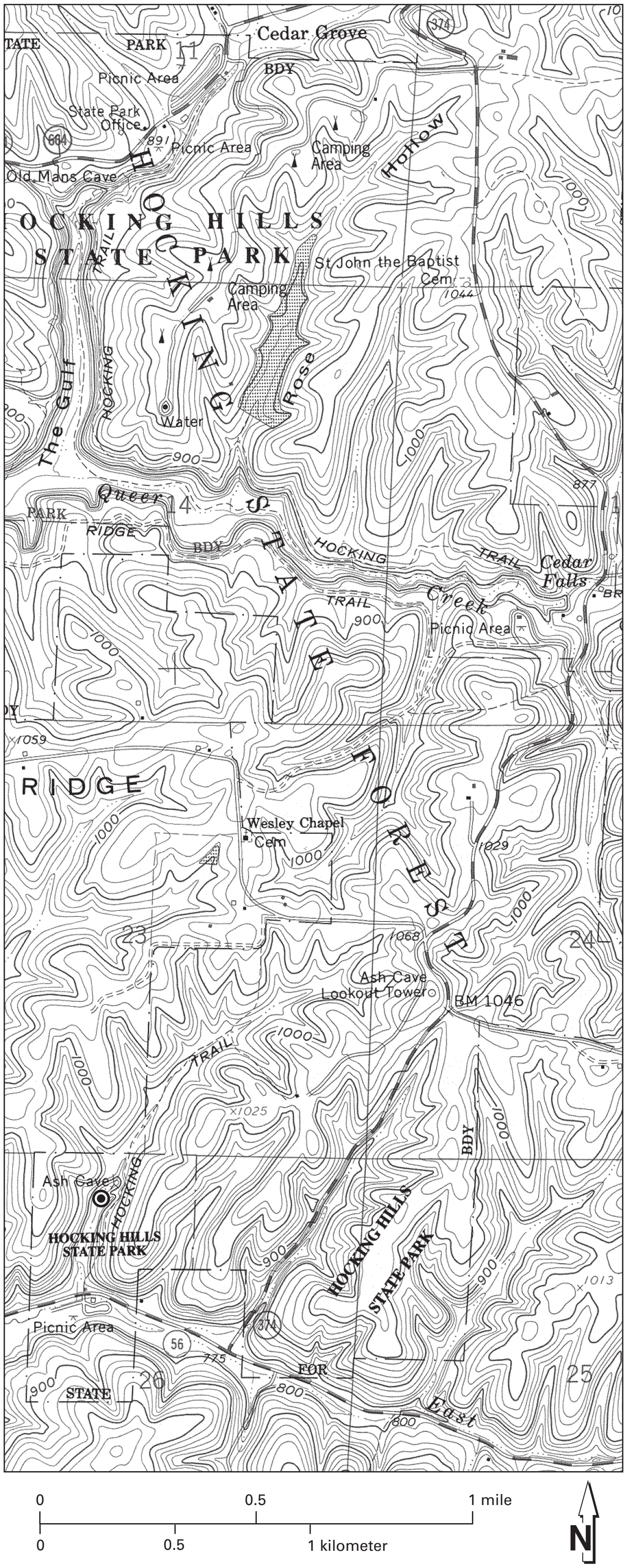

FIGURE 7-5.—Portion of the U.S. Geological Survey South Bloomingville, Ohio, 7.5-minute topographic quadrangle showing the location of Ash Cave.

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STOP 8: MOUND CITY GROUP, HOPEWELL CULTURE NATIONAL HISTORICAL PARK

by

Robert Petersen
and Timothy S. Dalbey

The Mound City Group, one of five earthworks that make up the Hopewell Culture National Historical Park, is on the west bank of the Scioto River in Ross County. The visitor center for this National Park Service monument is 5 km (3 miles) north of Chillicothe on Ohio Rte. 104 (fig. 8-1). The other earthworks in the park are Hopeton, High Bank, Hopewell Mound Group (North Fork), and Seip. A portion of Seip earthworks is administered by the Ohio Historical Society (see Stop 10).

During the Middle Woodland period (2,150-1,500 years B.P.), two cultural complexes developed in the Midwest, one in southern Ohio and Indiana and one in Illinois. The Hopewell culture spread along the Ohio River and up the major tributaries from the area that is now Marietta, Ohio, on the east to the area that is now Madison, Indiana, on the west. The Havana cultural complex occupied the Illinois River valley. The Ohio sites are more numerous and spectacular, but both complexes are considered Hopewell (Griffin, 1983).

The large Hopewell earthwork sites in Ohio have received the most attention, but few have been systematically excavated, and most of these were excavated around the turn of the century before modern absolute-dating techniques were established. Prufer (1973) attempted to chronologically order 61 of the major Hopewell sites based on ^{14}C dates and artifact traits. There is little doubt that his chronology will have to be revised as more dates become available (see, for example, Hatch and others, 1990). Hopewell chronology remains as one of the major tasks ahead for Hopewell archaeology in Ohio. There are many small reports on sites that have not been published. Many other mounds and earthworks have not been excavated or have been destroyed. Squier and Davis (1848) estimated that 100 earthen geometric enclosures and about 500 mounds existed in Ross County, Ohio, at the time they were mapping the area. They estimated about the same number existed in the land between the two Miami Rivers in the Cincinnati area, and probably as many up other major tributaries of the Ohio River. Until the 1980's, very few Hopewell village sites (nonmound or earthwork) were known or reported. In the 1990's, Hopewell village sites were located and excavated near the earthwork centers (Dancey and Pacheco, 1997).

Many of the Hopewell mortuary practices had their origin in the earlier Adena culture. Most of the excavations at earthworks concentrated on the construction of the mounds and mortuary practices. At some sites all the deceased were cremated; other sites contained bundle, flexed, or partial remains, interred as individual burials or in groups. A mound commonly covered charnel houses that were constructed over prepared basins. In many cases at Hopewell Mound Group (North Fork) and at Mound City, these basins contained cremated remains (Greber and Ruhl, 1989, p. 119).

Craft specialization by individuals was certainly performed, and some of the most elaborate objects were made for burial ceremonialism. At the Hopewell Mound Group site, Mound 25, a cache of 250 to 500 obsidian spear points were found in altar 2; Griffin (1983, p. 263) argued that the obsidian spear points at altar 2 were made by the male individual buried in Mound 11 who was buried with 136 kg of worked obsidian fragments (probably 95 percent of the obsidian recovered from Ohio Hopewell sites). The obsidian was traced to the Yellowstone National Park area (Griffin and others, 1969). Another example of individual craft specialization was found at Newark, Ohio, where 14 burials were found when a canal lock was being constructed. The burials were covered with sheets of mica that measured, in some instances, 2.5 cm thick and 20 cm long and, when added together, would fill three-quarters of a cubic meter (Squier and Davis, 1848, p. 72).

Greber (1976, 1979) studied the burial spacing on the floor of the largest mound at the Seip complex (see Stop 10). On the basis of the spacing, clothing ornamentation, and associated burial artifacts for 123 individuals, she inferred that a distinct social status existed for about 10 percent of the burials. She found a similar pattern at the Edwin Harness Mound in Liberty Township, Ross County (see fig. 8-2); some adult males had more elaborate burial goods (Greber, 1979), perhaps indicating social status.

A large trade network, commonly called the "Hopewell Interaction Sphere," appears to have involved mostly the acquisition and exchange of raw materials and finished goods. The non-Ohio raw materials excavated from the large mound sites indicate that more foreign raw materials were exchanged or brought into Ohio than Ohio raw materials were exported to other areas (Walthall and others, 1979). Some of the foreign raw materials include Gulf Coast marine items such as barracuda jaws, shark teeth, and shells and southern swamp items such as alligator teeth. Minerals such as mica, chlorite, meteoric iron, galena, copper, silver, and others were recovered in the mound excavations. In many instances, the sources of foreign materials have not been identified by quantitative methods; instead, source areas are commonly claimed as a result of mineral mining in areas today. A few Ohio raw materials were exported to other areas, such as Ohio pipestone found at Havana sites in the Illinois Valley and Ohio Flint Ridge blades reported in sites as far south as Florida.

HOPEWELL GEOGRAPHY

The most notable Ohio Hopewell sites and the sites that have received the most attention are large earthworks such as geometric sites with shaped earthen walls, clusters of various size mounds, large singular mounds, and hilltop enclosures (commonly called "forts") that have graded ways. Some of these enclosures are a few hectares, and some are over 40 hectares. Today, three areas retain remnants of the numerous earthwork structures that once existed: (1) the

FIGURE 8-1.—Combined portions of four U.S. Geological Survey 7.5-minute topographic quadrangles (Andersonville, Kingston, Chillicothe West, and Chillicothe East) showing the locations of the Mound City Group.

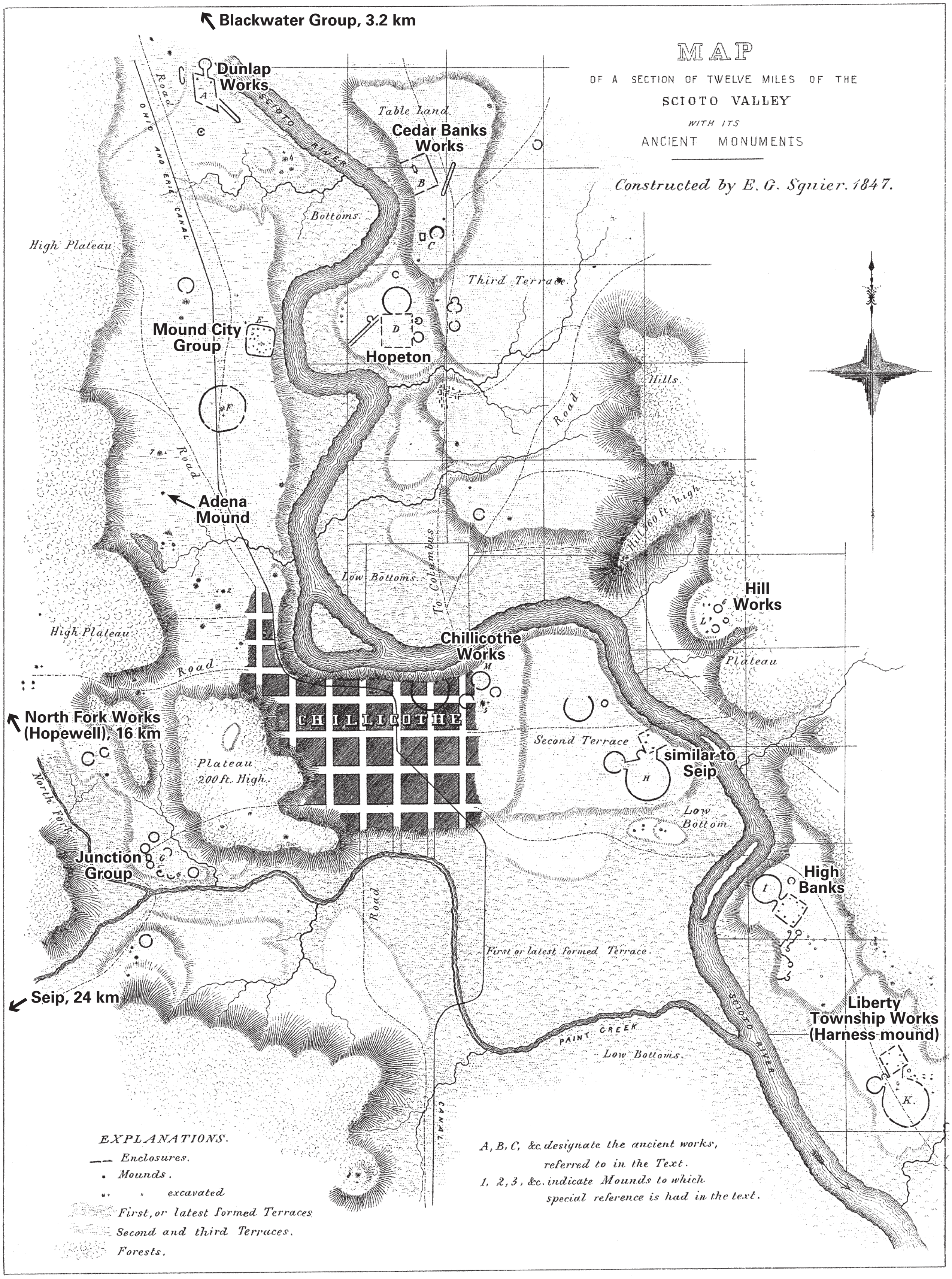

FIGURE 8-2.—Hopewell earthworks in the Chillicothe area (modified from Squier and Davis, 1848, pl. II).

Paint Creek and Scioto River valleys around Chillicothe, Ross County (fig. 8-2); (2) the central and southern part of Licking County (fig. 8-3); and (3) the southwestern corner of Ohio, including Butler, Hamilton, and Warren Counties (fig. 8-4). There is no doubt that there were other clusters, such as the confluence of the Ohio and Scioto Rivers, where the Portsmouth Works once existed (fig. 8-5). Four sites in the Paint-Scioto cluster in the Chillicothe area are among those where major excavations took place around the turn of the century: North Fork Works (now known as Hopewell Mound Group; see fig. 8-12), Seip (see fig. 10-1), Liberty Township Works (fig. 8-2, location of the Edwin Harness Mound), and the Mound City Group (fig. 8-6).

MOUND CITY HISTORY

The mounds and earthworks of Mound City Group were first mapped and measured in the 1840's. At that time, Ephraim George Squier, editor of the *Scioto Gazette*, and Dr. Edwin H. Davis, a Chillicothe physician, visited the site and produced a map of the earthworks (fig. 8-6). Squier and Davis published their work in 1848 as the first of the Smithsonian Institution's Contributions to Knowledge. The two carefully mapped and measured dozens of mounds and earthworks in southern Ohio. They recorded their observations at a time when many of the sites were being used for agricultural production.

The nineteenth century was a time of wild speculation concerning the antiquity and origin of the mounds in this part of North America. A theory was developed during this time that mounds in Ohio and other places were the work of an advanced vanished race or civilization of Moundbuilders that probably had their origin in Mesoamerica. These early archaeological theoreticians went out with preconceived ideas to find evidence that would support their theory. All of these concepts influenced the way in which sites such as Mound City were excavated and viewed. The contribution of Squier and Davis is great, not only for their early excavations but for the site maps they produced; their maps in many cases are the only record of the sites. In most cases, the maps they made are still the basic site maps for most earthworks and the only survey for some areas in 144 years (see J. B. Griffin's introduction in the 1973 reprint of the Squier and Davis report).

In 1846, the Mound City earthworks were preserved in a wooded lot. A few trees occasionally were removed, but the mounds were relatively undisturbed. During the 1850's, the wooded lot was completely cut, cleared, and cultivated. The mounds did not stop the farmers—they plowed up and over the mounds instead of going around them, resulting in leveling of the mounds and destruction of the top portions and the sides. Farming activity continued until 1917, when the U.S. government purchased the land for use as part of Camp Sherman, a World War I Army training camp. This purchase was 11 years after passage of the Antiquities Act of 1906 to protect ruins, historical markers, areas of scientific value, natural sites, and paleontological sites. Camp Sherman consisted of about 2,000 buildings and trained almost 40,000 troops at a time throughout the conflict (Hyde, 1921). Within the 5 hectares making up Mound City, about 50 buildings, a number of roads, and a railroad spur were constructed. Despite all of this activity, the leveling of the mounds was not complete. Portions remained undisturbed, and a great deal of information could still be learned from the site. From 1920 to 1922, as the buildings of Camp Sherman were being torn down, William C. Mills and Henry Clyde Shetrone began a series of excavations at Mound City (Mills, 1922).

Mills found that the Hopewell constructed not only Mound City but dozens of other earthworks in the area using mollusk shells, wooden digging sticks, limestone hoes, and baskets. The Hopewell had erected miles of embankments and moved tons of soil. The site plan of Mound City is different from other Hopewell earthwork sites. Most Hopewell earthworks have enclosures of more than 12 hectares inside high (up to 4 meters) walls that have numerous openings. Mound City is only about 5 hectares, inside a low wall of only about 1 meter, and has only two entrances into a square with rounded corners. Most Hopewell earthworks have only a few mounds inside the enclosure, but at Mound City there are 23 mounds within the wall. Only the Hopewell Mound Group (North Fork) site on Paint Creek has more mounds (fig. 8-12)—over 30—inside the enclosure, but the area inside the enclosure is huge (45 hectares) compared to Mound City. These two sites have many similar characteristics; more comparative research needs to be conducted on these two sites (see Greber and Ruhl, 1989).

Mills' (1922) excavations focused on the mounds, describing mound construction, burials, and elaborate grave goods found with the burials. In a few instances he found obsidian ceremonial spear points that represent only a fraction of the obsidian found at the Hopewell earthworks (fig. 8-7A). Grave goods recovered by Mills (1922) and later by Shetrone (1930) include stone effigy pipes fashioned into otters, bobcats, various birds (fig. 8-7B), and human figures; highly stylized pottery with a duck design (fig. 8-7C); copper plates; shell work; pearls; and marine shell.

In all, Mills and Shetrone excavated portions of 12 mounds. The rest of the mounds, generally the smaller ones, could not be relocated on the surface. They found a wealth of objects documenting what they believed to be a trade network, illustrating the richness of the Hopewell culture. With the aid of the measurements and mapping of Squier and Davis, Mills began restoring the mounds to their original appearance. In addition, Mills was instrumental in refuting earlier claims of a Mesoamerican origin of the Moundbuilders.

One additional benefit of Mills' work at Mound City was the definition of the Intrusive Mound culture, a late Woodland culture who added their burials to the Hopewell mounds. Squier and Davis had alluded to intrusive uncremated burials, but their documentation was less than convincing. Given the extent of the previous disturbances to the mounds, Mills held little hope for shedding any light on this subject. However, it turned out that he uncovered the remains of 13 intrusive burials. He was able to document complete tool-making kits that were with the burials; their specific tasks, he thought, reflected somewhat on the individual's life.

In recognition of the significance of the site and its potential for additional knowledge, President Warren G. Harding

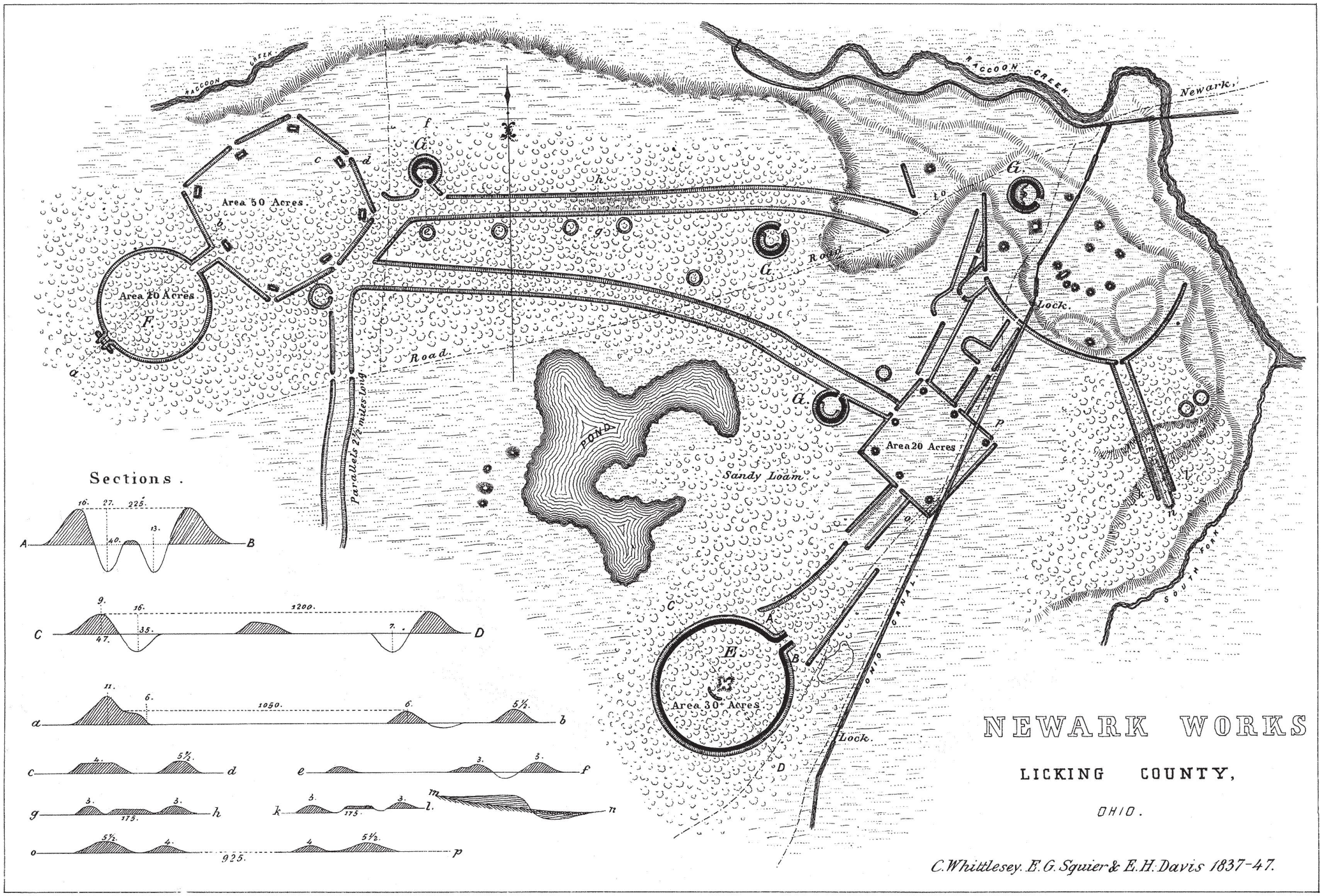

FIGURE 8-3.—Hopewell earthworks in southern Licking County (modified from Squier and Davis, 1848, pl. XXV). Compare this map to the later more complete map in Stop 6 (fig. 6-4).

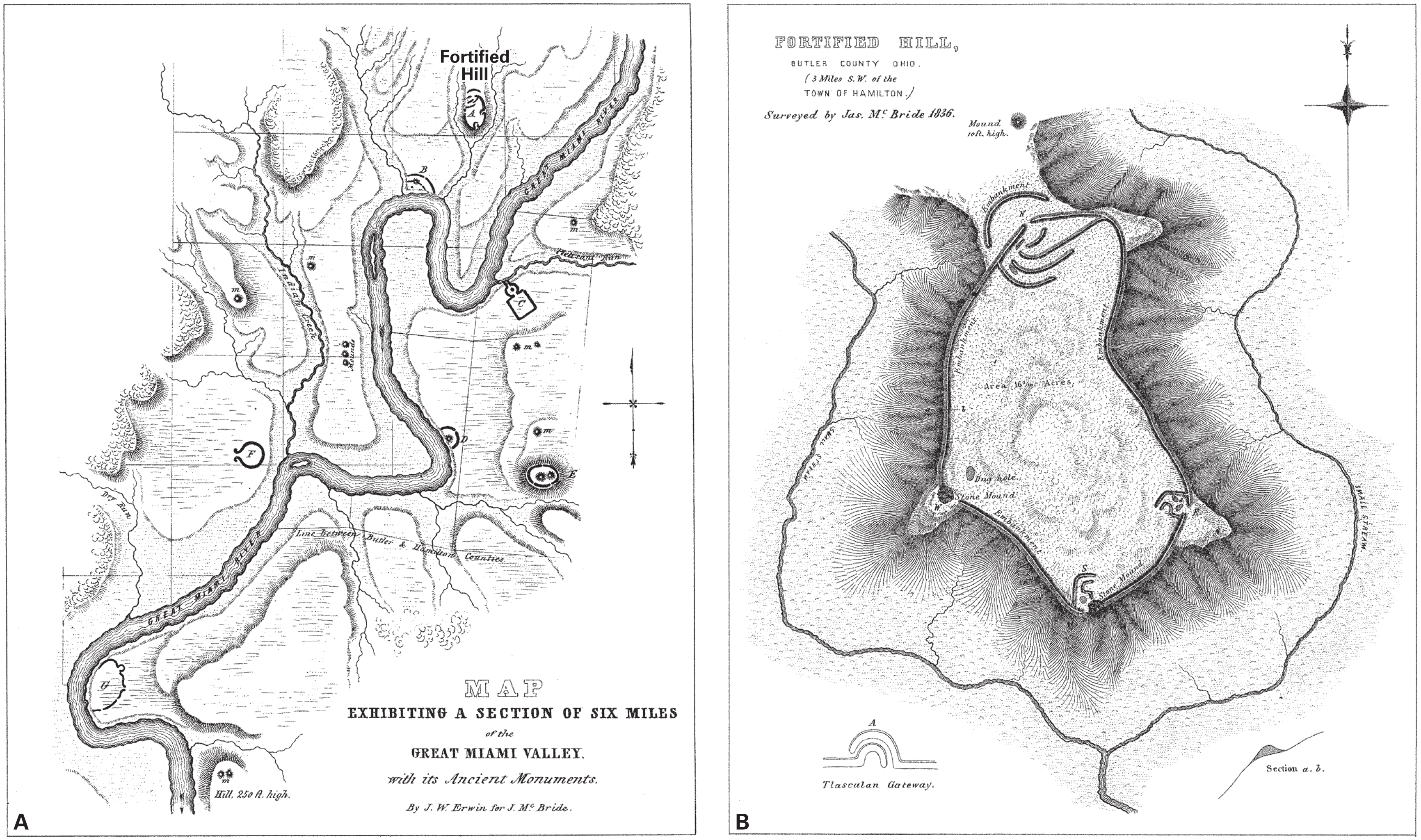

FIGURE 8-4.—**A**, Hopewell earthworks in southwestern Ohio. **B**, Fortified Hill in Butler County. (Both maps modified from Squier and Davis, 1848, pls. III, VI.)

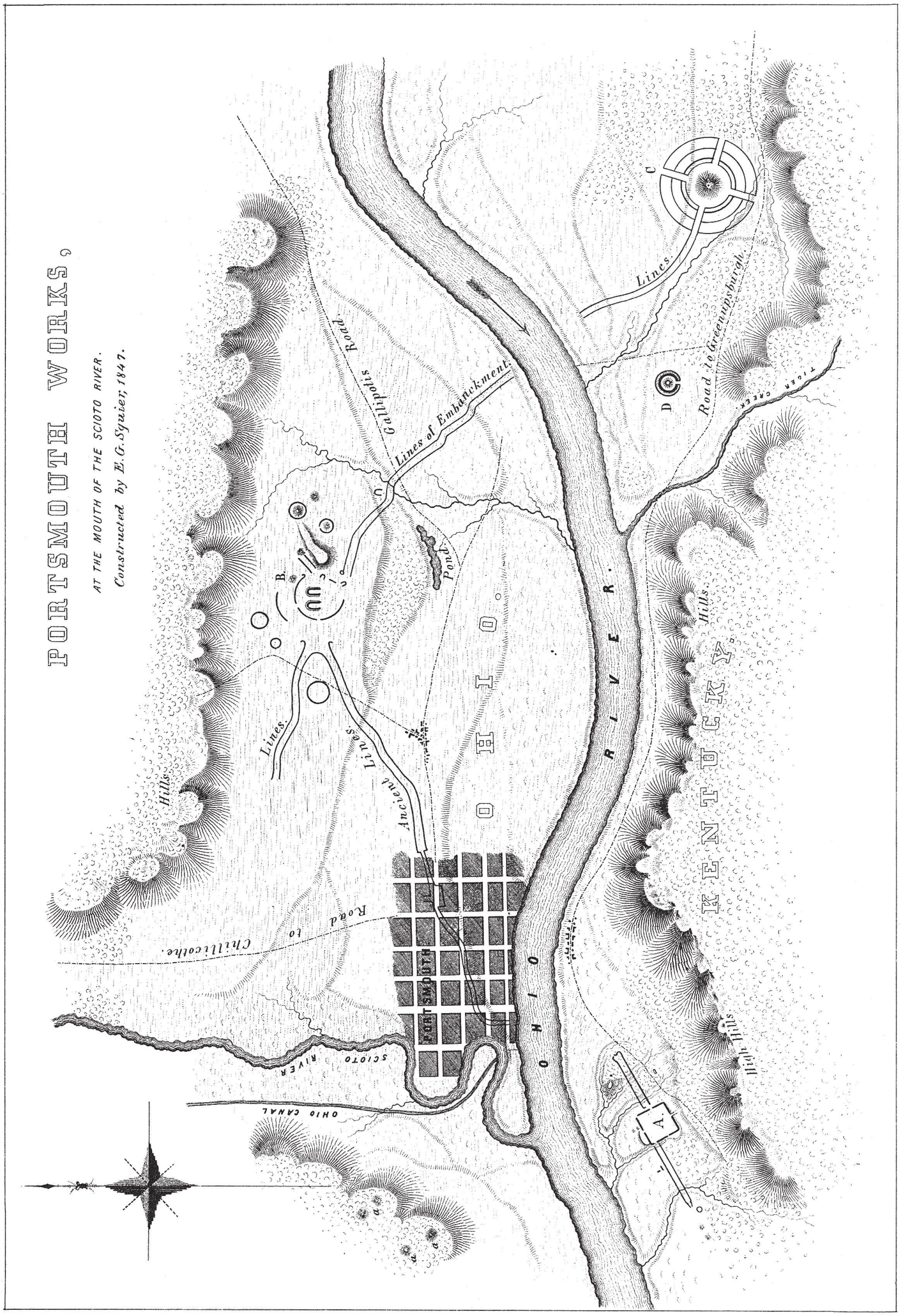

FIGURE 8-5.—Portsmouth earthworks on the Ohio River in south-central Ohio (modified from Squier and Davis, 1848, pl. XXVII).

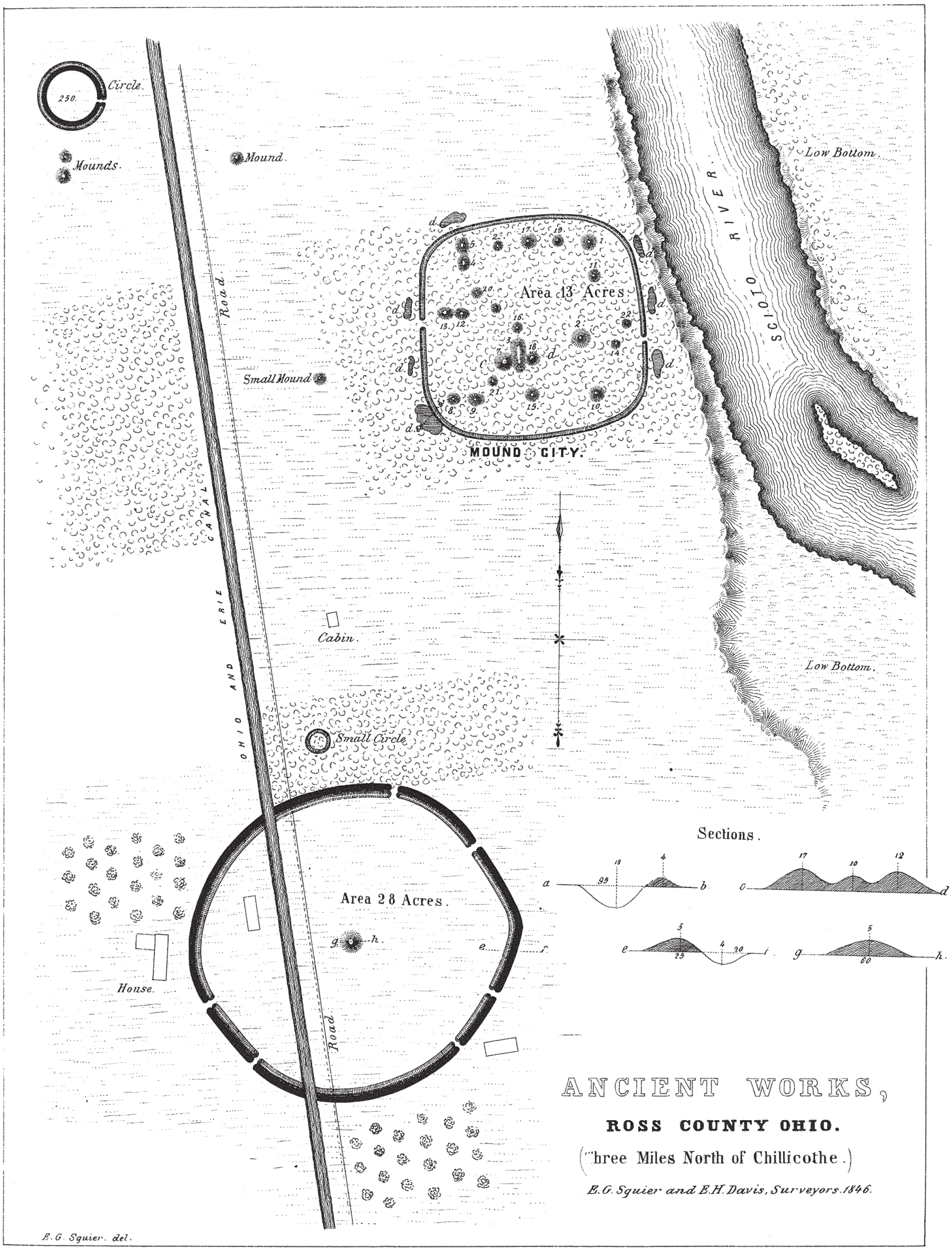

FIGURE 8-6.—Mound City earthworks north of Chillicothe (modified from Squier and Davis, 1848, pl. XIX).

signed a proclamation (No. 1633) establishing Hopewell Culture National Historical Park on March 2, 1923:

> . . . *"Mound City Group" of prehistoric mounds . . . is an object of great historic and scientific interest and should be permanently preserved and protected from all depredations and from all changes that will to any extent mar or jeopardize their historic value . . . .*

RECENT WORK AT MOUND CITY

Since that time, both research and restoration work has continued. The National Park Service continued the work of Mills (1922) and Mills and Shetrone (1930) through a series of excavations to further define the Hopewell culture and to provide details on specific mounds, as well as artifacts for public exhibition (Faust, 1965; Hanson, 1965). Many of the projects were done on contract with the Ohio Historical Society. Two of the people associated with these projects were Raymond S. Baby and Martha Potter Otto, who worked at the site in 1954, 1963, 1970, 1974, and 1975 (Baby, 1956; Baby and others, 1971, 1975; Baby and Langlois, 1977; Otto, 1980). Baby documented the existence of charnel houses as ritual structures constructed over empty basins, or altars, which had been used for cremating defleshed skeletal remains that were deposited nearby. Expanding upon the work of Mills, Baby (1956) was able to document the existence of items associated with what he defined as the "Death Ritual" as part of the burial ceremony, as interpreted in figure 8-8.

In addition to the work done by the Ohio Historical Society, the National Park Service conducted its own investigations into the Hopewell culture represented at Mound City. These excavations have provided additional details about mound construction as well as providing objects for exhibition in the museum at the visitor center. Through all these years the restoration work has continued by re-introducing forests and tall grasses that were once growing around the site in an attempt to recreate for visitors the setting of the earthworks in prehistory (fig. 8-9).

From all of the excavations conducted at Mound City, as well as excavations at other Hopewell sites, some light has been shed on their daily economy. They primarily relied on the plants and animals that were available locally through hunting, gathering, and collecting. River mollusks, fish, bear, deer, and a variety of smaller animals made up the meat part of their diet. So far, nut crops have been the most abundant plant remains, but recent work by Christopher Carr (Arizona State University) on accelerator dating of organic and seed remains from Hopewell pottery and the work of other researchers on plant remains from Hopewell sites will help resolve some of these uncertainties.

Brown (1979) compared Illinois Hopewell (Havana) with Ohio Hopewell and pointed out many salient features about

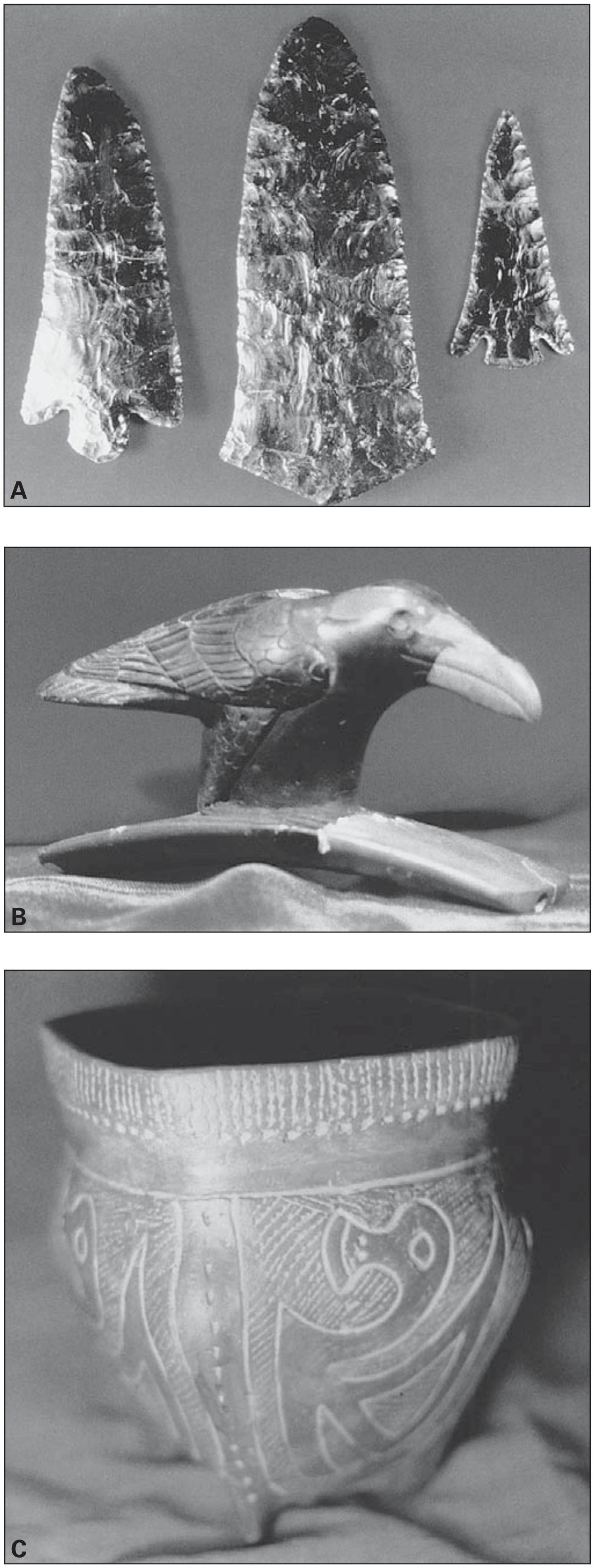

FIGURE 8-7.—Hopewell grave goods from Mound City Group. **A**, obsidian ceremonial points. **B**, bird effigy pipe. **C**, ceremonial ceramic vessel with duck design. Photos courtesy of the National Park Service, Hopewell Culture National Historical Park.

FIGURE 8-8.—Reconstruction of Hopewell ceremonialism. Photo courtesy of the National Park Service, Hopewell Culture National Historical Park.

FIGURE 8-9.—Reconstruction of Mound City.

the differences in burial practices. The Illinois Hopewell buried their dead in a crypt, whereas the Ohio Hopewell used charnel-house facilities and various burial practices, according to the status of an individual. Two charnel-house patterns and associated burial offerings excavated by Baby from Mound 10 and Mound 13 at Mound City provide excellent evidence of differential handling of the dead, probably by status (Brown and Baby, 1966). Brown (1979) reported that Mound 10 (fig. 8-10A) revealed three features in the floor of the mound: the first was a cremation with a copper headdress, the second was an empty basin, and the third was an oval-shaped pit (6.1 x 1.2 meters) containing the remains of a subadult on a bed of charcoal, with shell beads and pearls, lying on a bark sheet brought to this location and placed here, as the cremation took place elsewhere. Other grave goods placed with the individual included a copper headdress piece and copper adze in a woven bag. Prufer (1973, p. 45) reported charcoal from this burial dated to 1,772 ± 53 years B.P. (A.D. 178). Unburned human remains such as phalanges found in posthole debris suggests that corpses were processed in advance of cremation (Brown, 1979, p. 213).

Mound 13 excavations revealed (Brown, 1979) superimposed submound structures (fig. 8-10B). The upper mound (12.2 x 13 meters) was a large, more significant mound than a conjoined pair of separate mounds below. The center, a crematory floor, was fire hardened around the basin. The floor was littered with mica flakes, artifact fragments, and bits of cremations, covered by a thin sand lens. The principal burial feature was called the "Great Mica Grave," which was in the shape of a crematory basin (2.1 x 2 meters), made of dark earth, and contained complete and broken artifacts covered with large mica sheets. Inside were four cremations, one with a copper helmet headdress and a "mirror" made of mica. A charnel structure was built over the graves, capped by a mound 60 cm high that was covered with mica. Four mounded platforms, each having cremated remains and grave goods, were separate from the mica grave. Thirteen cremations were piled on the mortuary floor; they had some beads and shell ornaments, but were mostly without grave goods. One shallow subfloor pit grave containing broken artifacts was found near the floor burials. One child who

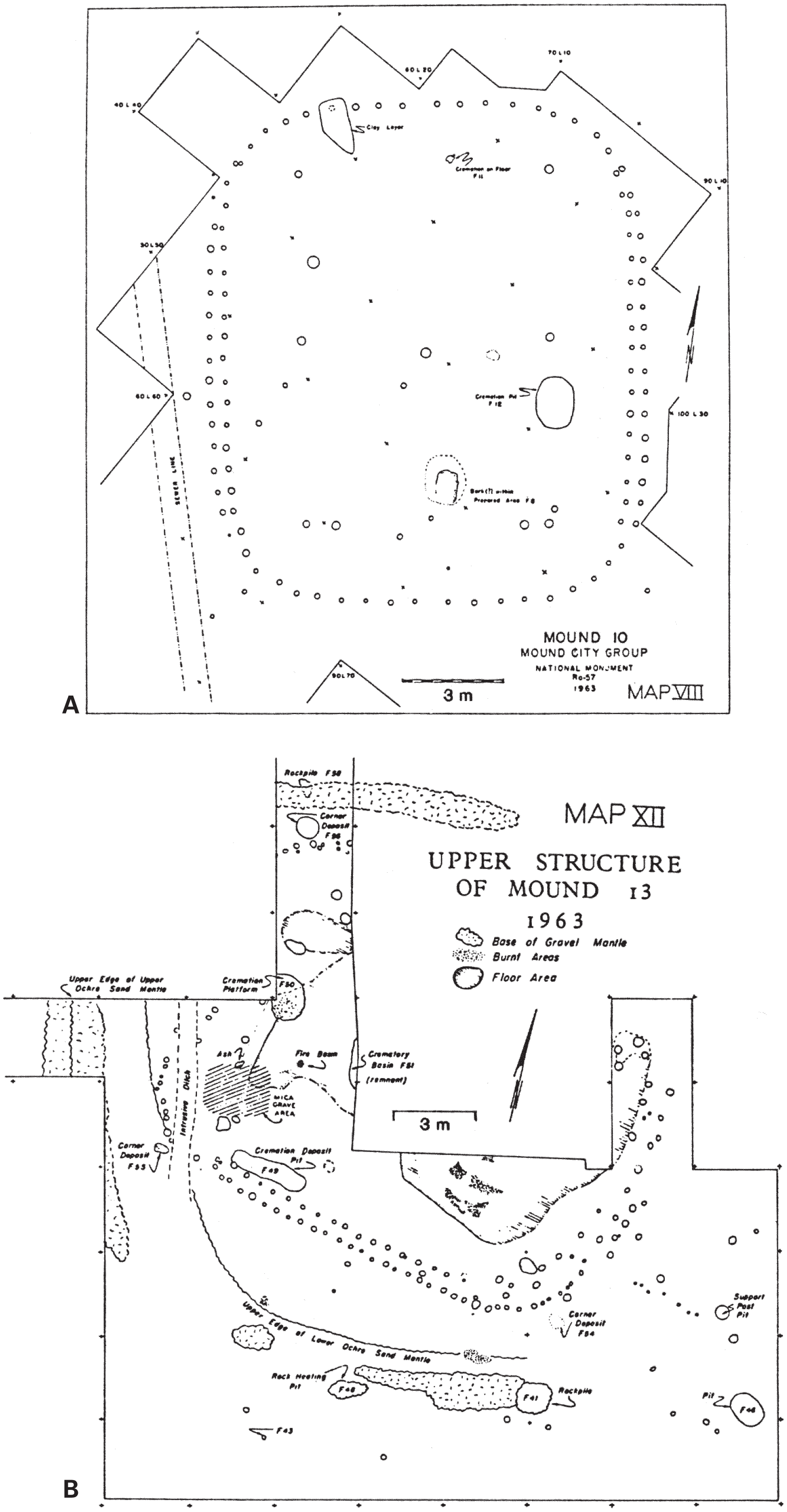

FIGURE 8-10.—**A**, charnel-house plan of Mound 10 of Mound City Group (from Brown, 1979, fig. 27.1). **B**, features in Mound 13 of Mound City Group (from Brown, 1979, fig. 27.2.).

had been cremated was found in a shallow pit outside a corner of a charnel house. According to Brown (1979, p. 215), the various types of burial practices clearly demonstrate distinct status treatment. The Great Mica Grave probably reflects the highest status grave, followed by the mounded platform cremations; the lowest status burials were the floor and subfloor locations. It would be interesting to date the subfloor burials to see if they represent the same time period. In contrasting the Ohio and Illinois Hopewell burial practices, Brown (1979) pointed out that the Ohio burial pattern reflects the size of the population and the complexity of the society.

Today, many questions remain unanswered in Hopewell archaeology. Additional research is needed in many areas: the preservation of the large earthwork sites and nonearthwork sites, excavation of habitation sites, precision dating of mound-building episodes and nonearthwork sites, and many others (Brose and Greber, 1979; Goad, 1979). To attain any of the research objectives listed above, one of the first things to be done is to secure the sites from destruction (Brose, 1976). Toward that goal, the National Park Service was authorized in 1980 to acquire the Hopeton site on the east bank of the Scioto River (fig. 8-11). After 10 years of negotiations, the Hopeton earthworks were officially added to the Hopewell Culture National Historical Park in 1990. The Hopeton site covers about 73 hectares, including a graded way running from the Scioto River to the earthwork. Many of the Hopewell sites probably had graded ways to a river waterway, and this site is one of the few that still retains this feature. River travel no doubt played a major role in Hopewell times and is another aspect that needs further research (see Brose and Greber, 1982, who described a dugout that had a ^{14}C of 3,550 ± 70 years B.P.).

As Hopeton was being added to the Mound City Group, a study mandated by the U.S. Congress was undertaken of other Hopewell cultural sites in Ross County to assess the feasibility of adding other sites to the Mound City Group. In spring 1991, legislation was introduced in Congress that would authorize the National Park Service to increase the acreage at Hopeton to include associated village and camp sites nearby and to acquire the Hopewell Mound Group (North Fork) earthworks west of Chillicothe (fig. 8-12), the High Bank earthworks southeast of Chillicothe (fig. 8-13), and Seip earthworks southwest of Chillicothe near Bainbridge (see Stop 10, Seip Mound State Memorial). In May 1992, the legislation was passed, and the name of the park was changed to the Hopewell Culture National Historical Park. Thus, after almost 150 years since their recording, the preservation of these Hopewell earthworks may be more secure.

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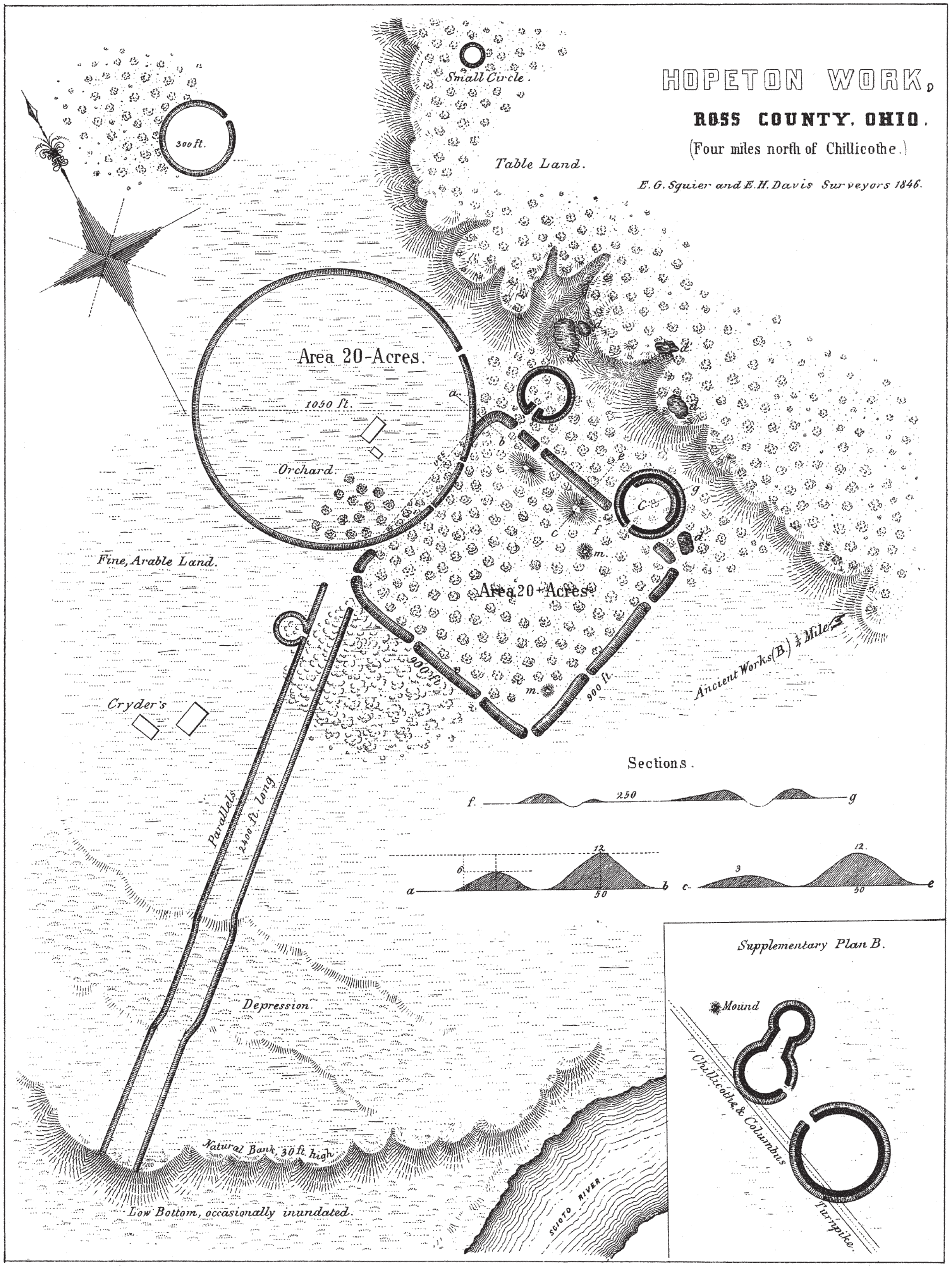

FIGURE 8-11.—Hopeton earthworks north of Chillicothe (modified from Squier and Davis, 1848, pl. XVII).

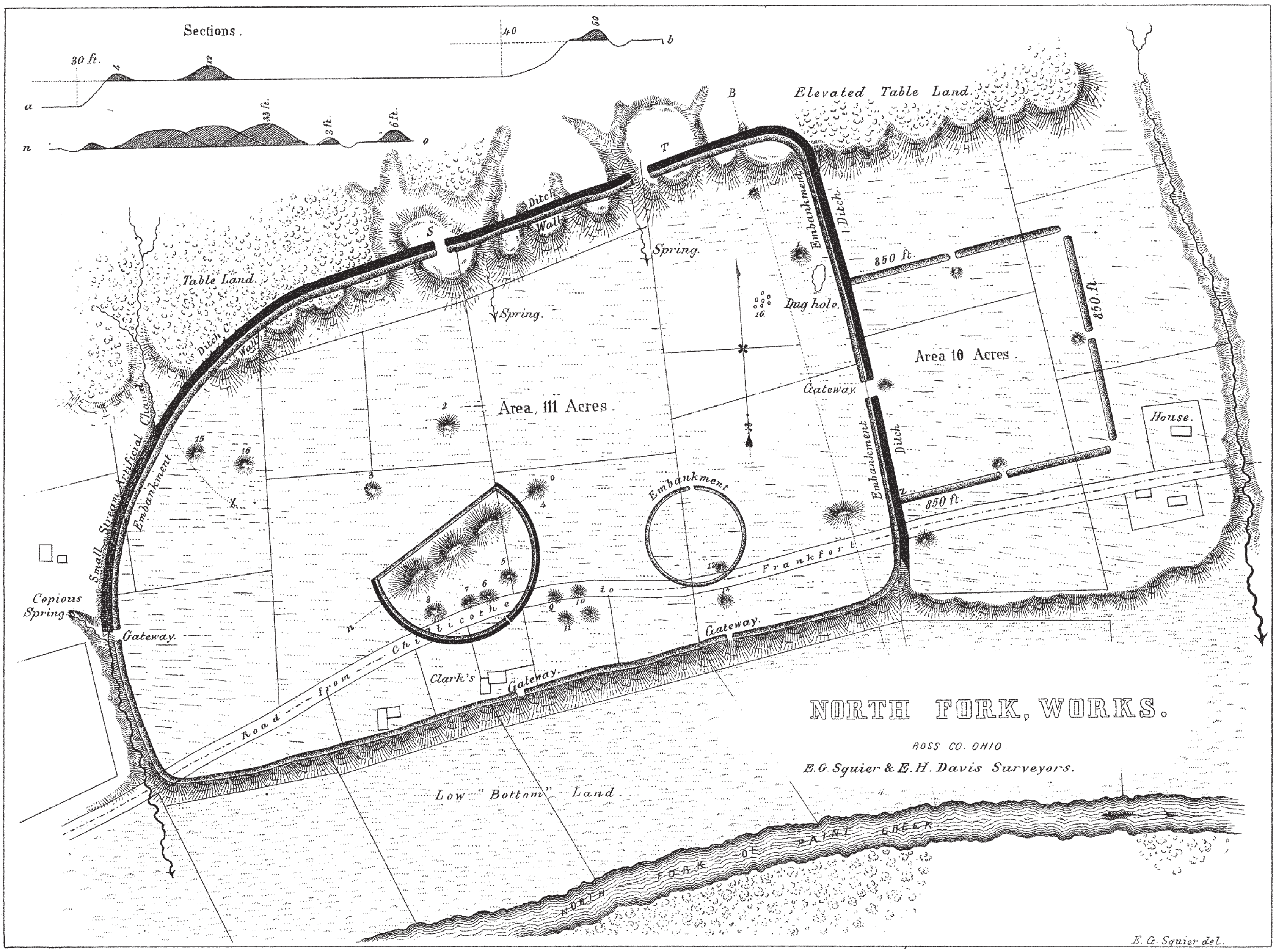

FIGURE 8-12.— Hopewell (North Fork) earthworks west of Chillicothe (modified from Squier and Davis, 1848, pl. X).

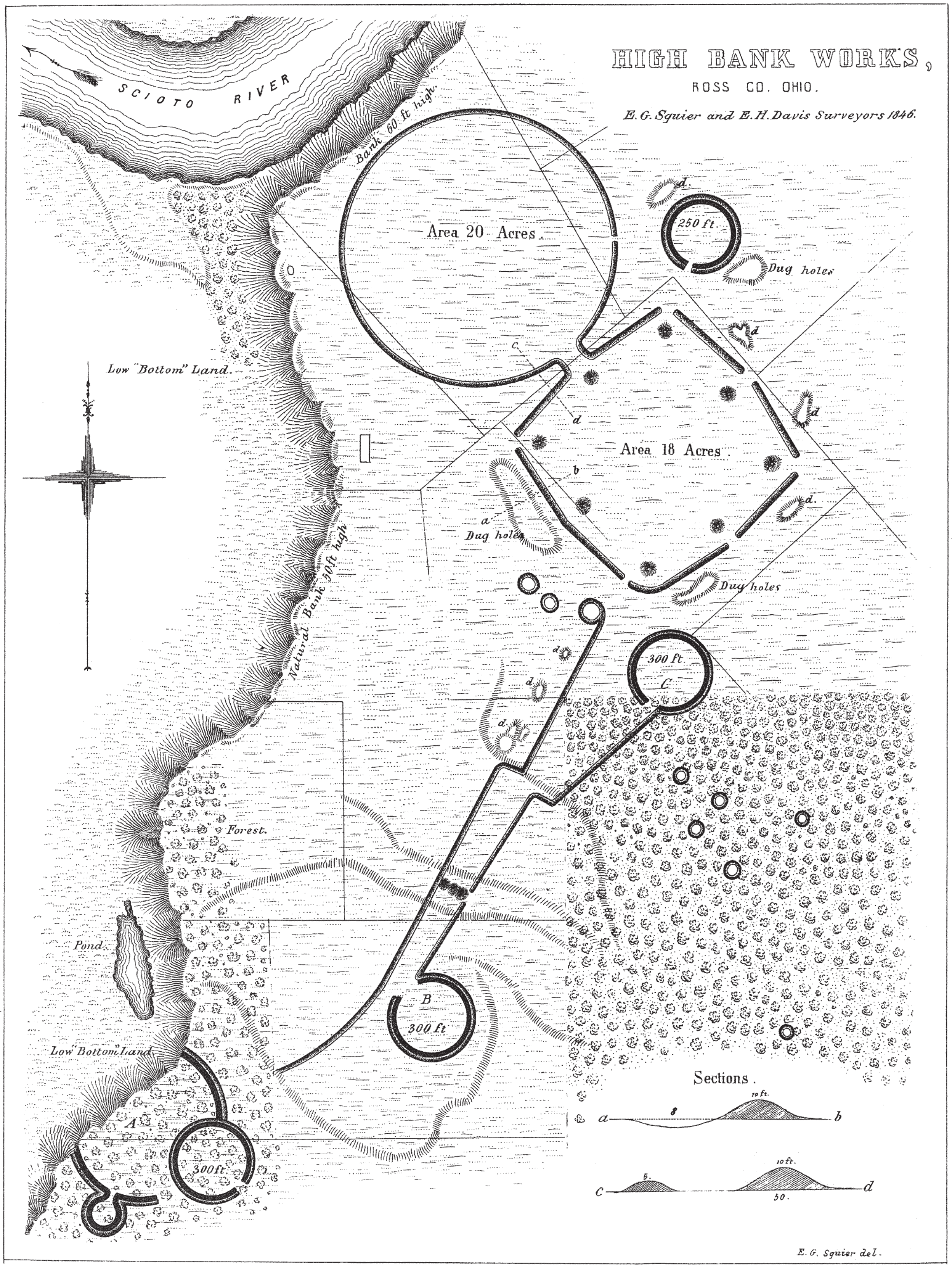

FIGURE 8-13.—High Bank earthworks southeast of Chillicothe (from Squier and Davis, 1848, pl. XVI).

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STOP 9 (DRIVE-BY): STORY MOUND, AN ANALOG TO THE ADENA MOUND

by
Timothy S. Dalbey

Between the Mound City Group (Stop 8) and Seip Mound State Memorial (Stop 10) is another archaeologically notable area of Chillicothe where the Adena Mound once existed. Story Mound, off U.S. Rte. 50 east of Cherokee and DeLano Streets in northwestern Chillicothe, Ross County, is thought to be very similar to the Adena Mound and is still preserved as an Ohio Historical Society property (see fig. 8-1).

Adena was the name of the mansion Ohio Governor and Senator Thomas Worthington built on the parcel of land he purchased in 1798. The site is on a promontory overlooking Chillicothe and the Scioto River valley 2 km (1.2 miles) to the east (see fig. 8-2). Below the mansion on the Scioto River floodplain a large mound, which became known as Adena, stood about 8 meters high and had a circumference of about 136 meters. In 1901, the land fell out of the Worthington family ownership, and the new owner wanted to remove the mound. This prompted William C. Mills to excavate the mound (fig. 9-1) before its destruction (Mills, 1902).

The Adena Mound was built in two periods. The second or outer period of the mound added about 2 meters to the height of the mound. The burials in the second mound-building period, for the most part, were not buried with elaborate grave goods and did not indicate much preparation for burial. One individual did have the remains of a woven loin cloth, but it disintegrated upon exposure and handling. Most of the soil making up the second, add-on period, was from the immediate surface around the mound and may be the reason the skeletons were not preserved very well.

The original mound was about 6 meters high and 27 meters in diameter, composed of dark organic soil from Lake Ellensmere next to the site. The first mound burials found were about 1.5 meters from the base. Most of the burials were wrapped with elaborate grave goods, in bark sheaths or coarse woven fabrics, then enclosed in a crypt of timbers. The skeletal remains of 21 individuals were well preserved. Grave goods from the mound included copper bracelets, woven cloth, copper rings, mica headdress, and pottery vessels. At 1.2 meters above the base, Mills stopped his downward excavating and began excavating the base of the mound from the outer edge inward until he discovered a depression with a large grave about 4 meters long by 3.5 meters wide and 2 meters deep, extending down into floodplain gravels (fig. 9-2). A log crypt encased two extended adult skeletons (burials 1 and 2) placed side by side in opposite directions. A slate gorget and a clay tubular pipe were placed between the burials. Another adult male (burial 3) was placed on the mound floor with only a bracelet of bone beads. Burial 4 was a redeposited burial that had over 200 bone and shell beads placed in a log crypt and three layers of bark from different types of trees. Burial 5, located on the base of the mound floor, was an adult male with an ovate-base stemmed projectile of chalcedony (probably from Flint Ridge) and two cloth-wrapped copper bracelets. Toward the center of the mound, burial 6 was a female with two copper bracelets over a boat-shaped limestone gorget fastened by two strings to the right arm. Burial 7 was an unadorned burial 1.5 meters from the


FIGURE 9-1.—Adena Mound (from Mills, 1902, p. 451).

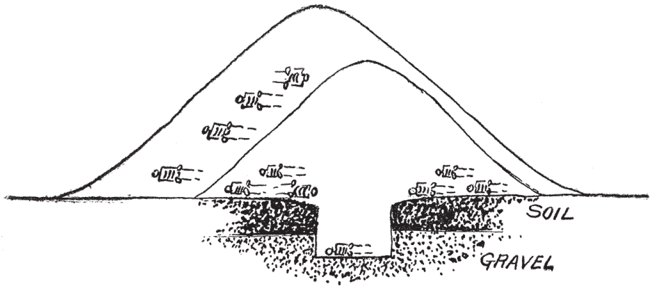

FIGURE 9-2.—Adena Mound cross-sectional view (from Mills, 1902, fig. 1).

base of the mound. Burial 8 is probably highly significant in that a child of about six years was placed in a log crypt (2.5 meters long by 1.7 meters wide by 0.75 meter deep) at the base of the mound. The crypt base was lined with gravel, then with bark; the body was wrapped in cloth, covered with bark, and small 4-cm-diameter logs were wrapped around the body with another bark covering. The child had two necklaces with over 200 shell and bone beads. Burials 9 and 10 were found together in a log crypt, as well as burial 11 placed in a log crypt with shell and bone necklaces. Below the crypt of burial 11, a huge ash lens 30 cm thick was found near the submound grave site. Abundant mollusk shells, along with bone remains of wild turkey, trumpeter swan, deer, bear, and raccoon recovered from the ash pit, suggest a large feast or offering was part of the burial ritual. Another large ash lens occurred on the opposite side of the submound crypt. Ten more burials were recovered from log crypts with more elaborate grave goods, among them a human pipe figurine (fig. 9-3) from burial 21 and a carved sandstone tablet so commonly seen in the literature.

Clearly, the time, care, and ceremonialism displayed in the mortuary practices at Adena are different from the Mound City mortuary practices. Adena crypt burials are closer to those described by Brown (1979). It ended up that the dirt from the Adena site was used in a B&O railroad cut 50 meters away, and the landowner planted crops where the mound once stood.

The burial practices and grave goods from the Adena Mound were considered to be the "type site" for Adena and pertained mostly to mounds, ignoring other nonmound sites. Again, at the time (the 1920's) the emphasis was on the excavation of mounds, and any time a mound was excavated a list of traits was compared to the Adena trait list for identification. Greenman (1932), Webb and Snow (1945), and Webb and Baby (1957) continued to add mounds and trait lists to an ever-increasing list of Adena traits that got longer after each new mound excavation. Dragoo (1964) presented ^{14}C evidence for the establishment of Adena in north-central Kentucky, but had many problematical dates, although he did recognize an early and a late Adena. Swartz (1971) held a symposium on Adena, and the consensus was that Adena was known almost entirely from a burial and ceremonial context (see discussion by Griffin, 1974). Adena nonmound sites are not well known, and excavations are even fewer. It has been suggested that the Adena traits occur late in the Early Woodland and that most of the burial practices associated with Late Adena are found in Hopewell. It is now thought that there are no radiocarbon dates for the Adena before 2,450 years B.P. (500 B.C.).

The Adena burial ceremonialism should be discussed within the context of the Early Woodland complex. The Early Woodland period is thought to have its origin in the Late Archaic in the northeast, south, and north-central Midwest with the occurrence of ceramics, cultivation of native plants, burial ceremonialism, and distinctive artifacts (Otto, 1979; Griffin, 1983). One problem with this concept is that in southwestern Ohio there is a lack of sites with dates ranging from late Late Archaic (sometimes called "Terminal" or "Transitional" Archaic) about 3,270 years B.P. (1,320 B.C.) through 2,270 years B.P. (320 B.C.), well within Early Woodland or Adena. This is the time period in which Early Woodland sites or a continuation of the late Late Archaic should be dated, but very few sites are known from this 1,000-year time span.

FIGURE 9-3.—Human effigy pipe (from Mills, 1902, fig. 28).

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STOP 10: SEIP MOUND STATE MEMORIAL

by
Martha Potter Otto

The Seip mound complex (fig. 10-1), on U.S. Rte. 50 just east of Bainbridge, Ross County, consists of a square and a complete circular enclosure connected by a larger irregular circular embankment, all enclosing a total of 49 hectares (fig. 10-2). The combination of squares and circles is typical of most of the Hopewell geometric earthworks in the mid-Scioto/Paint Creek valleys (see fig. 8-2). Excavations across a portion of the irregular circle demonstrated that the walls were originally 15 meters wide at the base and likely rose to a height of 3 meters. Several obvious borrow pits suggest the source of the soil for the earthworks. Within the irregular circle are three conical conjoined mounds (fig. 10-2, c) and an elliptical mound (fig. 10-2, b). The elliptical mound is 76 meters long, 38 meters wide, and 9 meters high and is surpassed in size only by Mound 25 of the Hopewell Mound Group. A smaller circular enclosure (fig. 10-2, a) in the southwest corner of the large figure along with the mounds blocking the four openings of the square are no longer visible on the ground.

Archaeological investigations by the Ohio Historical Society at Seip Mound began with William C. Mills's excavation of the three conjoined mounds in 1906 and 1908 (Mills, 1909). He continued with the excavation of the elliptical mound in 1926-1928 with H. C. Shetrone and Emerson Greenman (Shetrone and Greenman, 1931). These inquiries demonstrated that the mounds covered the sites of buildings that likely served a variety of social and ceremonial purposes, the ultimate one being burial of Hopewell individuals. A careful analysis of the burial layout beneath the elliptical mound and the objects accompanying individual deposits led N'omi Greber (1979), of the Cleveland Museum of Natural History, to conclude that the Hopewell people had reserved specific parts of the building for specific kin groups. In the 1970's, the Ohio Historical Society continued research at Seip Mound by examining the area between the elliptical mound, which had been restored by Greenman, and the northern segment of the enclosure. This work revealed the posthole patterns

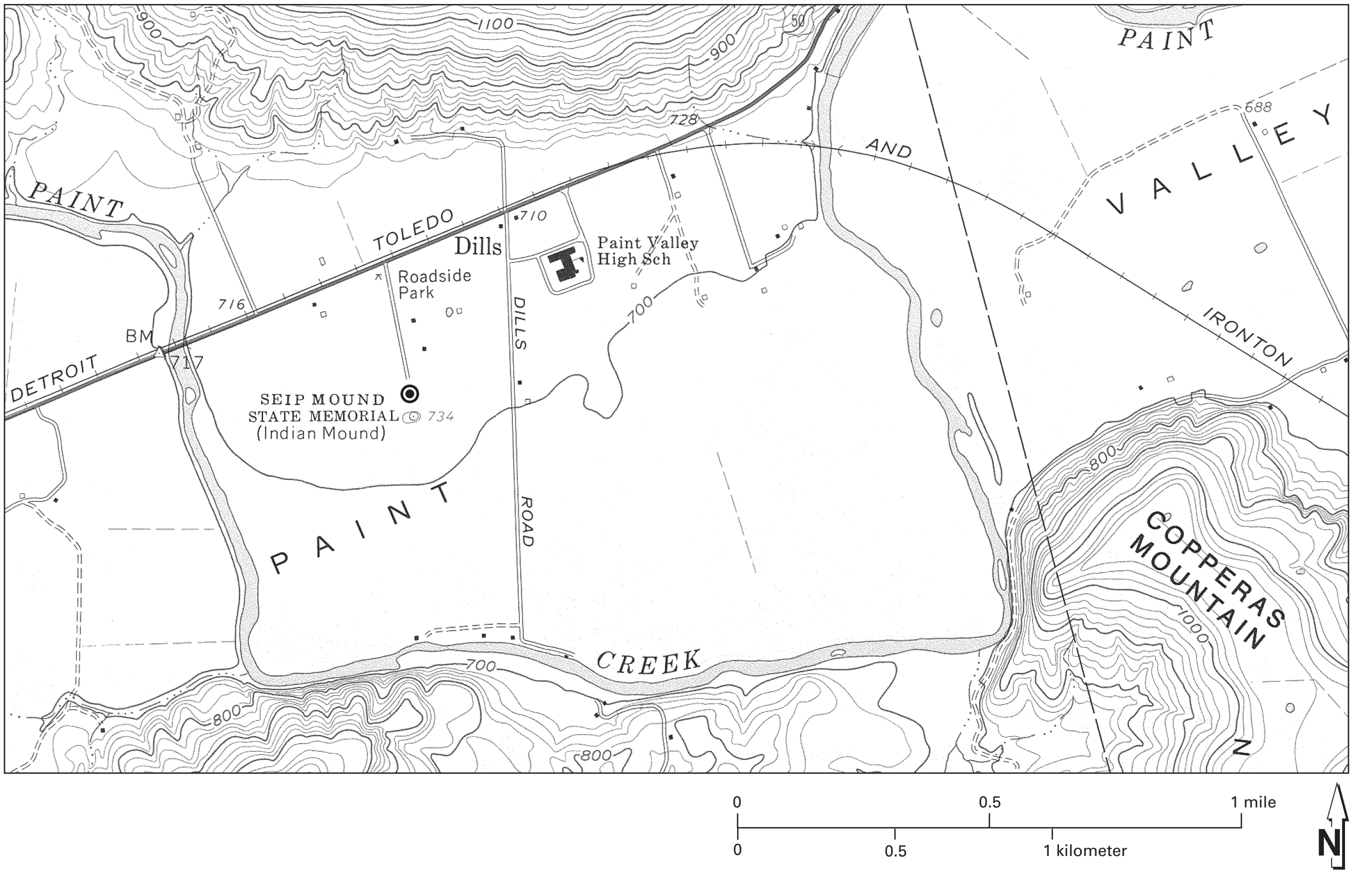

FIGURE 10-1.—Portion of U.S. Geological Survey Morgantown, Ohio, 7.5-minute topographic quadrangle showing the location of Seip Mound State Memorial.

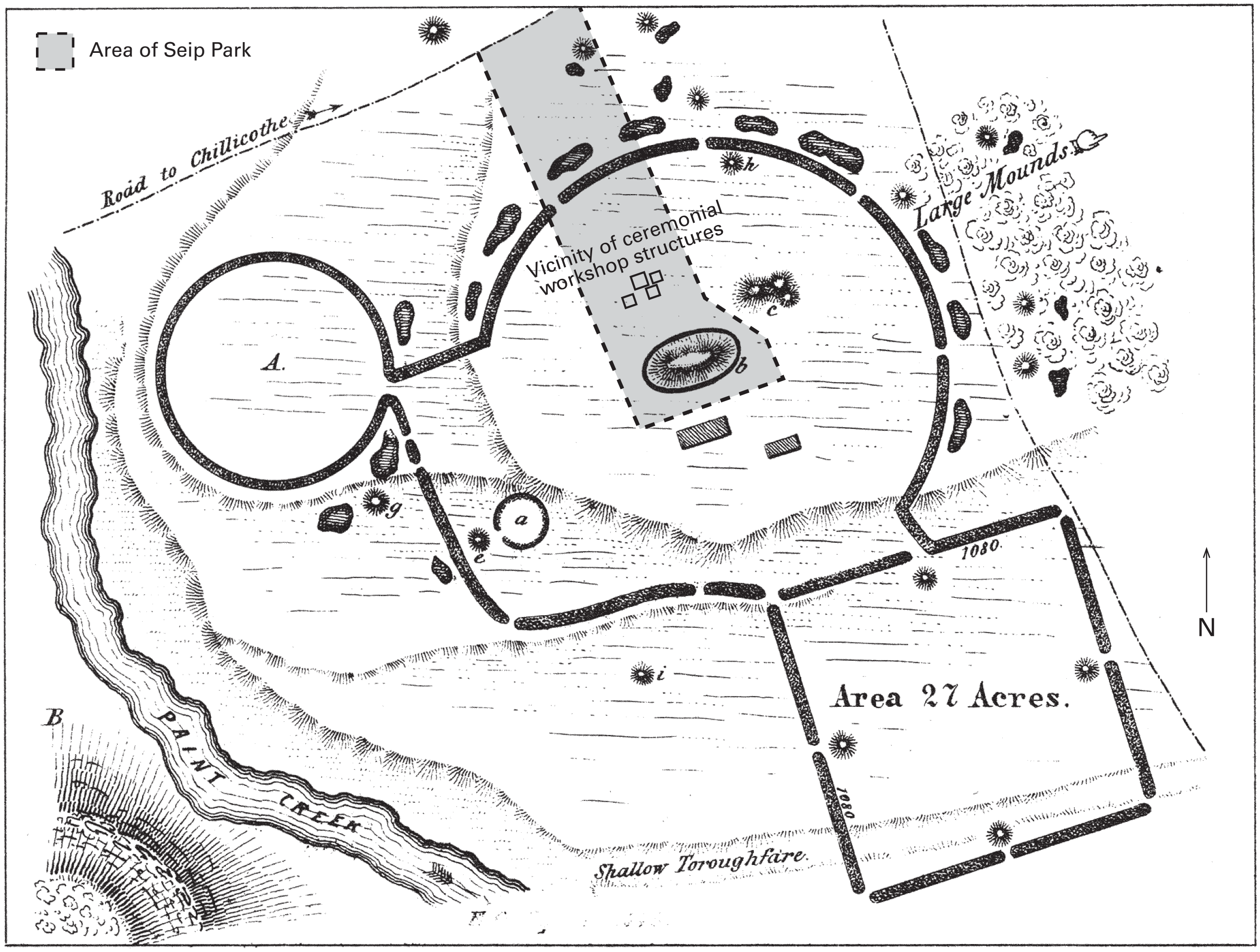

FIGURE 10-2.—Map of Seip earthworks with park plan superimposed (modified from Squier and Davis, 1848, pl. XXI, no. 2, and Baby and Langlois, 1979, fig. 4.1).

of a number of square to rectangular buildings which had not been covered by tall mounds. The nature of the debris on the house floors suggests that they served as workshops for artisans whose products likely ended up accompanying the burials in the "big houses."

Baby and Langlois's (1979) ^{14}C dates for these house sites had a mean (n = 2) date of 1,705 ± 68 years B.P. (A.D. 245). Greber (1979) also excavated the base of the Edwin Harness Mound, which is a large mound central to an earthwork very much like the Seip earthworks. This similar earthwork, known as the Liberty Township Works, is 25 km (15.5 miles) east of Seip Mound in the Scioto River valley (see fig. 8-2). Greber's ^{14}C dates for two features from the middle section of the Harness Mound had a mean (n = 4) date of 1,552 ± 67 years B.P. (A.D. 398). At two standard deviations, these dates clearly overlap and would span 424 years from 1,841 to 1,417 years B.P. (A.D. 109 to 533); this time may span the duration of occupation at these sites. Clearly, more radiometric determinations are needed to refine the occupations.

Since the 1928 excavations, the Society has maintained a 4-hectare tract as a public park, including a restored section of the irregular circle and the restored elliptical mound (fig. 10-2). The remainder of the site continued in private ownership and was subjected to cultivation which, along with erosion from Paint Creek's periodic floods, was especially devastating to the square enclosure. Recently, the farm immediately south and east of the Society's original tract has been bequeathed to OHS; plans for long-term research and development are underway. The National Park Service also is negotiating for and appropriating parcels of land that include parts of Seip Mound.

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STOP 11 (OPTIONAL): FORT HILL STATE MEMORIAL

by
Martha Potter Otto

Fort Hill State Memorial is located off State Rte. 41 on Township Rd. 256 in Brush Creek Township, Highland County (fig. 11-1). Like Fort Ancient (Stop 14), Fort Hill is a hilltop enclosure that likely was constructed by the Hopewell Indians (fig. 11-2) over 1,500 years ago. The wall, built of stone and earth, is positioned slightly below the level top of the hill; its upper surface in some places is nearly level with the summit and in other places somewhat below it. The embankment is approximately 3 km long and is broken by 33 irregularly spaced openings or "gateways" varying in width from 4.5 to 6 meters. The wall itself ranges in height from 4.5 to 6 meters and has a basal width of 12.2 meters. The enclosed area on top of the hill is about 16 hectares and over 120 meters above the road.

Archaeologists investigated a small portion of the wall in the 1960's and discovered that it is built with a core of Berea Sandstone (see fig. 7-3) slabs covered with soil. These materials were probably quarried from the hilltop itself; indeed, the ditch just inside portions of the wall was likely formed as the Indians dug up soil for the construction. There are also three distinct depressions within the enclosure that may have served as borrow pits.

In addition to the hilltop enclosure, there is a circular embankment 53 meters in diameter in the valley south of Fort Hill. When it was examined by the Ohio Historical Society in 1954, archaeologists discovered that the earth wall covered the site of a circular building that may have served as a meeting place for the Hopewell people when they visited the area (Potter and Thomas, 1970). Near the circle, the archaeologists also found remnants of a rectangular structure measuring 36.5 meters long. On the basis of the contents of several refuse pits associated with the structure, the investigators concluded that the building may have been some type of workshop where artisans made flint tools.

In addition to its archaeological features, Fort Hill is distinct because of its geological situation. It is located near the boundaries of the Appalachian Plateaus Province on the east and the Central Lowland Province to the west. It also marks the boundary between the glaciated and unglaciated portions of the state (see Stop 13). Given the diversity of soils and terrain on and around Fort Hill, it is understandable that it supports a wealth of native plants. There are northern species such as Canadian yew (*Taxus canadensis*), remnants from the glacial period, along the limestone gorge at the base of the hill. The brink of the cliffs is the most northwesterly station in the United States of Canby's Mountain-Lover (*Paxistima canbyi*), a southern Appalachian plant. Hiking trails lead visitors to these and other natural phenomena within the site; indeed, Fort Hill is a designated state nature preserve as well as being an archaeological site. The site also includes a museum.

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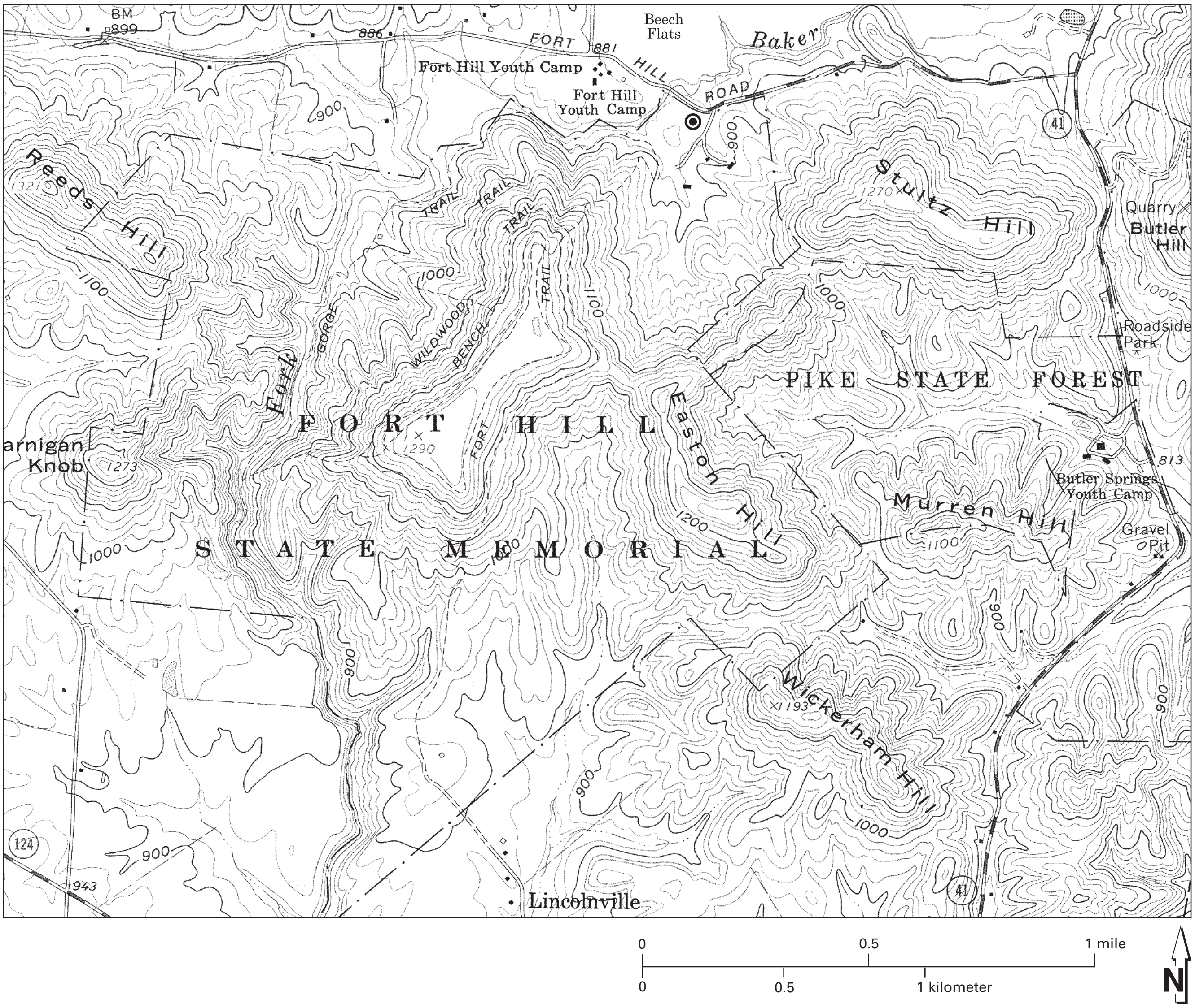

FIGURE 11-1.—Portion of U.S. Geological Survey Sinking Spring, Ohio, 7.5-minute topographic quadrangle showing the location of Fort Hill State Memorial.

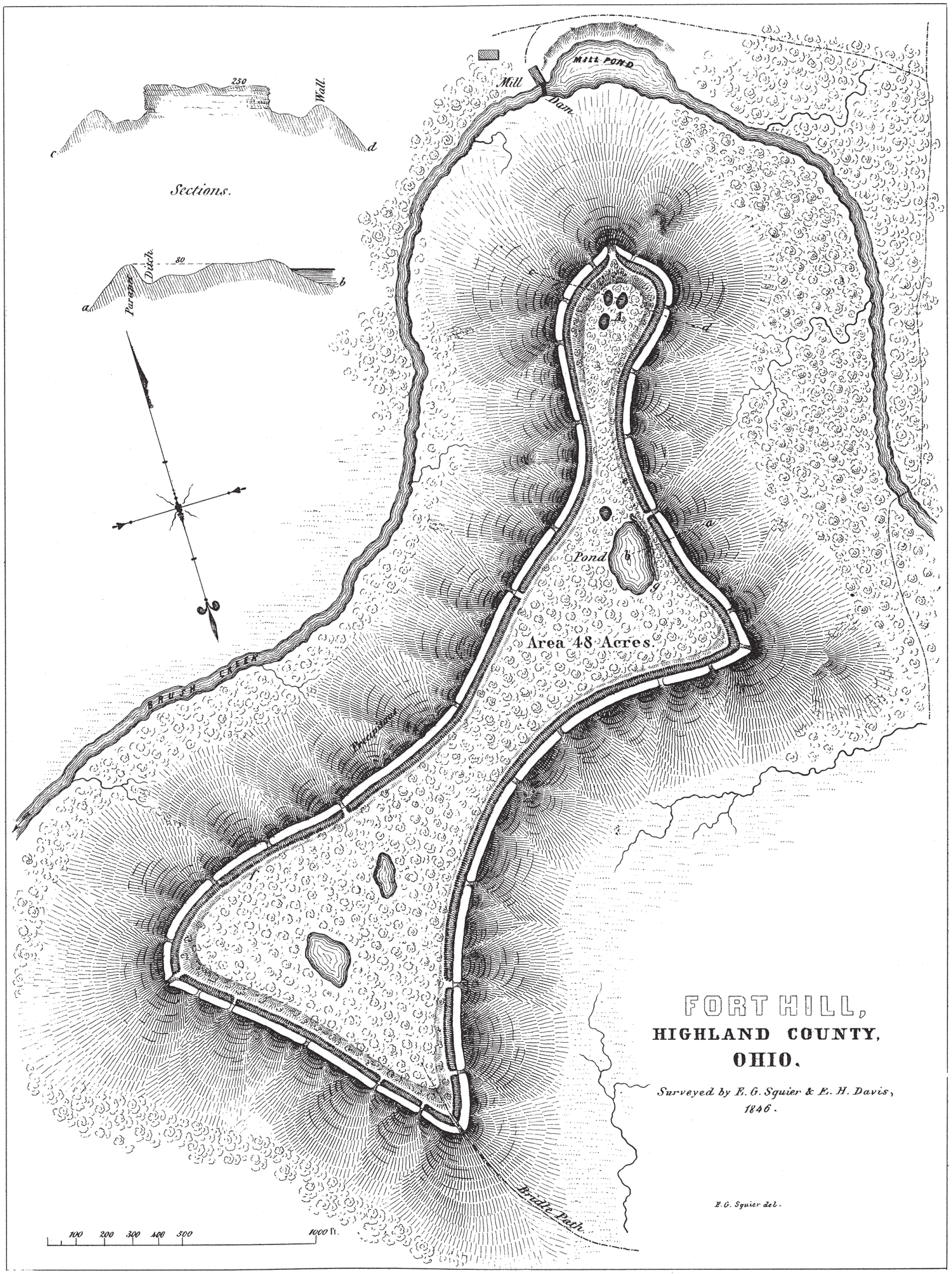

FIGURE 11-2.—Map of Fort Hill (modified from Squier and Davis, 1848, pl. V).

STOP 12: SERPENT MOUND

by
Martha Potter Otto
and Timothy S. Dalbey

Serpent Mound, on Ohio Rte. 73 near Locust Grove, in Adams County (fig. 12-1), is the largest and probably the most well known prehistoric effigy mound in the country (fig. 12-2). The earthen embankment, nearly 0.4 km long, appears to represent a gigantic serpent in the act of uncoiling, its body extending toward the tip of the narrow tongue of land on which it is built. At the bluff edge is an oval earthwork that archaeologists interpret as the open mouth of the snake. The average width of the serpent's body is about 6 meters, and its height along the head and body ranges from 1.2 to 1.5 meters.

Speculation about the "meaning" of Serpent Mound began as soon as it was recognized through the maps of Ephraim Squier and Edwin Davis published in 1848. Some nineteenth-century theorists associated the effigy with Indians of the southwestern United States and Mexico; others felt it symbolized the serpent in the Garden of Eden. Frederic Ward Putnam, curator of the Peabody Museum at Harvard University, was the first scientific investigator of the site, excavating and restoring the effigy between 1886 and 1889 (Putnam, 1890). During that time he also examined the nearby conical mounds and areas south of the effigy (fig.12-3).

Putnam's excavations indicated that the form of the serpent had been carefully laid out on the existing ground surface with stones or a combination of clay and ashes; stones were especially prominent in areas where the increased slope required greater stability. The core was then covered with soil scraped up from the immediate vicinity. The effigy did not cover any burials or remains of structures, nor did it contain any artifacts that might identify its builders. However, Putnam recovered artifacts typical of the Adena culture (800 B.C.-A.D. 1) in the conical burial mounds (fig. 12-3), suggesting that the serpentine embankment may have been built by those people. However, he also discovered habitation areas that had been occupied by the Fort Ancient people (A.D. 900-1500) in proximity to the mounds.

After Putnam's excavations and restorations of the mounds, Harvard University, which owned the property at that time, opened the site as a public park. In 1900, Harvard deeded the tract to the Ohio Historical Society, which continues to maintain it as an archaeological park.

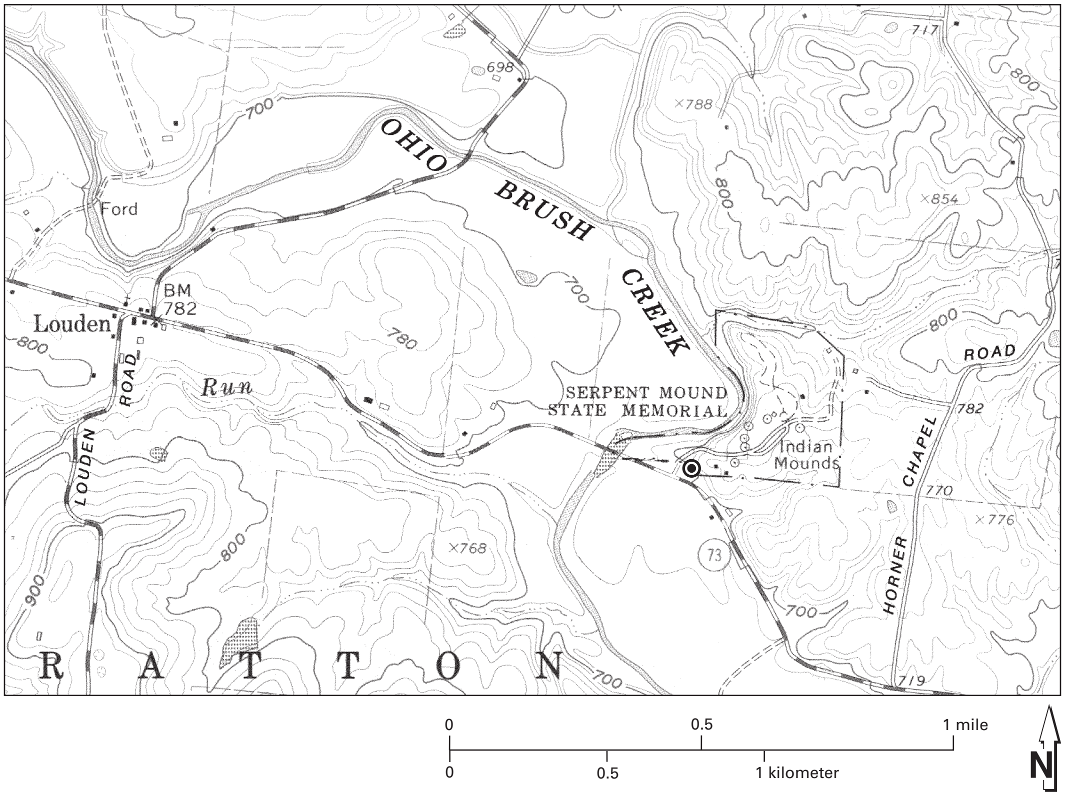

FIGURE 12-1.—Portion of U.S. Geological Survey Sinking Spring, Ohio, 7.5-minute topographic quadrangle showing the location of Serpent Mound State Memorial.

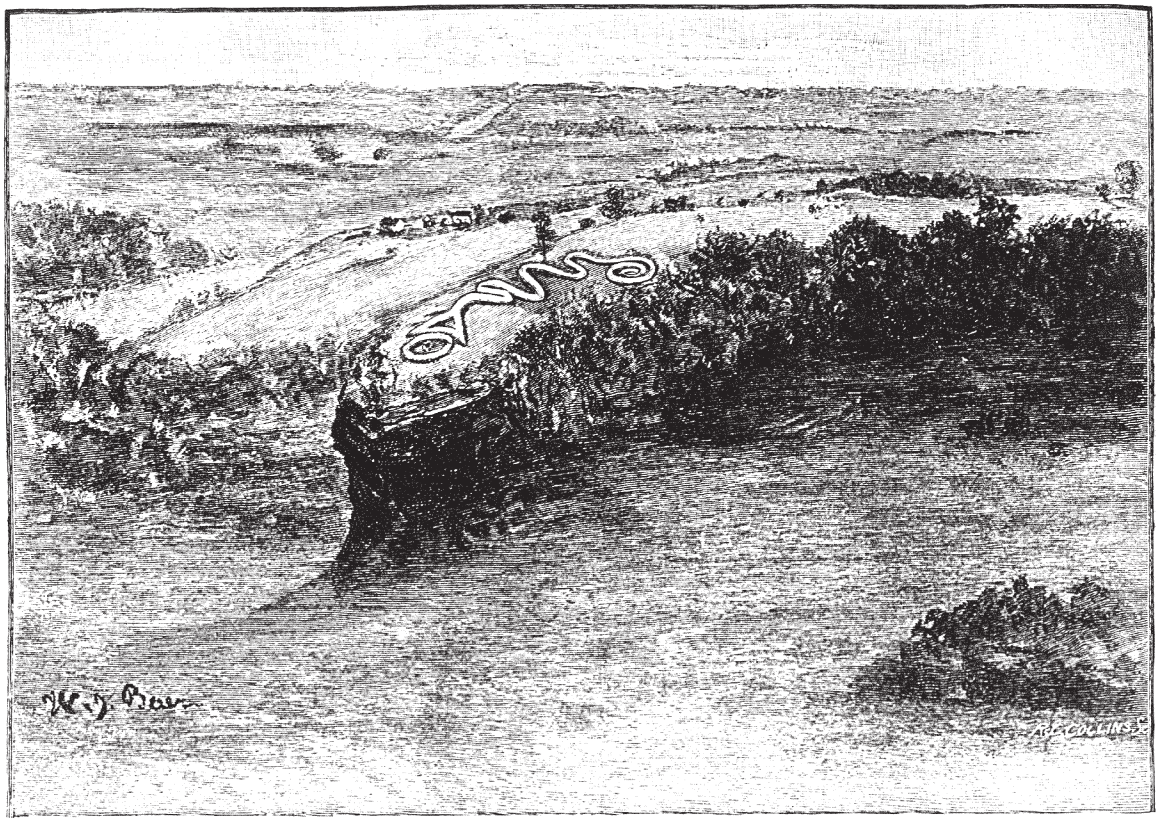

FIGURE 12-2.—Serpent Mound (from Putnam, 1890, 1973 reprint, p. 114).

In recent years, Serpent Mound has attracted several researchers interested in determining whether the effigy was built to record specific astronomical alignments, especially the summer solstice. Critical to research on that particular topic, as well as to our overall understanding of the effigy, is a precise chronology for its construction. To this end, in July 1991, a team of engineers and archaeologists located one of Putnam's backfilled excavation trenches. They carefully exposed the adjacent undisturbed soil profile to examine the stratigraphy of the effigy and to recover carbon samples for radiometric dating. The results of this project should be available soon.

In the late summer and fall of 1991, the Society sponsored test excavations in the vicinity of Putnam's Fort Ancient habitation site and one of the conical mounds, as a necessary prelude to the construction of a new water line. The long but narrow (1 meter wide) excavation trench will provide an excellent means of sampling a sizeable area. The work has already yielded evidence of occupation by Early and Late Archaic, Early and Late Woodland, and Late Prehistoric cultures. The investigations should be continued in the spring of 1992.

Serpent Mound sits within an unusual geological feature known as the Serpent Mound cryptoexplosion structure (fig. 12-4). This area is nearly 8 km in diameter and contains extremely faulted and folded bedrock. Such faulting is unusual in the normally flat-layered rocks of Ohio. A meteorite strike or a volcanic explosion are among theories presented to explain this phenomenon, but the site contains no volcanic material or meteorite debris. Schmidt and others (1961) favored an origin caused by an explosion of gas generated deep within the Earth and escaping along a zone of weakness in the rock layers. Reidel (1975) and Reidel and others (1982) challenged the gas exogenic theory and proposed that the 41-square-kilometer structural deformation is a result of endogenic faulting over a zone of crustal weakness. Geologists at the Ohio Division of Geological Survey have been studying core and seismic data from the disturbance and found the structure is related to a meteoric origin (Carlton and others, 1998).

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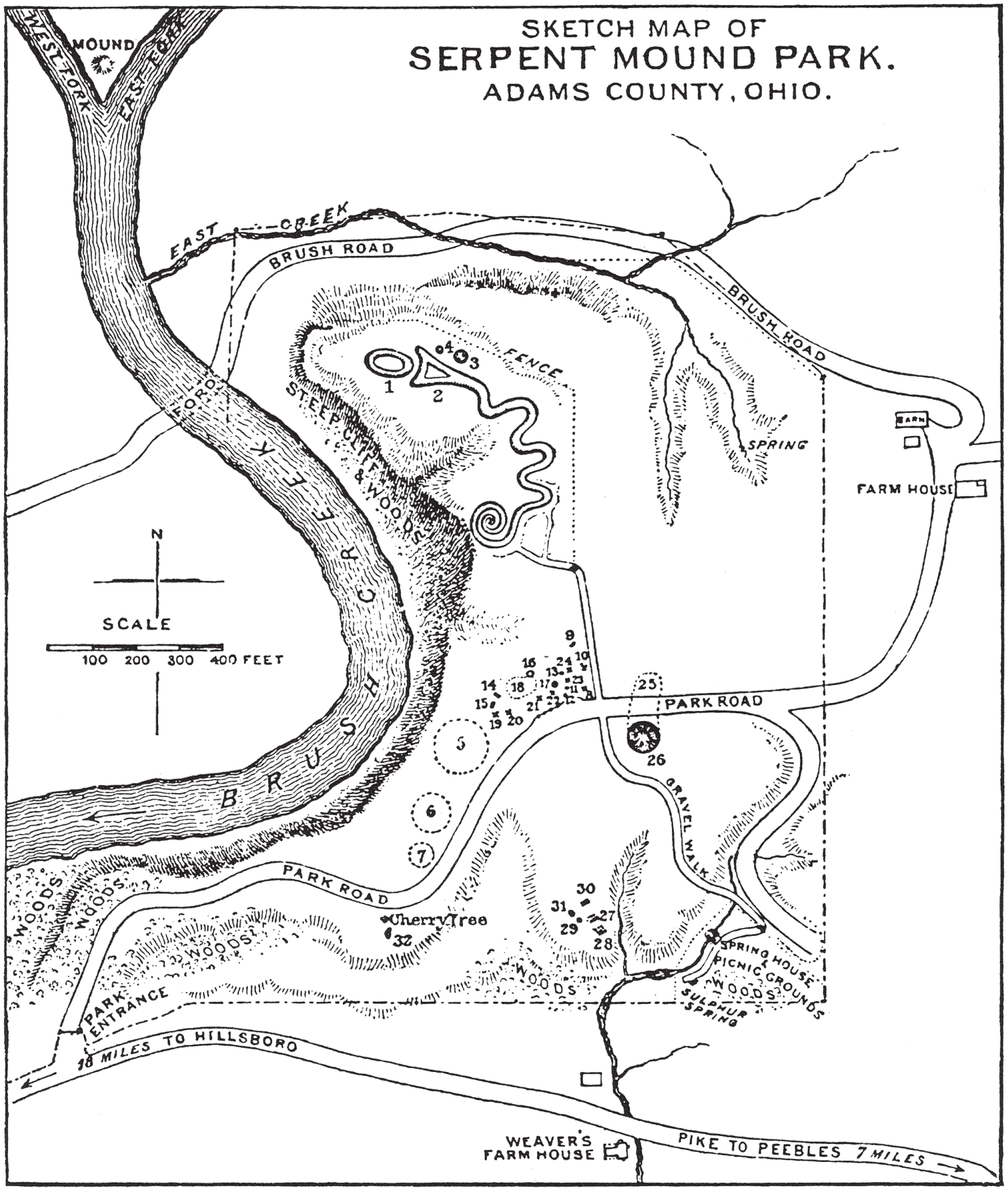

1, The Oval Embankment in front of the serpent's mouth. In this inclosure is a small mound of stones. 2, The Serpent. 3, A low Artificial Mound near the head of the serpent. 4, A very small Artificial Mound just west of 3. 5, 6, 7, Ancient Excavations, appearing like sink-holes. 8, 19, 20, 21, 22, 23, 24, and in space bordered by 18, 15, 20, 21, are Sites of Ancient Habitations. 9, Burnt Stones on the clay. 10, A recent Indian Grave over two graves. 11, Portions of Three Skeletons in a pile. 12, 13, Skeletons in the clay. 14, Grave with Two Skeletons. 15, Grave with Skeleton, over which was an ash bed. 16, Pieces of a large Clay Pot. 17, Small Burial Mound. 18, Several small Excavations in the clay, filled with dark earth. 19, 24, See above. This Village Site was afterwards found to extend 200 feet east and south. 25, Burnt space under the dark soil extending to the edge of large conical mound. 26, The Conical Mound, a monument over a single body. 27, 28, Cremation Places in the clay under the dark soil. 29, 30, 31, Very Ancient Graves deep in the clay. 32, Small Mound over four ancient graves in the clay.

FIGURE 12-3.—Serpent Mound Park (from Putnam, 1890, 1973 reprint, p. 116).

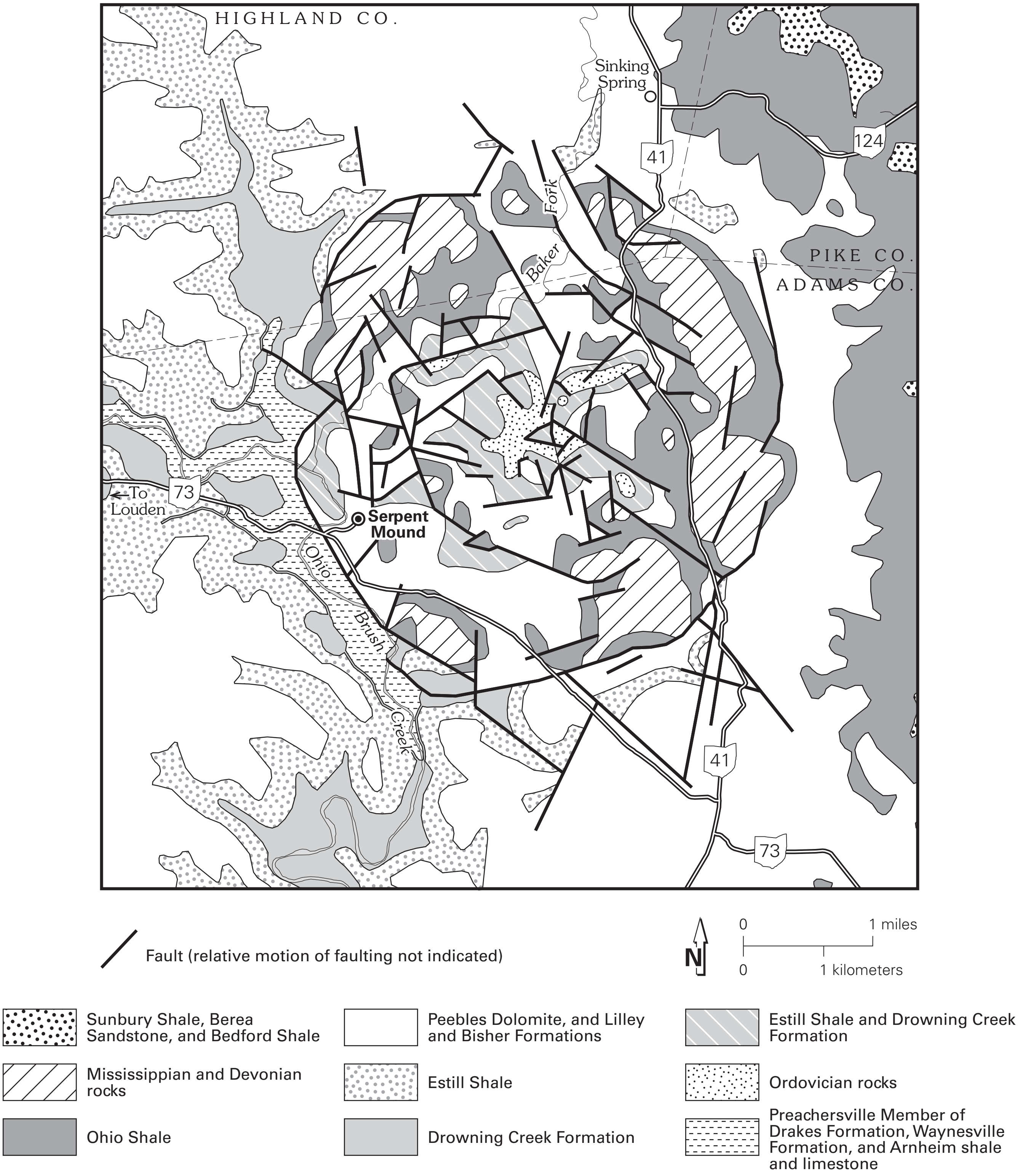

FIGURE 12-4.—Map of Serpent Mound meteor impact structure (modified from Riedel, 1975).

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STOP 13 (DRIVE-THROUGH): BEDROCK AND GLACIAL GEOLOGY FEATURES BETWEEN CHILLICOTHE AND FORT ANCIENT, WITH AN EMPHASIS ON HIGHLAND COUNTY, OHIO

by
Timothy S. Dalbey

Between Chillicothe (Stops 9 and 10) and Bainbridge (beyond Stop 10), U.S. Rte. 50 passes through the scenic Paint Creek valley (see fig. 10-1). Most of this part of the Paint Creek valley is filled with Wisconsinan outwash preserved as terraces or outwash plains (Quinn and Goldthwait, 1985). U.S. Rte. 50 parallels Late Wisconsinan outwash terraces on the north for several kilometers. Some of the larger hills are probably moulin kames that represent deposition of layered sand and gravel in a large hole in the ice. Above the long, low glacial terraces are perched alluvial fan deposits of sediments in a valley that was cut lower by an ice flow. Many of the lateral glacial features along resistant bedrock (Devonian and Mississippian) outcrops contain ice-contact stratified drift, kames, kame complexes, kame terraces, and eskers. Copperas Mountain, a spectacular basal 46-meter vertical exposure of Devonian Ohio Shale containing coal seams (described in Stop 7, see fig. 7-3), is visible to the southeast from the top of Seip Mound (Stop 10) (see fig. 10-1). The higher areas are covered with less than 3 meters of till or are exposed bedrock with a thin veneer of loess on the uplands. Flat outwash plains and large areas of Illinoian ground moraine are present to the west. Just north of Cynthiana (Pike County), after leaving Seip Mound, Ohio Rte. 41 passes through a lacustrine deposit from a glacial meltwater lake and then begins to weave in and out of glacial deposits and into the unglaciated southeastern corner of Highland County on the way to Fort Hill (Stop 11). At Fort Hill, there is an excellent view to the northeast of Beech Flats (see fig. 11-1), an Illinoian glaciated valley at elevations of 152 meters above the Paint Creek valley (Rosengreen, 1974).

Beech Flats consists of 12 meters of silt overlying sand, gravel, and till. The Beech Flats surface is at an elevation of 293 meters above sea level. Low-rising kames surround the surface of the flats. The silt was deposited in a proglacial lake that formed as Illinoian ice blocked the northward flow of drainage from the highlands to the south and southeast (Rosengreen, 1974).

As Ohio Rte. 41 continues southwest to Serpent Mound (Stop 12) in Adams County, it crosses Illinoian-glaciated areas drained by Ohio Brush Creek. From Serpent Mound the field-trip route heads northwest on Ohio Rte. 73 through Hillsboro (Highland County) to the Wisconsinan-age Mt. Olive Moraine. The topography of this end moraine is rolling and flat until New Vienna (on the Highland-Clinton County border), which is located in an area of flat ground moraine between the western edge of the Mt. Olive Moraine and the eastern edge of the Wisconsinan-age Cuba Moraine. North of New Vienna, the field-trip route takes Ohio Rte. 350 west along the axis of the Cuba Moraine, passing through the crossroads of Cuba, for which the moraine is named, and leaves the Wisconsinan glaciated area near Fort Ancient (Stop 14) in Warren County. The Fort Ancient area lies in a Wisconsinan interlobate zone between the Hartwell Moraine of the Miami Lobe and the Cuba Moraine of the Scioto Lobe.

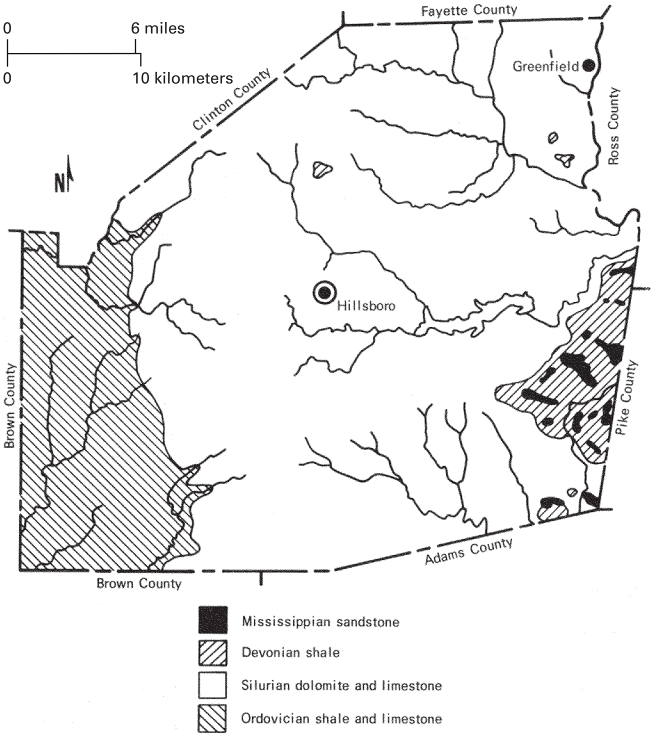
Highland County is rich in geological diversity—Ordovician through Mississippian bedrock is exposed throughout the county (fig. 13-1). Illinoian and Wisconsinan glacial deposits cover most of the county except the southeast corner, where the unglaciated Appalachian Plateaus have a relief of over 152 meters. Rainfall averages 1.1 meters annually, and average temperature is 0ºC in January and 23.3ºC in July (Rosengreen, 1974). The northern part of the county is covered by an extensive, flat Wisconsinan till plain, which is part of the glaciated Central Lowland and has topographic relief of 61 meters. The descriptions of the preglacial and glacial features of Highland County that follow are derived from Rosengreen (1974).

PREGLACIAL TOPOGRAPHY

The preglacial topography of Highland County consisted of a major divide running north-south along a middle Silurian (Niagaran) escarpment of Lilley-Bisher-Peebles Formations (Rosengreen, 1974). Drainage east of the divide flowed into the main Teays River channel, which is now the Scioto River valley. Drainage on the west flowed into the old Manchester River, which flowed toward Cincinnati and was a tributary of the Teays River.

GLACIAL FEATURES

There is no well-developed marginal ridge at the Illinoian drift border, probably due to erosion or because the glacier did not hesitate long enough to build a moraine (Rosengreen, 1974). The border of the Illinoian till conforms to the topography or laps onto hillsides. In the western portion



SYSTEM	Formation	Lithology	Thickness (ft)
MISSISSIPPIAN	Berea	Sandstone, buff to gray, fine-grained; interbedded thin shales	0-200
DEVONIAN	Ohio	Shale, dark-brown or gray, fissile; calcareous concretions; pyrite and marcasite	0-300
	Olentangy	Shale, blue, fissile; black partings	0-60
	Hillsboro	Sandstone, white or yellowish, fine-grained, friable	0-20
SILURIAN	Tymochtee	Dolomite, gray to blue-gray, very fine-grained; argillaceous partings	0-80
	Greenfield	Dolomite, tan to blue-gray, fine-grained, distinctly bedded	
	Peebles	Dolomite, light-gray to bluish-gray, very fine-grained, massive; vugs and cavities common	0-100
	Lilley	Dolomite, gray to bluish-gray, finely crystalline; argillaceous locally; crinoidal carbonate lithofacies	0-55
	Bisher	Dolomite, reddish-brown or buff, fine-grained, silty; locally with blue-gray limestone	0-84
	Rochester	Clay shale, bluish-green; weathering to light yellow	0-95
	Dayton	Limestone, gray to greenish-gray, fine-grained, very dense and hard	0-7
	Brassfield	Limestone, bluish-gray to pink, massive to thin-bedded; shale partings	0-50
ORDOVICIAN	Undifferentiated	Shale, greenish, calcareous; with thin-bedded limestone	12
		Shale, calcareous; with thin-bedded limestone	65
		Shale, calcareous; with thin-bedded limestone	30
		Clay shale, calcareous; with thin-bedded limestone	50
		Shale, calcareous; with thin-bedded limestone	5

FIGURE 13-1.—Generalized geologic map of Highland County and general stratigraphic section (from Rosengreen, 1974, table 1 and fig. 2).

of Highland County, the flat Illinoian till plain (about 240 square km/150 square miles) has a mean thickness of 16 meters. Just south of Hillsboro, kames and ice-contact drift make up the topographic features. The preglacial valleys are filled with up to 12 meters of till, and the uplands are covered with 5 meters of till. The Illinoian ground moraine was deposited with very little erosion of the preglacial surface. At several rock quarries in the area, weathered bedrock and residual soils extending to a depth of 4.5 meters are overlain by unoxidized till.

There are many Illinoian kames and eskers in the vicinity of Hillsboro. An esker just west of Ohio Rte. 73 about 4 km (2.5 miles) southeast of Hillsboro has been mined for sand and gravel.

Illinoian outwash terraces rise up to 15 meters above the present stream level along the upper reaches of Rocky Fork. In the area of Ohio Brush Creek near Serpent Mound, the outwash terraces rise 9 meters above the present stream level. Proglacial lakes, such as Beech Flats (see fig. 11-1), formed as glacial ice flowed into existing valleys and dammed northward-flowing streams. The outlet channel for the proglacial lake at Beech Flats is at an elevation of 293 meters above sea level between Fort Hill and Reeds Hill and created the present Baker Fork gorge to Ohio Brush Creek. This channel became the major glacial meltwater outlet in Highland County during the Illinoian Stage. Meltwaters drained into the Paint Creek valley on the east side of the Niagaran divide. On the west side of the divide, drainage was through the newly established East Fork of the Miami River and on to Cincinnati. The Paint Creek valley was also the major outlet channel for the Late Wisconsinan Reesville meltwater.

TILL DEPOSITS

Four tills in Highland County represent drift deposits of two major glacial stages: the Rainsboro Till is Illinoian (>130,000 years), and the Boston, Caesar, and Darby I Tills are Late Wisconsinan (Rosengreen, 1974). Each Late Wisconsinan till is represented by a localized end moraine, typically named after a town that lies on the moraine (fig. 13-2). The Mt. Olive Moraine correlates to the Boston Till and reached the southern maximum by 21,350 years B.P. The Cuba Moraine correlates to the Caesar Till and represents a retreat pause of the Scioto Lobe after deposition of the Boston Till. The Cuba Moraine has been dated at about 19,500 years B.P. In comparison, the Miami-Lobe Hartwell Moraine north of Cincinnati reached its maximum southern extent about 19,000-18,000 years B.P. The Reesville Moraine is associated with the Darby I Till and represents the last glacial stand in Highland County around 17,000 years B.P.

Most of the radiocarbon dates in Highland County were run on wood samples—mostly *Picea* sp. (spruce) and *Larix* sp. (larch) logs or branches—recovered from till deposits (Rosengreen, 1974). The absolute age of the earlier tills, such as the Rainsboro, is generally unknown, but many tills have been widely studied in other areas (Teller, 1967) and are of Illinoian age (perhaps 300,000-128,000 years ago).

Rosengreen (1974) has described the till units of Highland County in detail on the basis of the depth of carbonate leaching, pedological features, stratigraphy, clay mineralogy, pebble counts, and heavy minerals. In most cases the

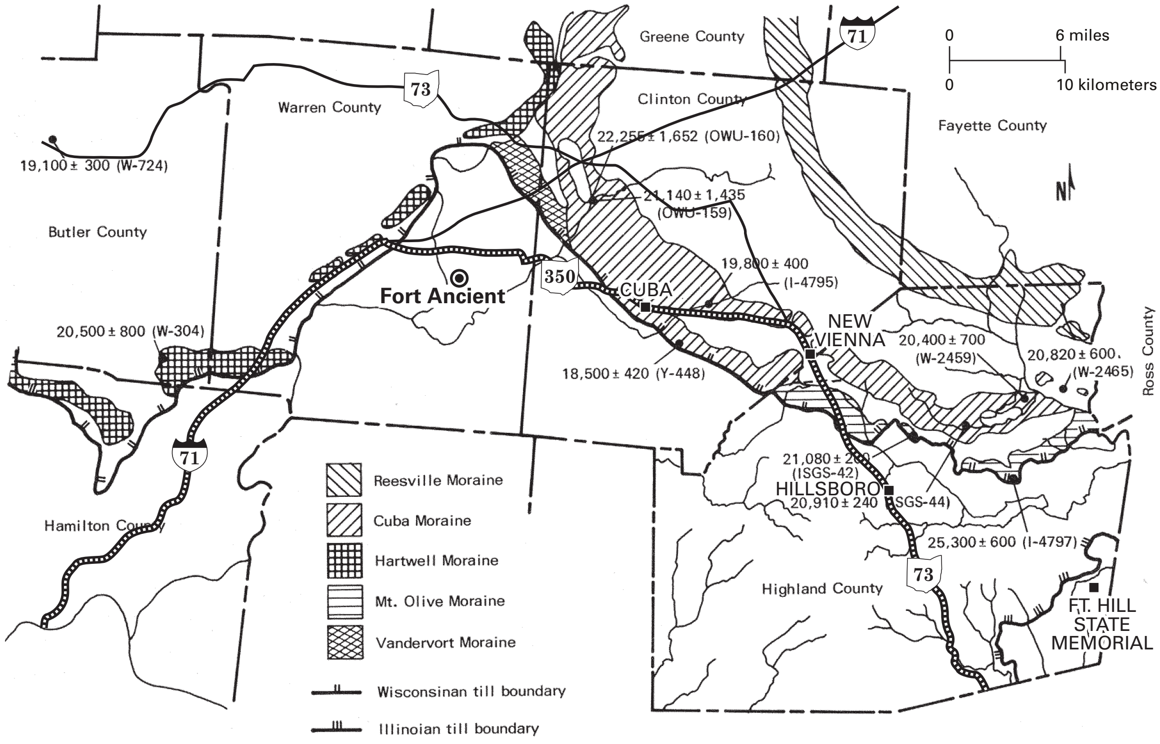


FIGURE 13-2.—Wisconsinan and Illinoian boundaries and end moraines in Highland County and adjacent areas. Radiocarbon dates for Late Wisconsinan end moraines also shown (modified from Rosengreen, 1974, fig. 14).

tills, except the Boston Till, were very similar in heavy minerals and clay mineralogy. Rosengreen (1974) hypothesized that the three similar-fabric tills all originated from the northeast, but the Boston Till may have had a northwest origin.

LATE WISCONSINAN MORAINES

Late Wisconsinan (Woodfordian) moraines in Highland County represent deposits of drift or till relating to three major movements of the glacier (Rosengreen, 1974). Some estimates have the Late Wisconsinan glacial advance at 30 meters per year (Goldthwait, 1959). At this rate the Late Wisconsinan glacier could have advanced from the area of Cleveland to the area of Cincinnati in less than 15,000 years.

Drift deposited during the first Late Wisconsinan advance (Boston Till) forms a sinuous lobate belt 0.62 to 6.4 km (1 to 4 miles) wide across the county; the Mt. Olive Moraine forms the 0.62- to 3.2-km-wide (1- to 2-miles) southern margin. Ohio Rte. 73 crosses the summit of the Mt. Olive Moraine about 4.8 km (3 miles) south of New Vienna at the western end of the moraine, which is buried by the Cuba Moraine.

The Cuba Moraine represents a pulse in the meltdown of the Scioto Lobe and has two elements, inner and outer. The eastern margin of the outer Cuba Moraine begins just south of New Vienna and continues westward into Clinton County. According to Rosengreen (1974), the inner Cuba Moraine represents a stand of Late Wisconsinan Scioto Lobe ice after a short retreat from the outer Cuba Moraine, and there is no stratigraphic evidence to suggest that there was a significant readvance of the glacier.

The hummocky topography of the Reesville Moraine in the northernmost part of Highland County is discontinuous. The moraine forms a gentle, arc-shaped rise and has not been radiometrically dated extensively.

The maximum glacial advance into Highland County by 21,000 years B.P is represented by the Mt. Olive Moraine. Following the initial advance, the glacier retreated and then advanced about 18,500 years B.P. to form the Cuba Moraine. The Late Wisconsinan Scioto Lobe retreated northward again as far as 20 km and readvanced about 17,400 years B.P. to form the Reesville Moraine. In less than 4,000 years the glacier had retreated from Ohio.

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STOP 14: FORT ANCIENT STATE MEMORIAL

by
Jack Blosser

This discussion is dedicated to the late Dr. Patricia Essenpreis, Department of Anthropology, University of Florida, Gainesville, Florida. It acknowledges the research of Dr. David Duszynski, Cincinnati Museum of Natural History, Cincinnati, Ohio, and Dr. Robert Connolly, Poverty Point State Commemorative Area, Department of Geoscience, Northeast Louisiana University, Monroe, Louisiana. It is through their work and research that this overview is respectfully written.

Fort Ancient State Memorial is located south of Oregonia on Ohio Rte. 350 in eastern Warren County, Ohio (fig. 14-1). Fort Ancient (fig. 14-2) is situated on an irregular-shaped bluff top that is 285 meters above sea level and rises 75 meters above the Little Miami River (Morgan, 1970). The site is classified as a “hilltop enclosure” because of its promontory location and manmade earthen walls, which range up to 7 meters high and 21 meters wide. The earthen walls encloses an area of 51 hectares. If the earthen walls were extended in a straight line, they would cover 5.7 km (3.4 miles).

The promontory on which the earthworks were constructed offers a dramatic and commanding view overlooking the Little Miami River, which cuts a deep and narrow gorge through Ordovician bedrock. The plateau is a remnant of Illinoian glacial scouring. The Little Miami River was a major outwash meltwater channel during and at the end of the Illinoian about 130,000 years ago (Fort Ancient Management Plan, 1985) The drainage of the bluff was deepened during the Sangamon Interglacial. The terminal Cuba Moraine of the Wisconsinan Scioto Lobe, is located 15 km (9 miles) east of Fort Ancient (see fig. 13-2). Again, the course of the Little Miami River carried glaciofluvial meltwaters that downcut the channel about 18,500 years B.P. Two streams, Randall and Cowen Runs, less than 200 meters apart, flow past two springs approximately 100 meters east of the site. A large circular mound was constructed near each spring, indicating their importance. West of the Little Miami River is the Hartwell Moraine of the Miami Lobe; meltwaters from this lobe also deposited outwash down the river at the end of the Wisconsinan (see fig. 13-2).

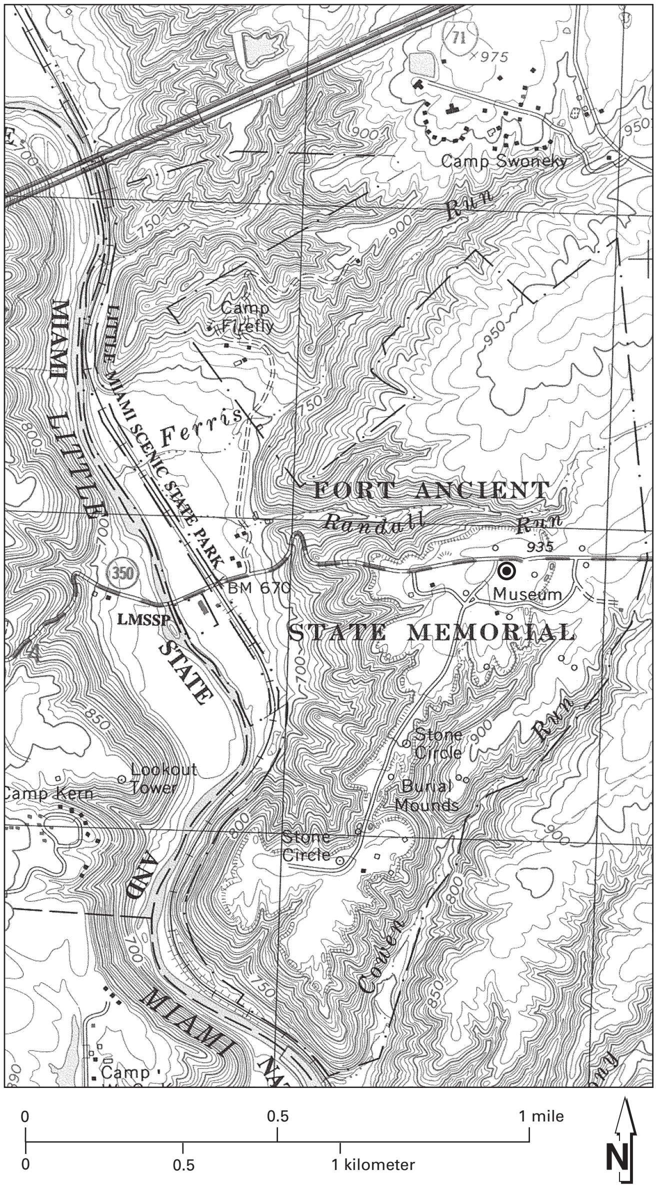

FIGURE 14-1.—Portion of U.S. Geological Survey Oregonia, Ohio, 7.5-minute topographic quadrangle showing the location of Fort Ancient State Memorial.

POSSIBLE FUNCTIONS OF FORT ANCIENT—HISTORY OF IDEAS FROM 1809-1940

The theorized functions of Fort Ancient have changed several times since it was first documented by the Philadelphia PORT FOLIO in 1809 (Essenpreis and Moseley, 1984). One early idea was that the site once served as a defense to ward off mastodon attacks (Atwater, 1820). Other early ideas proposed that it was a corral for herds of buffalo and deer so they could be slaughtered or a type of prehistoric sporting arena that included running races on top of the earthen walls. However, the idea that caught on and became prevalent into the twentieth century (up to 1939) was that this site was a fort built by ancient people as a defense against other groups of people. As this idea gained acceptance, so did the belief that the Mound Builders were an advanced civilization. At times it was postulated that their origin was in Mesoamerica and that they were one of the three great civilizations of the New World, along with the Aztec and the Inca. The Mound Builders were not assumed to have been ancestral to Native Americans and were assumed to have been violently destroyed by an indigenous native population.

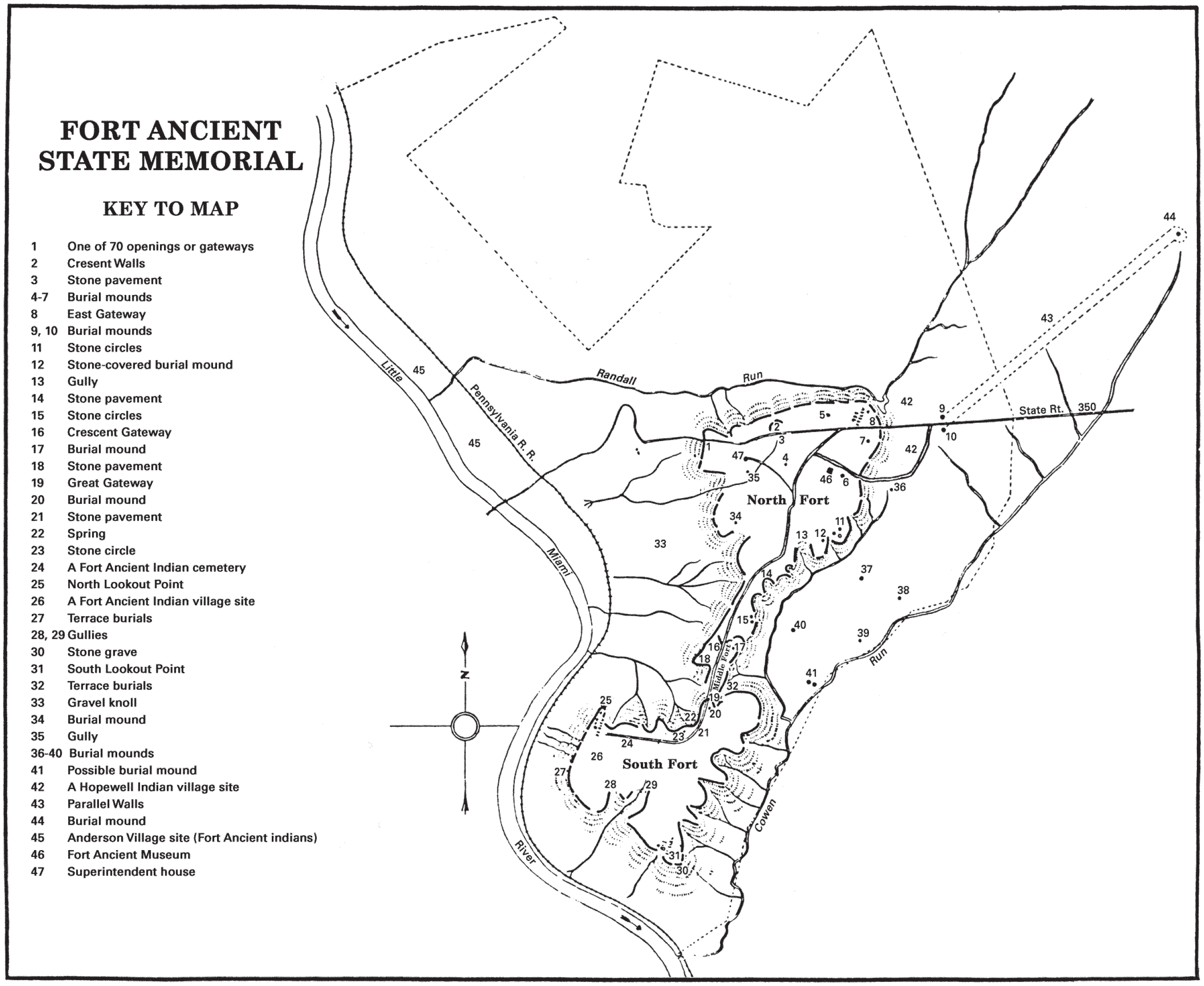

FIGURE 14-2.—Map of Fort Ancient State Memorial.

The "forts" were the last bastion of defense as the Mound Builders fortified themselves into these high places to fend off the barbaric natives invading the river valleys. This idea prevailed into the early twentieth century and today is known as the "Myth of the Mound Builders." The myth, an original idea at the time, was set forth as early as 1820 when Caleb Atwater published his description of the site in the Transactions of the American Antiquarian Society. Atwater, a forefather of American archaeology, visited several hilltop enclosures and concluded they were ancient fortifications, as no earlier group of people would have taken so much time to construct such a site for sport or culling wild herds of game.

Professor John Locke of Cincinnati was another individual who claimed that the site was used for military purposes. Locke surveyed the site and in 1843 published his findings, which were reissued in Smithsonian Contributions to Knowledge, volume 1 (Squier and Davis, 1848); Locke produced one of the best maps of the site (fig. 14-3). Although Locke interpreted the site to be defensive, his map indicated 72 openings within the earthen embankments. Many of the walls and associated gaps close off the heads of gullies, and access to the top of the site would have been easy. Another puzzling idea was that the interior ditch system, an architectural feature resulting from borrow areas for construction of the walls, was viewed as a sort of interior moat to slow down attackers. Later archaeological work at the end of the century was unable to locate structures that would have housed the thousands of people needed to defend such a large area. Likewise, there was no evidence of fences, or stockades within the many openings in the wall. Nor were there mass graves of people who may have died during battle.

The research and excavation work of Warren K. Moorehead during the 1880's and 1890's were the first excavations

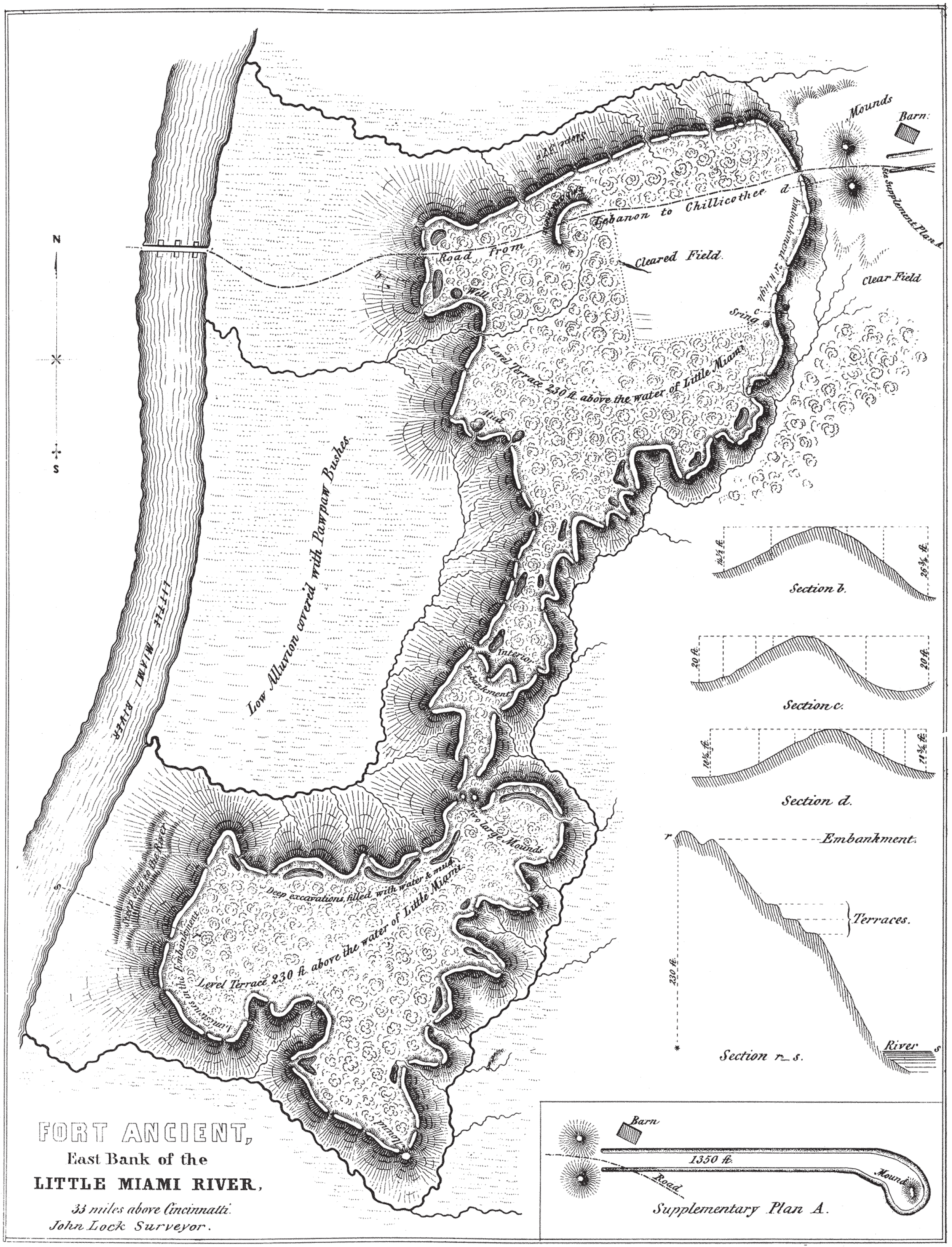

FIGURE 14-3.—Map originally drawn by John Locke in 1843 (from Squier and Davis, 1848, pl. VII)..

at the site. Moorehead excavated seasonally for a total of 43 weeks over several years and published the results of his excavations in two books titled *Fort Ancient Part I and Part II* (Moorehead, 1890 and 1908). It was Moorehead's work that led to the establishment of Fort Ancient as Ohio's first archaeological park in 1891.

William C. Mills excavated the site in 1908 and had recognized there were two separate groups of people, but could not discern the builders of the earthworks. Later, during 1939-1940, the Ohio State Archaeological and Historical Society and the Ohio State Museum located and excavated a large Hopewell village immediately east of the embankments. Many artifacts indicative of the Hopewell were recovered from inside the enclosure in borrow areas that were similar to those from the site outside the enclosure. William C. Mills had excavated at the site in 1908 and had recognized both Hopewell and Fort Ancient cultures, but could not discern the builders of the earthworks.

A FEW OF THE FORT ANCIENT EARTHWORK FEATURES

When the park was first established, it covered 73 hectares, mostly on the hilltop, but today covers over 275 hectares. In Caleb Atwater's recording of the site in 1820, he described a distinct geometric earthen wall on the plateau east of the enclosure. Near the base of two large earth mounds (nos. 9 and 10 in fig. 14-2), two long parallel earth walls (1 meter high, 4 meters wide, and 20 meters apart) stretched northeast 0.8 km and enclosed a small circular mound. The first 154 meters northeast of the two mounds (known as Twin Mounds) was paved with limestone, but much of the graded way has been damaged over the years by plowing and looting. This area of the earthworks lies outside the park, and 13 additional hectares of private property owned by John Ulrich and Dr. Nancy Roszell have been designated an archaeological preserve. The archaeological preserve incorporated a portion of a Hopewell habitation area and a major part of the parallel walls. Fort Ancient is one of six well known hilltop enclosures; the others are Miami Fort (Stop 2), Carlisle Fort, Fort Hill (Stop 11), Spruce Hill, and Fortified Hill. The Hopewell material culture, burial ceremonialism, and geometric earthworks at Fort Ancient also link the site to nonhilltop earthworks such as Hopewell, Mound City (Stop 8), Turner, and Seip (Stop 10).

Robert Connolly (1996) states that 11 radiocarbon dates were used in his study to "assess trends in site chronology and not in an attempt to fix absolute temporal parameters on earthwork construction or occupation" (p. 295). After eliminating the nonreliable or nonrelative dates, Connolly suggests the embankment wall construction was initiated "at the very latest", by A.D. 1, and people occupied the complex until at least A.D. 300 (pp. 295-300).

There are many hypotheses related to the construction of the earthen walls and mounds. It is most likely that limestone hoes and digging sticks were used to excavate the dirt, whereas scapulas of bear, deer, and elk were used to scoop the soil into fiber woven baskets about half the size of a bushel basket. There is an estimated 483,000 cubic meters (530,000 cubic yards) of soil that makes up the entire earthen walls (Moorehead, 1890). This translates to approximately 322 km (200 miles) of dump trucks placed end to end, each containing 15-20 tons of soil, or the distance from Fort Ancient to Cleveland, Ohio. The estimated amount of time to build the site is between 200 to 300 years.

Fort Ancient is divided into three areas (fig. 14-2) according to the stage of construction. The South Fort was constructed first overlooking the river. At the northern tip of the South Fort, an opening, or gateway within the earth wall, called the "Great Gate Way" (no. 19, fig.14-2), provides entrance to a narrower passage where the earthen walls become very apparent on both sides and forms the Middle Fort. Midway through the Middle Fort, heading north, is the passage through the "Crescent Gateway" (no. 16, fig. 14-2, and fig. 14-4A). Continuing northward through the narrow part of the site is the North Fort, a large open area with earth walls that in certain areas approach 7 meters (23 feet) in height (fig. 14-4B). Within the North Fort there are four stone covered, earth mounds (nos. 4, 5, 6, and 7), the "East Gateway" (no. 8), stone circles (no. 11), limestone pavements (no. 3), and a large crescent mound (no. 2, fig. 14-2, and fig. 14-4C). The museum at Fort Ancient is located in this part of the site near mound no. 6. The interior areas between these four mounds are vacant of Hopewell habitation. However, there is a large Hopewell habitation area (no. 42) just northeast of mound no. 7 outside of the earth walls. A second Hopewell occupation has been documented within the enclosure that will be discussed further in this chapter.

After the Hopewell cultural period ended *circa* A.D. 500, the site was abandoned until *circa* A.D. 1000, when a second group occupied the South Fort. Numbers 24 and 26 in the South Fort illustrate the locations of a Fort Ancient culture cemetery and habitation site. Upstream and east of the enclosure the large Anderson Village site (no. 45), another Fort Ancient village, is being eroded by the Little Miami River. The Fort Ancient people lived in walled villages, were agriculturists, and did not build large mortuary earthworks (see Stop 4). In the early speculations about who built the earthworks, it was the "Fort Ancient" people who were credited with building the site of Fort Ancient; it was later learned that the Hopewell people built the mounds, but the name of the site has been retained because it is so well established in the literature.

FORT ANCIENT AS A SOCIAL, CEREMONIAL, AND RELIGIOUS CENTER

After the excavations of the early 1940's, it was soon realized that the site probably served a more ceremonial function for social and religious gatherings. The evidence to support this hypothesis, ironically, had been uncovered in 1898 at the habitation site to the east near the parallel walls. A cache of artifacts, including 59 copper artifacts imported from the Upper Peninsula of Michigan, 44 pieces of galena (possibly from Illinois or southern Michigan), and 8 pendant fragments from the southern Appalachian Mountain region, was discovered in a small area 45 cm by 60 cm less than 0.5 meter below the surface. Over the top of these artifacts were more than 100 sheets of mica imported from North Carolina. All of the artifacts, including embossed copper breastplates,

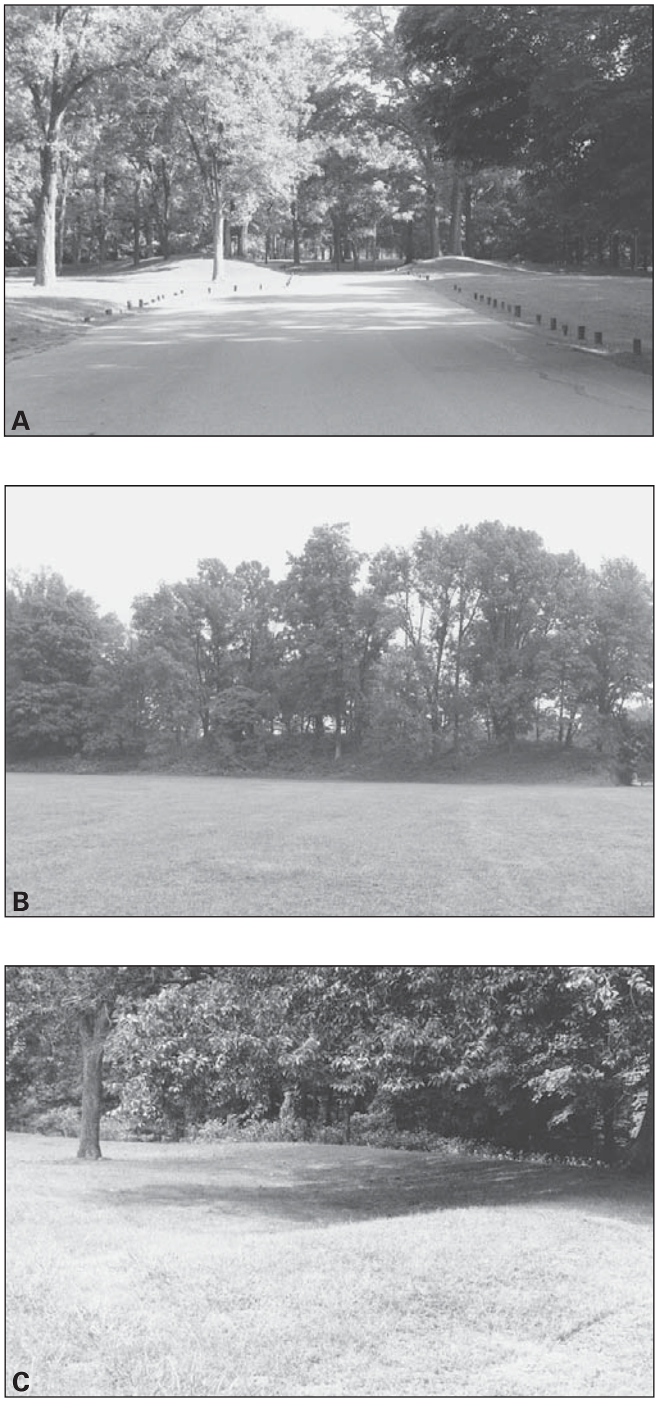

FIGURE 14-4.—**A**, the "Crescent Gateway" marking the entrance to the Middle Fort. **B**, earth walls over 6 meters high located at the northeast part of the North Fort. **C**, the "Crescent Mound," about 55 meters long and located in the North Fort.

copper axes, copper ear spools, reel-shaped copper gorgets, and copper bracelets, had been intentionally fractured. The intentional fracturing may have allowed the "spirit" of that object to be released, allowing it to be available to the deceased in the spirit world.

In the 1980's, near the parallel walls in the habitation site area, a second cache of artifacts was discovered by a farmer while plowing the field. Artifacts in the cache included 17 spear points and curved knife blades made of obsidian from Yellowstone National Park, Wyoming, 11 large ceremonial blades (up to >15 cm) of Wyandotte chert from Harrison County, Indiana (see figs. 8, 9), and 5 quartz-crystal blades from an as yet unidentified source (possibly Arkansas).

Excavation research by the late Dr. Patricia Essenpreis and Robert Connolly (1989) at the habitation site northeast of the earthwalls has uncovered a dense concentration of structures from posthole patterns. The structures are approximately 7 x 7 meters in size and appear to have been roofed. Many shallow pits and firehearths have been detected, and cultural debris has been mapped over an area of 30+ hectares. There is no doubt that this was a habitation area; the question is, was this a special village site with workshops for the crafting of ceremonial goods? Research by the author (Blosser, 1996) at the Jennison Guard site, a Hopewell village in Dearborn County, Indiana, near Miami Fort (see Stop 2, fig. 2-1), has provided evidence of mica cutout manufacturing and projectile-point production unrelated to a ceremonial complex. The material recovered from the Jennison Guard site suggests that perhaps ceremonial items were produced and brought to ceremonial sites or for trade.

During the late 1980's, Dr. David Duszynski, of the Cincinnati Museum of Natural History Planetarium, and Dr. Patricia Essenpreis (1989) focused on specific gaps in the embankments and the geometric alignments in the area of what are called the "Four Corners Mounds" (nos. 4, 5, 6, and 7). They hypothesized that the north, south, east, and west orientation of the mounds, combined with key gaps in the walls, lined up with the sun and moon seasonally to provide a type of calendar or observatory to help maintain annual repetitions of seasonal ceremonies and special events. If their hypothesis is correct, individuals may have gathered at a specific mound (fig. 14-5A) on a certain day of the year and watched the sun slowly rise through a U-shaped opening in the earthen wall (fig. 14-5B). The only solar alignment accurately demonstrated is the summer solstice on June 21. Two lunar alignments also are recorded as the maximum and minimum northern moon ascendance. This lunar cycle requires 18.6 years to complete. It is also interesting to note the geometric precision of the earth walls between the maximum and minimum northern moon rise. At midpoint between the two alignments is the gap associated with the summer solstice sunrise. Interestingly, this same opening marks the midpoint of the two lunar alignments that occur every 9.3 years, suggesting lunar alignments may have marked when specific decadal events were to have taken place. Other solar or lunar alignments are possible (fig. 14-5C), however, and more research is needed to test these hypotheses. One interesting "potential" alignment is the Winter Solstice sunrise. From the northwest mound and two openings to the south of Ohio Route 350, there is a 2° variance from a perfect align-

FIGURE 14-5.—**A**, one of the “Four Corners” mounds, which are 164.7 meters apart. Facing northeast in the North Fort, alignments with the sun and moon have been demonstrated by aligning the mounds with openings in the earth walls. **B**, standing on the southwestern mound, one can see the sun rising through this opening in the wall at 6:08 a.m. on June 21, the day of the summer solstice. **C**, standing on the southwestern mound, one can see the maximum northern moon rise through this gap in the wall, which happens every 37.2 years.

ment. It was found that the Civilian Conservation Corps in the 1930’s re-contoured portions of the earth walls and the openings within the walls. Since it had been established that the Summer Solstice opening had approximately 50 cm of fill resulting from the Civilian Conservation Corps reconstruction, the possibility exists that the 2 degree difference may be the result of their work as well.

More recent investigations at the site have changed the way archaeologists view Fort Ancient. After twelve years of monitoring and observing artifactual material exposed at the site the author recognized the first Hopewell village habitation within the North Fort enclosure. This hypothesis was later substantiated by Dr. Connolly when he excavated the area where the new museum and was to be located. According to Sieg (1996), four domestic structures and a possible fifth, were oriented in an arc shaped pattern. Two radiocarbon samples were dated from Structure Two posts: the first was 1830 ± 90 years B.P. (A.D. 120) (ISGS-3295), and the second was 1890 ± 70 years B.P. (A.D. 60) (ISGS-3296). “When calibrated, the intercepts at one sigma overlaps in the period from A.D. 83-231” (Sieg,1996). Connolly and others (1995) indicates the dates of site construction ranges from 100 B.C to A.D. 100. Sieg (1996) suggests that the structures may have been constructed after the embankment walls were built. The total extent of this habitation area has not been determined.

Current research by Ted Sunderhaus, Cincinnati Museum of Natural History research assistant, has focused on habitation debris at other locations within the Fort Ancient property, and has been looking into the relationships between the ponding areas and the ceremonial symbolism of the site. He has also located and reconstructed several stone circles and stone rings that have never been documented until now.

While 2 + 2 will always equal 4, the science of archaeology changes to reflect the current technologies of the day. What was thought to have been “gospel” truth in 1900 was scoffed at by the 1960’s. Today we look back and chuckle at some of the interpretations of the 1960’s. Who knows what will be recovered in the years ahead that will once again change the way we look at Fort Ancient?

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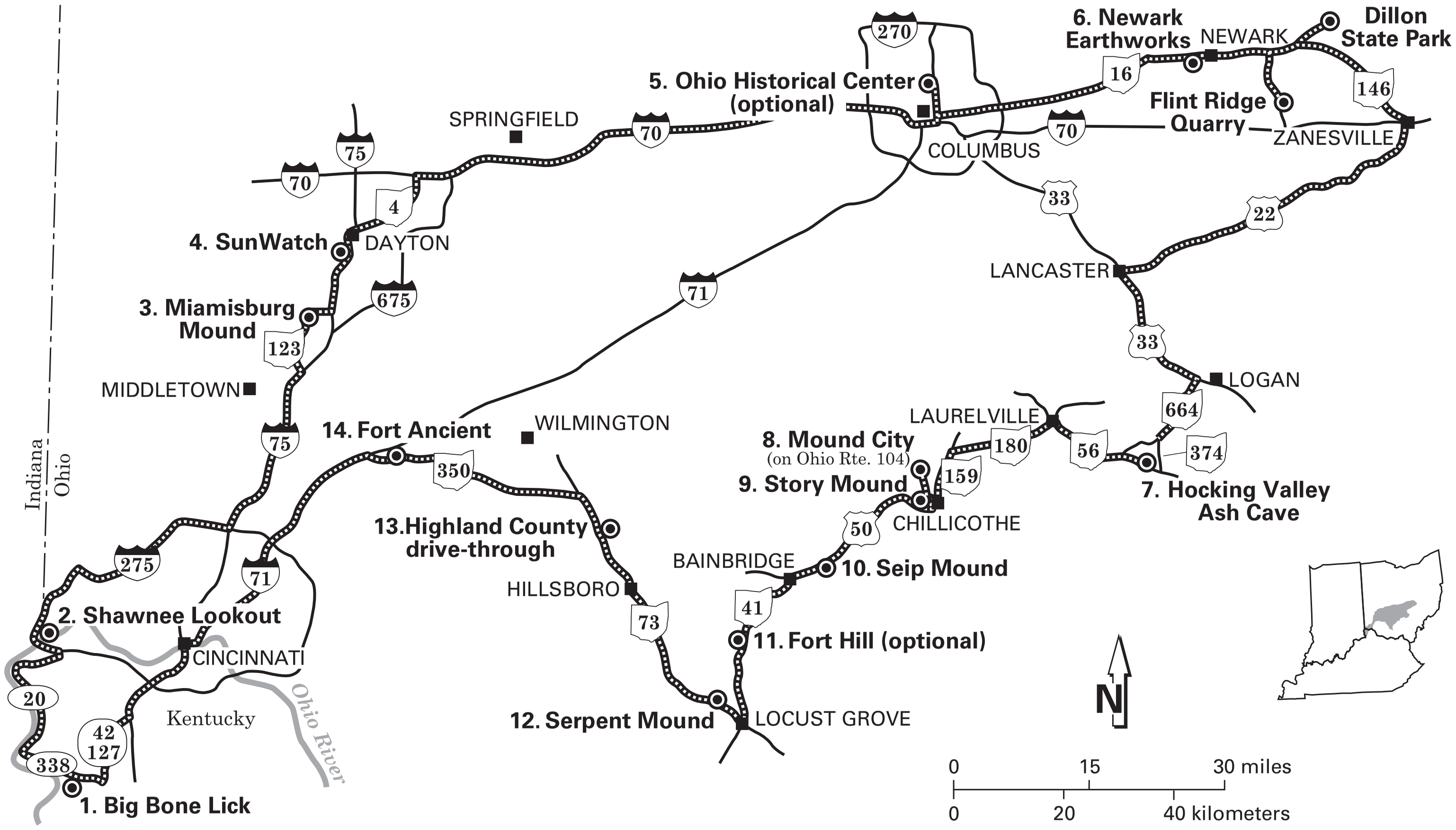

FIELD TRIP MAP AND STOPS