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of SV-2, Saltville, Virginia,
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Jerry N. McDonald

Virginia Museum of Natural History
Martinsville, Virginia 24112, USA
Correspondence Address: 444 E. Broadway,
Granville, Ohio 43023, USA

ABSTRACT

Saltville Valley is an important source of information about the environmental history of the Middle Appalachian region, especially for the past 15,000 years. The Saltville River coursed the valley until about 13,500-13,000 yrs BP, at which time it was diverted by headstream piracy and replaced, in Saltville Valley, by Lake Totten. At site SV-2 (=44SM37), three horizons dating from $14,510 \pm 80$ yr BP to about 13,500-13,000 yr BP document the presence of pre-Clovis people in Saltville Valley and provide insight into their lifeways. At 14,510 yr BP, pre-Clovis people appear to have butchered and processed hide, meat, bones, and tusks of a mastodon (*Mammot americanum*) and to have utilized parts of the skeleton of a musk ox (*Bootherium bombifrons*). Five hundred years later, at $13,950 \pm 70$ yr BP, human presence is suggested by unlikely arrangements, associations, and modifications of lithics, including flakes of chert that resemble biface reduction flakes. A midden dating from about 13,500 to 13,000 yr BP constitutes the youngest of the three pre-Clovis horizons recognized to date at SV-2.

SV-2 is one of the few and most complex pre-Clovis archeological sites in North America, and because it is a wet site, it contains a relatively extensive amount of organic information. Evidence suggests that the pre-Clovis people who visited Saltville Valley in 14,510 yr BP had a diversified ivory, bone, and lithic technology — possibly including a biface technology. These people appear to have been mobile hunters and gatherers who regularly visited and exploited the riparian and littoral zones in Saltville Valley where they utilized diverse faunal resources ranging from large mammals to small mammals, reptiles, amphibians, fish, and mussels.

INTRODUCTION

Saltville Valley (figures 1 and 2) is one of the earliest sites of record of late Quaternary vertebrate fossils in the United States (Jefferson, 1787) and remains an important source of information about the late Quaternary history of eastern North America (Ray, Cooper, and Benninghoff, 1967; McDonald and Bartlett, 1983; McDonald, 1984a, 1984b, 1985a, 1985b, 1985c, 1986, 1990, 1996a, 1996b; Delcourt and Delcourt, 1986; Holman and McDonald, 1986). Saltville Valley is now known to contain a record of lotic and lentic sediments that is nearly continuous for the past 15,000 years, that extends sporadically to at least 27,000 yr BP, and that possibly dates to as early as the Sangamonian Interglaciation (i.e., to ca. 100,000 yr BP). In addition to the geomorphic and hydrologic history recorded by these sediments, they also have provided depositional environments that have preserved a rich and diverse record of the plant and animal life of the region — especially that of the past 15,000 years, including documentation of how the regional biota has changed during that period.

The presence of humans in the Middle Appalachians is one facet of the biological history of the region that is documented in and near Saltville Valley. Although relatively little work by professional archeologists has been conducted in Saltville Valley or its immediate vicinity (Wedel, 1951; Holland, 1970; Michlovic, 1975; Egloff, 1981), there is a rich tradition of amateur interest in the archeological resources of the valley and, as a result, there is strong material evidence in the form of fluted projectile points (McCary, 1955, 1983, 1984, 1986) that humans have been in and around the valley since the time of the Paleo-Indian fluted point tradition, which was in place by circa 11,500 yr BP. The date of 11,500 yr BP is the lower, or older, limit of the generally accepted range of appearance (11,500 to 11,200 yr BP) of the Clovis (*s.l.*) culture, one typical material element of which was the fluted projectile point (Bryan, 1991; Stanford, 1991; Anderson and Sassaman, 1996; Goodyear, 1999a). Clovis (*s.l.*), in turn, was widely accepted as the earliest manifestation of human presence on the North American continent for decades (Bryan, 1991). Increasingly, however, the “Clovis first” concept is fading and, as it wanes, the term “pre-Clovis” is coming into use as an expedient label whose exact meaning(s) are not always clear or, at least, are not always clearly stated. In this paper, we use “pre-Clovis” solely in a temporal sense to mean before the generally accepted time of Clovis — that is, before 11,500-11,200 yr BP. We accept the evidence and reasoning that multiple cultures probably

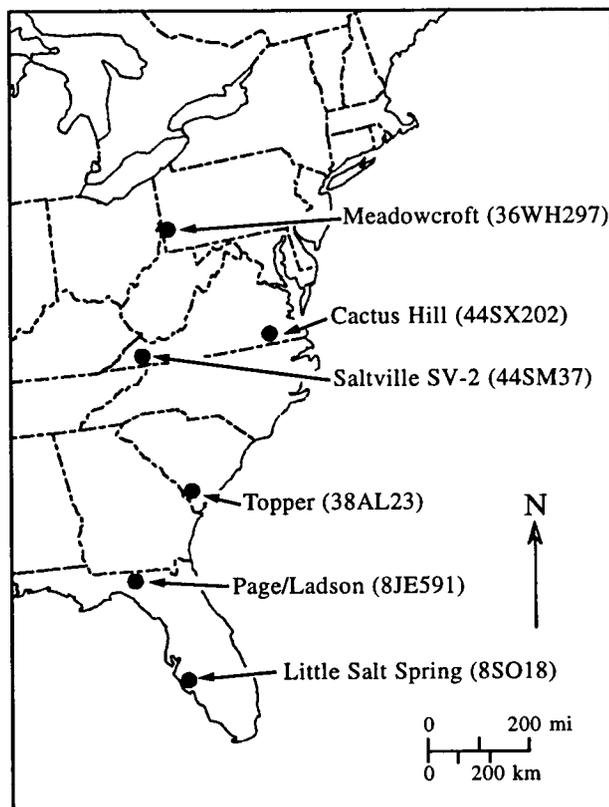


Figure 1. The location of Saltville and selected other sites in the Middle Atlantic and Southeast regions of the United States with putative pre-Clovis horizons.

existed in the Americas before Clovis time (Bryan, 1991; Goodyear, 1999a; Dillehay, 1989, 1997, 2000), and we allow that Clovis itself might eventually be found to predate the currently recognized 11,500 yr BP benchmark.

By the 1970s, investigations at a small number of archeological sites in the Western Hemisphere started to produce evidence suggesting strongly that humans had reached both North America and South America before Clovis time. This was not the first time that such a concept had been voiced, but it was the beginning of the modern movement that has resulted in what is now the rapidly growing acceptance of evidence that pre-Clovis and para-Clovis people were present in the Americas. Foremost among these sites was Monte Verde in the Province of Llanquihue in southcentral Chile, for it was Monte Verde where the quality of excavation, quantity of

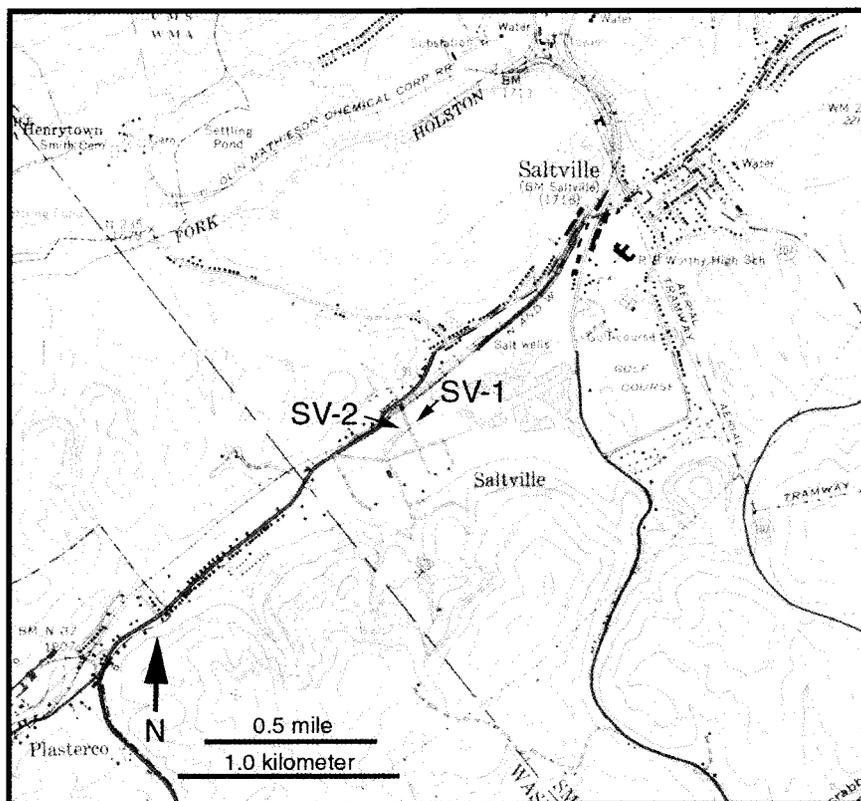


Figure 2. Saltville Valley and the location of sites SV-1 and SV-2 in the southwestern part of the valley. This area falls on parts of the Glade Spring and Saltville quads, USGS 1:24,000 series.

evidence, depth and breadth of analyses, and perseverance of the principal investigator finally resulted in the formal critical acceptance by a large number of North American archeologists of the evidence documenting that humans were in the Western Hemisphere before Clovis time (Dillehay, 1989, 1997; Adovasio and Pedler, 1997; Meltzer et al., 1997). In North America, it has been suggested for some time that the sites yielding the earliest, most abundant, and diverse evidence of the fluted point tradition were in the eastern United States and that the tradition might have originated in this region (Mason, 1962; Bryan, 1991; Stanford, 1991). Since 1975, however, evidence from Meadowcroft Rockshelter in Pennsylvania has been interpreted to suggest that humans were present in eastern North America prior to Clovis time, and perhaps to as early as about 20,000 yr BP (Adovasio

et al., 1975, 1980, 1999). The pre-Clovis record at Meadowcroft has been vigorously challenged by critics (e.g., Haynes, 1980; Mead, 1980), and vigorously defended by the investigators (e.g., Adovasio et al., 1980, 1999). Other sites in the southeastern United States have yielded evidence of human agency from before Clovis time, the most widely accepted of which include Cactus Hill, Virginia (McAvoy and McAvoy, 1997); Little Salt Spring, Florida (Clausen et al., 1979); Page/Ladson, Florida (Dunbar, et al., 1988, 1989); and Topper, South Carolina (Goodyear, 1999b) (Figure 1).

Until the 1980s, all evidence of Paleo-Indian presence from in and near Saltville Valley consisted of fluted projectile points that were either collected on the surface or from subsurface contexts that were either not documented or, if documented, had not been dated (McCary, 1984). Among the reported subsurface finds of fluted projectile points from the valley was the basal portion of a broken fluted point (Figure 3) collected by Rufus Pickle in a stratum of sand and gravel exposed on the side of a drainage ditch on the floor of Saltville Valley (Pickle, 1946). This stratum is considered tentatively to be either Unit W3 or, more likely, W4, sands and gravels emplaced by the Saltville River which are now known to date to a minimum of about 13,500 yr BP (McDonald, 1984b) (tables 1 and 2). Although Pickle's fluted projectile point could have been introduced to the gravel layer by geoturbation or bioturbation, processes known to have occurred in the valley, his report is commendably clear in describing the typical stratigraphy of the valley bottom sediments and it provides provocative early evidence suggesting that humans could have been present in Saltville Valley before Clovis time.

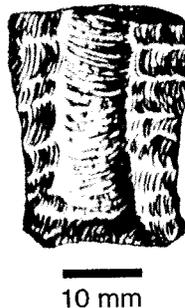


Figure 3. The basal portion of a fluted projectile point Rufus Pickle reported finding in fluvial gravel in Saltville Valley (from Pickle, 1946).

Table 1. Stratigraphic units represented in Saltville Valley at SV-1 and SV-2 (cf. figures 4, 5, and 8).

Unit¹	Description at SV-1	Description at SV-2
H1	Historic surface on lentic mud, ranges from 13 to 88 cm in thickness, transition from H2 is clear	Not present in excavated area; removed in 1964-1965 by bulldozing
H2	Lower, middle, and upper Holocene lentic mud, up to 174 cm in thickness, medium-gray with streaks of dark humic material, boundary with W1 is abrupt.	Present in northern and western part of site where bulldozing was less extensive, up to 60 cm in thickness, boundary with W1 is abrupt.
W1	Transitional from latest Wisconsinan to Holocene, organic-rich mud/soil/peat, 6 to 15 cm in thickness, very dark brown peaty paleosol and peat through dark reddish-brown peaty mud, radiocarbon dated at 10,050 ± 110 BP (Beta-5056, on soil) and 10,690 ± 130 BP (Beta-5055, on peat), paleosol and peat lie abruptly to clearly above unit W2 with the mud less distinctly separated from the underlying W2 due to geostatic shearing.	Present across most of site, 5 to 14 cm in thickness, usually as peat or peaty mud, boundary with W2 is abrupt to clear.
W2	Late Wisconsinan lentic mud, 58 to 120 cm in thickness, medium-gray with frequent streaks and splotches of dark humic material; upper 45 to 70 cm oxidizes rapidly when exposed to the atmosphere but lower zone does not, boundaries with underlying W3 and W4 are sharp to abrupt. Began to accumulate about 13,500 yr BP.	Present across most of site, up to 92 cm in thickness, uppermost of three discernible levels medium gray with very dark brown to black humic staining common to dominant, middle of three levels oxidizes rapidly when exposed to atmosphere, lowest of three levels does not oxidize visibly. Lower two levels pinch out to north and northeast where they are inter-tongued with colluvium eroding from nearby bedrock sources, boundaries vary from abrupt to clear.

Table 1 (continued).

Unit ¹	Description at SV-1	Description at SV-2
W3	Late Wisconsinan fluvial sediment series consisting of more-or-less well sorted silts, sands, and gravels to 15 cm in thickness, occupying the terminal channel(s) of the Saltville River, radiocarbon dated at $14,480 \pm 300$ yr BP (Beta-5701, on woody twigs), boundaries with W4 or P1 are sharp.	Fluvial sediments deposited by the active stream represented as sands and fine gravels occurring (a) as a sand lens across the flood channel, (b) as freshly scoured angular clasts of bedrock, primarily in and adjacent to the flood channel, and (c) as sand and fine gravel in the lowermost part of the flood channel, east of the pedestal, where the channel rejoins the channel of the terminal Saltville River. Colluvium from nearby bedrock sources was entering the riparian/littoral zone during this final phase of the Saltville River. The boundaries of all facies are sharp to abrupt.
W4	Late Wisconsinan fluvial lag gravels up to 15 cm in thickness, lying almost without interruption across stream-scoured upper surface of bedrock, boundary with P1 is diffuse.	Lag gravels lying atop the pedestal but absent as a relic stratum in the flood channel.
P1	Upper Mississippian Maccrady Formation underlying the entire floor of Saltville Valley, surface conditions vary from intensively scoured near the terminal channel of the Saltville River to pockets of deeply (> 1 m) weathered rock, fluvial and Quaternary-age fossils sometimes imbedded up to 30 cm in the weathered clay.	The Maccrady Formation underlies SV-2, surface conditions ranging from thoroughly scoured bedrock to deeply weathered pockets and curtains of plastic, sometimes pliable but tightly cohesive members.

¹ The named units are representative of the bedrock-fluvial-lacustrine sequence of sediments that typify the floor of the southwestern part of Saltville Valley. The column described here for SV-1 is a synthesis of exposures at SV-1 itself and in cross-valley trenches that were studied in 1982 and reported in McDonald, 1985a, 1985b, 1985c. The sedimentary equivalents of the named units described here for SV-2 are preliminary and general, and will be presented in greater detail in McDonald, n.d. Boundary terminology follows Dackombe and Gardiner (1983) and color terminology used in this table is based upon the *Munsell Soil Color Charts*, 1975 edition.

Excavations at Saltville since 1980, and particularly since 1992, have produced additional evidence that humans were in the valley since at least 14,500 years ago (McDonald, 1990, 1996a, 1996b; McDonald and Kay, 1999). This evidence includes lithics that are allochthonous to the watershed of the Saltville River and bone that has been modified by strongly patterned repetitive abrasion. Flakes of chert from and after about 14,000 years ago are morphologically similar to biface reduction flakes.

At present, there is materializing a critical mass of evidence sufficient to persuade a growing number of scholars from diverse disciplines that the Americas indeed might have been populated by humans prior to Clovis time, that these human colonists might have multiple geographic and ethnic origins, and that these dispersing colonists might have reached North America at different times and by different routes (e.g., Nichols, 1994; Dillehay, 1997, 2000; Dixon, 1999; Gruhn, 1999; Stanford, 1999; Schurr, 2000; Stanford and Bradley, 2000). The willingness of archeologists to increasingly accept the pre-Clovis occupation of the Western Hemisphere, in turn, creates a situation where numerous sites probably will be put forth as supporting the new model(s), and will require intensified and diversified critical analyses of the evidence on a scale not heretofore experienced simply because the evidence deserving of scrutiny very likely will, in most cases, be relatively scant and potentially diverse, and might not conform to existing cultural inventories or material and behavioral typologies currently accepted as typical of North American prehistory.

The information presented in this paper is but one result of a broad study of the paleoecology of Saltville Valley and its environs that was begun in 1980. Nearly twenty sites have been investigated during the course of this study, but most excavation activity has taken place at sites SV-1 and SV-2, both of which consist of late Wisconsinan stream and riparian contexts overlain by latest Wisconsinan and Holocene lentic contexts. Most artifacts of pre-Clovis affinity that have been identified and recovered from Saltville are from our paleoecology site SV-2, the southward extension of archeological site 44SM37 (McDonald, 1985b), but evidence of possible pre-Clovis human agency in the form of chert and modified bone and tusk is known from SV-1 and yet other probable pre-Clovis artifacts are known from at least one private collection. The purpose of this paper is to provide a summary of our current thoughts resulting from the excavation of the pre-Clovis levels of SV-2, to put on record a list of those objects and features we currently are analyzing as probable or possible evidence of pre-Clovis presence at SV-2, and to provide a detailed description of one

of the more important artifacts from the site, a bone tool (VMNH 721) that dates from the oldest pre-Clovis level at SV-2 and thus establishes the earliest documented presence of human agency in the valley. Results of our excavation at SV-2 will be treated more thoroughly in a book now in preparation (McDonald, n.d.), but the growing interest in and acceptance of pre-Clovis archeology makes a summary of that work desirable at this time and the attention that the bone tool is attracting requires that detailed information about its provenience and modification be made available. All dates presented herein are as radiocarbon years before present. Portions of the information about the pre-Clovis occupation of Saltville Valley included here have been presented elsewhere in the form of conference papers, short notes, or abstracts (McDonald, 1990, 1996a, 1996b; McDonald and Kay, 1999; McDonald et al., in press).

ENVIRONMENTAL CONTEXT

Geographic Setting

Saltville Valley (Figure 2) is in the Appalachian Ridge and Valley Province in southwestern Smyth and northeastern Washington counties, Virginia. The valley is shaped roughly like a scalene triangle, with the longest side of the triangle forming the northwestern edge. The floor of the valley, that portion lying below 1740'/530 m elevation above sea level, measures about 8000'/2.4 km in length and 2750'/0.84 km in greatest width and encompasses about 1 km² of generally level surface. About 20% of the floor of the valley is now covered with standing water, an artifact of the industrial extraction of salt brine during the later 19th and earlier 20th centuries.

The perimeter of the valley is marked abruptly on all sides by relatively high relief. A scarp rises some 400 to 600'/122 to 185 m above the valley floor on the southeast side and becomes a series of separate and somewhat lower peaks on the northeast side which crest at 300 to 400'/90 to 122 m above the valley floor. The northwest side of the valley is bounded by a wall of southeasterly dipping limestone that culminates in gently rounded knobs some 200'/60 m above the valley bottom. A break in this limestone at the northern tip of the valley forms the Saltville Gap, a narrow defile leading 2300'/0.7 km northwestward from Saltville Valley to the North Fork of Holston River.

Table 2. Radiocarbon dates for late Wisconsinan to earliest Holocene sediments in Saltville Valley.

Lab #	¹⁴ C yrs BP	δ ¹³ C	Material	Provenience and Significance
Not given ^a	9,930 ± 190		Bulk mud	W1 Dates low water phase
Beta-5056 ^b	10,050 ± 110		Paleosol	W1 Dates low water phase
Beta-5055 ^b	10,690 ± 130		Peat	W1 Dates low water phase
A-2985 ^b	13,130 ± 330	-24.8%	Wood	W2-P1 boundary Dates early lacustrine deposits
SI-641 ^c	13,460 ± 420		Tusk	Probably W2 ^d Dates earliest lacustrine deposit
Beta-65209 ^e	13,950 ± 70	-27.3%	Wood	W3 Dates last high-water event recognized for Saltville River
Beta-5701 ^b	14,480 ± 300	-25.02%	Wood	W3 Dates waning phase of Saltville River
Beta-117541 ^f	14,510 ± 80	-22.9%	Bone	W3 Dates waning phase of Saltville River

a Delcourt and Delcourt, 1986. This date is from SV-1.

b McDonald, 1984b. These dates are from SV-1 and allied trenches.

c Stuckenrath and Mielke, 1972.

d All proboscidean remains recovered at Saltville since 1978 have been found in units W2 (rarely), W3, W4, and (embedded in) P1. The dated specimen was incomplete, suggesting that it was found in units W3, W4, or P1.

e McDonald, 1996b; Wisner, 1996. This date is on the middle pre-Clovis horizon of SV-2.

f McDonald and Kay, 1999. This date is on VMNH 721 from the oldest pre-Clovis horizon recognized to date at SV-2.

Site SV-2 is located in the southwestern part of Saltville Valley at an elevation of ca. 1720/524 m asl along the north side of an artificial reservoir created by Olin Mathieson Chemical Corporation in 1964 and 1965. The geographic coordinates of the site are approximately 36° 52' 19" N, 81° 46' 27" W, and it is located on the Glade Spring quadrangle, USGS 7.5' series (Figure 2).

General Surface Geology and Geomorphology

Saltville Valley is a typical Appalachian strike valley that lies on the upper limb of the recumbent Greendale Syncline (Figure 4). The southeast pitching axis of the 170-mile-long Greendale Syncline is near the surface at Saltville and roughly parallels the surface trace of the Saltville Thrust Fault which lies alongside much of the southern and eastern edges of the valley. The northwestern edge of Saltville Valley is defined by the folded and partly recumbent Upper Mississippian Little Valley, Hillsdale, and Ste. Genevieve/Gasper limestones. Overlying the Saltville Thrust Fault are gently dipping strata, largely dolomites, of Cambrian and Ordovician age. The leading western edge of this thrust sheet is represented by the steep scarp and peaks which form the southern and eastern edges of the valley (Butts, 1940; Cooper, 1966; Conners, 1986).

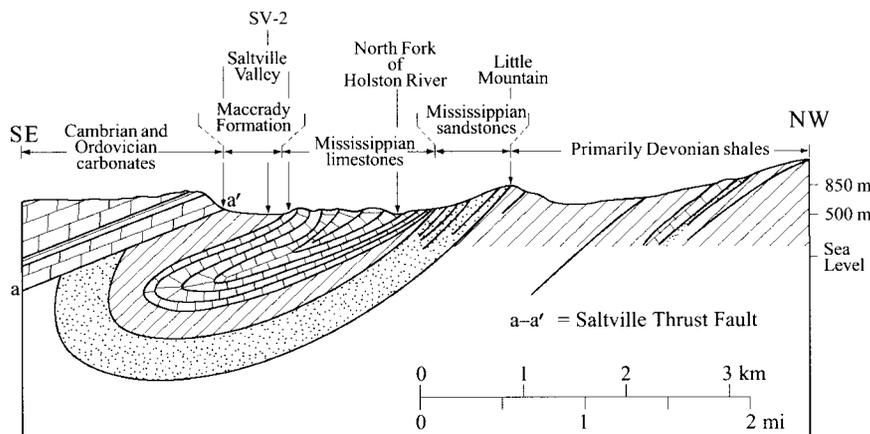


Figure 4. This diagram illustrates the basic geology of Saltville Valley and the regions that border it to the north and south. The transect lies approximately on the border of Smyth and Washington counties (modified from Cooper, 1966). The Greendale Syncline lies north of the Saltville Thrust Fault.

Saltville Valley lies entirely upon the Upper Mississippian Maccrady Formation, a highly variable sequence of shales, siltstones, and minor sandstones and limestones that incorporates significant quantities of gypsum, anhydrite, and halite. Much of the valley, including the area in which SV-2 is located, is underlain by the upper plastic shale members that are composed chiefly of illite and, less extensively, montmorillonite (Cooper, 1966). These shales are variously colored, ranging from grays and greens through yellow-browns to rose-browns and maroons. According to Cooper (1966: 15), "These shales have unusual or rather remarkable physical properties, the most pronounced characteristic being the tendency to disintegrate and flocculate on contact with water." The gypsum, anhydrite, and halite were also soluble, although variably so. The tendency for members of the Maccrady Formation to disintegrate or dissolve with relative ease accounts for the excavation of the valley — and for the value of many of these strata as distinctive geomorphic markers as will be demonstrated in the research reported below.

During the late Wisconsinan, until about 13,500 yr BP, Saltville Valley was coursed by the lower part of the Saltville River, a permanently flowing stream of modest size that originated to the east of Saltville Valley in that part of Rich Valley lying immediately north of today's Virginia Highway 107. The river entered Saltville Valley at its southwest corner, flowed north through the valley to its northern corner, then entered Saltville Gap and emptied into the North Fork of Holston River. Geomorphic and stratigraphic evidence indicates that, during the late Wisconsinan, the Saltville River had scoured at least half of the width of the upper (southwestern) end of the valley below 524 m to bedrock, and that in the southwest end of the valley the river was cutting laterally to the north, when it ceased to exist around 13,500 yr BP. Prior to and during the final millennium of its presence in Saltville Valley, the stream appears to have experienced an increased volume of flow, at least periodically, most likely a result of the increased precipitation that has been postulated for the region between 16,000 and 12,000 yr BP (Mills and Delcourt, 1991). Evidence of this higher energy includes intensified lateral scouring, accelerated downcutting, a dramatic increase in the size and number of boulders in the channel, and increased evidence of periodic high-water events. Intense rilling and the accelerated influx of colluvium further attest to the presence of periodically intense storms. The upper portion of the Saltville River was pirated by the lower portion of today's McHenry Creek — yet another suggestion of increased volume of runoff and the consequent acceleration of headwater erosion by

the responsible tributary of lower McHenry Creek. This piracy might have begun before 14,500 yr BP because colluvium appears to have been aggrading at SV-2 by this time, and was completed by 13,500 yr BP. The upper portion of today's McHenry Creek is the ancestral upper Saltville River.

Following the final capture of the upper Saltville River, the Saltville Gap became blocked and this resulted in the development of an upland lake — Lake Totten — over much of the floor of Saltville Valley (McDonald, 1984a). This blockage most likely resulted from mass wasting along the steep walls of the gap, events that would be expected consequences of the increased precipitation the region was experiencing. Sedimentary evidence reveals that the lake formed immediately after the river stopped flowing through the valley and quickly reached depths of, at minimum, about 5 m. After forming to this depth, the lake level subsequently was lowered to at least a depth of 3 m, then again quickly raised to or beyond the 5 m level — all during a period of discernible precipitation, rilling, sheet erosion, and deposition of colluvium in the riparian-littoral zone. The next major low-water phase that has been identified came at about 10,000 yr BP and apparently lasted for a few centuries before the water level again rose (McDonald, 1985a, 1985c).

The deposition of sediment within the lake occurred most rapidly during the early millennia of the lake's history, then slowed as the surrounding slopes became more stable. Most of the infilling sediments were insoluble fines eroding from the surrounding carbonate rocks or the extensively weathered Maccrady beds near the surface on the northwest side of the valley. Lesser contributions of more coarse sediments consisted of sand and fine gravels carried in from the surrounding carbonates by small streams and surface runoff, and colluvium, ranging from fines to boulders, that is especially prominent along the southeast side of the valley below the scarp of the thrust sheet. Table 1 and Figure 5 describe the typical stratigraphy of the valley bottom.

SITE SV-2

SV-2 is located on the north side of an artificial reservoir created in 1964 by the Olin Mathieson Chemical Corporation (Figure 2). This reservoir was located atop the channel of the extinct Saltville River, the lowest point in the bedrock surface along a northwest-southeast transect of the valley, and was enlarged by bulldozing the overlying lacustrine muds and some of

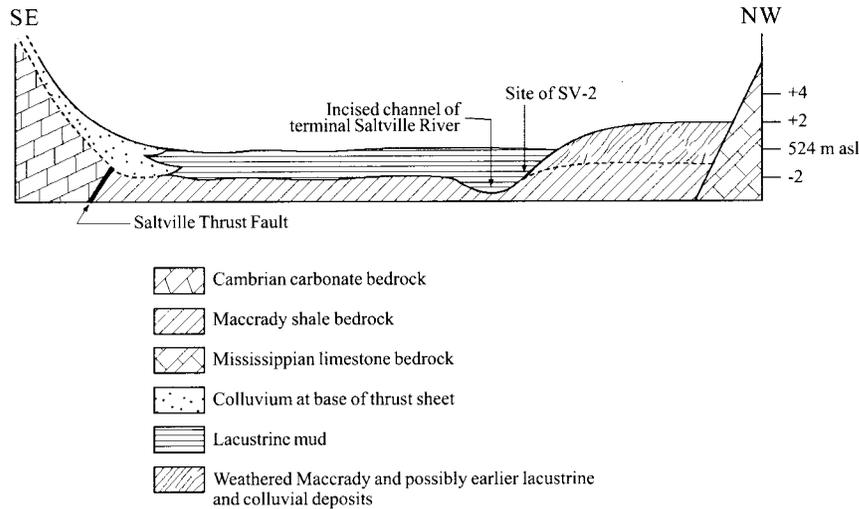


Figure 5. A generalized transect through the major unconsolidated sediments filling Saltville Valley (modified from McDonald, 1984b).

the stream gravels radially up-slope and outward from the pond area. The sloping sides of the resulting bulldozed surface exposed fluvial and lacustrine sediments *in situ*. During the excavation of SV-2 from 1992 to 1997, the clearly sorted, distinctively colored, tightly packed, and sharply bounded naturally bedded muds, sands, and gravels were readily recognizable and separable from the surface occurrences of disturbed, relocated, intermixed, disintegrating and weathered muds and gravels that had been displaced or exposed by the heavy equipment in 1964 and 1965. The objects and features described in this paper were excavated from sediments that were situated north of the graded surface and clearly had not been disturbed by the earth moving activity of 1964 and 1965.

SV-2 includes that area within grid cells 45 to 85 W and 10 to 35 S of the Saltville Valley Grid established by the author in 1982. Parts of SV-2 were excavated each year from 1992 to 1997 by the Virginia Museum of Natural History under the direction of the author and with the support of primarily volunteer crews. The initial investigation of SV-2 took place in June, 1992, when a trench 13 m in length and 0.6 m in width was cut to bedrock by backhoe parallel to the channel of the Saltville River for the purposes of (a) exposing the local stratigraphic section, (b) exposing the bedrock surface, and (c) exploring for concentrations of botanic and faunal

remains. A concentration of proboscidean ribs and an associated tool-like sliver of sandstone (VMNH 719) located in lacustrine muds near the southwestern end of this trench were interpreted as possible evidence of human agency, and suggested that the area immediately to its west should be investigated more extensively. This was done, and this area became the center of excavation activity from July, 1992, through August, 1997 (figures 6 through 9).

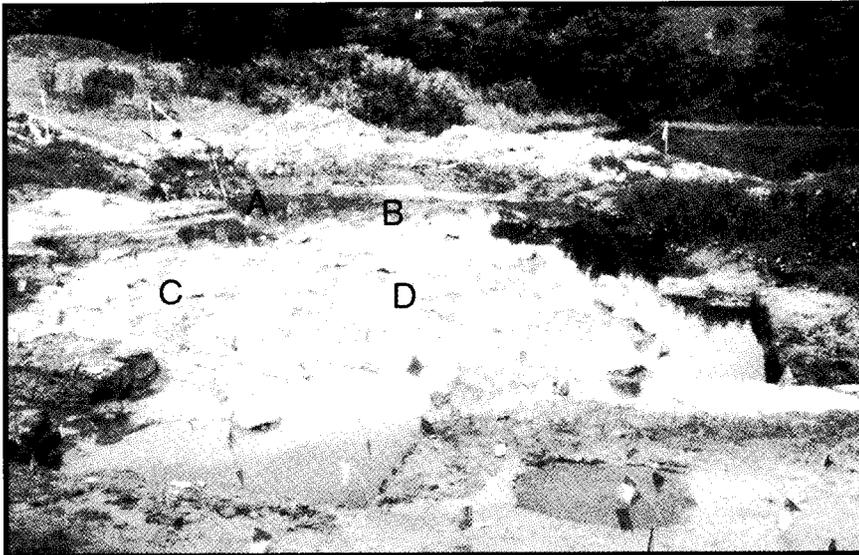


Figure 6. SV-2 immediately before excavation began in the summer of 1994, looking to the east across the pedestal. Water has just been pumped from the site sufficient to lower the water level to near the brim of the terminal channel of the Saltville River, visible to the right. The drained area constitutes the upper surface of the pedestal. The mastodon butchering (A) and tusk reduction (B) areas occupy the left and right parts, respectively, of the eastern end of the excavated area shown here. The cooking area (C) is to the left while the boulder-strewn hide, meat, and bone processing area (D) occupies the right part of the pedestal (see also Figure 7).

Beginning with the exploration of the western section of SV-2 in 1992 (57-68W, 18-27S), the area to be excavated was planed by bulldozer to a predetermined level, typically 0.3 to 0.6 m above the uppermost target horizon. The site grid, in one-meter squares, was then extended over the cleared area (Figure 7). Stratigraphic sections along the north and west high walls were measured and described, and more detailed descriptions were made

of lower stratigraphic sections throughout the site (Figure 8). The massive muds were removed in controlled increments by shovel, and more detailed work was conducted by trowel, brush, dental tools, dissecting needles, and air brushes, as required. Representative samples of unconsolidated sediments were collected and wet-screened. Location information was recorded to the centimeter within a three-dimensional Cartesian grid coordinate system. In all, 196 m² were excavated to bedrock during the six years of work at this site.

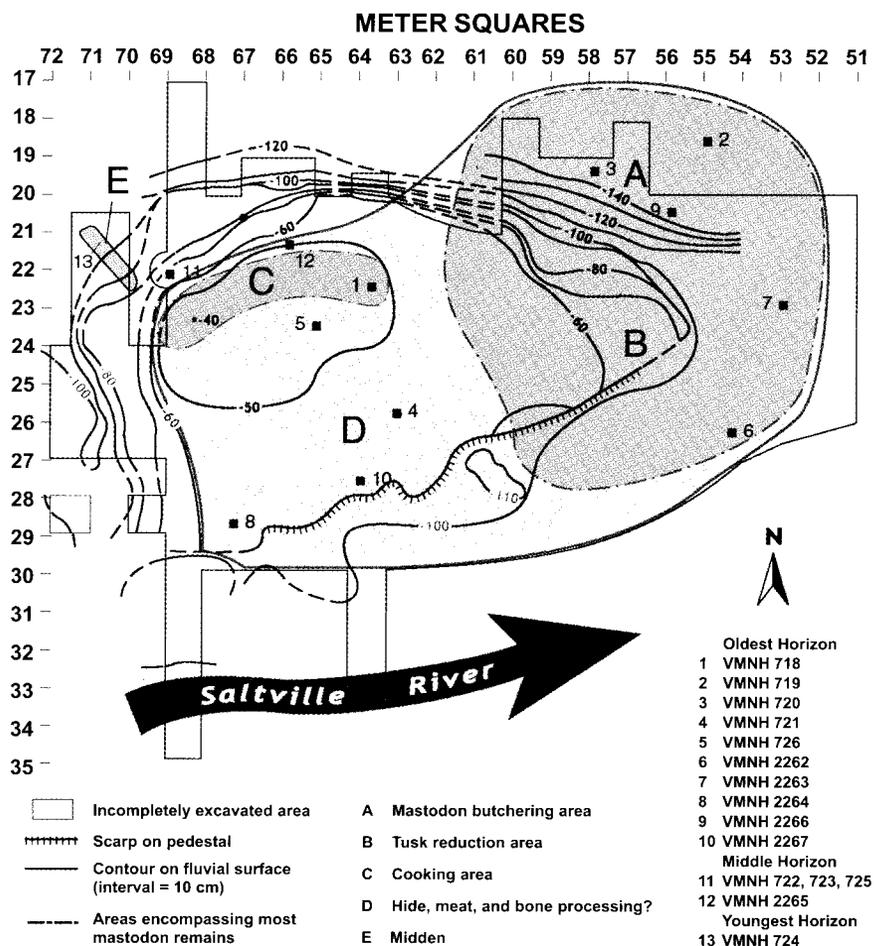


Figure 7. Plan view of the excavated area of SV-2 as of August, 1997, with contours showing the bedrock surface as of ca. 14,500 yr BP and the location and areas of pre-Clovis horizons, features, and artifacts shown.

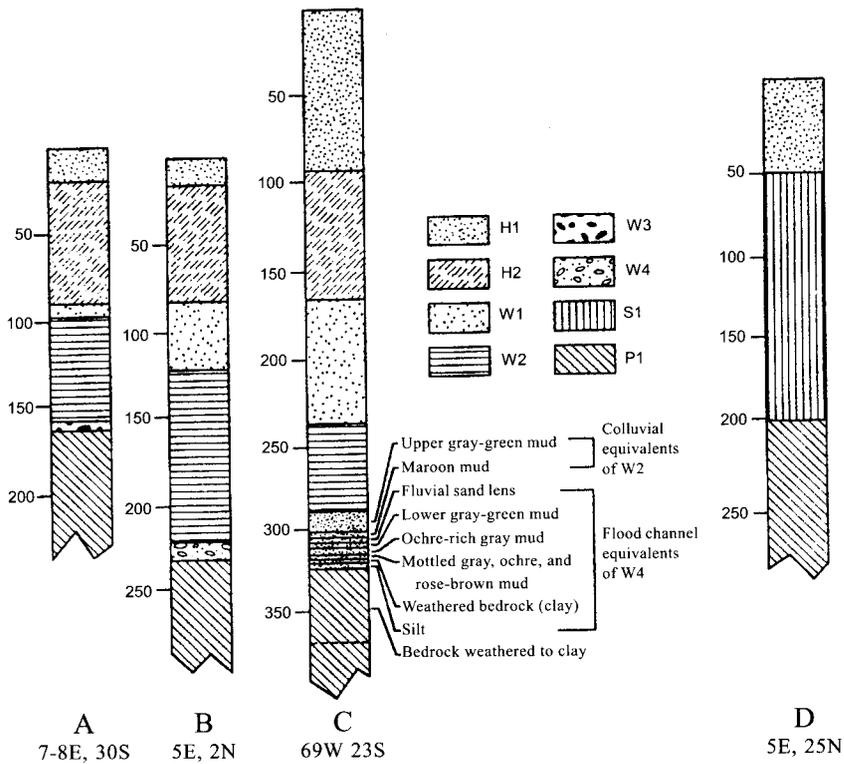


Figure 8. Stratigraphic section at SV-1 (columns A, B, and D) and SV-2 (column C). All columns extend from the local surface down. Columns A, B, and C have been adjusted arbitrarily so that the upper surface of Unit W1 shares a common plane in the illustration. Column B is over the terminal channel of the Saltville River at SV-1, and column C is over the flood channel of the Saltville River at SV-2. Column D illustrates the great depth of weathered bedrock (P1) and the mantle of what is possibly an earlier lacustrine deposit (S1) that occurs in the northern part of the valley where the Saltville River had not recently scoured before its capture.

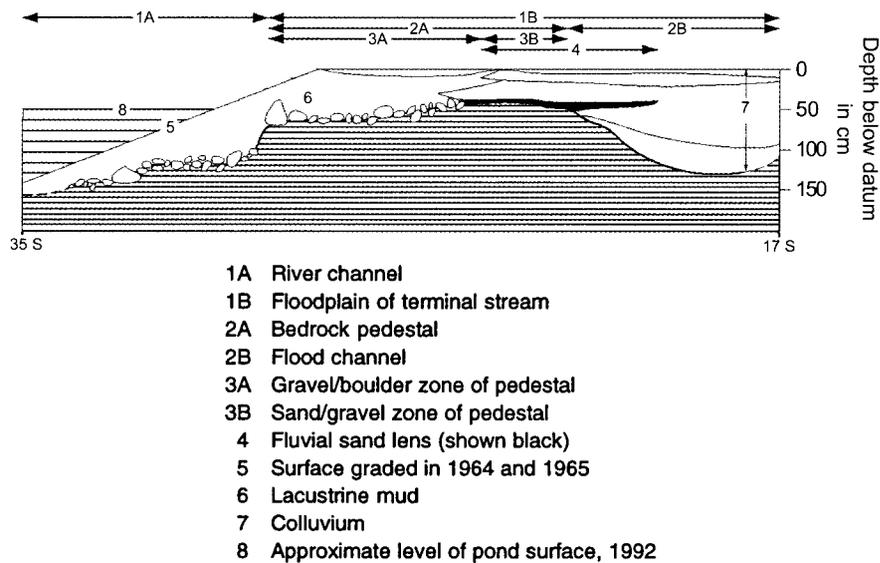


Figure 9. Stratigraphic cross section along grid line 69W in SV-2. Note especially the transition from massive lacustrine mud to the south to layers of colluvium in the north. It is the distinctly colored layers of colluvium which provide such clear stratigraphic control in what was the riparian zone of the terminal Saltville River at the time it was being frequented by pre-Clovis people. The oldest pre-Clovis horizon was situated upon the gravel/boulder zone and sand/gravel zone of the pedestal (zones 3A and 3B in this diagram). The middle horizon occurred within the fluvial sand lens (zone 4 in this diagram). The midden that formed the youngest horizon occurred to the west of this cross section in squares 70–72W21–24S at depths of 58 cm below datum at its northwestern end to 75 cm below datum at its southeastern end.

The Geomorphic History of SV-2

Geomorphic evidence recorded in and above the bedrock at SV-2 allows a detailed reconstruction of the geomorphic history of the site. Generally, 15,000 years ago, SV-2 incorporated part of the north side of the Saltville River and the adjacent cut bank zone into which the river was cutting laterally. By 14,500 years BP, the river was waning, and by 13,500 years BP it had been replaced by Lake Totten. As the river waned during its last millennium, pulses of colluvial aggradation were interspersed with erosion by high water, but the net result of the interaction of these opposing processes was that colluvium accumulated along the north side of the river faster than it could be removed and filled depressions north of the previously eroded surface. After Lake Totten formed, episodic influxes of colluvium continued to accumulate in the shallow still water of the northern part of the site, whereas more thoroughly mixed and chemically reduced fines settled out across the southern part of the site. Soon after the lake formed, its level at SV-2 was lowered and more episodic erosion both removed and redeposited sediments locally. Following a brief period of lowered water, the lake level again rose and SV-2 appears to have remained inundated until about 10,000 years BP. Following is a more detailed outline of the geomorphic history of the site during the period of concern here — circa 14,500 to 13,500-13,000 yrs BP.

The central feature of the bedrock surface exposed at SV-2 is a pedestal of relatively resistant Maccrady shales that was bordered on the south by the terminal channel of the extinct Saltville River and on the west, north, and east by a scoured overflow channel (figures 6, 7, and 9). The relatively flat surface of the pedestal dipped slightly to the south, toward the river channel. The south side of the pedestal, which formed the north side of the primary terminal channel of the river, was a scarp, the eastern end of which was undercut approximately 15 cm and held up by a thin, plastic lens of gypsum or anhydrite. The northern part of the river channel was well defined, it was underlain by thoroughly scoured bedrock, and it was floored with a continuous cover of well imbricated gravel interspersed with boulders up to 0.6 m in diameter and typically buried from half to all of their height in the smaller gravel. The section of the stream represented at SV-2 was well flushed of sand and mud; other than minor and discontinuous interstitial pockets of fines, the only significant accumulations noted were shallow deltaic deposits of sand along the southeastern end of the base of the pedestal scarp.

The overflow channel to the north of the pedestal, broadly U-shaped in transverse section, was cut into the bedrock whose shale members, having been spared exposure to fluvial erosion for at least several thousand years, had weathered extensively near the surface and were easily removed by the flood current. The gray-green shale that formed most of the south side of the overflow channel (the north edge of the pedestal) had been scoured to consolidated bedrock and much of the regolith had been removed from its surface. Other members of the Maccrady that were exposed on the south side of the overflow channel, however, were still in place as highly weathered plastic masses. The floor of the channel was indistinct, indicating either that our excavation had not reached the true bottom or, more likely, that it was lying upon bedrock that had weathered to clay and the boundary had been blurred by hydraulic and geoturbic mixing along the contact zone. A stratum of sandy mud was encountered at a depth of 122 mm below datum and was taken to be the bottom of the erosional channel. There was very little gravel present on the surface of the overflow channel, other than sharply angled fragments of gray-green Maccrady of proximate origin, and these occurred primarily against the south side of the channel. Where the overflow channel rejoined the main channel of the river along the east side of the pedestal, the bottom of the channel was filled with up to 7 cm of sandy mud, sand, and gravel which apparently had washed off of the pedestal and been deposited in the deeper, quieter water of the down-stream edge of the pedestal.

The upper surface of the pedestal is ovular in shape, incorporates approximately 80 m², dips modestly (2-2.8%) toward the river channel, stands between 0.4 and 0.6 m above the bottom of the river channel, and is covered with a veneer of imbricated stream gravels. Prior to the final phase of downcutting by the river, based on the dip of the surface and the fact that the grain size of the gravel forming the imbricated veneer increases toward the river channel, the pedestal was probably part of the river channel. Nearly 60 boulders, to 0.73 m in diameter, occur rather uniformly distributed over the southern half of the surface of the pedestal. These boulders are typically situated upon the gravel veneer, they lack imbricated particles around their bases, and they represent a grain size that is discontinuous with the next smaller grain size.

The fluvial landscape of SV-2 started changing around 14,500 yr BP (Table 2). Following the entrenchment of the primary channel and the excavation of the flood channel north of the pedestal (both events occurred prior to 14,500 yr BP), the flood channel started to fill with fines derived

from nearby weathered bedrock — probably the cut bank immediately to the north — that washed into the water-filled depression. This channel was filled by no later than 13,950 yr BP (Table 2), prior to which high water in the river laid down a sheet of sand that extended to the north far enough to cover the southern 2 m of the fill of the flood channel (Figure 9). Afterwards, at 13,950 yr BP, a series of puddling events filled several small depressions in the surface of the sand and bedrock with a sequence of superimposed layers of sandy fines, each of which terminated with a thin layer of fine organic matter. Thereafter, Saltville Gap became blocked and Lake Totten formed.

During the early history of Lake Totten, mixed and reduced mud was deposited in the vicinity of SV-2 that accumulated to a depth of at least 20 cm at 76W27S while, toward the northern edge of the lake, muds, primarily from the proximate weathered bedrock and primarily gray-green in color, accumulated along the littoral zone over the former flood channel. The lake then lowered to a level sufficient to expose the reduced lacustrine muds to the atmosphere, and the muds became desiccated. Renewed influx of weathered bedrock from the north, probably secondary transport of mud already laid down in the littoral region, filled the northernmost desiccation cracks with gray-green mud. This was followed immediately by the influx of a massive amount of maroon colored mud from the north which filled the southerly desiccation cracks in the reduced lacustrine mud and continued to accumulate until it covered most of the northern half of SV-2. This mud was thickest to the northeast and thinned to the south and the west, and did not undergo chemical reduction or mix with other muds.

During this lower water stage, surface runoff entering the site from the north excavated a large rill in the maroon mud where the ditch entered SV-2 near 71-72W21S, and by the time the water reached 70W24S it had eroded downward completely through the maroon mud and the underlying gray-green mud to bedrock. After the rill was formed, water continued to rise and deposited a mass of fluvial sand in the rill channel. Subsequently an elongated mass of distinctly more coarse materials dominated by paired bivalves of *Pyganodon grandis*, the giant floater clam (P. Parmalee, personal communication), was emplaced on top of this sand and the lower adjacent gray-green mud and bedrock. The bivalves were later covered with the sand and sandy maroon mud, and then a sheet of gray-green mud was deposited on top of the sand and maroon mud — an event that could have taken place either before or after the lake level rose to again inundate the site. Once inundated, SV-2 apparently remained under water until about 10,000 yr BP.

The Pre-Clovis Horizons

At least three horizons at SV-2 have yielded evidence that suggests the presence of humans at the site between 14,510 and 13,500-13,000 yr BP (Beta 117541, Beta 65209, Table 2). These horizons are described briefly below; for each, we identify its stratigraphic position and geomorphic attributes, the material considered to be products of human agency, and our current interpretation of its formation. Table 3 lists those features and objects considered to be of probable or possible human origin.

The Oldest Horizon: The oldest pre-Clovis horizon occurs upon and across most of the surface of the pedestal, beyond which it extends (a) north and east into mixed muds that had been aggrading after the flood channel was cut and (b) south onto fluvial gravels in the river channel. The primary unifying element of this horizon is the distribution of proboscidean skeletal and dental remains sharing aspects of their taphonomic histories that occur at various places on top of the gravel veneer of the pedestal, within a continuation of that topographic plane into the muds adjoining the pedestal to the east, and on top of the gravel in the river channel. Secondary unifying elements include (a) a fluvial sand lens that covers much of the northern one-fourth of the pedestal and extends into the mud filling the adjacent flood channel and (b) the similar taxonomic affinity (proboscidean and *Bootherium bombifrons*) and physical condition of bone, tooth, and tusk fragments from the southern and eastern halves of the excavated area. This horizon might in fact comprise two or more subhorizons, but the current stage of analysis of the relevant information does not support that determination. Unless there was clear evidence that faunal remains within the gravel blanket had been carried downward from the surface, such material was considered a part of the gravel stratum itself and not a part of the pre-Clovis horizon. The radiocarbon age of this horizon has been determined on what is considered culturally modified bone (VMNH 721) to be $14,510 \pm 80$ yr BP (Beta 117541); this date is consistent with the overall radiocarbon chronology of the site (Table 2) and may be taken to represent the minimum date by which humans were present at SV-2.

This horizon was established while the Saltville River was still extant, but probably after the process of piracy was underway and the river had begun to wane. At least one high-water stage following the creation of this cultural horizon is recorded by the fluvial sand lens that overlapped part of the pedestal and the colluvial fill in the flood channel (Figure 9), but this does not preclude the possibility that other high-water stages could have occurred between the time the cultural horizon was laid down and Lake

Totten originated. To the extent that high water might have influenced the composition of cultural material at this horizon, fluid mechanics predicts that it would likely have removed rather than imported such material; the water flow would have accelerated as the current passed from a deeper to a shallower depth as it moved from the primary channel onto the pedestal. The largest grain size recognized at this horizon for fluvial deposition is sand. No objects or features attributable to human agency were recognized from this horizon that reasonably could have been imported by fluvial transport. The most parsimonious interpretation of the site history from the time of the formation of the cultural horizon until the development of Lake Totten is that aggrading colluvium from the cut bank north of the site covered the floodplain and subsequently was removed by high water before lacustrine muds began to accumulate.

Numerous objects and features from this horizon are suspected of having a cultural origin. One set of objects comes from a zone ca. 1.5 m by 6.0 m occupying the crest of the pedestal (figures 6 and 7, zone C). Four subcircular clusters of randomly oriented bone fragments were distributed within this zone. The bone was concentrated at the surface, but fragments occurred to a depth of 25 cm below the upper surface of the cobbles. The largest (0.5 m in diameter) and most complex of the clusters, the one centered in 64W23S, yielded more than 150 small fragments of large bone, the largest being 7.0 cm in length, some if not all being probably proboscidean; fragments of a mastodon (*Mammut*) tooth; one small (6.2 mm) shatter fragment of chert worn on some surfaces but not others, and similar to an isolated partly worn flake from 65W24S (VMNH 716; Figure 10, object a); five fractured rocks (all on the surface of the cobble mass and possibly fire cracked); and a large (273 cm long) concretion (VMNH 718; Figure 11) from the bottom of the feature, shaped and oriented like a congealed mass of viscous fluid. At least twelve fragments of bone protrude from the surface of this concretion and numerous fragments occur within the mass.

The bone and tooth fragments from this cluster appear to have been modified in ways that are different from hundreds of otherwise similar fragments found at Saltville. Those under consideration here are more darkly colored than are most other bones found on surface gravels at Saltville and are mineralized to an unusual degree, particularly in that the vacuities of the cancellous bone are typically filled with a precipitate, probably calcium carbonate, visible to the unaided eye. The fragments of bone are uniformly sized, blocky (low length:width ratio), blunt-ended, with ends sometimes occupying a single plane and other times having two or more flat surfaces

Table 3. A list of objects and features of presumed affiliation with humans identified in this report.

Catalog	Feature/Object	Basis for Considering Object or Feature Number to Have Human Affiliation
Youngest Horizon		
Feature	Midden	Majority of contents are suitable food resources from riparian and littoral zone and have a common taphonomic history (no abrasion); charcoal present; contains chert that is allochthonous to the watershed; does not contain debris that is normally present in fluvial deposits in Saltville Valley.
VMNH 724	Chert flakes	Flakes are of chert that is allochthonous to the watershed and are typical of microdebitage associated with biface reduction or retouching.
Middle Horizon		
Feature	Cluster of resource lithics	Cluster contained two lithic types that are allochthonous to the watershed, another that is rare, and two autochthonous rocks that have patterned modifications.
VMNH 722	Chert nodule	Contains three (possibly four) contemporaneous parallel flake scars on one end.
VMNH 723	Oolitic chert nodule	One side contains a high polish that is discontinuous with adjacent surfaces, and one edge contains a moderately dense array of peck marks.
VMNH 725	Chert flakes	Flakes are of chert that is allochthonous to the watershed and are typical of microdebitage associated with biface reduction or retouching.
VMNH 2265	Cluster of concretions	These elongate concretions were found in a nested cluster with their liner axes at the vertical and in a sedimentary matrix in which they did not form.
Oldest Horizon		
Feature	Mastodon butcher zone	The cluster of proboscidean and ungulate fossils, stone and bone tools, and associated features suggests that a mastodon was butchered and subsequently processed by cooking, working the hide, and reducing the tusks. The patterned and interconnected array of bone and stone objects is difficult to explain by (a) geomorphic processes or (b) biological processes not including the use of fire and other tools.

Table 3 (continued).

Catalog	Feature/Object	Basis for Considering Object or Feature Number to Have Human Affiliation
VMNH 718	Concretion	The fluid form of this object suggests that it formed from fluid that originated on the surface of the gravel and flowed downward, and the numerous bone fragments contained within are identical to those produced when large bone is broken by percussion.
VMNH 719	Sandstone knife	Provenience, size, shape, and possibly worked edge suggest that this object could have been used to cleave meat or remove hide during the butchering process.
VMNH 720	Sandstone knife	Provenience, size, shape, and possibly worked edge suggest that this object could have been used to cleave meat or remove hide during the butchering process.
VMNH 721	Bone tool	Non-random wear on selected edges; dense patterned microwear of numerous parallel striations on sharpest, heaviest worn edge.
VMNH 726	Chert flake	The flake is of chert that is allochthonous to the watershed and is typical of microdebitage associated with the use and breakage of chert cutting or chopping tools.
VMNH 2262	Bone tool	Non-random wear on one surface exhibits flattening by abrasive grinding and entrenchment of a straight hemicylindrical groove of uniform depth and circumference.
VMNH 2263	Triangular stone	Hammer- or hand axe-sized object found in association with sectioned tusk fragments.
VMNH 2264	Abraded bone	Four pieces of naturally abraded bone were found positioned against boulder in non-random pattern least likely for natural emplacement by hydraulic processes.
VMNH 2267	Chert tool	Chert of this quality is allochthonous to watershed; shows patterned modification – frictional pitting, microplating with parallel striae, and percussion pits and flake scars.

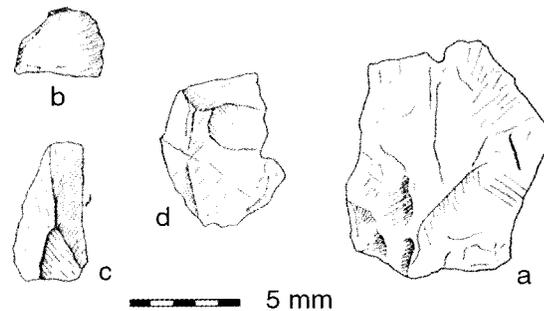


Figure 10. A selection of chert flakes from the pre-Clovis horizons at SV-2. The external surface is shown for flakes a, c, and d; the view of flake b is the internal or bulb surface. Flake a might be a product of wear damage, but flakes b, c, and d appear to be biface reduction debitage. Flake a (VMNH 726) is from the oldest pre-Clovis horizon, flake b (VMNH 725) is from the middle horizon, and flakes c and d (VMNH 724-B and -A, respectively) are from the midden of the youngest horizon.

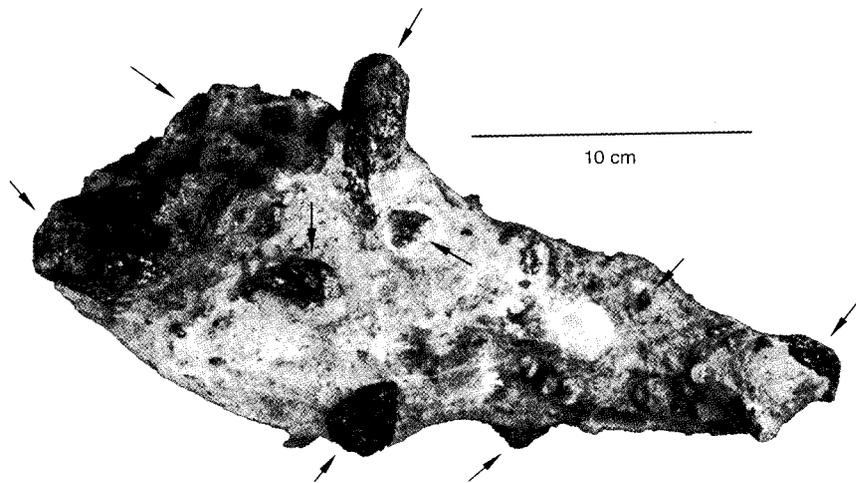


Figure 11. This concretion (VMNH 718) from the oldest horizon is presently interpreted as being one result of volatilized body fat that dripped from parts of an animal carcass roasting over a surface fire, flowed into the gravel, and congealed. Later, the congealed fat was replaced with minerals from the ground water and thereby formed the concretion. Numerous bone fragments occur inside this concretion and protrude from the surface as well. Arrows identify representative fragments of bone protruding from the surface of this concretion.

intersecting at well-defined angles, giving the impression of possibly having been chopped with a sharp-edged object or, more likely, shorn or crushed by one or more percussion impacts while fresh. The fragments were distributed in a circular to subcircular pattern, they occurred to as much as 25 cm beneath the surface of the host sediment, and the fragments were randomly distributed by size. They do not show evidence of abrasive rounding resulting from fluvial processes and they are free of tooth marks. Destruction and decay of long bones of proboscideans and mid-sized herbivores found in fluvial gravels at Saltville usually proceeded either (a) by tumbling and abrasion in active gravel systems, which resulted in sorting by size and rounding; (b) by abrasion by water-borne sand and fine gravels in flowing water, which resulted in a high polish on exposed surfaces; or (c) by progressive stepwise breakdown in inactive gravel systems, which resulted in a relatively great range in fragment size, with distinctly linear (high length:width ratio) fragments with stepped or tapering ends, distinct distance-decay in particle size outward from the center of mass, most particles lying on (not penetrating beneath) the erosional surface, and less pronounced and differently expressed mineralization than is seen in the fragmented bone being considered here. The dentine of the mastodon tooth from this feature is also atypical among remains of mastodon teeth known from Saltville; the dentine from this feature is often red-black in color (instead of black), brittle, and tends to fracture concoidally and often in flakes (rather than in rectangular blocks). The modified bones and teeth, the fragmented rocks, and the possibility that the concretion represents a mineralized mass of volatilized and subsequently congealed body fat suggests that all of these materials were associated with and modified by fire.

Spread throughout an area of some 80 m² in the eastern part of this horizon were partial bones, tusks, and a tooth of mastodon. The analysis of the proboscidean material from this mastodon zone has not been completed, but the skeletal and dental remains recovered suggest that only one individual is present. At minimum, the elements represented include seven complete or partial ribs, two fragments of limb bones, one tooth, and nine pieces of tusk, all of which show similar surface characteristics lacking evidence of fluvial abrasion or extensive subaerial weathering. A concentration of barkless woody twigs of uniform length and diameter, and pockets of matted herbaceous vegetation, found in muds near the tooth and tusk are considered to be part of the mastodon's gastrointestinal contents.

Objects that are possibly tools have also been found in the mastodon zone. Two pieces of sandstone (VMNH 719, VMNH 720), each of a size fitted to the human hand and possessing a sharp edge that appears to have been artificially enhanced by non-random abrasion, were found in the muds east of the pedestal in 55W19S and 58W21S, within the area encompassing the mastodon remains. One triangular piece of stone (VMNH 2263) of the size (158 mm wide x 146 mm high x 64 mm in maximum thickness) and shape that would allow it to serve as a hand-held axe or wedge came from the mud in 53W24S, proximate to an elongate wedge-shaped splinter of ivory. A piece of dense bone, considered to be part of the basicranial complex of a mid-sized herbivore (e.g., *Megalonyx*, *Cervalces*, or *Bootherium*) (VMNH 2262) containing an artificial hemicylindrical groove 12.5 mm wide, 4.5 mm deep, and 22 mm in length, was found lying on gravels in 54W26S (Figure 12). This object appears to have been broken after the groove was made; none of the missing portion was located.

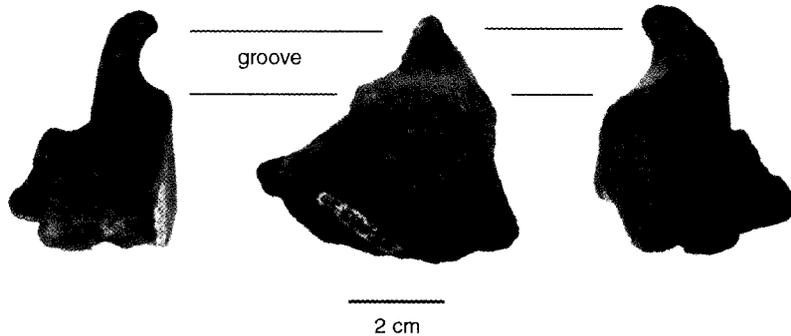


Figure 12. A piece of bone (VMNH 2262) from the basicranial complex of a mid-sized herbivore into which a hemicylindrical groove has been incised. This incised groove is the clearest case of patterned modification visible to the unaided eye of any object recovered from the horizons at SV-2 under consideration in this paper.

Two other objects and two other features of probable or possible human affinity also were found on the pedestal. (a) A partial tibia (VMNH 721), most likely referable to Harlan's musk ox (*Bootherium bombifrons*), was found on top of the gravel surface in 63W26S (Figure 13). This object, which has the size, shape, and edges of a knife or scraper, is described and discussed in greater detail below. (b) A tabular chunk of high quality chert

(VMNH 2267) measuring 12 mm by 34 mm by 47 mm was found in 64W28S on the gravel surface about 2 m southwest of the tibia (VMNH 721). This object has two sharp edges, each formed by the removal of one or two large flakes, and has had smaller flakes removed from each of the sides. Microscopic examination of some surfaces of this object shows friction pitting and parallel striae (microplating), indicators of directional movement under high pressure (Figure 14). At least one side opposite the pitting and microplating contains multiple flake scars and pits caused by percussion. The combined evidence suggests that this object might have been used as a wedge; according to this interpretation, when the object was driven into a resistant medium, the flakes were removed by the impact of the hammer and the leading edge of the wedge was subjected to pressure which caused the observed microplating and pitting (Kay, 1998). (c) Four pieces of fluvially abraded proboscidean bone (VMNH 2264) and one rock, all of similar size (ca. 15-20 cm diameter), were found positioned side by side and inclined against the south side of a boulder lying on top of the fluvial gravels in 68W29S. After these bones had been abraded, apparently by natural hydraulic processes based on the random rounding evident on each

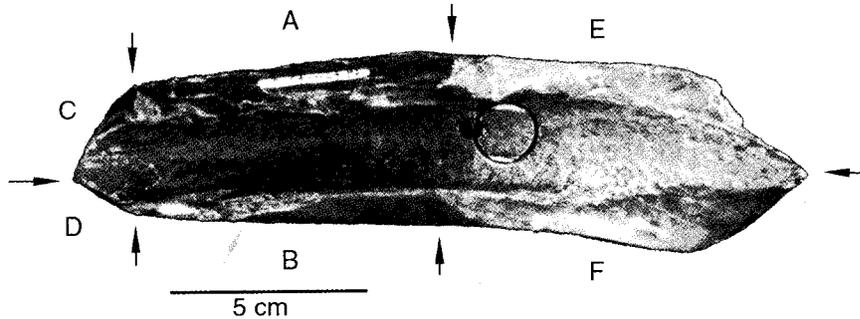


Figure 13. A fragment of the right tibia of a large ungulate (VMNH 721), probably Harlan's musk ox (*Bootherium bombifrons*). This specimen contains three pairs of fractures, all apparently contemporaneous. The black arrows indicate the transitions from one fracture plane (or in the case of A, zone) to the adjacent plane. The fracture surface of zone A was crushed and probably polished to reduce sharp edges, but otherwise it matches surface B. Surfaces C and D are essentially symmetrical, as are surfaces E and F. The gray arrow identifies one cone of percussion, and is oriented along the axis that leads to the complementary cone on the opposite side. The shape and size of this object suggest that it could have served as a tool, and microwear on the low angle fractures of the proximal end of this bone (surfaces E and F) show that it was subjected to numerous repetitions of some abrasive process (see also figures 17 and 18).

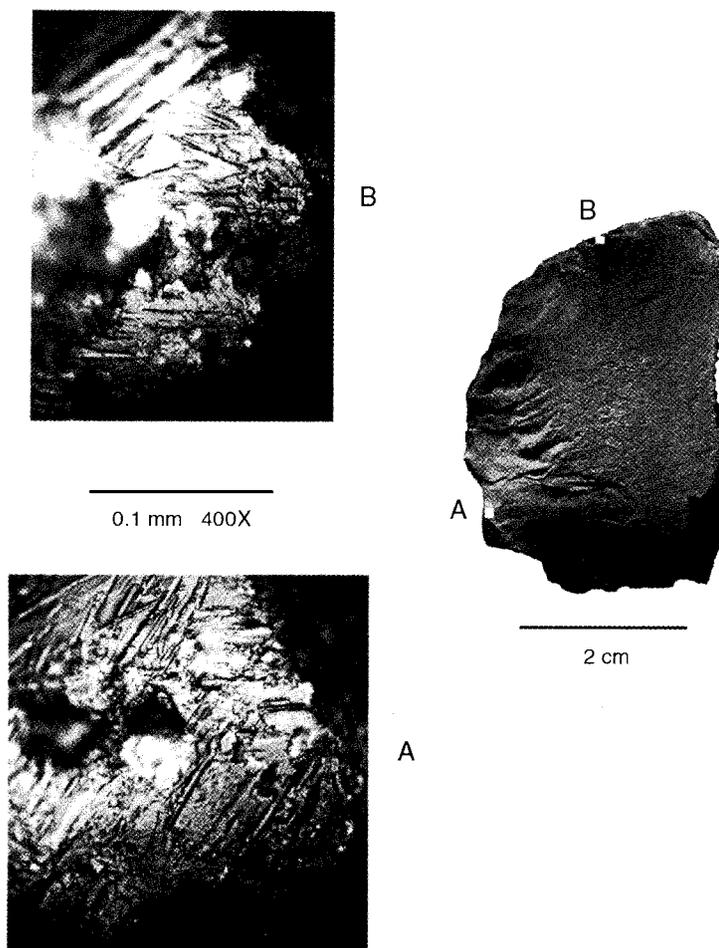


Figure 14. Pitting, and parallel striae formed by microplating, on the surface of the piece of chert (VMNH 2267) ostensibly used as a wedge (modified from Kay, 1998). Multiple flake scars and pits resulting from percussion occur along the entire side of the object that faces to the right in this image.

item, they were assembled and emplaced non-randomly against the boulder in a line parallel to the current flow and with their narrower edges facing upstream — the orientation least expected for cobbles imbricated by fluvial mechanics. (d) Nearly five dozen large rocks were exposed across much of the southern half of the site; some were in the river channel near or abutting the south edge of the pedestal but most were on the pedestal and lying upon the gravel veneer covering the pedestal (Figure 6). These rocks were of

uniform size (most 0.6 m–0.3 m in diameter), they were discontinuously larger than the next smaller size class of gravel (ca. 0.15 m and less diameter), and those that were on the pedestal were relatively uniformly spaced — all circumstances that are unexpected from natural hydraulic sorting and deposition. Elsewhere in the southwestern part of the valley, rocks of this size are typically concentrated in the bottom of the river channel where hydraulic energy was at its maximum, clustered, and embedded in imbricated gravels. The patterned size and distribution of the rocks at SV-2, however, suggest that they were possibly selected for size and placed on the pedestal by humans, perhaps after having been moved from the river channel to its edge, then up onto the floodplain.

The chert described above (VMNH 716, VMNH 2267) appears to be exotic to the watershed of the Saltville River, and the partial tibia (VMNH 721) and grooved bone (VMNH 2262) have both been artificially modified. Accepting that human agency is the most reasonable explanation for the presence of exotic chert in the valley and the modification of the two bones, the collective set of objects and features described here and associated with the chert and modified bone suggests that a mastodon was butchered and processed on the floodplain of the Saltville River some 14,510 years ago. Continuing with this reasoning, the butchering appears to have employed both high quality chert tools brought into the valley and expedient tools made from bone and low quality sandstone and dolomite available on-site. Some parts of the animal were cooked over surface fires along the crest of the pedestal, and some of these parts included bone that had been either crushed or chopped with sharp stone tools. During the cooking process, body fat was liquidized, dripped onto the gravel surface, and flowed beneath the surface. Simultaneously, bone fragments, dried and shrunken by the heat, fell onto the gravel surface. All or part of at least one tooth of a mastodon was placed in the fire. After the cooking was over, one mass of grease that had flowed into the gravel, along with the bone fragments it enveloped, cooled, congealed, and eventually was replaced with minerals from the ground water. The cluster of fractured rocks, oxidized and lying on the surface of the gravel, are consistent with the scenario that a surface fire was used here. Any wood or charcoal that remained from a log hearth or fuel could easily have been washed away or decomposed in place.

South of the cooking area was a workstation where, perhaps, large bones were fractured by crushing or chopping preparatory to cooking and where hide processing could have taken place. The boulders could have functioned as anvils, as seats, as tables against which fresh hide was pressed

as it was dressed by scraping, as platforms for drying meat or fish, or any combination of these and perhaps other functions as well.

The tusk fragments, stone hand axe, and grooved bone fragment were concentrated in the eastern part of the horizon. At least three linear segments and five large exterior flakes of tusk, along with smaller flakes, the putative axe, and the grooved tool were recovered here. The hemicylindrical groove in the modified bone (VMNH 2262) is the same diameter as are the diameters of ivory rods — at least some of which were probably projectile points — from Florida (Dunbar et al., 1989; Webb and Dunbar, 1999). This patterned association suggests the possibility that the tusks were being modified in this area, and the combination of linear tusk segments, an axe or wedge, and a grooved tool suggests that at least one product being produced here could have been ivory rods.

In general, the lowest cultural horizon at SV-2 appears to represent several facets involved in the processing of a mastodon carcass by pre-Clovis people. There is no evidence that this animal was killed by humans; it could have been scavenged. The center of mass of the animal at the time of its butchering can be surmised from the location of the inferred gastrointestinal mass and the few complete ribs. The variety and distribution of artifacts and features provides insight into the use of expedient and imported tools, and allows inferences to be made about the methods employed for butchering, preparation for cooking, hide dressing, and tusk reduction. The distribution of different features suggests that butchering, preparation of meat and bones for cooking, hide dressing, and tusk reduction were carried out in close proximity to one another (figures 6 and 7) — an opportunistic exploitation of available space and other resources for the needs at hand.

The Middle Horizon: The middle horizon is represented by two features situated within the fluvial sand lens (figures 7 and 9). The most prominent of these features consisted of a cluster of large pebbles and cobbles centered in 69W23S. This group of stones included an unlikely assortment and arrangement of resource lithics — that is, lithics of the type (quartz, exotic quartzite, oolitic chert, and chert), quality, and size as to be (a) suitable for use as tools, (b) by-products of the manufacture of tools, or (c) suitable for making tools. These cobbles and pebbles were set into a shallow (15 cm) subcircular depression with a surface area of about 0.7 m diameter. This depression, a discrete natural geomorphic feature and one of several similar features observed at the same level at the site, had been set into the upper surface of the fluvial sand layer; its southern edge was in contact with the bedrock which formed the north side of the pedestal, but the northern half

of the depression was bounded by sand. The depression had filled over a short time with sandy silt, bearing the color of the adjacent gray bedrock, in at least five stages, each stage separated by a thin film of dark, organic matter. The upper surface of this feature was covered by the maroon mud; the contact between the maroon mud and the gray sandy silt was distinct, but some very shallow (up to 2 cm) mixing of the two strata as a result of geoturbic shearing was evident along the shared boundary. All objects presumed to be products of human agency were found entirely or partly within the upper stratum of the depression fill. The sediment collected from the uppermost stratum of the fill to be screened was distinctly within the sandy silt fill and clearly below the contact surface with the overlying maroon mud. Nine fish skull bones, one piece of charcoal, and twelve pieces of microdebitage, including three chert flakes (VMNH 725; Figure 10, object b) that are morphologically consistent with biface reduction flakes, were recovered from the screened sediment. Woody twigs found *in situ* in the uppermost stratum of the sandy silt fill yielded a radiocarbon age of $13,950 \pm 70$ yr BP (Beta 65209); this may be taken as the age of the puddling event represented by the geomorphic feature, the minimum age for the deposition of the sand lens into which the feature was set, the minimum age for the deposition of the three chert flakes from the stratum, the maximum age for the emplacement of the resource lithics, and the maximum age for the onset of the blanketing of the pedestal surface by the colluvial maroon mud.

Seven concretions, five of which were elongate, and one prismatic column of weathered maroon-brown bedrock (VMNH 2265) were found in an indentation in the surface of the sand lens near the north edge of the pedestal in 66-67W22S. This depression had filled with maroon mud; the exterior of the concretions had taken on this color but their interiors are gray, indicating that they formed in a different sedimentary environment from that in which they were found. The five elongate concretions and the piece of weathered bedrock were all oriented with their long axes in the vertical, the least likely orientation expected for relatively dense elongate objects coming to rest randomly in a mud matrix. The two non-linear concretions were adhering to the upper surface of a rock, and had the form of a congealed splattering of a viscous fluid. The elongate concretions had the form of accumulated drops of a viscous fluid, although their form also is suggestive of fecal packing within the intestines.

It is hard to imagine that the non-linear concretions could have originated anywhere but where they were found, and their possible origin as animal

fat parallels the interpretation of the elongate concretions as also having originated as congealed viscous body fat. However, the facts that the color of the interior of the elongate concretions was gray, not the maroon color of the surrounding matrix, and that one of the elongate concretions had been broken in two places, but the missing pieces were not in the surrounding sediment, suggests that the elongate objects originated somewhere other than the maroon sediment in which they were found. In addition, it is difficult to envision how dripping grease or any other viscous substance could have separated itself so uniformly into five vertical columns of nearly equal length, with their upper ends lying on the same horizontal plane, in association and alignment with a similarly shaped column of weathered bedrock. Concretions are common at the fluvial levels at Saltville, and we favor a model of multiple origins for the concretions represented at this feature. Absent a stronger model to the contrary, we currently are of the opinion that (a) the two small concretions originated as grease, or possibly feces, dropped on the rock to which they were found adhering, and (b) the larger concretions and the column of bedrock were collected and placed in the depression by humans, perhaps paralleling in a distant way the collection and belief about "images stones" attributed to the Lake Superior Ojibwe by Schoolcraft (1853).

The Youngest Horizon: The youngest horizon is represented by a single feature located, in squares 70-72W21-24S, within a rill eroded into colluvium that appears to have been laid down soon after the time that Lake Totten came into existence. This feature (figures 7 and 15) consisted of a linear mass of selectively diverse organic and inorganic matter dominated by more than 200 immature individuals of the giant floater clam, *Pyganodon grandis*, a mussel which typically lives in mud bottoms of impoundments or streams with slow moving currents (Parmalee and Bogan, 1998). In addition to the mussels, the feature also included the remains of numerous small vertebrates (especially fish and amphibians), charcoal, and lithic debris, among which were more than 125 pieces of possible microdebitage, including a small number of chert flakes (VMNH 724) that are morphologically consistent with biface reduction flakes (figures 10, objects c and d, and 16). This feature extended for some 2.1 m along a northwest-to-southeast axis: its axis dipped gently to the southeast paralleling the dip of the rill channel, it was gently mounded into two low piles (12 cm and 5 cm high) to the northwest and sheet like to the southeast, it was lying upon the sandy channel fill to the northwest and bedrock and fluvial mud to the southeast, it was covered with the sandy channel fill to

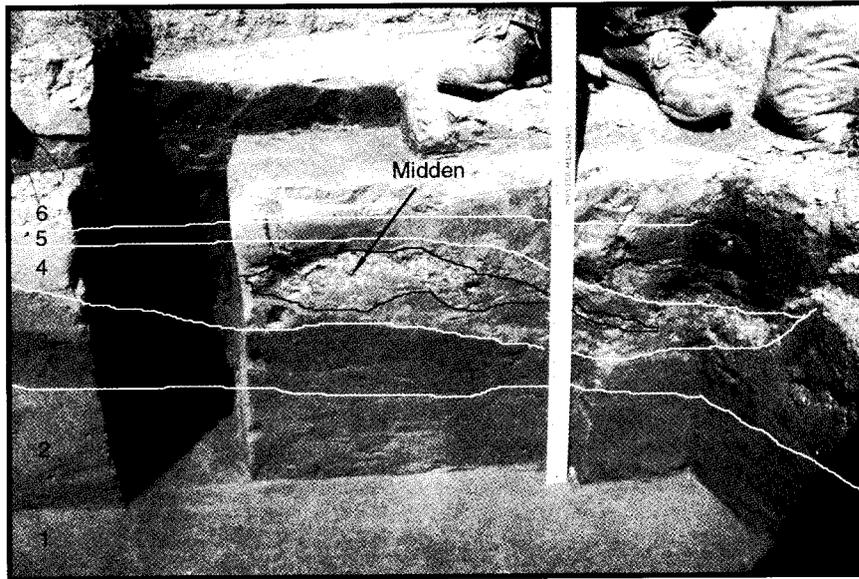


Figure 15. A cross section through sediments along grid line 71W where it transects the midden at 22S. This transect is near the higher northwestern end of the midden, outlined here in black. In this view, the midden is completely surrounded with fluvial sand filling a rill cut into the maroon mud. The sand fill, in turn, is completely surrounded by the maroon colluvial mud. Units represented are as follows: 1 = weathered bedrock; 2 = lower gray-green mud; 3 = maroon mud; 4 = sand fill in rill; 5 = maroon mud; 6 = upper gray-green mud.

the northwest and sandy mud to the southeast, it was distinctly bounded on all surfaces, on the bases of both grain size and composition it was distinctly separable from all sediments with which it was in contact, and on the bases of taphonomic condition of the organic constituents the hundreds of shells, bones, and teeth making up the mass had experienced essentially no fluvial transport or abrasion. The upper (northwest) end of the feature was situated 20 cm above the uppermost surface of the nearest remaining lacustrine muds. The rill appears to have been cut during the first low-water stage of Lake Totten by surface water flowing into the recently drained lake bed from the north. If this interpretation of its creation is correct, the age of the rill and the mass of bivalves within it is considered to be approximately 13,500 to 13,000 yr BP.

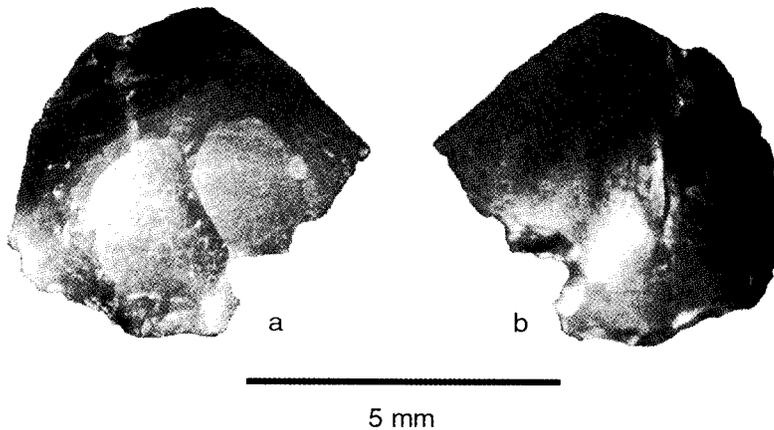


Figure 16. A chert flake (VMNH 724-A) from the midden in 71W22S in both external (left) and internal (right) perspectives. Clearly visible are the numerous flake scars on the external surface and the well-formed bulb on the internal surface. This same flake is represented as object d in Figure 10 above.

Even though this feature was located within an erosional channel and had been buried by sand and colluvium, it is difficult to interpret as being a sedimentary mass resulting from natural erosional and depositional processes. This discrete feature was too clearly distinct from the perspectives of grain size, selective diversity and condition of content, and sharpness of boundary, and it was in the wrong physical location, to be parsimoniously interpreted as a fluvial geomorphic feature. The sand matrix, the clustering and orientation of the mussel shells, and the association with bones and teeth of aquatic and terrestrial vertebrates preclude any possibility of this being a molluscan thanatocoenose. We consider the mass more likely to be a midden and its contents to be residues of human food resources and their procurement and preparation. It is reasonable to consider that the lowering of Lake Totten would have exposed mud flats from which pre-Clovis people easily and opportunistically could have harvested burrowing clams. Simultaneously, the lowered water could have created ponds wherein fish and amphibians became trapped and more easily collected. The numerous skeletal remains of amphibians, reptiles, and small mammals could represent the residue of food resources of either humans foraging through the riparian and littoral zone or the gastrointestinal contents

of larger predators (possibly mustelids or canids) taken by those humans. The use of stone tools in processing the food items could have resulted in breakage or required retouching, and the use of fires for cooking or any other use could have generated the charcoal. Once the debris was deposited in the rill on top of the sandy fill, subsequent surface runoff easily could have moved sand from above the midden down slope to cover the mass. The entire fill of the rill was subsequently covered by more of the maroon mud into which the rill had been cut.

THE TIBIA TOOL

VMNH 721 (Figure 13) is a part of the shaft of the right tibia of an adult mid-sized ungulate tentatively identified as Harlan's musk ox, *Bootherium bombifrons*, based on the surface details, absolute size, relatively elongate nature of the bone, and the presence of other bones and teeth of *Bootherium* within the same stratum of the site. The greater part of the external surface of VMNH 721 consists of the slightly convex medial surface of the tibia, including the distal end of the insertion area for the *M. popliteus*. The bone measures 195.2 mm in length, 48.9 mm in greatest breadth across the proximal end of the medial surface, and 36 mm in greatest breadth in transverse (medial-lateral) section. Adjacent parts of the caudal and cranial surfaces of the bone are also present. The caudal surface of the specimen, which is 90 mm in length and 20 mm in width, is essentially flat, contains no muscle lines, and shows no sign of curvature toward the cranial surface or toward the proximal or distal extremities. The caudo-medial angle is abrupt, approximating 90°. The bone is too large to represent *Rangifer* or *Odocoileus*, too gracile to represent *Bison*, and differs from the tibial characteristics of *Alces* in cross-sectional shape and muscle insertion patterns. The specimen has not yet been compared directly with tibiae of *Cervalces*.

VMNH 721 was found lying on the surface of the gravel in 63W26S. Most of the external surface of the medial face of the bone was in contact with a very thin layer (< 2 mm) of organic-rich clay that, in turn, was in contact with the gravel, and that part of the bone is more darkly colored than the other surface areas that were in direct contact with the gravels. The center of the object was at 56 cm E, 82 cm N as measured from the southwest corner of the square, its long axis was oriented at N61E, and the proximal end of the bone (the distal end of the tool) was pointing to the southwest.

VMNH 721 contains three pairs of mirrored parallel fracture surfaces (six surfaces total), two percussion-compression fracture cones directed into the medullary cavity, and extensive patterned wear. The breakage appears to have taken place while the bone was fresh, and the fracture surfaces appear to be contemporaneous. Each of the two low-angle fracture surfaces on the proximal half of the bone produced a sharp edge where they broke the external surface at the proximal end of the object. These edges converged to a common point at the proximal tip of the bone and created a sharp-edged, chevron-shaped surface. The two fracture surfaces across the distal end of the bone are short and relatively transverse, and produced a blunted end. The two lateral fractures are parallel but the mechanics of their formation were different; the cranial surface was removed along one low-angle fracture plane, whereas the caudal edge appears to have been shaped by crushing or multiple fractures rather than by removing a single flake. All of the breakage on this bone could have been achieved by a single percussion blow delivered to the shaft; if this was the manner in which the breakage took place, the hammer blow would have been delivered obliquely (probably trending toward the person using the hammer) to the caudal (crushed) edge of the bone. Alternatively, multiple controlled hammer blows could have produced the same result. The two percussion cones on the surface of the medullary cavity, however, could easily have resulted from a single blow to the caudal surface and do not, therefore, require multiple strikes. In any case, the bone most likely would have been cleaned of soft tissue before being broken to have allowed the optimal delivery and distribution of sufficient energy to accomplish the breakage.

With the unaided eye, abrasive wear is especially apparent across the sharp proximal edges and point, the fracture surface along the caudal edge of the bone, and along the external perimeter of the distal end (Figure 13). Distinct wear is evident along the entire chevron-shaped edge of what was the sharp proximal end of the bone. Although a piece of bone has been lost from the caudomedial side of this chevron, most likely the result of a fracture introduced when the bone was initially broken, this side appears to have been worn in a pattern mirroring that on the opposite side before the fragment was lost, but not after. In cross section from the interior to the exterior of the bone, the wear surface at the proximal end is asymmetrical, with more extensive wear evident on the exterior side than the interior side. Wear appears along the external perimeter of the distal end, but it is confined to the fracture angle. Also, several spots along the fractured edge of the caudal surface

are heavily worn, but other parts of this surface do not show wear. The fractured edge of the cranio-lateral surface shows almost negligible wear.

The patterned wear evident on this bone is decidedly non-random. That occurring along both the proximal and distal ends is consistent with the use of this object as a scraper or flesher. The wear on the proximal end is heavier and almost certainly would have been the primary scraping surface if, indeed, that was the function of the tool. The proximal end could have been used as a knife, but the cutting edge would have been short, the handle would have been too long to apply optimal leverage, and the tool would have been of relatively limited value. The proximal end also could have been used as a meat cleaver, mattock, or skinning wedge, an interpretation supported by the fact that parallel striations occur on the edge of the blade near the medullary cavity. The wear along the fractured edge of the caudal surface could be solely the result of handling the tool and adjusting the grip while working, but since it appears to be in some places even more extensive than the wear along the proximal edges, it is reasonable to consider that the sharp edges resulting from the crushing of the bone led the maker or user to dull the edge by abrasion. Also, whether the sharp edges in the grip area were intentionally dulled or not, the bone could have been wrapped in hide, bark, or some other material to provide both protection and a better grip.

The pattern of breakage and wear on VMNH 721 is not consistent with degradation in a fluvial environment and it is unique among other long bones of mid-sized herbivores collected from Saltville since 1980. The fracture surfaces are paired and symmetrical, they all appear to be contemporaneous, and the worn surfaces are non-randomly distributed across the bone. Physical evidence of carnivore gnawing and breakage is known from many bones recovered from Saltville, but no such evidence occurs on VMNH 721. A few randomly trending scars, probably attributable to trampling, are visible. No evidence of fluvial abrasion is apparent with the unaided eye, although scars of randomly directed particle strikes apparently resulting from the impacts of water-borne sediment are visible at various places on the object under magnification. The random trampling and particle-strike scars are demonstrably different than the non-random patterned striations attributed to scraping, meat cleaving, or hide wedging by pre-Clovis people.

Five cow tibiae and humeri were broken to produce bone flakes that were used experimentally to perform several tasks parallel to that or those for which VMNH 721 might have been used. A separate sharp-edged bone flake was used for each of the following tasks: cutting meat, cleaving meat,

cutting tendons, scraping meat and other soft tissue from bone surfaces, scraping the flesh side of hide, scraping the hair side of hide, wedging bone, scraping wood, wedging wood, and probing in sandy sediment. Throughout, particular note was made of the optimal orientation of the bone tool to perform the task, how pressure was applied, what leverage was required, what direction of draw was optimal, and how the blade contacted the material through which or across which it was passing while in use. Some of the observations made during this experiment are given in Table 4, and terms used in the table are identified in Figure 17. The microwear patterns produced by these different applications will be presented by Kay in McDonald (n.d.). Observations on the mechanics of bone tool use made during the experiment suggest that VMNH 721 was not used as a knife because the blade is too short and the object is too long to achieve effective cutting leverage. If VMNH 721 had been used as a digging tool, a wedge, or a scraper used on a hard surface like bone, the wear pattern would have been different. The wear facet on the proximal end of VMNH 721 is most nearly like the wear that would be produced by scraping hide, although no differences could be noted with the unaided eye between the scraping on the flesh side or the hair side of the hide. Evaluation of the experimentally produced microwear patterns and comparison of those patterns with the microwear on VMNH 721, however, might suggest other interpretations.

After evaluating the morphology of VMNH 721 and a reasonable range of functions to which it might have been put, given the presumed context in which it was found, and after experimentally replicating this range of potential functions and considering the mechanics involved and the wear patterns that would have resulted, we presently favor the interpretation that most of the wear on this object resulted from its use as a scraper or flesher, but that it also could have been used to remove or split the hide of one or more animals or to have split meat. The object could have been manufactured specifically for its intended use, or it could have been recruited for use after being created fortuitously when the tibia was crushed for other objectives, such as for marrow extraction.

The conclusion that VMNH 721 was used as a scraper on soft tissue or to work masses of meat and hides is consistent with the microwear patterns observed on the blade of VMNH 721 by Kay (1998; McDonald and Kay, 1999). In particular, Kay has observed numerous microscopic parallel grooves confined to the edge of the blade and generally oriented at or near right angles to the worn edge of the object (Figure 18), precisely the

placement and pattern one would expect had the working surface of the tool been restricted to the vicinity of the sharp edge and had the tool been drawn toward the user while cleaning the hide or separating masses of meat. Had VMNH 721 been used as a knife, *a priori* reasoning suggests that the wear striations would be rotated 90° from the orientation observed by Kay because the blade of the tool would have been drawn across the material being cut in a lateral-to-medial direction rather than drawn against the surface being scraped in an interior-to-exterior direction or against meat or hide being split in an exterior-to-interior direction.

DISCUSSION

The preceding facts and their interpretation provoke several questions, the most fundamental of which deals with the verity of attributing the enumerated objects and features to human agency. We share the opinion that all of the evidence invoked here to support our conclusion that pre-Clovis people were present at Saltville is not equally strong, and our caution in putting forth the emerging evidence explains in great part why we are only now presenting the outlines of a unified model of the context, content, and dynamics of pre-Clovis human activity at Saltville. Charles S. Bartlett, Jr., excavated in the eastern portion of Saltville Valley in the late 1970s and at SV-1 in 1980 and 1981, and his efforts yielded at least three probable pre-Clovis tools (one of which, VMNH 2268, is shown in Figure 19) from lag gravels, Unit W3, on the slip slope of a curve in the Saltville River. Our excavations first produced evidence from SV-1 that suggested a pre-Clovis presence in the valley in 1982, then more in 1984 and 1985, but not until 1990 (McDonald, 1990) did we begin to formally publicize the emerging evidence and our interpretation of it. It was not until work at SV-2 in 1992 produced objects of bone and stone that showed (a) non-random, geometrically patterned modifications that resulted from repeated exposures to a single mechanical process, or (b) required transport into the valley from source areas outside the watershed of the Saltville River that, in our opinion, a critical nucleus of strong evidence existed which established the presence of pre-Clovis people in Saltville Valley. We are of the opinion that the strongest positive diagnostic evidence of human presence at SV-2 consists of the (a) two pieces of modified bone from the lowest pre-Clovis level (VMNH 721 and VMNH 2262) (figures 13 and 12, respectively) and (b) high quality chert from all three levels (VMNH 724, VMNH 725, VMNH 726, VMNH 2267 and uncataloged microdebitage) (figures 10, 14, and 16) that appears to be exotic to the watershed of the Saltville River.

Table 4. A synopsis of the experimental use of bone blades in selected applications

Trial #	Task	Direction of Draw	Area Exposed to Wear	Expected Pattern of Microwear
1	Cutting meat	Lateral to medial, proximal to distal	Interior and exterior of blade, most extensive near blade edge	Numerous fine linear striations trending obliquely lateral to medial and proximal to distal; most dense near edge of blade
2	Cleaving meat; removing skin from carcass	Distal to proximal, lateral to medial to lateral across full breadth of tool	Entire tool-blade, interior, and exterior	Numerous fine linear and arcing striations trending distal to proximal and lateral to medial to lateral; distributed across blade and interior and exterior of tool toward distal end
3	Scraping soft tissue from bone	Medial to lateral	Edge of blade, exposure extending slightly from edge toward interior on interior side of blade	Numerous fine linear striations trending interior to exterior on and adjacent to blade edge, typically at or near blade perpendicular to edge
4	Cutting tendons	Lateral to medial, proximal to distal	Interior and exterior of blade, most extensive on and near blade edge	Numerous fine to moderate linear striations trending obliquely lateral to medial and proximal to distal; most dense on and near edge of blade
5	Scraping hide—flesh side	Medial to lateral	Edge of blade and interior side of blade near edge	Numerous fine linear striations trending interior to exterior on and adjacent to blade edge, typically at or near perpendicular to blade edge

Table 4 (continued).

Trial #	Task	Direction of Draw	Area Exposed to Wear	Expected Pattern of Microwear
6	Scraping hide — hair side	Medial to lateral	Edge of blade and interior side of blade near edge	Numerous fine to moderate linear striations trending interior to exterior on and adjacent to blade edge, typically at or near perpendicular to blade edge
7	Wedging bone	Distal to proximal, lateral to medial	Entire blade and interior and (especially) exterior beyond blade	Coarse linear and arcing striations of variable depth trending distal to proximal and lateral to medial to lateral; typically distributed across entire blade and exterior of tool toward distal end
8	Scraping wood	Medial to lateral	Edge of blade, exposure extending slightly from edge toward interior on interior side of blade	Numerous fine to moderate linear striations trending interior to exterior on and adjacent to blade edge, typically at or near perpendicular to blade edge
9	Wedging wood	Distal to proximal, lateral to medial	Entire blade and interior and (especially) exterior beyond blade	Fine to moderate linear and arcing striations trending distal to proximal and lateral to medial; typically distributed across entire blade and exterior of tool toward distal end
10	Probing in sand	Distal to proximal, lateral to medial to lateral, interior to exterior to interior	Entire distal end of tool	Moderate to coarse linear to arcing striations, variable depth and length, lowest parallelism of striations among all trials

Note: The periosteum, on the exterior surface of the bone, will record some of the wear and that record will be lost when the periosteum decomposes. The microwear record should be more durable on the interior of fresh bone than on the exterior.

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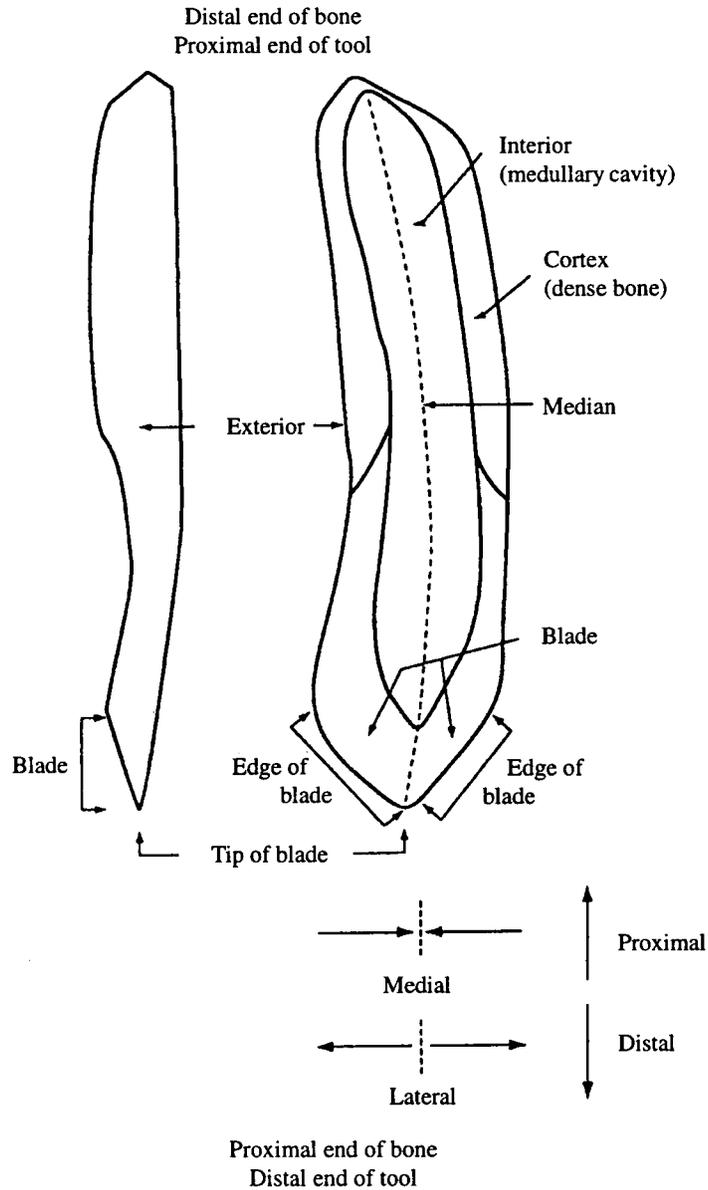


Figure 17. A diagram of a generalized tool similar in shape to VMNH 721 showing the location of features, and directions, referred to in Table 4. Note that in the case of VMNH 721 and the generalized example used here, the proximal end of the bone becomes the distal end of the tool, and vice versa.

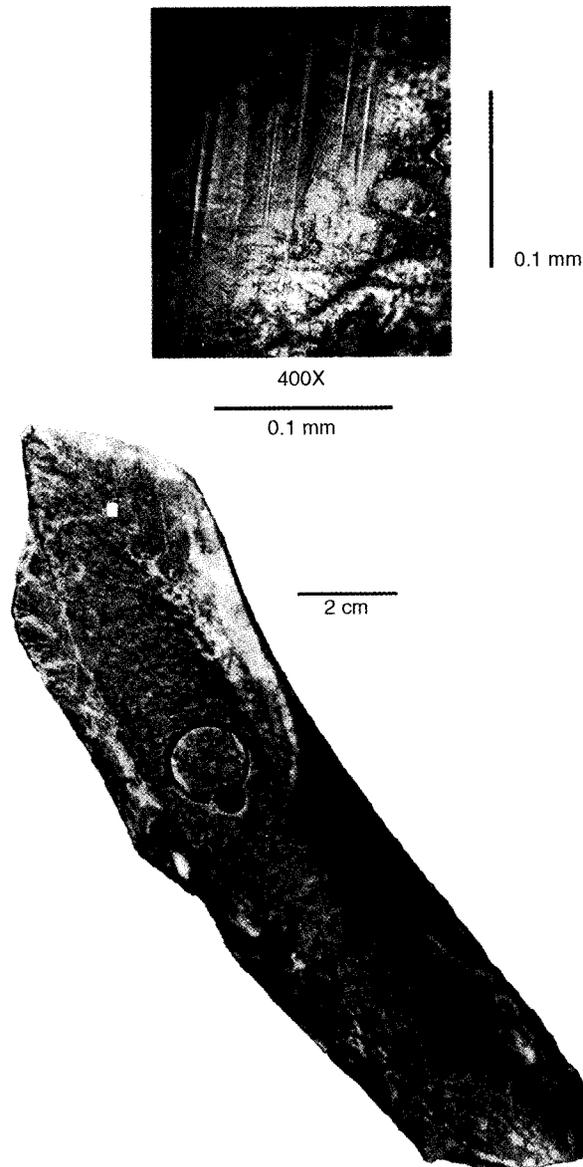


Figure 18. Microwear in the form of numerous striations on the blade of VMNH 721 is currently interpreted as the result of using the bone tool to scrape or otherwise modify hide or to cleave meat. The striations appear to have been made by extensive abrasive contact with soft animal tissue (from Kay, 1998). The circular incisions are where bone samples were taken for radiometric dating.

The partial tibia (VMNH 721) described above has a morphology that benefited from, if did not require, the bone being cleaned of most if not all soft tissue before being broken. The bone was broken while fresh, and all fracture surfaces are contemporaneous. Alluring as the gross morphology of this specimen might be to invoke human agency as the reason for its existence, it is the patterned microwear on the worn edge of the chevron-shaped proximal end of the bone (Figure 18) that establishes the specimen's greatest credibility as an artifact. The microwear pattern is documentary evidence that the object was repeatedly exposed to a fine-grained abrasive surface, and experimental abrasion of bone on a number of surfaces has suggested that the pattern of wear observed on VMNH 721 is most like that produced when the bone is used to scrape or drag along a surface of soft animal tissue in an interior-to-exterior (or vice-versa) direction, such as if scraping hide or cleaving meat (Kay, 1998, personal communication).

Unlike VMNH 721, it is the gross morphology of VMNH 2262 that most clearly establishes its credibility as an artifact. The artificial hemicylindrical groove, distinctly straight and of uniform diameter and depth below the adjacent flat surface, represents a non-random patterned geometric modification to the bone.

The chert objects (VMNH 724, VMNH 725, VMNH 726, VMNH 2267) invoked here as evidence suggesting human presence are allochthonous to the watershed of Saltville Valley and had to be transported to the valley by some means, and human agency is the most reasonable method of transport to invoke. The facts that the cataloged specimens (a) are of imported material and (b) show modification by either pressure or percussion with physical characteristics that have been shown experimentally to result from the manufacture and use of biface stone tools is strong evidence to accept the objects as artifacts. The case is strengthened by the absence of (a) microdebitage from sediments collected in the river channel proper and (b) larger pieces of randomly broken chert from which the microdebitage could have originated.

The strength of each of the foregoing specimens to stand alone as artifacts contributes to a synergistic effect of even greater strength for the collection as a whole when one considers that (a) these artifacts occur in a single site, in three distinct horizons which follow each other in relatively rapid succession, (b) that other probable artifacts occur in association with the bone and chert objects considered above, and (c) similar associations of objects or features of this type have not been

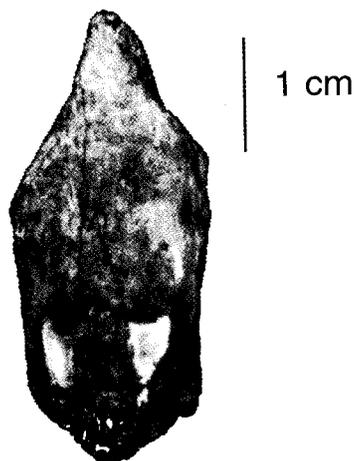


Figure 19. A probable pre-Clovis artifact (VMNH 2268) from SV-1 collected in 1980 by Charles S. Bartlett, Jr. Based on gross morphology and microwear, this object and at least two others like it, one from SV-1 and another from a site in the eastern end of Saltville Valley, have been identified as probable pressure flaking tools (Kay, personal communication).

recognized at other excavation sites throughout the valley during the seventeen years that investigations have been under way (although isolated objects of probable pre-Clovis origin have been found at other sites in the valley).

The absolute radiocarbon age of the lowest pre-Clovis horizon of $14,510 \pm 80$ yr BP (Beta 117541) was determined by analyzing a plug of cortical bone taken from the tibia tool (VMNH 721). There is, therefore, no question about the relationship between the bone tool and the radiocarbon age of the artifact. Further, the radiocarbon age derived from the artifact is in precise agreement with the age of the enveloping and bounding strata as determined by radiocarbon dates from SV-1 and SV-2. Lastly, the bone tool appears to have been modified while fresh; the external side of the blade edge shows the same pattern of wear produced on fresh bone when the tough elastic periosteum rolls back when the bone is being used as a scraper and pulls the outermost layer of bone with it, creating a stepped cross-sectional shape in sagittal view.

Each of the objects and features submitted here as evidence of human agency was found in discrete, sealed strata possessive of both stratigraphic and chronologic integrity. All boundaries between the enveloping strata and

those adjacent were sharp to distinct (Dackombe and Gardiner, 1983) and no evidence of burrowing, wallowing, wading, uprooting of trees, or other bioturbic processes was observed to have breached any stratum in the vicinity of any of the artifacts and features reported here. Minor geoturbic slippage was observed in the middle pre-Clovis level, in 69W23S, where the maroon mud related to the underlying puddle fill, but these sediments were of distinctly differing colors and the extent of the mixing was evident and shallow (up to 2 cm). Such disturbances had been observed at other locations in the valley, so the excavation effort was aware that these and other disturbance processes had been operative in the valley and was familiar with the field evidence of their occurrence. There is, therefore, no evidence that any of the objects or features reported here were introduced into the strata in which they were found by post-depositional biotic or geologic processes. No evidence in the field indicated that these objects were found in anything but their primary depositional context.

The artifacts and features from the lowest horizon indicate that, by 14,510 yr BP, the humans visiting Saltville Valley had a diversified ivory and bone technology, that they were capable of opportunistically exploiting locally acquired bone and lithic resources, and that they had knowledge of and utilized high quality chert resources obtained from outside Saltville Valley. A biface lithic technology appears possibly to have been in place by 14,500 yr BP and apparently was in place by 13,950 yr BP when the middle pre-Clovis horizon was created. The fact that three pre-Clovis horizons are represented at SV-2, that probable artifacts of pre-Clovis affinity have been found at two other riparian sites in the valley, and that the documented tool kit included lithics that were exotic to the valley, suggests that pre-Clovis people — mobile hunters and gatherers — regularly visited and exploited the riparian and littoral zones in Saltville Valley. The faunal resources utilized by pre-Clovis people at Saltville were diverse, and ranged from large mammals such as mastodon and woodland musk ox to small mammals, fish, amphibians and reptiles, and mussels. And, although there is no direct evidence of this at Saltville, surely these people exploited the available variety of floral resources as well.

A second central question focuses on the inventory of objects and features presented here as artifacts. Much of the inventory described above consists of organic material and relatively little of the inventory consists of lithic material, a characteristic — and a valuable characteristic — of wet sites where organic matter is typically preserved better than in dry environments (Coles, 1988; Daugherty, 1988; Purdy, 1988; Dillehay, 1989, 1997; Dunbar, et al., 1989). The presence of organic evidence of human agency, of

course, allows a more robust interpretation of the events and processes that unfolded at Saltville between 14,510 and 13,500-13,000 yr BP as results of human agency. Indeed, if the organic material were to be removed from the inventory, very little would remain in terms of artifacts and the bases for interpretation of what is left would be seriously diluted. It is important, therefore, to view the organic data as providing more valuable, rather than less valuable, insight into the processes that created SV-2.

SUMMARY AND PERSPECTIVE

Saltville Valley was coursed by the Saltville River until it was diverted by headstream capture about 13,500 years ago. At about 14,500 years ago, about the time that the piracy of the Saltville River was commencing, humans visiting the valley butchered and processed parts of a mastodon along a small section of floodplain north of the river. Parts of this mastodon were cooked over open fires, its hide was dressed, and its tusks were reduced to some end product or products — which possibly included ivory projectile points. Features and objects from the work area around the mastodon reveal information about the diversity and proximity of tasks that were carried out as part of the overall utilization of the carcass. Evidence that is particularly convincing of human agency includes a tool (VMNH 2267) made of chert that is exotic to the watershed and two bones possessing pronounced geometric modifications requiring multiple repetitions of similar abrasive motions (VMNH 721, VMNH 2262).

Some five hundred years later, other human beings left fleeting signs of their presence. Chert flakes typical of biface reduction and of chert that was exotic to the watershed are the objects from this horizon that most convincingly suggest the work of humans, although a piece of probably autochthonous oolitic chert (VMNH 723) is modified in ways that suggests it was used as a polishing and pecking stone.

A third horizon of pre-Clovis age is represented by a midden and is estimated to date to about 13,500 to 13,000 yrs BP. This feature contains a mass of bivalves along with skeletal remains of numerous small vertebrates and lithic microdebitage, several flakes of which are morphologically similar to biface retouching flakes. Again, chert of this quality is not known to occur within the watershed, and the shape, location, and content of the mass of bivalves cannot be explained as a natural thanatocoenose or geomorphic feature.

Special attention was given to one artifact, VMNH 721, a partial tibia of (probably) a musk ox that has been modified for use and apparently was used as a scraper or meat cleaver. This object has a very clearly expressed patterned microwear signature containing numerous non-random parallel striations in a location, of lengths, and with an orientation that supports the interpretation of the object primarily as a scraper, probably used on hides, and perhaps secondarily to cleave meat or remove or split hide. The radiocarbon date for the oldest pre-Clovis horizon at Saltville — $14,510 \pm 80$ yr BP — was also derived from this object.

Saltville Valley contains one of the few, and most complex, pre-Clovis archeological records in North America. The three distinct pre-Clovis horizons described here in outline form provide much information about the variety of resources used by the people who created them, the methods of resource use employed, and the spatial patterning of some of those methods. Each of the three horizons provides insight, albeit limited, into different facets of the material lifeways of pre-Clovis people. And, there are aspects of the pre-Clovis record at Saltville that enter the realm of spiritual, mystical, or simply idiosyncratic behavior — features such as the weathered proboscidean bones (VMNH 2264) or the vertically oriented concretions (VMNH 2265) which shout that human agency is responsible for their emplacement but that defy an immediate, demonstrably rational explanation. Lastly, there is tantalizing information that other evidence supporting the presence of pre-Clovis people is yet to be found at Saltville.

The early prehistory of the Western Hemisphere is entering a revisionary phase. The acceptance of the validity and antiquity of Monte Verde has created an environment of inquiry in which it is both safe and legitimate to consider the pre-Clovis peopling of the Americas. The record of information from Saltville is useful to have as revisionary thought about the early peopling of North America begins to take shape and faces critical examination. The more diverse the credible record at the outset, the more likely will we avoid applying unnecessarily limiting models of North American prehistory to the pre-Clovis period.

Saltville Valley — an open air, wet depositional environment possessing clear stratigraphy, unusually good preservation, and abundant data — is an important repository of information about the history of pre-Clovis humans in eastern North America. If the search for additional information

about the pre-Clovis people of Saltville is properly conducted, and if the information collected is properly repositied and studied, it should yield substantial additional insights into the pre-Clovis record that cannot be duplicated at dry sites, low elevation sites, or caves and rockshelters.

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comments, and understandably, every reviewer wanted the present paper to include more than it does about some features and objects from SV-2 or their interpretation. Decisions about where to draw the line between what was included in this "outline" and what was held back for publication later reflect my own subjective judgment and my familiarity with the state of analyses underway, and not necessarily the advice of the reviewers.

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