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Abstract: During the summer of 1915, Fred Luce and his family excavated two small shell middens on Indian Neck, an area of dense prehistoric occupation (now largely destroyed) in the town of Wellfleet, Massachusetts. Both middens appear to date from the Late Woodland period. Although not rich in artifacts, important faunal assemblages were collected from both sites. Analyses provide evidence of the broad range of terrestrial, marsh, coastal, and pelagic resources utilized by native inhabitants and suggest that, with an emphasis on warm weather resources, these locations were utilized on a year-round basis.

SITE BACKGROUND AND HISTORY OF EXCAVATION

Indian Neck is located on the eastern shore of Wellfleet Harbor, the largest embayment on the eastern side of Cape Cod Bay (Figure 1). Like the rest of the Outer Cape, the Wellfleet Harbor area has been shaped by a combination of geological processes. The land itself is Pleistocene outwash plain. In the Wellfleet area, this plain is characterized by a rugged knob-and-kettle terrain (Strahler 1966:23-5). Sea-level rise and the subsequent processes of erosion and deposition have been the most prominent factors in shaping Wellfleet Harbor. After deglaciation, the rate of sea-level rise was initially very rapid. The Atlantic has risen by nearly 50 meters (150 feet) over the last ten thousand years. During the last 2,000 years, however, sea-level rise has decreased to a rate of about 1 meter every thousand years (Oldale 1992:98). Though the rate was slower, the impacts of sea-level rise were still profound as terraces at low elevation were gradually submerged and fresh water streams and marshes became brackish.
As sea-level stabilized, the processes of coastal erosion and deposition that have defined Wellfleet Harbor area continued. Most important was the carving off of unconsolidated glacial sediments by longshore currents and their deposition as barrier bars and spits further down the beach. Through this process, known as long shore drifting, Wellfleet Harbor was formed. On the western side is a tombolo, or a string of islands (Bound Brook, Griffin, Great, and Great Beach) connected by sand spits. Behind this barrier is an extensive network of tidal creeks and marshes. Interspersed among these on the north and east sides of the harbor are prominent marine scarps and small bars. Indian Neck is one of the largest of these marine scarps (Strahler 1966:28-53).

Indian Neck has long been known as an area of dense prehistoric activity, and therefore collector interest. In his 1883 *Annual Report* to the Smithsonian, Henry Chase observed that ‘at several places on Cape Cod, people are becoming interested in Indian relics’ and lamented that it was difficult to purchase artifacts because the prices were so high. Indian Neck is one of the areas he discussed specifically (Chase 1885:879). By the early 20th century, serious avocational archaeologists such as Howard Torrey of Reading, MA began to collect intensively in the Wellfleet area. It was Torrey who introduced Fred Luce to the sites on Indian Neck.

Frederick Alanson Luce was born in 1871 on a farm just south of the New Hampshire state line in Haverhill, MA. His interest in local archaeology developed early and, as an adult, he was well known for his detailed knowledge of sites in the lower Merrimack Valley. This familiarity came both from his love of hunting and fishing, and through his business as a nurseryman and landscaper. Though Luce had little formal education, he was a thorough and meticulous man who recognized the importance of good record keeping. As a result, his excavation observations and well-cataloged collection provide a valuable record for sites that no longer exist. Luce also realized the need to protect the archaeological record. In 1914, he led the effort to organize the Haverhill Archaeology Society, an organization devoted to keeping important collections in the Haverhill area (Mahlstedt 1986).

Between 1915 and 1920, Luce, his wife Thena, and two sons, Stanley and Chauncey, spent most of their summer vacations on Cape Cod. The entire family shared Luce’s enthusiasm for archaeology and much of their time was spent exploring for and excavating sites. While their primary focus was on sites in the Truro area, especially around Corn Hill and High Head, occasional trips were made to other locations on the Outer Cape. In July 1915, the Luces decided to explore around Wellfleet Harbor. After looking over several areas, they decided to excavate two small ‘shellheaps’ on the west shore of Indian Neck. The materials recovered from these sites are the focus of this report.

**DESCRIPTION OF MATERIALS**

During the summer of 1991 the authors had an opportunity to examine the assemblages from these two sites. The artifacts were stored in drawers at the Haverhill Historical Society and had been sorted in a preliminary manner. Descriptive notes in Luce’s handwriting accompanied the material, and many of the artifacts were labelled with Luce’s catalog number. Based on this initial examination, the authors determined that a thorough re-examination of these assemblages was warranted. Through the courtesy of the Haverhill Historical Society, the materials were loaned to the R. S.
Peabody Museum where sorting and analysis (with the exception of the vertebrate fauna) was conducted.

The 'Indian Neck Shellheap'

The first assemblage, catalog #4136, was described by Luce as from the 'Indian Neck Shellheap.' This appears to have been a single discrete deposit. While no detailed excavation notes have survived, Luce did observe that all 'the contents of this heap were saved with the exception of broken shells and dirt' (Luce nd: unnumbered page). The collection confirms this description. Though sorted into general categories (shell, faunal, and lithic) and numbered, none of these materials had been washed. This lack of processing was fortunate since it preserved a considerable amount of small bone, incidental shell, and charcoal. A 4g piece of wood charcoal recovered from undisturbed midden soil within the outer whorl of a large channeled whelk was submitted for $^{14}$C analysis and returned a conventional date of $650 \pm 115$ B.P. ($\delta^{13}$C $= -25.5$ o/oo). The calibrated age range ($\pm \sigma$) is cal A.D. 1260-1410 (CALIB 2.0 [Stuiver and Reimer 1986]).

Mollusks

A total of 69 marine shells, both bivalves and gastropods, were included in this sample. Table 1 summarizes the species present by frequency and weight. A few general comments help to interpret the table.

As Luce noted, only 'complete' shells had been saved. This certainly biases the sample, especially in terms of softshell clam and scallop whose shells are thin and prone to breakage. Hardshell clams and oysters also

<table>
<thead>
<tr>
<th>Species</th>
<th>Quantity (%)</th>
<th>Weight in grams (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channeled Whelk</td>
<td>25 (36.2)</td>
<td>524.8 (40.5)</td>
</tr>
<tr>
<td><em>Busycon canaliculatum</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard Shell Clam</td>
<td>9 (13.0)</td>
<td>421.9 (32.5)</td>
</tr>
<tr>
<td><em>Mercenaria mercenaria</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oyster</td>
<td>9 (13.0)</td>
<td>213.4 (16.5)</td>
</tr>
<tr>
<td><em>Crassostrea virginica</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Moon Shell</td>
<td>8 (11.6)</td>
<td>46.0 (3.5)</td>
</tr>
<tr>
<td><em>Lunatia heros</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slipper Shell</td>
<td>7 (10.1)</td>
<td>12.6 (1.0)</td>
</tr>
<tr>
<td><em>Crepidula fornicata</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mud Dog Whelk</td>
<td>6 (8.7)</td>
<td>3.0 (&lt;0.1)</td>
</tr>
<tr>
<td><em>Nassarius obsoletus</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oyster Drill</td>
<td>2 (2.9)</td>
<td>4.0 (&lt;0.1)</td>
</tr>
<tr>
<td><em>Urosalpinx cinerea</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft Shell Clam</td>
<td>1 (1.4)</td>
<td>1.0 (&lt;0.1)</td>
</tr>
<tr>
<td><em>Mya arenaria</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surf Clam</td>
<td>1 (1.4)</td>
<td>12.0 (1.0)</td>
</tr>
<tr>
<td><em>Spisula solidissima</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bay Scallop</td>
<td>1 (1.4)</td>
<td>57.6 (4.4)</td>
</tr>
<tr>
<td><em>Aequipecten irradians</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>69 (100.0)</td>
<td>1296.3 (100.0)</td>
</tr>
</tbody>
</table>
seem underrepresented in this sample even though they have more durable shells; these species are common in other Late Woodland middens in the area (Bradley et al. 1982:50). Finally, some of the species present were probably incidental inclusions and do not reflect significant food resources. These include slipper shells, oyster drills and mud whelks.

In spite of these limiting factors, the sample still provides valuable, and even surprising, information. Of most interest is the high frequency of gastropods, especially Channeled Whelk (*Busycon canaliculatum*), in this assemblage. While occasionally noted in the shell assemblages from other sites on the Cape and Islands, this species rarely has been viewed as a significant food resource in and of itself.

However, a consistent pattern of modification argues that this was the case. The twenty-five 'complete' *Busycon* shells represent medium to large individuals, 11-15 cm in length (average length 14 cm). All examples displayed holes in the outer whorl or had large sections of the whorl removed (Figure 2). This pattern of modification suggests a systematic effort to extract the snail and its large muscular foot from the shell.

**Vertebrate Fauna**

Over 450 animal bones are included in this sample. These were analyzed by Spiess and represent a diverse array of marine and terrestrial species. Additional identification of marine mammals was made by Greg Early and

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Figure 2. Channeled Whelk Shells (*B. Canaliculatum*) modified for extracting snail. ‘Indian Neck Shellheap’, Wellfleet, MA. Unmodified example in upper right corner for comparison.
Table 2. Distribution of vertebrate fauna from the 'Indian Neck Shellheap,' Wellfleet MA (Luce #4136).

<table>
<thead>
<tr>
<th>TAXON</th>
<th>NISP</th>
<th>Weight g</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEA MAMMALS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottlenose dolphin, <em>Tursiops truncatus</em></td>
<td>8</td>
<td>101.0</td>
<td>1</td>
</tr>
<tr>
<td>Atlantic white-sided dolphin, <em>Lagenorhynchus acutus</em></td>
<td>7</td>
<td>47.0</td>
<td>1</td>
</tr>
<tr>
<td>Whale, large</td>
<td>19</td>
<td>142.0</td>
<td>1</td>
</tr>
<tr>
<td>?Whale, small; ?blackfish, <em>Globicephala melas</em></td>
<td>3</td>
<td>26.0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total sea mammals</strong></td>
<td>37</td>
<td>316.0</td>
<td></td>
</tr>
<tr>
<td><strong>LAND MAMMALS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dog, <em>Canis familiaris</em></td>
<td>1</td>
<td>1.6</td>
<td>1</td>
</tr>
<tr>
<td>Fox, species unidentified</td>
<td>1</td>
<td>3.0</td>
<td>n/a</td>
</tr>
<tr>
<td>Gray fox, <em>Urocyon cinereoargenteus</em></td>
<td>2</td>
<td>2.1</td>
<td>1</td>
</tr>
<tr>
<td>Raccoon, <em>Procyon lotor</em></td>
<td>3</td>
<td>4.2</td>
<td>1</td>
</tr>
<tr>
<td>White-tailed deer, <em>Odocoileus</em></td>
<td>40</td>
<td>294.6</td>
<td>3</td>
</tr>
<tr>
<td>Mammal, large, unident. (prob. deer)</td>
<td>40</td>
<td>27.7</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Total land mammals</strong></td>
<td>87</td>
<td>333.2</td>
<td></td>
</tr>
<tr>
<td><strong>TURTLES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Painted turtle, <em>Crysemys picta</em></td>
<td>35</td>
<td>35.0</td>
<td>3</td>
</tr>
<tr>
<td>Diamondback terrapin, <em>Malaclemys terrapin</em></td>
<td>36</td>
<td>37.0</td>
<td>3</td>
</tr>
<tr>
<td>Eastern box turtle, <em>Terrapene carolina</em></td>
<td>1</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>Snapping turtle, <em>Chelydra serpentina</em></td>
<td>6</td>
<td>12.2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total turtle</strong></td>
<td>80</td>
<td>85.2</td>
<td></td>
</tr>
<tr>
<td><strong>BIRDS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duck, small, species unident.</td>
<td>1</td>
<td>2.9</td>
<td>1</td>
</tr>
<tr>
<td>Common loon, <em>Gavia immer</em></td>
<td>1</td>
<td>1.1</td>
<td>1</td>
</tr>
<tr>
<td>Loon, small</td>
<td>2</td>
<td>5.1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Bird</strong></td>
<td>4</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td><strong>FISH</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish, unidentified</td>
<td>3</td>
<td>2.0</td>
<td>n/a</td>
</tr>
<tr>
<td>Fish, large, unidentified</td>
<td>73</td>
<td>38.1</td>
<td>n/a</td>
</tr>
<tr>
<td>Flounder, species unid.</td>
<td>4</td>
<td>1.2</td>
<td>1</td>
</tr>
<tr>
<td>Sturgeon, <em>Acipensur</em></td>
<td>82</td>
<td>171.4</td>
<td>n/a</td>
</tr>
<tr>
<td>Gadid, large (Cod family)</td>
<td>1</td>
<td>1.1</td>
<td>1</td>
</tr>
<tr>
<td>Striped bass, <em>Morone saxatalis</em></td>
<td>183</td>
<td>137.8</td>
<td>6</td>
</tr>
<tr>
<td>Sculpin, species unid.</td>
<td>1</td>
<td>3.1</td>
<td>1</td>
</tr>
<tr>
<td>Wolfish, <em>Anarhichas lupus</em></td>
<td>1</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>Swordfish, <em>Xiphias gladius</em></td>
<td>3</td>
<td>64.7</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total fish</strong></td>
<td>269</td>
<td>420.4</td>
<td></td>
</tr>
</tbody>
</table>
Butch Rommel; turtle specimens were identified by Thomas French (Table 2). The table presents species by taxon and includes the number of identified specimens present (NISP) as well as the weight of the sample and minimum number of individuals (MNI) represented. MNI counts are based on body part, presence of right/left elements, and age (epiphyseal fusion). Unless otherwise noted, identifications were made through matching archaeological samples against comparative skeletal specimens.

Marine mammals are well represented in the sample. Two species of Delphinidae were present. Based on vertebral elements, the Atlantic White-sided Dolphin was an adult animal of normal size, between 200-240 kg (Geraci and Lounsbury 1993:125). The Bottle-nose Dolphin, represented by fragments of the cranium and left flipper, was a large adult perhaps in excess of 300 kg (Geraci and Lounsbury 1993:127). The small whale taxon was represented by fragmentary vertebral epiphyses with diameters in the range of 10 cm probably from Long-finned Pilot Whales (Blackfish). Mass strandings of this species are common in the Wellfleet Harbor area (McFee 1990; Bradley and McFee 1991). The large whale taxon included specimens of either Balaenid (Right) or Balaenopterid (Finback) whales; skeletal elements represented included vertebral epiphyses with diameters up to 20 cm and large, flat sections of premaxillary bone. Several pieces of fragmentary bone, several of which were partially charred, were also present. Greg Early observed that, since 50% of the wet weight of large whale bone is oil, these bones could have been used for fuel.

Deer dominate the terrestrial mammal assemblage. An MNI of three is based on two adult and one immature tibia fragments; the two adult fragments have different distal width measurements. The wear pattern on one molar tooth indicates an adult deer 5-7 years of age.

Turtles are a surprisingly large component of the faunal assemblage. The sample includes freshwater species (Painted and Snapping Turtles), species that prefer a brackish marsh environment (Diamondback Terrapin), and terrestrial species (Eastern Box Turtle). In contrast to other published samples of turtle remains (Rhodin 1992), none of the examples from Indian Neck were burned.

Finfish are also a significant and diverse component of the faunal assemblage. Among the species represented are anadromous fish (Sturgeon and Striped Bass), pelagic fish that frequent estuaries (Flounder), and pelagic fish that are unusual in estuaries like Wellfleet Harbor (Cod, Sculpin, Swordfish, and Wolffish) (Curley et al. 1972:19). An MNI of 6 striped bass is based on the presence of 6 left premaxillae, all from very large fish. The swordfish vertebral bodies were 3.7 cm in diameter and represent a fish of moderate size.

As a concluding comment, it should be noted that bone weight may provide a more accurate estimate of biomass than does bone count. On this basis, the subsistence pattern for this site was one dominated by upland hunting (primarily for deer), hunting or collecting marine mammals (primarily for whale and dolphin), and fishing (primarily for Striped Bass). It should also be noted that large-bodied species butchered away from the site may be under represented by bone weight comparisons. As a result, marine mammals may have been even more important than bone weight comparisons indicate. Birds are a surprisingly minor component.

Lithics

A total of 77 lithic artifacts were included in the sample. The vast majority of these were flakes. Table 3 summarizes this sample
TABLE 3: Frequency of lithic materials by form from the ‘Indian Neck Shellheap’
Wellfleet, MA (Luce #4136)

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Block</th>
<th>Debitage</th>
<th>Rough Core</th>
<th>Biface</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>3</td>
<td>36</td>
<td>3</td>
<td>0</td>
<td>42</td>
</tr>
<tr>
<td>Quartzite</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Felsite</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>red/purple</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>other</td>
<td>0</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Other fine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>grained</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>volcanics</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chert</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>4</td>
<td>69</td>
<td>4</td>
<td>0</td>
<td>77</td>
</tr>
</tbody>
</table>

by raw material (descriptions after Borstal [1984:311] with the exception that ‘Saugus Jasper’ is not included with chert). Surprisingly, quartz rather than felsic rock predominates in this Late Woodland assemblage. This is contrary to Borstal’s observation that a high percentage of quartz is indicative of a Late Archaic presence (1984:325-26).

Unfortunately no diagnostic bifaces were present. The only tools included in the sample were one utilized flake of Saugus jasper and a large quartz cobble heavily worn and spalled through use as a hammer/anvil. The lithic assemblage also includes four pieces of fire-cracked rock.

**Ceramics**

Only two small ceramic fragments were present in this assemblage. Both are shell tempered: one is a thin (2 mm) rim sherd, the other a thicker (5 mm) body sherd. Both appear to have been decorated with exterior cord-marking. This is consistent with previous assessments of Late Woodland ceramics on the Outer Cape (Moffett 1957:5-8; Childs 1984:188-90).

The ‘Small Shellheap on Indian Neck’

The second assemblage, catalog #4139, was described by Luce as from a ‘small shellheap’ on the west side of Indian Neck. As with the previous excavation, this appears to have been a discrete deposit, one that Luce excavated in entirety. Here again, all the contents except ‘the dirt’ were saved. Luce added one more note of consequence when he observed that ‘this heap contained nearly all broken snail shells of various sizes’ as well as ‘a few chips, fragments of pottery, etc.’ (Luce nd, 4:144). This describes the assemblage quite accurately. Unfortunately, while small flecks of charcoal were present in the accompanying midden soil, none were deemed large enough for $^{14}$C dating.

**Mollusks**

A total of 157 marine shells, both bivalves and gastropods, are included in this sample. Table 4 summarizes the species present by frequency and weight.

The biggest surprise is the overwhelming presence of Northern Moon Shell (*Lunatia heros*). At 77% of the sample by frequency...
TABLE 4: Distribution of marine shell from 'small shellheap on Indian Neck' (#4139).

<table>
<thead>
<tr>
<th>Species</th>
<th>Quantity (%)</th>
<th>Weight in grams (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Moon Shell</td>
<td>121 (77.1)</td>
<td>906 (83.5)</td>
</tr>
<tr>
<td><em>Lunatia heros</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oyster</td>
<td>14 (9.0)</td>
<td>73 (6.7)</td>
</tr>
<tr>
<td><em>Crassostrea virginica</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Razor Clam</td>
<td>11 (7.0)</td>
<td>33 (3.0)</td>
</tr>
<tr>
<td><em>Ensis directus</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slipper Shell</td>
<td>5 (3.1)</td>
<td>4 (&lt;0.1)</td>
</tr>
<tr>
<td><em>Crepidula fornicata</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft Shell Clam</td>
<td>3 (2.0)</td>
<td>27 (2.5)</td>
</tr>
<tr>
<td><em>Mya arenaria</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard Shell Clam</td>
<td>2 (1.3)</td>
<td>41 (3.8)</td>
</tr>
<tr>
<td><em>Mercenaria mercenaria</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oyster Drill</td>
<td>1 (0.5)</td>
<td>1 (&lt;0.1)</td>
</tr>
<tr>
<td><em>Urosalpinx cinerea</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>157 (100.0)</td>
<td>1085 (100.0)</td>
</tr>
</tbody>
</table>

Figure 3. Moon Snail Shells (*Lunatia heros*) modified for extracting snail. 'Small Shellheap on Indian Neck,' Wellfleet MA. Unmodified example in upper right corner for comparison.
and 84% by weight, Luce was correct when he described this small midden as 'nearly all broken snail shells.' While size does vary, most examples are from medium to large individuals; the 84 'complete' examples range from 1.7 to 6.4 cm in length with an average of 5 cm. In every case, damage to the aperture of the shell was evident and for most, large portions of the exterior whorl had been removed. See Figure 3. As with the Channeled Whelks from the previous assemblage, this pattern of modification is strong evidence that these gastopods were collected and processed for their food value. While Moon Shells are not often included in the discussion of significant shellfish resources, they have been noted on other coastal sites in Massachusetts (Bullen 1949:131; Barber 1982:61-2; Little 1986:49-54). In addition, the sample described by Barber from Kidder Point, Maine (Spiess and Hedden 1983:111-13), appears to be very similar to that recovered by Luce.

The remainder of the mollusk assemblage is composed of the more common target species as well as incidental inclusions.

**Vertebrate Fauna**

In contrast to the large and diverse assemblage from the other Indian Neck site, only four pieces of vertebrate fauna were included in this sample. Two are from turtle plastron (Painted turtle), the other are split avian longbone (possibly turkey). One of these shows a series of cut marks.

**Lithics**

A total of 37 lithic artifacts were included in this sample. As with the other assemblage, the majority of these were flakes. Table 5 summarizes this sample by raw material. In contrast to the other Indian Neck assemblage where quartz was predominant, felsic rock is the most prevalent material.

This sample also includes five fragmentary bifaces. Three appear to be broken triangular projectile points; one of quartz, the other two of gray quartzite. Two others appear to be pieces of ovate knives; one of quartz, the other of reddish felsite. It should be noted that both of the ovate bifaces show evidence of water or sand abrasion; in the case of the quartz biface, this weathering is extreme. Close examination of the debitage also indicates that 40% shows evidence of weathering that ranges from a distinct polish to complete removal of flaking scars. It would appear that portions of this assemblage were exposed to either wind or water for some period of time.

**TABLE 5: Frequency of lithic materials by form from the 'Small Shellheap on Indian Neck' Wellfleet, MA (Luce #4139)**

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Block</th>
<th>Debitage</th>
<th>Rough Core</th>
<th>Biface</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Quartzite</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Felsite</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>red/purple</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>other</td>
<td>0</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Other fine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>grained</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>volcanics</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chert</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0</td>
<td>32</td>
<td>0</td>
<td>5</td>
<td>37</td>
</tr>
</tbody>
</table>
Ceramics

Four small ceramic fragments were present in this assemblage. All are shell tempered. The two large enough to characterize are both body sherds: one is 8 mm thick with a smoothed interior and exterior surfaces; the other is 7 mm thick with a smoothed interior and corded exterior.

INTERPRETATIONS

Comparison with other sites on Indian Neck

Indian Neck had one of the densest concentrations of prehistoric sites in the Wellfleet area. While many individuals visited and collected there, reports on their work are few and brief. No overall assessment of these sites has been made to date.

Howard Torrey collected extensively on Indian Neck during the 1920’s and 30’s. While he mapped only one site on the north end of the Neck, his catalog suggests he was active at several locations (Torrey nd). While the artifacts Torrey collected cover a broad chronological range, Late Woodland materials predominate. In her survey of several shell midden sites around Wellfleet Harbor, Boissevain also mentions one site on the north end of Indian Neck (Boissevain 1943:6). While she did not discuss this site separately from the others investigated, the descriptions of materials, including triangular projectile points and shell tempered pottery from all these sites, indicates Late Woodland assemblages.

Ross Moffet included two sites on Indian Neck in his report to the National Park Service (Moffet 1962). One (RM#35) was described as ‘a small, thin shell heap...high up in [an] eroding cliff’ facing Wellfleet Harbor. Referring to this as ‘the Indian Neck site,’ Moffet suggested this was a ‘Late Woodland 2’ occupation based on the artifacts recovered. It is likely that this highly visible site was also the location visited by Torrey and Boissevain. Many other individuals are also known to have collected from this location. Moffet’s second site on Indian Neck (RM#34) was also a shell midden. Located on low ground facing the Cove rather than the Harbor, Moffet noted that this site had been largely destroyed by new house construction.

In 1976, the Massachusetts Historical Commission assigned official state site numbers to these two sites, 19-BN-100 and 19-BN-101 respectively. Based on records from the Bronson Museum, the MHC also recorded three additional site locations on Indian Neck: 19-BN-99, 19-BN-102, and 19-BN-103. Unfortunately, little cultural or temporal information was available for these sites. Finally, during the summer of 1979, National Park Service archaeologists excavated portions of a Late Woodland shell midden that overlay the Indian Neck Ossuary (Bradley et al. 1982).

Unfortunately, it is not possible to link either of Luce’s shell middens with any of the six sites listed above. While Luce made detailed maps of his excavations in the Truro area, no comparable map for Wellfleet has been found. Nonetheless, Luce’s sites do fit well into the emerging pattern of Late Woodland occupation on Indian Neck, one that is characterized by a mosaic of middens and features that blanketed the northern end of the Neck.

It should also be noted that longshore currents and winter storms have continued to carve away at the face of the Indian Neck scarp with considerable site loss as a result. Based on personal observation, in excess of 2 m has eroded away from 19-BN-100 over the last fourteen years. It is possible that the areas where Luce and others excavated have been gone for a long time.
Resource Diversity

The most remarkable characteristic of these small assemblages is the exceptional diversity of resources utilized by the Late Woodland residents of Indian Neck. The species represented come from the full range of available environments, terrestrial, marsh, coastal, and pelagic, as well as from fresh, brackish, and salt water. Comparison with the Greenwich Cove site on Narragansett Bay helps to put this diversity in perspective. Bernstein's excavation exposed a midden roughly 260 m² (1993: 14). The Late Woodland faunal assemblage from this site included: 7 species of mollusk, 10 of terrestrial mammals, 2 of reptiles, 5 of finfish, and 3 of birds (Bernstein 1993:149). In comparison, Luce's much more modest excavations produced an equally, if not more, diverse faunal assemblage: 11 species of mollusk, 6 of terrestrial and 4 of marine mammals, 4 of reptiles, 7 of finfish, and 3 of birds.

This broad diversity of resources has been noted by previous researchers. While Boissevain did not provide a detailed or quantified list of faunal remains, she did make some important observations. Bird and fish bones were numerous as were terrestrial and marine mammals. Among the terrestrial species reported were white-tailed deer, elk, fox, and turtle; among marine mammals were seal, dolphin, and long-finned pilot whale. Also present were at least seven mollusk species (1943:9). Clearly, the area around Wellfleet Harbor in general and on Indian Neck in particular was a bountiful place to live.

The range of species exploited is less surprising when one considers the diversity of environments in the Wellfleet area. Within 5 km of Indian Neck, one has access to a full range of terrestrial habitats as well as the full spectrum of aquatic biomes - pelagic, tidal, brackish, and fresh. It is clear from the faunal record that native people wereknowledgeable as to what resources were available in these environments and skilled in their abilities to obtain what they needed.

Brief comment needs to be made on two groups of species clearly represented in these assemblages but traditionally overlooked in assessments of native subsistence. These are marine gastropods and marine mammals. While there have been many discussions of shellfish in native diet, the emphasis has usually been on bivalve species (Barber 1982; Hancock 1984a; Bernstein 1993:58-81). In contrast, both of Luce's assemblages indicate a significant use of gastropods as well as bivalves. This is a good reason why native people may have collected these marine snails on purpose. In addition to being an excellent food source themselves, both Whelks and Moon Shells prey on bivalves especially clams. By eating these competitive predators, native people could, literally, save the clams for another day.

While marine mammals have received some attention in the literature (Little and Andrews 1982), their overall role in the subsistence base of Outer Cape natives has been underestimated, especially in comparison with large terrestrial mammals such as white-tailed deer. While deer were undoubtedly important, it is likely that on the Outer Cape, marine mammals provided a larger percentage of the animal protein and fat. This is the result of two factors, size and availability. Based on bone measurements, the deer from these sites were small, weighing 50 kg or less. By comparison, an average adult blackfish exceeds 1000 kg (Geraci and Lounsbury 1993:123). In addition, several species of marine mammals are known to strand frequently along the Cape Cod coast. These include long-finned pilot whales (blackfish), Atlantic white-sided dolphin, harbor porpoise, and harbor seals (Early and McKenzie 1991).
Table 6. Indicators of seasonality based on vertebrate fauna from Indian Neck.

<table>
<thead>
<tr>
<th>TAXON</th>
<th>SEASONAL AVAILABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEA MAMMALS</strong></td>
<td></td>
</tr>
<tr>
<td>Bottlenose dolphin</td>
<td>unknown</td>
</tr>
<tr>
<td>Atlantic white-sided dolphin</td>
<td>present year round; peaks in mid-summer and mid-winter</td>
</tr>
<tr>
<td>Whale, large</td>
<td>April to November; spring and fall peaks</td>
</tr>
<tr>
<td>Whale, small; blackfish, <em>Globicephala melas</em></td>
<td>late summer to early winter</td>
</tr>
<tr>
<td><strong>LAND MAMMALS</strong></td>
<td></td>
</tr>
<tr>
<td>dog, <em>Canis familiaris</em></td>
<td>no seasonality, domestic</td>
</tr>
<tr>
<td>Gray fox, <em>Urocyon cinereoargenteus</em></td>
<td>year round availability</td>
</tr>
<tr>
<td>Raccoon, <em>Procyon lotor</em></td>
<td>year round availability</td>
</tr>
<tr>
<td>White-tailed deer, <em>Odocoileus</em></td>
<td>year round availability, no specific seasonality information in this sample</td>
</tr>
<tr>
<td><strong>TURTLES</strong></td>
<td></td>
</tr>
<tr>
<td>Painted turtle, <em>Chrysemys picta</em></td>
<td>March-October active</td>
</tr>
<tr>
<td>Diamondback terrapin, <em>Malaclemys terrapin</em></td>
<td>March-October active, hibernates winter</td>
</tr>
<tr>
<td>Eastern box turtle, <em>Terrapene carolina</em></td>
<td>May-October, assuming capture during active period</td>
</tr>
<tr>
<td>Snapping turtle, <em>Chelydra serpentina</em></td>
<td>April-October, assuming capture during active period</td>
</tr>
<tr>
<td><strong>BIRDS</strong></td>
<td></td>
</tr>
<tr>
<td>Duck, small, species unident.</td>
<td>winter if bufflehead or goldeneye, but species ID uncertain</td>
</tr>
<tr>
<td>Common loon, <em>Gavia immer</em></td>
<td>fall, winter, or spring. Most nest on fresh water away from coast spring to September.</td>
</tr>
<tr>
<td>Loon, small</td>
<td>fall migrant</td>
</tr>
<tr>
<td><strong>FISH</strong></td>
<td></td>
</tr>
<tr>
<td>Flounder, species unid.</td>
<td>unknown, because species uncertain</td>
</tr>
<tr>
<td>Sturgeon</td>
<td>spring spawner, maybe summer and fall inshore marine</td>
</tr>
<tr>
<td>Gadid, large (Cod family)</td>
<td>unknown, because species uncertain</td>
</tr>
<tr>
<td>Striped bass, <em>Morone saxatilis</em></td>
<td>summer</td>
</tr>
<tr>
<td>Sculpin, species unid.</td>
<td>unknown, because species uncertain</td>
</tr>
<tr>
<td>Wolffish, <em>Anarhichas lupus</em></td>
<td>in shallower water, spring and summer</td>
</tr>
<tr>
<td>Swordfish, <em>Xiphias gladius</em></td>
<td>summer</td>
</tr>
</tbody>
</table>
Blackfish are of particular note since they often strand in large numbers. Based on 82 mass stranding events within Cape Cod Bay, the average number of animals involved was 70; the range was from 2 to over 500 (Bradley and McFee 1992). In sum, stranded marine mammals provided native people with an opportunity to obtain, with minimal effort and risk, a caloric reserve that was exponentially greater than any other available food resource.

Seasonality

In addition to documenting the range of species utilized, the faunal assemblages from Indian Neck also provide an insight into when specific species were available (Table 6). Although some assessments of seasonality remain uncertain, the evidence strongly suggests that Indian Neck was used on a year-round basis. This is consistent with the seasonality data from other areas of concentrated Late Woodland occupation on the Outer Cape such as Nauset Bay (Spiess nd:26-8).

While a detailed model of seasonal availability for Wellfleet Harbor is beyond the scope of this paper, the faunal assemblages that Luce and others have recovered from Indian Neck help to document several important indicators. Spring resources include fish runs (flounder and sturgeon are spring spawners), nesting birds, and certain marine mammals. Harbor porpoise are spring stranders. Spring is also when Harbor seals haul out on shore to have their pups. In addition, spring is one of the two peak seasons for large whales in Cape Cod Bay. Summer resources include fish (striped bass, swordfish) and a broad range of terrestrial species that were hunted or collected (turtles). Summer is also one of two peak seasons for dolphin strandings. Fall resources include migrating birds, fish runs, and marine mammals. Blackfish mass strandings are most frequently fall events; fall is the other peak season for large whales in Cape Cod Bay. While large terrestrial mammals such as deer were available year round, fall is the preferred season for hunting (although there are no specific indicators of deer seasonality in the Luce assemblage). Winter resources include resident waterfowl populations (bufflehead and golden-eye) and marine mammals; dolphins are frequent winter stranders.

In general, the evidence suggests a pattern of year-round resource exploitation. This is especially the case when factoring in shellfish data. Hancock has demonstrated a pattern of winter and spring shellfish collection from comparable sites on the outer Cape (Hancock 1984b). Although similar analysis has yet to be done on bivalve assemblages from sites on Indian Neck (Bradley et al 1982:50), it is likely that the pattern of shellfish exploitation is similar to that documented by Hancock.

As Bernstein concluded about Greenwich Cove, resource-rich areas make ‘particularly attractive settlement location[s] capable of supporting year-round populations’ (1993:149). Based on the work of Luce and others, it is evident that Indian Neck also provided that kind of environment.

Implications for Social Organization

Traditionally, it has been assumed that the Late Woodland people of coastal New England were seasonal, not year-round, inhabitants. The discovery of an ossuary on Indian Neck during the summer of 1979 challenged that assumption. Elsewhere in the Northeast, ossuaries are related to sedentary, usually agricultural, populations with a tribal social structure (McManamon et al. 1986:21-25). While it has been argued that the population represented in
the Indian Neck ossuary was one of year-round, rather than seasonal, residents, only limited evidence was available to support this claim. The faunal assemblages from Indian Neck, and the year-round range of resources they contain, provide strong support for the presence of a permanent, year-round population.

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THE PLIMOTH PLANTATION SPRING SITE, 19 PL 522

Barbara E. Luedtke

HISTORY OF INVESTIGATIONS

The archaeological site located under Hobbamock's Homesite at Plimoth Plantation has been known for many years. The discoverer of the site is unknown, but is likely to have been either Harry Hornblower or Jesse Brewer. These men, both charter members of the Massachusetts Archaeological Society, were closely associated with the area; Hornblower's family originally owned the property on which the site is located, and Brewer worked as a gardener and handyman on the Hornblower estate (Loparto et al. nd). Although I have not been able to locate any of their notes on the site, it is impossible to believe that its existence could have been missed by two such astute and experienced archaeologists. The site was eventually entered into the Massachusetts Historical Commission's site files as the Plimoth Plantation Spring Site, and was assigned the site number 19 PL 522.

The Hornblowers established Plimoth Plantation, Inc. in 1947, and a reconstructed Pilgrim village first opened to visitors in 1957. A reconstructed Native American settlement was originally built adjacent to the Pilgrim village, but was moved to its present location in the early 1970's. Since then, when the interpreters who work at this encampment have built structures, dug storage pits, or cleared and worked gardens, they have often found artifacts and other traces of the site.

In addition to surface collecting, archaeological excavations have apparently taken place at the site as well. Hornblower is said to have invited members of the Massachusetts Archaeological Society to dig "on the Indian site at Plimoth Plantation" in the 1950's (Bates 1986: 81). James Deetz is said to have dug there, and several other individuals reported other test excavations. We were unable to locate notes from any of these excavations.

In 1988 Plimoth Plantation and the Departments of History and of Anthropology at the University of Massachusetts at Boston co-sponsored a conference on "Village Life in Old and New England." In the aftermath of this conference we discussed other possible areas of collaboration; Plimoth Plantation representatives mentioned that they would like to know more about the Plimoth Plantation Spring Site, and I offered to conduct an archaeological field school there during the summer of 1991. We agreed that the major goals of the project would be to determine the age, boundaries, and degree of disturbance of the site. Additional testing took place in 1992 to answer some of the questions raised by the first season.

We were excavating in a living museum visited by hundreds of people every day, and this constrained our testing strategy. Thus, we excavated primarily in three large blocks, for a total of 42 square meters the first season (Fig. 1). Three additional meter square test pits were excavated in between the large blocks during the 1992 season. In addition, 71 shovel test pits (STPs) were excavated to determine the
Figure 1. Plimoth Plantation Spring Site.

boundaries of the site. Details of excavation procedures and of the analysis are given in Luedtke 1992 and 1993.

SETTING AND RESOURCES

The Plimoth Plantation Spring Site occupies a shallow basin on the west shore of the Eel River, about .3 km from Plymouth.
Harbor (Fig 2). The site underlies the entire present village clearing, from the river on the east to the paved walkway leading to the Visitor's Center on the west, and from a large glacial boulder on the north to about 30 m into the woods on the south.

The topography, flora, and fauna of this area were very different at the end of the Pleistocene, but by 7,000 years ago a mixed coniferous-deciduous forest was established. The shoreline lay further east until about 3,000 years ago, and shallow Plymouth Harbor may not have taken its present form until 1,000 years later (Leveillee 1986:8). From then on there were undoubtedly minor shifts in plant and animal resources caused by changes in the climate and the river, but in general the site area would have looked much as it does today.

The rich resources of the Plymouth area were lauded by early European visitors (e.g. James 1963: 7-11), and the location of the Plimoth Plantation Spring Site would have provided access to a wide variety of different resource zones. Deer, wild turkey, and numerous smaller mammals and birds would have inhabited the rolling hills around the site, which would also have produced berries, grapes, nuts, and other useful plant resources. Freshwater fish and turtles lived in the adjacent river, which also produced great numbers of eels and anadromous fish such as alewives and shad in season. The ocean shore was within easy walking distance, and clams and mussels could have been collected from the beaches, which also produced cobbles of flakable stone for tools. Plymouth Harbor is said to have produced large numbers of bass, bluefish, lobster, and water fowl, and the open ocean held nearly inexhaustible quantities of fish, especially cod.

The site area may also have been farmed in later times, although the soils are classified as "Carver coarse sand" and described as excessively well drained. Water percolates rapidly through such soils, which generally do not retain enough moisture for

Figure 2. The Eel River Area.
good plant growth (Upham 1969: 77). This characterization may pertain primarily to large-scale agriculture, though; interpreters told us that they obtain good crops from the gardens in this area without additional watering. Apparently, these soils do retain sufficient moisture for farming on the scale practiced by Late Woodland and Contact Period farmers. Finally, as the name of the site implies, fresh water was also available in the near vicinity. We were told that a spring used to exist just to the north of the present canoe landing area, but that it had been drowned by rising river levels. In addition, a linear depression through the southern part of the site may mark the former path of a small stream or spring in that area.

CONDITION OF THE SITE

Few archaeological sites in Massachusetts have escaped at least some disturbance as a result of both natural and cultural forces. This area has been the focus of considerable human activity, especially during the last century, and we had been warned to expect some disturbance. We found that the nature and extent of disturbance varied considerably over the site.

Specifically, the north end of the site is far more disturbed than the south end, though this was not obvious at first. Only late in the project did it become clear that at some point, probably early in the 20th century, extensive earth-moving took place in this area. Such activities are normally quite apparent, as they usually result in buried soil horizons or zones of thoroughly mixed topsoil and subsoil. However, in this case the earth-moving probably took place while the area was being used for gardens, and thus special efforts were made to keep the humus-rich topsoil intact. As we reconstruct it, the people responsible (probably the Hornblower family) first scraped the topsoil to one side, then bulldozed the yellow subsoil. It is not immediately obvious whether this bulldozing was done to landscape the garden area, or was incidental to the laying of pipes and disposing of excess soil. Old aerial photos show small buildings in this area, and the earth-moving may have been associated with these. In any event, because the landscaping involved the subsoil alone, the disturbance is nearly invisible except in areas where pipes were laid, or in a few areas where thin layers of topsoil or of cinder and wire were buried. After the earth-moving was accomplished, the topsoil was carefully spread back over the garden. I have not found a report of this type of disturbance in print, although John Worrell states he has seen a similar example at another early 20th century site (Worrell, personal communication).

This disturbance was evident at Areas A and B, and in test pit 3, but not in Area C or test pits 1 and 2. Thus in Area A, we dug through approximately 30 cm of dark brown topsoil (Munsell color 10YR3/3) before encountering the sudden marked transition in soil color typical of the base of a plowzone. Below this transition was what appeared to be undisturbed yellowish brown sandy subsoil (10YR5/8). There were numerous pre-Contact artifacts, and virtually no post-Contact artifacts in this subsoil. A very faint mottling and a few vague and indistinct features were the only indication that this level was indeed disturbed. The layer of disturbed subsoil varied in thickness from 55 cm in the west to 15 cm in the east. The undisturbed subsoil is a slightly more uniform yellowish brown (10YR5/6) and contains truncated features and artifacts to a depth of 45 cm from the top of the layer. The topsoil and disturbed subsoil contained the same types of artifacts as the undisturbed subsoil, indicating
they had not been moved far.

Area B has similar soils and is similarly disturbed, although in this case the disturbance was obvious to us from the beginning because of the presence of two parallel trench lines with red ceramic pipes laid in them. The function of these pipes is unknown. As in Area A, it appears that the topsoil was removed before the pipe trenches were dug, and the ground surface was then built up a bit before the topsoil was spread back over the area.

The southern half of the site shows no evidence of bulldozing. The soils are much rockier and there is no clear plowzone, although the mixture of artifacts from all time periods in the topsoil suggests that the area has been plowed. Profiles show 30 cm of dark yellowish brown topsoil (10YR3/4) overlying rocky yellowish brown subsoil (10YR5/6). A light yellowish brown clay (10YR5/4) was encountered in some squares, usually at a depth of about 60 cm. In marked contrast to Areas A and B, few artifacts were found below 50 cm in this area.

Three additional test pits were excavated in 1992 to define the limits of the bulldozing more precisely. Bulldozing was evident in TP 3 but not in TP 1 or 2. All three test pits had fine sandy soils, but artifacts and features linked TP 1 to Area C and TPs 2 and 3 to Area A.

PRE-CONTACT ARTIFACTS AND FEATURES

Table 1 summarizes the pre-Contact artifacts found in both summers of excavation and in the surface collection. Flakes and stone tools were the most abundant type of artifact, and ceramics were fairly common. Features were also rather abundant, and included three hearths, five earth ovens, two fire pits, five refuse pits, one storage pit, and ten postmolds.

Food remains were rare, largely because of the lack of shell to neutralize soil acidity. Fragments of softshell clam (Mya arenaria), surf clam (Spisula solidissima), and mussel (Mytilus edulis) were found in several of the features, but not enough to result in significant bone preservation. Thus, bone was only present in the Pre-Contact levels as tiny calcined fragments. Bones representing bird, large mammal, small mammal, rabbit, turtle, possible dog, and possible beaver were identified. No seeds or nuts were found among the charred organic materials collected during excavation. Soil samples were taken for flotation but have not yet been processed.

Fish bones and hickory nuts were notably absent from all Pre-Contact levels at the Plimoth Plantation Spring Site. Both have been found at other sites in this region (Whiting and Brewer 1946:44, 46) and both should have been available in the vicinity of this site. Although fish bones are more porous and fragile than mammal and bird bones and thus less likely to survive in acid soils, calcined fish bones were recovered at the Shattuck Farm site, which has very similar soils (Luedtke 1985). It seems likely that fish were caught and eaten here, but that they simply were not prepared in ways that would allow their bones to become carbonized.

Hickory nuts preserve well because of their thick shells, which were often burned after the meats were removed. Two possible explanations for their absence seem most likely; either hickory trees did not grow in the immediate vicinity of this site, or the site was not occupied in the Fall, when hickory nuts are
harvested.

**CULTURE HISTORY**

Different parts of the site were used for different purposes over time. The recent history of Hobbamock's Homesite itself is instructive in this regard. Interpreters told us about numerous changes in the locations of the structures, racks, and gardens over the last 20 years, and the more ancient inhabitants of the site also surely moved their dwellings and activity areas to be closer to some resource or natural feature, to be in the shade or the sunlight, to allow the soil to lie fallow and regain its fertility, to get away from obnoxious insects, and for many other reasons. We need to think of camp sites as dynamic and changing, especially when they were used over long periods of time by people with differing ways of life and seasonal rounds. These differences will be mentioned as we outline the culture history of this site.

Although other sites in this region have produced PaleoIndian and Early Archaic artifacts (Loparto et al. nd), the earliest artifact found thus far at the Plimoth Plantation Spring site, a felsite Neville point, dates to the Middle Archaic. The point was found by an interpreter in the garden area near Area C, but our excavations uncovered no other definitely Middle Archaic artifacts. It is possible that Middle Archaic people did camp here but that all of the other things they left behind, such as flakes and fire-cracked rock, cannot be distinguished from artifacts left by later peoples. However, it is also possible that this tool is simply a spearpoint lost by a Middle Archaic hunter passing through this area.

Materials dating to the Late Archaic period were found in all areas, and the majority of the projectile points are Late Archaic types. This does not necessarily mean that this was the major period of occupation, though; it is likely that this site was used primarily as a hunting and stoneworking camp during this period, and both these activities would be expected to result in the presence of many projectile points.

A variety of Late Archaic types are present. The earliest are probably those of the Brewerton series; in fact, the two felsite Brewerton eared-notched points were the only projectile points found in the undisturbed soil layers, one in Area A and the other in Area C. Two Brewerton side-notched points were also found, both made of felsite and both from Area C or its vicinity. Small stemmed points and Squibnocket triangles were much more common; examples of the former were found in all three areas, while the latter were found only in Area C and in the surface collection. Two of the small stemmed points are made of felsite and six of quartz, while all the Squibnocket points are made of quartz.

Archaic pentagonal points, which first struck me as a peculiar cross between a small stemmed point and a Squibnocket triangle, form a distinctive class in this assemblage and are also recognized in the Massachusetts Historical Commission's typology (MHC 1984: 96-97). Seven, all made of quartz, have been found at the site, four from Area C and three from the surface collection. This point style may be especially common in southeastern Massachusetts (Luedtke 1992).

Although no points of the Susquehanna or Broadpoint tradition were found, steatite bowl fragments from the surface collection and from TP 1 probably date to the end of the Late Archaic.
Table 1. Pre-Contact Artifacts From Excavations and Surface Collection, 19 PL 522.

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
<th>Description</th>
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<tbody>
<tr>
<td>Projectile points</td>
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</tr>
<tr>
<td>Bifaces</td>
<td>31</td>
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<tr>
<td>Biface fragments</td>
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<td>Drill</td>
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<td></td>
</tr>
<tr>
<td>Flakes</td>
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</tr>
<tr>
<td>Utilized flakes</td>
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</tr>
<tr>
<td>Hammerstones</td>
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</tr>
<tr>
<td>Cores</td>
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<tr>
<td>Pestle fragments</td>
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<tr>
<td>Misc. worked stone</td>
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</tr>
<tr>
<td>Unmodified beach cobbles</td>
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<td></td>
</tr>
<tr>
<td>Fire cracked rock</td>
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<td></td>
</tr>
<tr>
<td>Ceramic sherds</td>
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</tr>
<tr>
<td>Steatite bowl frags.</td>
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<tr>
<td>Red ocher fragment</td>
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<td>Neville</td>
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<tr>
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<td>Brewerton side notched</td>
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</tr>
<tr>
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<tr>
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</tr>
<tr>
<td>Small stemmed point</td>
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</tr>
<tr>
<td>Rossville</td>
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<tr>
<td>Levanna</td>
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<td>Middle Woodland</td>
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<tr>
<td>Late Woodland</td>
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<td></td>
</tr>
<tr>
<td>Contact period?</td>
<td>1</td>
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</table>

Although artifacts representing all time periods were found mixed together in the disturbed topsoil of Area C, several facts suggest that Late Archaic people used this area intensively as a base for manufacturing preforms and stone tools from quartz beach cobbles. First, Area C produced a large number of oval and triangular bifaces and biface fragments, many of which are strikingly similar in size and shape to those described by Boudreau (1981: 12) as precursors to Late Archaic triangles and small stemmed points. Second, Area C has a higher frequency of quartz flakes than either Area A or B, and in southern New England quartz was especially favored as a raw material for stone tools during the Late Archaic (Borstel 1984:325-326; Otto 1988). Third, the ratio of quartz cortex to non-cortex flakes is considerably higher for Area C than for the other areas, suggesting that more primary tool manufacturing was done here, while inhabitants of Areas A and B did more secondary retouch and resharpening of their stone tools.

The cortex visible on many of the quartz flakes from Area C is rounded, slightly frosted, and shows occasional percussion marks, all characteristics typical of beach cobbles. Chunks of quartz can be found in the glacially deposited soils of Area C, but they do not have this distinctive cortex and a great deal of soil must be excavated to find them. On the
other hand, quartz cobbles with surfaces identical to those found on flakes and cores from Area C are abundant and easy to collect at the beach 300 m due north of the site. Felsite and rhyolite cobbles can also be found but are much less common.

Despite the many flakes and partially finished bifaces found in Area C, we found very few hammerstones. However, Boudreau states that he uses a deer or elk antler billet most of the time when he is thinning quartz, because it allows better control and helps keep the striking platform from crushing (Boudreau 1981:30). It is likely that the Late Archaic stone workers also used organic, and therefore perishable, tools for much of their quartz flaking.

In summary, Late Archaic people used all parts of the Plimoth Plantation Spring site, but their activities appear to have focused on the south half. If a stream or spring did run through the adjacent depression, this might explain the attraction of this area. The scarcity of stone tools such as scrapers and drills, and the large numbers of projectile points and bifaces, suggest that the site was primarily a hunting and/or fishing camp, and also a stone tool manufacturing location where quartz cobbles were worked into preforms and projectile points. No features, floral remains, or faunal remains can be definitely attributed to the Late Archaic at this time.

The Early Woodland period is represented by a felsite Rossville point found in Area A and by one sherd of possible Early Woodland pottery from Area C. The latter is sand tempered, thick, and rather poorly made, with numerous lumps and shrinkage cracks. Several small punctations are visible on what is apparently the interior surface. The sherd bears similarities to other Early Woodland sherds, but it could also date to a later period. On the other hand, some of the small stemmed points attributed above to the Late Archaic may actually date to this or to even later periods. No features, floral remains, or faunal remains could be associated with the Early Woodland period. In general, the lack of remains suggests short term and/or specialized uses of the site.

The Middle Woodland period is represented by a probable Fox Creek projectile point base, grit tempered sherds, and eight flakes of red or gold jasper, an exotic material commonly found on coastal sites in southern New England during this period (Luedtke 1987). Most of the artifacts diagnostic of the Middle Woodland were found in Area A, suggesting that people focused their activities toward the northern end of the site during this time period. In fact, no diagnostic Middle Woodland artifacts were found in Area C. Seven jasper flakes were found in Area A and one in Area B. In addition, the base of a jasper biface, probably from a Fox Creek projectile point, was found in an STP near the river. Assuming that grit temper is predominantly a Middle Woodland ceramic trait in the coastal zone (Luedtke 1986), sherds from six Middle Woodland vessels were found, all from the vicinity of Area A. One of these sherds appeared to have a line stamped or impressed across it, but no other decoration was evident on any of these sherds.

The presence of sherds from two of these vessels in association with a hearth in Area A suggests that this feature dates to the Middle Woodland. This feature was also one of the few not truncated by bulldozing, suggesting that it is older than most of the other features in Area A. The feature is interpreted as a hearth or campfire, which was constructed without much use of fire rock and which proba-
bly had a small rack over it, perhaps for cooking food. This rack is represented by three small postmolds; their spacing suggests that a fourth was also present, but it was either slightly shallower than the others or was simply missed during excavation. A similar hearth and rack combination, also dated to the Middle Woodland, was found at the Shattuck Farm site (Luedtke 1985: 168-169). In addition to the sherds, much charcoal, three fragments of fire cracked rock, three fragments of soft shelled clam, and twenty flakes of various stone materials were found in the feature. Bone fragments of birds and mammals were found nearby and may be associated. The assemblage suggests a family campsite at which a variety of foods were cooked.

Two Levanna points and 16 shell tempered vessel lots probably date to the Late Woodland period. There appears to have been a great deal of activity at the site during this period, and Late Woodland artifacts were found in all three areas. Sherds from seven vessels were found in or near Area A, two with incising, one stamped with a triangular toothed tool, and one that probably represents a miniature vessel with a cordmarked surface. Both temper and decoration suggest these sherds are Late Woodland in age (Luedtke 1986). Area B produced sherds from five vessels with incising, smoothed-over cordmarking, and cordmarking with possible scallop impressions. Area C produced one Levanna point made of quartz and sherds from three vessels, one of which had fabric impressed decoration. Another Levanna point of felsite was found in an STP near Area C, and TP 1 produced sherds from a vessel decorated with fine cordmarking.

Four features contained shell tempered sherds and are thus assigned to the Late Woodland period. One, a hearth in Area A, also contained fire cracked rock, flakes, surf clam fragments, one calcined mammal bone, and much charcoal. Nearby in TP 3 was a refuse pit containing charcoal, shell, fire cracked rock, and flakes in addition to several sherds. Area B produced a refuse pit containing a great deal of shell, some flakes, and fire cracked rock in addition to sherds. In Area C was a large storage pit which also produced two biface fragments, numerous flakes, fire cracked rock, and two calcined mammal bones. Since four of the five datable features at this site were found to be of Late Woodland age, it is likely that a high proportion of the undated features found in all three areas also belong to this period. This suggestion is supported by the fact that most of these features have been truncated by bulldozing and plowing, indicating that they originated in the higher, and thus younger, stratigraphic layers of the site.

The presence of many features probably attributable to the Late Woodland period suggests a number of new activities, especially farming and perhaps also processing of shellfish or other foods in earth ovens. In addition, it may be that people were staying for longer periods of time during this period, thus making it preferable to bury refuse rather than simply leaving it behind on the ground surface. The nearby Nook Farm Site, which also has a large Late Woodland component, has a similarly large number of features, suggesting that this is a common pattern for this region (Whiting and Brewer 1946; Leveillee 1986:48).

POST-CONTACT ACTIVITIES

European traders and explorers described the Plymouth area as well populated in the early 17th century. Although virtually all the original inhabitants died in the devastating
plague of 1617-18, other groups of Wampanoags continued to use the area after that time, and some may have camped at the Plimoth Plantation Spring Site. One sherd from Area C appears to represent part of a collared vessel, incised with numerous closely spaced parallel lines in a triangular pattern, all traits that suggest a very late and perhaps Contact Period date. Additional evidence for native use of the site during the Contact period is provided by flakes of ballast flint. English ships sometimes used flint cobbles from the beaches of Britain as ballast for trips to the New World, jettisoning it before picking up a load of produce for the return trip. Even today it is possible to find fragments of English chalk flint on Massachusetts beaches, and if the Native Americans in this region often went to beaches to find raw materials for stone tool making, they would surely have spotted this unusual and highly desirable material. Flint is fairly widespread at the site; one flake is from the surface collection and one piece of burned flint was found in Area C. Four flakes and one worked chunk of flint were found in Area B, and six flakes in area A. The latter area also produced a probable gun-flint fragment.

It might be argued that all the flint is from gunflints, but with the exception of the fragment mentioned above, none are of the right shape or have the characteristic battering. Also, three of the fragments have cortex, and gunflints do not. English chalk flint is one of the materials used in knapping demonstrations at the site (Nanepashemet, personal communication), and it is possible that some of the flakes we recovered came from this activity. Although most of the flint fragments are indeed from the topsoil, two pieces were found in the disturbed subsoil, indicating that at least some of the flint fragments must have been deposited before knapping demonstrations took place.

Three fragments of kaolin pipes, all found in the topsoil of Area A, also probably date to the Contact period (S. Mrozowski and S. Pendery, personal communication), but it cannot be determined whether they were smoked by natives or Europeans. Eel River was an identifiable neighborhood within the Plymouth colony, and parts of it were being farmed by English settlers in the early 1600s (Rutman 1967: 23-25). One such farm, known as the RM site, is located not far from the Plimoth Plantation Spring Site. One of the pipe fragments is part of a stem with a relatively large hole diameter, while the others are parts of pipe bowls. One is rather tall and narrow in diameter, with one or two incised lines around the top. The other is shorter and rounder, with a rouletted line around the top. Both are very similar to 17th century pipes on display at the Pilgrim Hall Museum in Plymouth.

A few other artifacts may be of 17th century age, including a metal button from the disturbed subsoil in Area A, several unusual lead pellets from the topsoil in areas A and C, and two pieces of glass. The first is from the topsoil in Area C, and the second, which is severely hydrated, is from the disturbed subsoil in Area B. In summary, all three areas of the site produced a few artifacts of Contact period age, and it is possible that the site was used by both natives and Europeans during this period.

Farming continued in this area into the 18th century, but we found only one artifact, a piece of "scratch blue" ceramic from the topsoil of area C, that definitely dates to the 18th century (S. Mrozowski, personal communication). Redware, bottle glass, kaolin pipe fragments, and a kettle foot, all from the topsoil, could date to the 18th or 19th century. The cinder and coal fragments ubiquitous at sites in New England could be from this period, as the
residue from coal-burning stoves and furnaces was often thrown out onto fields. In general, though, it appears that the area was not used intensively during the 18th and 19th centuries.

The area of the Plimoth Plantation Spring site was used for formal gardens by the Hornblower family, and numerous artifacts reflect this use. Fragments of red clay flowerpots were among the most common recent artifacts from all areas. Several fragments of slate may be from flagstones. Other items can be related to the small buildings and sheds that once existed in the area, including nails, construction materials, roofing slates, and window glass possibly from greenhouses. The massive disturbances in areas A and B can also be considered features dating to this period.

Finally, fragments of "clay pigeons" were found in all areas, and two pieces of modern-looking lead shot were found in the topsoil of Area A. These artifacts represent the sport of trapshooting, and probably date to the Hornblower estate period. Clay pigeon fragments were most common in squares and STPs close to the river, suggesting that the clay pigeons were shot out over the water and some of the fragments fell back onto land.

PLIMOTH PLANTATION PERIOD

One of the most unusual, and potentially confusing, aspects of this site is the fact that the most recent artifacts deposited here represent remains left by modern people re-creating traditional Native American life ways. All such remains were found in the topsoil, and most came from Area A, indicating that this area has been a center of activity for this most recent period. Many of the "reproduction artifacts" are easy to discern because they are made of organic materials that would normally decay after a few years. For example, two fragments of leather, a piece of rope, and part of a wooden bowl were recovered. Fragments of three different ceramic vessels were also found, and two of these were easy to spot as "reproduction wares" because of their thickness and mode of decoration. Sherds from a third vessel looked very much like Contact Period ceramics, and only a few small details made us suspicious enough to show them to an interpreter, who confirmed that they were from a reproduction vessel (Nanepashemet, personal communication). As mentioned above, some of the flakes of stone from the site may also be from recent demonstrations of stone knapping, and in addition, a few other stone tools have suspiciously fresh peck marks.

We encountered several features that probably date to this period as well, but these features, all of which were found in Area A, were quite easy to distinguish from Pre-Contact features because they began at the base of the topsoil and extended into or through the disturbed subsoil zone.

Most of the bones, shells, and crustacean remains from the upper levels of the site date to this period as well. Currently, bone and other remains from meals cooked by the interpreters are commonly scattered about the site, and much of the uncalcined bone in the topsoil is assumed to have been deposited in this way, although some may represent kitchen refuse thrown on the gardens by earlier inhabitants of the area. Shellfish in the upper levels are primarily quahog (M. mercenaria), in marked contrast to the Pre-Contact levels. We also found numerous uncalcined bones of small herring-sized fish, often with their vertebrae still articulated, near the base of the plowzone in Area A. They probably represent the re-
mains of fish used to fertilize corn hills in a garden that once existed in this area.

Finally, several pieces of plastic straws, cigarette butts, plastic buttons, pencil fragments, a plastic bead, flashcubes, the plastic strap from a camera, and a plastic film canister all represent artifacts dropped by tourists. All are from the topsoil of Areas A and B.

CONCLUSIONS

The Plimoth Plantation Spring Site is but one of many archaeological sites that once existed along the Eel River, which was apparently a major focus of habitation in the Plymouth area. The Massachusetts Historical Commission files show numerous sites all along the Eel River, and Brewer states, "On both sides of the river, east and west, I have found artifacts in all locations that have been plowed up during the past sixty years" (Brewer 1968:59).

The Plimoth Plantation Spring Site is typical of others in the region in its location (sheltered from the north and west, and near a river or pond) and in its high frequency of features (Brewer 1942:55). It is less typical in that it has little shell; Brewer reported that 11 of the 18 sites he found in the Eel River area were shell middens, and many were located considerably farther from the coast than the Plimoth Plantation Spring Site (Brewer 1942:56). Whether this lack of shell is due to the season during which the site was used or to its functions, the practical result for archaeologists is poor preservation of bone food refuse and bone tools. In addition, the quantities of artifacts found here are not as great as those recovered from other sites in this area (Loparto et al. 1993), suggesting that the Plimoth Plantation Spring Site may have been a specialized or temporary camp throughout most of its history, and that the major villages and long-term campsites were located elsewhere.

Nevertheless, while the Plimoth Plantation Spring Site is not the oldest or richest of the Eel River sites, it may be one of the last remaining. Furthermore, it has considerable potential for providing information on topics such as on Late Archaic stone working procedures, on the transition to farming during the Late Woodland, and perhaps on the interactions between Native Americans and Europeans during the Contact Period. It is well protected by its current owners, and thus represents an archaeological success story in an area where so much has been lost.

Acknowledgments. Many people at Plimoth Plantation helped me to organize and carry out this project, including Jim Baker, Carol City, Paul Cripps, Jamie Haines, Liz Lodge, and Nanepashemet. I owe special thanks to all the interpreters at Hobbamock’s Homesite, who contributed so much to our understanding of the site and to our enjoyment of the project. Arthur Vantangoli and Bernard Otto kindly shared their considerable knowledge of the archaeology of the region with us. The Office of Graduate Studies and Research at the University of Massachusetts at Boston provided partial support for a graduate assistant, and Chris Eck filled that position with great skill and aplomb. He also produced and drafted the original site map. The members of the field crew (Susan Barnaby, Kathy Corbo, Deborah Dameron, Diane D’Arrigo, Patty Dellorfano, Susan Donnelly, Claire Glasson, Yvette Hix, Tony Kim, John Linsley, Natalia Narishkin, Eric Nord, Marc Paiva, Chris Scales, and Roland Timmons) excavated with industry and unfailing good humor. Susan, Diane, Eric, Chris Scales, and Roland responded to my plea for volunteers to help with the 1992 season, as did Martine Cherau, Emilie Donlan,
Betty Foster, and Owen Royce-Nagle. Carol Gaffney did most of the lab processing of the artifacts from the 1992 season.

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Radiocarbon ages of marine shell and charcoal found in the same level of a small pit can help calibrate the ages of other marine shells. A pit at Myrick’s Pond is thought by the excavator to contain a single component, that is, its shell and charcoal were deposited at the same time (Alan Strauss 1993, personal communication). Here I report on the $^{14}$C measurements and their calibration to calendar years. The comparison represents a test of the new marine calibration method of Stuiver and Braziunas, and, as such, the calibrated shell and charcoal ages are in excellent agreement.

INTRODUCTION

Archaeologists do not commonly take multiple radiocarbon dates from a single feature, because they assume the material is all of the same age, and $^{14}$C dating costs money. Some archaeologists in the northeast have advised against dating shell because of its unreliability. The Myrick’s Pond site provides us with an opportunity to age not only wood charcoal, but also *Mercenaria mercenaria* (quahog) shell found with it in the same level in the same small pit (1.6 m x 1.2 m, with a maximum depth of 0.50-0.55 m). This permits us to test the accuracy of the marine calibration model of Stuiver and Braziunas (1993).

First, some definitions are necessary (see Stuiver and Polach 1977). B.P. means before 1950. $^{14}$C is radiocarbon. A raw $^{14}$C age is one without the corrections to be discussed here. Isotopic fractionation for carbon is the selection for or discrimination against any of the carbon isotopes, $^{14}$C, $^{13}$C, and $^{12}$C, during processes such as photosynthesis or metabolism, etc. Because of fractionation, a plant or tissue can show different ratios of $^{14}$C/$^{12}$C and $^{13}$C/$^{12}$C than those of the carbon source. $^{\delta^{13}}$C is a measure of the ratio $^{13}$C/$^{12}$C, and reflects fractionation in a sample. A $^{\delta^{13}}$C correction for fractionation is approximately 16($^{25}\delta^{13}$C) $^{14}$C yrs. The conventional $^{14}$C age is the raw age $^{\delta^{13}}$C-corrected. Calendar years are what we use every day. Calibrated, or Cal, years are years that have been calibrated by reference to tree rings. Atmospheric Calibration involves the comparison of the conventional $^{14}$C age of a terrestrial sample with tables or graphs showing conventional years as a function of tree-ring or cal years. Marine calibration is calibration for marine samples through a model ocean to tree-ring or cal years. Because $^{14}$C, which is formed in the atmosphere, spends up to several thousand years in the deep ocean, decaying all the time, the marine reservoir contains carbon with a $^{14}$C/$^{12}$C ratio smaller than that of atmospheric carbon. Therefore, a marine Reservoir Effect correction (about 400 yrs) is built into the marine model and $\Delta R$, an adjustment to the age of the local ocean, needs to be known or estimated.

Radiocarbon ages are determined by measuring the rate of $^{14}$C decay (counting the
emission rate of Beta particles) or the amount of $^{14}$C (counting the $^{14}$C atoms in an Accelerator Mass Spectrometer). We also measure $\delta^{13}$C by a mass spectrometer in order to correct the raw ages for fractionation. The resulting conventional radiocarbon age for terrestrial organisms may then be calibrated to cal years by atmospheric correction curves (Stuiver and Pearson 1993). For marine organisms, after the $\delta^{13}$C-correction, one uses marine calibration taking the reservoir effect into account through $\Delta R$ (Little 1993; Stuiver and Braziunas 1993).

**METHODOLOGY**

The first step is to determine the conventional $^{14}$C age, i.e., the raw $^{14}$C age, $\delta^{13}$C-corrected. Although ages measured in the past were not $\delta^{13}$C-corrected, recently measured ages usually are. If it is not so stated in the lab report, a phone call to the lab, with the lab number, will usually provide at least a yes or no. If it was not $\delta^{13}$C-corrected, one can estimate $\delta^{13}$C values for many materials (see Stuiver and Polach 1977). The $\delta^{13}$C-correction is approximately 400 years for shell and about 0 for charcoal. Obviously this correction is more important for shell than for charcoal.

The second step, once we have the conventional radiocarbon ages for our samples (Table 1), is, for charcoal, to use atmospheric tree-ring calibration curves. From the conventional age, calibration gives the mean cal age +/- sigma (the standard deviation, or the 68% probability interval), which is reported by Stuiver and Reimer (1993) with the mean in parentheses, and -sigma and +sigma ages on left and right. Some archaeologists prefer to report +/- 2 sigma. For shell, calibration requires also a reservoir effect adjustment, $\Delta R$. For the Cape and Islands and Boston Harbor, the local adjustment, $\Delta R$, to the marine calibration model has been recently determined from seven pairs of charcoal and shell from single component deposits, as $\Delta R = -95_{-45}^{+45}$ $^{14}$C years (Little 1993; Stuiver and Braziunas 1993). We use the marine calibration curves with this $\Delta R$ to calibrate the Brewster shell age. The results of the charcoal and shell age calibrations using CALIB 3.03 (Stuiver and Reimer 1993) are shown in Table 1 and Figure 1.

**DISCUSSION**

The marine shell calibration with $\Delta R = -95_{-45}^{+45}$ gives a shell date $\pm$sigma of cal A.D. 1051 (1184) 1279, which corresponds almost exactly with the charcoal sample cal A.D. 1036 (1212) 1278 (Figure 1; Table 1). These samples were found at 33-38 cm (charcoal) and 38-44 cm (shell) in the same slightly downward

<table>
<thead>
<tr>
<th>Material &amp; Provenience</th>
<th>Lab #</th>
<th>$\delta^{13}$C</th>
<th>conventional age $^{14}$C yrs B.P.</th>
<th>Calibrated Age AD $^{14}$C yrs B.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charcoal, TP-2 33-38cm</td>
<td>GX-19564</td>
<td>-26.1</td>
<td>865 ± 95</td>
<td>1036(1212)1278</td>
</tr>
<tr>
<td>Shell, EU1 38-44cm</td>
<td>GX-19318</td>
<td>+1.6</td>
<td>1150 ± 90</td>
<td>1051(1184)1279</td>
</tr>
</tbody>
</table>
Figure 1. Graph of dates ± one sigma for the charcoal and shell from the Myrick’s Pond site, showing shell and charcoal conventional 14C yrs and shell and charcoal calibrated years (ΔR = -95 ± 45 yrs; Little 1993; Stuiver and Braziunas 1993).

sloping level (A. Strauss 1993, p.c.). Their ages provide support for the 1993 value of ΔR for the Cape and Islands.

The testing and reassurance provided by the (now eight) shell/charcoal calibration pairs suggests that shell from the Cape and Islands with the marine calibration method is providing good calibrated ages. If the charcoal one finds in this coastal region is too small for radiocarbon aging, one could do a lot worse than choose a shell sample to age.

An alternative method for reporting archaeological shell dates in the northeast has been to assume the fractionation and reservoir effect corrections cancel (see Stuiver and Borns 1975), which is often the case. This method, using atmospheric calibration with a raw shell age, would have given cal A.D. 1235 (1287) 1383, which is roughly 75 years more recent than the charcoal age. In this example, the new marine model provides the best match with the charcoal sample.

The two methods, both in current use, are causing general confusion, and I urge the use of well-defined symbols. In reporting radiocarbon results one should always state the material (including species, if known), the δ13C value, if known, the Lab number, whether the date is δ13C-corrected (is a conventional age), and whether you are using one or two sigma. [The Bulletin does not require calibration, but, if you try it, please also report the foregoing facts as well as a reference for the calibration
These qualifications should stay with the age every time it's published.

SUMMARY

From a pit feature at Myrick's Pond, Brewster, thought to contain a single component, we have dated shell and charcoal from the same level. The calibrated ages are reassuringly similar with 68% probability intervals of cal A.D. 1030-1262 and cal A.D. 1050-1270. The similarity of the ages for the shell sample (marine calibration) and the charcoal sample (atmospheric calibration) from the same level supports the newly published ΔR value of -95±45 14C years for the marine model calibration of shell at the Cape and Islands (Little 1993; Stuiver and Braziunas 1993). Note that archaeologists in other coastal areas need to establish local ΔR's.

Acknowledgments: Alan E. Strauss kindly provided the sample of Mercenaria mercenaria shell and the sample of wood charcoal that were used for this experiment. Funds from the Nantucket Historical Association supported the shell date. The charcoal date was funded by the incoming and outgoing property owners (S. & M. Belastock and S. and C. Dolphi). Alan Strauss' Phase 1 intensive archaeological survey at Myrick's Pond was carried out under Massachusetts General Law Chapter 9, secs. 26-27c, as amended by Chapter 254, Acts of 1988, and the Brewster Wetlands Protection ByLaws, as amended Dec. 10, 1984. Barbara Luedtke and John D.C. Little read and made valuable suggestions for this paper.

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SHELL TOOLS OR PLOWZONE DAMAGE? A PRELIMINARY STUDY

Peter Pagoulatos

INTRODUCTION

The primary purpose of this paper is to present the results of a preliminary study comparing breakage patterns of shell after manufacture as tools to the breakage patterns created in shell by plowing activity. In this study, breakage patterns were assessed through controlled experiments, in which two different samples of hard-shelled clams (*Mercenaria mercenaria*, or Northern Quahogs) were subjected to either plowing or tool-making. One sample was percussed with a hammerstone; the other group of shell specimens was plowed. Each group of shells was then analyzed for certain types of breakage patterns.

Studies in ethnoarchaeology and experimental archaeology have contributed significantly to archaeological method and theory (Ingersoll, Yellen, and MacDonald 1977; Binford 1978; Gould 1980; Keeley 1980). However, the identification of artifacts manufactured from shell is still poorly understood (Brett 1974; Stanzeski 1981; Pagoulatos 1993). While certain studies have assessed the effects of plowing on archaeological deposits (Hoffman 1982; Frink 1984; Ammerman 1985; Odell and Cowan 1987), no studies have been attempted to compare plow-induced damage on shell with intentional shell tool manufacture.

In eastern North America, aboriginal societies used shellfish for food (Brennan 1974; Schaper 1989) and tools (Hariot 1893; Swanton 1946; Fundaburk and Fundaburk 1957; Hulton and Quinn 1964; Lewis 1971; Webb 1974). Shell was used to produce a variety of artifact forms, including ornaments, containers, digging implements, scraping tools, knives, projectile points, and even as temper for clay pottery (see Swanton 1946:252-253; Fundaburk and Fundaburk 1957:154; Lewis 1971:71-73).

The majority of shell tool evidence has been documented from the tidal bays and rivers along the Atlantic seaboard. In this region, shellfish species such as oysters and clams were widely available, and stone was often absent. Shell may have substituted as a practical alternative to stone for tool use; hard-shell clams, in particular, would have been useful for tool-making because of their smooth shape, form, thickness, and relatively predictable fracturing properties (Brett 1974:118).

With the advent of European colonization in the 16th century, many midden locations created by aboriginal peoples were plowed over by historic period farmers. Long-term, intensive plowing activity has undoubtedly disturbed the vast majority of shell midden accumulations, making it difficult to distinguish between broken shells produced by food resource extraction, tool-making by Native American populations, and plowing by Euro-American farmers.

With these problems in mind, a series of experiments were conducted to assess whether hard-shell clam tools could be distinguished from plow-damaged pieces. It was proposed that manually fractured shell pieces could be distinguished from shell debris produced by

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plowing activity, on the basis of attributes such as shape. In turn, distinguishing shell tools under experimentally controlled conditions from plow-damaged shell could aid in archaeological interpretation of shell middens, and allow for the development of hypotheses that could be tested against the archaeological record.

METHODS

Shells of hard-shell clams (*M. mercenaria*) were used in this study. Hard-shelled clams are bivalves with a pair of hinged valves; the beak near the hinge points to the anterior and away from the posterior of the clam shell (Waselkov 1987). This variety of shellfish is typically found in sands and muds of bays and inlets throughout much of the coastal zone of eastern North America (Rehder 1988).

A total of 50 clams were purchased from a local fish market (whole shells averaged 172 g in weight and 10 cm in length). These shellfish were initially placed over an open fire, composed of oak and quartz cobbles, to weaken the abductor muscles of the clams; this procedure took about 15 minutes. The clams were then easily opened without any tools, and the meat was removed using one valve of a clam as a 'shucking' tool.

Subsequently, 25 of these shells were reduced using random hand-held percussion techniques with a quartz hammerstone (320 g). The remaining 25 shells were subjected to two 10 inch (25 cm) deep plowings with a John Deere tractor. These plow-damaged shells were then collected from the ground surface and compared to those manufactured by the author.

ANALYSIS

Once the experiments were completed, all shell artifacts were counted and classified by shape (see study by Brett 1974). Initially, shells were sorted by body element, such as anterior and posterior ends, and an indeterminate category. Then, because of their sharper-edged attributes, posterior-ended shell debris produced by both manufacturing and plowing were selected, weighed, and classified by generalized shapes: triangles (Type 1), trapezoids (Type 2), rectangles (Type 3), and amorphous forms (Type 4). Type 1 shapes consisted of equilateral, right triangle, and isosceles varieties.

Data were compared using simple quantitative measures such as frequencies and percentages, to assess whether different shell specimen shapes existed, dependent upon tool manufacturing and plow-related activity. The data from the two experiments are presented below; the results from each experiment are summarized in Table 1.

Table 1. Comparative manufactured shell tools and plow-damaged shell specimens.

<table>
<thead>
<tr>
<th>Type</th>
<th>Manufactured shell tools</th>
<th>Plow-Damaged shell specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>Type 1</td>
<td>29</td>
<td>17.1</td>
</tr>
<tr>
<td>Type 2</td>
<td>15</td>
<td>8.8</td>
</tr>
<tr>
<td>Type 3</td>
<td>22</td>
<td>12.9</td>
</tr>
<tr>
<td>Type 4</td>
<td>104</td>
<td>61.2</td>
</tr>
<tr>
<td>Total</td>
<td>170</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Manufacturing: A total of 788 shell pieces were produced from tool-manufacturing, of which 170 (22%) consisted of posterior end fragments used for analysis in this study (Table 1). Of the 170 pieces, Type 1 (17.1%) and Type 4 (61.2%) varieties were most common. Type 2 (8.8%) and Type 3 (12.9%) shapes were less frequently noted (Figure 1).

Plow-damaged: Only 61 shell pieces were generated from plowing, of which 11 (18%) included posterior fragments (56% of the shell valves were not broken by the plowing). Although the sample size is relatively small, it is interesting to note that a similar range of shapes was identified for manufacturing and plow-damage (Table 1; Figure 2). Also, as for manufacturing, Type 1 (36.3%) and Type 4 (45.5%) forms were the most frequently present; Type 2 (9.1%) and Type 3 (9.1%) were uncommon.

CONCLUSION

Hard-shelled clams were widely used as food and tools by Native American populations throughout the Atlantic seaboard in both prehistoric and historic contexts. However, until this study, little was known concerning the differential effects of shell breakage from plowing and intentional tool manufacture. Our current data suggest that similar patterns of observable shapes were produced from these two different behavioral processes. There were few recognizable shape or shape-distribution differences between manufactured and plow-created shell specimens.

In general, a greater quantity of debris was produced by working shell with a hammerstone than was produced by limited plowing. Undoubtedly, repeated plowing for decades or centuries would result in higher amounts of...
shell debris.

The comparative analysis of tools manufactured from shells and shells subjected to plowing should allow for the development of testable hypotheses that can contribute to the archaeological record. Future avenues of investigation should include the study of other kinds of shell (e.g., oysters, mussels), with different percussion instruments (e.g., shell, wood, stone), as well as different methods of manufacturing (e.g., pressure-flaking), and plowing (e.g., animal driven, wooden, mechanical).

Acknowledgements. I would like to thank the Cultural Resource Consulting Group for making this project possible, as well as Richard Veit and Dr. John Grande (Director, New Jersey Agricultural Experiment Station, Pittstown) for their assistance. Any inaccuracies in this paper are the sole responsibility of the author.

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NOTES TO CONTRIBUTORS

The Editor solicits original contributions related to the archaeology of Massachusetts for publication in the Bulletin of the Massachusetts Archaeological Society. Authors of articles submitted are requested to follow the style guide for American Antiquity (57:749-770 [1992]). Manuscripts should be sent to the Editor for evaluation and comment.

Authors with MAC and IBM-PC compatibles are encouraged to mail 5.25" (13.3 cm) or 3.5" (8.9 cm) floppy disks containing their files in WordPerfect 5.1 or ASCII to the editor. In the case of MAC, high density disks are preferred. Disks will be returned upon request. Tables should be submitted camera-ready.

Reference citations in the text should include the author’s name, date of publication, and the page or figure number, all enclosed in parentheses, as follows: (Bowman and Zeoli 1973:27) or (Ritchie 1965: Fig. 12). References cited should be listed in a final section alphabetically by author and presented as follows:

Gookin, Daniel

The editor encourages illustrations, called figures. Each figure with its caption should fit within the space available (17 cm by 23 cm or 6 & 1/2 by 9 inches) on a Bulletin page. Full, half or quarter page figures should be planned carefully. If the lettering on a figure is large, most figures can be reduced. Figures must be referred to in the text and numbered in their order of reference, with their number placed lightly on the margins of their reverse sides. Every item in each figure and each person should be identified. All lettering must be clear and legible and have high contrast. Photos must be glossy prints with high contrast. Scales with dimensions should be included in all figures for which they are appropriate. Captions, not a part of the illustrations, should be typed on a separate sheet and numbered to correspond to the figures.

Dimensions and distances should be given in metric units or in metric units and English units.
During the 1991-92 field season the Chapter excavated at the Charlestown Meadows site in Westborough. In 1992, work also began at a second location in Westborough on property owned by Astra Pharmaceutical Products, Inc. The field crew consisted of members of the Chapter, Bridgewater State College students, and occasionally members of other chapters, with Dr. Curtiss Hoffman of Bridgewater State College as the principal investigator.

The excavation at Charlestown Meadows concentrated on an area known as IC in blocks DD5 and CC5. This area had several large red earth features, which were excavated so as to define their edges better. Thirteen new features, including a new house floor, were discovered and approximately 500 bags of feature soil were wet screened. A total of 98 artifacts were recovered, including 20 scrapers, 12 hammerstones, 7 knives, 5 wedges, 3 bifaces, 3 preforms, 3 cores, 2 groundstone fragments, 1 gunflint, and 9 points. Five small stemmed points were recovered: 3 of white quartz, 1 of green argillite and 1 of maroon felsite; 2 Beekman triangles: 1 of gray argillite and 1 of white quartz; 1 Brewerton eared triangle of gray quartzite and 1 Coburn stemmed point of gray felsite.

In June, 1992 the Chapter started work at Astra Pharmaceutical in Westborough. Astra is developing a ten year building program on a 36 acre site and the Chapter asked that an archaeological survey be conducted under the aegis of the Westborough Historical Commission because of several known sites within the premises. For an intensive survey we divided the 36 acres into 10 areas and excavated 128 test units (each 50 cm by 50 cm) in order to locate any prehistoric or historic cultural resources that might be impacted by the proposed construction. Three of the 10 areas contained sufficient cultural materials to warrant further investigation. Close interval (2 m) core sampling was conducted in the area known as Astra-3, because construction was proposed to start in this area in June 1993. This location, Astra-3, is adjacent to the Hoccomonco #3 site, which the chapter excavated from 1975-1977. Over 200 artifacts were retrieved from Hoccomonco #3, ranging in age from 1,000 to 8,000 years old; the single radiocarbon age obtained on charcoal was $1890 \pm 125$ $^{14}$C yrs B.P. (GX-4912; not $\delta^{13}$C corrected).

The close interval coring at Astra 3 revealed many loci of red soil, which usually indicates the presence of cultural features. We also learned through historic research and excavation that the site has never been plowed. Stratigraphy consisted of a thin forest loam covering a fine, windblown sand, which overlies gravel. Except where pits were dug into the underlying layers, the prehistoric material is mostly confined to the fine sandy layer.

We have excavated over 100 square meters out of total of 1200 in the undisturbed area. In 1992 and 1993 we recovered 425 stone tools, 8 ceramic body sherds, 3166 flakes, along with charcoal, nutshell, and charred animal bone. The stone artifacts include: 20 points (including 4 tips and 1 blade), 58 scrapers (including 8 thumbnail, 5 oval, 5 end, 5 side, 4 steep-edged, 1 preform, 2 bits, 1 bit fragment, and 2 fragments), 15 knives (including 6 bases, 3 mid-sections, 2 flake knives, and 1 semilunar frag-
ment), 1 drill midsection, 1 flake drill fragment, 1 flake burin, 6 gravers, 6 spokeshaves, 1 chopper, 1 chopper/core, 12 biface fragments, 39 hammerstones (including 2 fragments and 1 hammerstone/nutter), 6 pounding stones (including 1 fragment), 4 nutting stones, 4 anvils, 1 pestle, 1 pestle fragment, 2 digging tools, 22 wedges, 10 cores, 10 preforms, 8 ceramic body sherds, 5 pecked stone fragments, 4 ground stone fragments, 150 utilized flakes, and 2 quartz crystals (possible magic stones).

The projectile points included (Figure 1) 5 small-stemmed (2 white quartz, 2 crystal quartz, and 1 Attleborough red felsite); 4 Squibnocket triangles (3 white quartz, 1 crystal quartz); 3 Brewerton-eared triangles (1 white quartz, 1 crystal quartz [not shown], 1 tan granite); 2 Beekman triangles (1 white quartz, 1 crystal quartz); and 1 Levanna point (crystal quartz).

One of the 41 pit features that we dug this season went down over 150 cm into the gravel horizon. The gravel from the pit was scooped out and deposited in areas that were probably adjacent older pits, as a mixture of gravel and sandy feature soils bordered the pit. A digging tool, core, and 2 knife mid-sections were found deep within the pit. Analysis of the organics is incomplete but features have yielded turtle bone, hazel, acorn and hickory nutshell, and charcoal, in addition to artifacts and flakes. Most of the lithics were local quartz, quartzites, and granite. However, some Attleborough red felsite was used along with a small amount of flint and chert. The diagnostics, along with the radiocarbon ages on charcoal of $7850 \pm 90 \, ^{14}\text{C} \text{yrs B.P. (}\beta-67373\text{), } 4050 \pm 70 \, ^{14}\text{C} \text{yrs B.P. (}\beta-63428\text{), and } 1420 \pm 70 \, ^{14}\text{C} \text{yrs B.P. (}\beta-66798\text{), all } \delta^{13}\text{C-corrected, indicate that Astra 3 is a rich, multicomponent site.}$

In July we learned that the building scheduled to be constructed on the Astra 3 site was proposed for area 10. As a result our attention shifted to area 10, where a close interval (2m) core sampling was undertaken. A 90m x 45m grid was laid out on the grassy open field and approximately 2100 cores were examined. Several red soil loci were recorded and four 1m squares were dug in the red soil to verify the presence of cultural features. Several features were identified, including a charcoal pit and artifacts retrieved to date include several hammerstones, a quartzite knife, and a few pottery sherds. During the coming field season we shall concentrate on the Astra 10 site, because construction is now scheduled here by the end of 1994.

(from reports presented at M.A.S Annual Meetings, October, 1992 & 1993).

Figure 1. Diagnostic points, Astra Pharmaceutical Site, Astra-3, Westborough MA (A. Smith photo).