SECTION D

Bonus Case Studies

CASE STUDY

The mounds and earthworks that dotted the landscape of the Eastern Woodlands were of great interest to the first North American archaeologists. Much of the early scholarly attention focused on spectacular earthworks in Ohio, as discussed in Section A, as well as in Chapter 1 (Box 1.1). Bonus case study D.7, "The Hopeton Earthworks: Using New Technologies to Answer Old Questions" is also relevant. However, less spectacular earthworks also existed in places such as New York State, and many of these constructions received relatively early investigation. One of these earthworks was at the Ripley site excavated in 1906 by Arthur Parker (see Section E.1). The history of investigations at the Ripley site illustrates changing perspectives, methods, and research questions over a hundred years of study beginning in 1904. This case study provides a concrete example of how North American archaeology changed and developed during this period. As you read about the Ripley site, notice how research approaches to the site changed. Try to relate the research focus in the most recent studies, beginning in the late 1980s, to what you have learned about contemporary archaeological practice.

D.1. INTERPRETING THE RIPLEY SITE

A Century of Investigations

Sarah W. Neusius

For more than a century, a small knoll in southwestern New York, located along the bluff line of Lake Erie's southern shore, has been attracting people interested in the Indian past of North America. Dewey's Knoll, as this spot is called, is easy to overlook, and few suspect it of being significant historically and archaeologically. Although the commanding view of Lake Erie from this knoll is inviting enough that a local church has often held Easter sunrise services here, there are no ruins or other obviously ancient features. The farmhouse adjacent to Dewey's Knoll is from the mid-nineteenth century, but old farmhouses are not unusual in southwestern New York. Yet this ordinary-appearing area is the location of the Ripley site (Figure D1.1), which once contained a small crescent-shaped earthwork, and as a place to which collectors and

FIGURE D1.1 Location of the Ripley Site in southwestern New York State.

archaeologists have returned often since the nineteenth century. Like so many of North America's earthwork and mound sites, the earthwork at the Ripley site has been rendered invisible by plowing and erosion, but it remains significant for what it can tell us about the past. In addition, the history of investigations and interpretations for this site illustrates the development of North American archaeology.

Ripley was long viewed as a village and cemetery of late sixteenth-century Erie Indians, but work that my colleagues and I did in the late 1980s and early 1990s (Neusius et al. 1998) suggests that it should be interpreted in an alternative manner as a mortuary encampment used over several centuries. I will present our argument for interpreting the site differently after sketching other work and perspectives. The story of these various investigations at Ripley will introduce you to the site, but it will also demonstrate how complex and fascinating the puzzle of archaeological interpretation can be.

There are some things about the Ripley site that are not in dispute. This site is unequivocally Late Prehistoric and/or Protohistoric based on radiocarbon dating, ceramics, and a few Historic trade items. We know that people first used this site several centuries after AD 1000 and that late in the sixteenth century the site had some use. The inhabitants of southwestern New York at this time are generally believed to have been Northern Iroquoian tribal groups. In the voluminous historical resource known as the *Jesuit Relations* (see Thwaites 1959), the historic tribe is identified as the *Nation du Chat* or the Erie Indians. The Erie were defeated by the Seneca in the mid-sixteenth century and subsequently ceased to exist. While the volume of materials recovered from the Ripley site over the years suggests that it was a reasonably large and important place, the actual site area is not great; in fact, it seems to be largely confined to an area of about 2 hectares (5 acres) on Dewey's Knoll itself. In addition, burial pits are the primary type of feature on the southern half of the knoll, while other features, including postmolds, are more concentrated closer to Lake Erie in the northern center of the knoll. The earthwork may have been a circle originally, but it was a crescent opening toward the lake when first mapped.

The first known account of the Ripley site is attributed to George Morse, who remembered the site from his boyhood in the 1820s (Sullivan, Hunt and Wilkinson 1996). Morse described a "breast-high" C-shaped earthen ring whose two ends extended to the bluff edge. He said that his father plowed the earth ring down before planting corn on Dewey's Knoll in 1826 and reported that many artifacts came to light as the field was worked. He also described the presence of a stone mound that fell into Lake Erie when the bluff caved in and contained at least one human skeleton. The Ripley site location is recorded in an old county history (Edson 1875) as well.

Although not as well known today as those of Ohio, earthworks like the small ring or crescent at Ripley were fairly common in western New York and Pennsylvania. An early account of the antiquities of New York by Ephraim Squier (1851) recorded large numbers of enclosure sites that were circular, oval, or even rectangular, as well as linear or topographically aligned. Other observers also recorded this phenomenon and wondered whether these constructions were sacred enclosures or defensive fortifications (Cheney 1859). In the twentieth century, the idea that these earthworks were the bases of defensive palisades for fortified villages became the favored notion (Engelbrecht and Sullivan 1996). The Ripley site has long been considered this type of fortified village with an associated cemetery. However, in the nineteenth century, before the majority of the earthworks were obliterated by farming or other activities, it was often concluded that these variable constructions had a variety of functions. This did not mean, of course, that the matter was systematically investigated. Unfortunately many of these earthworks were destroyed before archaeology had matured enough to realize the importance of carefully investigating their nature.

In keeping with this pattern, although the Ripley site was known in the nineteenth century, little was learned about it. Other than the collecting of artifacts by antiquarians and curiosity seekers and the recording of the site's existence, investigations were not done. Meanwhile the earthwork was leveled by plowing and the calving off of undercut sections of the bluff edge went on at an unknown rate. This situation did not change until the first systematic excavations were done, at the beginning of the twentieth century.

EXCAVATING FOR MUSEUM COLLECTIONS

In the wake of the 1893 World's Columbian Exposition, museums all over North America began to seek ethnological and archaeological collections. It was clear from the response to the anthropological exhibits at this fair that the public was interested in American Indian antiquities and cultures. It was in this context that excavation was first done at the Ripley site, by archaeologists affiliated with museums.

Mark R. Harrington from the Peabody Museum at Harvard was the first archaeologist to excavate at Ripley. From July 23 through September 17, 1904, Harrington excavated six trenches between the rows of the plum trees in the orchard then found on Dewey's Knoll. Harrington did not write a report of his work, but his field notes and the collections he made have been curated at Harvard. The archaeologist reported that he had located 70 pits in the trenches and that 31 of these contained human burials. He also believed that he had encountered four oval-shaped structures or "lodge-sites." Included in Harrington's collections were ground and chipped stone artifacts, ceramic sherds, stone and clay pipes, a relatively large number of worked bone items, and pieces of refuse bone and shell. Glass and brass trade beads in several burials indicate interment after the arrival of Europeans in the Americas (Sullivan et al. 1996).

Both Harrington and Arthur Parker were protégés of Frederick Putnam. In fact, Harrington married Parker's sister, and the two men were close friends throughout their lives. Thus, it is no surprise that after being hired by the New York State Museum and setting out to acquire archaeological materials on New York's Indian past, Parker conducted excavations at the Ripley site where Harrington had previously worked. Between 1905 and 1910, Parker excavated at a number of sites in western New York, but the work at the Ripley site in 1906 was the most significant of these. One of Parker's goals was to obtain museum collections indicative of the Indian past of New York State. Unlike Harrington, Parker published a description of his findings in a New York State Museum Bulletin (Parker 1907). In this report, which has been described as a "landmark in the history of American archaeology" (Fenton 1968:12), Parker both describes his excavation in detail and sets forth an interpretation of the site—as a fortified Protohistoric Erie village with cemetery.

Nonetheless, Parker's work at Ripley differs in at least two ways from more contemporary archaeological work. First, his excavation techniques, though good for his time, were quite different from the detailed excavation methods used today. Parker staked out trenches across the site between the rows of the orchard located on Dewey's Knoll. His workmen removed soil from a part of the trench, throwing the unscreened dirt to the side. Parker then examined the cross section to look for pits and artifacts, even undercutting the fruit trees if necessary. Parker carefully troweled the features and collected the "important specimens" individually, while refuse materials, including animal bones, potsherds, and lithic debitage, were bagged together. Items found elsewhere than in features were simply labeled "general diggings." Although a remarkable amount of material did make it back to the New York State Museum, it is not clear how representative the collection actually is (S. Neusius 1996).

Second, Parker's analysis of the artifacts and features is largely descriptive, and his interpretations seem to modern eyes to be less related to the site's artifact assemblages than to general assumptions about Indian sites. He was working in a time when archaeologists assumed a shallow time depth for the Native American occupation of North America. To Parker, Ripley was an Erie site largely because it was located within the area believed to have been inhabited by Erie Indians. It was a "village with associated cemetery" because this was the sort of site expected among the known Iroquoian tribes. It was dated to the Protohistoric no later than AD 1610 because a few historic trade items were recovered. There was little reason to use the assemblages and spatial patterning to consider how many components might be represented or what the function of the site was, and radiocarbon dating had not yet been invented.

ARTIFACT COLLECTORS AND AMATEURS AT MID-CENTURY

After Parker, the Ripley site did not receive sustained professional attention for 80 years. A brief excavation by Alfred Guthe, from the nearby Rochester Museum of Arts and Sciences, was conducted in 1952. Guthe found some postmolds and pits and made a small collection, which is today at the renamed Rochester Museum and Science Center. However, Guthe did not report his findings, and Arthur Parker's interpretation remained the commonly accepted one. The lack of professional investigations does not mean that amateurs left the site alone, however. In fact, local tradition has it that one of Parker's field hands, Everett Burmaster, sold artifacts from the site to make money for beer and other weekend entertainment (Sullivan et al. 1996). Certainly artifact collectors continued to visit the site throughout the next few decades.

More invasive pothunting was done in 1957 by a farmer from northwestern Pennsylvania, Jordan Christensen, who in return for clearing of the scrub growth on Dewey's Knoll was allowed to excavate at the site. Christensen was interested enough to read Parker's report, and as a result, he knew where the cemetery, as opposed to the domestic area at the site, was supposed to be. Thus, he managed to excavate 54 graves, recovering the artifacts and those skeletal remains that interested him. Other skeletal material he simply returned to the excavated pits. In 1992 our team reexcavated a large, looted pit containing only postcranial remains and several mid-twentieth-century items such as a soda bottle. This may have been one of the graves disturbed by Christensen. Although Christensen clearly was a pothunter rather than an archaeologist, he did take some field notes and kept most of his collection intact. While our team was working at the site in the late 1980s and early 1990s, he donated his field notes and collection to the New York State Museum.

After 1959, Dewey's Knoll was plowed, which made surface collecting particularly productive. Quite a few people surface-collected at the site, and large numbers of artifacts were removed. Some of this material is still in local collections, but an unknown number of items were traded or sold out of the area. Essentially these materials are lost to scientific study, since it is doubtful that their origin at the Ripley site is even known to those now holding the artifacts. The same is true for most of the materials recovered by four amateur archaeologists, C. Conklin, W. Wheelock, J. Weber, and G. Schmahl, who excavated at the site between 1962 and 1966. These excavators encountered 66 burials and 52 pit features. There is a plan map of at least one structure, resembling the structures found by Harrington, but very little description of this work beyond a report on the 1962 excavations (Conklin 1962, 1989). The four amateurs divided the artifacts among themselves, which resulted in the eventual dispersion and loss of most of the materials. Fortunately, some of them are curated today by the Rochester Museum and Science Center and the State University of New York at Buffalo.

Surface collection of the site continued into the 1980s, and sporadic collecting along the bluff edge most likely is ongoing. In some ways this activity, as well as excavations by pothunters and amateurs, reflects the extreme interest of the local public in the site, or at least in the artifacts found there. Such interest is gratifying to archaeologists like myself, but it too often is destructive to understanding of the site and the people who lived there. A summary of these various unreported or partially reported excavations was done by our research team in the 1990s (Sullivan et al. 1996).

REANALYZING THE RIPLEY SITE

In the mid-1980s, when my colleague Lynne Sullivan (see the case study in Chapter 11) joined the staff of the New York State Museum, the Parker Collection from the Ripley site was one of the museum's large archaeological collections. Like the site itself, these materials had not been seriously studied since Parker's day. Even then, many analyses that are now routine had never been done. Thus, Sullivan assembled a team of archaeologists including myself to reanalyze the collections, and in 1987 we began to look at the various data sets (Sullivan 1996). Soon, we decided that some additional excavations at the site would be helpful to interpretations: representative assemblages of subsistence remains, lithic debitage, and ceramics, as well as radiocarbon dates on the site, would strengthen comparisons with better-known Northern Iroquoian groups whose sites had been investigated further east in New York.

Thus, after an initial electrical resistivity survey designed to clarify where the older excavation had occurred, we began our own excavations. In 1988 and 1990, test excavations were conducted at the Ripley site under the direction of Phillip D. Neusius, my spouse and colleague, in conjunction with field schools we jointly taught for Indiana University of Pennsylvania (Figure D1.2). Sullivan, other researchers, and students from several institutions also were involved. In addition to the excavations, our team did some systematic archaeological survey of the surrounding Lake Erie Plain and Allegheny Plateau, and interviewed local artifact collectors.

Our excavations showed clearly that there was still potential for investigation of the Ripley site. Concentrating on the nonburial area at the northern end of the site, we found postmold patterns largely intact. We also investigated the midden, which had been deposited on the southeastern edge of the knoll, and explored a possible palisade line on the western edge, deciding that it was a natural rather than cultural feature. Moreover, we collected representative assemblages of lithics, ceramics, and faunal remains, and took the first flotation and radiocarbon samples from the site. The flotation yielded the first tobacco ever recovered from a site in New York State, as well as radiocarbon dates from the fourteenth or early fifteenth century rather than the sixteenth or early seventeenth century. These excavations, as well as more detailed study of the Parker collections, began to suggest to us that the site was not quite what Parker had said (Sullivan et al. 1995). Could Ripley have had a more complicated history of use? Could it have been a special-purpose site rather than a village?

Thanks to funding from the National Science Foundation, we were able to return for a final, larger-scale excavation in 1992, to gather more data relevant to the topics of site function, dating, and structure. In these excavations, we used a backhoe to remove the plow zone in one large block area and in several transects so that we could record the feature patterning in these areas (Figure D1.3). The area exposed in 1992 was approximately 500 square meters (600 yds.^{2}) at the north end of Dewey's Knoll. In this manner we were able to extend an enigmatic line of posts discovered in 1988 and identify a large number of other features. In fact, in that single field season, we encountered and mapped more than 800 features, most of which (ca. 650) were postmolds. Figure D1.4 represents a portion of the features we recorded at the Ripley site.

We approached investigating the Ripley site rather differently from other people who had excavated there. This is not only because archaeological techniques have changed, but because our initial assumptions and questions also contrast with those of earlier generations. For example, unlike our various predecessors at the site, we took some care to avoid

FIGURE D1.2 Test excavations at the Ripley site were conducted in conjunction with the 1990 IUP Archaeological Field School.

FIGURE D1.3 Removal of the plow zone at the Ripley site revealed hundreds of small unexcavated stains like this one, many of them postholes; note two other postholes to the right (marked by flagging tape) and left that have been bisected and partially excavated.

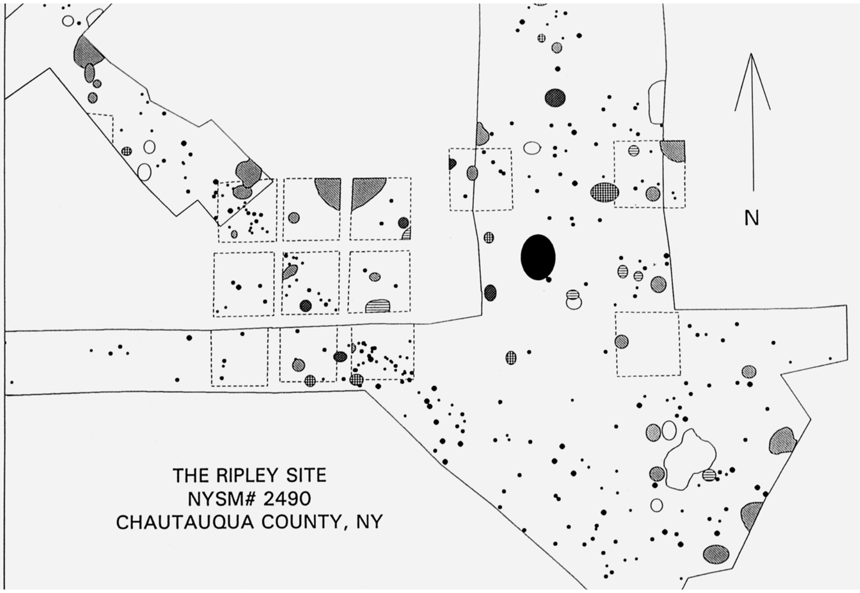


FIGURE D1.4 A portion of the features recorded at the Ripley site showing how trenches cleared in 1992 intersected with test squares dug in 1988 where a partial structure wall was encountered; the structure wall is marked by the linear array of postholes (small dots) running diagonally from northwest to southeast.

most of the human burials. This was because there already was a large sample of known burials, and our research was not directed at finding the fancy grave goods that make good museum specimens or fetch a high price at artifact fairs. Instead, we wanted to examine whether the site really had been a fortified village, what its dating was, and what the artifactual and ecofactual materials from it looked like in detail. Obviously the focus of our work would be excavations at the north end of the knoll, which Parker had designated the village area, and in the midden. Nonetheless, because of the high probability of finding human remains, beginning with the 1988 field season we contacted the Seneca, who were both the closest tribe and possibly the most closely related to the Erie, for whom there are no known lineal descendants. Then in 1992, when we discovered human remains in the village area, these contacts helped us determine how the remains might best be treated.

Our interest in the site, however, began with the collections, and we have remained deeply interested in what the patterning in material remains actually is, as well as in how such patterning informs the site's interpretation. Rather than being interested in the objects for their own sake, we have been concerned with assemblages of different classes of materials, with feature variability, and with spatial distributions. We believe that only these kinds of data will allow us to reconstruct the nature of the Ripley site with any confidence. The data also have given us a perspective on what the site represents that contrasts with Parker's.

First of all, we began our work assuming that the site was a single-component, Protohistoric site dating before AD 1610, but not before the late sixteenth century. This was what Parker had maintained, and it was how the site was perceived by archaeologists. However, the ceramic chronology for western New York isn't precise enough to conclusively indicate so narrow a date. The three main types of ceramics in the site collections are Ripley Plain, Niagara Collared, and Lawson Incised, all of which are believed to date between the thirteenth and sixteenth centuries. The designs and the vessel morphology in the Ripley assemblage are very similar to those in the ceramic assemblage from the Newton–Hopper site, a Late Prehistoric site located near Buffalo (Engelbrecht 1996). However, shell-tempered ceramics, which have been considered diagnostic of very late in the pre-Columbian sequence, are rare at Ripley (less than

5 percent of the assemblage), while most of the assemblage is tempered with grit, a form of temper that ranges more widely in time. If anything, the temper composition of the ceramics might mean that the Ripley site was earlier than Parker thought. In the end, what the ceramics tell us is that the site was utilized between the thirteenth and sixteenth centuries.

Parker also dated the site to the Protohistoric because some graves contained a small number of European items. Reexamined recently, these copper and brass trade items provide a date range between AD 1550 and AD 1580, which is quite close to Parker's estimate (Fitzgerald 1991). There can be no question, then, that the site was used in the Protohistoric period. This conclusion also is confirmed by the glass beads and the smoking pipes included in the various Ripley collections (Drooker 2004). However, it is possible that only some of the site dates to the Protohistoric.

This latter interpretation is more consistent with the distribution of the radiocarbon dates we have obtained from the site, as shown in Table D1.1 (Neusius et al. 1998). One of the 12 dates we obtained (Beta 82410) falls within the expected range, but reanalysis of the feature it came from (92-623B) suggests that the source feature had been disturbed. As a result, we rejected the Beta date as unreliable. All our other dates are from undisturbed, reliable contexts. One group of dates apparently indicates a Protohistoric occupation during the sixteenth century, and the other suggests an earlier occupation, dating to the fourteenth or early fifteenth century. Several dates are more ambiguous and do not clearly sort into one or the other of these two groups. Because the site may not be a simple single-component occupation, as the current suite of dates suggests, we would like to have more radiocarbon dates. The large number of postmolds and lack of clearly defined houses also indicates superpositioning of structures at the north end of the knoll. If the site was occupied only once, such superpositioning should be rare. The possibility remains that Ripley was occupied

TABLE D1.1 Radiocarbon Dates from the Ripley Site

Sample	Provenience	Feature-type	Radiocarbon Date (BP)	Calibrated Date Range (AD)
1. Beta 82409	Feature 92–234	Pit, small to medium, shallow	280 ±69	1470–1680 1745–1805 1935–1950
2. Beta 82408	Feature 92–440	Postmold	340 ±60	1935–1950
3. Beta 82414	Feature 92–678	Fire pit	370 ±60	1430–1655
4. Beta 82413	Feature 92–503	Subadult burial[1]	380 ±50	1435–1650
5. Beta 82407	Feature 92–83	Fire pit	390 ±60	1425–1650
6. Beta 82406	Feature 92–29, Level 2	Pit, large, indeterminate	410 ±70	1410–1650
7. Beta 82410	Feature 92–623B	Pit, large amorphous[2]	420 ±60	1415–1640
8. Beta 82415	Feature 92–469	Pit, small to medium, shallow	480 ±60	1395–1505 1595–1620
9. Beta 82412	Feature 92–541	Fire pit	480 ±50	1400–1485
10. Beta 82411	Feature 92–575B	Postmold	570 ±70	1290–1450
11. Beta 29941	Feature 88–51	Postmold[3]	620 ±110	1220–1470
12. Beta 29940	Feature 88–21	Postmold	710 ±110	1055–1090 1150–1430

1. This sample came from a small fire pit that appears to be a grave fire lit directly over the infant's skeleton as part of the burial activities.
2. One possible interpretation for this feature is that it is a remnant of a trench and feature excavation by Parker or another early excavator.
3. The sample consisted of an actual piece of charred post weighing 35 grams (1.23 ounces).

After Neusius et al. (1998).

without a serious break from the fourteenth through the sixteenth centuries. However, at present we think the existence of two components, separated in occupancy by some period of time, is more likely.

If we can consider Ripley a multicomponent site, what can we tell about how the site was used? Was it actually a village? Did people use the site differently at different points in the past? Feature analysis has suggested to us that it probably wasn't simply a village. For example, the presence of 218 known graves indicates that one of the main uses of the site was as a burial ground, as does the fact that graves comprise the most common type of feature other than postmolds. Another expectation we had about a village site is that hearths at which people prepared food should be fairly common. When we consider all the reported features from Ripley, even those we did not excavate, only 6 percent (30/508) appear to have been hearths or fire pits. In addition, a number of the features identified in this manner were described as grave fires because they were at the top of burial pits. The other pit features from the site vary considerably in shape and size, but refuse disposal does not appear to have been one of the functions, in contrast to what we would expect if the site had been inhabited for a long period of time. Storage pits, another feature expected at a village site, also are rare at Ripley. While the diversity of possible types of pit feature may mean that a variety of activities were taking place when people used this site, diverse activities could mean either that it was a village or that it was used differently each time it was occupied.

Analyses of the lithic assemblage also have contradicted our expectations for a village site. We reasoned that a lithic assemblage from a village should have evidence of the full range of stone tool manufacture because some tools would have been made in the village. However, the predominance of small flakes as well as the lack of **cortex** on the flakes indicates that most of the flintknapping done at Ripley was final-stage shaping or resharpening of tools. There is also some evidence for expedient use of small, local cobbles of chert, but hardly the full range of tool manufacturing. Moreover, we also would expect a wide variety of tools for a site that was a village. The Parker Collection lithics are not particularly diverse in tool types: 62 percent of the tools in the collection are well-made, whole projectile points. There are some, but relatively few, other stone tools (P. Neusius 1996). Interestingly, this contrasts with the composition of the assemblages we have collected ourselves. This lithic assemblage is only 37 percent projectile points, and other tool types are much more diverse as well. This contrast suggests the emphasis on burial features in Parker's excavation as well as our emphasis on the nonburial area of the site. Again, however, if there are two or more components at the site, it also could mean that the site was used differently at different times.

Another type of analysis that might suggest a nonhabitation use for the site involved chemical analyses of the residues on ceramic sherds from Ripley and other sites in western New York. This kind of analysis can indicate whether the plant remains cooked in a pot were grown locally. This study showed that the Ripley residues were anomalous within the group and suggested that the foods cooked in Ripley pots had been grown to the south and east on the Allegheny Plateau rather than on the Lake Erie Plain, where the site is situated. Of course, we don't know if the finding would apply to all sherds from the site. However, transporting grain and other foodstuffs to the site from some distance seems most consistent with a special purpose site rather than with a habitation or village site.

Finally, my own analyses of the faunal remains have contributed to changing perspectives on site use. I expected to find evidence for specific types of animal procurement. Since the site overlooks Lake Erie, it seemed logical that village inhabitants would have taken fish from the lake. Yet fishing does not predominate in this assemblage, which was carefully collected with fine screening and flotation. Only 15.4 percent of the bone specimens are from fish. Another strategy I expected to find evidence of is called **garden hunting**; this is the practice of eliminating competition for crops while obtaining high-quality protein by taking for food the game attracted to fields and gardens (S. Neusius 1996). This strategy, though documented for many horticultural people elsewhere, does not appear to be strongly represented at the Ripley site. Rather, only 1.4 percent of the specimens unambiguously represent animals typical of garden hunting, and it is not clear where deer were procured most often.

Based on preliminary comparison with other Late Prehistoric Northern Iroquoian village sites, I also expected a strong emphasis on selective hunting of highly ranked resources such as deer, elk, and raccoon. Thirty percent of the bone specimens probably do represent selective hunting, but this proportion is much lower than that in other Northern Iroquoian village sites. In addition, there are higher percentages of other animals such as foxes, canids, weasels, squirrels, and porcupines (23.8 percent of the specimens) than have commonly been found in village sites. All of this has led me to suggest that Ripley is not a village site and possibly is a special-purpose mortuary-related encampment. However, further examination of diversity and procurement strategy in Northern Iroquoian faunal assemblages is badly needed because there is no established baseline to show what these assemblages normally look like (S. Neusius et al. 1998).

Considering all that we have found in our analyses of both the Parker collection and the assemblages from our own excavation, our research team has argued that the Ripley site certainly was not a single-component fortified village with an associated cemetery. It is anomalous in too many ways, and it appears to have been a multicomponent site. On the other hand, exactly what the uses of the site were remains more ambiguous. It is possible that it always was a mortuary site at which people camped while engaged in burial rituals. It is also possible that the site's Protohistoric function was as a mortuary encampment, while in earlier times it had been a small habitation or village site.

There also are broader ramifications of our work at the Ripley site. First, since Ripley has been considered the type site for Erie ceramics and other traits, archaeologists may need to reevaluate some basic assumptions. A special-purpose site is less appropriate than a village site as a type site. Second, the common assumption that earthworks like the one at Ripley were bases for village fortifications must be reexamined. In this case, nineteenth-century suggestions that the earthworks of southwestern New York had a variety of functions seem to make good sense. Third, the whole issue of how archaeologists can recognize the use of sites or site types among Northern Iroquoians deserves much more attention. It is certainly not appropriate to simply use size or density of artifacts as the determinant of a village.

Throughout a century or more of study and interest, the Ripley site (Figure D1.5) has been investigated and interpreted in a variety of ways. Different underlying assumptions or ideas have led archaeologists to examine different data sets, ask different questions, and propose different interpretation Amateurs and pothunters also have had their own approaches to exploring the site. This has resulted in a tapestry of ideas and information about the Ripley site that nicely illustrates how North American archaeology has changed from a focus on museum specimens and broad speculations about sites to concern with what assemblages of features and artifacts mean. Attitudes about the excavation of human burials also have changed during this century. What unites our team with Parker, however, is an interest in explaining the site and its contents. At the Ripley site, as in archaeology in general, interpretation is at the heart of the enterprise.

FIGURE D1.5 Aerial view of the Ripley site during 1992 excavations showing trenches tarped for the evening; bright object to the left is a backhoe.

DISCUSSION QUESTIONS

1. What and where is the Ripley site? When was it first professionally excavated? When was the last professional research conducted at this site?

2. In what ways were the goals and methods of early professional investigators at the Ripley site like those of the artifact collectors who later worked at the site? In what ways were they different?

3. In what ways were the methods and interpretations of early professional investigators at the Ripley site like those of the most recent research team? In what ways were they different?

4. Do all earthworks have to have the same purpose? What functions seem likely for earthworks? How would you go about testing the function of earthwork sites?

CASE STUDY

In Box 2.2, we offered perspective on the importance of interdisciplinary research in contemporary archaeology. The complex questions archaeologists address often require the integration of many lines of investigation. This case study is about a large interdisciplinary research project at the Koster site, an Archaic period site located in west-central Illinois. Specifically, this research focused on changes in the environment and in human strategies during the Hypsithermal interval, a warm–dry mid-Holocene period mentioned briefly in the chapter. The Koster case highlights the need for scholarly teamwork in addressing complex archaeological problems and reviews the development of a project-related archaeological research center that was opened to the public. Although the work described here took place in the 1970s, the story of the Koster Project exemplifies the complexity of archaeological research problems and illustrates one way in which archaeologists and other scientists can work as a team. As you read this case study, pay attention to the many different kinds of data generated. Could human cultural ecology have been explored as effectively without the contributions of all the researchers involved?

D.2. IT TAKES A TEAM

Interdisciplinary Research at the Koster Site

Michael D. Wiant and Sarah W. Neusius

PROLOGUE: KOSTER SITE EXCAVATION, KOSTER FARM, GREENE COUNTY, ILLINOIS, 1975

We finally had reached Horizon 11, the remains of an Early Archaic settlement more than eight millennia old, at the depth of 29 feet (9 m) below the present-day ground surface. This deposit had been our objective since it was discovered in 1970 at the bottom of a 6-by-6-foot (1.8 × 1.8 m) shaft. In that test pit, an excavator had unearthed the remains of an ancient campfire with red-orange sediment, ash, and fragments of wood charcoal so well preserved that the fire appeared just extinguished, rather than 8500 years ago (Figure D2.1). For six summers, we had used shovels to excavate an immense hole in Theodore and Mary Koster's 3-acre cornfield, removing vast amounts of sediment while uncovering the remains left by those who had repeatedly occupied this spot over the millennia. The hole measured 40,000 square feet (3715 m^2) at the surface. For safety, we had terraced the walls, installed pumps around the perimeter of the excavation to lower the water table, and placed pumps in the excavation area to remove rainwater.

Now, with these precautions in place, we kept digging. In a 1512-square-foot (140 m^2) area at the bottom of the hole, we explored the remains of another ancient settlement. Setting aside our shovels, we excavated with trowels, brushes, and bamboo picks to expose each and every artifact larger than an inch (2.54 cm) and map its location. In many areas, we mapped the location of every artifact bigger than a quarter-inch (0.64 cm) and placed it in a coin envelope marked with the depth and horizontal position

FIGURE D2.1 An excavator uncovers evidence of a hearth in one of the original Koster test pits in 1970. Note flecks of black charcoal, gray areas of ash, and white speckles of mussel shell. The sediments themselves have been reddened as a result of the fires in this ancient hearth.

of the specimen. From this level the terraced walls of the excavation rose skyward, and when we raised the tarps protecting them, we could see a layer cake of what remained of camps and villages occupied between 8500 and 4000 years ago.

While a crew of 40 Northwestern University Archaeological Field School students continued the excavation at the Koster farm, others worked in Kampsville, a small town on the bank of the Illinois River, 9 miles (15 km) and a ferry ride from the Koster site. Structures that were once homes, a hardware store, a funeral parlor, and a post office now served as a paleoethnobotany laboratory, an archaeozoology laboratory, a central data processing and flotation laboratory, and a lithic artifact analysis laboratory. Within, a variety of scientists and students studied the objects we'd unearthed days before. At night, professors and students alike came together to discuss what Archaic period life had been like in the Illinois River valley.

During the past century, there have been many noteworthy multidisciplinary archaeological expeditions, but the Koster Project conducted during the 1970s remains an extraordinary example of the potential of coordinated archaeological research. We were fortunate to have been part of the team that excavated and interpreted the Koster site. In this case study, we introduce the many facets of this project, which was only one of the projects undertaken through the Kampsville research facility.

ORGANIZING ARCHAEOLOGICAL RESEARCH: STUART STRUEVER'S VISION

The Koster Project began with the vision of Stuart Struever, which transformed the practice of archaeology in the lower reaches of the Illinois River valley. Raised along the Illinois River, Struever had discovered prehistory as a young man in the farm fields around Peru, Illinois, where he collected artifacts and organized them into a museum display in his grandparents' home. Later, while a graduate student at Northwestern University, Struever became intrigued with the concept of a long-term, multidisciplinary archaeological program that could focus on complex problems like the reconstruction of regional subsistence and settlement systems. He saw the typical organization of North American archaeological projects at that time as limited by a failure to incorporate multiple researchers with distinct specialties. His ideas began to crystallize while he was working on his dissertation on Woodland subsistence-settlement systems, using the lower Illinois River valley as his research universe.

In 1963 Struever began to "conceptualize the idea of building an independent archaeological research center with a staff, facilities, and budgets necessary to sustain a long-term, regional scale, multidisciplinary research program" (Struever, personal communication, September 16, 2003). Five years later, he published a paper arguing that although advances in anthropological theory had fostered new and exciting problems for archaeology, solutions to these new problems required tools not then available. He concluded that archaeology lacked the institutional framework necessary for archaeologists, natural scientists, and technicians to work together on a problem. Both facilities and funding were inadequate for the kind of long-term cooperation necessary (Struever 1968b:150). With the discovery and subsequent excavation of the Koster site, Struever would have the opportunity to apply these ideas.

DISCOVERY OF THE KOSTER SITE: AN EXCEPTIONAL RESEARCH OPPORTUNITY

In 1961, following his excavations at the Koster Mound Group, Gregory Perino of the Gilcrease Institute in Tulsa, Oklahoma, had excavated a single test pit in a cornfield behind the Koster farmhouse. He discovered Early Woodland and Late Archaic artifacts and mentioned the finds to Struever. In 1969 Struever and his field school students, who were then excavating at a nearby Middle/Late Woodland site (see Chapter 12), decided to do some work at Koster. They were studying the rise of a local culture called White Hall. Encouraged by a local farmer who had discovered White Hall pottery at the Koster site, Struever and his field school arrived at the site late that summer to excavate a series of test pits.

Before long, the team discovered a stratified, multicomponent site in which prehistoric occupations could be clearly delineated. In each of the six Archaic period (10,000–3000 BP) cultural horizons identified that season, they found well-preserved plant and animal remains, large quantities of debris such as limestone and chipped stone debitage, and a variety of chipped stone, ground stone, and bone tools (Houart 1971). Here was an opportunity to explore a relatively unknown period of prehistory. The Koster site soon became the focus of the lower Illinois River valley archaeological program, and this program grew into the multidisciplinary research center, then known as the Foundation for Illinois Archaeology, of which Struever had been dreaming.

The Koster site excavation provided the chance to develop an institutional framework. A cadre of natural scientists, archaeologists, and students was drawn by the opportunity to explore an exceptional archaeological site (Struever and Holton 1979). Kampsville, an old riverboat town struggling in the new era of trucking, had numerous empty houses and storefronts to house the facilities of Struever's archaeological enterprise. Not surprisingly, fund-raising proved to be the most challenging endeavor, but with the guidance of Chicago businesspeople, Struever publicized the Koster Project throughout the United States. American archaeological sites long in the shadow of those in distant lands were illuminated by this exposure, and private funding followed.

By the mid-1970s, more than 200 students, staff, and faculty, including Struever's Northwestern University colleagues Jim Brown, Jane Buikstra, and Bob Vierra, were assembling each summer to work and study in a grassroots archaeological institute headquartered in Kampsville. The excavation of the Koster site proceeded in full view of an unprecedented audience frequently numbering more than 1000 visitors each week, many of whom had read national news stories about the site. The visitors peered over the rim of the excavation and watched four dozen students reveal the past, while guides provided information on what had been found. Many visitors would then drive the 9 miles to the Kampsville Archeology Museum to see ancient artifacts in interpreted museum exhibits.

Struever seized the opportunity to transform Kampsville by establishing a dispersed campus of laboratories, offices, dormitories, a library, museum, collection repository, and lecture hall, all nestled among the homes and businesses of the community. The Koster site was the centerpiece of archaeological research for a decade; but at the same time, archaeologists explored Archaic and Woodland period habitation and mortuary sites elsewhere in the region. We transported artifacts and a variety of samples back to the laboratory complex in Kampsville, where they were analyzed, often quickly enough to inform those in the field, who, in turn, could adjust excavation strategies if necessary. The flotation laboratory alone processed hundreds of half-bushels of sediment per day and sent samples of carbonized plant remains and small animal bones to the paleoethnobotany and archaeozoology laboratories, respectively. Archaeologists, botanists, geologists, **malacologists**, palynologists, zoologists, and many others worked together to uncover part of the past and develop an understanding of the natural and human history of the region.

The integration of the enterprise was articulated in Archaeology and the Natural Sciences, a field school course in which students, staff, and faculty had the opportunity to hear firsthand from those exploring the information potential of bits and pieces of the past. Guest lectures by leading archaeologists and scientists provided a unique vista of contemporary thought and research as well as constructive criticism.

All this, and more, created an unparalleled learning environment that fueled conversation and study well into many nights. Struever's experiment in the organization of archaeological research created an extraordinary milieu of discovery, expertise, information, and opportunity. Not only was it a heady time, but a surprising number of today's archaeologists passed through Kampsville in those years, going on to incorporate parts of Struever's vision in their own understanding of how to do archaeology. We were fortunate to be two of these young scholars.

EXPLORING THE ARCHAIC PERIOD: THE KOSTER PROJECT RESEARCH DESIGN

In the midcontinent, investigations of shell mounds in Kentucky during the 1930s and 1940s provided the first substantial inventory of preceramic material culture and evidence of cultural sequences. A decade later, the excavation and analysis of the Modoc Rock Shelter at the edge of the Mississippi River valley in southwestern Illinois signaled a major paradigm shift in the study of the Archaic period (Fowler 1959). At Modoc, researchers departed from the then prevalent classificatory approach by interpreting the sequence of occupations in terms of ecological adaptations. These were thought to have evolved from generalized foraging (10,000–8000 BP) to more localized adaptations (6000–4000 BP). Stratified deposits elsewhere further refined our understanding of Archaic period cultural ecology. The Koster site provided another, and in some ways a better, opportunity to explore the Archaic period.

The Koster site is located in Greene County, in west-central Illinois, in the lower reach of the Illinois River valley (Figure D2.2). In this stretch of its course, the Illinois River is deeply entrenched in a bedrock valley. Precipitous limestone cliffs mark the edge of the valley, some rising more than 200 feet (60 m) above the valley floor. **Loess**, a windblown sediment deposited near the end of the Pleistocene epoch, mantles the bedrock and forms the upland surface. The wall of limestone is broken only where tributary streams enter the valley and by steep ravines that channel precipitation runoff from small drainage networks reaching onto the upland surface. In many instances, sediment eroded from the upland surface has accumulated, creating landforms known as **colluvial** or **alluvial fans**, depending on the process by which sediment was deposited.

One such fan may be found on land formerly farmed by Theodore Koster. Here an intermittent stream, Koster Creek, which is rarely more than a few feet wide when flooded, reaches from the upland surface to the Illinois River floodplain. Historically, at least, Koster Creek emptied into the now-drained Calamus Lake, one of many large, shallow backwater lakes in the area. As the stream's drainage network

FIGURE D2.2 The location of the Koster site and the town of Kampsville in the lower Illinois River valley.

expanded, sediment eroded from its tributary headwalls and valley flanks accumulated where the creek enters the Illinois River valley, creating what is now known as the Koster fan. People lived on the surface of the Koster fan and abandoned it many times during the Archaic, so that the remains of their settlements have been buried and preserved in its body.

Unlike stratified deposits in many rockshelters, which often consist of thin, laminated beds of artifact-bearing sediment, the Koster fan consisted of artifact-bearing strata separated by relatively thick deposits almost entirely devoid of artifacts. Furthermore, Koster's inhabitants were not limited by the walls of a rockshelter, and their settlement could have been larger and longer term, while evidence of a wide range of activities might be preserved there. Finally, the long sequence of occupations at Koster provided a view of culture over a long span of time at a single site. What an opportunity to consider the complex Archaic period dynamic between environment and culture!

At the outset, Koster site research addressed two concerns: (1) a cultural chronology for the Archaic period in the lower Illinois River valley and (2) cultural development during the Middle to Late Archaic periods. The former required careful excavation of the stratified deposits at Koster and recovery of charcoal in sufficient quantities to assay its age. The latter required information on the environment around each settlement, the activities undertaken during each occupation, and comparisons between the settlements at different times.

Archaeologists have long been interested in how human societies adapted to environmental change, and those who study the Archaic period in the Midwest are particularly concerned with how the region's hunter-gatherers coped with environmental change during the Hypsithermal interval (Phillips and Brown 1983). The Hypsithermal interval, which occurred between 10,000 BP and 4000 BP, is the warmest postglacial interval to date. During the Hypsithermal, mean surface temperatures may have been as much as 3.6°F (15.8°C) above those recorded today. At the same time, an influx of dry Pacific air created more arid conditions. As a consequence, there was a significant change in vegetation and other aspects of the environment. In the American Midwest, for example, prairie expanded at the expense of forest, changing the distribution and abundance of a variety of plants and animals and, presumably, the way people lived. Koster provided an opportunity to search for evidence of climate change and how it may have influenced human history.

As excavation and analysis proceeded, a revised research design emerged that addressed four problems:

1. Refining the Archaic period cultural chronology for the central Mississippi drainage based on Koster site's clear, layered stratigraphic record,
2. Using the large excavation exposures to delineate what people were actually doing (their activities) during each occupation,
3. Reconstructing selected aspects of the regional and local paleoenvironment from the diverse but complementary indicators preserved in the deposits,
4. Formulating and testing models of cultural–ecological adaptation in the lower Illinois River valley area for both Archaic and Woodland occupations

FIGURE D2.3 Tub flotation in the Illinois River: as a sediment sample is poured by one person, the washtub is rotated back and forth, keeping light materials from dropping to the mesh bottom of the washtub as the sediment disperses. This floating material will be skimmed from the surface of the water.

Undertaking an ambitious research agenda such as this was beyond the means of a single scholar. The complexity of these problems required the skills of a variety of scholars; it took a team.

Some regional-scale studies had already provided a foundation for Koster site research. Of particular note is a study on the early vegetation of the lower Illinois River valley (Zawacki and Hausfater 1969), which drew on U.S. government land survey notes and plat maps as well as other sources. In addition, Meyers (1970) explored the distribution and abundance of chert resources used in making stone tools, and Parmalee et al. (1972) provided information on the Prehistoric animals in the region.

The significance of flotation to Koster site research also cannot be overstated. The recovery of small-scale plant and animal remains in large quantities through flotation was particularly important in addressing the paleoenvironmental and ecological questions raised in the Koster research design. Archaeologists had long sieved or screened excavated sediment, collecting objects that did not pass through and casting off the sieved sediment. However, as archaeologists developed a greater interest in subsistence and settlement during the mid-twentieth century, they began to realize that their samples were biased against small items. Struever was among those who recognized the presence of a variety of small-scale objects such as carbonized plant remains and animal bones in screened sediment. He developed "tub flotation" (Figure D2.3), a means to process large quantities of sediment and recover small-scale items (Struever 1968a). Larry Noble, a Northwestern University geologist, assisted with the development of a second step, chemical flotation, by which carbonized plant remains were readily separated from the remainder of the sample. In the end, the Kampsville Flotation Laboratory processed more than 10,000 flotation samples from Koster and provided unprecedented amounts of plant and animal remains to the botany and zoology laboratories. It is fair to say that the data generated revolutionized how we see the past.

THE ARCHAIC PERIOD AS SEEN FROM KOSTER: THE PATH TO SEDENTARY LIFE

We have a more sharply focused view of Archaic period environment and culture thanks to information from Koster and related sites studied by Kampsville archaeologists. A brief recapitulation of our present understanding illustrates the value of interdisciplinary research undertaken at a regional scale.

Using geological studies, analysis of artifacts, and abundant and well-preserved plant remains, Koster Project scientists developed a fine-grained chronology of geological events and Archaic period occupation. They documented the timing of episodes of deposition and erosion of fan deposits and determined that 19 distinct cultural components dating between roughly 9000 BP and 3000 BP could be recognized (Figure D2.4).

Studies of the geology and geomorphology of the Koster site, the Illinois River valley, and a variety of other archaeological sites chronicle landscape history and the forces that shaped it. Of particular interest was the depositional history of the Koster fan (Butzer 1978; Hajic 1990). Hajic's research drew on the analysis of stratigraphic exposures in the excavation area, continuous sediment/soil cores taken from the Koster fan, mechanical analysis of sediment, and a study of regional surficial geomorphology. Hajic (1990:69) concluded that regional paleoenvironmental changes, such as those associated with the Hypsithermal, correlated closely with the sequence of fan formation and stability at Koster. Comparison between the Koster fan and a similar deposit at the Napoleon Hollow site, some 40 miles (65 km) upstream, suggested that both sequences reflected these adjustments. Furthermore, because the depositional history of these fans is patterned, it is possible to predict where one might encounter similar deposits (Wiant et al. 1983). One of the most important conclusions to be drawn from these findings is that a substantial proportion of the Archaic period landscape is buried, especially in floodplain and valley margin settings. In other words, the archaeological record for such early times is incomplete because of the natural burial of landforms. This means that when one considers where people lived during the Archaic, as well as how they acquired food and other resources, this partial exposure of sites must be taken into account. Other sites and the information they contain may still remain buried.

FIGURE D2.4 The north wall of the main excavation block at the Koster site, with tarps rolled back to reveal the layered strata within which Koster researchers identified 19 distinct cultural components.

Evidence for the impact of the warmer and drier Hypsithermal interval on vegetation and fauna in the Illinois River valley remains equivocal. A single sequence of pollen samples from Koster suggests a relatively dry, open forest that persisted through the Middle Archaic, giving way to wetter woodlands later. Analysis of the land snails found at Koster generally supports the palynological study. Dry and open conditions persisted through the late Middle Archaic, until about 5700 BP, after which moister conditions prevailed.

Drawing on a variety of research, but especially plant remains, Asch et al. (1972) suggested that local rather than climatic factors are more important with respect to the distribution of forest and prairie in the Illinois River valley. In their view, the rugged valley margin landscape provided shelter for trees and seedlings, and forest has persisted here throughout most of the Holocene. Evidence for vegetation in the Illinois River floodplain itself remains sketchy. Butzer (1977, 1978) suggested expansion of bottomland prairie at the expense of forest at the outset of the Hypsithermal. Most researchers, however, have envisioned the persistence of forested areas within the relatively well-watered floodplain even if prairie was expanding in the uplands. Further work is required to determine which viewpoint is the more valid.

The faunal database indicates that between the early Middle Archaic and the late Middle Archaic at Koster, people increased their reliance on white-tailed deer as opposed to a variety of smaller animal resources. This might be due to the opening of the forest because deer prefer the forest edge. However, it might also be attributable to chaning settlement dynamics among human hunters, as suggested later in our discussion (Neusius 1986a).

The depositional history of the Illinois River floodplain has also been the subject of numerous studies by geoarchaeologists (e.g., Butzer 1977; Hajic 1990). In this case, the conclusions about environmental change drawn from the various databases have been similar. Of particular note with respect to hunter-gatherer subsistence potential, the Illinois River approached its modern-day stand at nearly 7000 BP. As a result, soon thereafter resource-rich backwater lake habitats were established. Lakes of this type are formed when spring floodwaters recede, leaving water and fish in low-lying floodplain areas such as the meander scars left by the former path of the river. Analysis of animal remains from Middle Archaic settlements at Koster demonstrates that an increase in the use of freshwater mussels and fish corresponds with the evolution of backwater lakes, underscoring the importance of this development for Koster's residents (Neusius 1986b; Styles 1986).

In addition to aiding paleoenvironmental research, Koster site data have been used to pursue several lines of inquiry concerning Archaic period cultural development. This work has allowed us to understand how the site was used and what specific activities people engaged in while living there. We also have been able to formulate and test models of cultural–ecological adaptation for the area by studying chipped and ground stone technology, subsistence and settlement organization, and sedentism. Much of this research concerns factors affecting foraging strategies and the development of sedentary, year-round communities. Archaeologists have become increasingly interested in how sedentism developed during the latter part of the Archaic, and the Koster site has taught us much about the first steps in this direction in the lower Illinois River valley.

These various types of research helped us develop a coherent picture of changing adaptation at Koster. It seems probable that increased reliance on abundant and storable resources promotes occupations of longer duration (Brown and Vierra 1983:186). In the lower Illinois River valley, we think that longer occupations, or base camps, have been characterized by more permanent structures, more dependence on aquatic resources, food storage, and expanded use of processed foods. Duration of occupation may also have affected how people used stone. Chipped stone technology may have become less expedient when people stayed for longer periods at Koster. The idea is that as local lithic resources were more heavily exploited, people had to be more careful with how they used stone (Lurie 1982).

The combined Koster research suggests that Early Archaic and early Middle Archaic people lived in residential camps, defined as briefly occupied, generally unstructured settlements. Base camps, defined as long-term structured settlements, appear next, and people lived in increasingly organized settlements as the Middle Archaic continued. Studies of the spatial patterning of artifacts, ecofacts, and features support this assertion (Carlson 1979).

Subsistence data also may support this idea. Animal usage during the Early and early Middle Archaic was generalized, which means that a wide variety of mammals, fish, and other animals were being utilized by people camped at the Koster site. However, beginning at 7500 BP, there is evidence of specialized nut harvesting and selective use of backwater habitats. By 6500 BP, Koster had become a large base camp positioned with access to a variety of habitats, and residents substantially increased their use of backwater lakes. Fish, mussels, and waterfowl contributed significantly to people's diet, and for the first time there is evidence that people collected small-scale seeds. Deer also were being taken in larger numbers by Koster's residents. This more focused use of deer may represent the need at Koster to feed larger numbers of people, who were living for longer periods at Koster.

Thus, we can conclude that during the Middle Archaic period people made the transition from highly mobile residential foragers to more sedentary collectors. This change may be attributable to the increased attractiveness of floodplain as opposed to upland settings, particularly during the warmest and driest parts of the Hypsithermal, as well as to the arrival of the floodplain at its modern gradient. On the other hand, these changes also could have been part of the development of integrated group decision making and task organization by people experiencing population growth and social change (Neusius 1986b). We do not fully understand the interplay of these different variables.

CONCLUSIONS

The Koster site provides important information on Archaic period paleoenvironment and changing human strategies in the lower Illinois River valley. Perhaps most significantly from an anthropological perspective, the development of sedentary life in this area has been documented. In essence, Koster taught archaeologists more about what happened than about why; but in our interpretations are many hypotheses that can be tested elsewhere: ideas about the development of sedentism, the role of environmental change, and human adaptation during the Archaic.

The Koster Project is but one example of a large-scale interdisciplinary archaeological investigation—one that illustrates the necessity of drawing on the expertise of a variety of scientists to address the problems of modern archaeology. It took a team, but it also took a leader to coordinate the research effort. In this regard, Koster exemplifies the realization of a challenging vision. The value of long-term, coordinated, regional research is clear, despite the complexity of developing a center to accommodate such research. Faced with increasingly complicated archaeological problems, archaeologists have developed innovative means of addressing them, and we will continue to do so. In the old river town of Kampsville, Struever's vision lives on today, though reduced in size and changed in scope, in the field schools and public programs conducted by the Center for American Archaeology. Most importantly, what we learned at Koster informs continuing research on the Archaic period.

FIGURE D2.5 The bottom of the Koster site excavation just before closing. Hoses indicate where pumps were placed in the block excavation; tarps held down by tires and, in the deepest test pit, plywood supports were used to help keep the sediments in place.

EPILOGUE: KOSTER FARM, 1978

For a decade we spent 12 weeks each summer in Theodore Koster's former cornfield. By the end of the 1978 field season, we had reached a settlement occupied 8700 years ago, but the effort had called for an increasing struggle to control the flow of groundwater and precipitation into the excavation (Figure D2.5). Now, we found we had no more reason to continue this struggle. Data from a few test pits and coring showed no evidence of more deeply buried artifact-bearing deposits. The decision was made to backfill the excavation.

The crews and visitors were gone as we removed the 500 tires that secured the wall tarps. We pulled these off and exposed the layer-cake record for a last time. The excavation was over, but the collection of artifacts, notes, and photographs remained, and they would continue to provide information for years to come. Meanwhile, we'd heard about the discovery of another site on a colluvial fan at Napoleon Hollow, 40 miles upriver. This time the excavation was to be funded through a contract to evaluate the highway corridor for a major new highway and bridge in the planning stages. Perhaps it would shed light on those parts of the Archaic period that Koster did not illuminate.

DISCUSSION QUESTIONS

1. Where and what is the Koster site? Can you think of several reasons for its status as an important site?
2. What was Stuart Struever's vision? Why was facilitating interdisciplinary research so important to the success of the Koster research?
3. The Koster site was buried in the layers of an alluvial/colluvial fan deposit. Why is it important to understand this context when looking for other Middle Archaic sites with which to compare Koster?
4. What is the Hypsithermal interval? Why was it relevant to understanding cultural change at the Koster site? Do you think it caused the cultural changes in the Koster record, or could there have been other factors? Explain.

CASE STUDY

As indicated in Chapter 3 of the text, archaeologists know far less than they would like about Paleoindian adaptations. The nature of the archaeological record at Paleoindian sites tends to limit what can be discerned. There are relatively few sites, and even these contain a paltry record of the total material inventory of Paleoindian groups. Nevertheless, archaeologists have pieced together some aspects of hunting and butchering strategies, especially from the kill sites of the Great Plains. The tools themselves provide insights into past adaptations as well. This case study shows that ethnographic sources combined with experimentation can enrich reconstructions of Paleoindian lifeways in the Southern Plains. In conjunction with a reassessment of collections from the original work by Edward B. Howard on the Clovis use of Blackwater Draw in eastern New Mexico, ethnographic analogy and experiment offer intriguing possibilities about the nature of Clovis weaponry and how it was employed during hunting. These speculations are not proved, but they remain important in stimulating future research about Clovis technology and hunting. Reading this case study should help you think about artifacts in terms of their probable use and about Clovis people as hunters. For example, exactly how did Clovis hunters kill mammoths and other large game?

D.3. WEAPONRY OF CLOVIS HUNTERS AT BLACKWATER DRAW

Anthony T. Boldurian

For 85 years, the Southern Plains has been a prolific source of information on Paleoindian chronology, ecology, and culture (Boldurian 2008). Discoveries from this region first proved the association of humans and Ice Age fauna in the New World. Also, here the mammoth-hunter Llano, or Clovis, complex was defined. It is the cradle of geoarchaeology in America and a world-renowned setting for Pleistocene paleoecology as well. The Southern Plains has one of the greatest concentrations of fluted points and associated sites known. From this rich database, key information continues to emerge at the forefront of Paleoindian research. Recently, collections and related data from “oldrdquo; sites of the 1920s and 1930s have been reexamined. An exploration of this sort entailed study of the type specimen Clovis artifacts from Blackwater Draw in eastern New Mexico. These type specimens were used in the original definition of the Clovis point and other artifacts in Clovis assemblages. In *Clovis Revisited*, Boldurian and Cotter (1999) reconsidered this collection in a contemporary light. Drawing from that project, this case study illustrates how ethnography and experimentation may help us better understand the use of Clovis weaponry in hunting mammoth and extinct bison.

BACKGROUND AND SETTING

While much of their culture may forever remain a mystery, Clovis groups in the Blackwater Draw left behind a trail of clues to their adaptations in the Southern Plains. The Southern Plains of North America is a vast territory wedged between the southern Rocky Mountains to the west and the Gulf Coastal Plain to the east (Fenneman 1931). A mosaic physiography, it encompasses the Pecos Valley of New Mexico, the Southern High Plains including the Llano Estacado or “Staked Plains” of eastern New Mexico and West Texas, the Osage Plains of Oklahoma, and the Rolling Plains and Edwards Plateau of Texas (Figure D3.1). Archaeological evidence from this region indicates how Clovis people survived the Ice Age wilderness. By identifying siliceous stones used in making tools, we trace Clovis footpaths to quarries where raw materials were obtained. From artifacts and features, we recognize favored camping spots and hunting grounds of these nomads. The artifacts themselves, and their position in the earth with associated remains, reveal the technology and function of utensils in Clovis subsistence. By radiocarbon calculation, the Clovis era lasted only

FIGURE D3.1 The Southern Plains, depicting sites mentioned in the text.

a few hundred years, between approximately 11,500 BP and 10,900 BP. It transpired during an episode of profound environmental change, when North America was emerging from the last Ice Age. Since Clovis hunter-gatherers lived especially close to the land, their culture can best be understood against a backdrop of shifting ecosystems.

ANCIENT ENVIRONMENT

A fragmentary, but telling record is available for piecing together shifting climates and habitats of the late Ice Age Southern Plains. Environmental data for the Llano Estacado between approximately 12,000 BP and 7000 BP come from variable sources, including pond sediments, buried soils, erosional surfaces, and sand dunes. Pollen spores, diatoms, freshwater mussels, and land snails also record ecological change. The collective information suggests that initially, the Southern Plains was a cool, humid grassland with lush habitats and plentiful game around springs, ponds, and perennial streams. Abundant surface water was matched by damp soils that possibly supported scattered stands of pine, spruce, and juniper. The existence of a coniferous forest by Clovis times is uncertain, and opposing views instead emphasize the region's prevalent tall grassland (Hall 2000; Holliday 1987). Ample moisture allowed grass to extend over upland slopes that divided adjacent stream valleys. After 10,500 BP, groundwater declined steadily. Warmer, drier conditions and lower water tables eradicated any existing tree growth, and open grassland receded from the uplands. Running water retreated to main river channels, along which the region's dwindling ponds and marshes persisted.

Drier soils meant sparser vegetation and a predominance of short-grass species and sagebrush, which accelerated soil runoff (Haynes 1995; Wendorf and Hester 1975). Winds became a dominant force, scouring exposed surfaces, building sand dunes, and transporting sediment into shrinking stream channels (Holliday 1997). In fact, the Blackwater Draw is a sand-choked headwater of the ancient Brazos River, one of the major streams flowing in the area. By 7500 BP to 7000 BP, the Southern Plains exhibited the cumulative effects of falling water tables, warmer temperatures, increased runoff, and intensified wind action. Lower biomass and biodiversity, diminished carrying capacity, and a corresponding decrease in human population potential hastened the demise of the Paleoindian period. This period had included the Llano (ca. 11,500–10,900 BP), Folsom (ca. 10,800–10,000 BP), and Plano (ca. 10,000–7500 BP) horizons (Cordell 1997). Striking ecological changes correlating with the warm and dry Altithermal brought a new episode of human prehistory—the Archaic (Antevs 1955; Irwin-Williams and Haynes 1970).

During Clovis times, the Southern Plains nurtured a diverse fauna, very different from that which typifies the region today. Remains from the Blackwater Draw include jackrabbit, raccoon, opossum, armadillo, gray wolf, red fox, black bear, and mule deer. There were salamanders, snakes, frogs, and rodents. Species now extinct in the area included the Carolina box turtle, Wilson's tortoise, peccary, and pronghorn (Slaughter 1975). Changing circumstances in the Southern Plains at the close of the Ice Age also coincided with the disappearance of "megafauna" species, including the Columbian mammoth, straight-horned bison, horse, camel, dire wolf, and saber-tooth cat (Lundelius 1972).

CLOVIS SUBSISTENCE

The paleoenvironmental picture of the Southern Plains suggests that Clovis groups there, as elsewhere in North America, utilized the changing ecosystem to better meet subsistence needs. Evidence hints that from prairie and meadow, Clovis people foraged numerous edible plants. Also, from shallow streams and ponds they probably took fish, turtles, and other wetland creatures. A preference existed for hunting mammoth and, occasionally, large bison. Some have proposed that killing entire mammoth herds or family units was the normal Clovis strategy in the Southwest and Southern Plains (e.g., Saunders 1977, 1980). Critics maintain the implausibility of such scenarios, calling attention to the many species in Clovis subsistence and the unlikelihood that these groups relied solely on mammoths for survival. Clovis hunters could have faced one problem after another in bringing down a herd of immense, yet agile, creatures all at once. Assuming success at this risky undertaking, the enormous amount of mammoth meat suddenly available from a mass kill would have far surpassed the short-term needs of a Clovis band. Such bounty would have overtaxed a band's ability to preserve and store meat.

More conservative views depict mammoths pursued either individually or only a few at a time, and bison taken in small groups. Team-coordinated Clovis hunters would have been keenly observant of prey behavior, making use of stream crossings, pond bottoms, and arroyos as traps (e.g., Wendorf and Hester 1975). Armed with atlatl, darts, spears, and perhaps sturdy cordage, they would have waited patiently crosswind from their quarry to avoid being scented. Having veiled themselves in acrid dung, the stalkers likely hid in silence amid tall grass, exchanging hand signals. Especially with mammoth, choosing the right moment to strike was as crucial as toppling the creature and impeding its ability to regain footing. With either mammoth or bison, a favorable outcome required precise timing and execution. Once up and running, away or toward them, these beasts were more than a match for the best hunters, who could neither outrun their prey nor attack them in flight (Cotter 1994:2). The idea that Clovis weapon tips may have been laced with natural toxins to serve as poison is intriguing, but currently lacking convincing hard evidence (Jones 2007).

Butchery and initial processing of a mammoth took place at the kill site. First, hide flaying was performed to lay open the flank along the upper side. Separation of limbs, scapulae, and ribs gave ready access to choice cuts along the backbone and to internal organs. At some sites, limb bones appear a short distance from the remaining skeleton where, presumably, they had been dragged to strip off meat for transport. Chopping of tusks to roughly shape ivory pieces before hauling back to camp also could have been accomplished at this time. Crushed skulls indicate intentional smashing to obtain brains (Hester 1972). Mandibles separated from crania suggest efforts to acquire tongues. Absence of caudal vertebrae implies that tails were severed and carried away as standard practice. Wendorf and Hester (1975) followed ethnographic accounts in proposing that mammoth tails served as Clovis fly whisks. They may also have been trophies marking a successful hunt. At the butchering ground, stone tools became nicked and dulled. Some of these the able workers rejuvenated and reused, while others they set aside in favor of replacements. Tools that broke beyond repair were simply tossed as work continued.

Despite this long activity list, mammoth skeletons from kill sites are largely articulated, presenting strong testimony that only partial butchery was a Clovis standard. It is reasonable to suppose that some meat was consumed raw on the spot by the busy, but jubilant butchering party. In two instances at Blackwater Draw, small fire features among the bone clusters indicate that cooking also took place. A hearth nearby the mammoth skeleton may also signify a campfire, possibly the remains of an overnight stay to guard an unfinished butchering job from intruders. Before surrendering a carcass to scavengers, certain hunting gear and butchery tools were retrieved, and other possessions packed in anticipation of moving on. It is no surprise that some serviceable utensils, having been misplaced or overlooked in the confusion of a hunt and subsequent butchering, were left behind.

A few Clovis-age bison kill and butchery sites have come to light at Blackwater Draw (Hester 1972), in northwestern Oklahoma (Bement and Carter 2003), and at the Aubrey site in Texas (Ferring 1989). Although details on the butchery of these animals are not yet available, the success of Clovis hunters in dispatching mammoths is attested to by a number of sites, including Domebo in Oklahoma; Poverty Hill, Lubbock Lake, Miami, McLean, and Aubrey in Texas; and especially near Clovis, New Mexico, in the Blackwater Draw (Figure D3.1). Discoveries made near Clovis in the 1930s by Edgar B. Howard (1935) and his party (Cotter 1937) qualified Blackwater Draw as the Clovis type site (Boldurian and Cotter 1999; Hester 1972).

ARTIFACTS: KEYS TO CLOVIS CULTURE

Unlike spectacular Anasazi ruins of the Southwest or impressive temple mounds of pre-Columbian Mexico, at a Clovis dig there is little to discover. In comparison to other prehistoric peoples, Clovis groups left remarkably faint traces of their presence upon the land. At Clovis sites faunal remains are generally lacking, as are fire features and postmolds from transitory dwellings. If not rapidly buried under suitable conditions, "soft" items such as a Clovis dip net, a skin bag, or a rabbit snare usually would decompose within just a few years. Lithic artifacts are the only debris that continually elude decay. However, stones alone impart a hazy picture of the sum of Clovis handiwork and industry. The few sites together with their poorly preserved and underrepresented remains leave archaeologists with a narrow view of this prehistoric culture. Nevertheless, from the "hard" and biased evidence, we appraise the lifeway of these early Americans.

Clovis is distinguished by a lithic technology that employed large biface cores. From such cores numerous flakes were detached and used as cutting/scraping tools. Eventually, the cores themselves were further refined into bifacial tools and weapon tips (Bradley 1991; Frison and Bradley 1999). Perhaps the most striking and informative examples of these biface cores come from cache localities in the Northwestern Plains/Rocky Mountains region, namely Anzick (Montana), Simon (Idaho), Drake (Colorado), and Fenn (Utah/Wyoming/Idaho). Prismatic blade manufacture from prepared conical cores was added to this stone technology. Clovis prismatic blades, which are long, narrow, and slightly curved flakes with triangulate or trapezoidal cross sections, served as ready-made butchery and kitchen utensils that were thin and sharp.

Though delicately made, they were tough, dependable, and versatile (Boldurian and Hoffman 2009). The Clovis prepared core and prismatic blade industry entailed a complicated manufacturing procedure (Bordes and Crabtree 1969; Collins 1999). Its presence in the New World at this early time establishes a connection between Clovis and the Old World Upper Paleolithic in which similar industries have been identified.

Far surpassing blades as an archaeological trait of Clovis is the distinctive fluted projectile point, a product of refined biface manufacture (Figure D3.2). A detailed understanding of Clovis point manufacture is emerging, owing to the discovery of large bifaces in caches, along with an examination of biface reduction debris or debitage from a few excavated sites chiefly in the American West and midcontinent. Akin to cases observed in the north, Clovis groups in the Southern Plains also made tool caches. By contrast, caches in this region comprise predominantly large blades instead of bifaces and fluted points. Examples include discoveries of 17 (Green 1963) and 5 blades (Montgomery and Dickenson 1992), respectively, from Blackwater Draw, 26 from McKee/Anadarko in western Oklahoma (Hammatt 1970), and possibly other caches (Tunnell 1978). The Keven Davis collection, located off the Southern Plains in the Gulf Coastal Plain of East Texas, further defines this Clovis regional pattern of caching blades (Collins 1999).

FIGURE D3.2 Type-specimen Clovis fluted points and unibeveled bone rod from Blackwater Locality No. 1, recovered in New Mexico by Edgar B. Howard in 1936 (cast replicas).

In a few instances, fortune has favored the recovery of Clovis bone and ivory artifacts, suggesting that a well-developed bone technology complemented the people's flintworking skills. Included in this category are unibeveled and bibeveled bone rods (Figure D3.2), minimally shaped pieces of mammoth ivory (Saunders et al. 1990), and a single known example each of a burnisher-billet (Saunders et al. 1991) and a shaft wrench (Haynes and Hemmings 1968). The burnisher was fashioned of mammoth tusk, and the wrench was likely made from mammoth long bone, perhaps a femur. Perishable implements of bone and ivory further facilitated the mobile hunter lifestyle of Clovis groups (Stanford 1991). These items are virtually duplicated in Eurasian Upper Paleolithic artifact assemblages, and they underscore the historical connections between the Old World and Clovis.

THE PROBLEM

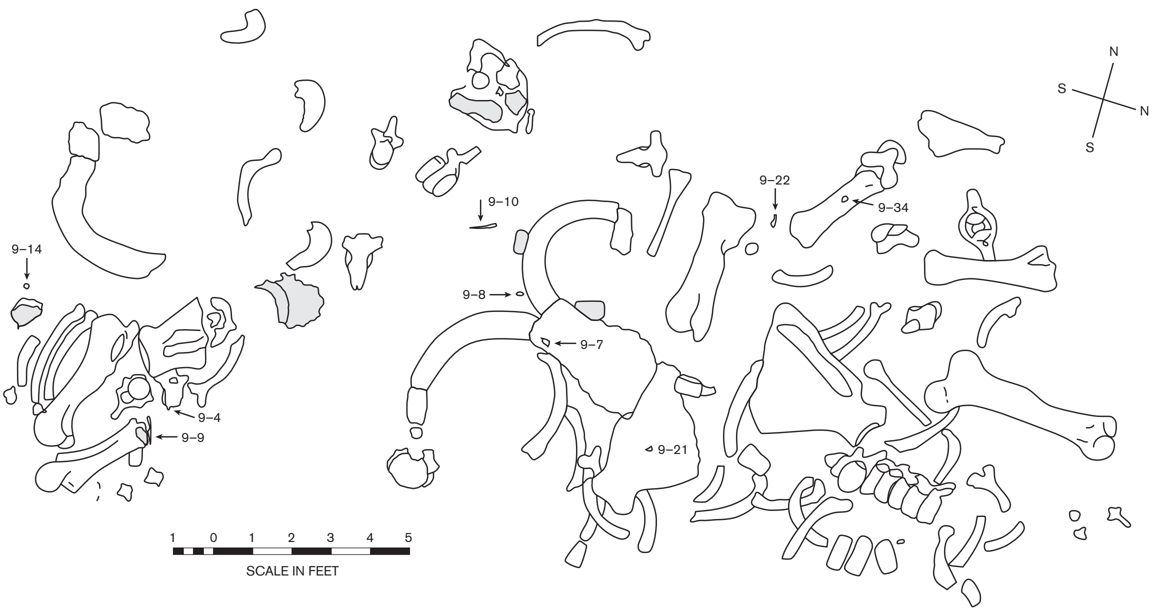
Portrayal of Clovis adaptations, especially the role of large animals in subsistence, is undergoing careful reassessment and revision. Today, we know that these hunters did not devote all food-getting efforts to acquiring mammoth and bison meat. Also, we now recognize that Clovis predation alone did not force mammoths and other megafauna to extinction (e.g., Martin 1973). Yet, after 70 years, the big-game hunting stereotype attached to the Clovis lifeway endures. Since Clovis culture was first recognized, the manner in which the distinctively fluted projectile points were employed also has been open to speculation and debate (Frison 1989; Meltzer 1993). Though biased, archaeological remains of Clovis hunting gear indicate that both hard (e.g., stone, bone, ivory) and soft (e.g., wood, sinew, mastic) materials were key in the assembly. Beyond this recognition, we have discerned only vague images of what instrument or device Clovis hunters used for killing mammoth and bison.

After many years and examination of a number of kill sites, important questions linger. What did Clovis spears and darts actually look like, and how were fluted points attached to them? Were the slender bone rods found at some Clovis sites portions of these weapons, and if so, how did they, along with the stone tips, conjoin into a spear? Since the 1930s, Blackwater Draw remains alone among Clovis sites in demonstrating how fluted points, bone rods, and other tools may fit into the overall context of a mammoth kill. Thus far, other Clovis sites at which bone rods have been unearthed have been non-kill localities, such as caches. In revisiting Clovis through the discoveries of Howard's expedition, our case study offers an opportunity to learn more about these long unanswered questions about Clovis hunters and their intriguing technology.

HOWARD'S COLLECTION

The type-specimen Clovis artifacts are housed at the University of Pennsylvania Museum of Archaeology and Anthropology. The collection contains stone and bone artifacts recovered by Howard from several locations along the Blackwater Draw. However, the collection is comprised mostly of artifacts from a single site. Such an assortment, or **subassemblage**, is thought to embody the sum of technological, economic, social, and ideological activities of a bygone people, and therefore to enable behavioral reconstructions. For example, from stone artifacts we may better understand the lithic technology that produced them, along with prehistoric subsistence and diet, trade and exchange, group mobility, and possibly craft specialization, areas in which tools played an integral role.

Many of the artifacts from the university museum's Clovis collection are fragmentary. In antiquity, these implements were broken during manufacture,



9-4 = 36-19-2 Complete projectile point
9-7 = 36-19-1 Side scraper onblade
9-8 = 36-19-7 Retouched flake (missing)
9-9 = 36-19-5 Beveled bone artifact
9-10 = 36-19-6 Beveled bone artifact
9-14 = 36-19-9 Biface thinning flake tool
9-21 = 36-19-4 Impact-broken projectile point
9-22 = 36-19-3 Complete projectile point
9-34 = 36-19-10 Biface thinning flake tool

FIGURE D3.3 Plan of the 1936 Clovis Mammoth Pit excavation at Blackwater Locality No. 1, based on Cotter (1937). Note in situ location of artifacts.

use, or repair. Archaeologists can partially decipher the history of an artifact from its physical condition or other purely intrinsic evidence. For example, an impact fracture on a projectile point indicates that it was broken during a specific activity or use. Likewise, blood residues preserved along the edge of such a tool lends direct evidence on how, or for what purposes, it was used. Naturally, knowledge of an artifact's provenience, associations, and overall context yields far more data on its overall history. Context permits an estimate of an artifact's age, prevailing environment at the time of its deposition, and, via association with other items, richer interpretations about its function.

Unfortunately, many artifacts recovered by Howard's team had been disturbed from their original context, either by natural erosion of Dust Bowl winds or by human gravel mining, thereby diminishing their archaeological value. Tarnished contexts attributable to both natural and cultural forces of change are disheartening realities of archaeology. Despite many unfortunate circumstances of field archaeology, researchers occasionally discover what they pursued from the start. So it happened that Howard's team gained a rare opportunity to retrieve artifacts and their contexts in mammoth and bison kill settings. These finds, exposed by careful excavation, gave archaeologists a glimpse of artifact—bone associations and their positions within the layered sediments (Figure D3.3). Data gathered from these *in situ* discoveries documented the fact of mammoth hunting and, ultimately, formed a basis for defining the Clovis culture. This case study focuses mainly on the Clovis specimens for which Howard was able to record excellent provenience and association.

ARTIFACT DESCRIPTIONS

Chief among various artifacts described in Boldurian and Cotter's (1999) study were the Clovis type-specimen fluted projectile points and bone rods. Careful description of these specimens is important background to considering the implications for reconstructions of Clovis weaponry and hunting.

Projectile Points

From region to region across the Americas, Clovis points vary somewhat in overall size, shape, and fluting features (Figure D3.4). Though all Clovis points are fluted, all are not the same size. The smallest Clovis points are barely 25 millimeters (1.0 in.) long. Almost certainly not weapon tips, these miniatures may have been charms or toys. Conversely, the largest points are about 225 millimeters (almost 9in.) long. Such huge specimens, ordinarily found in caches, may signify ritual offerings or social status. Usually, Clovis points are about 65 millimeters (2.5 in.) long, while those over 100 millimeters (almost 4in.) are uncommon. The lengths of the type specimens are 81.2 and 110.5 millimeters (3.2 and 4.6 in.), respectively.

Large or small, all Clovis points are lanceolate, or spearlike, in plan shape. Some are narrow like a willow leaf, while others are oval like a birch leaf. The basal margin (i.e., line along the base) can vary from nearly straight to slightly concave to almost U-shaped. Cross sections of the blade and base have maximum width and thickness very near the artifact's midpoint. Blade element lateral margins arch slightly and symmetrically toward an acute tip. All edges are straight

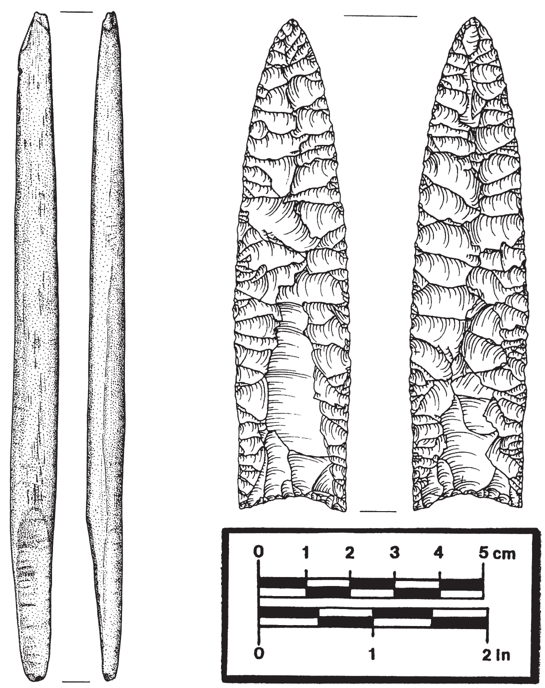


FIGURE D3.4 Drawings of the original Clovis type specimen fluted points and bone rods from Blackwater Locality No. 1.

and symmetrical. In all these aspects the type specimens are highly typical of Clovis weapon tips.

Thinning of the base for hafting was accomplished via fluting, a complicated procedure for detaching either a single channel flake or multiple small flakes from each face along the base. Some Clovis points have only subtle fluting via shallow flake removals, while others are distinctively grooved. After fluting, edges along the base and lateral margins were polished up to the base–blade juncture to further facilitate hafting. Edge rounding from this intentional polish *is* easily detected on Clovis points, including both type specimens. A few Clovis points made of obsidian show use wear from hafting. Scratches and striations—evidence of such wear—appear in the channel flake scars along the base (see Frison and Bradley 1999; Tankersley 1994). Though the type-specimen points do not exhibit such wear, they do show unmistakable reshaping and refurbishing of the blade edges, thus indicating that each had been attached to a shaft and was a well-used implement.

Bone Rods

Other Clovis artifacts that emerged in 1936 from Blackwater Draw are bone rods, two of which appeared among the mammoth bones and fluted points. Subsequent searches of Clovis sites have netted relatively few of these items. While 25 come from just two Western caches—Anzick and East Wenatchee (Washington)—another 25 have been found between central Alaska's Tanana Valley and the Gulf of Mexico. Except for two from Sheriden Cave, Ohio, these rods are absent from the Eastern Woodlands north of Florida. In northern Florida at least 21 rods have emerged from the Aucilla, Ichetucknee, and Santa Fe rivers. The limestone region drained by these mineral-rich rivers is ideal for bone preservation. A formal experiment conducted by Boldurian (2007) and his students using a fresh or "green" femur taken from a modern Asian elephant indicated that Clovis bone rods likely were fashioned from either mammoth or mastodon long bones. Less frequently, specimens were made of ivory. The shortest complete rod is 133 millimeters (5.5 in.), the longest about 300 millimeters (11.75 in.), and they average 212 millimeters (8.25 in.). The type specimens measure 252 and 234 millimeters (9.9 and 9.2 in.), respectively.

Like the type specimens, all Clovis rods are slender, cylindrical, and smooth. Though usually straight, some have a slight bend. They are either unibeveled or bibeveled, with one or both ends angled to create a flat face. Typically, this surface has been roughened either with oblique or grid striations to help with splicing and lashing the rod to a shaft. Bibeveled rods have bevels on the same side at opposite ends. Unibeveled rods have a tapered and blunt opposite end, in some cases showing damage from force of impact. Howard's excavation produced one rod of each type.

Though usually undecorated, two Clovis rods from Wenatchee have apparently nonutilitarian zipperlike etching along one side. Such features may be property marks like those noted by Boas (1899) on harpoon tips and arrow foreshafts of Alaskan Inuit. This way of denoting identity and ownership of hunting weapons possibly extended to Clovis groups (Gorman 1969). Clovis bone rods are rare *and* enigmatic. Using Inuit examples, Cotter (1937) first proposed that the Blackwater Draw rods were foreshafts. Thereafter, archaeologists discussed what these objects were again and again, another idea following almost each new discovery. The list of possible functions now includes projectiles, fleshers, pressure flakers, pry bars, hafting levers, sled shoes, and ceremonial staffs. Many researchers still endorse the rods-as-foreshafts notion.

HUNTING: AN ETHNOGRAPHIC VIEW

Archaeological views of hunting recognize two related components of this ancient activity identified by ethnographers: tracking and marksmanship. Tracking facilitates marksmanship and frequently resumes after the hunter's spear has reached the target but failed to bring down the quarry. Tracking is as integral to hunting as shaping a spear shaft or making a weapon tip. However, tracking entails fundamentally nonmaterial behavior, including a hunter's primary senses and abilities in following the spore of prey. Steeped in oral tradition beyond other hunting-related behavior, tracking is a unique and remarkable skill upon which marksmanship heavily relies (Laughlin 1980). Unfortunately, the nonmaterial nature of tracking allows archaeologists to contribute little to discussions of this process. Therefore, most archaeological analysis focuses on marksmanship and the technology and tools that support it.

For thousands of years, Arctic Inuit technology has included the harpoon, a specialized spear with a detachable head for hunting seals, walrus, and whales. Earlier harpoons featured a barbed head of bone or ivory socketed in a mainshaft. Attached to the barbed tip was a braided sinew line that extended either to the shaft or to a float. With the head's tangs firmly embedded in the animal's flesh, hunters were able to retrieve frenzied, yet agile sea mammals once they had been struck. A later elaboration of this ingenious tool was the composite or toggling harpoon, which replaced the barbed point with a toggle head as the detachable component (Arnold 2004). Trailing from a hole in the toggle head was the sinew line. Joining the harpoon head to a mainshaft was a slender, bone foreshaft. At one end, the foreshaft was either "loose" and socketed or "fixed" to the mainshaft. If fixed, the foreshaft was beveled and the contact surface roughened, thereby adding extra purchase for secure lashing along a splice. At the tip, the foreshaft was tapered and blunt for inserting into a matching cavity in the harpoon head's base. The harpoon head assembly was tipped with a sharp stone (later metal) projectile, called an end blade.

Upon penetrating the animal, the sharp head detached from the foreshaft. Under the animal's skin and blubber, the head responded to line tension by turning at a right angle to the line, holding fast and tethering the prey (Laughlin 1980). Toggling harpoons, which were developed especially for hunting sea mammals, have a wide distribution among northern maritime hunters. They were known among the historic Inuit from the eastern tip of Asia, including the Chukchi Peninsula, extending along the Aleutian Islands, and especially throughout coastal Alaska. Eastward beyond the Canadian Arctic, they were common from Hudson Bay to eastern Greenland (Birket-Smith 1959; Rousselot et al. 1988).

CLOVIS WEAPONRY AND ARCHAEOLOGY

As mentioned earlier, the exact manner in which Clovis people assembled their weaponry for the hunt has been debated. Having unearthed many of their distinctive fluted projectile points, archaeologists are still uncertain how these tools actually were put to use. Fluted points may have been hafted directly to a thrusting spear for close-encounter attack. Alternatively, a midshaft or foreshaft may have been used to secure a point, the opposite end of which was either spliced onto or inserted into a mainshaft (Lahren and Bonnichsen 1974). Perhaps such an arrangement completed a dart propelled by an atlatl- or spear-thrower, allowing attack from a safe distance. Some argue that both spears *and* darts were used by Clovis hunters. Experiments with replicative Clovis hunting gear have demonstrated that both types—thrusting spears and darts—are effective in penetrating the hide of modern elephants (Frison 1989; Huckell 1982).

Cotter's (1937) original proposal that the Blackwater Draw bone rods served as foreshafts received a boost upon discovery of other specimens along with Clovis points from Anzick. Using Cotter's inspiration, Lahren and Bonnichsen (1974) offered a model of Anzick rods as foreshafts (Figure D3.5).

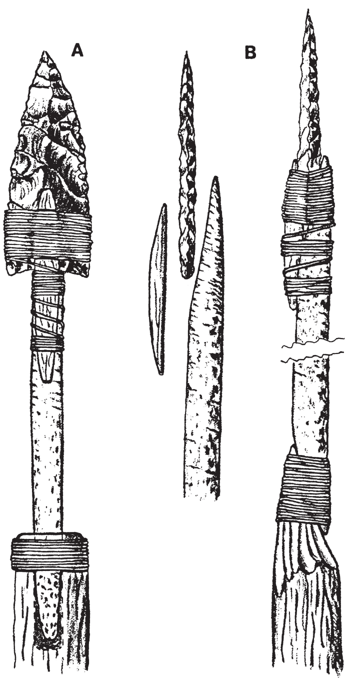


FIGURE D3.5 Reconstruction of Clovis bone rods as foreshafts. Based on specimens recovered from the Anzick site in Montana: (A) front view and (B) side view.

Although Cotter's proposition about foreshafts has been widely applied, his specific suggestions concerning how they worked in Clovis weaponry have been overlooked. Cotter hatched his ideas about the first bone rods from the knowledge that such items existed in Upper Paleolithic assemblages of Western Europe. Aided by firsthand examination of the University of Pennsylvania Museum's ethnographic collections, his analysis further noted similarities to foreshafts used by Inuit hunters from western Alaska to northeast Greenland (Figure D3.6). Influenced by the need to also explain Clovis bibeveled rods, researchers kept the rods-as-foreshafts idea, but lost the notion of a fluted point fixed to a detachable head.

Relying further on the museum's examples of Inuit weaponry, Cotter suggested the possibility that the unibeveled shaft from Clovis may have been fashioned to accommodate a toggle in which a stone point was mounted. The ethnographic record shows that toggling devices are used solely in securing a line to sea mammals, which can easily avoid capture by swimming under pack ice. Toggling harpoons are effective on prey in open waters. However, it is doubtful that Clovis hunters would have desired to be attached by a toggle line either to a panic-stricken mammoth at a waterhole or to several bison dashing wildly over the edge of a ravine. It may be that Clovis weaponry combined a unibeveled foreshaft with a detachable spearhead that functioned unlike a toggle.

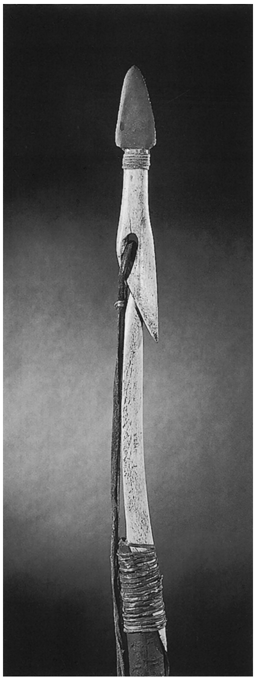


FIGURE D3.6 Inuit toggling harpoon, including bone foreshaft and socket with stone end blade, from Point Barrow, Alaska, 1896–1897.

During the Clovis Revisited Project, Boldurian and Cotter (1999) tested one such idea, using a bison vertebra as source material. A surprising confirmation of our brief experiment came by way of an antler artifact similar to our detachable spearhead made of bison bone. Termed by Stanford (1996) a foreshaft socket, this specimen from an Indiana bog matched exactly in concept of the hafting device we proposed. The tool, fashioned from unspecified antler, dates to approximately 7990 BP—the Early Archaic period of post-Clovis time. Stanford proposed that an implement such as this, despite its slightly more recent age, served in Clovis hunting gear. For our case study, a virtual duplicate of the Indiana foreshaft socket was fashioned and affixed to a Clovis-style bone rod and one of the Blackwater Clovis points (Figure D3.7). Antler from modern mule deer was used for the replication. Except for the toggle line, similarities between the experimental model and the Inuit harpoon are striking (Figures D3.6 and D3.7).

A Clovis spear or dart tipped with a detachable foreshaft socket, like the one produced here and proposed by Stanford, may have held other advantages over a toggling harpoon or a spear with a long, detachable foreshaft on the head assembly. According to Churchill (1993), detachable barbed harpoon heads work their way deeper into the thoracic cavity of a fleeing animal owing to its muscular contractions. Conceivably, a foreshaft socket fitted with a fluted point would have been able to penetrate via muscular contractions into a mammoth or large bison. By comparison, toggling harpoon heads are not designed for this purpose. Moreover, a long and cumbersome foreshaft assembly might have encountered obstructions as it moved through an animal's rib cage. A compact point-and-socket device might have been more effective in bagging the formidable mammoth and bison because of the increased hemorrhaging and visceral damage caused by its steady movement (Rozoy 1978). The model advocated here

FIGURE D3.7 Experimental Clovis spear/dart, including bone foreshaft and antler socket with fluted point.

also may apply elsewhere across America or in Clovis procurement of other prey, where associations have been documented.

CONCLUSION

The scarcity of Clovis sites is matched by the normally poor and partial preservation of material items they offer for learning about these Paleoindians. In searching for fresh clues to the First Americans, archaeologists are revisiting Paleoindian sites of the 1920s and 1930s. Blackwater Draw, first investigated 75 years ago, is one example of this trend. The Clovis Revisited Project (Boldurian and Cotter 1999) was devoted to redescribing the Clovis type-specimen artifacts and considering them anew, using our current knowledge of the Paleoindians as a reference. The project illustrates how unexpected answers to the most basic, yet fascinating questions about Clovis people and their lifeways await our discovery. This case study shows that these "old" artifacts, when combined with ethnography and experimentation, can offer new understanding of their role as tools, and intriguing possibilities about Clovis hunting in the broader context of subsistence.

ACKNOWLEDGMENTS

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DISCUSSION QUESTIONS

1. Characterize the environmental setting for Clovis occupations on the Southern Plains such as Blackwater Draw. Do you think this environment suggests anything about the probable role of large game in Clovis subsistence?

2. What kinds of archaeological data from Blackwater Draw does this case study consider? What are the limitations of these data for understanding Clovis?

3. Are ethnographic data relevant to the reconstruction of Clovis weaponry and subsistence behavior? Under what circumstances? Explain your answer.

4. How can experimentation with making and using tools provide insight into what Clovis people's technology and hunting methods were like? How should archaeologists incorporate such insights in their research?

CASE STUDY

Contemporary archaeological research in California as well as in other parts of North America originates both in the need to answer general research questions and in the need to manage cultural resources effectively. A number of research questions of great interest in California archaeology revolve around understanding the development of maritime adaptations in southern California. In fact, this topic is significant more broadly as well, because it relates to how the Americas were settled and to how complex hunter-gatherer societies originate. This was illustrated in the case study for Chapter 3 ("Paleocoastal Occupations of California's Northern Channel Islands"). Happily, as detailed in the present case study, management concerns related to inventorying and protecting cultural resources on federal property have led to the identification and investigation of important coastal sites on San Clemente Island, which is a military reservation operated by the U.S. Navy. The Eel Point site provides important evidence for early seafaring and settlement by maritime hunter-gatherers along the southern California coast. As you read this case study, keep in mind the role of cultural resource management laws in giving archaeologists the opportunity to record valuable information. Consider whether Eel Point would have been investigated without the CRM mandate.

D.4. EEL POINT AND THE EARLY SETTLEMENT OF COASTAL CALIFORNIA

A Case Study in Contemporary Archaeological Research

L. Mark Raab and Andrew Yatsko

THE PUZZLE OF COASTAL PREHISTORY

Indiana Jones. Archaeologists in pith helmets, pursued by avenging mummies. Obvious exaggerations of reality, if not outright fantasy, these celluloid heroes have created some of the most enduring impressions of how archaeologists work. The rugged individualist, digging where he or she pleases for rare or valuable artifacts, is a common stereotype. While modern archaeology can certainly involve adventure, the reality of the situation is far different. Today, archaeologists rarely excavate without formal permission, they often work with interdisciplinary research teams, and they mainly seek answers to important scientific or cultural questions.

Many of these features of modern archaeological research are reflected in a program launched by the authors nearly two decades ago. Our objective was not simply digging or collecting artifacts, but rather to answer a question: what role did ancient coastal peoples play in the early settlement of North America? As we looked at the study of coastal prehistory, we saw an interesting contradiction between what archaeologists had long believed about the prehistory of coastal North America and what new evidence is actually telling us. We suspected, and believe even more strongly now, that seafaring ways of life played a far larger role in the early settlement of North America than is yet fully understood.

Like all archaeologists, we had been taught that North America's first inhabitants were the Paleoindians; trekkers from Siberia who crossed the Bering land bridge into North America during the last Ice Age in pursuit of prey such as elephants and bison. This conclusion stemmed, in part, from discovery of mammoths killed between 12,000 to 13,000 years ago near Clovis, New Mexico, establishing the Clovis culture as the oldest in North America. The waning of the Ice Age doomed these "megafauna," forcing humans, around 10,000 years ago, to adapt to new plant and animal communities across North America. As indicated in Chapter 7, "Archaic" cultural patterns took hold in California, based on the hunting of medium and small game and the collection of plant foods such as seeds and acorns.

Remarkably, California's 750-mile (1200 km) coastline was thought to have played little or no role in this transition to post–Ice Age conditions. Since the 1920s, archaeologists theorized that the earliest peoples of California avoided maritime hunting and gathering in favor of more productive terrestrial food resources. According to this theory, groups living on the southern California coast did not turn to the sea for food or other resources in any appreciable way until about 2000 to 5000 years ago. Many archaeologists supposed that thousands of years had been required to gradually develop the technological skills and cultural orientations favorable to life on the ocean. Once groups took to the sea, however, most theorists suggested that boat travel to the Channel Islands off the southern California coast, along with intensive fishing and sea mammal hunting, quickly developed. The last stage in this scenario was the emergence of intensively maritime groups such as the Chumash Indians of the Santa Barbara coast a millennium or two before these peoples were contacted by European explorers in the 1500s and 1600s.

In broad outline, then, the traditional story of coastal prehistory was a relatively simple one involving the gradual, trans-Holocene (post–Ice Age era) development of maritime cultural patterns. For the last 70 years, the orthodox model of coastal pre1history could be described essentially as "Clovis first, coastlines last."

Beginning in the 1970s and 1980s, serious cracks began to form in parts of this model. The 1970s witnessed the emergence of cultural resource management (CRM). With the backing of new state and federal laws, archaeological studies became a routine part of development projects. One result was a dramatic increase in the number of archaeological excavations on the California coastline, as well as funding for detailed studies of the excavated materials. This funding also introduced the first widespread use of a revolutionary archaeological tool: radiocarbon dating. Although developed shortly after World War II, radiocarbon dating did not become routine in California archaeology (or most other parts of the country) until the 1970s and 1980s, owing principally to a lack of research funds. In the absence of radiocarbon dating, archaeologists could only guess at the age of many coastal archaeological sites. Following traditional theories, they usually guessed that these sites were of comparatively recent origin.

When radiocarbon dates began to come back from coastal excavations, the results were surprising. While many coastal sites were of late Holocene age, others yielded dates of 8000 to 10,000 years (Moratto 1984). Moratto and some other archaeologists quickly recognized that these dates could not be reconciled with the traditional ideas about coastal prehistory. The study of maritime cultural origins clearly begged for new approaches.

THE CALIFORNIA CHANNEL ISLANDS AND COASTAL PREHISTORY

The study of coastal prehistory in Southern California has centered on the Channel Islands, eight islands that lie off the southern California coast (Figure D4.1). At approximately 1 square mile (2.59 km^2), Santa Barbara Island is the smallest, and at about 150 square miles (390 km^2), Santa Cruz Island is the largest. At least as far back as the 1850s, these islands have attracted archaeological attention, including researchers from as far away as Europe. This interest is scarcely surprising when one considers that the islands contain tens of thousands of well-preserved archaeological sites, spanning a wide range of time.

At about 58 square miles (150 km^2), San Clemente is the southernmost and fourth largest of the Channel Islands. The island is situated about 48 (125 km) miles from the harbor of Los Angeles, and about 22 miles (35 km) from the nearest island, Santa Catalina. Like all the Channel Islands, San Clemente offers an exceptional degree of archaeological preservation because it has escaped the pervasive urban-industrial development of the mainland coast, and it lacks burrowing animals such as gophers. While gophers may not seem like a serious problem in comparison to the spread of urban civilization, studies show that these and other burrowing animals, digging through archaeological deposits over centuries or millennia, often cause serious damage. By contrast, the integrity of cultural deposits on San Clemente Island often rival the best found anywhere in the world.

The Channel Islands lend themselves to the study of coastal prehistory in another important way.

FIGURE D4.1 Location of Eel Point site on San Clemente Island.

In comparison to the mainland, the Channel Islands have "depauparate" terrestrial plant and animal communities. This means that only a fraction of the plant and animal species found on the mainland were available for food on San Clemente and the other Channel Islands. On San Clemente Island, for example, the largest terrestrial animal was a diminutive fox (*Urocyon literalis*), about the size of a house cat. Edible plant species were similarly restricted. By contrast, however, the island's marine environment was teeming with edible species, including fish, shellfish, sea mammals, crustaceans, and birds. This means that San Clemente Island's ancient inhabitants depended overwhelmingly on marine foods for survival. San Clemente Island is, in effect, a sort of "California Galapagos," a natural archaeological laboratory for the study of cultural adaptations to the marine environment.

SAN CLEMENTE ISLAND RESEARCH

Archaeological research on San Clemente Island afforded an extraordinary opportunity to pursue questions about early coastal prehistory. In part, this opportunity stemmed from the transformation of American archaeology in recent decades by governmental policy. During the 1970s, agencies of the federal government and many states geared up to comply with environmental protection laws, including the protection of archaeological sites threatened by development projects. San Clemente Island is a military reservation, used by the U.S. Navy since 1934 for a variety of vital training missions. San Clemente Island was known to contain thousands of prehistoric archaeological sites, including some of the oldest and best preserved on the North American Pacific Coast. Responding to this challenge, the Navy hired Andy Yatsko in 1984 to manage the island's archaeological resources, a job that included development of the necessary base of supporting information and research protocols.

The result was formation of the San Clemente Island Cultural Resources Management Program (CRMP), which has evolved over the last two decades to encompass a wide range of studies, including archaeological surveys, excavations, laboratory studies, and preparation of numerous academic theses, dissertations, and publications (Raab et al. 2004). Although the CRMP is based on a number of federal laws and regulations pertaining to archaeological preservation (King 2008), two key provisions of the National Historic Preservation Act (NHPA) of 1966 have played a dominant role in its development.

The first of these, Section 106 of the NHPA, is a procedural and reactive provision, obliging federal land-managing agencies such as the U.S. Navy to identify the effects of construction, training, and other activities on historic properties, including archaeological sites. If adverse effects are anticipated, federal agencies must consult with the appropriate state historic preservation officer, the federal **Advisory Council on Historic Preservation (ACHP)**, and other parties. Consultation is aimed at minimizing adverse effects, which can involve options ranging from project abandonment to project redesign to conducting research formulated to mitigate the loss of historical resources. The second provision, Section 110 of the NHPA, is more proactive in character, requiring agencies to develop programs for the ongoing identification and protection of historic properties. On San Clemente Island, this provision has resulted in improved inventories of archaeological sites on the island, as well as the collection and analysis of basic scientific and technical information with which more informed resource management programs can be designed.

Over time, implementation of these management policies has involved employment of consulting archaeologists, generally working for private firms. Responding to the needs of specific development projects and the requirements of Section 106, scores of archaeological surveys and excavations have been conducted on San Clemente Island. At the same time, the CRMP developed cooperative research agreements with archaeologists representing regional academic institutions. Efforts of this kind typically have been focused on research projects designed to improve the quality of basic scientific information available to resource managers—information that often is more difficult to collect during more episodic "106 actions." Extending over a period of years or decades, these agreements have proven an ideal vehicle for compliance with Section 110 of the NHPA. The authors developed one such agreement in 1987.

Under terms of this agreement, a variety of productive research projects have been carried out on the island, including large-scale archaeological site surveys of the entire island and excavations of individual archaeological sites representing a wide range of time periods. This work resulted in scores of publications, academic theses, and dissertations, and in a greatly expanded understanding of the archaeology of San Clemente Island (Raab and Yatsko 2000; Raab et al. 2004). Among these investigations is the Eel Point archaeological site (Figure D4.2), the oldest known settlement of San Clemente Island. Occupied between 8000 and 9000 years ago, Eel Point has yielded interesting data on early seafaring and other aspects of early maritime cultural development.

Thus modern archaeological research in the United States, far from matching the stereotype of Indiana Jones, is an undertaking that often must be coordinated among numerous institutions and in compliance with public policy mandates. While these developments have undoubtedly made the practice of archaeology more challenging, experience on San Clemente Island shows that for those willing to develop the appropriate research plans and partnerships, the satisfactions of archaeological discovery remain as strong as ever.

FIGURE D4.2 Eel Point from the northeast.

THE EEL POINT ARCHAEOLOGICAL SITE

Although scores of archaeological sites on San Clemente Island have been investigated to various extents, the Eel Point site stands out in the study of maritime cultural patterns because of its age and extensive cultural deposits. The authors conducted four seasons of excavation at Eel Point between 1994 and 2003, following three seasons of work by archaeologists from the University of California, at Los Angeles, between 1983 and 1986 (Meighan 2000). Most of these efforts were summer archaeological field schools, involving university undergraduates and graduate students from across the United States and from several other countries. To date, the authors' research has yielded 47 radiocarbon dates, establishing a relatively detailed cultural chronology (Cassidy et al. 2004; Raab et al. 1994). Cultural deposits in some parts of Eel Point reach a depth of nearly 4 meters (13 ft.), containing abundant bones of dietary origin, stone tools, bone and shell artifacts, and cultural features of various kinds,

FIGURE D4.3 Recording a profile at Eel Point.

all in an excellent state of preservation (Figure D4.3). Here was an opportunity to find some answers about early maritime culture and its development across time.

Contemporary visitors to Eel Point find a mound of shell-bearing midden (deposits containing domestic refuse) rising to about 3.5 meters (11.5 ft.) above a marine terrace, located on a headland of erosion-resistant volcanic rock that gives the site its name. Perhaps 5 acres at the base, more than 90 percent of the mound, has accumulated during the last 3500 radiocarbon years (Raab et al. 1994). Today, however, Eel Point scarcely resembles the place encountered by its first inhabitants between 8000 and 9000 years ago. The site's initial occupants selected a shallow natural depression on the lee of a stone outcrop to establish their residential base, probably enjoying a degree of protection from prevailing winds. Occupying an area perhaps 30 meters (100 ft.) in diameter, this location included substantial habitation structures, hearths, pits, work areas, and "toss zones" containing food debris, along with bone, stone, and shell artifacts.

Eel Point continued to be occupied until European contact in the sixteenth century. During all this time, the site's occupants continued to get most of their food from the sea. Excavation shows that Eel Point was an important settlement, as witnessed by house floors, hearths, living surfaces, and refuse deposits. The latter offer particularly detailed insights into patterns of fishing, sea mammal hunting, and shellfish collecting. This research shows that Eel Point's maritime economy changed substantially across time. During the Early Holocene (ca. 9000–7000 years ago), sea mammals, such as sea lions, and shellfish comprised the bulk of the marine food supply. By the late Holocene (ca. 3500 years ago), fishing intensified dramatically, as did sea otter hunting (Porcasi et al. 2000). The first circular shell fishhooks appeared about 3300 years ago, making them some of the oldest of their type on the North American Pacific Coast (Raab et al. 1994). Considerable evidence argues that these changes reflect long-term depletion of the most productive food resources as a result of human harvest pressures (Porcasi et al. 2000).

EARLY SEAFARING

Some of the most important contributions of the Eel Point research are data on early sea travel and island colonization. Archaeologists had speculated for decades that the New World might have been reached by boat on a time horizon as early as Clovis or conceivably even earlier. This idea seemed logical, in that clear evidence exists of Ice Age and early Holocene sea travel in East Asia, close enough to the North Pacific Coast of North America to make early sea contact plausible (Erlandson 2004).

But when were watercraft actually used in coastal North America? Answering this question is difficult, since archaeologists can rarely expect early watercraft to be preserved, given their construction of animal hide, wood, and fibers or other perishable materials. Instead, clues about the advent of seafaring have generally come from locations that required water travel. The California Channel Islands, for example, are a strong circumstantial case for early sea travel. Radiocarbon dates from Daisy Cave on San Miguel Island, for example, showed that this island was occupied by about 12,200 years ago (Erlandson et al. 1996; also see Chapter 3's case study), an antiquity approaching that of the Clovis culture. Although lowered sea levels during the last Ice Age shortened the distance that had to be traveled by water to perhaps 2.5 to 5 miles (ca. 4–8 km), there is no doubt that some form of watercraft was required to reach the Northern Channel Islands during the late Pleistocene.

What about San Clemente Island? Located in a deep ocean basin, San Clemente Island has never been closer to the mainland than at present. Watercraft of some kind had to be used to reach Eel Point during the early Holocene. This fact places early Holocene archaeological evidence from Eel Point in an interesting light. Cassidy et al. (2004) describe an interesting toolkit from the basal cultural stratum of Eel Point, dating between 8000 and 9000 years ago. Based on replication of some of these stone tools and the examination under high-power magnification of experimentally induced tool wear patterns, Cassidy et al. (2004) concluded that Eel Point's earliest inhabitants possessed a wide range of tools, including wood wedges, drills, reamers, planes, and abraders (Figure D4.4). Interestingly, this toolkit closely resembles one used by historic Chumash Indians of the Santa Barbara coast to make wooden-planked, seagoing canoes for travel to the Northern Channel Islands (Cassidy et al. 2004).

While we are not suggesting that Eel Point's early inhabitants were related to the Chumash or that they were making wood-planked canoes, the data strongly suggest that Early Holocene Channel Islanders possessed the capability to fabricate sophisticated watercraft of materials such as wood and animal hide. This discovery opens up a way of studying early use of watercraft and the maritime cultural adaptations that may have been made possible by this key technology. While archaeologists can rarely expect to find watercraft remnants, they can recover tools used to manufacture boats, assembling this and other kinds of evidence for the comparative study of seafaring capabilities across time (Cassidy et al. 2004).

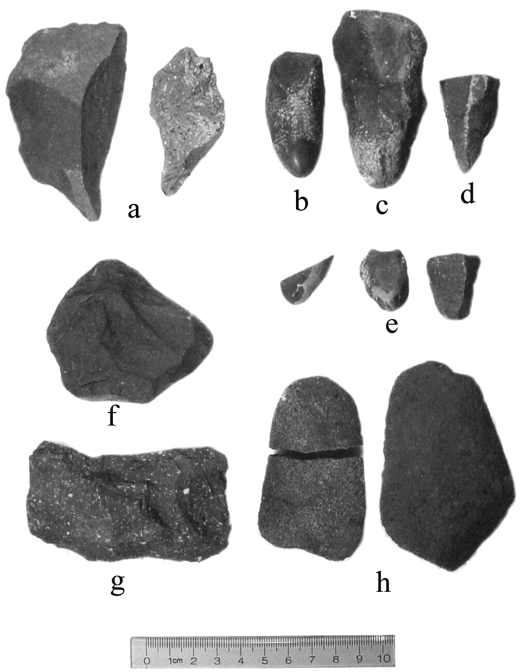


FIGURE D4.4 Tools from the Eel Point site: (a) drills, (b–d) reamers, (e) reamer tips, (f) wedge, (g) scraper plane, and (h) abrader.

Much remains to be learned about maritime prehistory, but research on San Clemente Island already suggests important revisions to our understanding of maritime prehistory. Whereas archaeologists once imagined that sea travel and intensive maritime modes of economy and settlement developed gradually across the post–Ice Age era, it *seems* increasingly clear that maritime peoples were present in North America from quite early times. Whether these ancient mariners rival the antiquity of North America's earliest terrestrial settlers remains to be seen, but there can now be little doubt that coastal peoples were among the continent's oldest cultural traditions. From our perspective, these results are important testimony to the power of research questions, rather than simply a quest for exotic objects in faraway places.

DISCUSSION QUESTIONS

1. What and where is the Eel Point site? How can it help resolve the puzzle of coastal prehistory" referred to at the opening of this case study?

2. How have Sections 106 and 110 of the NHPA led to the development of cooperation between academic institutions private consultants and the U.S. Navy as illustrated by the Eel Point investigations?

3. What might be the significance of changes in the marine food supply documented at Eel Point? Can you think of reasons besides depletion of resources by humans to explain more intensive fishing in the late Holocene?

4. Evaluate the argument that the existence of woodworking tools similar to those used by the Historic Chumash to make planked canoes means that Eel Point's early Holocene inhabitants made sophisticated watercraft. Should all these tools be interpreted in this manner?

CASE STUDY

Many Americans instantly recognize pictures of the spectacular cliff dwellings of Mesa Verde National Park such as Figure 9.8. Some know that the abandonment of the Mesa Verde region in southwestern Colorado and, indeed, of much of the northern Southwest 700 years ago is a perennial topic of archaeological debate. However, this area of Colorado has provided archaeologists with data concerning other, earlier movements of Southwestern peoples and even with important evidence for the evolution of village life in the Southwest and elsewhere. The Dolores Archaeological Program, a large cultural resource management project undertaken during the late 1970s and early 1980s in the Dolores River valley north of Mesa Verde proper, provides an example of how mitigation of archaeological sites has prevented the loss of important information about past peoples of the Southwest. As you read this case study, think about how the Dolores Archaeological Program contributes to understanding of the transition to settled village life in the Southwest. How do the circumstances that affected settlement and abandonment of the Dolores River valley provide insights concerning the connections between farming, population growth and aggregation, and abandonment in this part of the world?

D.5. THE DOLORES ARCHAEOLOGICAL PROGRAM

Documenting the Pithouse-to-Pueblo Transition

Sarah W. Neusius

A visitor to the Dolores River valley, just north and west of the town of Dolores, Colorado (Figure D5.1) in the early 1980s, you could not have failed to notice that major construction was being undertaken. This part of the Dolores Valley was a busy place in those years, during which the McPhee Dam and Reservoir and associated features were under construction. Large earthmovers and dump trucks rattled noisily along gravel "haul roads" moving earth to the dam site; abandoned farmhouses were boarded up and then dismantled. Construction workers in pickups and vans were everywhere, going to and from work when their shifts changed and, during their off hours, frequenting local establishments. Some of these workers in hard hats and jeans, however, were not building the dam or other project features. Instead, they were archaeologists, including survey and excavation crews, geoarchaeologists, and other analysts investigating archaeological sites located within the project area. These researchers were involved in a large archaeological mitigation project known as the Dolores Archaeological Program (DAP). DAP's most basic goal was to recover significant information about the river valley's past inhabitants before the dam was finished and the waters of the McPhee Reservoir would close over the record these people had left.

DAP came into existence under contract with the U.S. Bureau of Reclamation, which was constructing the dam and reservoir along the Dolores River. The Bureau of Reclamation had agreed, as required by law, to develop a data recovery program for the cultural resources that would be affected by this project. The primary contractor was the University of Colorado, but a number of subcontractors, including Washington State University and several independent consultants, were involved with the DAP between 1978 and 1985.[1] The Bureau of Reclamation also developed a **memorandum of understanding (MOU)** with the U.S. Bureau of Land Management to curate the archaeological collections and DAP records at

1. The Dolores Archaeological project was funded by the Bureau of Reclamation, Upper Colorado Region, Salt Lake City, Utah under Contract No. 8-07-40-S0562.

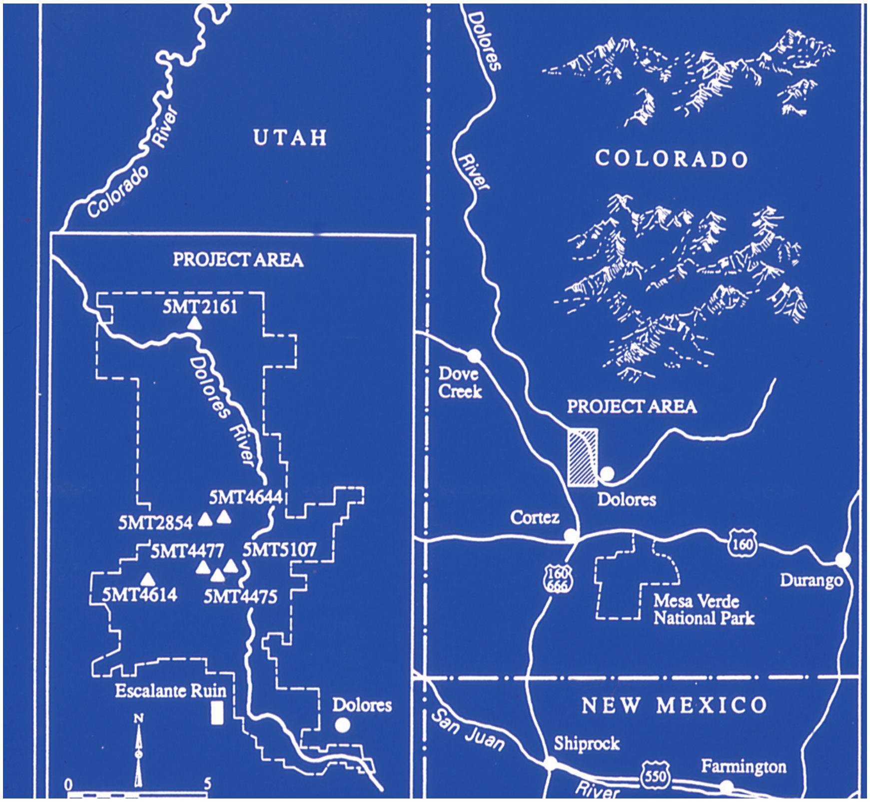


FIGURE D5.1 Location of the Dolores Project Area in southwestern Colorado.

a public facility to be called the Anasazi Heritage Center.

Although the most senior principal investigator, Dr. David Breternitz, had much experience working in the Southwest, DAP did not develop to answer research questions per se. Instead, the program existed to meet a public need—the need to make sure that a large federal project did not destroy important information about this country's heritage. There were likely to be **significant cultural resources** in the reservoir project area, and for us to be able to provide an understanding of the cultural past in the Dolores Valley, these resources had to be inventoried, tested, or excavated more fully.

Because these overarching goals had to be met as cost-effectively as possible, DAP was a logistical challenge of great magnitude. The size and complexity of the DAP dwarfed previous research in the area. DAP archaeologists had to decide how to acquire a representative sample of sites and what precisely to record, collect, and study for each site. DAP was obliged not only to take care of what it collected and recorded, but it had to create a computerized database that would be a tool for future researchers. Meanwhile the Bureau of Reclamation understandably placed priority on speedy fieldwork that would clear parts of the area for construction. This tension between a client's need to minimize delay and the archaeologist's need to carefully structure a project to ensure that important information is not missed remains a challenge in CRM projects of all sizes today.

To get DAP work done, a large number of archaeologists and specialists converged on the Dolores area; for a time DAP was one of the largest employers in the county. Having so many archaeologists working together at one time produced a kind of synergy in which ideas about the area's culture history, archaeological methodology, and data management were productively generated and integrated. I came to DAP in the fall of 1981, when the project was already in full swing, to take over the analysis of animal remains recovered from DAP sites. In the scheme of the project, I was only one of several secondary-level investigators, but I authored many DAP reports (e.g., Neusius 1986b, 1988; Neusius and Gould 1988). I learned much about the regional archaeology and continue to regard my three years at DAP as among the most formative in my career. Because of its complex nature and the quality of the data it produced, DAP provides a good example both of CRM archaeology at its best and of Southwestern archaeology in general.

WHAT DID DAP ARCHAEOLOGISTS WANT TO FIND OUT?

The project area, which is located approximately 10 miles (16 km) north of Mesa Verde National Park, is a portion of what archaeologists have called the Mesa Verde Region within the traditional area of the Ancestral Puebloans of the northern Southwest. Initially DAP had rather general goals centered on finding out what cultural resources existed in the project area, what past time periods these resources represented, and what they indicated about the regional culture history. Of course we knew some things about the archaeology of the Dolores Valley, but previous archaeologists had not studied it intensively.

Archaeologists knew that southwestern Colorado was inhabited for much of the past 8000 years. The general developmental sequence was thought to change from early seasonal use by foragers to settlement by horticultural people as regional population grew. Eventually, during Pueblo I times, these farmers began to aggregate into villages, which in turn grew larger over time. The well-known large cliff dwellings of Mesa Verde were understood as the culmination of this regional trend, followed by the precipitous abandonment of the entire region around 650 BP (AD 1300, or the end of Pueblo III). It was this regional abandonment that was of greatest interest, and many theories had been proposed about its causes. One of the most popular of these theories was that farmers at this northern margin of the Anasazi area were unable to continue to make a living as the result of drought and other environmental factors.

Because relatively little was known about human use of the Dolores Valley, it was important and interesting to document its past, but no one really understood how significant the results of a large multidisciplinary CRM project done in this valley would be. When DAP began, it was necessary to formulate research questions that would guide both the collection and the analysis of data. The initial questions were very broad, but as more and more data were collected and as analysis progressed, our ideas became directed more toward archaeological rather than management problems.

It was clear that while wild resources would have been relatively abundant, farming in the Dolores River valley would likely always have been rather precarious. Elevations within the project area range between approximately 6900 and 8000 feet (2100–2440 m) above sea level. This is a semiarid area (Figure D5.2), which today supports relatively more vegetation than much of the Southwest, even away from the river itself, because it receives an average of between 17 and 18 inches (43–48 cm) of rain per year. Several distinct vegetation communities as well as a wide variety of wild plant and animal resources can be found within the DAP study area today.

However, the most important environmental characteristic for Ancestral Puebloan populations would have centered on the possibility of growing crops. Today the Dolores River valley is at the upper margin of the dry farming belt in the northern Southwest (Peterson 1986). There is just enough water (more than 14 in., or 36 cm, per year) and a

FIGURE D5.2 The Dolores River valley environs.

long enough growing season (at least 110 days without frost) to make farming possible. The greatest agricultural risk undoubtedly has to do with length of the growing season rather than moisture. All over the Southwest, farmers of the past would have had to consider both water and frost-free period. On the Colorado Plateau, in general, farmers can attempt to increase the amount of available moisture by selecting field locations at higher elevations; but as they do so, they must keep in mind the shortening of the effective growing season. At Dolores, balancing these factors is complicated by cold-air drainage, a temperature inversion not uncommon in narrow mountain valleys, which causes the valley bottom to actually have a shorter growing season than areas on the sides of the river canyon and on the mesa top (Petersen and Clay 1987).

Prior to the DAP, it made sense to attribute the lack of large Puebloan sites to the Dolores Valley's inability to support large human populations. In this view, the valley was a relative backwater culturally in comparison to areas just a few miles to the south and west that were lower in elevation and warmer. However, DAP surveys fairly quickly showed that most of the human occupation of this part of the Dolores Valley had been between 1350 BP and 1000 BP (AD 600–950). Evidence of occupation by both Archaic Tradition and Protohistoric peoples is much scarcer than that of Anasazi tradition populations and is confined largely to several seasonal and short-term encampments. Second, even within the Anasazi tradition (1950–750 BP/AD 11200), those who occupied the area prior to 1350 BP seem to have been mostly seasonal users in small family groups (Gross 1984). The vast majority of Dolores sites represent Basketmaker III, Pueblo I, and the very beginning of Pueblo II in the Pecos classification. Although the immediate Dolores area apparently was abandoned between 975 BP and 900 BP (AD 975–1050, or Pueblo II), some use by later Puebloan people is again evident. The Historic period utilization of the valley also was notable, but the DAP ultimately was not responsible for investigation of these cultural resources (Kendrick 1982).

In one way, this concentration of sites during the Basketmaker III and Pueblo I times detracted from DAP archaeologists' ability to understand large segments of the past in the Mesa Verde region. However, in another way, this temporal clustering of occupation during a brief 350-year span told us something very important. It indicated that at least in this one small valley, the Anasazi did not follow the expected model of gradual population growth and slow aggregation into villages, only to abandon their homes for one reason or another around 650 BP. Instead, people moved into the valley during the seventh century and then largely abandoned it before 1000 BP, several centuries before the region as a whole was abandoned. Moreover, the large number of small village sites dating to the eleventh century BP suggests that the Dolores Valley likely supported a fairly dense and aggregated population during the peak years of its use. Figuring out the specifics of this unexpected pattern meant addressing the following more focused questions:

1. Why was the primary Prehistoric use of the Dolores River valley restricted to the period between 1350 BP and 1000 BP (AD 600–950)?
2. How was the Anasazi settlement in this area linked to processes of settlement aggregation in the pithouse-to-pueblo transition, to the intensification of farming, and to the concentrations of social power that were taking place more generally within the northern Southwest at this time?
3. Were environmental or climatic conditions what first made the Dolores River valley attractive and eventually made it much more marginal for farmers and for aggregated Anasazi villagers, or were there other causes?

WHAT DID DAP ARCHAEOLOGISTS ACTUALLY DO?

Of course it is not possible to explain all that was done as part of the DAP. A wide variety of investigations were made, and much of what was done involved basic fieldwork. Because DAP archaeologists sought to document site distribution and the character of sites within the project area, fieldwork included large amounts of archaeological survey. All of the area to be directly impacted by the construction of the dam, reservoir, and associated features was surveyed. Other areas were more selectively surveyed, to thoroughly document culturally meaningful settlement systems. A large number of site excavations also were conducted (Figure D5.3). Some sites received only limited test excavation, while at others much more intensive excavation was undertaken. On the largest sites receiving intensive excavation, it wasn't feasible

FIGURE D5.3 Excavated site at Dolores; note surface room-block in the center and excavated pit structure to the right.

to excavate the whole site, but several smaller sites were completely excavated. Whatever the level of investigation, it was considered important to expose structures and features so that the site plan and the architecture could be well documented. These kinds of data helped with the temporal designations for a site because certain architectural features and configurations were known to date to certain times. These data also eventually provided one means of estimating population using calculations based on available floor area and site size (Schlanger 1986), as well as a way of discerning aspects of past social structure.

Close to a million artifacts and ecofacts were collected during DAP survey and excavation. A wide variety of special samples also were collected from DAP sites. Sampling for macrobotanical remains through flotation, as well as pollen sampling, was generally focused most intensively on structure contexts believed to have been sealed soon after abandonment. Since dating of the various contexts was important, sampling for radiocarbon, archaeomagnetic, and tree-ring dating also was frequently done.

The processing and analysis of all the materials and samples collected from DAP survey and excavation was a gigantic undertaking. "For every day in the field, archaeologists spend two to five in the lab": this often-repeated truism certainly applies here. DAP rented a large vacant apple shed outside Dolores, then added a number of trailers and ultimately a second apple shed for additional office, lab, and storage space. The DAP lab was a beehive of activity, staffed by a large number of archaeologists and support personnel. DAP's analytical organization included one group of people who studied the ceramics, another focusing on the lithics, a third focusing on settlement studies, and the environmental group (of which I was a part), which included ethnobotany, geology, and zooarchaeology. In addition, from time to time there were other specialists investigating special topics and other staff in administration, basic laboratory processing, report production, computerized data processing, and photography. Finally, curators from the Bureau of Land Management were on site to curate and receive the collections and to plan the Anasazi Heritage Center, a small museum and interpretive center now located adjacent to the McPhee Reservoir.

There were a number of important tasks undertaken during DAP laboratory analyses. I was involved in documenting what animals the people had used, while others looked at the plant remains. We tried to determine the nature of past subsistence and also to get a sense of what plant and animal communities had been present in the past. This meant that we had to physically examine each recovered piece of animal bone and each plant part to place the specimens according to species. Similarly painstaking work went on in all sections of the lab. Ultimately, besides developing data relevant to reconstructing farming and other economic activities, DAP archaeologists developed data relevant to the reconstruction of regional and local climate, to the size of the human population at any point in the sequence of occupation (called the momentary population), and to the degree of social differentiation and control at various points in the sequence. These analytical activities went beyond direct observation and description of artifacts, ecofacts, features, and structures; often we used computer programs to make detailed statistical study of data assemblages. Through these myriad studies, we developed the large DAP database and began to draw conclusions about what it meant.

WHAT DID DAP ARCHAEOLOGISTS FIND OUT?

Today the sites we worked are under the waters of the McPhee Reservoir. However, Escalante Ruin at the edge of the reservoir and the Anasazi Heritage Center adjacent to it offer first-rate exhibits about the area's culture history. Scholars and students having research interests in Puebloan cultures, particularly those of Basketmaker III and Pueblo I age, might get permission to use the collections and unpublished reports housed there by the Bureau of Land Management. The project also has been described in a series of volumes published about DAP by the Bureau of Reclamation. What might you learn if you took advantage of these resources?

Reviewing the changes in architecture and site plan between Basketmaker III and Pueblo I times helps clarify the nature of DAP results. At Dolores we designated sites dating between 1350 BP and 1230 BP (AD 600–720) as Period 1 sites and considered them to generally correspond to local phases and subphases of Basketmaker III. These Anasazi, who seem to have been concentrated in the southern part of the project area, were the first Puebloan settlers of the river valley. People lived in small, dispersed family homesteads of one or two families; their actual dwellings were the shallow pithouses they constructed, while a variety of surface structures, pits, and outdoor activity areas served storage and other functions. Figure D5.4 shows a typical site plan for 1350 BP to 1190 BP, with a refuse deposit or midden to the south and east of the pit structure and an arc of other facilities to its north. Several of these homesteads may have been affiliated, forming a dispersed neighborhood, but true villages did not exist.

After Period 1, the Dolores record consists mainly of Pueblo I sites grouped into Periods 2 through 4 and some of Period 5 between 1250 BP and 1050 BP (AD 700–900). At first most sites continue to be laid out like the earlier dispersed homesteads. However, pit structures do become deeper and less rounded in shape, perhaps because a greater variety of ritual activities were being conducted inside these structures in addition to domestic activities (Gross 1986). At one site, Grass Mesa, there is evidence for up to 13 pit structures, one of which is quite large. This oversized structure may have functioned to draw the community together through ritual or public activities. Archaeologists often call such buildings integrative structures. This early occupation at Grass Mesa could be an indication that the village, or some social subset of it, was increasing in social and political importance.

By 1190 BP (AD 760), toward the end of Period 2 and in Period 3, a more typical Pueblo I village structure is evident (Figure D5.5). Sites from this time on usually contain a surface room block consisting of a double row of rooms, a plaza and pit structure area to the south of the room block, and a midden area further to the south. The usual pattern is two back-row rooms to every front-row room. DAP archaeologists assumed that such three-room suites were the dwelling and storage space for a family unit. The pit structures can be described as square with rounded corners and larger floor areas. They have ritual features although domestic activities also are evident. The general interpretation of Period 2 and 3 pit structures is that they served as space for a unit of two or more cooperating families, called an interhousehold group, to share meals and some ceremonial activities. Several oversized pit structures from this period might indicate cooperative activities between two or more interhousehold groups. These include a great kiva built close to 1150 BP (AD 800) with a floor area

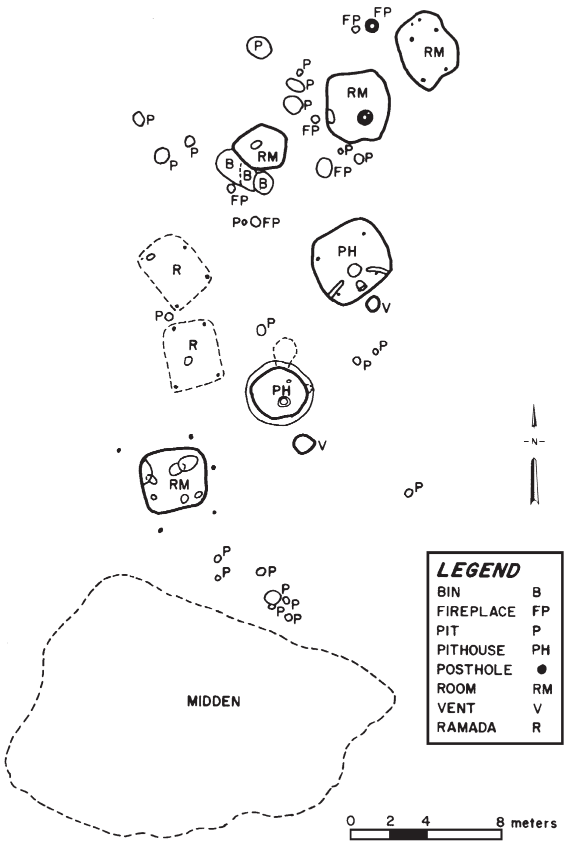


FIGURE D5.4 Idealized plan for sites dating from 1350 BP to 1190 BP (AD 600–760).

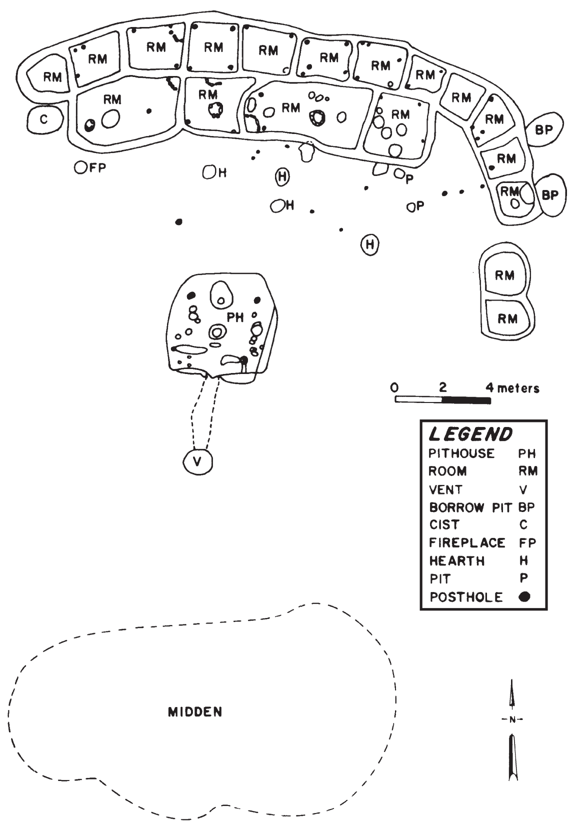


FIGURE D5.5 Idealized site plan for period from 1190 BP to 1100 BP (AD 760–850).

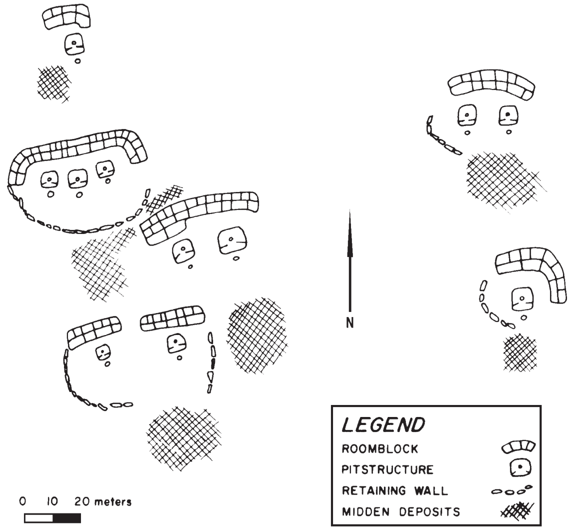


FIGURE D5.6 Idealized site plan for 1100 BP to 1050 BP (AD 850–900).

of 400 square meters (4300 ft.^{2}), which was found at Grass Mesa.

The end of Pueblo I, dated to 1100 BP to 1050 BP (AD 850–900), is represented in DAP Periods 4 and 5, during which village aggregation continues. There are both large aggregated villages and smaller, outlying settlements (Kane 1986a). Large aggregated villages have several room block units, often in a crescent shape, with associated pit structures, while the outlying settlements may have had only a single room block, more like those from earlier periods. Midden deposits are generally located to the south of the room block and pit structure configurations (Figure D5.6). At the larger sites, up to 40 pit structures may have been in use at one time. Once again the pit structures are interpreted as locations for interhousehold activities, and the oversized pit structures are viewed as integrating even larger groupings, perhaps representing clans. The largest pit structures from this period may not have had evidence for domestic activities at all. Kane (1986b) proposed that the settlement data indicate two tiers of settlements at this time, with lower-tier settlements having one to three room blocks and upper-tier settlements having seven or more room blocks plus oversized pit structures with ceremonially associated features and artifacts. These latter settlements could signal the beginning of some social groups having greater power. A possible great kiva indicative of community integration as well is located in a rockshelter known as Singing Shelter.

It is during the same time period that agricultural field houses (Kohler 1992), small sites with just a few surface rooms located away from villages in field areas, become notable in the Dolores record. Presumably their appearance is associated with the process of aggregation into settled villages by farmers practicing shifting cultivation. Kohler has used information from the DAP database to propose some interesting associations with resource scarcity and concepts of ownership (Kohler 1992). It also is during Period 4 that we see the strongest case for agricultural intensification and for a corresponding decrease in game procurement. Similarly, there may be differences in reliance on stored grain between settlements at this time (Gross 1986). The existence of settlements of different sizes may reflect developing hierarchies or may simply result from variable productivity of the agricultural lands among the settlements.

Finally, there is another pattern evident at the end of Pueblo I, particularly during Period 5, in which two sites, Grass Mesa and Rio Vista Village, show much more variability in architecture, abandonment of parts of room blocks, and additions to others. Some small, highly variable pithouses, which DAP called "pocket pitstructures" seem to have been used as dwellings only. Larger pit structures, which have evidence for both domestic and ritual functions, appear along with these pocket units. In addition, some of the back rooms in room blocks have hearths and other features, suggesting that they were used for living rather than for storage. Whether this variability indicates impending break down of the mechanisms that previously had integrated communities is uncertain.

Early Pueblo II occupations at Dolores are found in the center of the project area during Period 6, between 1030 BP and 970 BP (AD 920–980); but even here, only some of the formerly occupied room block units are reoccupied. In addition, pit structures, of which there generally are one or two per room block, are circular rather than rectangular. These pit structures appear to have had ritual functions exclusively, and they suggest the pattern of kivas known from later Pueblo times. Surface rooms seem to contain areas for mealing or corn grinding, an activity previously evident inside pit structures. Archaeologists assume that domestic activities have been relocated to surface rooms almost exclusively. Changes in ritual features within pit structures, however, also suggest some new patterns of ritual integration.

After Period 6, the Dolores area is more or less abandoned. As a result, there is much less information for this part of the sequence. Many of the late sites are not village sites, but farmsteads without room blocks. In other words, aggregation into large villages was not the rule, at least within the Dolores Valley itself.

These findings about village aggregation are closely associated with the second type of conclusion that can be drawn—population estimates for the number of households in the Dolores Valley. It appears that villages were being formed and population aggregation was happening as population levels in the Dolores Valley increased. Figure D5.7

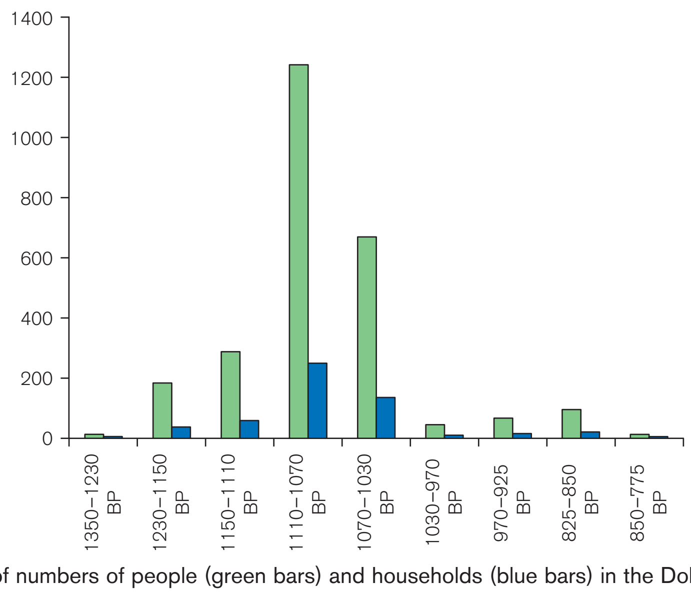


FIGURE D5.7 Estimates of numbers of people (green bars) and households (blue bars) in the Dolores Valley over time.

summarizes DAP estimates of the population in the Dolores area during Pueblo times: people began to move into the valley around 1350 BP, and the size of the population increased gradually for two centuries in Periods 1 and 2. The rate of population growth at this time is too rapid to have come from reproduction alone, and in-migration of populations from elsewhere is suggested. This is particularly true after 1110 BP, with a maximum population peak between 1110 BP and 1070 BP (AD 840–880) of around 1250 individuals, which DAP estimated meant a population density of about 19 people per square kilometer (1 km^2 = 0.3861 $mi.^2$). Following 1070 BP, population declined rapidly so that the valley appears to have been abandoned by the end of Period 5, or 1030 BP (AD 920). There may have been some reoccupation of the area between 970 BP and 850 BP (AD 980–1100), but after 850 BP (AD 1100) the population was as low as it was at the beginning of the sequence.

It is clear that a pattern of slow population growth and aggregation does not fit the Dolores case. Instead, there was a short period during which this small river valley was attractive to the Anasazi. In fact, though the first Anasazi came to the Dolores Valley around 1350 BP and villages began to be formed a hundred years later, it was only after 1150 BP (after AD 800) that population really grew rapidly and villages reached their largest size. Then after a brief period, population dropped precipitously, and in less than 150 years Pueblo II people had largely abandoned the Dolores Valley. The obvious question is, what happened?

Climatic and environmental data may partially explain why people came to the valley and why they left. A number of DAP studies tried to assess the agricultural attractiveness of the Dolores River valley (e.g., Petersen 1986; Schlanger 1986). As noted earlier, the project area is at the upper edge of today's dry farming area. Thus, small changes in climatic variables can make the valley either more or less attractive than surrounding areas. We can conclude that greater warmth reduces the chance of too short a growing season at Dolores, while, at the same time, greater dryness makes other areas that are warmer more marginal in terms of water. When it was warm and dry, people might have migrated into the Dolores Valley, and when it was cool and moist, they might have migrated out. It now is generally agreed that the Dolores Valley would have been most attractive to farmers between 1190 BP and 1050 BP, or AD 760 to AD 900 (late Period 2 through early Period 5), which is precisely when the in-migration and village aggregation occurred. Between 1075 BP and 1000 BP, however, Petersen (1986) has found evidence for a period of severe drought followed by an interval of shortened growing season. He suggests that this prolonged time of unfavorable weather destabilized the Dolores Anasazi farming system beyond redemption. This could be the case, even though there are some Anasazi in the valley during Period 6. Schlanger (1986, 1988) has looked at the Dolores data in a regional context. She provides further indications that local population movements happen in response to the interaction of a variety of environmental factors prior to the more total abandonment of southwestern Colorado.

However, a purely environmental model for the Dolores archaeological record may fail to account for all of the variability. Notably, it may not fully account for the aggregation into large villages, even if it does correlate with the overall pattern in population growth and decline. Many developments seem to have taken place during Period 4, essentially prior to extreme climatic stress. The possible settlement hierarchy during the peak population, in combination with large, oversized pit structures, provides some hints of greater sociopolitical integration, as does the increased evidence of ritual or ceremonial activity in these structures after village aggregation. Moreover, other lines of evidence indicate that agriculture was intensified as population levels rose while game procurement decreased in importance. This may have resulted in more emphasis on stored grain (Gross 1986; Petersen et al. 1986), especially in large settlements. It seems likely that for the people living in the Dolores Valley, both social and environmental considerations were important. It would be naïve to attribute the record solely to environmental factors. Instead, we can conclude that a number of factors probably interacted in the process of village aggregation, sociopolitical development, and population change shown by the Dolores record.

The DAP database is much richer than can be indicated here. The data suggest a complicated interaction between variables that archaeologists can still explore today as new data from elsewhere are gathered. From this brief summary, you can see that DAP provided new understanding of what is important in the prehistory of the Mesa Verde Region and beyond during the pithouse-to-pueblo transition. Rather than gradual evolution of more complex societies, we now envision populations and subpopulations, perhaps even households, positioning themselves opportunistically in terms of a number of variables, both environmental and sociopolitical. What we didn't lose to the waters of the McPhee Reservoir because CRM archaeology was done at Dolores is an example of how Southwestern peoples began to aggregate into villages.

It has been said that good research generates new research problems. Although the Dolores Archaeological Program was a CRM data recovery project, good research has surely resulted. Some archaeologists have used the project data for further investigations (e.g., Kohler 1992; Potter 1997). Other archaeologists now are exploring other regional cases (e.g., Wilshusen and Blinman 1992; Wilson and Wilshusen 1995). As they do so, ideas about the past will change and models will be refined yet again.

DISCUSSION QUESTIONS

1. Why was the Dolores Archaeological Program conducted in the location described? Did these origins make it different from other archaeological projects? How?
2. In what ways was the Dolores archaeological record incomplete, and why did this make it particularly significant?
3. How would you characterize the significance of oversized pit structures and great kivas in the Dolores record? What about the development of multiroom pueblos and the appearance of large sites with many room blocks and pit structures?
4. What causes can you think of for migration and abandonment of areas like the Dolores River valley? What kinds of evidence would you seek to test your ideas?

CASE STUDY

As pointed out in Chapter 8's case study about excavation at Gatecliff Shelter, Nevada, cave sites that contain multiple stratified components can provide archaeologists with important records of cultural change. In the Southeast, one such site is Dust Cave, located in northern Alabama. Hidden away in a swamp caused by a dam on the Tennessee River, this site, which contains a sequence of Late Paleoindian through Middle Archaic components with well-preserved subsistence remains, was the focus of more than a decade of excavation. Archaeologists built an elaborate field camp and with their students spent several summers excavating this cave's deposits. Now their work is adding significantly to our understanding of these time periods in the Southeast. This case study tells about the field schools conducted at Dust Cave and shares some of the results obtained from this long-term project. Since the dates in this case study are calibrated dates, you may want to refer to Chapter 2, in which we explain how calibrated and uncalibrated dates correspond (see "A Word About Dates and Dating"). As you read this case study, compare what has been learned at Dust Cave with the text's discussion on Paleoindian and Archaic technology and subsistence in the Southeast. How does evidence obtained from Dust Cave fit expectations based on the text?

D.6. THE DUST CAVE ARCHAEOLOGICAL PROJECT

Investigating Paleoindian and Archaic Lifeways in Southeastern North America

Renee B. Walker, Boyce N. Driskell, and Sarah C. Sherwood

Researchers first investigated Dust Cave (1Lu496) in 1989, during a University of Alabama archaeological survey of caves in the bluffs adjacent to Pickwick Lake, a part of the Tennessee River system. The Tennessee Valley Authority (TVA) commissioned the survey to find, evaluate, and protect archaeological sites on its property (Goldman-Finn and Driskell 1994). The federal government formed the TVA in 1933 to exploit the energy potential of this large river system; over 50 dams have since been constructed to improve navigation and produce hydroelectric power. Dam construction inundated much of the Tennessee River valley, threatening the loss of many archaeological sites. The TVA organized and financed programs of archaeological salvage to recover archaeological data from the largest, most prominent sites (e.g., mounds, shell middens) prior to inundation. With support from programs such as the **Civil Works Administration (CWA)** and the Works Progress Administration (WPA), these and similar programs constituted what has come to be known as "**New Deal archaeology**" (Lyon 1996).

Archaeologists of the New Deal era focused on large-scale excavations with many unskilled laborers. Although conducted very differently from how we do archaeology today, the projects of the New Deal archaeologists laid the foundation for future research. While cultural resource laws protect remaining sites on TVA property, the sites are nevertheless threatened by erosion along the shorelines or by looting from artifact hunters. Even though looters overlooked the buried archaeological deposits at Dust Cave, heightened water levels in nearby Pickwick Lake caused degradation of organic remains within the lowest deposits of the cave. For this reason, archaeologists have excavated a large portion of the deposits to recover organic remains before they completely dissolve. The ensuing data provided, and will continue to provide, important information on the early inhabitants of the Eastern Woodlands of North America.

The archaeological site of Dust Cave is in northwestern Alabama, just outside the town of Florence (Figure D6.1). Amateur speleologists initially explored the cave in 1984 (Cobb, 1987; Cobb et al. 1995; Goldman-Finn and Driskell 1994) and reported finding a few prehistoric artifacts on the surface. The site's floor was covered with a loose and dusty sediment, hence the derivation of its name, Dust Cave. In 1989 a research team directed by Boyce Driskell from the University of Alabama in Tuscaloosa reinvestigated the site (Driskell 1994). After a decade of intensely focused research, we now know that people periodically lived in Dust Cave between 13,500 cal BP and 5700 cal BP (11,500–3600 cal BC). The limestone cave environment protected and preserved abundant organic materials, including bone, shell, and plant remains (particularly nuts and seeds), as well as microstratigraphy rarely recovered in large quantities in open-air sites. These materials provide insights into early forager diets and environmental changes. Excavators also recovered large quantities of stone

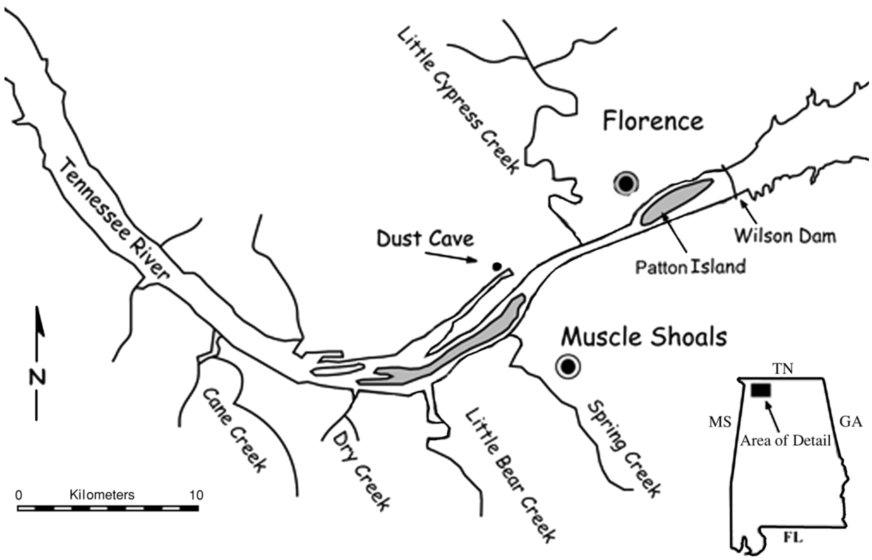


FIGURE D6.1 Location of Dust Cave relative to Pickwick Lake and pre-impoundment mainstream Tennessee River.

tools and debitage, allowing the archaeologists to examine lithic resource use, tool manufacturing techniques, and tool use.

Today, Dust Cave is located on the banks of Coffee Slough, a cypress swamp on the northern periphery of the river valley. When Prehistoric people occupied the cave, however, it was not near a swamp. At the end of the Pleistocene and into the Early Holocene, the area fronting the cave entrance was a broad, low floodplain watered by a series of springs issuing from the base of the limestone and drained by a series of small, slow-moving streams. In 1938 this physiography changed with the construction of Pickwick Landing Dam, which inundated much of the lowland area between the river and the bluffs forming Pickwick Lake (Goldman-Finn and Driskell 1994; Sherwood et al. 2004). Many of the caves located along this bluff were flooded after dam construction, but Dust Cave and several others were high enough to avoid a similar fate.

Initially, Dust Cave did not look as promising as other caves investigated by the University of Alabama team during the summer of 1989. The opening was only about a 0.5 meter high and 2 meters wide (1.6 × 6.6 ft.), and the team of students and field supervisors had to slide into the cave on their stomachs (Figure D6.2). Like other caves investigated that summer, small 30 by 30 cm test excavations (sometimes referred to as "shovel tests" but in this case excavated by small hand trowel) were placed within the cave and excavated in 10-centimeter (3.9 in.) levels. Although the cave may have had little potential initially, it is important in archaeology to be systematic and consistent and so, even if the cave has no visible archaeological deposits, researchers must rule out more deeply buried deposits. To this end, each of the test units was excavated to a depth of about one meter. It was only in the last few centimeters that artifacts began to appear under 90 centimeters (35 in.) of archaeologically sterile sediments.

FIGURE D6.2 View of the cave during early testing of the site. The buckets mark the front of the opening.

With the discovery of deeply buried archaeological deposits, the Dust Cave Archaeological Project was born. At that time, none of us knew that the project would last 12 seasons and result in the training of many budding archaeologists. From the start, investigations at Dust Cave had two main goals: to recover important data to answer research questions about the people utilizing the site, and to train students in the methods of excavation of a complex and deeply stratified archaeological site.

GOALS OF DUST CAVE AS A RESEARCH PROJECT

Initially, the goals of excavation at Dust Cave were to determine the depth and width of the cultural deposits in the cave, establish the chronology of the site, and document the nature of the deposits. The first few seasons of excavation revealed that the cave deposits were much deeper and older than anyone had suspected. Students and researchers excavated several 2-by-2 meter (6.6 × 6.6 ft.) test pits inside and outside the entrance chamber of the cave and into the dark-zone passages to answer the first research question: what are the dimensions of the cultural deposits in the cave (Figure D6.3)? It was determined from these test pits that the entrance chamber, or front of the cave, held the main portion of the cultural deposits. Excavators found cultural deposits further back, in the dark zone, but these were fairly shallow and ephemeral. Likewise, the test pits located on the slope in front of the cave were not as dense in cultural materials as the pits in the entrance chamber. From the test pits excavated in the entrance chamber, it was determined that cultural deposits at the site, extending down to the bedrock floor of the cave, covered more than 5 meters (16.4 ft.).

The test pit excavation results led to the excavation of a large trench, 12 meters long by 2 meters wide (40 × 6.6 ft.) from the entrance to near the back wall of the entrance chamber (Figure D6.4). The trench was completed in 1994. Exposure of the

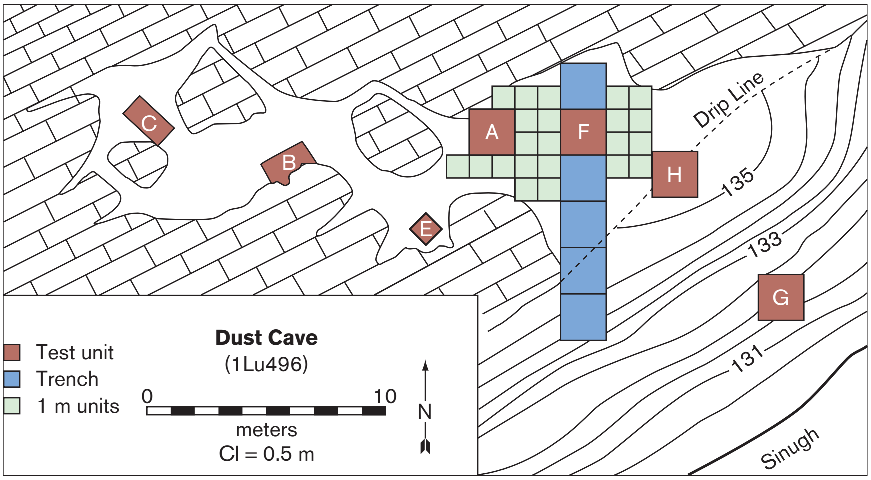


FIGURE D6.3 Excavation units at Dust Cave.

FIGURE D6.4 View of the test trench excavated between 1990 and 1994, the supports were removed briefly to photograph the extent of the trench and then replaced.

stratigraphy from outside the cave to the back of the entrance chamber made it possible to determine the depositional relationships from different parts of the site, and this excavation provided additional important clues to the nature of the cultural deposits. Researchers identified five cultural components in the cave's deposits. The earliest occupation dates to the Late Paleoindian period from 13,500 cal BP to 11,500 cal BP (11,500–9500 cal BC). The Early Archaic period spans approximately 11,500 cal BP to 8900 cal BP (9500–6900 cal BC) and is represented by the Early Side Notched component. Finally, the Middle Archaic period (8900–5700 cal BP or 6900–3700 cal BC) is represented by the Kirk Stemmed component, the Eva/Morrow Mountain component, and the Benton component, after which time the cave, nearly full of sediment, was abandoned. These components represent a chronological sequence supported by over 40 radiocarbon dates (Sherwood 2001; Sherwood et al. 2004). This is an unusually long sequence of dates, and the preservation of the deposits is remarkable. These factors have led us to research the geoarchaeology of the deposits, human–environment interactions such as those relating to subsistence activities and climate change, and changes in cultural traits through time. This research will continue for years to come.

RESEARCH ON THE STRATIGRAPHY OF DUST CAVE

Research on the stratigraphy of Dust Cave was always an essential part of the investigation. The layers at the site are extremely complex and contain sediments from several different sources and processes, cultural and natural. Natural processes include sediments derived from a combination of Tennessee River overbank deposition, colluvial deposits from outside the cave, and spring deposits from deep inside the karstic system of underground drainage. The distinct overbank sediments made up the majority of the earliest deposits in the cave, indicating that river levels were higher than they are today and more prone to flooding. During dry phases between flooding episodes, human activity introduced large amounts of ash, charcoal, and other **anthropogenic sediments**. The presence in the cave of microstratigraphic concentrations of anthropogenic sediments as well as hearths and small charcoal pit features (Figure D6.5) suggests that the majority of the artifacts probably result from human activity (Sherwood 2001).

The stratigraphic zones were the most complex aspect of excavation and the hardest for students (and staff) to grasp. We used the term "zone" to refer to the three-dimensional rock and sediment units (layers) within the cave (Sherwood 2001). We used a tripartite system to designate these zones, representing three graduations of size and extent of layers in the cave. The smallest zone, the tertiary unit, consisted of lenses that were usually highly localized. These were the smallest layers that we could distinguish in the field and excavate. Many of these lenses probably represent single depositional episodes or activities. Primary and secondary zones were aggregations of these tertiary units. Students and researchers described and mapped zones in the field based on color, texture, structure, and postdepositional features (Figure D6.6). This recording system allows the correlation of complex stratigraphy at a variety of scales, where stratigraphic units vary in size and extent and do not consistently appear in vertical profile. To understand the exact formation of these zones, trained geoarchaeologists assisted during excavations, providing intense analysis in the field. Geoarchaeologists also used microscopic examination of sediment samples in this section (Goldberg and Sherwood 1994), and various chemical analyses were performed in controlled laboratory conditions to learn more about the stratigraphy (Homsey 2004).

SUBSISTENCE RESEARCH AT DUST CAVE

Researchers analyzed botanical and faunal remains from Dust Cave to investigate changes in subsistence

FIGURE D6.5 View of test unit A showing microstratigraphic concentrations of anthropogenic sediments (left side and lower area of unit) and pit features (upper right side of unit).

FIGURE D6.6 The east side of the site, showing the microstratigraphic layers. The white tags in the wall have the zone designations using the tripartite system described in the text.

strategies and environmental variation through time. The occupation of the cave spanned a critical time in the adaptation of prehistoric humans to their surroundings. During initial occupation, the climate shifted from the cold and extremely variable precipitation conditions marking the end of the Pleistocene to the warmer, more seasonal environment of the Holocene. This period was marked by the extinction of many large mammal species, such as mammoth, mastodon, and Pleistocene horse, although these species were likely extinct in the area prior to the occupation of Dust Cave. Other more subtle changes in the faunal population available for hunting and trapping occurred during human occupancy of the cave, however, and the environment continued to change during the time people periodically occupied Dust Cave. One significant change, associated with the Hypsithermal interval, occurred between 8000 and 5000 years ago, causing decreased rainfall and warmer temperatures (Delcourt and Delcourt 1981).

Botanical Remains

Paleoethnobotanical study provides information on economic activities by examining seasonality, the importance of nut mast resources, and differences in feature utilization. The botanical materials recovered through water screening and flotation of the cave's deposits contained mostly nutshell, primarily hickory (Detwiler 2000; Detwiler-Hollenbach 2003; Walker et al. 2001). The relatively large quantities of hickory recovered, as well as the presence of hickory in nearly all samples, speaks to its importance in the diet of the site's inhabitants. The samples also included acorn, black walnut, and hazelnut shell. While acorn appears in small quantities in nearly all samples, black walnut and hazelnut are primarily found in the lower Paleoindian levels, suggesting a decline in their use through time. The majority of the seeds recovered from the site are carbonized hackberry seed fragments. Additional fruit species include persimmon, grape, and sumac. Among the weedy seeds, chenopod is most frequently recovered, particularly in the Late Paleoindian and Early Archaic samples, suggesting that the cave's early occupants regularly used this plant, which was eventually cultivated by Late Archaic peoples.

Other seeds identified in the samples, which may not have economic importance but aid in determining seasonality, include smartweed, stargrass, bedstraw, pine, and fragments that possibly represent black gum, poke, and nightshade. One of the most notable aspects of the assemblage is that all the fruits, nuts, and seeds ripen in the late summer or autumn. This supports a late summer and autumn occupancy of the cave, assuming that the inhabitants did not employ storage strategies. Burning wood and other plant materials created most of the features in the cave, and several of the smaller ash pits seemed to contain mainly burned nutshell (Homsey 2004).

Faunal Remains

The analysis of faunal remains recovered from Dust Cave revealed that the exploitation of certain animals changed significantly through time. For example, zooarchaeologists identified a high percentage of bird bones in the Late Paleoindian levels, but fewer bird remains in later occupations (Walker 1997, 1998). In addition, a large percentage of the bird bones from the Late Paleoindian occupation were those of waterfowl. Many of the duck and goose long bones recovered from this component had distinct cut marks as well (Walker and Parmalee 2004).

Changes in subsistence at Dust Cave probably reflect changing climatic conditions and perhaps changes in cultural preference as well. Specifically, the Hypsithermal interval mentioned earlier probably had a significant impact on the availability of animals near the cave. For example, a heavy reliance on aquatic species such as waterfowl, muskrat, swamp rabbit, and pond turtles, observed in the Late Paleoindian and Early Archaic components, changed to a dependence on such terrestrial animals as white-tailed deer, turkey, squirrel, and box turtle in Middle Archaic occupations. In addition, the utilization of open, ecotone, and closed habitats also varied between the components for Dust Cave. In general, closed-habitat species (e.g., squirrel, passenger pigeon, otter, beaver, owl, box turtle, raccoon, wood rat, muskrat) were found in the Late Paleoindian occupation, with emphasis also on open-habitat species (e.g., prairie chicken, bobwhite). Later faunal assemblages at the cave are more representative of ecotone habitats, with species such as deer, fox, rabbit, and skunk. The increase in terrestrial and ecotone-preferring species may be an indication that Hypsithermal climatic conditions caused closed forest areas near the cave to shrink in size.

Occupants of Dust Cave also had domestic dogs, which they buried in small, shallow pits. Researchers found four dog skeletons from Dust Cave, dating to between 8900 cal BP and 5700 cal BP (6900–3700 cal BC). The dogs are all extremely well preserved, ranging in age from 1 to 4 years, and with no obvious cause of death evident. Pathological observations on the vertebral skeleton are indicative of animals carrying a heavy load on their backs (Walker et al. 2005). This finding is consistent with ethnographic accounts that Native Americans used dogs as pack animals.

Another interesting aspect of the diet of the people utilizing the cave is the small quantity of white-tailed deer bones recovered from the cave's deposits. White-tailed deer were one of the most important resources for prehistoric North Americans, particularly in the Eastern Woodlands. However, zooarchaeologists identified very few white-tailed deer bones from the Late Paleoindian component of the cave. This indicates less emphasis on white-tailed deer as a primary food resource during the Late Paleoindian and more emphasis on smaller mammal and bird resources. Later, the acquisition of white-tailed deer increased, but only slightly in comparison to other sites occupied at the same time. This increase may also have been due to the warming and drying conditions brought on by the Hypsithermal, creating the edge environments that white-tailed deer prefer. This does not mean, however, that deer were not an important resource to these Prehistoric people, only that during their stays at Dust Cave, deer meat was not of paramount importance. Perhaps people occupying Dust Cave were focused on other resources such as nuts, waterfowl, or fish.

STONE TOOLS

People who camped in Dust Cave used a technique archaeologists refer to as **knapping** to make artifacts such as spear tips, knives, scrapers, and drill bits from stone. Stone projectile points are the most distinctive chipped stone tools found at Dust Cave (Driskell 1994). Other tools from Dust Cave include expedient tools made from flakes and blades. The knapping process produces flakes as a by-product of core reduction. Blades are, by definition, elongated flakes produced intentionally by means of specialized knapping techniques. In each case, these artifact types commonly exhibit very sharp edges, and people used them without additional modification for various cutting and scraping chores. People also modified some flakes and blades further to serve special needs such as scraping, drilling, perforating, and incising. Other knapped artifacts included bifaces, or generally oval-shaped artifacts that had been flaked on both sides. Ancient people used these artifacts as choppers or knives but also as preforms or blanks that could be further refined into tools such as projectile points, hafted drill bits, or hafted scrapers (Figure D6.7).

Pitted cobbles, called "nutting stones," probably functioned as anvils for cracking nuts (hickory nuts,

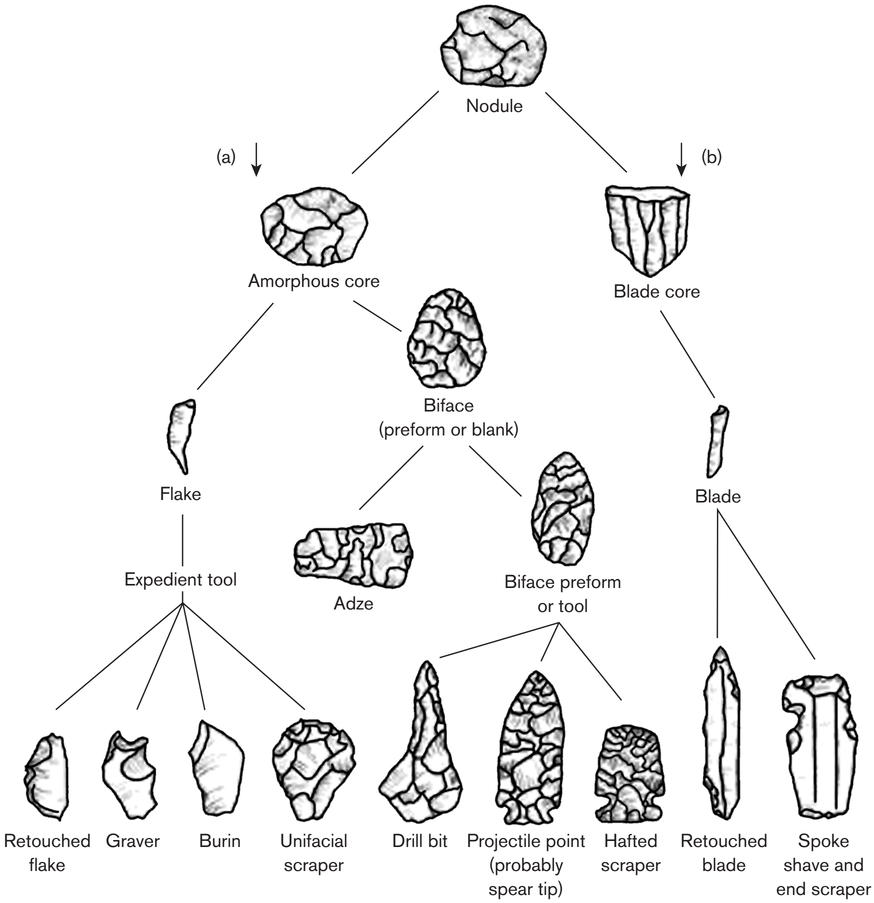


FIGURE D6.7 Chipped stone tools at Dust Cave were made from nodules or cobbles of locally available Fort Payne chert; cores were reduced to produce bifacial tools (a) or blade tools (b).

acorns, and black walnuts). Processing of nuts at Dust Cave appears to have been an important activity throughout its occupation (Homsey 2004). Researchers found several pecked, ground, and polished pestles at Dust Cave. The Dust Cave inhabitants probably used these artifacts to ground minerals, vegetal materials, or both with these implements.

While needs for stone tools, and their functions, changed little at Dust Cave over the millennia, stylistic changes in projectile points are notable. Projectile points changed from the Paleoindian lanceolate forms of the terminal Pleistocene to the Archaic notched and stemmed forms of the Early to Middle Holocene (Meeks 1994, 1998). At Dust Cave, as in most other Prehistoric sites of the Late Pleistocene and Early to Middle Holocene in the eastern United States, archaeologists can use the "**law of association**" to date artifacts and other materials found in the same context with diagnostic projectile points or stylistically similar tools from a known time range. Distinctive styles from Dust Cave include the Cumberland, Quad, Beaver Lake, Dalton, and Hardaway Side Notched, all from Paleoindian remains, while later, Archaic deposits at the cave contain notched (Big Sandy) and stemmed (Kirk Stemmed and Serrated, Eva, Morrow Mountain, Sykes, and Benton) projectile points (Figure D6.8). People from Dust Cave

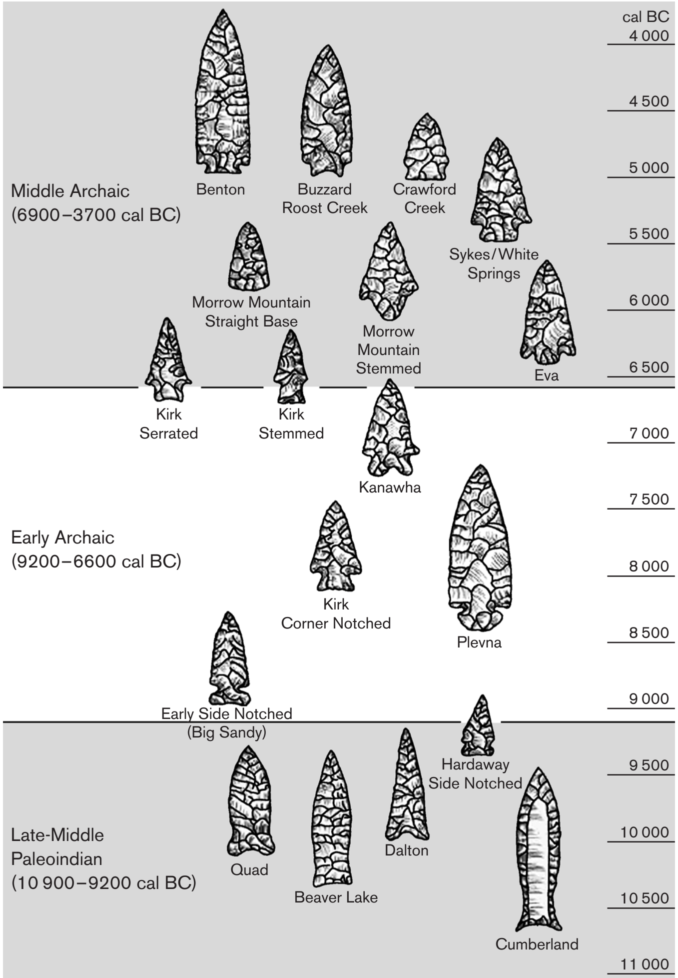


FIGURE D6.8 Projectile point types found at Dust Cave.

probably used the projectile points as spear points or as projectiles tipping darts thrown with aid of an atlatl.

Another important change in tool production and use over time involved blades. The Paleoindian toolmaking tradition seen in the earliest deposits at Dust Cave included production of prismatic blades removed from specialized blade cores (Meeks 1994). Although no blade cores have been uncovered at Dust Cave, researchers found a number from surface collections nearby (Collins 1999). These artifacts disappeared from the toolkit at Dust Cave at the end of the Paleoindian utilization, or soon thereafter, and were replaced by flake tools and by an increased focus on bifacial technology (Randall 2002).

Together, recovery of tools used for food procurement and recovery of a wide variety of plant and animal food remains from Dust Cave provide an important and rare opportunity to reconstruct subsistence strategies during seven millennia of prehistory in the mid-South. The information derived from Dust Cave will be used in research into these subsistence practices for many years to come.

GOALS OF DUST CAVE AS A FIELD SCHOOL

The field school aspect of Dust Cave presented many challenges from the beginning. First, the site is remote and quite inaccessible: although it is only a few miles outside the northwestern Alabama town of Florence, it lies at the base of a high bluff on the perimeter of a modern-day cypress swamp. Small boats were usually the best way to transport people and materials to and from the site (Figure D6.9). In addition, owing to the inaccessibility of the site, the team of students, teaching assistants, and the site director camped there each season. A large part of the success of the field research depended on perseverance and ingenuity in creating a habitable place for people to live and work. Students and teaching assistants helped build showers and privies, while tents were set up each season to support and house as many as 25 camp occupants. During one season students helped build a large wooden-beamed kitchen/dining pavilion, complete with a tin roof (Figure D6.10). This was an improvement over the previous kitchen, which was a large tent over a plywood platform. In subsequent seasons, students and teaching assistants added a lab and new shower adjoining the main structure. The result was a several-tiered seasonal structure housing a full kitchen, a classroom and eating area, a laboratory equipped with microscopes and computers, and a lower shower and sink area, complete with a hot water heater, all powered by an army surplus generator.

Although it was wonderful to have a substantial structure to go to when it rained and to gather for meals and lab work, considerable muscle power was required to get materials into camp. We brought all the construction materials via a four-wheel-drive truck to the boat landing, loaded them on the boat, unloaded them from the boat, and then carried them up the hill to be placed in the structure. This was all done in the evening, after a day spent excavating in the cave. This aspect of camp life also inadvertently served as a team-building exercise, and we all took pride in the camp and the structure as it progressed. Participants not only worked together in the excavation, they also worked together to keep the camp running smoothly. This made the bonding process that occurred at the Dust Cave Archaeological Project that much greater.

As is often the case with a long-term project, the excavation strategy at the cave changed over time. During the testing phase, researchers excavated the cave in 2-by-2 meter units in 10-centimeter arbitrary levels. Later, as the complexity of the deposits became clearer, we shifted to excavation in 1-by-1 meter units in 5-centimeter arbitrary levels within stratigraphic zones. This made excavation extremely complicated but allowed a greater resolution, spatially and temporally, of the data collected in the field. Students kept track of their units by means of detailed excavation forms and consultation with the teaching assistants. Teaching assistants rotated students periodically out of the cave to take part in other tasks including water screening of the sediments, flotation for smaller remains (such as

FIGURE D6.9 Transporting people and equipment to the cave.

FIGURE D6.10 The kitchen (upper) and laboratory (lower) facilities that were constructed at the Dust Cave field camp.

seeds and small animal bones), and lab work. Only the initial stages of lab work were conducted at the camp laboratory. Students sorted artifacts into major categories such as bone, shell, and lithics to be transported back to the university for detailed analyses. "Classroom" sessions during the field school included basic lectures in regional culture history and lectures in topical specialties, provided by the teaching assistants in lithic analysis, faunal analysis, geoarchaeology, and paleoethnobotany. This didactic program was supplemented by visits from research collaborators and professional mentors who were always persuaded to lecture about their own research and research specialty.

Guided by a staff member, students engaged in small individual and group research projects stemming from the research at the cave. We spent the last evening of each field school watching the students present the results of their projects. Many of these projects became websites made, accessible via links from the project website. Two of the field schools benefited from a Research Experiences for Undergraduates (REU) grant from the National Science Foundation that provided tuition, stipend, and travel money for 10 students. This grant particularly sought to encourage minority student participation in research. During this time, the project was enriched by the participation of diverse students from across the country. Computer equipment to enhance the student research projects and assistance associated with the NSF funding came from IBM Corporation. Setting up and maintaining computer equipment in the swamp was no small task, but the efforts paid off, enabling the students to better carry out their research projects and helping the staff maintain the site's relational database during the field season.

MAKING SENSE OF THE ARCHAEOLOGICAL RECORD AT DUST CAVE

Although 12 seasons were spent excavating at Dust Cave, the work has really just begun. As you probably have started to realize, excavation is only the first step in the process of research. With literally hundreds of thousands of artifacts and flotation and sediment samples to process, archaeologists are only now beginning to synthesize the material from the cave. However, we feel that we have already made great strides in understanding human behaviors and environmental change during the time people occupied the cave.

In particular, research on the origins and development of the deposits at the cave has been very productive. With initial research by Paul Goldberg and the completion of a dissertation on the topic (Sherwood 2001), we now have a detailed chronological and depositional framework. This framework allows us to view the context of materials, as well as how they changed through time (Sherwood et al. 2004). Another dissertation has explored the origins and functions of features found in the cave (Homsey 2004). Homsey's research used micromorphology, archaeological chemistry, and feature structure to provide insights into the types of activity and their intensity by component.

The research undertaken so far has also led to significant progress in understanding the patterns of subsistence represented by the Dust Cave floral, faunal, and lithic remains. The abundance of floral remains from Dust Cave indicates a much heavier reliance on plant foods than had been documented for other Paleoindian sites. The site's occupants appear to have relied on the fall nut mast, such as hickory and acorn, as well as fruits and weedy seeds, such as hackberry and chenopod (Detwiler 2000; Detwiler-Hollenbach 2003; Walker et al. 2001). Similarly, study of the faunal remains indicates that hunter-gatherers began to diversify their diet prior to the beginning of the Holocene and altered their diet to adapt to regional environmental changes. Other researchers have documented this pattern of subsistence for later periods in the prehistory of the Southeast, but Dust Cave provides evidence for very early adoption. Recovered stone tools, primarily related to hunting, would be insufficient to support these interpretations without the rich organic remains from the cave. Thus, the unique preservation of Dust Cave provides a rare and exciting opportunity to investigate many aspects of hunter-gatherer subsistence economy.

The research at Dust Cave and its findings are particularly important in the context of a growing body of evidence that suggests that the early inhabitants of the North American continent subsisted by means of different strategies in different regions. While the concept of Pleistocene peoples of North America as "big-game hunters" persists in archaeological literature as well as in the popular imagination, sites like Dust Cave, where large quantities of fragile organic remains are recovered, provide evidence that a large number of species, floral and faunal, were often exploited in the daily lives of these early Americans. Most researchers now believe that Late Paleoindian subsistence in the eastern United States was based not at all on hunting large game, or megafauna, but rather that the generalized foraging strategy prevalent during the Archaic is well established as early as 11,000 cal BC. Research on botanical, faunal, and lithic remains at Dust Cave has provided more evidence to support this increasing awareness. Thus, as we continue to synthesize our research at Dust Cave, we hope to provide more answers to questions about how people adapted to local environmental conditions and how these changes affected the lives of early inhabitants of North America.

DISCUSSION QUESTIONS

1. What threats to preservation affect Dust Cave? Why did the TVA want archaeologists to investigate this hard-to-access cave site?
2. What factors made the excavations at Dust Cave challenging? What factors made Dust Cave a good place to train students in archaeological techniques?
3. When and how did people use Dust Cave? What was the environmental setting of Dust Cave like when people lived there, and how did it change over time?
4. What does the Late Paleoindian record from this site indicate about the subsistence of Paleoindians? Explain why these findings are important to archaeological debate about Paleoindians.

CASE STUDY

The mound and earthwork complexes of Ohio have excited American imaginations for nearly two centuries (see Section A). But although archaeologists have put to rest the most fanciful myths about who built these large topographic features, we still know surprising little about how they were constructed. The large size of these sites makes it difficult to excavate significant portions of a mound complex, posing a problem both for scholars and for managers who must preserve and interpret earthworks in a responsible manner. This case study shows how archaeologists from the National Park Service are using modern geophysical techniques to explore earthwork sites and then ground-truthing their findings with informed testing. The Hopeton Earthworks Project has shown that far from casual accumulations of earth, these constructions represent placement of different, carefully selected sediments. The color and perhaps the texture of the earth seem to have mattered to the designers and builders of the earthworks. The project also has shown that the dating of these earthworks can be more variable than archaeologists have thought. The possible Late Woodland modification or construction of part of Hopeton raises many questions. As you read this case study, ask yourself how its findings might alter understanding of Middle and Late Woodland cultures in Ohio. What new perspectives do you gain from reading about this project?

D.7. THE HOPETON EARTHWORKS PROJECT

Using New Technologies to Answer Old Questions

Mark Lynott

When European colonists entered the Ohio River valley, they discovered a large number and variety of earthen mounds and geometric earthworks. Small conical mounds were present throughout eastern North America, but in the Ohio River valley the early settlers encountered giant enclosures with walls 10 feet (3 m) tall and higher. The earthen enclosures were built in geometric shapes: circles, squares, and rectangles. Some of them included several of these geometric forms, as well as pairs of long, linear parallel walls. The accumulation of the vast amount of soil needed to build the long and tall earthen walls seemed to represent considerable organized effort. Many of the colonists viewed the Native people of the Ohio River valley as savages, incapable of constructing such impressive monuments.

In the first half of the nineteenth century, a few scientific reports (e.g., Atwater 1820; Brackenridge 1814) fueled considerable speculation about the origin and nature of the earthen monuments in the eastern United States. This led to the development of theories about a lost race of mound builders that were variously identified as migrating Polynesians, Egyptians, Greeks, Romans, Israelites, Vikings, Welsh, Scots, and Chinese (Silverberg 1968).

The first scientific studies of the earthworks began to appear in the mid-nineteenth century. *Ancient Monuments of the Mississippi Valley* by E. G. Squier and E. H. Davis was published by the newly created Smithsonian Institution in 1848. This massive study provided detailed drawings of earthworks throughout eastern North America, but the focus of the authors' effort was southern Ohio in the area near Chillicothe.

The question of who built the earthen mounds and geometric enclosures in eastern North America continued to be debated among the growing scientific community in the United States throughout the nineteenth century. The answer to the question was finally addressed when Cyrus Thomas directed investigators conducting surveys and mound excavations throughout eastern North America. His published report of their research (Thomas 1894) demonstrated the continuity between the Historic Native residents of North America and the pre-Columbian people who built the mounds.

Once the fledgling discipline of archaeology had demonstrated that the great earthen monuments had been built by the Indians, archaeologists turned their attention to exploring the mounds and studying their contents. In their landmark study, Squier and Davis explored more than 100 mounds in southern Ohio. Their excavations revealed the presence of human burials with associated mortuary objects. In many cases the mounds were built as a series of events, which were exposed as discrete strata in the mounds. Excavation of the mounds also revealed evidence of complex mortuary rituals that included cremation of the deceased, and deposition of the remains, along with a range of wonderful objects and ornaments on platforms or altars. Most noteworthy was the discovery of more than 200 beautifully carved stone animal effigy pipes in one of the small mounds at Mound City group near Chillicothe.

The spectacular mortuary objects and ornaments incorporated into many of these burial mounds served to focus early archaeological research on the excavation of burial mounds. Warren K. Moorehead conducted excavations at a large mound group in 1891 and 1892 for the purpose of recovering materials to display at the **World's Columbian Exposition** in Chicago. His excavations revealed numerous burials and elaborately prepared altars. He collected a massive number of artifacts, including carved stone pipes depicting animal and human figures, necklaces of pearls and perforated bear canine teeth, and sheets of mica cut into a variety of elaborate shapes. In one mound he found a cache of 7000 chipped flint disks, and throughout the excavations he found a vast number and variety of copper objects. These included panpipes, breastplates, axes, adzes, earspools, and sheets of copper cut into birds, fish, serpents, and geometric shapes. One of the most impressive copper ornaments he collected was a deer antler headdress that must have been used by a shaman. At the time of Moorehead's excavations, the site was owned by Captain M. C. Hopewell, a former military officer, and archaeologists later named the culture that built the mounds after this site.

When the early colonists began settling the Ohio River valley, there were literally thousands of mounds and hundreds of geometric earthworks in this region. However, as towns developed and grew, and farmers cleared forests and cultivated the rich valley bottoms, the earthen monuments began to diminish in size and number. Even nineteenth-century scholars lamented the destruction of the archaeological record and noted the damage resulting from annual cultivation. Today, mounds and earthworks are still present in southern Ohio, but mainly in cemeteries or parks where they have been intentionally preserved. Only a handful of mounds, and even fewer earthwork sites, have been preserved in a manner that allows us to appreciate their original size and grandeur. In most cases, those that remain are but a shadow of their original size and form. Fortunately, new technologies and new archaeological methods are making it possible to extract valuable information from sites that have been nearly destroyed by years of cultivation.

HOPETON EARTHWORKS

The Hopeton Earthworks are located a few miles north of downtown Chillicothe, Ohio. The site is located on a Pleistocene terrace in a horseshoe bend of the Scioto River. Known since early in the nineteenth century, the earthworks were mapped and described by Squier and Davis in *Ancient Monuments of the Mississippi Valley* (Figure D7.1). The earthworks consisted of "a rectangle, with an attached circle, the latter extending into the former, instead of being connected with it in the usual manner" (1848:51). The authors also described two smaller circles that were integrated into the north side of the rectangle and a pair of parallel walls that extend from the northwest corner of the rectangle 2400 feet (730 m) to the southwest. The walls of the two larger geometric enclosures were formed by a series of wall segments. The walls of the great circle had three segments and three gateways. The rectangle had 11 segments and 12 gateways. The large circle was reported to be 1050 feet (320 m) in diameter, and the rectangle was measured at 900 by 950 feet (275 × 290 m). Each was estimated to enclose 20 acres.

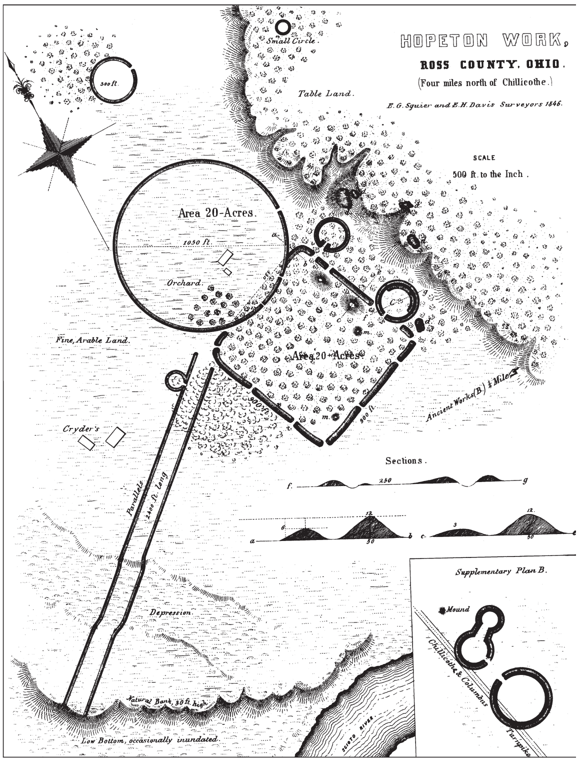


FIGURE D7.1 Squier and Davis's map of the Hopeton earthworks, Ross County, Ohio.

Like most of the great Ohio earthen enclosures, the Hopeton Earthworks were of monumental size. Here is the report of Squier and Davis:

> [The] walls of the rectangular work are composed of a clayey loam, twelve feet high by fifty feet base, and are destitute of a ditch on either site. They resemble the heavy grading of a railway, and are broad enough, on the top, to admit the passage of a coach. The wall of the great circle was never as high as that of the rectangle; yet, although it has been much reduced of late years by the plough, it is still about five feet in average height. It is also destitute of a ditch. It is built of clay, which differs strikingly in respect of color from the surrounding soil. (1848:51)

As with most of the other great earthen enclosures in southern Ohio, the vast size of the site served as a deterrent to systematic archaeological investigations. Most of these great sites have been subjected to only one or two summers of archaeological research, so investigators have tended to focus their efforts on mounds associated with the enclosures, rather than the enclosure walls. Consequently, after more than 150 years of study, archaeologists are still unable to state definitively when the walls were built. Also, how were they built? And why were they built?

These are not new questions. Questions about the origin and antiquity of the earthworks of southern Ohio are present in the earliest descriptions of the sites. Many of the early writers also speculated about the function of these giant geometric enclosures. Some thought the enclosures were for defense; sacred or religious purposes were suggested by others. In their description of the Hopeton Earthworks, Squier and Davis observed that since there were no ditches and only a few relatively small "dug holes" in association with the large earthen walls of the enclosure, vast amounts of soil had had to be carried from another location. Although they did not elaborate on this issue, they clearly raised the question of how the walls were built.

GEOPHYSICAL INVESTIGATIONS

Archaeologists have been using geophysical instruments to prospect for subsurface archaeological features for many decades. Most of the early instruments were slow and cumbersome to use, and data had to be first recorded by hand and then manually entered into a computer program for analysis. In the last decade, digital technology, improved sensors, and microcomputers have combined to increase the efficiency and effectiveness of these instruments manyfold. A survey that required 2.5 hours a quarter-century ago can be accomplished today in under 20 minutes. In addition to the increased speed in recording data, the new instruments are many times more sensitive, and data can be directly downloaded to a computer. This makes it possible for archaeologists to begin conducting large-scale geophysical surveys and looking at large sites comprehensively, rather than in small pieces.

The National Park Service initiated the geophysical survey at the Hopeton Earthworks in 1997. Initially, it was hoped that the geophysical survey could be useful in identifying subsurface features associated with Hopewell habitation sites and possibly locating vestiges of earthen walls that are no longer visible. However, the efficiency and effectiveness of this approach soon convinced us that it would be possible to survey the entire site, and for the first time, take a comprehensive look at a large Ohio Hopewell earthwork site.

Under the leadership of internationally recognized geophysicist John Weymouth, we started work on the southwest edge of the rectangular enclosure at Hopeton. The area to be studied was laid out in a grid measuring 20 by 20 meters (65 × 65 ft.). Each 20-by-20-meter block was individually surveyed by means of instrument readings along linear transects spaced 1 meter (3.28 ft.) apart. Thus each survey block consists of 21 linear transects of instrument readings. To analyze data across a large area, a computer may be used to combine individual survey blocks.

The initial geophysical study at Hopeton incorporated three geophysical instruments: an RM-15 resistance meter, which measures resistance to an electrical current, and, to measure magnetic fluctuations, an FM-36 fluxgate gradiometer and a G-858 cesium gradiometer. After survey of an area measuring 80 by 140 meters (265 × 460 ft.), and careful consideration of the resultant data, archaeological testing was conducted to evaluate the utility and accuracy of the instrument data. Overall, the archaeological testing showed that the geophysical survey was highly effective in identifying the location of larger subsurface pits and other features. However, the instruments were ineffective in identifying small features, like postholes. Although we thought it might be possible to increase the number of transects surveyed within a 20-by-20-meter block to identify smaller features, this diminished so greatly the number of blocks that could be surveyed in the time available that survey coverage of the entire site would have been nearly impossible. The balance between the intensity of the survey coverage, the size of the site, and the time and funding available for a project must be considered on a site-by-site basis. The initial study at Hopeton also suggested that the cesium gradiometer provided the best combination of speed and sensitivity for survey work at this site.

The Geometrics G-858 cesium gradiometer has two magnetic sensors attached to a staff. For this project, we used the staff and sensors in a vertical configuration, with the lower sensor 30 centimeters (12 in.) above the surface and the upper sensor 100 centimeters (40 in.) above the lower sensor. The upper sensor records the total magnetic field at the same time that the lower sensor is recording the magnetic field of the soil below the sensor. The survey was conducted in walking mode, using a 0.2-second cycle with traverses spaced at intervals of 1.0 meter and readings spaced at 14 cm (5.5 in.) along transects (Figure D7.2).

After the initial geophysical survey and testing project demonstrated that this combination of methods was an effective way to study large and diffuse archaeological sites, plans to study the entire site were developed. While we were confident that our geophysical survey would be effective on the large flat areas that surround the earthworks, we were uncertain as to how effective the geophysical survey would be over the earthen walls that form the earthwork. With assistance from John Weymouth, Bruce Bevan, Rinita Dalan and a number of other archaeologists and geophysicists, we began geophysical survey on the south wall segments of the large rectangle in 2001. Once again we tried several different

FIGURE D7.2 Geophysical survey at the Hopeton earthworks in progress.

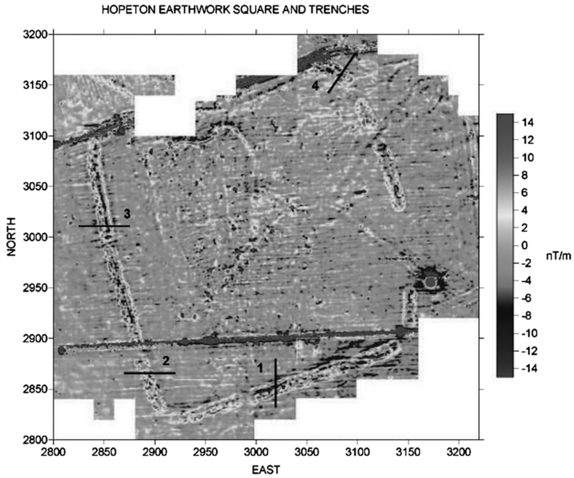


FIGURE D7.3 Results of geophysical mapping of the rectangular enclosure at Hopeton, indicating numbered trenches (1–4); magnetic readings shown in nanoteslas per meter (nT/m).

instruments to evaluate their relative effectiveness for this project. While each of the instruments produced valuable data in particular circumstances, we once again decided that the cesium gradiometer was most effective for overall survey coverage.

Agricultural activities have reduced the height and widened the width of the walls of the rectangular enclosure considerably. Walls that were 12 feet high in 1848 are no more than 3 feet high in most cases today, and in some places are only barely visible. The most important accomplishment of the geophysical survey was the discovery that the wall segments of the rectangular enclosure are distinctly visible in the magnetic survey data (Figure D7.3). The sharp boundaries on the interior and exterior of the wall segments are in marked contrast to the topography of these features, which is very gradual due to years of annual cultivation. The sharp magnetic contrast between the core of the wall and the surrounding soils of the landform suggested that the interior of the wall must have been constructed from soils that differ markedly from the naturally occurring soils of the alluvial terrace.

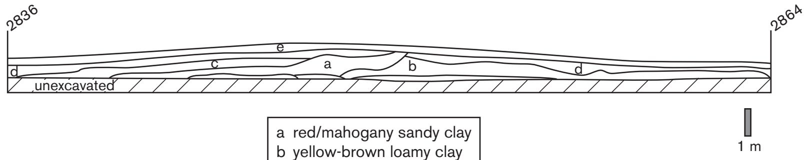
Careful examination of the magnetic data shows that the interior and exterior of the wall segments are separated by approximately 15 meters (50 ft.), which is consistent with the nineteenth-century descriptions of the earthwork. The magnetic data also depicts the earthen wall in segments with gateways, just as the site was mapped in the mid-1800s. In an effort to determine how much of the original wall was preserved at Hopeton, we used the geophysical survey data to select four locations around the rectangular enclosure for test excavations.

EXCAVATION OF THE RECTANGULAR ENCLOSURE

In the summer of 1996, Bret J. Ruby of the National Park Service directed the excavation of a trench 1 meter wide across a segment of earthen wall at the northwest corner of the rectangular enclosure at Hopeton. Aerial photographs indicate that this section of wall had been preserved in a fence row since at least 1938 and is currently 20 meters long and 1.5 meters high. The 1996 test trench revealed that there were three different soil deposits in the core of the wall, each representing a different stage of construction. Using the information gained from this initial testing project, we developed a plan for testing other less well preserved wall segments to determine whether we might be able to learn how and when they were constructed.

We used the geophysical survey data to evaluate the potential preservation of the core of the wall segments to select a location in the central segment of the south wall of the rectangle for testing in 2001 (Lynott and Weymouth 2002). We aligned the trench location

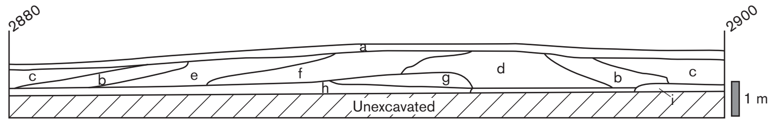
North wall, Trench #1, 33RO26



a red/mahogany sandy clay
b yellow-brown loamy clay
c yellow-brown loamy clay
d gray-brown loam
e plow zone

(a)

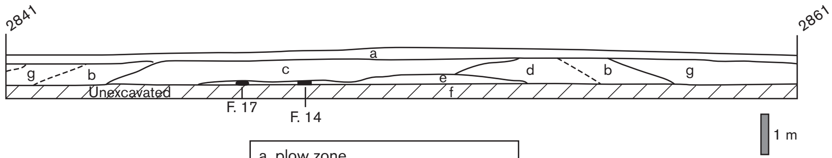
North wall, Trench #2, 33RO26



a plow zone
b dark brown organic loam, original wall surface
c redeposited embankment soil
d yellow loamy clay
e yellow-brown-red mottled clay loam
f red sandy clay
g dark gray-brown clay loam
h yellow-brown clay subsoil
i yellow clay and gravel

(b)

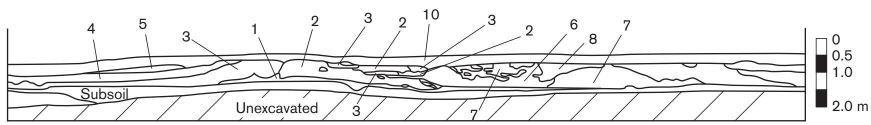
North wall, Trench #3, 33RO26



a plow zone
b original wall layer
c red-brown clay loam
d yellow-brown clay loam
e basal wall layet, silty gray loam
f undisturbed yellow-brown subsoil
g redeposited wall fill

(c)

West wall, Trench #4, 33RO26



Unit 1 dark gray loam w/lenses of gravel
Unit 2 gray loam
Unit 3 red loam, similar to structure to subwall, but redeposited
Unit 4 dark gray, highly organic loam
Unit 5 redeposited loam with gravel that has been washed or plowed off the original wall surface
Unit 6 loam, gray-brown
Unit 7 loam
Unit 8 alternating gravels and loams, appears to be intrusive from the top
Unit 9 dark organic layer, same as unit 4 but on opposite side of wall
Unit 10 modern plow zone

(d)

FIGURE D7.4 Of the four trenches across the Hopeton earthworks, Trench #4 (bottom), dug across the western wall of the enclosure, showed distinctive sediments and structure.

to cross-section the wall, and laid it out with stakes and string. It was 1.5 meters (5 ft.) wide and 48 meters (160 ft.) long. The length of the trench was selected to ensure the exposure of the core of the original wall and most of the soil that had been pulled down off the wall by annual cultivation. We excavated the trench by backhoe, with the operator carefully removing small amounts of soil along the trench alignment. Several archaeologists watched closely as the soil was removed, and backhoe work was frequently halted as the archaeologists examined an exposed soil change or the appearance of charcoal. In several places where potential features were exposed, the backhoe operator left large amounts of soil in situ for later excavation by hand. Although very few artifacts were observed during the excavation of Trench 1, three prehistoric features were exposed, recorded, and excavated. When that work was completed, one wall of the trench was carefully scraped, cleaned, and examined to better understand how the wall had been constructed.

Examination of the trench wall permitted us to record the construction sequence for this segment of the south wall (see Figure D7.4). Construction began by removing all the dark topsoil that was present at this location and exposing the compact yellow silt–loam subsoil. On top of the exposed subsoil, archaeologists found a large burned oak log. Since none of the adjacent soil had been oxidized or hardened by fire, it appeared that the log had been burned elsewhere. The visible portion of the log was 80 centimeters (31.5 in.) long and extended into the east wall of the trench. The exposed section of the log was nearly 20 centimeters (8 in.) in diameter, too large for the piece to have been accidentally deposited at this location as part of a basket of soil. It is more likely that the log was part of a ritual associated with construction of the wall segment. In excavations of other wall segments at Hopeton we have revealed more features indicating that rituals involving fire were a common part of wall building at this site.

We were able to reconstruct part of the procedure for creating the south wall as follows. After the burned log was laid on top of the subsoil, large amounts of additional yellow silt–loam sediments were piled up in a row to form the base of the wall segment. Next, red sandy–loam sediments were piled on the top and south (outer) side of the yellow silt loam. A gray-brown loam was then added to cover the top and both sides of the wall. These soils were slightly more than a meter deep and represent only the basal third of the original wall. These layers can be discerned in the portion of Figure D7.4 labeled "North Wall, Trench #1, 33RO26." Agricultural activities had truncated the wall above this level, so it is impossible to determine whether other types of soil were used in building the upper two-thirds of the wall segment. Trench 1 exposed gray organic layers that sloped upward from the margins of the wall toward the center of the wall. Although these have been truncated by cultivation and buried by slope wash from the top of the wall, they appear to be the original interior and exterior wall surfaces, organic soil layers that formed on the base and sides of the wall after it was constructed.

Three other trenches have been excavated across the rectangular enclosure at Hopeton using the same methods described for Trench 1 (Figure D7.4). Trenches 2 and 3 were excavated across segments forming the west wall of the enclosure. Trench 4 was excavated across the curved segment that forms the northeast corner of this enclosure. Although there was general similarity in the manner in which these wall segments were constructed, there was also significant variability between the segments.

The west wall of the enclosure is composed of three wall segments and the associated gateways. Trench 2 was excavated in an east–west direction to cross-section the segment at the south end of the wall. Trench 2 was 43 meters (140 ft.) long and 1.5 meters (5 ft.) wide. Trench 3 was oriented east–west across the northernmost wall segment in the west wall. This trench was 50 meters long and 1.5 meters wide. Excavation of both trenches revealed that construction of the wall segments also had been initiated by removing the topsoil from the area and exposing the yellow-brown silt–loam subsoil. Construction of the wall segments began with large amounts of gray-brown silt–loam being piled on top of the exposed subsoil. The next step in the construction of these wall segments was to pile large amounts of yellow-brown silt–loam on the eastern half of the dark gray-brown silt–loam layer. A red-brown sandy loam was then piled on the top and west side of the developing wall segment. The amount, configuration, and color of these soils differed quite markedly between the two wall segments, but both were built with three different types of soil that had been deposited in large homogeneous strata. Compare the parts of Figure D7.4 showing Trenches 2 and 3. The outer and inner surfaces of both original walls were visible, but they were truncated near the center of the wall and covered by wall fill that has been pulled down and outward by years of cultivation.

During the construction of these wall segments, the wall builders built small fires on the top of the various soil materials prior to covering one soil with a soil of a different type. These burning episodes were preserved as small features, usually covering less than 0.25 square meter (2.7 ft.^{2}). The features mainly comprised small charred wood fragments and red and oxidized soil, indicating that burning had occurred at this location. Sometimes a small number of fire-cracked rocks, burned bones, chipped stone objects, or tiny fragments of mica were found in the features.

Trench 4, excavated in the summer of 2003, was oriented southwest to northeast across the curving wall segment that forms the northeast corner of the rectangular enclosure. The trench was 1.5 meters wide and 41 meters (135 ft.) long. The relationship of this wall segment to the Great Circle at Hopeton (see 20-acre round enclosure in Figure D7.1) suggests that this was either the first or the last segment of the rectangular enclosure to be constructed. This is the only curved segment of wall associated with the rectangular enclosure.

Just as in the first three trenches, construction of this wall segment was initiated by removal of topsoil from the area where the wall segment was placed. However, in this case, the topsoil was not removed from the area to the north of where the wall was constructed. The subsoil is reddish in this area of the site, which is in strong contrast to the yellow-brown subsoil that was exposed under the other wall segments. The different colored subsoil is a reflection of different naturally occurring soil types that are present on this landform. Once the topsoil was removed, a dark gray loam with lenses of fine gravel was laid down, covering the red subsoil under the wall segment and merging with the dark gray topsoil that was not removed from the north side of the wall segment.

The core of this wall segment comprises three large fairly homogeneous soil deposits and dozens of smaller ones (see Trench 4 in Figure D7.4). A thick layer of gray loam was placed on top of the dark gray loam and gravel, and this material forms the central core of the wall segment. A red sandy loam was deposited immediately south of the gray loam. The red material partly overlies the gray sediments and extends about 10 meters (33 ft.) to the south. The contact between the red and gray sediments is sharp and clear, just as we observed in other wall segments. On the north side of the gray loam core, the situation is different. The gray loam deposit thins on its north edge, and a gray-brown loam was piled on top of this and extends to the north about 5 meters (16 ft.). The contact between the gray and the gray-brown loam is marked by numerous lenses of gray loam, gray-brown loam, red sandy loam, and gravel. Many of these lenses appear to have resulted from the dumping of basketloads. This is unique among the wall segments that have been examined at Hopeton; that is, this segment has a different construction history than the others we explored. As noted in the other wall trenches, a dark gray organic soil zone that dipped down and outward from the top of the wall segment was present on both the interior and exterior of this wall segment.

Several features were exposed by the excavation of Trench 4. Two unusual linear features comprising burned wood and a white **calcined** material were found resting on top of the dark loam that forms the base of this wall segment. It is unclear what these features represent, but obviously they were placed at this location as part of the initial wall construction. Within the fill of the wall, there were three different small features consisting of burned wood and burned soil. These were similar in size and form to the features described earlier from the other wall segments. Another small area of burned soil and charred wood was found about 7 meters (23 ft.) north of the exterior of the wall. With the exception of the last feature, all the features described from Trench 4 are associated with stages of wall segment construction.

Because the contacts between all the soil layers exposed in all the wall segments were generally very sharp and distinct, we believe that very little time elapsed between depositions of the different materials. To test the validity of this observation, we collected soil samples from each of the trenches for micromorphological study, the analysis of thin sections of intact sediment columns. Microscopic analysis of the sediment grains may provide evidence of how they were deposited and whether they exhibit evidence of weathering or other alteration after deposition. Thus far, analysis of sediments from Trench 1 indicates no evidence of weathering or soil formation at the contact between the soil materials used to build the wall (Mandel et al. 2003). This means that the construction of the wall segment must have occurred in a few years or less.

One of our goals has been to determine when the walls of the rectangular enclosure were built. Although the micromorphological study of the soils used to build the wall segments indicates rapid construction of each segment, we are unable to determine from the soils alone whether the wall segments were built about the same time or sequentially, over a number of years. Fortunately, the people who built the wall segments seem to have conducted rituals that included burning wood and other materials in association with the various stages of wall construction. Wood charcoal collected from these feature was used for radiocarbon dating. Four radiocarbon dates from features in Trenches 1, 2, and 3, plus two other radiocarbon dates, were obtained from features in a 1996 trench (Ruby 1997). Although radiocarbon dating can at best produce results that can be confidently assigned to a century, our results suggest these wall segments were likely built between 1800 BP and 1700 BP (AD 150 and 250).

As already discussed, we noted that the construction of the wall segment exposed by Trench 4 was significantly different from the other trenches at the rectangular enclosure (Lynott 2004). Features associated with construction of this wall segment produced two radiocarbon dates, and both are at least 800 years more recent than the dates obtained from the other trenches. Since one of the samples was taken from a feature at the very base of the wall segment, it isn't likely that the younger dates represent intrusive episodes that postdate actual construction of the wall segment. When these later dates are considered in association with the unusual construction methods recorded in Trench 4, it seems likely that this wall segment either was built many centuries after the other wall segments or, more likely, was modified or repaired at this later time.

WHAT DOES IT ALL MEAN?

You may be wondering why this detailed description of the layering and construction history of the Hopeton earthwork segments is important. Systematic recording and study of the great Hopewell earthworks of southern Ohio began in the mid-nineteenth century. Efforts to understand when and how the giant earthen walls that formed these enclosures were built have been ongoing for more than 150 years. Archaeologists have excavated single trenches across earthen walls at several large earthworks and extrapolated the data obtained to the entire site. However, the work on the rectangular enclosure at Hopeton demonstrates that variation in wall construction methods, and even in the age of wall construction, may be significant within individual earthworks. This is a new and significant finding.

Understanding the methods and materials used to build these walls also is important, because the amount of time and energy invested in construction is a reflection of the values and social organization of the people who built the enclosure. Study of the materials used to construct the walls at Hopeton indicates that all the soil and gravel selected for this purpose was available on the landform where the site is located, or in the adjacent streambed. The massive amounts of soil used to build the walls were being quarried with hand tools and carried in baskets, and it is apparent that vast amounts of soil were being moved all across the site. This substantial earthmoving resulted in the creation of a cultural landscape that reflected the worldview of the people who built it.

Rather than simply scooping up soil and piling it into an earthen wall, people built the wall segments at Hopeton with carefully selected soils. The entire process began by removing all topsoil from the area in which a wall segment was to be built. The action of exposing the yellow or red subsoil certainly provided a very stable foundation for the wall segment, but it also probably was related to the Hopewell people's efforts to manage the spirit world. In the wall segments that have been examined on the south and west sides of the Hopeton rectangular enclosure, the wall builders always placed red or reddish-brown soil on the side of the wall that would be viewed from the outside of the enclosure. Yellow soils were always placed on the side of the wall that would be viewed from the inside of the shelter. The contacts between the different soils used to build these wall segments are sharp and clear, and it is obvious that both the selection of soil and its placement in the wall were carefully engineered. These wall segments were all built about 1750 BP (AD 200).

The curving wall segment that forms the northeast corner of this enclosure is quite different. In this area, the topsoil was removed to expose red subsoil. This wall segment is constructed primarily of red sandy loam and two different shades of gray loam.

There are large homogeneous deposits of these materials, but the contacts between the different soil materials are frequently marked by mixing of the types, with basket-loading sometimes apparent. In this instance, the red soil was placed to be visible from the inside of the rectangular enclosure, and the gray loam would have been visible from the outside. Of course, as time went by, and soil formed on the earthen walls, the wall colors would have become less noticeable. The variation we have noted in the color placement and construction methods between these wall segments may be related to some intended differences in function. However, the radiocarbon dates from the curved wall segment suggest that this wall segment was constructed about 800 years after completion of the other wall segments. This discovery is very important and makes us want to know whether earthen wall construction, or at least repair or modification of earthen walls, continued into the Late Woodland period at other large geometric enclosure sites in southern Ohio.

As archaeologists and geophysicists continue to study the relationship between geophysical data and the archaeological record, it is apparent that these data will provide a more accurate depiction of the original placement and size of the wall segments than can be obtained from either current topographic maps or even the historic maps of nineteenth-century archaeologists. Recent interpretations suggest that gateways at Hopeton and other Hopewell enclosures were specifically situated to view solar and lunar events. Evaluation of these hypotheses can be accurately conducted through large-scale geophysical mapping of these sites. Geophysical survey also provides an efficient and effective way to develop a holistic view of the archaeological record of these giant earthen monuments. This can be a particularly effective way to view large sites, especially when done in concert with systematic surface collections and strategic testing efforts.

The timing of the introduction of these new technologies to the study of Ohio Hopewell is critical. Earthworks and mounds were once plentiful across all of southern Ohio. Urban growth, agriculture, and other development activities have damaged or destroyed nearly every single earthen monument in this region. The forces that are impacting the archaeological record continue to escalate as population grows, cities expand, and agriculture continues. A number of important sites have been purchased and preserved. Unfortunately, now that methods and technologies that permit effective study of these large sites are becoming available, the vast majority of large Ohio Hopewell sites are being erased from the cultural landscape. Increased efforts to preserve sites for future study are certainly needed, but more large-scale archaeological studies of these great places are also needed before the resources are lost forever.

DISCUSSION QUESTIONS

1. What sequence of construction seems to be typical at the Hopeton earthworks? How does the earthwork section exposed in Trench 4 differ? Why might this be?
2. Compare the geophysical investigations with those conducted at the Double Ditch Village site described in Chapter 10's case study. What arguments would you make for the incorporation of these techniques in archaeological projects in general?
3. What alternative explanations can you think of for the disparate dates obtained by this project? How would you test these alternatives?
4. Explain why the accelerating pace of mound and earthwork destruction is such a concern. Structure your explanation as if you were addressing the general public rather than the archaeological community.

CASE STUDY

As Chapter 12 indicates, greater understanding of the French and British periods in the Midwest and Upper Great Lakes can be gained from historical archaeology. Historians and archaeologists have worked closely at Fort Michilimackinac, located at the Straits of Mackinac in Michigan. This is one place that you can visit a reconstructed fort to learn about early European settlement (see Section H). Here, for several decades, archaeological investigations have been aiding in research and public interpretation efforts. This case study addresses a fact about frontier trading posts that is often forgotten—that these settlements were multiethnic communities in which complex interactions took place between people of different backgrounds and socioeconomic classes. Thus archaeologists can use them as a context in which to explore aspects of ethnicity. For example, ethnic identity can be expressed through dietary patterns. You may be able to think of special ethnic foods that your family makes and eats. Similarly your family may avoid certain types of food for ethnic, religious, or socioeconomic reasons. In this case study, the subfield of zooarchaeology is used to look at the choices people at Fort Michilimackinac during the British period made with respect to meat and fish and asks how these choices reflect ethnic identity. As you read about this research, think about foodways. Is it a surprise that something so mundane can help determine important aspects of the past social fabric?

D.8. ETHNICITY AND CLASS IN COLONIAL FOODWAYS

Elizabeth M. Scott

SITE BACKGROUND AND SETTING

In the summer of 1763, British soldiers and fur traders arrived at Fort Michilimackinac, at the tip of what was to become the Lower Peninsula of Michigan (Figure D8.1).[1] They moored their sailing ships offshore, rowed in birch bark canoes to the land's edge, and walked into a bustling frontier settlement. French fur traders, missionaries, and settlers had built this fortified trading center around 1715, strategically situating it on the strait separating Lake Michigan from Lake Huron. Although Britain had defeated France in what was known in the New World as the French and Indian Wars, the peace treaty of 1761 contained quite favorable terms for the residents of Michilimackinac: they were allowed to keep their real and personal property, their church, and to keep practicing Roman Catholicism.

In terms of day-to-day life, this meant that when the British arrived at the fort, there was literally no room for them. The French continued to own their houses and other property, so there was little the British could do about housing except to pay what they considered to be exorbitant rents to the French. Although a barracks was built in 1769 and one of the row houses was taken as a commanding officer's house, many of the soldiers and officers continued to be housed in French-owned dwellings throughout the 1770s. After 1764, a sizable village (called the "subarbs") grew up outside the fort's eastern wall, where many British and French traders lived. But the interior properties of the fort remained largely in French hands.

Thus, the British were in fact colonizing a French colony, an activity that might be called secondary colonization. For nearly 50 years, the French had occupied this post, engaged in acquiring beaver, otter, mink, bear, and other furs from Native American groups in exchange for various items of European manufacture. The furs were shipped back to Europe, where they were made into a whole range of materials, from book bindings to felt hats. The French also married Native Americans, and their offspring came to be called *Métis*. In 1761, the British arrived at a community where strong ties of marriage, kinship, and business existed between the French and the local Native people.

The French town of Michilimackinac was laid out in streets, lined with houses built one adjoining the other in a long row, with a fenced yard behind

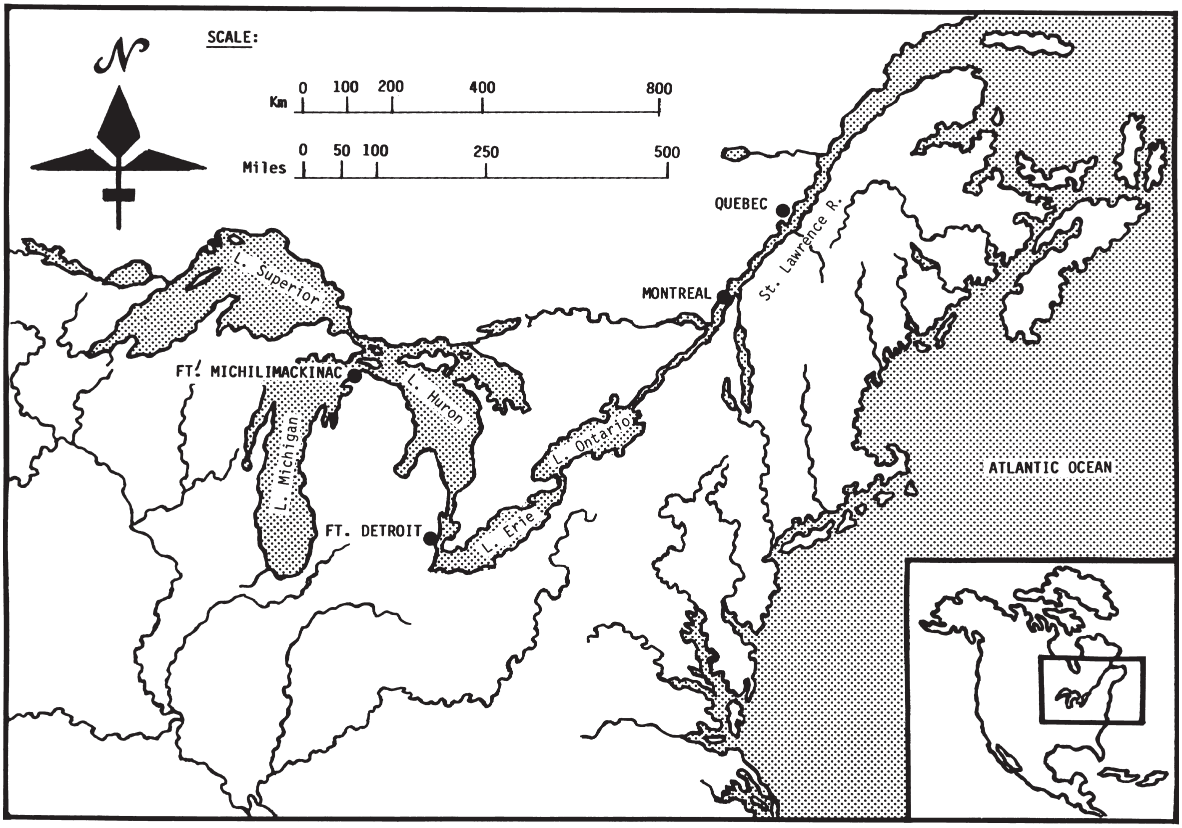


FIGURE D8.1 Location of Fort Michilimackinac.

each. Several maps illustrate this row house arrangement, and it has been shown to be true archaeologically as well (Figure D8.2). The row houses were built by the French around 1730 and were rebuilt around 1765 in exactly the same way: vertical posts in the ground (*poteaux-en-terre*) with clay chinking, called *bousillage*, pressed between the posts. The sizes of the houses varied slightly, according to the wealth of the owner, but were roughly 23 feet square (1.85 m; 20 French feet), probably with a garret above. These row houses and yard fences have been revealed archaeologically by the stains, and sometimes the remains, of wooden posts set into ditches; the houses have been labeled alphabetically by archaeologists (e.g., House C, House D).

One of the ways historical archaeologists identify who lived in a house is by studying the kinds of

FIGURE D8.2 Excavations of House D in progress at Fort Michilimackinac, with reconstructed Houses AB and C on the left.

material culture the people left behind: broken ceramic dishes, bottle glass, buttons, gun parts, jewelry, and other objects. Through historical records, we can determine which country manufactured certain artifacts of material culture and even have some idea of the cost of those items vis-à-vis other items at the time. However, in situations of secondary colonization, where one cultural group is in political and economic control, the material goods available for sale or barter will be those of the dominant group. In this case, everyone in the fort had access to the same British-manufactured items, or items obtained through British trade routes, whether the buyer was French, British, or *Métis*. For this reason, the artifacts may not be very useful in determining the ethnic identity of the residents of a given household.

Instead, in these sites, it is often the evidence from food remains that provides us with the clearest case for determining the ethnicity of the former residents. Differences in diet between the households examined here suggest that French, British, *Métis*, and German Jewish colonists were neighbors along one street in the fort. The faunal remains also suggest different economic positions for these households.

PROJECT GOALS

This zooarchaeological project set out to determine to what degree animal remains could be used to ascertain the ethnicity and economic class of past residents of Fort Michilimackinac. Ethnicity refers to a set of beliefs, practices, and customs through which a group of people define themselves as somehow set apart from others in a population. Colonial societies, such as that at Michilimackinac, are often quite ethnically diverse. Cuisine is one of the means by which people express their ethnic identity, through the kinds of foods they prefer, the ways in which they prepare them, and the kinds of foods they detest or avoid.

Regardless of the kinds of foods one prefers, in capitalist societies, economic position often has much to do with the ability to obtain such foods. Historical records such as price lists, cookbooks, personal diaries, and government accounts provide some idea of the desirability and cost of certain foods relative to others. This is where food preferences meet the realities of daily life: we often eat what we can afford to eat, and we often cannot afford to eat what we would prefer. Whereas the historical records might tell us the relative costs of particular meats or the foods preferred by the upper classes, the animal remains from an archaeological deposit tell us what people actually ate (and, by their absence, what they didn't eat).

Interpretations about the ethnicity or economic class represented by a faunal assemblage, however, must be tied to specific historical, environmental, economic, and social contexts. All these factors come into play in determining the foods that would have been consumed by particular people in a past society, and we must pay attention to all of them when we try to interpret the food refuse they left behind. This project looked at Fort Michilimackinac during the period of British colonial rule (1761–1781) and aimed to understand the degree to which the ethnicity and economic position of people in several households along one street could be interpreted, based on food remains.

DATA COLLECTION AND ANALYTICAL METHODS

The project included data from historical, ethnographic, and archaeological sources. Historical and ethnographic data provided some indication of the diets of French, British, German Jewish, Ottawa, Ojibwa, and *Métis* peoples in eighteenth-century North America. These data were used to hypothesize what the content of the resulting faunal assemblage might be for each of these groups. Then the archaeological faunal data were compared against the models to see which best explained the data.

The archaeological deposits at the site were excavated by troweling and were water-screened through 1/16-inch (0.16 cm) window screen mesh. This allowed the recovery of even the smallest animal bones, teeth, and shells. The remains were identified by using comparative osteological collections at the Illinois State Museum in Springfield, and at Mackinac State Historic Parks, in Mackinaw City, Michigan. The zooarchaeological database consisted of remains from five different households, collected from areas that included house interiors, fenced yards behind the houses, streets outside the yards, and privies.

Zooarchaeologists use a variety of methods to analyze and interpret animal remains from archaeological sites (see, e.g., Reitz and Wing 1999). For this project, the fragments of bone, shell, and teeth were identified to the lowest possible taxon, or taxonomic designation (species, genus, family, order, class). The materials identified for each taxon were counted and weighed; the fragment counts are referred to as the **number of identified specimens (NISP)**. The NISP and the weights comprise the primary data used in faunal analysis.

However, zooarchaeologists usually want more than simply a list of counts and weights for identified specimens. Secondary data are data based on calculations made from the primary data; those utilized most often are the **minimum number of individuals (MNI)**, an estimate of how many animals are represented, and **meat weight estimates**. Data like these allow us to better interpret the excavated remains.

To calculate the MNI represented in a faunal assemblage, we look at the skeletal elements for each taxon and evaluate them in terms of side (right or left), size of the individual, age (from degree of fusion of bone or eruption of teeth), and sex indicators (Reitz and Wing 1999:194–199). Based on these data, we can conservatively estimate the minimum number of individuals of each species, genus, or family that are represented by the bones found in a particular assemblage. This gives us a better understanding of the role played by various species in the diet; those represented by the most individuals may have been most important (in the case of large animals) or the most easily caught in large numbers (in the case of fish). Although this is indeed a calculation, it provides a firmer foundation for interpretation than does a simple fragment count (NISP). For example, a cow might be represented in an assemblage by two bones, and a trout might be represented by fifteen bones. If we relied simply on NISP figures, we would say that the trout was more important than the cow, because there were more trout fragments than cow fragments. However, when we estimate how many individuals could be represented by these bones, we find that both species were represented by one individual.

Yet, is there any way to determine which of these animals was more important to the diet of the people who lived at the site? Another kind of secondary data often relied upon by zooarchaeologists is the calculation of meat weight estimates. There are two broad categories of meat weight calculations (Reitz and Wing 1999:221–231). One, known as the **White method** (White 1953), estimates the entire weight of an animal and assumes that each individual was consumed entirely. The other, known as **skeletal mass allometry** (Reitz et al. 1987), estimates the weight only of the meat that would have been adhering to the bones recovered. The latter method was used in this project. It relies on regression formulas to predict meat weight based on bone weight. Thus, the bone weight for a particular species is put into a formula, which then estimates the weight of the meat, or biomass, likely to have been on those bones. Thus biomass, or meat weight, estimates provide a way to gauge the meat contribution of certain species relative to other species in past diets.

FINDINGS

This study found that food remains can help identify the households of people of various ethnic groups and economic classes. Ethnographic, historical, and archaeological evidence indicates that Native American groups in the area, specifically the Ojibwa and the Ottawa, exploited a variety of wild resources, especially the lake trout, whitefish, and sturgeon that abounded in the Great Lakes, and large fur-bearing mammals such as deer, elk, moose, and bear (e.g., Feest and Feest 1978; Martin 1981). Although no Native Americans were allowed to live inside the fort at Michilimackinac after 1764, their food traditions would have influenced many *Métis* individuals, who lived in several households at the fort.

Previous zooarchaeological studies examined French period faunal assemblages (1715–1761) from Michilimackinac and found that the French, *Métis*, and Native American residents consumed primarily wild species, particularly fish and wild mammals (Scott 1985, 2002). Domestic species contributed very little to the diet overall, with pig being the primary domestic species consumed. Beef was consumed only in the wealthier French households. The kinds of wild species consumed by the French period residents will be important in our interpretation of some of the later faunal assemblages at Michilimackinac.

The NISP for British period households was 153,214. As is common with faunal assemblages, many bones could not be identified beyond whether they were mammal, bird, fish, or another vertebrate class. However, after removal of specimens likely to have come from nonfood animals, total biomass could be estimated at 121.059 kilograms (266.935 lbs.), and estimates could be made as well for each animal

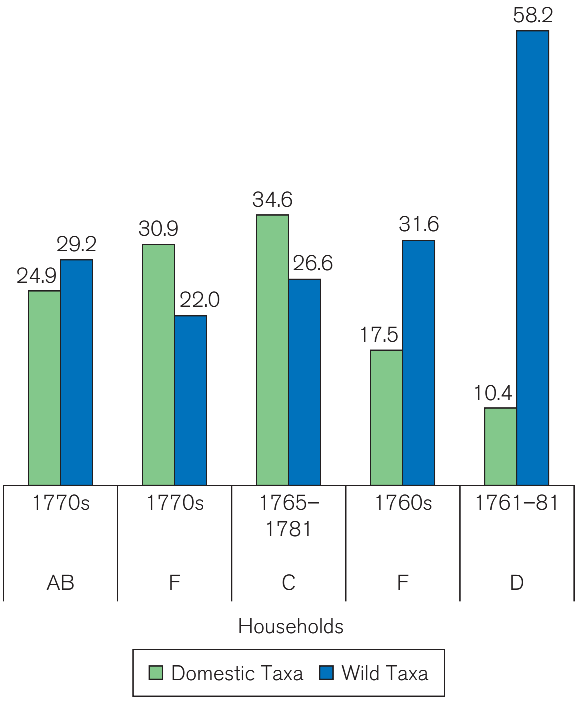


FIGURE D8.3 Percentage of total biomass from domestic and wild animals in the British period households.

taxon. These biomass estimates provided a basis for comparisons among the different British period households. Apparently diet was quite varied with respect to the contributions of domestic versus wild species (Figure D8.3).

The households with the highest percentages of meat weight from domestic species are House AB of the 1770s, where two King's 8th officers lived; House F of the 1770s, where a British fur trader of moderate to upper economic means probably lived; and House C, the residence of Ezekiel Solomon and Gershon Levy, two German Jewish traders who had accompanied the British army to Michilimackinac. These three households correspondingly had the lowest proportion of meat from wild species. The households with the lowest percentages of meat from domestic species are House F of the 1760s and House D. These two households look much more like the earlier French period assemblages in terms of the greater importance of wild species.

British Diets

Travelers' narratives, military correspondence and records, personal diaries and correspondence, and merchants' accounts provide information about the kinds of foods consumed by British colonists at Michilimackinac (Scott 1991, 1996). In addition, eighteenth-century British colonial cookbooks provide a guide to British food preferences at the time (McKibbin 1976; Simmons 1984 [1796]). In general, British diets were dominated by meat from domestic animals: cattle, pigs, sheep, chickens, and geese. Supplementing these were hares, game birds (such as grouse and passenger pigeon), and fish.

The faunal assemblage at Michilimackinac that looks most stereotypically British is that of House AB (Figures D8.4 and D8.5), where two officers from the elite King's 8th lived (Heldman and Grange 1981). The food remains of these men, who had arrived at this frontier location in 1774, reflect an emphasis on domestic meats (beef, pork, mutton, and chicken) (Figure D8.4) and fish (Figure D8.5); the only wild mammal present is the hare; the most important birds in the diet were duck, swan, grouse, and passenger pigeon. These wild species are precisely those that are included in British colonial cookbooks of the period, and swan had been eaten by Britain's upper classes since medieval times (Serjeantson 1989).

The diet in evidence in House F of the 1770s also suggests British occupants, but of a more medium economic position than the officers. Domestic species comprise nearly one-third of the estimated meat weight, nearly all of which was beef and pork. Fish were next in importance in terms of meat weight. The most important wild mammals were hare and beaver, while the most important birds were goose, duck, and passenger pigeon. Mutton provided only a very small proportion of the meat represented, which suggests the occupants of House F in the 1770s were not as well off economically as the officers. The inclusion of beaver, even in small amounts (2.1 percent of total meat weight), suggests a more moderate economic position, since the meat of this rodent was not a preferred food among the British. The material remains associated with this household suggest that the main occupant was a fur trader of moderate to wealthy income, consistent with the dietary evidence of a more moderate economic position.

House D during the British period was occupied first by British foot soldiers; after a barracks was built

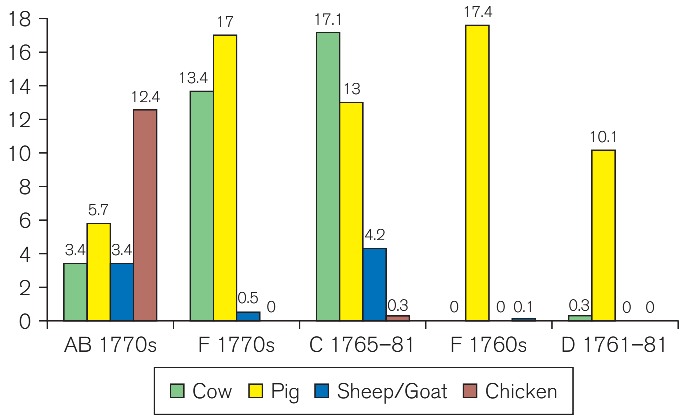


FIGURE D8.4 Percentage of total biomass provided by different domestic animals in the British period households.

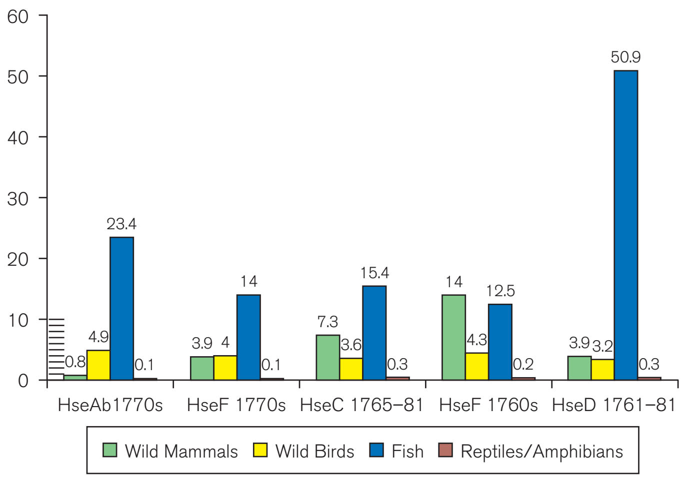


FIGURE D8.5 Percentage of total biomass provided by different wild animals in the British period households.

elsewhere in the fort, British officers moved in. Documentary records suggest that one, perhaps the only, noncommissioned officer living in House D in the 1770s was the surgeon's mate, David Mitchell; he was married to a local *Métis* woman, Elizabeth Bertrand (Evans 2001:8). If she were responsible for much of the cooking for the household, her French and Native American heritage might explain the high proportions of wild species we see in the assemblage there, and the correspondingly low proportion of domestic species (nearly all of which comes from pork) (Scott 2001). However, since the overwhelming majority of meat from wild species consumed in House D came from fish (Figure D8.4), it is useful to note that catching and smoking/drying fish were among the duties of soldiers at the fort, to replace or augment their allotted provisions (Parker 1976:72). It is possible that the large role played by fish in the diet in House D during this period resulted from a combination of soldiers' duties and *Métis* food preferences.

French Diets

In addition to the zooarchaeological studies noted earlier, historical documents provide some idea of the kinds of foods available to French colonists at Michilimackinac (Scott 1985, 1996), and French cookbooks indicate the kinds of foods that were preferred (e.g., LaVarenne 2001). Domestic animals formed the mainstay of the French diet, but the French generally consumed a much wider range of wild species (especially wild birds) than did the British.

In House F during the 1760s, we have perhaps our best evidence of French residents continuing to live in a house during the British regime. Compared with the other British period households, the residents of House F in the 1760s seem to have continued a diet much more like that of the earlier French period than like that of their 1760s neighbors. The consumption of beaver, which was nearly the only mammal in this faunal assemblage, suggests that the occupants of this house in the 1760s were French-Canadian or *Métis*. Beaver was the most important wild mammal in the diet, contributing 13.4 percent of the total estimated meat weight, similar to the amount contributed by pork (17.4 percent). This is the highest proportion of beaver in the diet of any British period household, and it is similar to the degree of beaver consumption seen in the earlier French period. In the French period House F, beaver contributed 14.9 percent of the total meat weight; next door, in House E, beaver contributed 12.7 percent of the total meat weight (Scott 1985).

Historical documents indicate a British distaste for beaver meat. It is also possible that French-Canadians consumed beaver to a greater degree than did the British for religious reasons. In 1749 Peter Kalm noted that the pope had classified beavers with fish, because the beaver "spends most of his time in the water" (Benson 1987:534), and there are similar references at least as far back as the 1600s (e.g., Faulkner and Faulkner 1987:224). Beaver, then, could be eaten by Catholics on fast days.

Jewish Diets

Historical records of Jewish congregations throughout the British colonies (Marcus 1959, 1970), eighteenth-century travelers' reports (e.g., Benson 1987), and zooarchaeological studies of Jewish households in Amsterdam (Ijzereef 1989) and Arkansas (Stewart-Abernathy and Ruff 1989) provide some indication of the kinds of foods consumed by Jewish colonists in North America. Observant Jews avoided consumption of pork, wild animals, and other prohibited meats. However, there was a range of consumption (from abstention to liberal use) of pork and wild animals among other persons who identified themselves as, and were considered by others to be, Jewish.

A relatively small number of Jewish immigrants settled in Canada following the British colonization of New France. Among these were the German fur traders Ezekiel Solomon and Gershon Levy, who in 1765 bought the structure known to archaeologists as House C (Halchin 1985). Figures D8.3 to D8.5 combine the faunal assemblages from this house's interior and its yard (1765–1781). The data suggest a higher consumption of meat from domesticated animals than in any of the other British period households. The highest proportions of both beef and mutton also are found in House C, suggesting a relatively high economic position. Wild species, especially fish, are present in moderate amounts.

However, it is possible to date the yard deposits somewhat more closely. Here archaeologists can distinguish the deposits of the 1760s from those of the 1770s, which means we can look at change through time in the diet in House C (Figure D8.6). The faunal assemblage from the 1760s consists of 4867 specimens with an estimated biomass of 16.635 kilograms (36.67 lbs.), while the 6103 specimens from the 1770s have an estimated biomass of 36.097 kilograms (79.58 lbs.). Interestingly, a shift toward a more observant Jewish diet may be evident. Through time, the proportion of pork drops considerably, as do the proportions of wild mammals, birds, and fish. Conversely, beef and mutton increase considerably (Figure D6.6). The difference in pork consumption in the two periods parallels the difference between non-Jewish and nonkosher households that Ijzereef (1989) found in Amsterdam.

The ceramic and glass artifacts found in the yards of these two periods clearly show an increase in wealth for Solomon through time (Halchin 1985). It may be that when Solomon arrived at Michilimackinac as a trader, he could afford to eat only what the majority of inhabitants (French

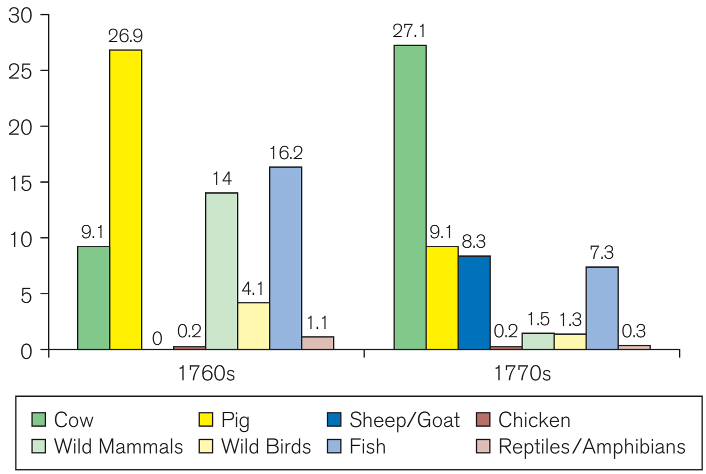


FIGURE D8.6 Percentage of total biomass provided by different animals in House C during the 1760s and 1770s.

Canadians) ate; his diet in the 1760s shows an emphasis on wild mammals, fish, and pork, very similar to a French Canadian diet at the fort. In addition, Solomon may have chosen to de-emphasize his Jewishness by eating as others did. Later, when he was successful in the fur trade, he could afford not only the more expensive foods (beef and mutton), but also more expensive ceramics and glassware. He could demonstrate his economic position and place in society in these ways and, perhaps simultaneously, choose a diet that set him apart from the majority of inhabitants. His shift toward a more observant diet in the 1770s would have coincided with his known increased involvement with the Jewish congregation in Montreal.

This case study provides an example of how zooarchaeology can inform us not only about what people ate in the past, but also about how those food choices were related to the ethnicity and economic position of a site's residents. Fort Michilimackinac was an extremely diverse community between 1761 and 1781, made up of men, women, and children of various cultures and economic classes. Food was one way in which various cultural traditions could be both maintained and altered. Food remains also provide archaeologists with a means to distinguish between the households of people of different ethnic or religious groups, especially on sites of multiethnic communities, where the material culture was largely controlled by one group. By drawing on historical, ethnographic, and artifactual evidence, we can provide a cultural and temporal context for the zooarchaeological data, which can in turn enrich interpretations of archaeological sites.

DISCUSSION QUESTIONS

1. How do zooarchaeologists calculate NISP, MNI, and meat weight? What are the advantages and disadvantages of each of these measures in determining dietary importance?

2. Contrast the expected dietary patterns of French, British, *Métis*, and Jewish inhabitants at British Fort Michilimackinac. How well do the faunal assemblages from different houses correspond to these expectations? Can you think of other potential material correlates for ethnicity? Why is ethnic identity difficult to determine in this community?

3. In what ways does class as opposed to ethnicity seem to have affected the choice of foods? Do you agree that ethnicity seems to be the more important factor in foodways? Explain.