### THE BULLETIN

**Volume 116  2000**

**Contents**

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Ancient Shoreline at Hunter's Home</td>
<td>1</td>
</tr>
<tr>
<td>Robert J. Gorall</td>
<td></td>
</tr>
<tr>
<td>Prehistoric Fishing in the Lower Hudson Valley: In Search of Evidence</td>
<td>12</td>
</tr>
<tr>
<td>Hans F. Schaper</td>
<td></td>
</tr>
<tr>
<td>Woodland Period Subsistence at Lamoka Lake: Animal Bones from the Buffalo Museum of Science Excavations</td>
<td>25</td>
</tr>
<tr>
<td>T. Cregg Madrigal</td>
<td></td>
</tr>
<tr>
<td>Nail Identification at Old Fort Niagara</td>
<td>35</td>
</tr>
<tr>
<td>Almon E. Leach</td>
<td></td>
</tr>
<tr>
<td>Local History: If It's All Written Down, Why Dig?</td>
<td>50</td>
</tr>
<tr>
<td>Ellis E. McDowell-Loudan</td>
<td></td>
</tr>
<tr>
<td><em>In situ</em> Thought in Eastern Iroquois Development: A History</td>
<td>57</td>
</tr>
<tr>
<td>Wayne Lenig</td>
<td></td>
</tr>
<tr>
<td>Theodore Whitney Commendation Award: NYSAA Annual Meeting 1999</td>
<td>70</td>
</tr>
</tbody>
</table>
Potsherd from the Shoreline Site
The New York State Archaeological Association

Officers
President ........................................ Louise L. Basa
Vice President .................................... Ellis MacDowell-Loudan
Secretary ........................................... Susan Winchell-Sweeney
Treasurer ........................................... Carolyn O. Weatherwax

Publications
Researches and Transactions
The Bulletin
Occasional Papers

Publications Chairman
William E. Engelbrecht
Dept. of Anthropology, Buffalo State College
1300 Elmwood Avenue  Buffalo, New York 14222

The Bulletin
Editor ................................................ Charles F. Hayes III
Associate Editor ............................... Martha L. Sempowski
Layout ........................................ Patricia L. Miller/PM Design

The views expressed in this volume are those of the authors and do not necessarily reflect the position of the publisher.

Published by the New York State Archaeological Association.
Subscription by membership in NYSAA. For membership information write:
Susan Winchell-Sweeney, 101 Whiting St. #1G, Winsted, CT 06098

The minutes of the NYSAA Annual Meeting will no longer be printed in The Bulletin. Members may obtain a copy of the most recent meeting by contacting Susan Winchell-Sweeney at the above address.

Back numbers may be obtained from
Publication Sales, Rochester Museum & Science Center,
657 East Avenue, Box 1480, Rochester New York 14603-1480

Entire articles or excerpts may be reprinted upon notification to the Editor.
All manuscripts submitted are subject to editorial correction or excision where such correction or excision does not alter substance or intent.

ISSN-1046-2368
Copyright © 2000 by the New York State Archaeological Association

Cover photograph by Ralph Brown.
The Ancient Shoreline at Hunter's Home

Robert J. Gorall, Lewis Henry Morgan Chapter, NYSAA

A well known archaeological site located in western New York is being threatened with destruction. New York State is in the process of purchasing thousands of acres of farm and marsh land near what was once the northern edge of Cayuga Lake with the intention of reclaiming it for future wildlife habitat. The state’s plan is eventually to dig a series of ponds in the area of the archaeological resource known as the Hunter's Home Site. Excavations conducted by the author in 1995 and 1996 were aimed at salvaging information from the site before further land acquisition and likely reflooding make such a project impossible.

Background

For centuries, the Hunter's Home area, which is located in the eastern portion of New York's Wayne County, has remained an attraction to various people. The groups range from very early Archaic hunters and fishermen to the Iroquois League's Cayuga who established permanent villages in the area. These residents were in turn followed by European missionaries, hunters, trappers, and modern day farmers. During the late nineteenth and early twentieth centuries, the abundant waterfowl resource of the marshlands attracted numerous market hunters to the region. These men soon after established a well known hunting lodge that bore the descriptive name, Hunter's Home (Secor 1987).

Scientific interest in Hunter's Home began with the recognition by knowledgeable people of the important Native American artifacts that were being discovered in the vicinity. The practice of surface hunting farmland and digging in refuse has proceeded at Hunter's Home for over a century, with some private collections exceeding a thousand specimens (Secor 1987). For several decades, archaeologists have become interested in unraveling the complicated record of this location. That effort was initiated by the study of numerous collected artifacts and excavations by William Ritchie in 1960, Peter Pratt in the 1960s, and Harold Secor in 1977, 1978, and 1990. This report is the latest attempt to uncover more of the story, and to add to the accumulated deposit of information for future archaeologists to ponder (Figure 1).

It is apparent from past archaeological records (Ritchie 1965; Secor 1983, 1987; Cox and Lewis 1965) that there were many periods of occupation at Hunter's Home and evidence was quickly found to support that conclusion. It was thought that the particular spot chosen for our excavation, the Shoreline Site, had been totally undisturbed; however, this proved not to be the case. Generally speaking, the original shoreline of Cayuga Lake was located in a slightly different contour than the present landscape would suggest. Although all of our findings were carefully measured and recorded, interpreting the site chosen (the original beach line facing in a westerly direction next to a shallow bay) proved to be a formidable undertaking. Lithic material of different Archaic periods (Ritchie 1971) was scattered throughout the various levels of the excavation. Pottery was also intermingled throughout, although only a few of the recovered fragments could be pieced together in reconstruction. This continued to be the situation even though a great deal of pottery was removed in a fairly good state of preservation. The area was not a midden in the truest sense, but over the centuries, wave action caused by the prevailing westerly wind had churned the shoreline so relentlessly that a merging of the components resulted. Artifacts of various cultures were mingled throughout the upper section of our unit profiles. Fortunately, below this level a more distinct scene evolved, enabling us to decipher some of our discoveries and place them in their proper context.

Methodology

In late August of 1995, a datum point was established in a large solid tree located in close proximity to the higher sloping land which was to be the focus of our efforts. Working from a permanent spike imbedded into the tree 48 in from ground level, the four primary directions were determined by hand held compass. Due to farming conditions the tree was used as the closest permanent reference point available and the units to be excavated were plotted out in a south and westerly direction from the starting point. The top 4 in of sod had been stripped from the work area. Thirteen 5-ft units were staked out and by the end of the 1995 season, 5 units had been completely excavated, along with a large adjacent trench approximately 20 ft by 12 ft in size. During the 1996 season, the same reference points were used and a 2 ft wide trench was surveyed and established in a north/south direction with measured stakes driven into the
ground at 2-ft intervals for approximately 54 ft. A grid of 5 ft squares were then arranged in conjunction with and tangent to the trench (Figures 2 and 3). In addition, 4 squares were plotted 22 ft west of the datum point and two were excavated (Units 1 and 2). One final unit was dug 50 ft west of the 1996 trench and designated Unit 50W (not shown).

Due to the circumstances associated with the excavation of the Shoreline Site, it was imperative to have a simple strategy to recover meaningful information in the time available. Bearing this in mind, it was decided at the beginning to use English measurement instead of metric throughout the excavation. Most of the participants who were expected to become involved were without experience, and it would not only be easier and more expeditious for them to use the familiar calculation, but would also result in less chance of errors.
Figure 2. Shoreline Site excavations; 1995-1996 (revised by Patricia Miller from sketch map drawn by Robert Gorall).
Site Description

The site encompasses a low rise on a generally level area above rich muckland. Spring inundation has occasionally covered the site and had obviously done so many times in the past. Presently the majority of the land in the immediate vicinity is being utilized for farming, but the cultivated areas are separated by marshland and occasional hedgerows, and small wooded thickets which result in dark, mosquito-infested localities which discourage exploration. Along the edges of some fields, earthen dikes have been constructed in an attempt to keep the Seneca River within a designated course. On several occasions during past springtime floods, a dike would give out, and waters would once again return to their natural course.

Excavation

As stated above, the top 4 in of sod had been removed by farm machinery, and some excavating was done by shovel testing and shoveling refuse from the trenches in 1995 and 1996. Thereafter, the main tool employed throughout the excavations was the hand trowel. Each 1 in level of material was kept separate and listed according to unit and depth. After removing the topsoil in the first trench (1995), it became evident that if we were to accomplish good results from our limited time allotment we needed to rely on $\frac{1}{4}$ in mesh screen for the bulk of the screening, and to reserve the use of $\frac{1}{4}$ in screen for any recognized special circumstances, such as fire pits and other features. Units 5, 7 and 11 were all excavated and screened through $\frac{1}{4}$ in screen as a control. The variety of projectile points recovered helps to confirm that the Hunter’s Home area was indeed a very popular spot over many centuries (Figures 4 and 5). An inventory of the materials recovered accompanies this report.

Although some units and the west trench were excavated in 1995, no recognizable features were identified. Most artifacts were located where they were expected to be: considerable pottery in the top 18 in, very little pottery in the next 4 in and almost no pottery below that level. One classic

Figure 3 Excavating, Units 10 and 11 at Shoreline Site: looking north.

Figure 4 Lithics from Shoreline Site. Top row: Lamoka points. Second row: Brewerton (side notched) points. Third row: crude, straight stem, small Archaic points. Fourth row: LeCroy, untyped corner notched, Vosbug, possible knife, Fox Creek, Levanna point.

Figure 5, Artifacts from Shoreline Site. Top row: 2 glass beads, untyped point, clay pipe fragment, untyped point, Brewerton side notched point. Second row: Lamoka point, Madison point, Susquehanna Broad point, Brewerton point, Susquehanna Broad point, chert blade, Brewerton base (top), untyped base. Third row: pipe fragment, small celt, scraper, Susquehanna Broad point base, Meadowood knife ?, Hopewellian type (possible Snyder point).
bifurcated LeCroy point was recovered near the base of Unit 5, confirming a very ancient occupation near the old lake shore. Other bifurcates were also recovered.

The extreme blackness of the soil throughout the unit walls made it most difficult to discern a clear profile of any layering or habitation floors. This was particularly true of the soil when it became wet with rain water. We were, however, able to uncover seven distinct strata along the north wall profile of Unit 7 (Figure 6) and six in the eastern trench wall profile.

Due to the thick mantle of black soil covering the site, if post molds existed, the light colored sub-soil lay too deep to show any, trace or outline of them. A few deeper rodent burrows and root paths were present. Artifacts were found to varying degrees in almost every excavation unit, the most prevalent being pottery fragments, animal bone, and chert chips. Fire-shattered rocks, from 1 in to 4 in in diameter, were scattered throughout the entire excavation, and charcoal pieces were numerous, particularly toward the lower end of the beach line. No apparent concentrations or “hot spots” of artifacts or debris were observed.

Features

Unit 2 produced one Feature at the 19 to 20 in level. Along the south wall, mottled soil containing numerous fish scales (small and large) was encountered and screened. Also small angular stones, a few chert chips, and charcoal flecks were recovered. At the 21 in level, dark brown soil produced some root-shaped cores filled with sandy material which upon later analysis proved to be nodules composed of fine sand and silt cemented with calcite and/or hematite (Robert Navias, Geologist, personal communication). At 23 in, nodule inclusion pieces formed an arc and included three pottery pieces in the dark earth. This material, known locally as “bog iron,” was removed, but other than a few more charcoal flecks, nothing else was recovered from the feature.

A feature was also uncovered near the bottom of Unit 7. What proved to be a lens of ashy material was lying directly on the hard sand of the unit at a 17 in depth from the ground surface (Figure 7). Fire-burnt sand and burnt rock of medium size were present. The ash platform was 3 in thick at maximum and covered half the unit floor before extending into the wall in a westerly direction. A half unit (5 ft by 27 ft) was opened to the west and adjacent to Unit 7 and designated as Unit 12. Excavation produced burnt bone and a woodchuck tooth; charcoal flecks and flint chips were distributed throughout the matrix. All material from the area was filtered through ¼ in screen. This appears to have been a hearth or fire pit which had been scattered by the action of wind and waves, perhaps early after its use.

Artifactual Materials

European Trade Materials

In 1995, near the surface of Unit B2, two glass trade beads were discovered (1 red round and 1 red cane type) along with a scrap of brass. One more glass trade bead (red cane variety, burnt) was recovered in 1996 also near the surface. These are the only Contact period artifacts found at the excavation other than several modern shotgunshell casings.

Lithics

Most of the material used for projectile points, drills, and scrapers at the Shoreline Site is Onondaga chert. A few pieces of darker chert were found, but the majority of lithic artifacts and debris are of Onondaga chert, and suggest either trade or travel to bring the material from its source for none is to be found in the immediate vicinity. A more exotic jasper material was found in only two of the artifacts (Figures 8 and 9), and one bifurcated projectile point of the Kanawha type (Converse 1973) was chipped from Oriskany chert which probably originated near the Delaware River area (LaPorta
Clastic rocks used for hammerstones, pestles, and those numerous net sinkers were probably obtained from the general region (Figures 10 and 11). One stone had been completely encircled by pecking and could have been used as a net weight.

The two harpoons excavated from Unit 7 at 29 in and from the trench location 44 to 46 ft at the 24 in depth were made of deer bone, as was the single, small awl recovered (Figure 12).

Figure 8. Drills from Shoreline Site. Left to right: expanded base with side notches, expanded base, straight drill, expanded base, modified point drill.

Figure 10. Shoreline Site. Top: broken half pestle. Bottom: roller pestle (11 1/2 in long).


Figure 11. Varieties of net sinkers from Shoreline Site.

Figure 12. Shoreline Site bone material. Top and center: unilaterally barbed harpoon fragments; Bottom: awl of deer bone c. 5 cm. long.
Faunal and Floral Remains

The great majority of bone material was located between the 15 to 28 in levels throughout the excavations. Fish vertebrae and literally thousands of fish scales were recovered. A complete faunal analysis was done by Marie Lorraine Pipes and has been described elsewhere, as part of a fuller account of these excavations (Gorall 1999: Appendix B). A summary of that faunal analysis is included here as Appendix A. A few charred hickory nut shells were also uncovered in the excavations, along with pitted stones, possibly used as nut crackers (Ritchie 1929).

Soapstone

A total of eleven pieces of soapstone or steatite, ranging in length from 1 in to 4 in, were found during the 1995 and 1996 seasons (3 in 1995 and 8 in 1996) (Figure 13). They were all excavated from three separate units at depths of from 10 in to 27 in; four pieces were found in Unit 8 at the 10 to 20 in depth. Although this talc material was widely used throughout New York State and the east coast (Bushnell 1940), to the writer’s knowledge no definite source for these fragments has yet been located. The light color of some specimens does, however, suggest a possible southern Pennsylvania connection.

Ceramic Pottery and Pipes

The identification of the fourteen ceramic rimsherds shown (Figures 14, 15, and 16) was made by reference to the standard publications on the subject (Ritchie and MacNeish 1949, MacNeish 1952). The pottery types and designs ranged from crude to extremely fine. Nine pipe bowl fragments and four pipe stems were also found (Figure 17).
Summary and Conclusions

The true archaeological value of our work resides in the discovery of the original beach line along with the soil profile. Further work is now possible having established the beach line excavations as a reference point, as well as a general vertical stratigraphic pattern. Although we were able to uncover seven distinct layers in the stratigraphic profile (Figure 6), none of the "floors" contained a clear platform of artifactual material diagnostic of any one specific group.

The many groups of early people who populated this area were drawn by the ready food supply of fish in the shallow bays. Although deer were certainly exploited, the great number and variety of net sinkers (Kraft 1992) found throughout the different stratified formations are testimony that, over the centuries, fishing was the main attraction. Also, remnants of turtle, beaver, goose, and other birds and animals were present (see Appendix A: Faunal Analysis Summary). Nut shells confirm an autumn presence, as do fragments of deer antlers. However, it is doubtful that a year-round residency occurred, due to the conditions which prevail at this open spot facing the westerly winds.

The earliest evidence of occupation at the Shoreline Site is the LeCroy projectile point found resting just above the original sub-soil. Some Susquehanna lithic material was discovered above that depth, and Brewerton points, as well as Point Peninsula and early Owasco pottery above the Susquehanna materials. In turn, the next evidence left by a prehistoric culture was late Owasco pottery which may prove to be transitional to early Iroquois. Finally, manufactured material consisting of glass trade beads and scraps of brass are witness to the presence of post Contact Iroquois people.

The majority of faunal material was recovered at depths between 16 in and 24 in, indicating a greater population or longer habitation during the early, middle, and late Archaic periods. Inventory of the artifact assemblage and distribution suggest almost continuous occupation of this locality over a span of perhaps 7000 years. In the writer's opinion, it is possible that the whole chronicle of development of prehistoric people of New York State could lie buried beneath the dark, quiet earth of Hunter's Home and its environs.

Acknowledgements

Our "crew" consisted of four part-time people the first year and six in 1996. My thanks to those dedicated individuals seems quite inadequate, but knowing of their interest in science and witnessing their enthusiastic progress in field activities, I do extend a sincere "Thank you" to Muriel Gorall, Newark, New York; Dale Knapp and Ralph Brown of Webster, New York and Jean Satter who drove from...
Syracuse, New York to help out. I would also include in this star cast Dr. Ann Morton who was kind enough to bring to the site for a day, several anthropology students from St. John Fisher College, Rochester, New York, who also helped with the work. To Harold Secor of Savannah, New York, without whom this project could not have taken place and who has contributed more to the study of these early people than anyone, a special thanks.

Several photographs accompanying this report are in large measure the result of a fine understanding of the photographic process and interest in the artifacts by two veteran volunteers, Ralph Brown and Dale Knapp. Sadly, Ralph passed from this world in December 1997. A longtime member of the NYSAA, he was a fine man and we miss him. Other photos were taken by the author. The bone material was examined and reported upon by Marie-Lorraine Pipes, M.A., Zooarchaeologist, from Fairport, New York, and I am greatly indebted to her for her very professional contribution. Of course, I do extend my sincere appreciation to the landowner, Mr. Neil Malone of Savannah, without whose kind permission this project could not have taken place.

References Cited

Bushnell, David I. Jr.
1940  The Use of Soapstone by the Indians of the Eastern United States. Smithsonian Report of 1939, No. 3578, Washington D.C.

Converse, Robert N.

Cox, Donald D. and Donald M. Lewis

Gorall, Robert J.
1999  The Ancient Shoreline at Hunter’s Home. The Iroquoian, No. 24, Lewis Henry Morgan Chapter, NYSAA.

Kraft, Herbert C.

MacNeish, Richard S.

Ritchie, William A.
1929  Hammerstones, Anvils and Certain Pitted Stones, Researches and Transactions of the New York State Archaeological Association 7(2). Lewis Henry Morgan Chapter NYSAA.

Ritchie, William A. and Richard S. MacNeish

Secor, Harold

Table 1. Inventory of Identifiable Artifacts from the Shoreline Site.

<table>
<thead>
<tr>
<th>Year</th>
<th>Chert</th>
<th>Projectile points</th>
<th>Scraper</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>11 complete</td>
<td>11</td>
<td>9 end scrapers</td>
</tr>
<tr>
<td></td>
<td>Bifurcated-base</td>
<td>1</td>
<td>3 thumbnail scrapers</td>
</tr>
<tr>
<td></td>
<td>Hopewelian (Adena?) type</td>
<td>1</td>
<td>2 from projectile point bases</td>
</tr>
<tr>
<td></td>
<td>Brewerton sided-notched</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lamoka</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meadowood</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Madison</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>small untyped</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17 incomplete (8 tips 9 bases)</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>20 complete</td>
<td>20</td>
<td>7 side scrapers</td>
</tr>
<tr>
<td></td>
<td>Vosburg type</td>
<td>1</td>
<td>2 end scrapers (1 of jasper)</td>
</tr>
<tr>
<td></td>
<td>Brewerton side-notched</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lamoka</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Levanna</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LeCroy</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kanawha type</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fox Creek</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(utilized as knife)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>untyped</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>29 incomplete (15 tips 14 bases)</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drills</td>
<td>2 with broken shafts</td>
<td>2</td>
<td>2 expanded base</td>
</tr>
<tr>
<td></td>
<td>bladelet</td>
<td>1</td>
<td>1 notched expanded base</td>
</tr>
<tr>
<td></td>
<td>ovate</td>
<td>1</td>
<td>2 incomplete</td>
</tr>
<tr>
<td></td>
<td>(possibly chaledony)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceramic Pipes</td>
<td>1 stem</td>
<td>1</td>
<td>3 stem fragments</td>
</tr>
<tr>
<td></td>
<td>5 bowl fragments</td>
<td>5</td>
<td>4 bowl fragments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass Beads</td>
<td>2 glass beads, 1 cane 1 red round</td>
<td>2</td>
<td>1 small red glass bead (burnt)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soapstone</td>
<td>3 large pieces, one with drilled repair hole</td>
<td>3</td>
<td>8 pieces</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bone</td>
<td>1 bone awl</td>
<td>1</td>
<td>2 fragments of harpoons (unilaterally barbed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stone</td>
<td>1 small celt</td>
<td>1</td>
<td>numerous netsinkers: majority flat with side notches, a few round shaped. Some very small and quite large examples were recovered. “Canoe anchors” (Kraft 1992). Hammerstones, pestles, and anvilstones were recovered.</td>
</tr>
<tr>
<td></td>
<td>1 large roller pestle</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>hammerstones, pitted stones, netsinkers (including one with pecked groove around circumference)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Appendix A

Shoreline Site Faunal Analysis Summary 1996 Field Season
by Marie Lorraine Pipes, Zooarchaeologist

The faunal analysis recovered from the Shoreline Site at Savannah, New York, during the 1996 season received a Stage 2 level of analysis allowing for identification of species, element, and bone modifications. Two types of counts were obtained, the Total Number of Fragments (TNF) and the Minimum Number of Units (MNU). The TNF count serves mainly as a curational tool. It reflects the number of bone fragments comprising a single line of data entry. For example, seven bone fragments that mend to form single deer mandible have a TNF count of 7. The MNU count represents an adjusted count based on mends. So in the example from above the same data entry line will have an MNU count of 1. Both types of counts were obtained after the faunal assemblages were examined for mends. General age at death indicators were recorded where possible. Identifications were made with the aid of a comparative faunal type collection and the use of the reference materials following this summary. Some deer bone showed cut or butcher marks. A vertebra fragment from a large fish also had cut marks. Almost all bone material showed black surfaces indicating discoloration from fire or a chemical reaction to muck land soil. Eight of the deer bone specimens exhibited canine gnaw marks, as did bones of an unidentified medium sized mammal.

As in 1995, in the 1996 faunal recovery deer was by far the most abundant species represented at the shoreline excavation. Among the numerous other identified species were rabbit, passenger pigeon, duck, goose, turtle (both small and large), snapping turtle, muskrat, fox, and raccoon. The vertebra of an unidentified snake and a worn wolf molar also were recovered. Some deer bone showed evidence of having been bisected vertically or horizontally by chopping. Intrusive cow and horse tibiae were also recorded, most probably remnants of earlier farming activity. The full faunal analysis report of the Shoreline Site excavations has now been published (Gorall 1999: Appendix B). Following are the references used for the analysis.

References Used in Faunal Analysis


1968 Fish, Amphibian and Reptile Remains from Archaeological Sites. Papers of the Peabody Museum of Archaeology and Ethnology, 56(2). Harvard University, Cambridge, Massachusetts.

1979 Osteology for the Archaeologist. Papers of the Peabody Museum of Archaeology and Ethnology, 56 (4 and 5) Harvard University, Cambridge, Massachusetts.

Prehistoric Fishing in the Lower Hudson Valley: In Search of Evidence

Hans F. Schaper, Louis A. Brennan/Lower Hudson Chapter, NYSAA

The prehistoric inhabitants of the lower Hudson Valley are believed to have hunted mammals and gathered a diversity of plant products in their pursuit of daily survival. This view is based mainly on the fact that chipped stone projectile points emerged as the most numerous artifacts at Archaic and Woodland sites. It is suggested here that, due to the maritime character of the lower Hudson region, the subsistence strategies of its inhabitants differed from those of upstate and inland New York areas by greater emphasis on fishing activities. It seems arguable that despite the deceptively sparse archaeological traces, it may have been fishing activity - not deer hunting - that supplied the bulk of food to the lower Hudson Valley Indians during most of the year:

Introduction


The region under consideration here stretches from Cold Spring to Staten Island and from the western Hudson shores to the Long Island Sound, approximately 3,000 sq km. It is located within the biome which “seems to have been one of the most conducive to human utilization of any area of the Northeast” (Tuck 1978:35). There was an abundance of fine drinking water, wildlife, and plants, as well as an unusual wealth of aquatic life and species. This study attempts to investigate an apparent paradox: the availability of enormous volumes of fish in the lower Hudson River during the past eight millennia matched by only minimal amounts of archaeological evidence of fishing (e.g., fish bones and fishing equipment) recovered from prehistoric sites in the region.

Environmental Setting

After the Wisconsin glacier retreated and the Hudson Valley was deglaciated about 15,000 years ago, a large diversity of fish, including striped bass, shad, herring, and Atlantic salmon swam the rivers, lakes, and bays of the lower Hudson lands (Funk 1976:7). Oyster beds formed from Canada to Florida. The mainland included the Continental Shelf, which terminated about 150 km east of the present shoreline, while the Hudson River discharged fresh water through a deep long gorge into the ocean. Subsequently, rising sea levels flooded the shelf at rates decreasing from 38 cm per century 5000 years ago to 10 cm per century at 1000 B.P. (Schuldenrein 1995:51). The Hudson River is an estuary whose bottom is below sea level as far north as Troy. Topography along the shores varies considerably, "Sea-level fluctuations alter the relative depth of water in a region ...current flow around islands, and wave fetch distance across open water' (Belcher 1989:187). Nevertheless, "the environmental setting in New York, as first encountered by Europeans, had persisted, with relatively minor variations, through a considerable span of prehistoric time" (Funk 1976:7). The lower Hudson Valley differs from other regions of New York State in its marine environment shaped by the estuary, the coastal area, and the Long Island Sound.

Previous Research

The first European visitors to the northeastern shores and rivers found the American natives engaged in catching fish using a variety of methods and implements. A Dutch official described Indian use of large seines, gill nets and tykes, many designs of traps, fish spears, hooks, and weirs as part of the regional technology (Van der Donck 1968:97, 1996:121). He was well positioned to study local practices as he owned 24,000 acres on the shores of the river, from the Bronx to Yonkers (Van der Donck 1996:104). Louis Brennan excavated and radiocarbon dated oyster shell middens of Archaic and Woodland vintage between Croton and Yonkers. He verified native activity in the lower Hudson Valley since the Archaic period (Brennan 1981:43). Funk compiled distribution charts for more than 30 stone tool and projectile point types in the Hudson Valley, providing an invaluable basis for extending
The Bulletin  • Number 116

The research (Funk 1976:201). They suggest continuity of cultural materials in the lower Hudson region. An investigation of anadromous fish and fishing in the Hudson River drainage provided pertinent data (Brumbach 1986). Diverse locations on Staten Island and on Eastchester Bay were investigated by Alanson Skinner who recorded many netsinkers and harpoon fragments (Skinner 1909:215). Reginald Bolton documented 94 sites between Staten Island and the northern tip of Manhattan, many of them fishing and oystering locations, possibly of the Woodland period (Bolton 1934:130-156). These various reports and monographs, however, explain little about fishing practices in the lower Hudson Valley during Archaic or Woodland periods because of the skimpy residue of artifactual material and verifiable features.

Subsistence And Natural Resources

Until recently, deer hunting supplemented by gathering of plant foods and oysters was considered the predominant subsistence activity in the lower Hudson lands during prehistoric periods. Fishing was thought to have been incidental. The plant food supply is season bound, however, and oysters, despite their large beds on the estuary shores, rarely supplied a sufficient amount of food. In the face of the immense fish population of the Hudson River - a readily accessible, year round food source - native subsistence priorities in the region should be reconsidered. Did deer hunting, so vital in other sections of the Northeast, actually furnish most of the food consumed in this maritime region? Or had the inhabitants of the lower Hudson Valley adapted to the marine conditions by concentrating on fishing and fish consumption?

Evidence

Existing evidence for prehistoric fishing activities in the region is meager. Most biodegradable objects like bones and nets have perished. Only 7 fish bones from the Archaic period and 27 of the Woodland period have been identified as items of pre-colonial fishing (Table 1). Two bone harpoons and 4 harpoon fragments from opposite ends of the region are on

Table 1. Prehistoric Bones of Fish and Whales in the Lower Hudson Valley.

<table>
<thead>
<tr>
<th>Site</th>
<th>Fish Bone/Mammal Bone</th>
<th>Period</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogan Pt</td>
<td>bullhead catfish (1)</td>
<td>Archaic</td>
<td>White 1974:71</td>
</tr>
<tr>
<td></td>
<td>bony fish (210)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>perch-like (23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>white perch (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>striped bass (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>cel (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>cod (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>toad fish (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>black sea bass (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woolcott Location 1</td>
<td>bullhead catfish (1)</td>
<td>Archaic</td>
<td>White 1974:71</td>
</tr>
<tr>
<td>Tellers Rockshelter</td>
<td>fish-NID</td>
<td>?</td>
<td>Fiedel 1991:149</td>
</tr>
<tr>
<td>Ossining Rockshelter</td>
<td>fish vertebrae-NID (4)</td>
<td>Archaic</td>
<td>Fiedel 1986:44</td>
</tr>
<tr>
<td>Twomblly Landing</td>
<td>sturgeon (1)</td>
<td>Archaic</td>
<td>Brennan et al.1970:14</td>
</tr>
<tr>
<td>Inwood</td>
<td>sturgeon</td>
<td></td>
<td>Bolton 1909:86</td>
</tr>
<tr>
<td>Manhattan N.W.</td>
<td>&quot;a few fish bones&quot;(midden)</td>
<td></td>
<td>Skinner 1920</td>
</tr>
<tr>
<td>Throgs Neck</td>
<td>catfish (15)</td>
<td></td>
<td>Bolton 1934:81-82</td>
</tr>
<tr>
<td></td>
<td>sperm whale vertebrae (6)</td>
<td></td>
<td>Bolton 1976:119-120</td>
</tr>
<tr>
<td></td>
<td>some fishbones</td>
<td></td>
<td>Bolton 1976:123</td>
</tr>
<tr>
<td></td>
<td>sturgeon (1)</td>
<td></td>
<td>Skinner 1919:119</td>
</tr>
<tr>
<td></td>
<td>stingray (1)</td>
<td>Woodland</td>
<td>Bolton 1909:86</td>
</tr>
<tr>
<td></td>
<td>Dog fish (1)</td>
<td>Woodland</td>
<td>Skinner 1920</td>
</tr>
<tr>
<td></td>
<td>Blue fish (1)</td>
<td>Woodland</td>
<td>Bolton 1934:81-82</td>
</tr>
</tbody>
</table>

NID = Not Identified
Only 1 plummet and a single bone fishhook were documented. A tally of 74 counted netsinkers includes 42 sinkers (57%) from a single location (Table 2). Many uncounted sinkers were reported, and at some fishing camps on Staten Island, netsinkers outnumbered projectile points (Skinner 1909:44). The remains of "extensive stone fishweirs in the bed of the Croton River" near the confluence of the Cross River were still visible seven decades ago, but are now submerged by the Croton Reservoir (French 1925:17). The existence of prehistoric fishing nets is indicated by net impressions preserved on earthenware (Bolton 1934:81).

Discussion

Archaeological sites and shell middens from Staten Island to Cold Spring attest to a nearly continuous human presence in the lower Hudson Valley for at least eight millennia. During that time, the Hudson River supported a teeming aquatic life. It appears puzzling, therefore, that the evidence for fishing by prehistoric occupants is virtually absent. What could explain that gap between the wealth of available fish in the lower Hudson and the skimpy traces of their exploitation during prehistory? Few people will dispute that fishing contributed occasionally to the dinner table of early inhabitants, but since the archaeological record consists largely of collections of stone projectile points, hunting and gathering activities have been postulated as providing the Indians' major food source. The scarcity of fish bones and fishing equipment from archaeological contexts merely underlines the view of hunting primacy. Twenty years ago even Brennan had wondered if the lack of fish bones at oyster shell middens might imply that lower Hudson Indians did not eat fish (White 1974:71). However, this notion does not square with the report by an eyewitness on "Fare and Food of the Indians," who noted fish and meat equally used in meals (Van der Donck 1996:108-109).

The question has been raised, "Can the intensive exploitation and processing of anadromous fish, such as sturgeon, by prehistoric Native Americans be identified archaeologically?" (Amorosi 1991:95). In fact, most prehistoric Hudson River sites do not contain many components of mammalian fauna either. Wickers Creek yielded a total of 2,238 mammal bones which represent one single skeleton fragment per two years of human presence. The Dogan Point site, reflecting human visitations spanning seven millennia, yields only 2,787 mammal bones. These faunal remains give us a clue about the species which were consumed, but they do not furnish convincing proof of the predominance of hunting in the past.

Table 2. Prehistoric Fishing Equipment in the Lower Hudson Valley.

<table>
<thead>
<tr>
<th>Site</th>
<th>Tools</th>
<th>Period</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hendrickson</td>
<td>netsinkers (8)</td>
<td>Woodland</td>
<td>Eisenberg 1989:42</td>
</tr>
<tr>
<td>Parham</td>
<td>netsinkers (1)</td>
<td>Archaic</td>
<td>Funk 1976:187</td>
</tr>
<tr>
<td>Wickers Creek</td>
<td>netsinkers (2)</td>
<td>?</td>
<td>Ludwig 1988:53</td>
</tr>
<tr>
<td>Throgs Neck</td>
<td>netsinkers (2)</td>
<td>?</td>
<td>Kaeser 1996:9</td>
</tr>
<tr>
<td>Clasons Point</td>
<td>netsinkers (42)</td>
<td>Woodland</td>
<td>Bolton 1976:123</td>
</tr>
<tr>
<td>Desoris Pond L.I.</td>
<td>netsinkers (6)</td>
<td>Woodland</td>
<td>Skinner 1919:53</td>
</tr>
<tr>
<td>Port Washington L.I.</td>
<td>netsinkers (4)</td>
<td>Archaic/Woodland</td>
<td>Skinner 1919:101</td>
</tr>
<tr>
<td>Wilkins L.I.</td>
<td>netsinkers (10)</td>
<td>Archaic/Woodland</td>
<td>Smith 1950:127</td>
</tr>
<tr>
<td>Harlem River Dep.</td>
<td>some netsinkers</td>
<td>Archaic/Woodland</td>
<td>Smith 1950:127</td>
</tr>
<tr>
<td>Isham Gardens</td>
<td>some netsinkers</td>
<td>?</td>
<td>Finch 1909:70</td>
</tr>
<tr>
<td>Mariners Harbor &amp;</td>
<td>several netsinkers</td>
<td>?</td>
<td>Finch 1909:70</td>
</tr>
<tr>
<td>Tottenville</td>
<td></td>
<td></td>
<td>Skinner 1909:08</td>
</tr>
<tr>
<td>Shimnekock Hills</td>
<td>harpoon fragments (2)</td>
<td>?</td>
<td>Skinner 1915:127</td>
</tr>
<tr>
<td>Clasons Point</td>
<td>harpoon barb</td>
<td>?</td>
<td>Skinner 1919:89</td>
</tr>
<tr>
<td>Manhattan</td>
<td>harpoon (bone) (8.5 cm)</td>
<td>?</td>
<td>Skinner 1920:190</td>
</tr>
<tr>
<td>Rabuilt Cave</td>
<td>harpoon (bone) (12.25 cm)</td>
<td></td>
<td>Vargo and Vargo 1983:17</td>
</tr>
<tr>
<td>Clasons Point (East River)</td>
<td>fish hook (bone)</td>
<td>Archaic</td>
<td>Skinner 1919:94</td>
</tr>
<tr>
<td>Manhattan</td>
<td>plummet (1)</td>
<td></td>
<td>Lenik 1992:22</td>
</tr>
</tbody>
</table>
1. Re-evaluating the Hunting-Fishing Relationship

There are many indications of a potentially lively fishing activity. The aquatic life in the Hudson River presented a well stocked food larder and the substantial number of campsites suggests many human occupants (Westchester alone contains a few hundred sites). The oyster middens along the river shores indicate that the early inhabitants were well aware of the available food in the river. Finally, the fishing practices of adjoining regions are not likely to have been a secret to their Hudson River contemporaries.

Collectively, these aspects collide with the notion that fishing activities in the lower Hudson Valley were negligible and merely supplemented hunting. Indeed, only a few decades after the Dutch founded New Amsterdam, an observant official reported that the Indians:

... all have a passion for hunting and fishing.... Spring and part of summer are given over to fishing, but when... the early hunting season approaches, many young men quit fishing. The elderly go on longer, until winter.... It is done with the seine, pound nets, small tykes, gill nets, and gaffs [Van der Donck 1996:121].

Cultural changes during the Woodland period did not seem to affect the mode of making a living in the prehistoric lower Hudson Valley. The introduction of new projectile point styles, horticulture, and ceramics were not accompanied by any evidence that fishing technology had evolved. Spears, nets and sinkers, baskets, and weirs were rudimentary though effective equipment still in use when Verrazano entered New York Bay.

2. Populations: On the Move and Settled

The first people who entered the Hudson region on foot or by water craft probably headed northward in spurts and stops. The ice sheet had retreated and the newcomers entered a region of spruce woodlands replacing tundra. According to Ritchie, "The paleo-Indian also shared with a majority of his successors a decided choice for main waterways. The thin scatter of fluted points in the Northeast follows the principal river systems" (Ritchie 1957:7).

The prehistory of the northeast coast probably unfolded much like that of the Pacific northwest. The new migrants utilized the marine resources and light, skin-covered vessels may have been used (Drucker 1955:21). The lower Hudson Valley seems to have been continuously occupied from the Late Archaic through the Woodland periods, as indicated by archeological research on sites from Bear Mountain to Staten Island (Skinner 1915; Brennan 1977; Roberts 1988; Lenik 1992; Claassen 1995; Funk 1996) (Figure 1). Little is known of the actual movements of peoples through the valley, but radiocarbon dates suggest that groups could have settled for lengthy periods and been in contact with each other (Schaper 1993:32). Repeated, short term occupations during the Archaic period may be difficult to separate from sedentary occupations lasting centuries.

Current evidence for Paleo-Indian and Early Archaic habitations consist of: 18 fluted projectile points and 126 stone items from the Port Mobil Site on Staten Island (Kraft 1977:6); 2 probable piano points and 1 fluted point base from Wickers Creek (Ludwig 1988:41); another possible PaleoIndian point found at the Warren's Landing Site (Zern 1989); and a yellow jasper fluted point excavated at White Plains (Fiedel and Zern 1987:3). A Le Croy occupation site was
investigated at Armonk (Boesch 1996) (Table 3). Many sites yielded artifacts from the Archaic as well as Woodland periods indicating reoccupation through time. Only a dozen kilometers from the Paleo-Indian Port Mobil Site, excavations at Oyster Island (now Ellis Island) bared a Woodland shell midden with flakes, pottery fragments, and turtle shell (Pousson 1986:218, 237). The oyster beds surrounding the island could not have existed before the bank was in large part sub-tidal, beginning roughly 2,500 years ago. (Pousson 1986:11). Many shell middens in the vicinity would therefore reflect life during the Woodland period.

3. Subsistence: Fish, Fowl, Mammals, Oysters, Roots, Nuts.

The Hudson River would have been a rich source of anadromous fish and eel. The different life cycles of fish species demanded periods of intense activity at particular times of the year and perhaps helped to promote the development of means to preserve food. It may also have created leisure time and seasonal immobility unlikely to favor a nomadic way of life. The eastern woodlands offered to the early hunters caribou, bear, beaver, wolf, raccoon and other game. Eisenberg suggests that "Paleo-Indian dependence on caribou as a major prey species can... be questioned" (1978:122). White tail deer became the major game animal in the subsequent Archaic period - often speared with the help of the atlatl. Faunal remains indicate that 90% of the quarry consisted of white tail deer. Game may have been slaughtered on the spot, which could explain the lack of deer skulls and teeth at sites. One common practice of catching deer and other mammals was by trapping them (Salwen 1978:161). Other hunting methods included cooperative group drives where deer would be chased into the river, snared at the neck from canoes, and their rumps forced upward to drown the animal (Skinner 1915:44). Bow and arrow hunting did not come into use in this area until a millennia after pottery making was known in this region. Deer were immensely useful for their hides, antlers, bones, and sinews, but this does not imply that it also constituted the major food source for the inhabitants of the lower Hudson region.

Likewise, the millions of oyster shells framing the Hudson shores do not signify that bivalves were the staple diet of Indians, although they demonstrate the exploitation of untold oyster beds since the Archaic period. Mollusks have been widely overrated as a food source. "One red deer supplies as many kilojoules (or calories) as about 50,000 oysters..." (Rowley-Conwy 1993:62; Dennell 1979). Even when other supplies were scarce during the winter, ice fishing probably yielded more food than clusters of frozen oysters broken from rocks near the shore. It has been estimated that the annual contribution of shell food may range from 5 to 20 percent (Bailey 1978:39). Oyster meat probably served the natives as a dietary supplement, and for trade or tribute. Shell deposits seem to have resulted from activities already noted by Meehan: a) habitation sites; b) camping episodes; c) processing sites (Ceci 1984:63).

During Paleo-Indian times there seemed to be much unpredictability of wild food plants, and it appears that no food grinding tools were used (Snow 1980:154). Manos and grinding blocks turned up at sites of succeeding periods suggesting that roots and nuts were in more plentiful use after the Middle Archaic. Horticulture added to the diversity of meals in the Late Woodland period and indicated more sedentary conditions. Egalitarian relations may have prevailed and facil-

<table>
<thead>
<tr>
<th>Location</th>
<th>Artifact</th>
<th>Dating B.P.</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogan Point</td>
<td>oyster shell</td>
<td>C(^14): 6950 +/- 100</td>
<td>Claassen 1995:161</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C(^14): 5650 +/- 200</td>
<td>Claassen 1995:162</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C(^14): 5580 +/- 80</td>
<td>Claassen 1995:162</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C(^14): 5470 +/- 70</td>
<td>Claassen 1995:163</td>
</tr>
<tr>
<td>White Plains</td>
<td>fluted point(reworked)</td>
<td>Paleo-Indian</td>
<td>Fiedel 1987:3</td>
</tr>
<tr>
<td>Wickers Creek</td>
<td>Plano point-mid section</td>
<td>Archaic</td>
<td>Ludwig 1988:41</td>
</tr>
<tr>
<td></td>
<td>Plano point-basal fragment</td>
<td>Archaic</td>
<td>Ludwig 1988:41</td>
</tr>
<tr>
<td></td>
<td>fluted point-base</td>
<td>Archaic</td>
<td>Ludwig 1988:41</td>
</tr>
<tr>
<td>IBM-Armonk Site</td>
<td>—</td>
<td>LeCroy Occupation</td>
<td>Boesch 1996</td>
</tr>
<tr>
<td>Twombly Landing</td>
<td>MacCorkle point</td>
<td>Archaic</td>
<td>Brennan et al. 1970</td>
</tr>
<tr>
<td>Port Mobil</td>
<td>18 fluted points</td>
<td>Paleo-Indian</td>
<td>Kraft 1977</td>
</tr>
<tr>
<td></td>
<td>126 stone tools</td>
<td></td>
<td>Kraft 1977</td>
</tr>
<tr>
<td>Occurrences No. 27</td>
<td>MacCorkle point</td>
<td>Archaic</td>
<td>Schaper 1997</td>
</tr>
</tbody>
</table>
4. Fish Abound

The abundance of fish was impressive - over 130 different species of fish have been identified in the Hudson River (Eisenberg 1989:22). According to Funk,

> The Hudson and its tributaries abounded in such fresh-water food fish as brook trout, small mouth bass, and wall-eyed pike, but the largest quantities of protein available to the Indians were provided by spring runs of shad, herring, striped bass, Atlantic salmon, and other marine species in what must, literally, have been astronomical numbers [Funk 1976:7].

The Hudson estuary was inducing anadromous species like the sturgeon to spawn upstream. "Sturgeon grew to enormous sizes, judging from the scutes found on Indian sites. Indeed, early records tell of sturgeon measuring fourteen to eighteen feet in length" (Kraft 1983:12). Striped bass, sea sturgeon, and eel were three species available in the lower Hudson twelve months of the year. The striped bass ranges in weight up to 18 kg and large numbers winter in the Haverstraw Bay area (Brumbach 1986:57). The eel, a catadromous fish, spawns in the ocean during mid-winter and the young eel elvers migrate to freshwater rivers. In fall, fully grown, they weigh up to 7 kg and may be trapped while returning to the sea. Sometimes whales ventured up the Hudson River and into the Long Island Sound where Indians would dismember the stranded mammals (Van der Donck 1968:11; Bolton 1976:120). Stranded whales were also scavenged occasionally by some Native American groups in New England as well as on the northwest coast (Salwen 1978:162; Colton and Arnold 1998:682). Even sea turtles, harbor seals, and porpoises strayed on occasion into the lower Hudson estuary (Van der Donck 1968:55; Brumbach 1986:47). Tributaries like the Croton, Sawmill, and Bronx Rivers contained viable fish populations which were also exploited, as were others at inland brooks and lakes.

The species of available fish did not seem to vary noticeably during Hudson prehistory: Archaic period catfish bones turned up at Dogan Point and at the Woolcott Site (White 1974:71), while 15 catfish bones were excavated in Manhattan from a Woodland period site (Bolton 1909:82). A sturgeon bone was excavated at the Archaic Twombly Landing Site (Brennan 1968:14), while another sturgeon bone fragment was dug up from a Woodland period site in Manhattan's Inwood section (Bolton 1909:86). Scales of sturgeon were also recovered from food pits (Bolton 1934:107). Both species - catfish and sturgeon - are still swimming in the Hudson River today.

5. Fishing Technologies

Spearfish from rocks or canoes could feed a family but would not produce sufficient food for larger groups. The schools of fish migrating in the wide Hudson would have lent themselves to harvesting of larger numbers by nets, traps, and weirs near the shore (Brumbach 1986:39). Still, some fish were taken with harpoons or spears. Leisters were specialized tools - fish spears often bearing a long bone point flanked by prongs to hold the prey. Choice of methods to entrap fish depended on the seasonal fish runs, characteristics of river bottom or shoals, and the skills of fishermen. Weirs, basket traps, seines, or gill nets, often used in conjunction with canoes, were all methods customarily employed by American natives from Alaska to Florida long before the Europeans arrived. Fire was also used to attract fish at night, and occasionally poison, although no application of poison is recorded in the lower Hudson (Speck et al. 1946:13).

Fishing with nets and seines appears to have been the predominant method of taking aquatic game from the Hudson River. A recorded netsinker from an Archaic context indicates net fishing in Haverstraw Bay. From the total of 74 documented netsinkers, 42 items (57%) originate from a single location at Throgs Neck. These have to be ascribed to the Woodland period since they were found in contexts with sherds. Many other sinkers were not dateable. Large quantities of netsinkers, mostly grooved, were found at shell heaps of Tottenville on Staten Island, in the vicinity of Burial Ridge and other neighboring localities. They suggest the existence of specialized fishing stations (Skinner 1909:215). Funk (1976:201) lists 66 netsinkers at 35 low-lying camps on the Hudson north of Croton. It can be reasonably expected that many such net weights were lost in use and buried in the Hudson bottom sands. Three East River sites at the Long Island shore produced 20 netsinkers (Smith 1950:127). Descriptions of seines from 70 to 80 fathoms in length (420-480 ft) using notched stone netsinkers and small sticks for floats date to the early Dutch settlement. Indians also caught fish "in little set nets, six or seven fathoms long, braided like a herring net. They set them on sticks in the river, one and one-half fathoms deep" (Skinner 1915:42-43). The colonists continued net fishing in the Hudson, as indicated by an indenture of 1785 assigned to Philip Van Cortlandt: "the privilege of having a fishing seine or net drawn for fish during every fishing season" (Anonymous, 1785).

Larger fish like sturgeon could be harpooned or speared. Only a few bone harpoon fragments have survived. One harpoon - 8.5 cm (long) from a shell midden site in Manhattan - featured a hole for rope attachment (Skinner 1920:190). Another bone harpoon (12.25 cm long and a harpoon fragment were recovered at Rabuilt Cave (Vargo and Vargo 1920:190).
Scharf reports:

"...fishhooks, pointed fish gorges, and harpoons, all made of bone, have been found in great numbers on Owasco and Iroquois sites" (Kraft 1986:152).

6. Fish Weirs in the Hudson?

Fish weirs are structures designed to impede the movement of fish while permitting water to continue along its path. They were positioned in rivers, at shorelines or confluences. Often combined with fish traps or nets, they permitted the catching of larger quantities of fish than was possible with lines, gorges, and hooks. The fish could be removed from weirs with spears, leisters, nets, or baskets. Some weirs were constructed of rocks in rivers and arranged to guide fish into narrowing traps. They could also be combined with wickerwork and eel pots (Kalm 1937:423-424). Other weirs were built of wooden stakes like those in Maine (Peterson et al. 1994), Boylston Street in Boston (Johnson 1942), and Virginia (Hariot 1588). In these, saplings were forced into the silt. The space between stakes may have been filled with wattle, sometimes strengthened with stone. The stakes found at Sebasticook in Maine were 5-12 cm thick and 1-2 m high. Construction and maintenance of weirs required many hands to coordinate the effort. It has been estimated that "...30-60 person days or more may have been necessary for a 60 m (+) long section of weir..." (Peterson et al. 1994:216). The use of fish weirs may well reach back past the Early Archaic period. Bones of shad and eel have been dated to about 8000 B.P. in the Connecticut River drainage, although the specific technology of taking them is unknown (Peterson et al. 1994:216). The Boylston Street weir in Boston is dated between 4910 and 4500 B.P. (Lavin 1988:104), but stone weirs were much simpler to construct and most likely preceded such wood stake installations in the Northeast. Early New Amsterdam colonists also noted that Indians used weirs to take fish (Van der Donck, 1968). On Eastchester Bay, Skinner explored an Indian village site at Weir Creek Point (Kraft 1986:109). He also observed that, "In a few localities... stone fish weirs built up across the streams... may still be found" (Kraft 1915:109).

It is difficult to date the stone fish weirs in the Croton river or to ascertain their native origin. Nevertheless, Scharf reports:

...in 1697 when the (Cortlandt) Manor was erected, except (for) a few white people near the mouth of the Croton... the whole Manor was occupied by the Indians. True, their title to the lands had been duly purchased, but, as in almost all Indian purchases, a right to hunt and fish...and plant corn, was practically reserved by the Indians [Scharf 1886:124].

The presence of other unspecified weirs in the area was also noted (French 1925:17). It seems unlikely that Stephanus van Cortlandt who established the manor as a fur trading post would have built fish weirs 25 km from it. It would have been important for native inhabitants of the area to trap, net, and preserve river fish like perch and catfish or the striped bass. These anadromous species traveled in their periodic runs up the Hudson estuary and into fresh water streams like the Croton to spawn.

Weirs, like nets, failed to enter the archaeological record in the lower Hudson Valley. They may have been associated with oyster-processing stations like Dogan Point, Piping Rock, Wickers Creek, Inwood, Weir Creek Point, and Tottenville, but no prehistoric weirs have so far been identified in the lower Hudson River itself. They were probably located on flats and shoals and are now covered by silt as the river grew wider with rising sea levels.

7. But Where Are the Fish Bones?

If fish were consumed regularly for thousands of years, what would account for the scarcity of ancient fish bones in the archaeological record? One major factor may be the use of large-grid screens by archaeologists, which permitted fish bones to slip undetected through the mesh. Such unintended loss during excavations had been noted long ago (White 1974:71). Recent research work at Dogan Point used three-decker screens with ½ in mesh on top and 1/16 in mesh at the bottom. The smallest mesh retained 84% of the fish remains (Claassen 1994:33). Taphonomic influences may promote the rapid disappearance of some skeletal materials, as indicated by Butzer, "water and gravity effects discriminate against... small fragile bones other than teeth" (1982:196).

It is also possible that ritual concepts may have included redepositing fish bones in the river. Some tribes on the West coast returned all salmon bones to the sea as a spiritual debt to the natural world (Drucker 1974:155), and the local Siwanoy returned small fish caught in nets to the water (Kazimiroff 1982:32). Small size Hudson oysters seem only to have been collected when food supplies were scarce; hence, the small percentage of oyster shells (less than 5 cm) contained in middens (Scherer 1993:30). Did the cultural beliefs of the Hudson Valley Indians include the preservation of future food supply? Such measures, deliberate or not, would tend to prevent over fishing or the exhaustion of the oyster beds.

8. Chipped Stone Tool Kit

Stone projectile points are ordinarily thought of as hunting equipment used on terrestrial game, but bone or antler points were also used. Not many of these were recovered, not even...
in the many shell middens excavated by Brennan where lime-leaching would tend to preserve faunal materials. It is likely that spears and harpoons carrying chipped stone projectiles, or those with bone points, served to impale fish or to remove them from traps or weirs. While there is no documentation of chipped stone points used on fish in the lower Hudson, such have been recorded in other areas. A harpoon with a stone point dating to the early Archaic period was recovered in New England (Fowler 1971-1972:15). In Alaska, spears used in whale hunting during Woodland periods were armed with chert blades, while Aleuts used chipped stone points and the Koniag mounted slate blades on whale darts during post-contact times (Rousselot et al. 1988:161, 172). Immunological, microwear, and other scientific tests of projectile points may yield ultimately more specific answers to stone point use in the lower Hudson area (Petraglia et al. 1996:134).

A work station south of Coxsackie dating to the Fourmile phase of Middle Woodland yielded over 200 Petalas blades possibly produced for dressing of sturgeon and game (Funk 1976:295). Most of the blades were made of Normanskill chert. Similar blades found on sites west of the Hudson River were chipped from local argillite. They were often buried near fish processing spots to be dug out for use in spring and fall (Kraft 1986:107). An unknown percentage of what have been classified as stone projectiles were likely to have been hafted and used for knives. These could also meet the dual purpose of cutting up fish or mammals. Gramly and Funk report that, "Most fluted point Paleo-Indian sites in the Northeast display a heavy predominance of locally available lithics and minor amounts of raw materials from distant sources" (1990:9). This appears to be true for subsequent periods, as quartzite and quartz vastly outnumber other materials used for points in the lower Hudson Valley.

Gouges to help fashion canoes would seem to be part of the tool kit required to exploit the waters during the Archaic period. Funk lists fifteen gouges from low-lying camps near the Hudson shores (1976:201). Woodworking tools and fire-charring were often used in the late Archaic period to produce watercraft (Kraft 1986:62), but no canoes of that period have been excavated. This craft was such an indispensable part of

Figure 2. Chest decorations of catfish bones (after Bolton 1934:96).
Figure 3. Possible fish effigies from Wickers Creek (unconfirmed). Drawn by Margerie Schaper c. 1/2 actual size.

native life that images of canoes were often part of painted house decorations (Van der Donck 1968:39). Other indications of marine-dependent lifestyle could be ornaments like the chest decoration of catfish bones described by Bolton (Figure 2) and some unidentified clay fish effigies found at Wickers Creek (Figure 3).

Conclusions

The maritime character of the lower Hudson Valley formed by the Hudson estuary, its coastal areas, and the Long Island Sound distinguishes it from inland areas of New York. The abundance of fish life in the river, the fertile oyster beds, and the countless flocks of ducks could have facilitated the adaptation by prehistoric residents to extensive fishing activities supplemented by hunting. The Indians could have met most of their subsistence needs by fishing in the river, its tributaries, coastal areas, and the sound. Although nets and leisters may have perished, "This absence can be explained if one assumes a technology based on the use of natural barriers or the construction of weirs and traps" (Brumbach 1986:38-39). Re-evaluation of subsistence priorities may challenge the unquestioned assumption that deer hunting was the primary food source of the lower Hudson inhabitants.

At present, the sparse amounts of excavated artifacts related to fishing are insufficient to allow a valid comparison with hunting to determine which of these activities supplied the larger amount of food to local residents during the Archaic and Woodland periods. But prehistoric fishing activities rather than deer hunting could conceivably account for the predominant food supply during most of the year in the lower Hudson region.

Acknowledgements

I am grateful to Dr. Thomas H. McGovern for his support of the study. I am especially indebted to Dr. Robert E. Funk who not only read my draft paper, but corrected many of my errors.
and misjudgments, adding many valuable suggestions. Discussions with Jay McManus of the NYSAA and Philip LaPorta of Hunter College stimulated additional searches. Also many thanks to the librarians at the Huntington Free Library; Jill Taylor, librarian at the Historic Hudson Valley; Diane Dallal from the South Street Seaport Museum; and Michael Cohn and Tom Lake for competent advice on fishing. Ilena Ayala and Eric Schaper supplied needed help with the computer work. Any errors of fact or judgment are solely my own responsibility. I also wish to remember the prehistoric fishermen whose lives are the subject of this study and those of them who got maimed, drowned, or killed in their pursuit of their livelihood.

References Cited

Amorosi, Thomas

Anonymous

Bailey, G. N.

Belcher, William R.

Boesch, Eugene

Bolton, Reginald Pelham

Brennan, Louis A.

Brumbach, Hetty Jo

Butzer, Karl W.

Ceci, Lynn
Claassen, Cheryl

Claassen, Cheryl (editor)

Colton, Roger and Jeanne E. Arnold

Dennell, R. W.

Drucker, Philip

Eisenberg, Leonard

1989 The Hendrickson Site: A Late Woodland Indian Village in the City of Kingston, Ulster County, NY Man in the Northeast 38:21-53.

Fiedel, Stuart J.


Fiedel, Stuart J. and Geary Zern

Finch, James K.

Fowler, William S.

French, Alvah P. (editor)

Funk, Robert E.
1976 Recent Contributions To Hudson Valley Prehistory. New York State Museum and Science Service Memoir 22, Albany.


Gramly, Richard Michael and Robert E. Funk
1990 What is Known and Not Known About the Human Occupation of the Northeastern United States Until 10,000 B.P. Archaeology of Eastern North America 18:5-32.

Harrington, M.

Hariot, Thomas

Johnson, Frederick, editor
Kaeser, Edward J.

Kalm, Peter

Kazimiroff, Theodore L.

Kraft, Herbert C.


Lavin, Lucianne

Lenik, Edward J.

Ludwig, Brian V.

Peterson, James B., Brian S. Robinson, Daniel F. Belknap, James Stark, and Laurence K. Kaplan


Petraglia, Michael, Dennis Knepper, Petar Glumac, Margaret Newman and Carole Sussman

Pousson, John F.

Ritchie, William A.

Roberts, William I. IV

Rousselot, Jean-Loup, William W. Fitzhugh and Aron Crowell

Rowley-Conwyn, Peter

Ruttenber, Edward M.
1872 History of the Indian Tribes of Hudson's River: Their Origin, Manners and Customs, Tribal and Sub-Tribal Organizations, Wars, Treaties etc. Kennikat Press, Port Washington N.Y.

Salwen, Bert
Schaper, Hans F.
1997 Undocumented prehistoric artifacts from the Lower Hudson Valley. Database in possession of the Louis A. Brennan/Lower Hudson Valley Chapter, NYSSA, Malfa, Katonah, N. Y.

Scharf, J. Thomas

Schuldenrein, Joseph

Skinner, Alanson

Smith, Carlyle S.

Snow, Dean R.

Speck, Frank G., Royal B Hassrick and Edmund S. Carpenter

Tuck, James A.

Van der Donck, Adrian

Vargo, Jack and Donna Vargo

White Richard S. Jr.

Zern, Geary
Woodland Period Subsistence at Lamoka Lake:
Animal Bones from the Buffalo Museum of Science Excavations

T. Cregg Madrigal, Department of Anthropology, Rutgers University, New Brunswick New Jersey

Excavations conducted by the Buffalo Museum of Science at the Lamoka Lake Site in Schuyler County, New York in 1981 and 1987 resulted in the recovery of faunal remains and artifacts dating to the Archaic and Woodland periods. The Woodland period assemblage, the primary focus of this article, is dominated by white-tailed deer bones, but the analysis shows that these bones have been affected by several taphonomic processes which have altered the surface condition of bones, taxonomic representation, and skeletal element profiles. There is no evidence that only high-ranking body parts of deer were transported to the site. Instead, entire carcasses were probably brought to Lamoka Lake, where they were processed for meat and marrow. Very limited seasonality data indicate that the site was occupied, at a minimum, during part of the summer or fall.

Introduction

The Lamoka Lake Site in Schuyler County, New York, is most famous for its Late Archaic component, but since its first scientific excavation, the presence of a Woodland period occupation at the site has been recorded (Ritchie 1932). In this paper I present the results of the first zooarchaeological study of animal bones from Lamoka Lake that date to the Woodland period occupation. These faunal remains were recovered during excavations by the Buffalo Museum of Science in 1981 (Gramly 1983) and 1987, and were analyzed as part of a study of Late Archaic subsistence in central New York (Madrigal 1999).

The Lamoka Lake Site is located on the Glaciated Allegheny Plateau on the eastern shore of a small stream about 1.1 km long that connects two small, shallow, weedy lakes: Waneta Lake to the north and Lamoka Lake to the south. Originally, Waneta Lake drained south through the stream to Lamoka Lake, which drained south into Mud Creek, a tributary of the Cohocton River.

Previous Archaeological Research

The Lamoka Lake Site is estimated to cover about one hectare, with the most intensively occupied portion of the site covering 0.4 ha (Ritchie 1969:71). The Rochester Museum of Arts and Sciences (now the Rochester Museum & Science Center) conducted excavations supervised by William Ritchie from 1925 to 1928 (Ritchie 1932). In 1958, Ritchie, by then at the New York State Museum, excavated five trenches in association with palynological studies of Lamoka and Waneta Lakes conducted by Clair Brown. Ritchie's 1962 excavations exposed over 140 sq m in the northern portion of the site (Ritchie 1969:69). No further professional excavations were conducted at the site for almost twenty years. In 1981 and 1987, R. Michael Gramly, then of the Buffalo Museum of Science, excavated two 1 m x 4 m trenches in the western portion of the site near the shore of the stream (Gramly 1983, and personal communication 1993). Soil was screened through 6.4 mm (1/4 in) mesh. Abundant artifacts, bones, and macrobotanical remains dating to the Late Archaic and Middle Woodland periods were recovered. The most recent excavations at the site were conducted by a Utica College field school led by Tony Luppino in 1991. The field school excavated over 60 sq m to a depth of over one meter. All deposits and artifacts were attributed to the Late Archaic period.

Three main stratigraphic units have been identified at the site. The uppermost is a light-colored topsoil or plow zone, described as a light clay loam with few artifacts, approximately 30-46 cm thick. Woodland period artifacts are sometimes found in this level, especially in the northern portion of the site (Ritchie 1969:42).

Beneath the plowzone is the thick black midden deposit, which in some areas extends to a depth of over 1.2 m. Ash lenses, sand lenses, hearths, and other features were found throughout the midden. The dark midden overlies the subsoil, a grayish or light tan sand and gravel mix (Ritchie 1932:85, 1969:71). The subsoil had an irregular, uneven surface, due apparently to both intrusion by pit features and to natural depressions created by tree throws and rodent disturbance.

Gramly's 1981 excavation on the western edge of the site adjacent to the stream recorded a different stratigraphy. The lower 80 cm were below the water table and sterile deposits were reached at one meter. The uppermost stratum, reaching a maximum depth of 40 cm, is a loose brown soil containing Late Archaic and Historic artifacts. Gramly identifies this as slopewash that accumulated after historical period cultivation of the area began. Beneath the slopewash was a layer of "very
dark gray or black, peaty A soil” (Gramly 1983:130), averaging 40 cm thick and containing Woodland period artifacts. Beneath the peaty soil was a layer of “grayish brown silty sands - apparently lake or stream deposits. Capping this zone was a 10 cm layer of flat limestone pebbles intermixed with large animal bone fragments and Late Archaic artifacts. The black peaty zone "...lay unconformably upon this shingle or rubble. The rubble appears to be a lag deposit minus fines which had been removed by waves and currents” (Gramly 1983:136).

The 1981 test excavation by the Buffalo Museum of Science (Gramly 1983) recovered 700 artifacts, including a small number of historic period artifacts from the uppermost layer. Woodland period artifacts from the dark gray silty sand include Levanna and Jack's Reef points and 142 potsherds, only three of which could be identified; these include one Jack's Reef Corded, one Point Peninsula Corded, and a third sherd with a "coarse cord -malleated exterior with horizontal and oblique cord impressions" (Gramly 1983:133). Gramly attributes this strata to the Kipp Island to early Owasco phases (c. seventeenth century A.D). Butternut (Juglans), wild cherry (Prunus), plum (Prunus), and arrowwood pits, as well as twigs, branches, and roots, were found in this level (Gramly 1983:133). Additional artifacts were found during the 1987 excavations but have not yet been studied.

Zooarchaeology
Buffalo Museum of Science Faunal Assemblage

The entire faunal assemblage contains 10,808 specimens. Based on stratigraphic information and associated artifacts, bones were divided into four temporal groups: Late Archaic, Woodland, Mixed, and Unprovenienced. The last group includes all teeth from the 1981 excavation, which had been accidentally combined in the same bag during initial processing (see Gramly 1983), and a small number of other specimens. The Late Archaic sample was chosen for the most detailed analysis. All minimally identifiable bones were measured and checked for modification marks using a 10x hand lens. All medium mammal long bone fragments were also measured and examined for marks. Minimally identifiable bones from the other time periods were examined using the same methods as for the Late Archaic, with the exception that medium mammal long bones were not measured or examined for marks. Unidentifiable bones from all contexts were counted and checked for burning.

The greatest number of bones, 8,076, date to the Woodland period; 1,298 are attributed to the Late Archaic; 1,217 are from mixed levels; and 217 are unprovenienced. A total of 21 taxa were identified from all levels. These include three reptiles, five birds, and 13 mammal species. Only one taxa, the domestic dog (Canis familiaris) was found exclusively in the unprovenieneced sample, where it is represented by a single tooth. Many bones could only be tentatively assigned to a specific taxa. These are indicated by a "cf." designation in Table 1, but are combined with the more firmly identified bones in the text.

White-tailed deer is easily the most abundant animal in the assemblage, and the vast majority of bones identified as medium mammal are almost certainly also from deer. Therefore, in the following discussion, identified medium mammal axial bones are combined with the deer bones for the study of skeletal part profiles. Skeletal part profiles were quantified using Number of Identified Specimens (NISP), Minimum Number of Individuals (MNI), Minimum Number of Elements (NINE), and Minimum Animal Units (MAU). NINE is determined for each element without regard to side. For example, an assemblage with five left distal humeri and four right distal humeri would have an NINE of nine. NINE was also determined for long bone segments (proximal, distal, or shaft). A complete humerus, for example, would be recorded as one proximal, one distal, and one shaft segment. In fact, there were no complete deer long bones in any of the assemblages, and the humerus is the only long bone for which some specimens retained both one epiphysis and part of the shaft. MAU is calculated by dividing the NINE for each element by the number of that element in a single carcass. For example, humeri and other long bones would be divided by two because each animal has a left and a right of each long bone, but deer first phalanx MNE would be divided by eight, because each of the four limbs has two first phalanges.

Deer bones provide limited evidence for seasonality. Three antler fragments and two frontals came from the Woodland context, but the antlers do not provide any definitive information on seasonality. Both of the Woodland frontals have pedicles, but because of severe surface abrasion, it is not possible to say with certainty whether the antlers had been shed. Epiphyseal fusion data (Table 2) indicate an emphasis on yearling and adult deer, although three unfused second phalanges indicate at least one deer younger than five to eight months old, most likely indicating a summer-fall death.

Late Archaic Sample

The Late Archaic assemblage contains 16 taxa. Of these, deer is by far the most common species, represented by 188 of the 385 identifiable bones and at least eight individuals. The next most common species is turkey, with five bones and at least two individuals. No other species has more than two specimens or one individual. Species found in Late Archaic but not later contexts are possible blue-winged teal, possible wolf, lynx or bobcat, striped skunk, and muskrat. The Late Archaic
Table 1. Lamoka Lake animal Bone from the Buffalo Museum of Science Excavations. Number of Identified Specimens (NISP) and Minimum Number of Individuals (MNI) of Taxa by Chronological Period.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Common Name</th>
<th>Late Archaic</th>
<th>Mixed</th>
<th>Woodland</th>
<th>No Provenience</th>
<th>Total and Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NISP</td>
<td>MNI</td>
<td>NISP</td>
<td>MNI</td>
<td>NISP</td>
<td>MNI</td>
</tr>
<tr>
<td>Sternotherus odoratus</td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>cf. S. odoratus</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Terrapene Carolina</td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>22</td>
<td></td>
<td>36</td>
<td>1.43%</td>
</tr>
<tr>
<td>Vipers</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Neociconyx nocturnus</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Anas cf. discors</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Branta umbella</td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Meleagris gallopavo</td>
<td></td>
<td>5</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ectopistes migratorius</td>
<td></td>
<td>5</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>large bird</td>
<td></td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>medium bird</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Canis familiaris</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>cf. Canis lupus</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>cf. Urocyon cinereoargenteus</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Vulpes/Unus</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>cf. Vulpes/Unus</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Lynx sp.</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mephitis mephitis</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Procyon lotor</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>raccoon</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Ursus americanus</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>cf. U. americanus</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>carnivore</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>cervid</td>
<td></td>
<td>4</td>
<td>3</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ceraxus comatus</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>cf. C. comatus</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Odocoileus virginianus</td>
<td></td>
<td>172</td>
<td>8</td>
<td>104</td>
<td>4</td>
<td>482</td>
</tr>
<tr>
<td>cf. O. virginianus</td>
<td></td>
<td>16</td>
<td></td>
<td>1</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Mephitis denti</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Castor canadensis</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>cf. M. canadensis</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Marmota monax</td>
<td></td>
<td></td>
<td>6</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>cf. M. monax</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Odontomys rufescens</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sorex sp.</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>medium mammal</td>
<td></td>
<td></td>
<td>96</td>
<td></td>
<td>191</td>
<td></td>
</tr>
<tr>
<td>small mammal</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>indeterminate Mammal</td>
<td></td>
<td>58</td>
<td>2</td>
<td>30</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Total Identifiable</td>
<td>385</td>
<td>23</td>
<td>318</td>
<td>10</td>
<td>1609</td>
<td>24</td>
</tr>
<tr>
<td>Not Identifiable</td>
<td>913</td>
<td>899</td>
<td>6467</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td>1298</td>
<td>1217</td>
<td>8076</td>
<td>217</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Table 2. Lamoka Lake Animal Bone from the Buffalo Museum of Science Excavations. Summary of Epiphyseal Fusion of Deer Bone. Total = the total number of specimens with data on epiphyseal fusion. Fused = the percentage of the total number of elements that were completely fused.

<table>
<thead>
<tr>
<th>Element</th>
<th>Epiphysis</th>
<th>Late Archaic</th>
<th>Mixed</th>
<th>Woodland</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Fused</td>
<td>Total</td>
<td>Fused</td>
<td>Age</td>
</tr>
<tr>
<td>Humerus</td>
<td>Distal</td>
<td>8</td>
<td>2</td>
<td>8</td>
<td>2-8 mo</td>
</tr>
<tr>
<td>Radius</td>
<td>Proximal</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>2-5 mo</td>
</tr>
<tr>
<td>2nd Phalanx</td>
<td>Proximal</td>
<td>7</td>
<td>2</td>
<td>11</td>
<td>5-8 mo</td>
</tr>
<tr>
<td>1st Phalanx</td>
<td>Proximal</td>
<td>4</td>
<td>4</td>
<td>10</td>
<td>11 mo</td>
</tr>
<tr>
<td>Tibia</td>
<td>Distal</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>17 mo</td>
</tr>
<tr>
<td>Femur</td>
<td>Proximal</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>20 mo</td>
</tr>
<tr>
<td>All Metapodials</td>
<td>Distal</td>
<td>3</td>
<td>1</td>
<td>9</td>
<td>20-23 mo</td>
</tr>
<tr>
<td>Radius</td>
<td>Distal</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>20-29 mo</td>
</tr>
<tr>
<td>Femur</td>
<td>Distal</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>23-29 mo</td>
</tr>
<tr>
<td>Tibia</td>
<td>Proximal</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>23-29 mo</td>
</tr>
</tbody>
</table>

The fauna are discussed in more detail and compared with other Late Archaic fauna from Lamoka Lake in a separate report (Madrigal 1999).

Woodland Sample

Of the 8,076 Woodland specimens, 1,609, comprising 13 taxa, were minimally identifiable (Table 1). Once again, deer is the most common species, with 499 specimens and at least 12 individuals. In contrast to the Late Archaic sample, woodchuck (NISP=6), bear (NISP=6), and raccoon (NISP=4) are the next most common species, although no taxa other than deer has an MNI greater than one. Three of the woodchuck bones (a complete cranium, a scapula, and a cervical vertebra) are stained differently than the other bones, and this, together with their completeness and better preservation, suggest that they result from a relatively recent natural death and not the result of Woodland period occupation. Ruffed grouse and tree squirrel were found only in the Woodland assemblage. Other species found in the Woodland assemblages are musk turtle, box turtle, snake, turkey, fox, wapiti, and beaver.

Mixed Sample

The Mixed sample is similar to the Late Archaic one, although it contains two species not found in the Late Archaic sample: passenger pigeon and black-crowned night heron. There are 105 deer bones, but passenger pigeon is the only other species represented by more than one identified bone.

Unprovenienced Sample

The unprovenienced sample contains mostly loose teeth; of these, the majority (128 of 217) are deer. Dog, raccoon, fox, wapiti, and beaver were also identified. The remainder of this article focuses on the Woodland assemblage, although comparisons with the Late Archaic and the Mixed samples will be made when relevant.

Taphonomy

Abundant actualistic and experimental research has convincingly demonstrated that all bones are affected by a series of taphonomic processes from the time an animal dies until its bones are analyzed by the zooarchaeologist (Binford 1981; Brain 1981; Lyman 1994). At each stage, taphonomic agents, such as weathering, consumption by carnivores, and butchering, can modify, delete, destroy, or add to the fauna assemblage. Therefore, a taphonomically informed analysis is essential to any study of archaeological fauna remains in order to correctly understand the processes by which bones are introduced to a site, modified, and differentially destroyed or preserved, and to determine more precisely which characteristics of faunal assemblages are directly attributed to human activity. Failure to identify how non-human taphonomic factors have affected an assemblage means that it will be impossible to identify specific human behaviors that have patterned an assemblage.

All sediment from the Buffalo Museum of Science (BMS) excavations was screened using 1/4 in mesh, and all bone was saved. No flotation analysis was conducted during these excavations, so small animal remains are expected to be severely underrepresented. In fact, no fish bones are present in this assemblage, and small birds and mammals are very rare. Fish and other small bones were found, however, in a Late Archaic assemblage from a different part of the site that was excavated using identical techniques (Madrigal 1999). This suggests that the complete absence of fish remains and the paucity of
other small animal remains in the assemblage is not solely a result of excavation techniques. Many very small bone fragments are present, but these are mainly unidentifiable fragments of larger mammal bones. As discussed below, the specific characteristics of the BMS sample are more readily explained by other taphonomic processes.

Based on experimental and actualistic research, Marean (1991) has suggested that the amount of post-depositional fragmentation that a faunal assemblage has undergone can be estimated by recording the relative completeness of carpals and tarsals, which are relatively dense and are unlikely to be intentionally broken by humans. The Completeness Index (CI) is determined by "estimating the fraction of the original compact bone that is present, summing the values, and dividing by the total number of specimens" (Marean 1991:685). A high CI value does not preclude earlier carnivore ravaging of podials, nor can it be used to argue that the abundance of podials accurately represents the original assemblage deposited by humans; the use of the CI is based on the observation that while carnivores often destroy podials, those that survive ravaging are relatively complete (Marean 1991). The BMS assemblages have greater evidence of post-depositional fragmentation than do the other Lamoka assemblages (Madrigal 1999). The Mixed group has the lowest CI value (60.7%), while the Archaic (71.8%) and Woodland (70.5%) samples are slightly less fragmented. The Mixed levels appear to have been redeposited as slopewash (Gramly 1983), which may help explain its slightly lower CI value.

Several taphonomic processes, including weathering, trampling, and abrasion, can affect bones after they are discarded by humans and carnivores, but before they become buried. Bone weathering is rare, with over 96% of all bones being unweathered. Rodent gnawing is virtually non-existent, with only two specimens from the Woodland assemblage having rodent tooth marks. Only two trampling marks were identified, and these could have been caused by the movement of gravel across bone surfaces by fluvial action.

In contrast, surface abrasion, resulting in a rough (not polished) texture over the surface of most or all of the bone, is common in all contexts. It is most common in the Archaic period sample, where over three-fourths (78.8%) of examined bones have some abrasion, with moderate to heavy abrasion found on about one-third of all bones. While 70.7% of the Woodland sample are abraded, only 53.1% of the Mixed sample are similarly affected. Trampling, fluvial action, and eolian activity may all cause bone surface abrasion, but fluvial action seems to be the most likely candidate for causing the modification seen in this assemblage, especially given the context from which the bones were recovered. Abrasion is not limited to a single surface, as would be expected with eolian activity, and almost no trample marks were identified on any of the bones. Abrasion is caused by the impact of sedimentary particles carried by the water on the bone surface; however, it is also possible that some of the modification of bone surface texture may be due in part to the bones being buried in a wetter, less-well-drained sediment than were bones in the main site. The surface abrasion is likely to have destroyed most bone modification marks (Shipman and Rose 1983).

In addition to abrading bone surfaces, water can transport certain bones away from a site, or cause bones to accumulate at another site. Beginning with Voorhie's (1969) experimental study of water transport of sheep and coyote skeletons, many archaeologists and paleontologists have studied the differential transport of skeletal elements by water (Behrensmeier 1975; Korth 1979; Boaz 1982; Frison and Todd 1986; Coard and Dennell 1995). Voorhie's original study (1969) found that ribs, vertebrae, sacrum, and sternum are readily transported by water, while the skull and mandible are more resistant to transport and form a lag deposit. Other bones are intermediate in their susceptibility to transport. There are several problems with applying this and other studies to the BMS assemblage. First, while experimental studies deal with complete elements, virtually all of the Lamoka bones are fragmented. Differences in the size, weight, and shape of specimens between whole and fragmented elements will affect transport potential, so that, for example, a distal humerus fragment cannot necessarily be expected to be as susceptible to fluvial transport as a complete humerus. Secondly, experimental studies generally deal only with intrataxonomic, not intertaxonomic, variation in transport potential. The near-absence of small animal remains in the BMS assemblage may be due to the winnowing of smaller, lighter bones (including small mammal, bird, and fish) by fluvial action. Nevertheless, because it is not clear exactly how the bones of different sized animals are affected by water, a different depositional pattern between near-stream and main site contexts - such that only deer and a few medium-sized mammals were discarded near the stream - cannot be ruled out. Finally, Behrensmeier (1975) and others (Lyman 1994:172) have noted that the Voorhie's groups are related to the structural density of bones, with the most easily transported bones (ribs and vertebrae) also being the elements most susceptible to density-dependent destruction. Therefore, in a situation like Lamoka Lake, where it cannot be assumed that complete, unmodified skeletons were discarded intact, the relative abundance of different elements cannot be used, by itself, to distinguish between fluvial dispersal and other density-dependent patterning, such as carnivore scavenging.

There is scarce but definite evidence for carnivore activity on white-tailed deer bones. While only eleven deer bones exhibit carnivore tooth marks (Table 3), it is likely that many less conspicuous tooth marks were destroyed by the subse-
Table 3. Woodland Period BMS deer bones with at least one carnivore tooth mark. N = number of bones with at least one carnivore tooth mark/total number of bones examined.

<table>
<thead>
<tr>
<th>Element</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astragalus</td>
<td>2/33</td>
<td>6.1%</td>
</tr>
<tr>
<td>Calcaneum</td>
<td>3/21</td>
<td>14.3%</td>
</tr>
<tr>
<td>Humerus</td>
<td>2/36</td>
<td>5.6%</td>
</tr>
<tr>
<td>Innominate</td>
<td>3/7</td>
<td>42.9%</td>
</tr>
<tr>
<td>Mandible</td>
<td>1/1</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The Bulletin  • Number 116

quent abrasion of the bone surfaces. Neotaphonomic studies indicate that several taphonomic processes, including carnivore gnawing and consumption of bone, are mediated by the structural density of bone parts. In general, less dense bones or bone parts are more prone to destruction. There is, however, no significant correlation (r_p=0.03, p=0.886) between deer volume density (Lyman 1984) and deer and medium mammal NINE counts (Table 4, Figure 1a), suggesting that carnivore scavenging of deer bones did not play an important role in the formation of this faunal assemblage. A closer look at deer long bones provides further insight.

Marean and colleagues (Marean and Spencer 1991; Marean et al. 1992) have recently demonstrated experimentally that long bone epiphyses and axial elements are preferentially destroyed by scavenging hyenas, but long bone midshaft fragments will preserve nearly 100% of the original number of elements. Assuming that other carnivores, such as dogs, behave similarly, examination of long bone shaft fragments may therefore provide a more accurate record of the relative frequency of elements discarded by humans than do epiphyses. Because long bone midshaft fragments are so important, a deliberate effort was made to identify as many of these shaft fragments as possible to element. Although the sample size is small, there is a strongly negative but insignificant correlation between the Woodland period long bone shafts and volume density (r_p -0.42, p=0.483; Figure 1b). In contrast, a correlation using only long bone epiphyses and volume density

Figure 1. a. Comparison of Volume Density (VD) and Minimum Number of Elements (MNE) for Woodland period deer and medium mammal bone from the Buffalo Museum of Science Lamoka Lake Site faunal assemblage; b. Comparison of Volume Density (VD) and Minimum Number of Elements (MNE) for Woodland period deer long bone epiphyses from the Buffalo Museum of Science Lamoka Lake Site faunal assemblage; c. Comparison of Volume Density (VD) and Minimum Number of Elements (MNE) for Woodland period deer long bone shafts from the Buffalo Museum of Science Lamoka Lake Site faunal assemblage.
Table 4. Lamoka Lake Animal Bone From the Buffalo Museum of Science Excavations. Summary of Deer and Medium Mammal in Terms of Number of Identified Specimens (NISP), Minimum Number of Elements (MNE), and Minimum Animal Units (MAU). *px=proximal, sh=shaft, di=distal. **Rib, cervical, thoracic, and lumbar values are for medium mammals. ***VD=Volume density. Volume density and scan site from Lyman (1984).

<table>
<thead>
<tr>
<th>Element</th>
<th>BMS Late Archaic</th>
<th>BMS Mix</th>
<th>BMS Woodland</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NISP</td>
<td>MNE</td>
<td>MAU</td>
</tr>
<tr>
<td>Scapula</td>
<td>15</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Humerus, px</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Humerus, di</td>
<td>11</td>
<td>11</td>
<td>5.5</td>
</tr>
<tr>
<td>Humerus, sh</td>
<td>4</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>Radius, px</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Radius, di</td>
<td>3</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>Radius, sh</td>
<td>3</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>Ulna, px</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Ulna, di</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ulna, sh</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Metacarpal, px</td>
<td>6</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>Metacarpal, di</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Metacarpal, sh</td>
<td>5</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Carpals</td>
<td>10</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Femur, px</td>
<td>6</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Femur, di</td>
<td>2</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Femur, sh</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Tibia, px</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tibia, di</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tibia, sh</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Fibula</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Metatarsal, px</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Metatarsal, di</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Metatarsal, sh</td>
<td>6</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Patella</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Astragalus</td>
<td>19</td>
<td>15</td>
<td>7.5</td>
</tr>
<tr>
<td>Calcaneum</td>
<td>7</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Other tarsals</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>First phalanx</td>
<td>9</td>
<td>5</td>
<td>0.63</td>
</tr>
<tr>
<td>Second phalanx</td>
<td>12</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Third phalanx</td>
<td>3</td>
<td>3</td>
<td>0.38</td>
</tr>
<tr>
<td>First phalanx of the styliiform bone</td>
<td>3</td>
<td>3</td>
<td>0.38</td>
</tr>
<tr>
<td>Second phalanx of the styliiform bone</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Third phalanx of the styliiform bone</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Innominate</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Atlas</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Axis</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mandible</td>
<td>2</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Cranial</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Rib</td>
<td>4</td>
<td>1</td>
<td>0.04</td>
</tr>
<tr>
<td>Cervical</td>
<td>1</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Thoracic</td>
<td>1</td>
<td>1</td>
<td>0.08</td>
</tr>
<tr>
<td>Lumbar</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
results in a strongly positive but insignificant correlation ($r_p=0.48$, $p=0.451$; Figure 1c). These results indicate that some density-dependent patterning is present in the assemblage, but long bone shaft fragments do not appear to have been affected by this. The causes of the patterning seen in these assemblages cannot be ascertained solely through these correlations, but the differential representation of less dense epiphyses is most likely due to some combination of carnivore scavenging and fluvial transport.

Zooarchaeologists have often tried to explore hunter-gatherer transport and processing decisions by correlating skeletal element frequencies with indices of the economic utility of carcass parts (Binford 1978; Speth 1983; Metcalfe and Jones 1988; O’Connell and Marshall 1989). Plotting element frequency by utility should result in different utility curves (Binford 1978) that may be indicative of different exploitation and transport strategies. Because long bone shaft fragments from the BMS assemblage were identified as to element and used with epiphyses to calculate MAU values, the resulting skeletal part profile should be relatively immune to the effects of density-mediated attrition of skeletal elements that can affect skeletal part representation, and consequently, the shape of utility curves (Grayson 1989).

Deer whole-bone element MAU were compared to experimentally derived average net (Kcal/hour) meat and marrow yields (Figure 2a-b). Marrow net yields are based on an average of six modern deer killed in New Jersey (Madrigal and Capaldo 1999; Madrigal and Holt n.d.), while meat yield is based on the average of three deer (Madrigal and Holt n.d.). There is a strong positive correlation, significant at the 10% level, between marrow net yield and whole-bone MAU ($r_p=0.60$, $p=0.09$), but meat net yield is negatively correlated with deer MAU ($r_p=-0.23$, $p=0.49$). These results provide no evidence for the preferential transport and discard of high-ranking meat cuts at this site. Instead, it seems more likely that entire deer carcasses were transported to the site. The strong correlation with marrow net yields suggests that deer element abundances at the site are more indicative of processing techniques, specifically hammerstone fracture of long bones for marrow removal, than they are of any transport decisions.

Stone tool cut marks and hammerstone percussion marks (Blumenschine and Selvaggio 1988) can provide additional information on the butchery techniques used, but unfortunately they are rare on these bones, presumably because of the surface abrasion on most bone surfaces. Eight deer bones and two medium mammal rib bones have cut marks. Cut marks are found on two humeri and on one each - radius, femur, fibula, innominate, metatarsal, astragalus, and occipital condyle. Percussion marks are found on two femur shaft fragments, one metatarsal shaft fragment, and one medium mammal dentary fragment.
Discussion

The Buffalo Museum of Science assemblage is less well preserved than any of the other Lamoka assemblages studied (Madrigal 1999), and many bones have some degree of surface abrasion. There are many large bone fragments, and the assemblage is dominated by deer. Fluvial action has modified the surfaces of deer bones (making them less useful for modification mark studies), and perhaps removed some small deer elements. Fluvial activity may have also preferentially removed or destroyed many small animal bones, although different depositional patterns by humans and natural processes cannot be ruled out. Both species representation and deer skeletal part profiles have been affected by fluvial action and carnivore scavenging. While there is no evidence for differential transport of deer body parts to the site, long bones with higher marrow net yields appear to have been broken open more often than those bones with lower marrow yields. At a minimum, the site was occupied at least during part of the summer or fall, based on epiphyseal fusion data. While deer appear to have been a very important food source during the Woodland period at Lamoka Lake, it is not possible, using only this assemblage, to evaluate the importance of birds, fish, or small mammals.

Preserved animal bones from Woodland contexts are relatively rare in central New York and the Woodland assemblage from Lamoka Lake is one of the larger ones known. Animal bones from two other important Woodland sites in central New York have been studied by John Guilday. The Kipp Island Site is located near Schoharie in Montezuma Marsh in Seneca County. Animal bone was found in both pit features and in the marsh adjacent to living areas. Fish bones and scales were found mainly in pits, while most large mammal bone was found in the marsh, not in pits. Guilday identified 4,613 specimens and 30 species (Ritchie 1969:242-243). Bullhead catfish were the most common taxa, represented by 1,100 specimens and at least 411 individuals. A total of 741 deer bones from at least 22 individuals was also found. Other fish identified include channel catfish, walleye, northern pike, bass, and sucker. Other species identified at Kipp Island include frog, turtle, Canada goose, merganser, turkey, dog, bear, and elk. Deer bones were poorly preserved and no bone modification marks were identified (Ritchie 1969). The bone assemblage from the marsh may represent a depositional pattern similar to that of Lamoka Lake.

The Westheimer Site is located near Schoharie on Fox Creek. Bone found in stratum 3, locus 1, dating to the Woodland period was identified by John Guilday (Ritchie and Funk 1973:149). A total of 7,441 bones from at least 62 individuals was recovered. All bone was poorly preserved and fragmentary. Deer, represented by 4,567 bones and at least 49 individuals, was the most abundant animal. Based on their size, an additional 2,812 unidentified bones are probably also from deer. Other animals include moose, bear, fox, wolf, lynx or bobcat, beaver, porcupine, box turtle, painted turtle, and rattlesnake. Among deer bones, astragali are most common, followed by mandibles or teeth. Most bones had a limey coating, but seven cut marks were identified on astragali. The presence of both attached and recently shed antlers indicate a fall or winter occupation. Five fawns were identified; four of these were over six months old, while one was only one month-old. The latter indicates a summer death. Some fish vertebrae were found at the site, but they were not studied by Guilday.

The Lamoka Lake Woodland assemblage discussed here appears similar to those of the Kipp Island and Westheimer sites in that deer is very abundant. Unlike Kipp Island, no fish bones were found at Lamoka, but this may be due to the fact that no Woodland period features were excavated at Lamoka. Very little information was provided on skeletal part profiles of deer from either Kipp Island or Westheimer, so it is not possible to compare the Lamoka deer bone sample to those from other Woodland sites. However, based on this analysis, the Lamoka and Kipp Island sites seem to have similar depositional patterns, with large mammal bones deposited in or near the water, away from the main living areas. Both the Westheimer bones and those Kipp Island bones from the marsh have probably also suffered taphonomic attrition similar to that seen at Lamoka Lake.

Acknowledgements

I thank the Buffalo Museum of Science and especially Kevin Smith for allowing me to study the Lamoka Lake assemblage. I also thank Michael Gramly for discussing his excavations at Lamoka Lake with me. This research was funded by the National Science Foundation (Dissertation Improvement Grant SBR 95-22828) and by Rutgers University.

References Cited


Blumenschine, Robert J. and Marie M. Selvaggio  

Boaz, Dorothy Dechant  

Brain, C. K.  

Coard, R. and R. Dennell  

Frison, George and Lawrence Todd  

Gramly, Richard M.  

Grayson, Donald K.  

Korth, W.  

Lyman, R. Lee  


Madrigal, T. Cregg  

Madrigal, T. Cregg and Salvatore D. Capaldo  

Madrigal, T. Cregg and Julie Zimmerman Holt  

Marean, Curtis W.  

Marean, Curtis W. and Lillian M. Spencer  

Marean, Curtis W., Lillian M. Spencer, Robert J. Blumenschine, and Salvatore D. Capaldo  

Metcalfe, Duncan and Kevin T. Jones  

O'Connell, James and Brendan Marshall  

Ritchie, William A.  


Ritchie, William A. and Robert E. Funk  

Shipman, Pat and Jennie Rose  

Spleth, John D.  

Voorhies, M.  
1969  Taphonomy and Population Dynamics of an Early Pliocene Vertebrate Fauna, Knox County, Nebraska. *University of Wyoming Contributions to Geology Special Paper I*. 34
Nail Identification at Old Fort Niagara

Almon E. Leach, 15 The Common, Lockport, New York

Several thousand nails dating as far back as the seventeenth century have been recovered during archaeological investigations at Old Fort Niagara, Youngstown, New York. This paper describes a classification system for these nails based on published literature describing characteristics of nails manufactured during specific historic periods to aid in dating excavated levels. It also describes some investigations which were made, and the development of techniques for examining and classifying the nails.

Introduction

Several thousand nails spanning the time period from the earliest French explorers in the seventeenth century to modern times have been recovered at Fort Niagara. All three of the recognized major types of nails have been found: 1) handwrought nails, 2) cut nails, and 3) wire nails. There is a significant difference between the nails recovered at Fort Niagara and the nails used in the studies undertaken by Mercer (1976 [1923]) and Nelson (1968) (see Figures 1-6). These previous studies used nails recovered from old houses and dated by knowledge of the period of house construction and modification. Virtually all of the Fort Niagara nails have lain in the ground for long periods of time, some for three hundred years, whereas the nails used in the dating studies were removed from attics and other interior locations where they were protected from weathering. Therefore, the Fort Niagara nails show much more corrosion. This is not necessarily detrimental to the identification process, however, for certain nail features are actually better revealed by the corrosion (such as grain direction). Other features, such as head characteristics, are probably less easily classifiable as a result of corrosion.

Classification System

The classification chart presented here (Table 1) is the second classification chart developed during this program, and is based on literature describing past work on dating and classifying recovered nails (Bradley Smith c. 1970; Swank 1892; Mercer 1976 [1923]; Nelson 1968; Loveday 1979). This chart is intended as an aid in making a rapid, visual identification (a 10x magnifier is often a help) for entry into a computerized database for later study. In some cases, simple laboratory techniques have been utilized to aid in the classification, but, for the most part, visual examination of recovered nails is all that is necessary. The quantity of nails recovered is such that detailed laboratory examination of all of them is not possible. Table 2 is a listing of the nail types found in Table 1 showing their major characteristics and classification designations. Table 3 is a flow diagram to aid identifiers in determining classification designation. Figures 1 through 6 are illustrations of early nails, and are referred to in Table 1 as visual aids in identification.

The original classification chart (Version A) is included as Appendix A, together with a note on the use of the classification system. Version B (Table 1) evolved from Version A, and was generated by the author and Mrs. Patricia Scott, based on Mrs. Scott's extensive archaeological investigations at Old Fort Niagara. Version B makes no changes in manufacturing dates; it simplifies the coding system and arranges the codes in the chronological order of nail introduction to the commercial market. Version A is included as a matter of technical interest only; Version B should be used by anyone contemplating the classification of nails in accordance with this paper.

Handwrought Nails

There are many different subtypes of handwrought nails, but no time-related subclassifications of these nails can be made due to the lack of historical data. For nails of English origin, existing documentation does provide enough information for some use-subclassifications (National Archives of Canada 1813). These subclassifications are described in Figure 7.

Cut Nails

Cut nails have by far the largest number of subclassifications. This type of nail was invented late in the eighteenth century, and its entire evolutionary development took place during the eighteenth and nineteenth centuries. They were made by shearing tapered nails from wrought iron or steel plate, as illustrated in Figure 8. The history of this type of nail has been covered in several papers (all are included in the reference list), but not all accounts agree. The classifications shown in Table 1 have been extracted from the literature and...
**Table 1. Nail Identification Chart – Version B.**

<table>
<thead>
<tr>
<th>SQUARE OR RECTANGULAR SHANK</th>
<th></th>
<th>ROUND OR WIRE SHANK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type (B01) pre-1840</strong></td>
<td><strong>Type (B02) 1790+</strong></td>
<td><strong>Type (B19) 1873+</strong></td>
</tr>
<tr>
<td>Hand Wrought</td>
<td>Cut</td>
<td>Wire</td>
</tr>
<tr>
<td></td>
<td>Rectangular shank cross-section; two opposite faces parallel; other two faces taper to point over full length of shank. Wrought iron specimens often have woody appearance if corroded.</td>
<td>Round shank cross-section (If galvanized 1875+)</td>
</tr>
<tr>
<td><strong>Type (B03) Wrought Iron</strong></td>
<td><strong>Type (B13) Steel 1884+</strong></td>
<td><strong>Type (B20) 1873-1890 Wrought Iron</strong></td>
</tr>
<tr>
<td></td>
<td>Good machine heads. Cut opposite sides. See figure 6.</td>
<td>Woody appearance if corroded. (If galvanized 1875-1890)</td>
</tr>
<tr>
<td><strong>Type (B04) 1790-1840</strong></td>
<td><strong>Type (B09) 1840+ Grain parallel to shank (parallel grained)</strong></td>
<td><strong>Type (B21) 1883+ Steel</strong></td>
</tr>
<tr>
<td>Grain perpendicular to shank (cross-grained)</td>
<td><strong>Type (B10) c. 1840? Crude machine? heads Cut common side.</strong></td>
<td>Typical of modern wire nails, including brads.</td>
</tr>
<tr>
<td><strong>Type (B05) 1790-1830</strong></td>
<td><strong>Type (B11) 1840-1860 Crude machine heads. Poor vining (shank crushed under head). Cut opposite sides.</strong></td>
<td><strong>Type (B22) UNIDENTIFIABLE</strong></td>
</tr>
<tr>
<td>Hand-made heads. Cut common side. See figure 2.</td>
<td><strong>Type (B12) 1840-1900 Good machine head. (no shank crushing). Cut opposite sides. See figure 6. (If galvanized, 1875-1900).</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Type (B06) 1810-1830</strong></td>
<td><strong>Type (B15) 1796-1810 Wrought iron. Grain perpendicular to shank. Hand-made. See figure 4.</strong></td>
<td></td>
</tr>
<tr>
<td>Hand-made heads. Cut opposite sides. See figure 2.</td>
<td><strong>Type (B16) 1810-1840 Wrought iron Grain perpendicular to shank. Machine made. See figure 5.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Type (B07) 1815-1840</strong></td>
<td><strong>Type (B17) 1840-1900 Wrought iron. Grain parallel to shank. Machine made. Cut opposite sides. (If galvanized 1875-1900)</strong></td>
<td></td>
</tr>
<tr>
<td>Crude machine heads. Poor vining (shank crushed under head). Cut common side. See figure 3.</td>
<td><strong>Type (B18) 1884+ Steel. Grain parallel to shank. Machine made. Cut opposite sides.</strong></td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. Some typical handwrought nail types (after Nelson 1968). Diagrams courtesy of the American Association for State and Local History. All rights reserved.
Figure 2. Early cut nails with handmade heads (after Nelson 1968). Diagrams courtesy of the American Association for State and Local History. All rights reserved.

Figure 3. Early machine-headed cut nails (after Nelson 1968). Diagrams courtesy of the American Association for State and Local History. All rights reserved.

Figure 4. Early cut nails with handmade heads (after Nelson 1968). Diagrams courtesy of the American Association for State and Local History. All rights reserved.

Figure 5. Completely machine-cut sprigs and brads (after Nelson 1968). Diagrams courtesy of the American Association for State and Local History. All rights reserved.
were selected on the basis of visual characteristics of recovered nails. These classifications are of course subject to revision as the study progresses.

Early cut nails (type B04) were made with the wrought iron grain flow perpendicular to the nail shank axis. Both Nelson (1968) and Keene (1972) point out that the slag inclusions in the nails caused them to break during clinching, thereby making them inferior to handwrought nails for this purpose. It is probable that they also had a tendency to break even during normal driving. These early cut nails were probably regarded as a cheap, inferior substitute for handwrought nails. Grain flow direction is usually rather easily determined in Fort Niagara nails made of wrought iron, as exposure to ground corrosion has outlined the elongated slag inclusions.

In examining cut nails for classification in accordance with the system represented by Table 1, it is important to distinguish between nails sheared from opposite sides of the nail plate and those sheared from a common side. When cut nails were first manufactured, the usual practice was to advance the nail plate through the shearing operation, shearing the nails from a common side (Figure 8). This was the simplest mechanical operation, but one which did not lend itself readily to automatic heading. Thus, early cut nails continued to be hand headed. It was not until the development of nail cutting machines that flipped the nail plate between

---

**Table 2. Outline of Version B Nail Typology for Old Fort Niagara Nails.**

<table>
<thead>
<tr>
<th>II. CUT (other than brads, sprigs, lath nails, L-head)</th>
<th>B02</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1790+)</td>
<td></td>
</tr>
<tr>
<td>A. WROUGHT</td>
<td></td>
</tr>
<tr>
<td>(1790-1900+)</td>
<td></td>
</tr>
<tr>
<td>1. Cross grain (grain perpendicular to length)</td>
<td></td>
</tr>
<tr>
<td>(1790-1840)</td>
<td>B04</td>
</tr>
<tr>
<td>a. Hand made head - Cut common</td>
<td></td>
</tr>
<tr>
<td>(1790-1830)</td>
<td>B05</td>
</tr>
<tr>
<td>b. Hand made head - Cut opposite</td>
<td></td>
</tr>
<tr>
<td>(1810-1830)</td>
<td>B06</td>
</tr>
<tr>
<td>c. Crude machine head - Cut common</td>
<td></td>
</tr>
<tr>
<td>(1815-1840)</td>
<td>B07</td>
</tr>
<tr>
<td>d. Crude machine head - Cut opposite</td>
<td></td>
</tr>
<tr>
<td>(1820-1840)</td>
<td>B08</td>
</tr>
<tr>
<td>2. Parallel Grained (grain parallel to length)</td>
<td></td>
</tr>
<tr>
<td>(1840+)</td>
<td>B09</td>
</tr>
<tr>
<td>a. Crude machine head? - Cut common</td>
<td></td>
</tr>
<tr>
<td>(c. 1840?)</td>
<td>B10</td>
</tr>
<tr>
<td>b. Crude machine head - Cut opposite</td>
<td></td>
</tr>
<tr>
<td>(1840-1860)</td>
<td>B11</td>
</tr>
<tr>
<td>c. Good machine head - Cut opposite</td>
<td></td>
</tr>
<tr>
<td>(1840-1900)</td>
<td>B12</td>
</tr>
<tr>
<td>(if galvanized 1875-1900)</td>
<td></td>
</tr>
<tr>
<td>B. STEEL (Note: all have good machine heads)</td>
<td></td>
</tr>
<tr>
<td>(1884+)</td>
<td>B13</td>
</tr>
<tr>
<td>III. CUT (headless brads, spigs, lath nails, L-head)</td>
<td></td>
</tr>
<tr>
<td>B14</td>
<td></td>
</tr>
<tr>
<td>A. WROUGHT</td>
<td></td>
</tr>
<tr>
<td>1. Cross grain (grain perpendicular to length)</td>
<td></td>
</tr>
<tr>
<td>a. Handmade</td>
<td></td>
</tr>
<tr>
<td>(1796-1810)</td>
<td>B15</td>
</tr>
<tr>
<td>b. Machine made</td>
<td></td>
</tr>
<tr>
<td>(1810-1840)</td>
<td>B16</td>
</tr>
<tr>
<td>2. Parallel grained (grain parallel to length)</td>
<td></td>
</tr>
<tr>
<td>a. Machine made – cut opposite</td>
<td></td>
</tr>
<tr>
<td>(1840-1900)</td>
<td>B17</td>
</tr>
<tr>
<td>(if galvanized 1875-1900)</td>
<td></td>
</tr>
<tr>
<td>B. STEEL</td>
<td></td>
</tr>
<tr>
<td>1. Appears grainless</td>
<td></td>
</tr>
<tr>
<td>a. Machine made – cut opposite</td>
<td></td>
</tr>
<tr>
<td>(1884+)</td>
<td>B18</td>
</tr>
<tr>
<td>(if galvanized 1875+)</td>
<td></td>
</tr>
<tr>
<td>IV. WIRE (1873+)</td>
<td>B19</td>
</tr>
<tr>
<td>A. WROUGHT IRON</td>
<td></td>
</tr>
<tr>
<td>(1873-1890)</td>
<td>B20</td>
</tr>
<tr>
<td>(if galvanized 1875-1890)</td>
<td></td>
</tr>
<tr>
<td>B. STEEL (including modern brads)</td>
<td></td>
</tr>
<tr>
<td>(1883+)</td>
<td>B21</td>
</tr>
<tr>
<td>V. UNIDENTIFIABLE</td>
<td>B22</td>
</tr>
</tbody>
</table>
“Flattened” shanks (an approximate constant rectangular cross-sectional shape in the upper shank). Made to hold fast without opening the wood, especially used where liquid is to be contained (gutters, liquid vessels).

Clasp heads – made to sink into the wood so a plane can pass over the nail (often used for boxes).

Round, flat heads, perhaps no countersink under the head; used by coopers to fasten barrel hoops.

Sprigs (headless, flat, short, tapered nails). Used for glazing windows and for sashes; slightly larger ones used for canister shot cases.

Hemispherical heads (die dog). Head made in a die; used to fasten metal to wood (hinges). Considered a decorative head.

“Clover” nails (round, flat heads with a countersink under the head). Used for fastening metal articles to wood (fastening “cloves” to axle trees).

Exceptionally large diameter heads with respect to shank length (scupper nails, bellows nails). Used to fasten leather or canvas to wood.

Dog nails (conical, 8 to 12-sided heads). Used to fasten hinges to doors. (metal articles to wood); also used on brimstone tubs.

Rose heads. General purpose nails; either flat or sharp points.

Brads (headless, flat, tapered nails). Identical to sprigs, except longer; smaller sizes may have L-heads; square points indicate “cut” nails, made at a later date.


Precise, square heads on spikes – die-made heads.

Tacks (short nails with large heads). Used for fastening paper to wood rod and for upholstery.

Figure 7. Physical features of handwrought nails (type B01) from the classification system of Table 1. Drawings courtesy of the National Archives of Canada 1813.
each shearing operation that automatic heading devices became successful. Therefore, as a general rule, cut nails that were cut from a common side preceded cut nails that were cut from opposite sides; this is reflected in the dates for cut nails shown in the table.

Figure 9 is a diagram that shows how to distinguish between shearing from opposite and common sides by determining the orientation of shear angles. Metal shears (even modern ones) will always shear at a slight angle because of the forces developed as the shear blade passes through the metal. Unless corrosion is extreme, these angles can almost always be determined by visual examination. The shank of a cut nail sheared from opposite sides will have a pyramidal cross-sectional shape, while that of a cut nail sheared from a common side will have a parallelogram cross-sectional shape. By the year 1840, industrial equipment was capable of producing wide sheets of wrought iron, so that strips perpendicular to the rolling direction could be sheared from the sheets for feeding into the nail-cutting machines. This method oriented the slag inclusions parallel to the nail shank and resulted in a nail that was superior to handwrought nails in every respect. Handwrought nails ceased to be made at about this time.

The Bessemer steelmaking process was invented and went into commercial use in the United States in 1860 (United States Steel Corporation 1957). The open-hearth process fol-

Figure 8. Illustration of the cut nail shearing process (after Nelson 1968: Figure 3). Diagrams courtesy of the American Association for State and Local History. All rights reserved.

Figure 9. Cut nail shank cross-section shapes—sheared from opposite and common sides.
allowed soon after and began production in 1870. Steel, now being cheaper to produce than wrought iron, soon became the ferrous material of choice for most commercial articles. Among these articles were, of course, nails.

Loveday (1979) states that the first steel cut nails were made in Wheeling, West Virginia, in 1886. Swank (1892) indicates that they were made as early as 1883. This transition to steel was undertaken by the Wheeling mills to reduce the cost of their cut nails and was remarkably successful. Loveday (1979) further states that other nail mills in the eastern United States were financially strapped and did not follow suit immediately. Swank (1892) gives these United States production figures: in 1884, steel cut nails constituted 5% of the total cut nail production (the balance being wrought iron), and by 1890, over two-thirds of cut nail production was of steel. Obviously, the transition from wrought iron to steel for cut nails occurred quite rapidly between 1883 and 1890.

Wire nails

The manufacture of wire nails began in the United States in the 1850s (Swank 1892) with the marketing of small escutcheon pins. Swank states that both wrought iron and brass were used. As early as 1873, a wire nail was advertised in Iron Age magazine and, by 1878, wire nails up to 2 1/2 in long were being advertised. Major wire nail manufacturers were organized in the early 1880s and by 1886 the cheaper wire nail began making deep incursions into the cut nail market. United States cut nail production was 8,160,973 kegs in 1886 and wire nail production was 500,000 kegs in the same year (5.8% of total nail production). A decade later in 1897, cut nail production had dropped to 2,100,000 kegs and wire nail production had risen to more than 9,000,000 kegs (81.1% of total production). By 1912, wire nail production accounted for 92% of the total nail production in the United States.

The development of inexpensive steel had a major impact on wire nails. Loveday (1979) credits the development of steel with providing the major impetus for the production of commercial steel wire nails. Wrought iron wire nails were produced and sold between 1873 and 1890, but the majority of wire nails were made of steel beginning in 1883. The practice of galvanizing (zinc coating) nails for corrosion protection began in the last quarter of the nineteenth century. According to Norris (c. 1960:4), the production of zinc was not technically feasible until 1860. He also comments on the:

... phenomenal growth of the galvanizing industry, especially in wire and roofing, which created an effective demand for zinc metal during the last quarter of the nineteenth century [Norris c. 1960:4]

Therefore, it is believed that galvanized nails were not in use at Fort Niagara before 1875.

Galvanized nails can be easily recognized when relatively new by their silvery-metallic appearance, which becomes gray for nails which have been weathered or in the ground for some time. Figure 10 shows the corrosion color of galvanized nails which have been in the ground for a period of years.

Special Tests

Visual examination is the primary technique used to classify nails according to Table 1. Furthermore, certain simple physical and chemical tests have been useful from time to time as aids to classification. These are:

1. The nitric acid test. Lead coating of nails was a common practice during the eighteenth and nineteenth centuries. It is sometimes difficult to distinguish between lead coating and galvanizing (zinc coating). A drop of concentrated nitric acid on the nail in question will quickly make this distinction (American Society for Testing and Materials 1974). Zinc will react immediately with the nitric acid, whereas lead will not react at all. Some experience with this test is desirable, because iron will also react (at a slower rate) with nitric acid.

2. The spark test. Sometimes it is desirable to know whether a nail is made of wrought iron or steel. This can be revealed by the spark test (American Society for Metals 1976) which is an easily-learned method of estimating carbon content. Wrought iron contains very little carbon, whereas the various types of steel used for nails will usually contain upwards of 0.20% carbon.
Investigative Findings

Lead-Coated Nails

During the course of screening nails recovered at Fort Niagara, it was observed that a large number of early nails had a dark gray metallic coating. This coating differed in appearance from that of galvanized nails and was found on nails which were manufactured much too early to have been galvanized. Chemical spot tests (American Society for Testing and Materials 1974) confirmed that the gray coating was not zinc. Even before identification tests were undertaken, it was surmised that the coating was lead. Lead coating could have been used to improve the corrosion resistance of the nails and prolong the life of structures (especially roofs) in which they were used. Lead could have been applied to iron nails with relative ease in a blacksmith shop, and certainly would have been in plentiful supply for use as shot at Fort Niagara.

The early nineteenth-century practice of coating nails with lead appears to have gone almost undocumented. British military and Naval records mention “tinned” nails (National Archives of Canada 1813), as does Gwilt (1982 [1867]). The term is a general one and may apply to solder- and lead-coated nails, as well as tin-coated nails. Gwilt suggests that lead-coated nails were used for a variety of purposes, including nailing lead, leather, and canvas to hardwood, and that such nails were the same as clout nails dipped in lead or solder.

Spot tests for lead were inconclusive, as the coatings had been subjected to extreme weathering conditions. A complete chemical analysis of a sample taken from coated nails was then performed by emission spectrograph and atomic absorption (Buffalo Testing Laboratories 1991). Results were:

<table>
<thead>
<tr>
<th>Element</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>0.02</td>
</tr>
<tr>
<td>Boron</td>
<td>&lt; 0.0006</td>
</tr>
<tr>
<td>Beryllium</td>
<td>&lt; 0.0006</td>
</tr>
<tr>
<td>Calcium</td>
<td>&lt; 0.0006</td>
</tr>
<tr>
<td>Chromium</td>
<td>&lt; 0.0006</td>
</tr>
<tr>
<td>Copper</td>
<td>0.06</td>
</tr>
<tr>
<td>Iron</td>
<td>Major constituent</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.03</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>0.002</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.02</td>
</tr>
<tr>
<td>Sodium</td>
<td>&lt; 0.0006</td>
</tr>
<tr>
<td>Nickel</td>
<td>0.06</td>
</tr>
<tr>
<td>Lead</td>
<td>0.2</td>
</tr>
<tr>
<td>Silicon</td>
<td>0.2</td>
</tr>
<tr>
<td>Tin</td>
<td>&lt; 0.0006</td>
</tr>
<tr>
<td>Titanium</td>
<td>0.002</td>
</tr>
<tr>
<td>Vanadium</td>
<td>&lt; 0.0006</td>
</tr>
<tr>
<td>Tungsten</td>
<td>&lt; 0.002</td>
</tr>
<tr>
<td>Zinc</td>
<td>&lt; 0.0006</td>
</tr>
<tr>
<td>Zirconium</td>
<td>&lt; 0.0006</td>
</tr>
<tr>
<td>Gold</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Iron was found to be a major constituent, as expected, with 0.2% lead and 0.2% silicon present. Eighteen other metallic elements were present in much smaller, insignificant amounts. Inasmuch as lead cannot be alloyed with iron to any significant extent (American Society for Metals 1973), the lead found could not have been in the iron of the nail; it could only have been in the coating. With virtually no tin present, the coating could not have been conventional solder. The silicon present can be accounted for by the silica inclusions always present in wrought iron. This analysis is considered satisfactory evidence that the coating was lead and that the coating sample collected contained considerable residue of corroded wrought iron.

Figures 11 through 13 consist of photographs of several lead-coated nails. With practice, lead coating can usually be distinguished from zinc by visual methods. The concentrated nitric acid test can be used for confirmation if necessary.

Examination of nails recovered at Fort Niagara to date indicate that the practice of coating nails with lead was very common and used over a period of years. Over two-thirds of all cross-grain cut nails (manufactured between 1790 and 1840) recovered from one particular test unit had been lead-coated. In addition, many handwrought nails were also lead coated, as well as a substantial number of straight-grain cut nails manufactured after 1840. In fact, it appears that lead coating continued on a somewhat sporadic basis almost up to the time that galvanized nails became available.

The precise date when lead coating started is not known, but it seems to have been well before 1796, while the fort was still under English control. Perhaps it was a practice brought by English troops and continued by Americans after 1796.

Unusual Surface Coatings

Two unusual coatings have been found on nails recovered from the ground at Fort Niagara:

1. A bright red, powdery, adherent coating, probably an oxide of lead (Pb₂O₄). Figure 14 illustrates examples.
2. A silvery metallic coating, found less frequently. This coating is tightly adherent and almost has the appearance of modern chromium plating. It is particularly unusual in that it is obvious that considerable corrosion (or erosion) took place before the coating came to be in place on the nail. This coating sometimes occurs on the same nail as the red coating described above and is illustrated in Figure 15.

Recovered nails having the above coatings are predominantly types manufactured during the period that nails are known to have been lead-coated, so it is difficult not to assume a relationship between an original lead coating and the above secondary coatings.
A puzzling question was: how could a metallic lead coating be converted to an oxide of lead (PbO₂)? And why on some nails and not on others? Lead has been used for many years for its excellent corrosion resistance to atmospheric conditions. Its behavior under a wide variety of conditions has been studied and documented (American Society for Metals 1987). In no case has an example been recorded of lead being converted to its oxide by exposure to any type of atmospheric condition at normal temperatures. Lead salts are the usual corrosion product under normal atmospheric conditions.

There is, however, a condition under which a coating of lead on a nail might be expected to react to become its oxide — being subjected to high temperatures. It is possible that those nails having a powdery coating of red lead oxide were in a building that burned, or were in a building that was deliberately demolished and then burned.

An experiment was carried out to determine if this could be verified. The experiment consisted of coating modern nails with lead and then exposing them to a wood fire. Both reducing and oxidizing conditions would exist for nails in a burning building. Lead coated nails driven into a heavy timber not totally consumed by a fire would be under reducing conditions throughout the fire (the nails would be closely surrounded by carbonaceous material at all times); lead coated nails which were loose or driven into light timber totally consumed by fire would be under oxidizing conditions after they became free in the fire. Both states would have to be provided by the experiment. Therefore, Lead-coated nails were subjected to a wood fire under these conditions:

1. Driven into a heavy timber that was allowed to char and reach red heat, but was removed and allowed to cool with the nails still in place.
2. Driven into a thin piece of wood that was totally consumed, the nails then becoming loose in the fire.
3. Placed loose in the fire.

These nails are shown in Figure 16. Results were as follows. The lead coating of nails still in place (condition 1 above) (Figure 16a) had been remelted into globules, but was still bright metallic in appearance and had not been oxidized, as expected. The lead coating of nails freed from the wood by burning (condition 2) (Figure 16b) had very apparent traces of bright red lead oxide, identical in appearance to the powdery red coating found on some of the excavated nails. The lead
coating of nails placed loose in the fire (condition 3) (Figure 16c) had disappeared and was replaced with black iron oxide. The results of this experiment provide evidence that the red coating found on recovered nails was caused by their having been lead-coated before being burned in a building or trash fire. It is believed that the silvery coating is similar in origin to the red coating in that it is the result of a lead-coated nail having been in a heavy timber exposed to, but not totally consumed by fire. The coating would have been remelted - probably heated to a temperature well above its melting point where it could dissolve and erode a significant amount of iron from the nail - and then re-solidified on the nail without having been oxidized.

Another factor serves to strengthen this rationale concerning the origin of these coatings. The nails shown in Figure 14 were recovered from a site (Test Unit 361) near the foundation of a barracks (Building 464 [Dunnigan and Scott 1991]) built in 1807-1810 (B04 nails would have been used for construction). The nails shown in Figure 15 were recovered from a site (Test Unit 411) within the foundation of a seawall blockhouse (Building 469 [Dunnigan and Scott 1991]) built in 1842 (A0005 nails would have been used for construction). It is important to note that both of these buildings were burned to the ground on May 19, 1850 in a catastrophic fire which destroyed a hospital as well.

Metallographic Examination

Metallographic examinations were made of both early handwrought nails and late steel cut nails. Typical structures are shown in Figures 17 and 18. The structure of the early handwrought nail (type B01) (Figure 17) is coarse-grained, as expected, and has the elongated slag inclusions typical of wrought iron. There is no evidence of dark-etching iron carbides in the structure. This structure would also be typical of wrought iron cut nails. The structure of the steel cut nail (type B 13) (Figure 18) is fine-grained and shows a uniform distribution of dark-etching iron carbides typical of steel. There is no significant presence of inclusions. These structural characteristics are representative of steel nails made since 1884.
Table 3. Identifying Nails by Version B Types.

Note: Because many excavated nails are highly corroded, some of the attributes will be obscured.

| IF: | Four tapered sides  
|     | Grain is woody  
|     | Grain parallel to the length of shaft  
|     | Squarish shank cross section  
| NAIL IS: | **B01** (pre 1840)  
|         | hand-wrought nail or if head type known  
|         | hand-wrought, _____-headed nail  
|         | nail (hand-wrought) (_____ head)  
| IF: | Front and backs parallel to each other and only two sides taper to the tip  
|     | Can’t tell if nail is wrought iron or steel  
| NAIL IS: | **B02** (1790+)  
|         | nail (cut) cut nail  
| IF: | Front and backs parallel to each other and only two sides taper to the tip  
|     | Grain is woody  
|     | Head is broken off or indeterminate type  
| NAIL IS: | **B03** (1790-1900)  
|         | wrought iron, cut nail  
|         | nail (cut) (wrought iron)  
| IF: | Front and backs parallel to each other and only two sides taper to the tip  
|     | Grain is woody  
|     | Grain perpendicular to length of shank (cross grained)  
|     | Indeterminate shank cross section  
|     | Head broken off or of indeterminate type  
|     | Tip, if not destroyed by corrosion or use, slightly rounded  
| NAIL IS: | **B04** (1790-1840)  
|         | wrought iron, cross grained, cut nail  
|         | nail (cut) (wrought iron) (cross grained)  
| IF: | Front and backs parallel to each other and only two sides taper to tip  
|     | Grain is woody  
|     | Grain perpendicular to length of shank (cross grained)  
|     | Parallelogram shank cross section (cut common)  
|     | Head broken off or of indeterminate type  
|     | Tip, if not destroyed by corrosion or use, slightly rounded  
| NAIL IS: | **B05 or B07** (1790/1815-1830/1840)  
|         | wrought iron, cross grained, cut common, cut nail  
|         | nail (cut) (wrought iron) (cross grained) (cut common)  
| IF: | Front and backs parallel to each other and only two sides taper to tip  
|     | Grain is woody  
|     | Grain perpendicular to length of shank  
|     | (cross grained)  
|     | Parallelogram shank cross section (cut common)  
|     | Handmade irregular head  
|     | Tip, if not destroyed by corrosion or use, slightly rounded  
| NAIL IS: | **B05** (1790-1830)  
|         | wrought iron, cross grained, cut common,  
|         | handmade _____-headed, cut nail  
|         | nail (cut) (wrought iron) (cross grained) (cut common) (hand headed) (_____ head)  
| IF: | Front and backs parallel to each other  
|     | only two sides taper to tip  
|     | Grain is woody  
|     | Grain perpendicular to the length of the shank  
|     | (cross grained)  
| NAIL IS: | **B06** (1810-1830)  
|         | wrought iron, cross grained, cut opposite,  
|         | handmade _____-headed cut nail  
|         | nail (cut) (wrought iron) (cross grained) (cut opposite) (hand headed) (_____ head)  
| IF: | Front and backs parallel to each other and only two sides taper to tip  
|     | Grain is woody  
|     | Grain perpendicular to the length of the shank  
|     | (cross grained)  
| NAIL IS: | **B06 or B08** (1810/1820-1830/1840)  
|         | wrought iron, cross grained, cut opposite, cut nail  
|         | nail (cut) (wrought iron) (cross grained) (cut opposite)  

46
Palalleogram Shank cross section (cut common)
Crude machine made head
Tip, if not destroyed by corrosion or use, slightly rounded in early ones or squared off

**Nail Is:** B07 (1815-1840)
wrought iron, cross grained, cut common, crude machine-made ——-headed, cut nail nail (cut)
(wrought iron) (cross grained) (cut common)
(crude machine made head) (___ head)

**IF:**
Front and backs parallel to each other and only two sides taper to tip
Grain is woody
Grain perpendicular to length of shank (cross grained)
Truncated pyramid shank cross section (cut opposite)
Crude machine made head
Shank crushed under the head
*Tip, if not destroyed by corrosion or use, slightly rounded*

**Nail Is:** B08 (1820-1840)
wrought iron, cross grained, cut opposite, crude machine-made ——-headed, cut nail
nail (cut) (wrought iron) (parallel grained)
(cut opposite) (crude machined made head)
(____ head)

**IF:**
Front and backs parallel to each other and only two sides taper to tip
Grain is woody
Grain parallel to length of shank (parallel grained)
Indeterminate shank cross section
Head broken off or of indeterminate type

**Nail Is:** B09 (1840+) (if galvanized 1875-1900)
wrought iron, parallel grained, cut nail nail (cut)
(wrought iron) (parallel grained)

**IF:**
Front and backs parallel to each other and only two sides taper to tip
Grain is woody
Grain is parallel to length of shank (parallel grained)
Parallelogram Shank cross section (cut common)
Crude machine made head?
Shank crushed under the head
*Tip, if not destroyed by corrosion or use, squared off*

**Nail Is:** B10 (c. 1840?)
wrought iron, parallel grained, cut common, crude machine-made ——-headed cut nail nail (cut)
(wrought iron) (parallel grained) (cut common)
(crude machine head) (___-head)

**IF:**
Front and backs parallel to each other and only two sides taper to tip
Grain is woody
Grain is parallel to length of shank (parallel grained)
Truncated pyramid shank cross section (cut opposite)
Crude machine made head
Shank crushed under the head
*Tip, if not destroyed by corrosion or use, squared off*

**Nail Is:** B11 (1840-1860)
wrought iron, parallel grained, cut opposite, crude machine-made ——-headed, cut nail nail (cut)
(wrought iron) (parallel grained) (cut opposite)
(crude machine made head) (___ head)

**IF:**
Front and backs parallel to each other and only two sides taper to tip
Grain is woody
Grain parallel to length of the shank (parallel grained)
Truncated pyramid shank cross section (cut opposite)
Good machine made head
*Tip, if not destroyed by corrosion or use, squared off*

**Nail Is:** B12 (1840-1900) (if galvanized 1875-1900)
wrought iron, parallel grained, cut opposite, good machine-made ——-headed, cut nail nail (cut)
(wrought iron) (parallel grained) (cut opposite)
*good machine made head* (___-head)

**IF:**
Front and backs parallel to each other and only two sides taper to tip
Made of steel (no apparent grain)
Truncated pyramid shank cross section (cut opposite)
Good machine made head

**Nail Is:** B13 (1884+)
steel, cut opposite, good machine-made ——-headed, cut nail
nail (cut) (steel) (cut opposite) (good machine
made head) (___-head)

**IF:**
Front and backs parallel to each other and only two sides taper to tip
Grain is woody
Appears to be a brad, sprig, lath nail, or L head
Can’t tell anything else about the nail

**Nail Is:** B14
cut, brad or cut sprig or cut lath nail or cut L-head
nail (cut) (brad) or nail (cut) (sprig) or nail (cut)
(lath nail) or nail (cut) (L-head)
Acknowledgements

The author wishes particularly to acknowledge the invaluable advice and assistance of Mrs. Stuart Scott in revising the classification chart from Version A to Version B. Also, this work could not have been accomplished without the support and guidance of Mr. D. S. Knight and Dr. and Mrs. Stuart Scott through the volunteer group participating in the archaeology program at Old Fort Niagara.

References Cited

American Society for Metals

American Society for Testing and Materials

Bishop, J. Leander

Bradley Smith, H. R.

Buffalo Testing Laboratories

Dunnigan, Brian Leigh and Patricia Kay Scott

Gwilt, Joseph

Keene, John T. Jr.

Loveday, Amos J. Jr.

Mercer, Henry C.

National Archives of Canada
1813 British Military and Naval Records "C" Series, Board of Ordnance, Memoranda. 17 March 1813. A Description of the Nails.... 17 March 1813 (RG 8, I, “C” Series, Volume 1433: Microfilm Reel C-3787).

Nelson, Lee H.

Norris, James D.

Swank, James M.

United States Steel Corporation

Addresses
American Society for Testing and Materials
1916 Race Street
Philadelphia, Pennsylvania 19103

American Society for Metals
Metals Park, Ohio 44073

Buffalo Testing Laboratories
902 Kenmore Avenue
Buffalo, New York 14216
Appendix A

The chart below is the original classification chart (Version A). The coding system used for the chart was as follows. Each nail type on the chart was given a two-digit code number: 01 through 17. An individual nail classification was expressed as the chart issue letter and a four-digit code number, A0001, A0002, etc. If a nail's identification was a certainty as one of the two-digit codes, that code number became the last two digits of the four-digit code (i.e., A0001, A0014). If, however, a nail was badly corroded or fragmented (as is usually the case) and could only be identified as one of several possible types, then the four digit code was used to indicate a range of types. For example, a shank fragment that is clearly a cut nail with grain direction parallel to the shank could be classified as type A1013, showing that it belonged somewhere between codes 10 and 13. Its date of manufacture would be after 1840.

### SQUARE OR RECTANGULAR SHANK

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Hand-Wrought</td>
</tr>
<tr>
<td></td>
<td>Pre 1840</td>
</tr>
<tr>
<td></td>
<td>Usually square shank, irregular surfaces. All four shank surfaces usually</td>
</tr>
<tr>
<td></td>
<td>taper to point. Sometimes a woody appearance if corroded. See figure 1.</td>
</tr>
<tr>
<td>02</td>
<td>Cut</td>
</tr>
<tr>
<td></td>
<td>1790+</td>
</tr>
<tr>
<td></td>
<td>Rectangular shank cross-section; two opposite faces parallel, other two</td>
</tr>
<tr>
<td></td>
<td>faces taper to point over full length of shank. Often woody appearance, if</td>
</tr>
<tr>
<td></td>
<td>corroded.</td>
</tr>
<tr>
<td>03</td>
<td>Wrought Iron</td>
</tr>
<tr>
<td></td>
<td>1790-1840</td>
</tr>
<tr>
<td></td>
<td>Grain Perpendicular to Length</td>
</tr>
<tr>
<td>04</td>
<td>Handmade heads. Cut common side. See figure 2.</td>
</tr>
<tr>
<td>05</td>
<td>Handmade heads. Sprigs, brads, lath nails. See figure 4.</td>
</tr>
<tr>
<td>06</td>
<td>Handmade heads. Cut opposite sides. See figure 2.</td>
</tr>
<tr>
<td>07</td>
<td>Machine heads (heads are either out L-shaped or absent). Sprigs and brads.</td>
</tr>
<tr>
<td></td>
<td>See figure 5.</td>
</tr>
<tr>
<td>08</td>
<td>Crude machine heads. Poor vising (shank crushed under head). Cut common</td>
</tr>
<tr>
<td></td>
<td>side. See figure 3.</td>
</tr>
<tr>
<td>09</td>
<td>Crude machine heads. Poor vising (shank crushed under head). Cut opposite</td>
</tr>
<tr>
<td></td>
<td>sides. See figure 3.</td>
</tr>
</tbody>
</table>

### ROUND OR WIRE SHANK

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Wrought Iron</td>
</tr>
<tr>
<td></td>
<td>1873+</td>
</tr>
<tr>
<td>15</td>
<td>Wrought Iron</td>
</tr>
<tr>
<td></td>
<td>1873-1890</td>
</tr>
<tr>
<td></td>
<td>Sometimes woody appearance if corroded.</td>
</tr>
<tr>
<td>16</td>
<td>Steel</td>
</tr>
<tr>
<td></td>
<td>1883+</td>
</tr>
<tr>
<td>17</td>
<td>Unidentifiable</td>
</tr>
</tbody>
</table>

Grain Parallel to Length

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Wrought Iron</td>
</tr>
<tr>
<td></td>
<td>1840-1860</td>
</tr>
<tr>
<td></td>
<td>Poor vising (shank crushed under head). Crude machine heads. Cut opposite</td>
</tr>
<tr>
<td></td>
<td>sides.</td>
</tr>
<tr>
<td>11</td>
<td>Wrought Iron</td>
</tr>
<tr>
<td></td>
<td>1840-1900</td>
</tr>
<tr>
<td></td>
<td>Same as type (10), except no shank crushing and good machine heads.</td>
</tr>
<tr>
<td>12</td>
<td>Wrought Iron</td>
</tr>
<tr>
<td></td>
<td>1875-1900</td>
</tr>
<tr>
<td></td>
<td>Same as types (10) and (11), except galvanized.</td>
</tr>
<tr>
<td>13</td>
<td>1884+</td>
</tr>
<tr>
<td></td>
<td>Good machine heads. Cut opposite sides. See figure 6.</td>
</tr>
</tbody>
</table>
Local History: If It's All Written Down, Why Dig?

Ellis E. McDowell-Loudan, SUNY College at Cortland, N. Y.
Gary L. Loudan, Lamont Memorial Free Library McGraw, N. Y.

Accidental discovery of an unmarked segment of an early European-American burying ground in Homer, New York created an opportunity to gain insight into funerary practices. Study of the human remains answers some questions, but raises many others. Public interest, public education, and community cooperation are highlights of the research.

Introduction

Except for instances when historic resources appear unexpectedly in sites where the Cortland County Archeology Survey projects are located, the focus has been on prehistoric cultural resources with relevance to study of settlement patterns and subsistence activities in the area. This report represents one of those unforeseen events. It could be billed as emergency archaeology.

The Story

Tuesday, April 19, 1994, 1:15 PM.: While attending a Faculty Senate Meeting at SUNY Cortland, there was an emergency telephone call, which led to my summons from the meeting. It was the New York State Police! According to the police detective, a construction crew had been hired by the Board of Education to install an elevator in Homer Elementary School (Figure 1). The school is located on the historic Homer Green (Figure 2). The elevator shaft was inside a storage room which also gave access to the wind tunnel blower system surrounding the school. While jackhammering through 6 in of concrete in the basement of this 1925-vintage part of the school, workers broke through the concrete and underlying rubble into unmarked graves.

Police, the coroner, and numerous other officials were contacted. The coroner inspected the skeletal materials ruling out "foul play" as the cause of death. The remains predated the construction of the school, suggesting that since the school was built on the site of a meetinghouse and church with a burying ground behind it, these were probably unmarked Homer colonists' graves from the early 1800s. Homer history, however, included European settlers' reports of Native American graves a few blocks away. These burials were said to represent Native Americans who had died and been interred before the Military Tract was surveyed and colonized by New

FIGURE 1. Homer Elementary School, facing west. Entry in right background is just to the right (south) of the area beneath which the burials were found during excavation of the elevator shaft.

Englanders in the late 1700s. Indeed, a Homer resident and gerontologist at Cortland College reported that his backyard was purported to be part of the prehistoric Native American cemetery (William Lane, personal communication).

Once notified, the coroner called the State Historic Preservation Office and Public Health Office in Albany; personnel from the County Health Department, Department of Environmental Conservation, local and State Police, the District Attorney, and the school principal were notified. Someone suggested that they should consult an archaeologist, and referred them to McDowell-Loudan. Months later, we learned that the "someone" was Dr. William Starna of SUNY Oneonta, who is retained by New York State for this referral service.

The police wanted to send a squad car to pick me up and escort me to Homer immediately. They assumed that archaeological expertise would enable instantaneous determination of identity, age, sex, cause of death, and ethnic identity of the fragments of human bones.

For those familiar with physical anthropologist-turned mystery writer, Aaron Elkins' fictional "bone detective," Gideon Oliver, it is easy to imagine some of the thoughts that crossed my mind while attempting to explain the need for references and equipment (Elkins 1987, 1991). With a brief delay to gather supplies and equipment including reference materials (El-Najjar and McWilliams 1978; Brothwell 1981; Morse et al. 1983; Bass 1987), we arrived at the school about 2:30 p.m.
The Bulletin  •  Number 116

The Setting

At the school, a crowd of officials, including uniformed policemen, stood on the front porch. One patrolman was stationed inside the building, at the doorway to the storage room where the burials were located. His duty was to record all people who entered the room. By the following morning he had recorded about 30 different individuals, with age, sex, telephone numbers, addresses, and reason for entry.

The location of the human remains within a concrete block and plaster storage area was awkward and restrictive. The construction crew had been using power tools, with water spray to keep down dust and to cool their equipment as they removed a section of concrete flooring and the underlying gravel and rubble. This excavation outlined the location of the proposed elevator shaft. In its center, they had begun to shovel out the buried rubble, encountering bones. On the north and south sides of the room, in an effort to locate footers and other important structural features of the existing building, they had undercut the concrete block and plaster walls. In one of these undercut areas, they had encountered more bones.

At first, they thought the bones were from a cow or pig. Once they recognized that the bones were human remains, however, they avoided them, and contacted authorities. Presumably, this transpired in the early morning of April 19. When we arrived that afternoon, shattered fragments of skull, scattered teeth, slivers of unidentifiable bone, and some wooden fragments that appeared to be rotten and crumbly, were lying on the concrete ledge above the excavations as well as within the excavations themselves. Bits of what appeared to be human ribs were exposed, at a depth of about 6 in beneath the concrete floor, and in an area underlying the side wall and floor where the wall was undercut. Inspection of the building and its foundation showed us that when the school was built, the original ground surface level would have been approximately 5 to 6 ft above the level at which the human remains were encountered. Just by chance, these burials had been missed.

According to historical accounts of Homer (Everts et al. 1876; Smith 1885; Blodgett 1975), a meetinghouse which served as a school was located where the elementary school stands today. This earlier structure burned, the lot was leveled off, and the current school was erected (Homer Police Chief David Sampson and County Coroner Robert Howe, personal communication).

Within the excavated area in the storage room, we cleared away rubble from the center of the room to reveal the outline of a grave just beneath the fill. The teeth and skull fragments, some still in situ, but most on the ledges and scattered in the vicinity, showed that the head portion of

Figure 2. Early sketch of Homer Green, facing west from east side of Homer Avenue. Church in center is left (north) of the 1860s meeting house.
the grave had been truncated, destroying the lid of the coffin. Small bits of wood, preserved because of corroded metal fasteners, appeared, and eventually helped demarcate the contours of the wooden coffin.

Wednesday, April 20, 10:00 A.M.: After a propitiously timed appointment with an orthopedic surgeon, Dr. Jose Lopez, during which we discussed the Homer discoveries, we proceeded to Homer to continue with investigations. A policeman was still stationed at the door of the storage room, recording all who entered and continuing to follow procedures for standard forensic research. There was concern about scheduling excavations to avoid problems with the reopening of school after the Spring Recess on the following Monday. Also, it was essential to provide for our access to the building and for security of the human remains at all times. We were notified that reporters from Cortland and Syracuse newspapers had requested appointments to interview us and to gather information on the discovery. While this was to be expected, we were concerned that there should be no circus-like appearance to the work that we were doing. Fortunately, the reporters with whom we had contact were professional in their approach and cooperative in their effort to maintain the tone we wished to set. The press coverage was well researched and respectful in content.

The big question, of course, was "could these be Native Americans?" If we encountered any evidence which suggested that they were, excavation would stop immediately and Onondaga Nation leaders would be contacted. This was the arrangement we made on the telephone before we visited the site the first time. We reiterated this statement to Homer officials and the press, on numerous occasions.

Excavations had to be extended, as the many bits of bone scattered around the area were documented, placed in labeled plastic bags, and saved for analysis. Bucket after bucket of rubble that had been trucked in when the lot for the school was graded before construction in the 1920s, had to be hand-carried upstairs and outside, through a series of doors. Visitors, official and unofficial, were enthusiastic and eager to offer any assistance they could. By the end of Wednesday, we had cleared much of the rubble from the grave containing the first of the two skeletons. It was evident that the individual was a child about 4 ft tall, who had been buried in a wooden coffin, and who appeared to have been wrapped in something, possibly a shroud, which had been fastened in place, along the left side, with tiny, straight, cut-metal pins that were still quite shiny. There was a bit of green tarnish on two of the pins, including one that lay on the left innominate bone (pelvis). It had left a circular green stain there. Other metal bits, possibly nails, located at what turned out to be head and foot areas, had preserved 1 to 4 in sized fragments of wooden container through the corrosion of the fasteners.

Thursday, April 21: After morning classes, during which there was avid student interest in the news reports they had heard about emergency archaeology in Homer, we continued excavations, with on-going conferences with various powers that be. The newspaper reporters were persistent in daily calls and appearances at the site to get updates.

There were some minor, but interesting, errors in the newspaper and radio reporting which included reference to the skeleton "facing east in the Christian way," and our "excavating with dental picks, brushes, and spoons." The spoon part kept reappearing in follow-up articles, until a different reporter prepared his feature article and corrected the wording.

Friday, April 22, 8:30 A.M.: Working around classes and impending final examinations, two Cortland College honors students in archaeology, Richard Kirk and Holly Sickles, came to observe the burial excavations. They helped map the excavation area and the first of the two burials. Later in the day, when we managed to get the first child’s remains exposed, Dr. Lopez came after surgery, lay down on the dirt, refused rubber gloves or kneeler, and began to look, exclaim about the "little one," and provide the most wonderful lecture on human growth and development! He used his remarkable and gentle touch to inspect the tiny bones and to accompany his study with quiet commentary about what he was observing about the "kiddo." It was fascinating to confer about ossification processes, growth plates, bones and their proportional sizes, age estimation, and problems of determination of the sex of a child’s skeleton, while scrutinizing the individual.

During inspection of the feet of the child, Dr. Lopez noted that they were sort of squeezed into the bottom of the coffin. The more he looked, the more abnormal the shaping of the feet appeared. He offered to come back again once we had the feet cleared so that he could inspect the bone structure more closely.

Saturday, April 23: Continuing the excavations in the morning, we hoped to expose the entire burial in such a way as to document with certainty that this was indeed a European-American style of burial. We were assisted by Holly Sickles and her husband, Mark Gravino, a wooden furniture designer who is skilled in wood identification. Gravino inspected the fragments of coffin and concluded that they appeared to be hemlock in fiber structure. This interpretation correlated well with the records we had been gathering in Homer of extensive use of the prolific hemlock forest for much of the carpentry in the early village.

Dr. Lopez returned to the site with his camcorder and an excellent medical text for our use (Clemente 1987). He filmed his evaluation of the skeleton and lamented the fact that the Village of Homer did not plan to fund DNA testing on the materials to see whether more could be learned about the early population attributes of incoming New England resi-
students of the area. As he said of our knowledge of the past: "There are so many things that we still don't know!"

Once the feet had been exposed more fully, Dr. Lopez verified that the navicular and cuboid bones were deformed. The child's right foot was congenitally misshapen - a clubfoot. I noted that the right knee seemed to be enlarged, although measurement showed that the difference between the left and right knee was very minor, and consensus was that this slight enlargement might be a result of favoring the foot.

Exhumation

Sunday, April 24, 8:30 a.m.: The Homer Police Chief and the Coroner witnessed the exhumation of the first individual. Wrapped in plastic bags and cushioned with styrofoam, the remains were placed in a box for safe-keeping until further analysis and reburial could occur. The box was locked in the Archeology Laboratory at SUNY Cortland, at the request of Chief Sampson and the Coroner, Mr. Howe.

Monday, April 25: The construction crew removed the ledge above the second burial in about 30 minutes, using water spray and jack-hammers. Fortunately, they were able to remove much of their rubble enabling us to begin our work immediately after they finished. Once Burial #2 (also that of a child) was cleared of overburden, Dr. Lopez inspected it and discussed skeletal features that could be determined. Where the second individual's skull, mandible, neck vertebrae, clavicles, and scapulae should have been, there was a hole containing different soil and shattered bone fragments mixed with rubble. Initially, we thought this was due to the construction work, but closer inspection indicated that the disturbance had occurred earlier; the bones may have been missing even before the floor of the school was poured in 1925. Soil mixture within and between the two burials seemed to confirm this.

Both of the children had been buried on their backs, facing up, with feet at the east end of the grave, and legs extended. The younger child (Burial 1) had arms crossed, and hands raised with fingertips near opposite shoulders. The older child's arms appeared to have been displaced at some time, because the bones that remained were out of position and did not appear to have been raised or crossed. Although the newspapers referred to this as a "Christian burial practice," and said the individuals were "facing East," rather than "up," many societies, including Native American ones, have buried their dead in this position. The use of wooden coffins, however, was introduced into the Americas by Europeans, as we understand, and there are no records of any Native Americans having been interred in the early historic Homer Burying Ground.

When the scattered teeth and jaw fragments were removed, we took them to Dr. Jeffrey Stannard, a dental surgeon, for his inspection. Again, we were met with enthusiastic scientific interest. He noticed that the teeth belonged to two different children, not just the first child, as had been thought initially. He had his technician X-ray a mandibular ramus (the portion of the lower jaw that connects to the skull beside the ear), and was fascinated to see that it contained a forming molar without the root portion developed yet. On the basis of this information, he narrowed the estimate of age of the first child to between 6 and 7 years old, and suggested that the other teeth belonged to a slightly older individual, possibly between 9 and 11 years of age. This, too, may help us, eventually, as we try to learn the identity of the two children. Also, he loaned us an excellent dental textbook that had belonged to his father (the late Dr. Earl Stannard). It provided developmental sequences for dentition which we referred to on numerous occasions (Massler 1946).

Analysis and Conclusions

Examining all of our information, we reached the following conclusions. In the case of the first burial, the growth plates of shoulders and hips, or thin tissue layers with seams at the ends of bones, are open, reflecting the youth of the individual. This indicator of age, combined with the size of the bones themselves, the proportions of the longbones, pelvic girdle, shoulder girdle, and skull, support the age estimation of a child about 6 years old. This assumes a relatively "normal" rate of growth and development. Since there was no clear evidence of arrested growth, such as horizontal discolored lines in bones, abnormal joint size and shape, or unusual thinning or porousness of the bones themselves, this age estimate seems valid.

The cause of death could not be determined through analysis of the skeletal remains. Clubfoot is not a fatal condition, and all of the other bones and the teeth appear healthy and strong. The fractures noted in various bones show no signs of infection or healing, and appear to be post mortem breaks.

The second child's bones were slightly longer and larger, proportionately, suggesting the age of 9 to 11 years. Bone damage was much more extensive in this instance, but slightly more ossification, or bone growth, was visible.

Trying to determine the sex of the children was unsuccessful. In adults, the pelvic bones differ in height, breadth, general shape, and muscular attachment point appearance; the degree of wear and tear present at the pubic symphysis, at the front of the pelvis, can often help with differentiating between male and female (Schultz in Washburn 1963). The overall ruggedness or roughness of muscle attachments tends to contrast between the sexes, with males usually having somewhat more robust joint areas and other locations for muscle attachments. The bones of the face, and those of the mastoid region below the ear, may appear slightly larger in males than...
females, too. Skeletal remains of juveniles, however, do not reflect these attributes, in most cases. Growth and development during infancy and early childhood occur in diverse areas at different periods, with the longbones lengthening, thickening, then ossifying and becoming more robust at the articular ends, as growth in these areas becomes complete. Deterioration from burial, especially in acid soils, like the context found beneath the floor of the elementary school, tends to erase even more of the potential clues to the sex of an individual.

Lengthy illnesses, especially those correlating with high fevers for prolonged periods, or faulty diet, or congenital conditions, or serious injuries, may cause variations in the scheduling of parts of the growth and development process and may be reflected by abnormalities in the teeth and bones themselves. In the absence of soft tissue, other potential clues to causes of death or other parts of the medical history of an individual may be difficult to identify.

Perusal of the records of births and deaths in early periods of Homer’s history, shows the birth of many children in some families, with comments that some within most of these families did not survive to adulthood. Epidemics of smallpox, as well as many childhood diseases, took their toll. The evidence for these diseases may not show in the bones. Pneumonia and other bronchial conditions were common problems, too. Again, their clues would not be present in the bones unless they had been part of a long, intense period of illness coupled with poor diet, so that their effects were reflected in arrested growth and development. There did not seem to be evidence of this in either of these children.

Were these two individuals Native American children? It seems certain that they were not. The location in which they were found was definitely part of the historic Homer Burying Ground. Plotting of the buildings that existed on the site prior to the construction of the elementary school points to an overlap of recent structures and the cemetery grounds. Documentary analysis provided information about use of stone and wooden grave markers, many of which were lost as parts of the graveyard became overgrown as relatives of the deceased moved away or died. Were there special items buried with these people? The 6 year old child had a series of small metal pins along the left side of the body. These pins, according to the coroner, are characteristic of early 1800s shroud pins. Collaborating evidence came from a retired minister who said the practice was characteristic of many Roman Catholic burials in the 1800s (Oletha Williams, personal communication).

Other traits which could assist us included distinctive features of the dentition of adults (Turner 1986, 1987), but the fragments we were finding were those of children. We had upper incisors, the front teeth, and these lacked the traits of shovel-shaping which occur in high frequency in Native American and Asian populations. Another trait which might have been enlightening was the number of roots of the lower second molar. Native American and Asian populations frequently have three roots; Europeans most often have only two. In young children, however, the tooth itself can be seen in X-rays, but the roots often have not developed. This was the case with the mandibular specimen X-rayed by Dr. Stannard. Similarly, the first lower molar lacked its root or roots (one, if Native American or Asian, two, if European). The lower molars of Native Americans and Asians have six cusps (raised humps for grinding) but Europeans have only four. In this case, the X-rays showed four cusps, the European trait. Although these dental attributes are present in combination consistently, they are not universal in occurrence. However, combining all these attributes and the corresponding shapes of the two coffins, and other grave features, we concluded they were European/Caucasian children.

June 2: The skeletal remains of the two children were transferred from the SUNY Cortland Archeology Laboratory to Glenwood Cemetery, in Homer. Each child was placed in a casket, under the supervision of the coroner and Glenwood Cemetery Supervisor. The caskets were sealed by the coroner and locked in the chapel building for interment later in June, when the minister of the Homer Congregational Church performed a ceremony of reburial, and the individuals were interred in the section of the cemetery set aside for all those from the historic Burying Ground, each with a stone marker labeled “UNKNOWN.”

June 7: We were notified that fragments of a third grave had been encountered. Located west of the other two burials, this individual’s grave was about 1 ft deeper than either of the other two, and was located outside the area which was going to be disturbed for the elevator shaft or any of its construction activity, according to the contractor. Since all except the foot of this individual lies beneath the floor of the school, it was decided that the individual would be left undisturbed; the fragments of coffin, nails, and phalanges (foot bones) would be replaced in that area of the excavation, and the grave would be resealed beneath the flooring of the school.

While only the toe and foot bones were inspected, and a small fragment of rusty metal and wood fiber could be seen, this grave resembled the other two. No convincing age estimate could be given, but the toe bones did hint that the individual was an adult. This was demonstrated by the growth areas on and between these bones. The growth plates had ossified or united, suggesting that the individual was older than the other two. Growth in these areas tends to be completed between 12 and 22 years of age, and this growth had occurred.
The Questions Continue

Who were the two children? Were they related? The story that can be extrapolated from the bone fragments tells of two children, both showing sturdy young bodies, only one of which had noticeable evidence of any abnormality, a clubfoot. Even with this indicator of individuality, at a time when the medical field lacked the techniques to correct the condition, the 6 year old child appears to have grown strong bones and teeth, with normal-looking indicators of maturation, until an illness or accident ended the story. In the case of the 9 year old, again, the sturdy child appears to have grown well until something happened to cause an abrupt end to life.

Was the older individual, known only through foot bones, a third family member? Did all three die from an epidemic or shared accident, or do they represent deaths over a longer period of time? Was there a grave marker of stone or wood? Were there special items buried with these people? The first burial had the small metal pins along the left side of the body. Were all three people buried in like manner, with the pins preserved only in the first grave because of coincidentally better preservation? Why was this portion of the Burying Ground missed when the rest was moved to the new cemetery? Does this occurrence reflect (1) the location was in the oldest part of the cemetery; or (2) the individuals were ones whose relationship to others in the village did not warrant continued curation of their section of the cemetery; or (3) all of the family members in this case were lost through an epidemic leaving no one to care for that portion of the cemetery; or (4) the fact that there may have been different perceptions of what "matters after death? These questions await further study and may not be answered through existing documents.

Why dig? It is evident that all is not written down, or if it once was, many records have been lost. We may not be able to identify who these three people were. Our knowledge of them is skimpy, at present, but they are remembered and given new importance by people of today because of their rediscovery by accident in 1994. Some people from Central New York have become interested in their ancestry because of the questions raised by these events. The records of their families, previously taken for granted, may be treasured and preserved more carefully as a result of this new sensitivity.

Many Native Americans emphasize concern for their Seventh Generation to come, and for the value of oral as well as written tradition. Through these traditions, one builds on the good things and learns from past errors. Many other people assume that if and when they ever want to learn of their heritage, it's all written down and awaiting them. Less than 200 years ago, three people died and were buried in the Homer Burying Ground. We know not what the circumstances were, nor what lessons we might learn from them.

References Cited

Bass, William M.
1987 Human Osteology: A Laboratory and Field Manual.

Blodgett, Bertha E.

Brothwell, D. R.

Clemente, Carmine D.

Elkins, Aaron

El-Najjar, Mahmoud Y. and K. R. McWilliams

Everts, Ensign and Everts

Massler, Maury and I. Schour

McDowell-Loudan, Ellis E. and Gary L. Loudan
1994a Removal and Analysis of Human Remains, Homer Elementary School, Cortland County;


Morse, Dan, J. Duncan and J. Stoutamire, editors 1983 *Handbook of Forensic Archaeology and Anthropology*. Published by the Editors, Rose Printing Co., Tallahassee, Florida.


NOTE: This report has been modified from a presentation given at the 1995 annual meetings of the New York State Archaeological Association in Syracuse, and expands on the report prepared for the Cortland County Health Department and the Village of Homer (McDowell-Loudan and Loudan 1994a), and an article, published in *The Chesopiean* (McDowell-Loudan and Loudan 1994b).
**In situ Thought in Eastern Iroquois Development: A History**

Wayne Lenig, Van Epps-Hartley Chapter, NYSAA

A literature review reveals that there are many unresolved discrepancies concerning the timing and mechanics of Mohawk, Oneida, and Onondaga "tribal" development during the Late Woodland period. It is suggested that a fresh examination of regional site sequences using the "direct historic approach" might yield new insights into the chronology and processes responsible for the evolution of the historic eastern Iroquois "tribes."

**Introduction**

During the 1960s and 70s, Northeastern archaeologists reached a strong consensus that the historic eastern Iroquois, especially the Mohawk and Onondaga, were the outcome of geo-stationary cultural evolution that stretched back hundreds (some said thousands) of years. In pragmatic terms, the adoption of this so-called *in situ* hypothesis resulted in diminished archaeological interest in Middle and Late Woodland sites within the eastern Iroquois homelands. After all, researchers already "knew" that the Oneida, Mohawk, and Onondaga were the product of a long uninterrupted development from the Owasco culture. Owasco, in turn, developed directly from the Point Peninsula culture which flourished in the same geographic area since at least A.D. 700.

By the early 1980s, repetition and oversimplification had transformed *in situ* into a "buzzword" conveying a multitude of poorly comprehended assumptions. Even more appalling, archaeologists in contiguous Iroquoian areas seemed to be adopting the *in situ* hypothesis and uncritically accepting many of these assumptions. This paper was originally drafted at that juncture. It was conceived as an effort to demonstrate that all of the questions concerning eastern Iroquois development had not been answered. It was an appeal to arms - a wake-up call for researchers to recognize that things were not as obvious as some people wanted us to believe. There really was very little general agreement when one focused upon the details.

Since that time there have been several challenges to the so-called Iroquoian *in situ* hypothesis. Starna and Funk (1994) raised many important and provocative questions concerning the theoretical assumptions of conventional *in situ* thought, and Dean Snow has offered an alternative model which derives Iroquoian culture in New York from a late Middle Woodland or very early Late Woodland migration of people from the south (Snow 1995a). Starna's and Funk's concerns have gone largely unaddressed, but several researchers have challenged Snow's model, most notably Clermont (1996) and Crawford and Smith (1996).

This paper is not concerned with the questions of method and theory that Starna and Funk have raised, nor is it a critique of Snow's or any other alternatives to *in situ* Iroquoian development. It is a simple review of the development of *in situ* thought as it relates to the eastern Iroquois during the final phase of the Late Woodland period. The paper is written from a historical perspective, but the intent is to offer something more than history. By revisiting the burning issues and arguments of the past half century, it is hoped that a new generation of professional and amateur archaeologists will discover that there are still several different, and often conflicting, views of eastern Iroquois development that fall under the rubric of *in situ* evolution. The term "*in situ* hypothesis" was originally directed toward the process of transition from Owasco to Iroquois material culture. Even in this limited sense, however, the idea that there is a single hypothesis of how these things occurred does not stand up to scrutiny. The purpose of this paper is to stimulate some new interest in the timing of and processes responsible for the historic distribution of eastern Iroquois "tribes."

**The Development of Terms and Concepts**

The theory that the Mohawk evolved *in situ* from a native populace who had inhabited New York State for centuries was a radical concept when first proposed over fifty years ago. Former New York State Archaeologist Arthur C. Parker's influence was still strong in academic circles, and until his death in 1955, Parker clung tenaciously to the idea that the Iroquois were relative newcomers to the state. According to this long-established scheme, Algonquians (presumably ancestors of the Mahican, Esopus, Wappinger, and Minisink) had been the makers of the distinctive pottery vessels found on prehistoric sites in central and eastern New York. This "Algonquian-ware" was characterized by a plain, expanded or thickened lip, rather than the wide collar which appeared at the mouth of Iroquoian-ware. Decorations were
applied to the vessels before they were fired by impressing the edge of a cord-wrapped paddle or serrated stamp into the wet clay. The resulting designs were generally confined to the shoulder, neck, and lip of the pot. Unlike the smooth-bodied Iroquoian vessels, these Algonquian pots were textured over nearly the entire surface by random cord-maleation or fabric impressions. Sometime between A.D. 1550 and 1600, the Algonquians were believed to have been displaced by Iroquois invaders, the makers of the technically superior, incised-decorated, collared pots found on subsequent historic-period archaeological sites (Parker 1922 (1):70-73).

It was an elegant explanation; it accounted for the occurrence of two distinctly different types of pottery, and enjoyed the added ring of veracity provided by oral traditions which supported the notion of a recent Iroquoian migration. By the 1930s, this scheme was so widely accepted that the major archaeological problem of that day seemed to be determining the original Iroquoian homelands and routes of emigration. Since these postulated hearths were all located beyond the borders of New York State, significant advances in prehistoric Iroquoian studies awaited attention from archaeologists in neighboring states and Canada (Parker 1922 (1):98-106).

While seemingly accepting most of this migrational scheme, William A. Ritchie was uncomfortable with one point. There was simply not enough evidence to justify the use of historical ethnic labels for assemblages of prehistoric material culture. Based upon recurrent associations with non-Iroquoian stone tools and some feeble stratigraphic evidence, Ritchie deduced that most of the cord-decorated, thickened-lip pottery was earlier than the alleged Iroquoian forms. Still, the situation seemed very confusing, and data were not sufficient to correlate the corded pots with either the historic Algonquin or the Iroquoian people. Ritchie's response was to abandon Parker's historic taxonomy. In its place, Ritchie constructed an archaeological framework based upon the McKern taxonomy, that had become widely accepted in the Midwest. Most of Parker's Algonquin pottery became part of the prehistoric Owasco culture, named for the type-station at the outlet of Owasco Lake (Ritchie 1944:29-101).

The concept of an archaeological culture was expedient, but it only temporarily sidestepped the historical ethnic issue. What Ritchie's approach did provide was a much needed respite from entrenched preconceptions. During the subsequent period, archaeologists could examine Owasco culture in a more objective manner. Hopefully, continued investigation would produce evidence that could be utilized to reconstruct the processes which led to the historic distribution of Algonquian and Iroquoian people.

In 1947, Richard S. MacNeish began his doctoral research at the University of Michigan. MacNeish's topic involved the isolation and identification of distinguishing features in the material culture of each Iroquoian tribal group: How could archaeologists distinguish among Mohawk, Oneida, Onondaga, Cayuga, Seneca, Huron, Erie, and Neutral? Very quickly, MacNeish realized that ceramic cooking vessels seemed to exhibit the greatest variability of any class of artifacts from one historically recognized tribal area to the next. By October, at the annual Iroquois Conference in Allegany State Park, he unveiled the first viable system for pottery typology in the Northeast. Over 60 types were defined and their developmental sequences postulated as well as possible, given the very fragmentary and incomplete data. Specific diagnostics were proposed for most Iroquoian tribal areas as well as for Hudson Valley Algonquian pottery. Now, Northeastern archaeologists had an analytical tool with which to make comparisons.

Collaborating with Ritchie, MacNeish next turned his attention to pre-Iroquoian pottery. In 1949, their joint article was published in American Antiquity, defining 31 additional Owasco and pre-Owasco pottery types and hypothesizing an evolutionary model for their development. Here, for the first time in print, we find the suggestion that Mohawk pottery might have developed, at least in part, from the vessels of the Castle Creek and Bainbridge Owasco people of the upper Susquehanna Valley (Ritchie and MacNeish 1949).

MacNeish's study of northeastern pottery continued sporadically throughout 1948 and 1949. He visited individual collectors and archaeologists all over upstate New York and the contiguous areas of Canada. It was during this time that the stage was set for the next era of Iroquoian archaeology, for MacNeish was an excellent teacher and motivator. His enthusiasm and willingness to discuss theories and pass along the methods and techniques of pottery analysis and seriation resulted in continued high-level research and publications from enlightened researchers such as James Pendergast and Donald Lenig.

Iroquoian Pottery Types (MacNeish 1952) contributed far more than the first printed definitions of MacNeish's ceramic taxonomy. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology.

In 1947, Richard S. MacNeish began his doctoral research at the University of Michigan. MacNeish's topic involved the isolation and identification of distinguishing features in the material culture of each Iroquoian tribal group: How could archaeologists distinguish among Mohawk, Oneida, Onondaga, Cayuga, Seneca, Huron, Erie, and Neutral? Very quickly, MacNeish realized that ceramic cooking vessels seemed to exhibit the greatest variability of any class of artifacts from one historically recognized tribal area to the next. By October, at the annual Iroquois Conference in Allegany State Park, he unveiled the first viable system for pottery typology in the Northeast. Over 60 types were defined and their developmental sequences postulated as well as possible, given the very fragmentary and incomplete data. Specific diagnostics were proposed for most Iroquoian tribal areas as well as for Hudson Valley Algonquian pottery. Now, Northeastern archaeologists had an analytical tool with which to make comparisons.

Collaborating with Ritchie, MacNeish next turned his attention to pre-Iroquoian pottery. In 1949, their joint article was published in American Antiquity, defining 31 additional Owasco and pre-Owasco pottery types and hypothesizing an evolutionary model for their development. Here, for the first time in print, we find the suggestion that Mohawk pottery might have developed, at least in part, from the vessels of the Castle Creek and Bainbridge Owasco people of the upper Susquehanna Valley (Ritchie and MacNeish 1949).

MacNeish's study of northeastern pottery continued sporadically throughout 1948 and 1949. He visited individual collectors and archaeologists all over upstate New York and the contiguous areas of Canada. It was during this time that the stage was set for the next era of Iroquoian archaeology, for MacNeish was an excellent teacher and motivator. His enthusiasm and willingness to discuss theories and pass along the methods and techniques of pottery analysis and seriation resulted in continued high-level research and publications from enlightened researchers such as James Pendergast and Donald Lenig.

Iroquoian Pottery Types (MacNeish 1952) contributed far more than the first printed definitions of MacNeish's ceramic taxonomy. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, MacNeish was free to detail his own ideas about in situ ceramic typology. Unbridled from the restrictions of co-authorship, Mc...
regions of central New York. Onondaga and Oneida, he believed, were the descendents of Owasco and early Iroquois people who had inhabited the Saint Lawrence Valley in Canada and northern New York until around A.D. 1550. For uncertain reasons these Saint Lawrence Iroquoians were believed to have migrated south, splitting into recognizable Onondaga and Oneida in early historic times. The Mohawk, he reiterated, developed from the Castle Creek and Bainbridge Owasco people of the upper Susquehanna Valley, after moving northward and passing through an intermediate stage of ceramic development as typified by the Goodyear Lake, Deowongo Island, and Chance sites in Otsego and Schoharie Counties. According to this model, the Mohawks first arrived in their historic homeland in substantial numbers during late prehistoric times.

By linking Ritchie's Owasco culture and the historic Iroquois in a direct genetic relationship, MacNeish proposed a radically different concept of prehistoric cultural dynamics. Even he had to admit that the hypothesis was somewhat tentative and in need of refinement and corroboration. Yet its boldness, the hypothesis laid a challenge which would spur Iroquoian archaeology for the following forty years.

Among the first to accept the challenge was William A. Ritchie. At the Bell-Philhower Site, a multi-component Minisink village in northern New Jersey, Ritchie recognized an opportunity to investigate the prehistoric development of ceramics manufactured by a known Algonquian-speaking people. What he discovered gave reason to question some of the assumptions that had previously been made regarding the sensitivity of ceramics as indicators of ethnicity. The earlier occupation at Bell-Philhower was characterized by pottery which bore a striking resemblance to Castle Creek and Bainbridge Owasco pottery from the Susquehanna Valley. Features associated with the later occupation at Bell-Philhower produced incised-decorated collared sherds, virtually indistinguishable from defined Mohawk types. Ritchie's conclusion was that the historic Minisink were, at least in part, descended from Susquehanna Valley Owasco people who migrated to the upper Delaware in late prehistoric times (Ritchie 1949).

Thus, as the decade of the 1950s began, prehistoric cultural relationships among Owasco and Algonquian/Iroquoian ethnic groups were more confusing than ever. In eastern New York, there seemed to be good evidence that the final stage of prehistoric Owasco development in the upper Susquehanna drainage dispersed in a bifurcated pattern, giving birth to both the Algonquian-speaking Minisink of the upper Delaware, and the Iroquoian-speaking Mohawk in present-day Montgomery County, New York. On linguistic grounds, the model was untenable, but Ritchie was soon at work attempting to resolve the discrepancies.

The Chance Horizon

The Chance horizon, as originally defined by Ritchie (1952), was postulated as the earliest manifestation of material culture that could be recognized and identified as prehistoric Mohawk. Lacking 14C dates, the horizon was assigned to a relative chronological position between Castle Creek Owasco and the well-known fortified hilltop Mohawk villages, which were presumed to date in the late fifteenth or early sixteenth centuries. The temporal duration of the Chance horizon was also undetermined, although Ritchie did theorize that an earlier, as yet unrecognized (and presumably pre-Mohawk), stage of development existed between Castle Creek and the Chance horizon.

Of the five sites used to define the Chance horizon, two were located south of the Mohawk Valley in Otsego and Schoharie Counties, on the route which MacNeish believed the Castle Creek people used to immigrate to the valley. The two sites that were located within the traditional Mohawk homeland had not been excavated by Ritchie, so he was forced to rely upon questionable and inadequate samples unearthed under poorly controlled conditions. In the end, only one of these sites, Oak Hill #2 (Cnj 40), produced a trustworthy - if inadequate - ceramic assemblage. The fifth type-station was the Kingston Site (Rab 1). Located east of the historic Mohawk homeland, it is difficult to fathom just how Ritchie was proposing that this site pertained to Mohawk, or even Iroquoian development. MacNeish (1952:85) speculated that the Kingston Site might have been a prehistoric Mahican site. Despite this seemingly scanty and somewhat equivocal evidence, Ritchie perceived a pattern of ceramic development from which he tentatively advanced some very complex ideas concerning the genesis of the Mohawk people.

The Chance Horizon (Ritchie 1952) marks the first attempt by someone other than MacNeish to use the new pottery typology to define and describe a ceramic complex of proposed temporal and spatial significance. In those typological terms, the "predominant" pottery during this early Mohawk period included: Chance Incised, Durfee Underlined, Iroquois Linear, Oak Hill Corded, Goodyear Lipped, Ostungo Notched Lip, and a "new" type defined by Ritchie in this publication, Deowongo Incised. Restated in terms of attributes, Ritchie's Chance horizon pottery usually exhibits well defined low to medium height collars (less than 2½ in high) (<5.75 cm) decorated with oblique, oblique opposed, and/or horizontal linear motifs on the exterior or outward facing surface of the collar. A small percentage of vessels are collarless, with an expanded or everted lip, bearing similar design motifs on the narrow upper or outward facing surface. The majority of decoration is executed by the technique described as "meticulous fine line incising." Other less com-
mon techniques include impression with the edge of a
cordwrapped paddle or plain paddle (linear punch) and
interrupted linear - long single line elements - that are actually
made up of a series of 1 to 3 in (2.25-7 cm) long incisions
which frequently overlap slightly at either end.

None of the collared types designated as horizon
markers display the deep basal collar notches which occur
with monotonous regularity on later Mohawk pots. However,
Deowongo Incised and frequently Durfee Underlined sherds
exhibit short vertical or oblique incisions and sometimes even
shallow elliptical impressions at the collar base. These
"incipient notches" may also occur on sherds of the Oak Hill
Corded type, where they usually take the form of corded
elliptical impressions. The collarless vessels, on the other
hand, frequently bear small notches on the outer lip edge.

Neck decoration, so common on late Owasco vessels, is scarce on Chance horizon pottery. When it is
encountered, it is most frequently found on expanded-lip
forms in combination with a somewhat more elongated neck
than is typically present on the collared pots of this period.
Sub-neck decorations are not infrequent on collared pots, but
are normally confined to the bulging shoulder just below the
classically shorter and more constricted neck. Decorative techniques include fine line incising, punctuation
with various small objects and, rarely, impression with the
edge of a cordwrapped paddle. Frequent shoulder motifs
include annular bands of vertical or oblique incisions, oval or
circular punctuates, and horizontal lines. Sometimes these
elements appear in combination with each other. Filled
triangular designs, similar to the collar motifs, constitute
another popular shoulder decoration of the Chance horizon.

Vessel shapes are generally more globular than
Owasco forms, and sizes are consistently smaller than the pots
from Castle Creek sites as well as later Mohawk pots. Ritchie
finds that, like the later Mohawk vessels, the majority of
Chance horizon pots have a smooth surface treatment,
although a few exhibit check-stamping on the body below the
neck. Aplastic grog, mostly biotite mica, is finely textured and
seems to constitute a higher proportion of the paste than it did
in Owasco times. This combination of attributes often results
in giving the sherds a somewhat sandy texture.

While Ritchie assures us of the "predominance" of
the foregoing attributes and types, it is clear that other
presumably uncharacteristic sherds occur in Chance horizon
assemblages as well. Examination of trait tables reveals that
Rice Diagonal, Ostatungo Incised. Cayadutta Incised, Fonda
Incised, and other types usually considered more typical of
later stages in Mohawk ceramic development occur on all but
one of the Chance horizon type-stations. That remaining
component, the Chance Site (Shr 1), is considered, on
typological grounds, the earliest of Ritchie's proposed
sequence.

While the Chance site did not produce any of the
recognizably later Mohawk pottery types, it did yield
substantial quantities of earlier Owasco pottery in
combination with Chance horizon types. In typological terms,
Owasco Oblique, Owasco Herringbone, Owasco Platted,
Owasco Collared, Bainbridge Collared, and Goodyear Corded
were all present in the ceramic sample. Ritchie explained that
he believed these sherds to represent a "scanty" intermixed
Owasco component; consequently, he eliminated them from
his pottery analysis and trait table.

Non-ceramic artifacts that could be considered as
true horizon markers are unknown. Broad, concave base,
triangular chert projectile points, within the range of variation
noted for Ritchie's Levanna and Madison types, are reported
from all but the Oak Hill #2 Site. Shared Owasco artifacts
include spall-based chert engraving tools, triangular strike-a-
lights, and so-called "sinew" or string stones. The remaining
portion of the identified Chance horizon tool inventory would
have been equally at home on earlier Owasco or later
Mohawk sites. Completing this list are: ovate chert knives;
chert endscrapers; thick polled stone celts and adzes; notched
shale and pebble netsinkers; pebble hammers; chert hammers;
anvilstones: mammal long bone splinter awls; and distally
perforated deer phalangeal tinklers or gaming pieces.

At the time the complex was defined, all known Chance horizon sites were located south of the Mohawk
River. All were on high ground, and according to Ritchie,
most were not located near any major body of water.
Components seemed smaller than the Castle Creek and
Bainbridge sites on the upper Susquehanna, and also smaller
than the known village sites in the Mohawk homeland, such
as Ostatungo, Garoga, and Cayadutta. Storage or refuse pits
were not recorded on any of the Chance horizon sites.
Settlement pattern data are very meager. A single row of
postmolds at Deowongo Island (Rfs 1) was reported as
possible evidence of a longhouse at that site.

Ritchie's interpretation of the evidence provided by
the Chance horizon involves multiple parentage for Mohawk
culture. The expanded-lip pottery, collared forms decorated
by interrupted linear or cord impression, as well as the Second
Woods Effigy smoking pipes, are all traits which Ritchie
believed the Mohawks inherited from Owasco progenitors.
Unlike MacNeish, however, Ritchie felt that this Castle Creek
influence was only of minor importance. Instead, he looked
to Jefferson County and the Saint Lawrence Valley for the
source of the mainstream Mohawk pottery tradition. There, in
pre-Chance horizon times, dwelt a numerous population of
"undifferentiated" Iroquoian peoples - the makers of globular-
bodied, collared pottery which Ritchie felt was the inspiration
for later Mohawk/Oneida/Onondaga cooking vessels. In the
early years of the Chance horizon, substantial numbers of
Jefferson County Iroquois were thought to have moved southeastward, eventually settling in the Mohawk Valley. Concurrently, bands of Castle Creek folk were pushing northward into the same area. The amalgamation of these two cultural traditions resulted in the birth of Mohawk culture during the Chance horizon. Elaborating further, Ritchie suggested that the Oneida represented an even later splinter group from the Mohawk population, who moved westward into Oneida and Madison counties during late prehistoric or proto-historic times. The Onondaga, he believed, originated in the manner proposed by MacNeish - as a southward migration of the Jefferson County Iroquois in late prehistoric times.

While Ritchie cautioned that his model of eastern Iroquois development was hypothetical, he was quick to point out that it was considerably more harmonious with linguistic evidence than MacNeish's. Mohawk, Oneida, and Onondaga - the three Iroquoian-speaking groups - were conceived as descendants of a common ancestral population. Owasco, then, could be conceptualized as ancestral to Algonquian-speaking groups. Ceramic similarities could be explained as the result of the diffusion of ideas from the evolving power centers of eastern Iroquoia to their presumably weaker Algonquian-speaking neighbors. The Chance Horizon (Ritchie 1952) was an ingenious attempt to resolve archaeological, historical and linguistic evidence, but as data continued to accumulate, it became clear that Ritchie's model also contained discrepancies.

The Oak Hill Horizon

In 1960, Donald Lenig, one of the chief contributors to the growing data bank, first committed his ideas concerning Iroquois origins to print (Lenig 1960). The Oak Hill horizon was conceived by Lenig as a 150 year-long period of prehistory which occurred between the end of recognizable Owasco culture and Chance horizon times. Ceramic development during this period was characterized by a "preponderance" of collared pottery vessels decorated by cord-wrapped paddle edge impressions.

During the first half of the horizon, the most common collar decoration was said to consist of horizontal bands, sometimes broken under castellations by vertical, oblique, and/or oblique-opposed motifs. Originally dubbed Weaver Corded, this type was later renamed Kelso Corded. As defined by Lenig, it subsumed both Owasco Corded Collar and Bainbridge Collared Incised (Ritchie and MacNeish 1949). When executed in so-called "push-pull," or interrupted linear technique, the motif had been called Bainbridge Linear by Ritchie and MacNeish (1949). A supposed variant was termed Iroquois Linear by MacNeish (1952), but Lenig used the term Bainbridge Linear for all varieties. In the latter part of the Oak Hill Horizon, Lenig believed that opposed filled triangular motifs, repeated continuously around the collar, became more popular. He called this type Oak Hill Corded. It differed from MacNeish's type of the same name by excluding all those sherds in which the main motif was horizontal banding, with oblique triangles occurring only under castellations.

Many of these vessels retained the longer neck and characteristic neck decorations of Owasco pottery. Shoulder decoration was also very common, and included both incised and cord-impressed motifs similar to those outlined for Ritchie's Chance horizon. Body surface treatment during the Oak Hill horizon is linked to earlier Owasco pottery by the frequent occurrence of both cord malleation and check-stamping, although most of the Mohawk Valley Oak Hill horizon components reported by Lenig produced predominantly smooth or smoothed over check-stamped body sherds (Lenig 1965).

Smoking pipes in early Oak Hill times were seen as an "elaboration" of late Owasco pipe styles. Decorated and underdecorated obtuse angle elbow pipes and bulbous-bowed proto-trumpet pipes decorated with intricate cord-impressed linear patterns predominate. The latter style has been referred to by both Lenig and Ritchie as the Willow Point pipe type (Lenig 1965:15; Ritchie 1965:311). During the second half of the Oak Hill horizon trumpet and effigy pipe styles which would persist throughout the Chance horizon began to appear. The "Second Woods Effigy" and the "Weaver Banded" types, as well as an open-mouthed effigy which Lenig called the "Garoga Effigy" style are among the most numerous (Lenig 1965:15-17).

Stone and bone artifacts are extremely rare on Mohawk valley Oak Hill horizon sites. The inventory recorded by Lenig is even more restricted than Ritchie's list for the Chance horizon. Splinter mammal long bone awls, antler flaking tools, a perforated turtle carapace, a fragment of a polished bird bone tubular bead and deer phalangeal tinklers complete the list of worked bone artifacts. Triangular chert projectile points, triangular chert knives, anvil stones, and notched pebble netsinkers are the only stone tools that can be listed with any degree of certainty.

Of the thirteen sites used to define the Oak Hill horizon, two (Deowongo Island and Weaver Lake) were located south of the valley, well beyond the limits of the historically recognized hearthland of the Mohawks. Both of these sites were situated on lakes, and even by Donald Lenig's admission, both seem to have produced a wide variety of pottery indicative of a longer than normal occupational span. Eleven components, then, remain within the historic Mohawk heartland. Five of these sites (Dewandalaer, Sand Hill #1, Swart-Farley, Galligan #1, and Oak Hill #2) are either multi-component sites on which there is clear horizontal overlap with a proto-historic or seventeenth-century Mohawk occupation, or they are
Mathes responsible for change. Mohawk ceramics were emphasized slow but steady stylistic drift as the primary factor outside contacts or immigration. Instead, Lenig to both Ritchie and MacNeish, he found very little evidence homeland well back into the Point Peninsula era. In contrast same culture bearers probably lived within the Mohawk Valley since early Owasco times. He conjectures that these culture which Lenig believed had been present in the Mohawk as the culmination of a gradual Development of Five Nations Iroquois Culture

horizon in time, but he did not accept Ritchie's concepts of archaeological complex directly following the Oak Hill horizon continued to recognize the Chance horizon as a legitimate sites throughout eastern and central New York. Lenig he confidently predicted the presence of Oak Hill horizon sites reported by Lenig, in that it is located on the flood plain, directly adjacent to the Mohawk River.

Donald Lenig saw the Oak Hill horizon as the proverbial bridge between two cultures - a developmental stage which transformed the old Owasco techniques of pottery decoration into the evolving collared globular vessel shapes. He envisioned this stage of ceramic development as a true horizon, an expression of material culture that linked the eastern Iroquois, proto-Cayuga/Susquehannock, and the Hudson and upper Delaware Valley Algonquian groups. Like Ritchie's Chance horizon, the Oak Hill horizon was postulated as the earliest expression of material culture which could be correlated with historically identifiable people (e.g., Mohawk, Minnisink, etc.). Unlike the Chance horizon, it was not conceived as unique to a specific ethnic group. While Lenig's data came primarily from the traditional Mohawk homeland, he confidently predicted the presence of Oak Hill horizon sites throughout eastern and central New York. Lenig continued to recognize the Chance horizon as a legitimate archaeological complex directly following the Oak Hill horizon in time, but he did not accept Ritchie's concepts of eastern Iroquois development.

The Oak Hill Horizon and its Relation to the Development of Five Nations Iroquois Culture (Lenig 1965) views the inception of recognizably Mohawk material culture as the culmination of a gradual in situ evolution of Owasco culture which Lenig believed had been present in the Mohawk Valley since early Owasco times. He conjectures that these same culture bearers probably lived within the Mohawk homeland well back into the Point Peninsula era. In contrast to both Ritchie and MacNeish, he found very little evidence for outside contacts or immigration. Instead, Lenig emphasized slow but steady stylistic drift as the primary factor responsible for change. Mohawk ceramics were conceptualized as the most conservative expression of unaltered Iroquoian development.

While he was not very specific concerning Oneida cultural evolution, Lenig suggested that they probably shared a relatively isolated development parallel to that of the Mohawk. Onondaga, according to Lenig, resulted from the diffusion of Mohawk-Oneida material culture into the Saint Lawrence Valley. The resulting blend of cultural traditions during the Chance Horizon evolved into the recognizable material culture of the Onondaga. Like Ritchie and MacNeish, Lenig believed that the Saint Lawrence Iroquois migrated to the Onondaga homeland during late prehistoric or early protohistoric times. The hypothesis allowed for the linguistic interrelationships among Mohawk, Oneida and Onondaga, but it recognized Owasco as a material culture tradition which had little or nothing to do with the language which its bearers spoke.

William A. Ritchie did not accept the concept of the Oak Hill horizon as it was originally proposed. (Ritchie 1960a) He saw Owasco Corded Collar and Bainbridge Collared Incised pottery (Lenig's Weaver/Kelso Corded) as possible evidence of interaction between Castle Creek Owasco and the postulated "undifferentiated" Iroquois of the Saint Lawrence Valley, but he believed that these pottery types only occurred in small quantities on late Owasco sites - never as a major type on sites which might represent an independent phase or horizon (Ritchie 1960b). Lenig's proposed later type, Oak Hill Corded, Ritchie found interesting and provocative. Nevertheless, the extremely small ceramic samples and poor representation of sites which Lenig reported left him unconvinced that the assemblages actually constituted a phenomenon with sufficient temporal depth to qualify as a horizon or phase. As late as 1961, Ritchie wrote:

I believe that in its present form [the in situ hypothesis] is too simplistic and facile to account for the evidence at hand.... In a word, I strongly suspect that Iroquoian cultures represent various composites of traits derived not only from Owasco and directly or indirectly from Point Peninsula, but from other cultures in the general area not comprehended within these cultural categories [Ritchie 1961:30-31].

After completing excavations at the Kelso Site (Bwv 12) near Syracuse in 1963, Ritchie reconsidered the evidence, and with some modifications, accepted the concept of a transitional Owasco-Iroquois cultural assemblage. The Kelso Site produced a very high percentage of Owasco Corded Collar (Lenig's Weaver/Kelso Corded) in association with Oak Hill Corded and a small percentage of Chance horizon and earlier
houses found on early Owasco sites. Ritchie speculates that single central fireplaces, and bear a marked similarity to the longest axis. These structures characteristically contained houses. The first were oval not exceeding 36 ft (11 m) on the more thoroughly investigated and contained two types of stockades were double and even triple in some places and consisted of 3 to 6 inch (7 -14 cm) diameter posts surrounding stockades were in situ.

Ritchie's reformulated Oak Hill phase was provisionally dated from A.D. 1300-1390 on the basis of 
(determinations. While he clearly stated that the Oak Hill phase should be considered as an intermediate developmental stage between Castle Creek Owasco and the Chance horizon, Ritchie was not nearly as authoritative concerning the particulars of regional Iroquoian development. The sequence of sites that he utilized to illustrate the progression of development begins on the upper Susquehanna with the Bainbridge and Castle Creek Sites of the Castle Creek phase and the Clark Site of the Oak Hill phase; then moves to the Kelso Site, an early Oak Hill phase component west of Syracuse in Central New York and winds up in the Mohawk Valley at late Oak Hill and Chance phase sites. Ritchie implies that the general evolutionary sequence of events illustrated by this selection of sites is valid in any and all areas of upstate New York east of the Genesee River and west of the Hudson River, but the specific tribal sequences involved are not enumerated. Most certainly he intended to include Mohawk and probably Oneida as end-products of this evolutionary scheme, but it is difficult to deduce what, if anything, Ritchie was proposing for Onondaga, Cayuga, Seneca, and Susquehannock.

Due to the very competent and careful excavations that were accomplished at the Kelso Site under Robert Funk's direction, we have, for the first time, a good deal of settlement pattern information from a transitional Owasco-Iroquois site. Consequently, Ritchie was able to infer some generalized social and demographic conclusions about the Oak Hill horizon as an independent developmental stage. In changing the name from horizon to Oak Hill phase, Ritchie appears to have had nothing more pedagogic in mind than the consistent application of terminology that he had adapted from Willey and Phillips (1958) for the Northeastern archaeological sequence (Ritchie 1965:301-303).

Ritchie's redefined Oak Hill phase was provisionally dated from A.D. 1300-1390 on the basis of 
(determinations. While he clearly stated that the Oak Hill phase should be considered as an intermediate developmental stage between Castle Creek Owasco and the Chance horizon, Ritchie was not nearly as authoritative concerning the particulars of regional Iroquoian development. The sequence of sites that he utilized to illustrate the progression of development begins on the upper Susquehanna with the Bainbridge and Castle Creek Sites of the Castle Creek phase and the Clark Site of the Oak Hill phase; then moves to the Kelso Site, an early Oak Hill phase component west of Syracuse in Central New York and winds up in the Mohawk Valley at late Oak Hill and Chance phase sites. Ritchie implies that the general evolutionary sequence of events illustrated by this selection of sites is valid in any and all areas of upstate New York east of the Genesee River and west of the Hudson River, but the specific tribal sequences involved are not enumerated. Most certainly he intended to include Mohawk and probably Oneida as end-products of this evolutionary scheme, but it is difficult to deduce what, if anything, Ritchie was proposing for Onondaga, Cayuga, Seneca, and Susquehannock.

Due to the very competent and careful excavations that were accomplished at the Kelso Site under Robert Funk's direction, we have, for the first time, a good deal of settlement pattern information from a transitional Owasco-Iroquois site. Consequently, Ritchie was able to infer some generalized social and demographic conclusions about the Oak Hill horizon (1965). The Kelso Site consisted of two overlapping stockaded villages, each about 2 acres (8.095 m=) in size. The surrounding stockades were double and even triple in some places and consisted of 3 to 6 inch (7-14 cm) diameter posts set in rows between 4 and 6.5 ft (1.2-2 m) apart. Oblique buttressing postmolds set at an angle suggest that the stockade was 12 to 15 ft (3.65-4.6 m) high. The eastern village was more thoroughly investigated and contained two types of houses. The first were oval not exceeding 36 ft (11 m) on the longest axis. These structures characteristically contained single central fireplaces, and bear a marked similarity to the houses found on early Owasco sites. Ritchie speculates that these structures were probably occupied by small clan units. True longhouses, averaging 22 ft (6.7 m) wide by 120 ft (36.6 m) long comprise the second type of structure in the eastern village. Ritchie argues that three longhouses and three of the oval structures coexisted. He estimates the village population at about 225 individuals. No food storage pits were found at Kelso, but ample evidence of horticulture led Ritchie to infer that perhaps some of the small oval structures were utilized for food storage. Several flat bottom oval roasting pits were located outside the structures. Ritchie thought that they might have served some ceremonial purpose. Confirming the pattern noted earlier in the Mohawk Valley, artifacts were generally scarce at Kelso. Rough stone chipped disks interpreted as possible tilling hoes, mullers, metates, cylindrical pestles, biconcave mortars, stone chisels, and bone mat weaving needles are all that can be added to the list of Oak Hill and Chance phase tools. Ritchie theorizes that the residents of the Kelso Site exhausted local resources, removed to another location "for a decade or so," and then returned to Kelso and built the second village. This implies that Ritchie believed the archaeological evidence was consistent with the historically documented practice of relocating Iroquoian villages about every ten years. He also notes that the overall settlement pattern at Kelso is consistent with a matrilineal, matrilocal, clan-structured society as were the historic Iroquois (Ritchie 1965:305-312).

The Garoga Phase

The New York State Museum excavations at the Getman (Cnj 25) and Garoga (Las 7) Sites within the Mohawk homeland contributed new data which modified Ritchie's framework for Iroquoian evolution. The Getman Site seemed to fit the diagnostics for the Chance horizon except that there was a disturbingly high percentage of fully notched-base pottery, some storage pits were present, and the site was located on the north side of the Mohawk River. Undaunted, Ritchie adjusted the definition (Ritchie 1965:311-316). The redefined Chance phase (presumably limited to eastern Iroquois) was thought to date from some time in the fourteenth century until about midway through the fifteenth century, or A.D. 1450. On the basis of pottery, Ritchie felt that the Getman Site dated near the end of the phase. Like each Kelso village, it was small, had a multiple row of palisades surrounding the habitation area, and was located a fair distance from any major body of water. The village contained at least three coexisting longhouses, averaging about 110 ft (33.5 m) long. Ritchie estimated the population at 160 people.

The newly defined Garoga phase, as typified by the Garoga Site, was characterized by much larger villages located on tributary streams in strong, naturally defensible loca-
sions, often with steep cliffs on three sides, and generally located at a distance from major waterways (e.g., the Mohawk River). The majority of pottery found on Mohawk sites of this phase exhibit deep fully notched collar bases. MacNeish's Otstungo Incised, Cayadutta Incised and Fonda Incised are the major types. Ritchie infers that the phase lasted from about A.D. 1450 until early European contact, A.D. 1550 (Ritchie 1965:317-323).

Dating the Proposed Phases

Thus, by the mid 1960s, the concept of a 250-350 year span between Castle Creek phase Owasco sites and the first "contact" Iroquois villages had become fairly well accepted. This long hiatus provided plenty of time for three prehistoric phases of Iroquoian development, and coincidentally, these proposed phases seemed to average about the same length of time that Ritchie was proposing for each of his three phases of Owasco development. Ritchie’s Chance and Garoga phases and Lenig’s Oak Hill horizon were all attempts to deal with the growing body of evidence from transitional Owasco-Iroquois sites. Each attempted to outline a period of relatively stable ceramic expression that could be utilized as synchronous markers. All were conceived as efforts to fit the data into an existing archaeological framework.

There was still considerable skepticism concerning this in situ model, and a number of prejudices had developed, even among those who were proposing a break with older migrational theories. Owasco had been conceived as something distinct and dissimilar from Iroquois. If an acceptable evolution of one into the other was to be proposed, then it seemed to follow that it either must have been a very complicated process, or it must have taken a great deal of time to affect the change. It was a nearly inescapable predisposition resulting from years of stressing the differences, particularly in the pottery, between the two cultures.

Then there was the advent of radiometric carbon dating, a mixed blessing at best. The process was expensive and there were few laboratories that could perform the tests. Early results were based upon the solid carbon method of analysis, now recognized to be unreliable. A single standard deviation often exceeded the antiquity of the mean date, and there was no knowledge of environmental 14C fluctuation. Not surprisingly, early 14C dates from Owasco and transitional Iroquois sites tended to support the new hypothesis of long and gradual evolution.

In the midst of growing complacency, one voice quietly (and characteristically) offered an alternative. While assessing the validity of a 14C date from the Oakfield Fort Site, the type station for the Oakfield phase, which represented a rough temporal equivalent of the Oak Hill horizon in western New York, Marian White (1958) presented a startling proposal for a very short transitional period between "Owascoid" and "Iroquoian." She was the first to suggest, based upon extrapolation from the estimated rate of change observed in historic Seneca ceramics, that the transitional period in western New York probably only lasted from about A.D. 1385-1485, or about one hundred years. Her admittedly impressionistic assessment of the period was one of rapidly changing ceramic styles.

Meanwhile, James Tuck (1972) was making discoveries within the Onondaga homeland which would have a profound effect on theories of eastern Iroquois development. Like Lenig, Tuck believed that Iroquois material culture resulted from slow in situ stylistic drift from the antecedent Castle Creek phase. Unlike anyone who had gone before, he proposed that the historic Onondaga were a product of that same in situ development, with little or no influence from the Saint Lawrence Valley. Tuck utilized Ritchie’s data from the Kelso Site and practically single handedly conducted large-scale excavations at seven or eight additional sites in the Syracuse area. The resulting prehistoric sequence and settlement pattern study provides us with the most convincing and detailed picture of regional evolution from Owasco to Iroquois.

Tuck’s excavations revealed a sequence of small sites which produced ceramic assemblages similar to Lenig’s Oak Hill and Ritchie’s Chance sites. His use of individual ceramic attribute analysis was groundbreaking and produced convincing ceramic seriations. However, it is very difficult to make close ceramic comparisons with Mohawk sites because both Ritchie and Lenig reported their ceramic samples in type frequencies. Armed with a series of 14C dates, Tuck proposed that, regardless of dates from other Iroquoian areas, the Onondaga Oak Hill phase ran from about A.D. 1300-1400; while the Chance phase lasted from about A.D. 1400-1500 (Tuck 1972:197).

From 1955 until 1963, Peter P. Pratt collected archaeological data for his dissertation on early Oneida development. Pratt's interest in Oneida archaeology began in the mid 1950s when he was employed by the Madison County Historical Society to supervise archaeological excavations at the Nichols Pond Site. Pratt discovered that there was a prehistoric village site that produced ceramics and other artifacts which were virtually indistinguishable from late Chance phase Mohawk sites such as Getman. After a diligent effort, Pratt was unable to locate any predecessors for Nichols Pond within the Oneida homeland. Echoing Ritchie, he suggested that the Oneida probably separated from a common Mohawk/Oneida population living in or near the traditional Mohawk homeland. Presumably, these people first arrived within the traditional Oneida area at the Nichols Pond Site (Pratt 1976:107, 1977:62-63).
Summaries of the Issue

While the flurry of fieldwork and analysis which marked the 1950s and 1960s abated sharply during the 1970s, the decade produced three important summary statements which touch upon eastern Iroquois origins. The first is a monograph which summarized the results of the New York State Museum's "Settlement Pattern Program" (Ritchie and Funk 1973). In it, Ritchie left us his final printed thoughts on this issue. He views Mohawk, Oneida, and Onondaga as the culmination of in situ development of three separate local populations who shared a Castle Creek phase Owasco material culture. Thus Ritchie and Funk joined Lenig and Tuck as in situ literalists who felt that the historic eastern Iroquois (Mohawk-Oneida-Onondaga) could be traced to Owasco ancestors who lived within the same geographic homelands.

Ritchie and Funk also remind us to be careful in the way that we use archaeological phases, for they are, after all, arbitrary and theoretical constructs (Ritchie and Funk 1973:167). It was very good advice, and perhaps it explains their reluctance to be very specific concerning the timetable for their proposed evolutionary scheme. In fact, at one point they state that, on the basis of 14C assessments, the Oak Hill phase probably dates "to the closing decades of the fourteenth century" (i.e., A.D. 1370-1400), while in another place they have no difficulty accepting a 14C date of A.D. 1390±150 years for the Getman Site, which by their own estimation dates to the "late Chance phase" (Ritchie and Funk 1973:274, 307).

The second statement was made by MacNeish who hesitantly reviewed the evidence which had accumulated since 1952 (1976). He accepted Lenig's and Tuck's evidence for in situ development of Mohawk and Onondaga back to Oak Hill times, but suggested that ultimately Mohawk, Oneida, and Onondaga seem to have had their roots in the Castle Creek Owasco population of the upper Susquehanna Valley. This interpretation is an adjustment of MacNeish's original hypothesis for Mohawk origins, extending the concept to Oneida and Onondaga. He also reiterates the strong ties which he still perceives between Saint Lawrence Iroquois and proto-historic Onondaga ceramics, suggesting that while Saint Lawrence influences may not account for the genesis of the Onondaga, they certainly make a major contribution after about A.D. 1550.

Essentially, MacNeish conceives a parallel and harmonious evolution of Mohawk-Oneida and Onondaga through the late Chance phase. The postulated influx of Saint Lawrence influence and/or people during proto-historic times results in a divergence of Onondaga pottery from the more conservative Mohawk-Oneida series. MacNeish also cautions that the extension of Ritchie's Garoga phase to Onondaga is somewhat misleading, for the term is borrowed from Mohawk chronology and it obscures the ceramic divergence at this level of development. MacNeish neatly sidesteps one of the problems involved in assigning calendrical dates to the Owasco-Iroquois transition by dealing with individual components rather than phases or horizons. Some of the sites are seriated based on ceramics, while others seem to have been placed in the sequence on the basis of 14C dates or geographic location. The resulting chart is somewhat perplexing to among strongly committed to the concept of synchronous northeastern ceramic development; however, it can be roughly transmuted into the following phase-equivalent sequence: Castle Creek c. A.D. 1200-1300; Oak Hill c. A.D. 1300-1400; Chance c. A.D. 1400-1480; Garoga c. A.D. 1480-1580 (MacNeish 1976).

Finally, Tuck's 1978 synthesis of Iroquois development is probably the best known and most widely read, for it was published in the Smithsonian's Handbook of North American Indians. In his treatment of eastern Iroquois development, Tuck added nothing to his previous effort. He remained committed to literal in situ development for Mohawk, Oneida, and Onondaga back into pre-Castle Creek Owasco times. He also continued to reject the idea of any significant Saint Lawrence Iroquoian influence upon the development of historic Onondaga culture. Temporal assessments for the phases of the Owasco-Iroquois transition are estimated as follows: Castle Creek c. A.D. 1200-1300; Oak Hill c. A.D. 1300-1400; Chance c. A.D. 1400-1500; Garoga c. A.D. 1500-1580 (Tuck 1978).

At the end of the decade, the Rochester Museum & Science Center sponsored a conference on Iroquois pottery. An excellent collection of the technical papers presented at the conference was subsequently published (Hayes et al. 1980). Unfortunately, due to circumstances beyond anyone's control, an important paper dealing with eastern Iroquois ceramic evolution (Lenig 1979) could not be included. In it, Lenig reviewed and updated his concepts of in situ development, comparing them with the generally accepted synthesis that Ritchie and Tuck had proposed in the late 1960s. One major point that he made was that the Oak Hill horizon and Ritchie's Oak Hill phase were not synonymous terms. Lenig's Oak Hill horizon had been conceived as an entity of broad geographic distribution, but limited temporal scope. The horizon concept accentuates the convergence of certain traits in both pottery cooking vessels and smoking pipes, regardless of the ethnicity of the maker/user. The point of the horizon concept is that it facilitates cross-cultural (or in this case cross-ethnic) comparisons in time and space. The major assumption implicit in Lenig's approach is that "horizon styles" appear, become popular, and disappear at about the same absolute time throughout the entire affected region. A horizon is basically a temporal construct.
On the other hand, Ritchie's Oak Hill phase is predicated on a cluster of archaeological traits (ceramic and non-ceramic) that ostensibly define what is unique to Mohawk, or rather to eastern Iroquois. The culture-phase approach emphasizes divergence in an attempt to recognize and trace the development of individual ethnic groups. A phase, therefore, is basically a cultural construct. The primary axiom is that different cultural groups will always display discernible differences in the archaeological record.

The use of either of these systems does not automatically preclude the application of the other. Rather, they may be used in conjunction with each other; phase to reveal divergence and horizon to accentuate convergences [Lenig 1979:6].

A second point made by Lenig in this paper deserves repetition:

As originally defined, the Oak Hill Horizon was divided into an early and a late manifestation... [This] disturbed Ritchie who thought it encompassed too long a period of time to fit the definition of a horizon. Therefore, he renamed the late portion of the horizon the "Oak Hill Phase," and included the earlier portion in his Castle Creek Phase [Lenig 1979:4].

In other words, Lenig's Oak Hill horizon comprises at least a portion of what is now generally considered to be Castle Creek phase Owasco material culture. This is an important concept to understand when contemplating the temporal depth of the Owasco-Iroquois transition.

The 1970s also spawned James Bradley's major revision of the historic Onondaga site sequence. While the thrust of Bradley's research was directed at the proto-historic and early historic periods, he did review the prehistory in some detail. The picture that he presented is basically concordant with Tuck's; yet Bradley was troubled with the generally established timetable for *in situ* Onondaga development. He noted that if the current 14C dates were assumed to be accurate, the number of sites dating within the sixteenth century increases implausibly. Alternatively, Bradley suggested that seriation and extrapolation back in time from proto-historic sites would seem to place the entire Garoga phase in the fifteenth century. He concluded that there continue to be serious unreconciled discrepancies in the chronology or temporal assessment of Onondaga "tribal" evolution (Bradley 1987:44).

Bradley's second point of departure from Tuck's model concerns the relationship between Onondaga and Saint Lawrence Iroquoians. Like MacNeish, Bradley perceives a substantial influx of Saint Lawrence pottery and other artifacts on late prehistoric and early proto-historic Onondaga sites. He notes that the sequence of Saint Lawrence Iroquoian villages in nearby Jefferson County seems to terminate at very nearly the same time that these artifacts appear in significant numbers on Onondaga sites. Bradley hypothesizes that the Jefferson County Iroquoians, or possibly a subgroup of them, were absorbed into the Onondaga population after a period of warfare, possibly triggered by competition over shared hunting territory. He bolsters his argument by citing similar theories concerning the absorption of the "border" Saint Lawrence Iroquoian population in Grenville County, Ontario, by the Huron, at this same time period (Bradley 1987:83-87).

The 1980s and 1990s were marked by renewed interest in Mohawk archaeology. In 1982, Dean Snow and William Starna initiated a ten-year long field program dubbed the "Mohawk Valley Project." Exploratory excavations were carried out at ten Mohawk sites, but the emphasis was upon large proto-historic and historic-period villages. Of the four prehistoric sites examined, none dated earlier than the Chance horizon. The final project report summarized MacNeish's, Ritchie's, and Lenig's work on transitional Owasco-Mohawk sites, but added nothing new (Snow 1995b:49-83).

Susan Bamann's work at two early Chance phase sites, Second Woods and Fox Lair, helped to clarify the picture of the early Chance phase which Ritchie had sketched after viewing material from Second Woods in private collections (Bamann 1993). Starna's contributions to the Mohawk Valley Project included directing the fieldwork at the Elwood Site. The material culture and settlement pattern information uncovered at this important late Chance phase village closely parallels Ritchie's finds at the Getman Site. By demonstrating the close similarities between Getman and Elwood, Starna and Snow have reaffirmed Ritchie's decision to expand the original definition of the Chance phase to include sites fitting this pattern (Snow et al. 1985:7-16). Unfortunately, Snow also chose to include Ostungo - a site that Ritchie used to define the Garoga phase - as an example of a late Chance phase site (Snow 1995:15-138). Since Ostungo fits all of the diagnostics for Ritchie's Garoga phase and none of those for the Chance phase, this move may serve to confuse others seeking a clear understanding of the Mohawk sequence and framework.

Another theme that has reappeared and gained credence over the last twenty years, is the idea that at least some of the disappearing Saint Lawrence Iroquoians may have relocated to villages of the eastern Iroquois (Mohawk, Oneida, and Onondaga). As previously mentioned, neither MacNeish nor Bradley ever really abandoned that concept with reference to the evolution of the historic Onondaga people. Kuhn, Funk, and Pendergast (Kuhn et al. 1993) raised the possibility that a few Saint Lawrence potters may have lived at early proto-historic Mohawk sites as well. Engelbrecht (1995) finds a very strong statistical correlation between...
pottery from terminal Jefferson County sites such as Caen (c. A.D. 1580), and samples from early seventeenth-century eastern series Mohawk villages, such as Barker and Martin. The historic Mohawk population may, therefore, have been augmented by an unknown number of these immigrants just prior to their earliest contacts with the Dutch.

Conclusions

We have seen that over the past fifty years several different and often conflicting views of eastern Iroquois in situ development have been proposed. Cultural phases and temporal horizons have been conceived, described, and amended with little attempt to understand how each of these creations has affected pre-existing models and alternative explanations. In fact, there has been no mention of any of the inconsistencies in the literature. Consequently, we are left with a number of disparate and frequently mutually exclusive archaeological phases and horizons bearing similar or even identical labels. Current summaries of the "in situ hypothesis" do little to clarify the picture. For the most part, each author presents one of the existing models and implies that everything is rosy; archaeologists are in "general agreement." There is little doubt that "Castle Creek," "Oak Hill," "Chance," and "Garoga" convey something to most archaeologists working in the Northeast. The question is, do these terms mean the same things to each of us? Because of these disparities in the literature, I suspect that many of us have been using differing operational definitions for these terms.

During the 1970s and 1980s, there was very little interest in culture history and chronological issues in American archaeology. Processual studies were promoted as the raison d'etre for the "new" anthropological archaeology. One of the ironies of that position was that processual models frequently compare data from spatially separated components which must be closely segregated temporally. It is no coincidence that this kind of research has categorically failed to produce conclusive results in the historic Five Nations homeland, for in the final analysis, all such studies have rested upon regional site sequences and chronologies that were based on divergent timetables and conflicting views of cultural dynamics.

Nothing could be more fundamental to a classification system than this question, for if there is no clear-cut method to decide where a site belongs within the systemic framework, no purpose is served by retaining the scheme. Nevertheless, our current models are more than a little blurred and out of focus on this issue. Where, for example, does the Castle Creek phase end and the Oak Hill phase begin? Settlement pattern criteria are not consistent from Susquehanna River to Mohawk Valley to Central New York sites. The only codified differences in Castle Creek and Oak Hill material culture involve theoretical changes in the ceramic assemblages. Even then, ceramic smoking pipes in late Castle Creek and early Oak Hill are reported to be identical, leaving only pottery cooking vessels as phase indicators. Is the period of transition crossed at the point that we recover a majority of Oak Hill pottery styles? If so, then the Bainbridge Site (Una 4) must surely qualify as an Oak Hill component, for the excavated sample produced 60% cord-impressed decorated, collared pottery. Yet, Ritchie and Funk (1973) place it within the Castle Creek phase, reserving "early" Oak Hill status for the Kelso Site (Bwv 12) - a site which yielded 95% Oak Hill pottery types.

These kinds of controversies exist at the interfaces of nearly all archaeological phases, and similar arguments could go on and on. It is not my intention to belabor this issue, but we must understand that as long as we continue to use the culture phase and/or horizon approach, we have to clarify the diagnostics. If we fail, we will continue to compare apples and oranges in meaningless combinations ad infinitum.

A third problem with our current understanding of the Owasco-Iroquois transition has resulted from our crude attempts to utilize radiocarbon dating. Until fairly recently most laboratories were returning dates with a single standard deviation of 100-150 years. In the behavioral sciences, the minimum level of accuracy in statistical analysis demands a 95% confidence level, and that, in turn, requires an interval of ±1.97 standard deviations (sigma's) from the mean. A radiocarbon date that is reported with a ±50-year standard deviation can only be considered accurate within a span of 588 years. Even the more refined modern assays with a standard deviation of ±50 years can only be deemed accurate within a 197-year period. By some estimates, that could be enough time to encompass every cultural stage from Castle Creek through the proto-historic era. Neither is the corrected $^{14}$C mean date likely to be an accurate assessment of the calendric-
cal mean. In fact, there is a greater than 92% probability that the corrected calendrical mean date is incorrect. Assuming that the absolute date of a site falls within one sigma of the corrected $^{14}$C mean has become a fairly standard practice in northeastern archaeology, although the probability of that assumption being valid is only 68%. That doesn’t sound too bad, but when two such date ranges are compared, the chance for valid conclusions are only 4 in 9, or about 45%. Such comparisons become even less meaningful when additional dates are added to the analysis. Frankly, using $^{14}$C dates to seriate Middle and Late Woodland components is about as valid as psychic divination.

It is time that we re-examine all of our assumptions concerning the timing and dynamics of eastern Iroquois development. Historical archaeology has made great strides in the last two decades. It is now possible to date many of the early seventeenth-century eastern Iroquois components with pinpoint calendrical accuracy. Many of the sites utilized by Donald Lenig, Richard MacNeish, William A. Ritchie, and others to anchor the upper end of their prehistoric site sequences have been re-evaluated in the light of modern ethnohistorical and archaeological methods. These early contact and proto-historic components provide archaeological control data that can be utilized to "upstream" in the archaeological record, much the way ethnohistorians use written records to provide clues to interpret earlier social and cultural behaviors.

Some archaeologists might argue that there is little to be gained from old approaches, but it is my contention that "the direct historic approach" has not yet delivered all of its potential in Iroquoian archaeology. By identifying a European material culture horizon which can be absolutely dated to the earliest seventeenth-century Dutch contacts, we can establish a relatively early zero-point which may, in turn, be used to synchronize local site sequences throughout Iroquoia (Lenig 2000). Geographically delineated local sequences and micro-sequences might then be re-examined using the techniques of seriation, and cross-dating. A more macrospective view should allow us to identify missing sites in individual sequences and adjust for varying periods of site occupancy. This "big picture" approach would ultimately provide the ability to synchronize inter-regional studies to a degree that we have never before been able to attain. In other words, in order to ask those fine-grained processual questions that we all want to explore, we must begin by ordering our universe. A first step might be the updating and adjustment of late Woodland local site sequences in eastern New York. In a future article, I hope to begin that process.

References Cited

Bamann, Susan E.

Bradley, James W.

Clermont, Norman

Crawford, Gary W. and David G. Smith

Engelbrecht, William

Hayes, Charles F. III, George R. Hamell, and Barbara M. Koenig, (editors)

Kuhn, Robert D., Robert E. Funk and James F. Pendergast

Lenig, Donald J.
Lenig, Wayne
2000 Patterns of Material Culture During the Early Years of New Netherlands Trade. Schedules for publication in forthcoming issue of Northeast Anthropology. (58).

MacNeish, Richard S.

Parker, Arthur C.

Pratt, Peter P.

Ritchie, William A.
1944 The Pre-Iroquoian Occupations of New York State. Rochester Museum of Arts and Sciences, Memoir 1, Rochester, New York.
1949 The Bell-Philhower Site, Sussex County, New Jersey. Indiana Historical Society, Prehistory Research Series 3(2), Indianapolis.
1952 The Chance Horizon: An Early Stage of Mohawk Iroquois Cultural Development. New York State Museum Circular 29, Albany.
1960a Correspondence: W. A. Ritchie to D. J. Lenig, November 29, 1960. original in possession of the author.

Ritchie, William A. and Robert E. Funk

Ritchie, William A. and Richard S. MacNeish

Snow, Dean R.

Snow, Dean R., William A. Starna, David Guldenzopf and Robert D. Kuhn

Starna, William A. and Robert E. Funk
1994 The Place of the In situ Hypothesis in Iroquoian Archaeology. Northeast Anthropology 47:45-54.

Tuck, James A.

White, Marian E.

Willey, Gordon R. and Philip Phillips
Theodore Whitney Commendation for Charles F. Hayes III
Annual Meeting NYSSA 1999

He is the image and essence of the career archaeologist. Over the course of the last 40 years, Charles F. Hayes III has come to personify the Rochester Museum and Science Center in the minds of many. Equally tactful and gracious in his interactions with colleagues, museum visitors, and native peoples, Charles has played a key role in the perception of the museum as a congenial learning environment - for both avocational and academic interests. With his background in field archaeology and scholarly activities, Charles has been a most effective facilitator of anthropological research at the RMSC. The cordial relationship that he has long enjoyed with the Native American community has maintained the earlier partnership fostered by Arthur C. Parker to the mutual benefit of both groups. Charles has had an equally long history with the NYSAA, acting in numerous functions at both the chapter and state levels. In fact, his continuing presence at the RMSC provided a home to an organization which would otherwise have had no actual base. It would not be an exaggeration to say that Charles Hayes' professional life has been one of dedication to advancing knowledge of native culture in New York State, in terms of his own archaeological efforts and in his encouragement of others.

After field work in the southwest, a Bachelor's Degree in Anthropology from Harvard, and a Master's Degree from the University of Colorado in 1958, Charles immediately took up his career as an archaeologist at the Rochester Museum of Arts and Sciences. During his early years as a Junior Anthropologist and later Curator of Anthropology, he became actively involved in field work in a number of New York State sites ranging from prehistoric sites in the Bristol Hills and Genesee Valley, through the Iroquois Richmond Mills and Cornish Sites, to late historic sites such as the Stone-Tolan tavern site. His investigations of settlement patterns at these sites resulted in a number of publications in the RMSC Museum Service Series, as well as the museum's Research Records series, The Bulletin of the NYSAA, Pennsylvania Archaeologist, and the Eastern States Archaeological Federation Bulletin. During these curatorial years, he was instrumental in the planning and installation of many RMSC exhibits relating to Native American life in New York State, while at the same time teaching part-time courses in archaeology and anthropology at the University of Rochester and St. John Fisher College.

Later, as Charles' role shifted first to that of Museum Director and then to that of Director of Research, he became a strong advocate for archaeological and other anthropological research at the RMSC. With close ties among both avocational and professional archaeologists, particularly through his relationships in NYSAA, and among members of the local native community, he was able to bridge some of the critical gaps, and help to encourage broad-based interest in local New York state archaeology.

One important step early on was in helping to initiate the RMSC's long-term curation of the large historic Iroquois collections belonging to Charles Wray and Donald Cameron, and in helping to set up and maintain relations with the Rock Foundation which had acquired these collections. This brought with it a new emphasis on research in historic Iroquois archaeology at the museum, and Charles was a key figure in promoting and facilitating access to the collections for researchers from around the world. In large and small ways, many NYSAA members have been the beneficiaries of this access (Bill Engelbrecht, Peter Pratt, Greg Sohrweide, Dean Snow, Bob Navias, Dick Hosbach, Jim Pendergast, Bob Gorall, Daryl Wonderley, Bob Hasenstaab, Chuck Vandrei, etc.) to name just a few from the long list of people who have done research at the museum over the last 20 years. Under his direction, the museum became a permanent safe archive for the research data of much of this primary archaeological research.

Another outstanding contribution that Charles made during this period lies in the organization of the high caliber, topical, archaeological conferences that so many of us have

70
enjoyed since the first one on Iroquois pottery in 1979. The publications resulting from these conferences, all of them organized and edited by Charles, have become familiar and valued sources in most of our libraries.

Throughout this entire period, Charles has played important roles in both the Morgan Chapter, and in the NYSAA, itself. He has held many offices in both organizations, including NYSAA President, Vice president, Fellow, and Publications Chairman. Most importantly, he has served in the time-consuming role of editor of The Bulletin since 1983. In addition, he has been an active member and officer of NYAC, and was appointed as New York State representative on the Committee for Public Understanding of Archaeology for the SAA in 1971. Lastly, Charles has been a trustee of the Seneca Iroquois National Museum for more than 20 years, helping to enhance relations with Native Americans for both the RMSC, and for archaeologists in general. A most recent illustration of this has been his involvement on an advisory committee for the building and furnishing of the longhouse at Ganondagan, which was based upon his excavations at the Cornish Site.

Lorraine P. Sounders

Editor’s Note:
It was a great honor to have received this award and I want to express my appreciation to all members of the New York State Archaeological Association for their vote of confidence. Without the unique support that the membership has given me over the Years, many such activities so eloquently described would not have been possible.

Charles F. Hayes III
# Past and Present NYSAA Award Recipients

## The Achievement Award
- Charles M. Knoll (1958)  
- Louis A. Brennan (1960)  
- William A. Richie (1962)  
- Donald M. Lenig (1963)  
- Paul L. Weinman (1971)  
- Peter P. Pratt (1980)  
- Herbert C. Kraft (1989)  
- Lorraine P. Saunders (1999)  
- Martha L. Sempowski (1999)

## Theodore Whitney Commendation
- Gordon C. DeAngelo (1998)  

## Fellows of the Association
- Monte Bennett  
- James W. Bradley  
- Louis A. Brennan  
- William S. Cornwell  
- Dolores N. Elliott  
- William E. Engelbrecht  
- Lois M. Feister  
- Stuart J. Fiedel  
- Charles L. Fisher  
- Robert E. Funk  
- Thomas Grassmann O.F.M.  
- Alfred K. Guthie  
- Gilbert W. Hagerty  
- Charles F. Hayes III  
- Franklin J. Hesse  
- John D. Holland  
- Richard E. Hosbach  
- Paul R. Huey  
- R. Arthur Johnson  
- Edward J. Kaeser  
- Herbert C. Kraft  
- Roy Latham  
- Lucianne Lavin  
- Donald M. Lenig  
- Edward J. Lenig  
- Julius Lopez  
- Ellis McDowell-Loudan  
- Richard L. McCarthy  
- James F. Pendergast  
- Peter P. Pratt  
- Robert Ricklis  
- William A. Ritchie  
- Bruce E. Rippeteau  
- Donald A. Rumrill  
- Bert Salwen  
- Lorraine P. Saunders  
- Harold Secor  
- Martha L. Sempowski  
- Dean R. Snow  
- David R. Starbuck  
- David W. Steadman  
- Audrey J. Sublett  
- James A. Tuck  
- Stanley G. Vanderlaan  
- Paul L. Weinman  
- Thomas P. Weinman  
- Marian E. White  
- Theodore Whitney  
- Charles F. Wray  
- Gordon K. Wright

## Certificate of Merit
- Thomas Amorosi  
- Roger Ashton  
- Charles A. Bello  
- Monte Bennett  
- Daniel M. Barber  
- Malcolm Booth  
- James W. Bradley  
- Ralph Brown  
- Art Carver  
- Gordon DeAngelo  
- Harold R. Decker  
- Elizabeth M. Dumont  
- Lewis Dumont  
- William F. Ehlers  
- Dolores N. Elliott  
- Garry A. Elliot  
- Lois M. Feister  
- John Ferguson  
- Robert E. Funk  
- Joan H. Geisman  
- Stanford J. Gibson  
- Gwyneth Gillette  
- Robert J. Gorall  
- R. Michael Gramly  
- George H. Hamell  
- Elaine Herold  
- Franklin J. Hesse  
- Richard E. Hosbach  
- Paul R. Huey  
- Vicky B. Jayne  
- Dale Knapp  
- Albert D. La France  
- Kingston Larmer  
- John R. Lee CSB  
- Edward J. Lenig  
- William D. Lipe  
- Adrian O. Mandzy  
- John H. McCashion  
- Ellis E. McDowell-Loudan  
- Dawn McMahon  
- Jay McMahon  
- Brian L. Nagel  
- Annette Nohe  
- Alton J. Parker  
- Marjorie K. Pratt  
- Peter P. Pratt  
- Louis Raymond  
- Saul Ritterman  
- Lucy Sanders  
- William Sandy  
- Barbara Scuilly  
- Harold Secor  
- Annette Silver  
- Gregory Sohrweide  
- Mead Stapler  
- David W. Steadman  
- Marilyn C. Stewart  
- Kevin Storms  
- Tyree Tanner  
- Neal L. Trubowitz  
- George Van Sickel  
- Charles E. Vandrei  
- James P. Walsh  
- George R. Walters  
- Alvin Wanzer  
- Beth Wellman  
- Henry P. Wemple  
- Roberta Wingerson  
- Stanley H. Wisniewski