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Cover Photo: Prehistoric ceramic sites in Southwestern Connecticut and adjacent section of New York

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CHANGING PALEOECOLOGICAL RELATIONSHIPS DURING THE LATE PLEISTOCENE AND HOLOCENE IN NEW ENGLAND

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ABSTRACT

This review briefly describes the glacial conditions, plants, animals, and the interrelationships among them and humans during the following times: (1) at 40,000 B.P. when the ice sheet extended a little south of the U.S. - Canadian border, (2) from 18,000 B.P. when the ice sheet reached its maximum extent to 14,000 B.P. when the great melt-out began, (3) from 14,000 - 9000 B.P. when the spruce-pine forest invaded, humans arrived, and many large mammals became extinct, (4) from 9000 - 3000 B.P. when relatively warm and dry conditions prevailed and large populations of broad-leaved deciduous trees arrived, and (5) from 3000 B.P. to the present when the climate was cooler and moister and when Europeans arrived to disrupt the ancient relationships between Native Americans and the environment.

INTRODUCTION

Profound biotic changes occurred in New England during and just after the final melting of the last substage of the Wisconsinan glaciation. The questions of why such changes came about and how they affected Native Americans are not easily answered, but remain fascinating in any case. We have started with 40,000 B.P. not because it was a time of the deepest "winter" and the farthest ice advance of the Wisconsinan glaciation, but because it was a time when the glacier was in about a median stage of its extent during the late Pleistocene and a time that is thought to be previous to the advent of humans in New England.

40,000 B.P.

If for a moment we could transport ourselves back to 40,000 B.P. in New England, we would probably have found (1) no people, (2) no glacier, except in the northwestern part of Vermont and some of Maine, and (3) a very unfamiliar plant and animal population.

Considering the first of these observations, no evidence now exists for human occupation at that time in New England. Whether the glacier destroyed such evidence or whether we have not yet dug deep enough in certain deposits are at least possibilities to consider. There is, however, evidence of something resembling hearths together with some dubious artifacts that date as old as 35,000 B.P. (L-299D) and even 38,000 B.P. (UCLA-110) in southwestern North America (Haynes 1967). But Haynes had strong reservations about these sites being actually caused by humans. Waters (1985) agreed with these reservations and concluded that the Clovis culture is still the oldest unequivocal evidence for man in the Americas south of the ice sheets. The earliest Paleo-Indian sites in northeastern North America have been dated between 11,000 and 10,000

B.P. (Grimes *et al* 1984). On the other hand, it may be significant that recent finds reported in the public press give dates of 32,000 B.P. for a site in Brazil, and 33,000 B.P. for one in Chile (Wilford 1986).

On the second point, the continental ice sheet, although extending over a vast area of Canada, left a large portion of North America ice-free during the entire 64,000 or so years of the Wisconsin glaciation. If we had lived in New England about 40,000 B.P. we would probably have thought of the ice-front as no less static than the one today in Greenland.

As for the third observation, the vegetation in New England consisted mainly of a cool-climate forest made up of spruce (*Picea*) and lesser amounts of pine (*Pinus*), evidently largely jack pine (*Pinus banksiana Lamb.*) (Delcourt and Delcourt 1981). Jack pine today is almost exclusively Canadian, extending north to approach Hudson Bay, east to Nova Scotia, and west to the Rockies (Little 1971). Spruce (at least *Picea mariana* Mill., B.S.P.) covers much the same region, but extends into Alaska at one end and into New England at the other. Jack pine can occupy drier sites than spruce while spruce commonly occurs along the edges of bogs and lakes, as well as in a transition region between open muskeg and gentle slopes of more upland areas (Larsen 1980). The soils must have been underlain with frozen ground or permafrost. In fact evidence for permafrost in ground south of the ice sheet during the last glacial epoch is now known (Péwé 1973). One is tempted to judge from present day Canada what conditions were like in those days, but such comparisons have been questioned (e.g., Ritchie 1977).

The spruce-pine forest was sometimes broken up by tundra-like areas, presenting a mosaic of forest, open woody scrub, and herbs called "woodland" (intermediate between tundra and forest) (R. Davis and Jacobson 1985). In a different view, although Larsen (1980:1) used "taiga" to mean the boreal forest consisting of spruce, larch, fir, pine, and other less important tree species, he emphasized the lack of a static, geographically homogeneous flora within it. Instead he pointed out the importance of a "continuum" in which communities are arrayed along various "ecoclines", that is, changing the number of individuals of each species from one kind of habitat to another.

True tundra (treeless by physiographic definition) occurred mainly near the mass of ice which was then encroaching on the present U.S. - Canadian border. Lake Erie and another lake of similar size in the St. Lawrence River Valley drained south into the Hudson River to the Atlantic Ocean. Land extended eastward from New England to a line roughly going from Nova Scotia to George's Bank off Cape Cod (Delcourt and Delcourt 1981).

The tundra, forest, and open areas within the forest, provided fodder for an extraordinary variety of large mammalian herbivores. These included various Artiodactyla (with even-toed feet), Perissodactyla (with odd-toed feet) (Savage and Russell 1983:382), at least six genera of Proboscidea (elephant-like animals) (Dragoo 1979), and many others such as certain Edentata (e.g., sloths) (Kurtén and Anderson 1980:128).

Although not necessarily a model for Pleistocene times, many of the present day Canadian spruce forests are associated with ground-living mosses and lichens. These lowly plants commonly form a ground cover that is not only important to the life-cycle of the spruce itself (Larsen 1980:212), but serve as food for grazing mammals. Not much has been known about the food of the mammoth and mastodon other than some sketchy observations of remains in China and Siberia. Recent analyses of mammoth dung from a cave in western U.S. revealed the presence of grasses, sedges, and some woody plants (Mead *et al* 1986). Mammoth teeth, like those of present day elephants, were well adapted to grinding such things as grasses and leaves of willow, alder, and the like, whereas the jagged teeth of the mastodon were adapted to coarser fare, such as spruce branches and leaves.

Other large herbivores must also have been important. Among the Artiodactyla were the Antilocapridae or pronghorns and the Cervidae including the white-tailed deer (*Odocoileus virginianus*) and the caribou (*Rangifer*), both of which still exist today. Another important ungulate was the giant deer or stag-moose (*Cervalces*) that became extinct shortly after the end of the Pleistocene. Of the Bovidae, two species of bison, now extinct, lived in those days: *Bison antiquus* and *B. occidentalis*. *Bootherium* was a woodland musk ox associated with spruce and pine, also now extinct. Another woodland musk ox, *Symbos*, was associated with spruce and fir and survived briefly into post-glacial times. Still another musk ox, *Ovibos*, survives to the present, perhaps because it could escape human hunters by ranging further north than the humans. *Euceratotherium* was a bovid shrub ox associated with *B. antiquus*. Besides *Euceratotherium*, another shrub ox was *Preptoceras* (Martin and Guilday 1967:59).

The cervids are in general browsers, as foresters so well know today from the depredations of deer on young trees; the bovids are largely grazers, although there are notable exceptions in both groups. The woodland caribou (*Rangifer caribou*) of today feeds in summer on plants like those eaten by the moose: herbs, aquatics like lily pads and their roots, and some browse. In winter they dig through the snow for mosses, lichens, and grasses and if the snow is very deep, eat the hanging lichen *Usnea*. The barren-ground caribou (*R. arcticus*) of today feeds largely on lichens and grasses the year round (Hamilton 1939:139). In winter, however, it depends on grasses, true mosses, crowberry, and bearberry; in spring it browses on willow and birch; and in summer on various plants including mushrooms. *Ovibos* feeds mostly through the snow on grasses, mosses, lichens, and willow (Hamilton 1939:157).

Among the Edentata, sloths had existed in North America since the Pliocene and had spread far north from their South American origins, feeding on tree leaves and the like. One species of *Megalonyx* is known from beds in Indiana and is thought to have measured 3.5m from head to tail-tip. Another one, *Paramylodon*, whose bones were found in Kentucky as well as California, grew to a size of about 2.5m in length (Martin and Guilday 1967).

The Perissodactyla also made up an important part of the ungulates or hooved animals. Judging by the fossils, *Equus* was common in the steppes of North America and certain species may have lived in woodland situations as the tarpan does today in Polish forest preserves. Although seven species of *Equus* occurred in the Pleistocene (Savage and Russell 1983), all became extinct by 8000 B.P. Species of *Tapirus* and two genera of peccaries were also numerous.

Among the Rodentia, the giant beaver and two genera of capybara might be mentioned as important and, unlike others of their kind, were adapted to a cold climate (Martin and Guilday 1967).

Most fossils of Carnivora have been found outside New England so that we can usually only guess that they also occurred there. What is known indicates that the Carnivora were sometimes specialized predators. One of the saber-tooth cats, *Smilodon fatalis*, preyed on large, slow-footed animals, perhaps sloths, although there was a case of a wolf's skull found with a saber still stuck through it (Savage and Russell 1983). Another smaller saber-tooth cat preyed on young proboscids (Martin and Guilday 1967). Species of *Felis*, *Lynx*, and *Leo* may also have occurred in New England. The larger cats and bears were probably at the top of the predator hierarchy. Two genera of bears, *Arctodus* and *Tremarctos* lived throughout the Wisconsinan epoch.

Several writers have tried to sort out this mammalian array into geographical regions. Recently L. Martin *et al* (1985) have proposed a number of faunal provinces for North America in the late Wisconsinan epoch for the time after 25,000 B.P. One that concerns us here is the *Ovibos* faunal province with *R. tarandus* (caribou) and *Dicrostonyx* (a lemming) as common species. This represents the more northern of the two northeastern faunal provinces and bordered on the ice sheet to the north. It also includes mammoth (*Mammuthus* spp.), wolf, fox, and bear. The second province is that of *Symbos-Cervalces* and includes *Sangamona* (fugitive deer), *Castoroides Ohioensis* (giant beaver), and *Microtus xanthognathus* (vole). Other genera in this second province also include *Mammut* (mastodon), *Megalonyx* (sloth), *Martes* (martin), *Arctodus* (bear), *Tapirus* (tapir), *Equus* (horse), *Platygonus* (peccary), and *Bootherium* (musk ox). Species of *Mammuthus* are relatively rare in this second group as compared to the first. Although there is much overlap, the second province is more southern, but still within the range of the taiga which then extended to the present North Carolina northern border.

Widespread crops of conifer seed along with those of grasses and other small plants should have provided at least a seasonal food supply for armies of birds and rodents. The population cycles of rodents, like mice and lemmings, have long been the wonder of naturalists. The rodents and birds in turn sustained a number of carnivores, especially species of *Canis*: dog, dire wolf, wolf, fox, and coyote. Wolves and dogs, of course, can attack larger prey upon occasion. Many other smaller mammals as well as reptiles, birds, molluscs, and insects have been studied for these times.

18,000 to 14,000 B.P.

Around 18,000 B.P. the ice sheet of the late Wisconsin reached its farthest advance in New England. Somewhat older dates of 18,900 and 19,450 B.P. are given for this by Denton *et al* (1986). Whichever is correct, temperatures were universally lower than today about this time and the unglaciated land surface of the earth was generally drier than that of today (Peterson *et al* 1979). The ice had advanced south of present day Long Island as much as 100km out over land of the continental shelf and over land that stretched northeast as much as 300km from present day Cape Cod and the offshore banks (Edwards and Merrill 1977). The sea was then 123m below is present level (Whitmore 1967). Oldale (1986), however, gives 100m and maybe half that for glacial times.

The glacier began to recede only a few millennia after 18,000 B.P. as the climate warmed. We are generally agreed that it did warm; what caused the warming remains a mystery -- but not for lack of effort to solve it. Recent theories include volcanic activity affecting atmospheric CO_2 levels (Porter 1986), eccentricities in the earth's orbit together with certain other factors including variations in atmospheric CO_2 levels (Schneider and Thompson 1979, Denton *et al* 1986), interstellar gas (hydrogen and helium) passing through our solar system to affect ultraviolet radiation (Paresce and Bowyer 1986), and solar cycles of radiant energy causing cyclical glacial melting as recorded in varved deposits (Williams 1986).

Carbon dates obtained from glacial drift bordering on soil deposits in the Great Lakes region indicate that marked ice recession occurred about 14,000 B.P. in Ohio and about 12,000 B.P. in Ontario (Imbrie and Imbrie 1986, citing Goldthwaite *et al*). Oxygen isotope measurements made from foraminiferan deposits in the deep sea purporting to measure temperature, have yielded several different ages for the start of the last melting of the ice sheet. By one such chronology, a massive volumetric recession began about 14,000 B.P. (Denton *et al* 1986 citing Mix and Ruddiman).

In spite of the melting of the ice sheet in southern New England, great blocks of ice, sometimes covered by glacial debris remained for centuries and even millennia in valleys, lakes, swamps, and ponds. Lingering ice in valleys frequently dammed the drainage so that flood waters carrying debris were forced to flow on either side of the ice and create terraces. There is hardly a physiographic formation in New England that does not have some relation to the effects of the last glacier: rounded hillocks, drumlins, moraines, glacial till, rock-strewn fields, (ice) crevasse fillings, kames, eskers, alluvial fans, kettle holes, and huge erratics (Flint 1930). New alluvium has been added to outwash plains since the glacial times, even in the present century, as shown by Russell Handsman of the American Indian Archaeological Institute.

Cores from bogs and lake-bottoms have yielded evidence that by 14,000 B.P. southern New England was ice-free while the glacier still extended into central Vermont, New Hampshire, and most of Maine (R. Davis and Jacobson 1985). A vegetation map of eastern North America (Delcourt and Delcourt 1981) for 14,000 B.P. shows that much of Connecticut, eastern Massachusetts, and land to the north and northeast of Cape Cod was in tundra; to the south, mostly over land now submerged, the principal land cover was spruce. This was based largely upon M. Davis's (1969) study at Rogers Lake near Old Lyme, Connecticut, where the main vegetation was herbs, shrubs, and small amounts of spruce and pine, together with lesser amounts of oak (*Quercus*) and ash (*Fraxinus*). More recent studies show that poplar woodland had invaded north over much of the eastern part of Massachusetts and a bit of southern New Hampshire, while tundra covered most of central and western parts of Massachusetts, most of New Hampshire, and more than half of Vermont (R. Davis and Jacobson 1985).

With southern New England clear of ice by 14,000 B.P. and maybe even earlier, Paleo-Indians could have entered its tundra and boreal regions. In support of this idea are signs of human occupation in the form of charcoal deposits at the Meadowcroft Rockshelter near Pittsburgh, Pennsylvania, just south of where the Laurentide ice sheet had come. The charcoal in one sample near the bottom of the dig dated to 21,380±800 years B.P., 19,430 B.C., (SI-2121) (Adovasio *et al* 1985). In spite of criticism of the authenticity of this date, Shutler (1985) strongly favored it and stated that it was high time to stop ignoring such early evidence for man's presence. However, as mentioned before, much later dates around 11,000- -10,000 B.P. are generally accepted for the Paleo-Indian advent.

In the time from 18,000±-±14,000 B.P. the fauna outlined above for earlier glacial times did not face serious deterioration. Only 3000 years later did many of the larger animals become extinct over much of North America (Martin 1967:95).

14,000 B.P. to 9000 B.P.

The extensive tundra, poplar woodland, and mixed woodland (poplar mixed with spruce and certain other tree species) soon gave way to new plant associations after 14,000 B.P. Some thirty years ago the time of 12,500 B.P. was considered to be about the start of the "Pre-Boreal" interval in northeastern U.S. when spruce, fir, pine, and oak began to take over from the tundra. Simultaneously the "Allerod Interstade" was beginning in northwestern Europe (Deevey and Flint 1957). Since 1957 research on fossil pollen and macro-plant material preserved in bogs and lakes, much of it pioneered by Deevey and his students, has revealed a picture of different parts of New England undergoing changes at different times.

At 12,000 B.P. northern Maine was still covered by ice. According to Hare (1976), a large island of it, separate from the continental glacier extended from just south of the eastern end of the St. Lawrence waterway southwestward toward northern Vermont. At this time central Maine, northern New Hampshire, and most of Vermont were in tundra (R. Davis and Jacobson 1985). In western Massachusetts there was a very high percentage of non-arboreal pollen (mostly from herbs and shrubs),later giving way to an open boreal forest with spruce predominant so that by 9600 B.P. this land had gone over to a closed boreal forest (Whitehead 1979).

In southern Connecticut, M. Davis's (1976) graphs for 12,000 B.P. indicate that spruce had not yet peaked. Instead, large amounts of *Cyperaceae* (sedges) and lesser amounts of *Gramineae* (grasses), chenopods (goosefoots and pigweeds), *Artemisia* (a genus of Compositae), mosses, Lycopodium, and ferns were represented, together with some small amounts of woody plants: spruce, pine, alder, birch, and oak (M. Davis 1969). At 11,000 B.P. spruce was predominant with pine and birch in lesser amounts. By 10,000 B.P. spruce was peaking and associated with lesser amounts of pine and birch, and by 9000 B.P. the land was being taken over by pine, principally jack pine, which arrived around 9500 B.P. and peaked just after 9000 (M. Davis 1976). Land also existed extending northeast from the vicinity of Cape Cod where tundra and spruce-pine forest occurred, the spruce-pine being nearer to the Atlantic Ocean (Edwards and Merrill 1977). White pine (*Pinus strobus* L.) arrived from the south in the latitude of New York City about 10,000 B.P. (M. Davis 1976). Some tree species are thought to have possibly survived in "refugia" along the shores of the ocean or on debris on top of the ice. Most species migrated north as individual species, not as associations, following the lowlands and valleys.

Estimates of the paleoclimate have been made from the kind of vegetation that occurred at a certain time, but differences in rates of plant migration, although very slow, make this difficult. One would expect that the light, winged seeds of pine and spruce would blow readily in the wind to new locations whereas the nut trees depend largely upon birds and mammals or occasional water transport for shorter dispersal distances. Actually, it has been shown that birds and mammals move the heavy seeds farther on the average than the wind blows the winged seeds (Webb 1986). Certain herbs have light feathery attachments to the seeds that allow dispersal for hundreds of miles. The early invasion of poplar into New England may have occurred because of the light, fluffy seed attachments.

Furthermore, some species are better adapted than others to establishing themselves on rugged sands, gravels, and clays left by the glacier. For example, black spruce is adept at seeding into burned areas from cones that survive on fire-killed trees (Larsen 1980:331). For further on these migrations see Bernabo and Webb (1977) and Wright (1976).

In spite of the difficulties of estimating climate from plant associations or single species, spruce should be a good indicator of a cool, moist paleo-climate. Its resistance to harsh, cool conditions must have depended on an array of adaptations: branch layering (a common way of reproduction); mechanical resistance of leaves, stems, and branches; shallow rooting on poorly aerated soils; root grafting to form mats of many individual trees; resistance to winter drying and low temperature; quick recovery of photosynthesis in brief warm periods; and ability to set seed in a short growing season.

The first evidence for mankind's arrival into this predominately coniferous forest and woodland dates from about 11,000- -10,000 B.P. (Grimes *et al* 1984). One in Connecticut dates to 10,190±300 years B.P., 8240 B.C., (W-3931) (Moeller 1980). A date from the Bull Brook II site in eastern Massachusetts where fluted points were found is 8565±284 years B.P., ^{13}C corrected, (GX-6279) (Grimes *et al* 1984). This date is now thought to be too young and older dates have been obtained from other northeastern sites within the ca 10,000 - 11,000 B.P. range.

Many of us have accepted the idea that Paleo-Indians were predominately big game hunters. However, new excavation techniques which recover such things as seeds, suggest that they were hunter-gatherers of all kinds of plant and animal food along the waters where they camped (Moeller 1984). There is now no doubt that they hunted caribou; evidence for this has been found from Michigan to

Massachusetts (Funk 1984). Funk concluded that the caribou was a basic source of protein for the Paleo-Indians although general gathering supplemented their diet.

The question of whether or not the Paleo-Indians brought about the megafaunal extinction around 11,000 B.P. has been debated for at least 30 years. If fire had been used to drive game as is indicated by finds of Paleolithic man's activities in Europe, the Paleo-Indians could also have used fire and affected the vegetation. But in the Northeast, we have no proof of this in the form of charcoal deposits over broad areas (Moeller 1980). Also Guilday (1967) pointed out that fire could even have benefitted certain kinds of vegetation which then seeded in, or like the poplar and grasses, could spring up from roots.

Martin (1967:76) has long favored the idea of a wave of megafaunal extinctions brought about by human hunters. In central Africa pygmies, wielding only spears, are able to wound an adult elephant, then follow it until it dies. But the elephant population there is declining as a result of several other things: drought, loss of range to cattle farming, and modern firearms. Martin (1967:95,chart) concluded that the main wave of extinction of *Mammut, Mammuthus, Paramylodon,* and *Equus* cf complicatus did not occur until 11,000 B.P. and the mastodon may have lived a little later. In fact enclaves of relict animals may have survived into mid-Holocene times, but proof of this is lacking. Martin also pointed out that the Clovis fluted point hunters pursued the mammoth for a short time in western North America before they were replaced after 11,000 B.P. by Folsom point hunters who killed bison (Martin 1967:97). The principal megafauna apparently survived no later than 10,000 B.P. and maybe no later than 10,800 B.P. (Meltzer and Mead 1985). These dates barely overlap the recorded arrival of humans in northeastern North America. If we accept the Meadowcroft Rockshelter dates of around 21,000 B.P. as those of occupation sites, then the overlap is considerable. Recently in a swamp in Genesee County, northwestern New York, bones of mastodon, wapiti (American elk), and white-tailed deer, as well as those of passenger pigeon, caribou, elk, raven, and condor dated to 10,450±400 years B.P.,8500 B.C., (no lab number given) have been found. Cultural remains included a Clovis point and a bifacial flint knife or scraper; the point found with elk bones, the scraper 20cm above the mastodon bones (Steadman *et al* 1986).

Other possibilities for the cause of extinction in which as many as 32 genera of large mammals disappeared in a remarkably short time (Meltzer and Mead 1985) include disease and habitat deterioration. In both animals and plants, disease can follow severe stress brought on by drought, cold, heat, inadequate minerals or certain other shortcomings of the ecosystem. Cyclic changes (from 1 to 10 or so years) in mammalian populations in our own time are an established concept and go on in the best of times. Climatic changes could also have had an ill-effect on animal mating habits and thus on reproduction (Slaughter 1967). Great dust storms were at one time thought to have caused the extinctions (Hamilton 1939:25). This is not at all a ridiculous notion when we consider the vast loess deposits in Europe and Asia associated with the melting of continental glaciers. Much of New England's loess blew off to sea. However, a loess deposit is known that rests <u>on top</u> of a Paleo-Indian site in the Upper Delaware River Valley (Dent 1986). High summer temperatures could also have been a problem for such animals as the woolly mammoth and the musk ox. The latter can suffer severely from temperatures over 50° F (Bergman 1986).

A widespread die-out of grasses and other tender annuals could have prevented the mammoth from storing enough fat to survive the winter. In favor of the changing habitat theory, two genera of proboscidians became extinct toward the end of the <u>lower</u> Pleistocene and as many as nine genera died out at the Pliocene-Pleistocene boundary (Dragoo 1979), long before mankind was on the scene. Martin (1967:81) tells of other such extinctions before the Wisconsin.

We can reasonably assume that the boreal forest invasion into most of New England between 11,000 and 10,000 B.P. (R. Davis and Jacobson 1984) seriously reduced the kind of food palatable to certain of the large herbivores. But why could not these animals have simply migrated farther north ahead of the encroaching forest?; a question asked 40 years ago by Hibben (Martin 1967:87). In the final analysis it seems to me that the Paleo-Indians brought those animals to extinction that were easily hunted when they were already under stress from a diminished food supply. With increased competition from more adaptable animals and no inherited fear of mankind, they fell easy prey to Paleo-Indian hunters who worked in groups and either drove them into swamps and traps or so wounded them with spears that they died later.

Great numbers of mastodon and mammoth bones have been found by fisherman over the years off the East Coast extending from Cape Hatteras to a little beyond Cape Cod (Whitmore 1967). Teeth and other bones have been recovered from at least 40 sites on the continental shelf. Mastodon remains are more common than those of mammoth and both range in chronology from 11,465 to 8130 B.P. with the oldest found on George's Bank off Cape Cod, the youngest south toward Delaware. Several mammoth species occurred; one northern, one southern, and one apparently intermediate. Remains of horse, tapir, musk ox, and "giant moose" have been found, sometimes at depths of up to 120m (Whitmore 1967).

Around 10,000 B.P. the continental glacier in eastern North America had shrunken enough to leave the Great Lakes much as they are today, although another lake about the size of Lake Erie still survived in the St. Lawrence Valley, draining to the northeast instead of down the Hudson River. Tundra at this time was largely limited to the region along the ice front in Canada, with the exception of a large patch of it in Central Maine (Delcourt and Delcourt 1981).

According to R. Davis and Jacobson (1985), northern Maine was in mixed woodland at 10,000 B.P. with a few patches of it in the mountains of Maine and New Hampshire, while a forest of paper birch, poplar, jack pine, red pine (*Pinus resinosa* Ait.) and fir (*Abies balsamea* (L.) Mill.) existed most everywhere else in New England. At Moulton Pond, Maine, there was a marked change at about 10,500 B.P. when jack pine gave way to white pine, the latter reaching a peak about 9200 B.P. Meanwhile at this site spruce declined to very low levels at 10,500 B.P. and arboreal birch replaced dwarf birch (R. Davis *et al* 1975). At Rogers Lake, Connecticut, spruce and pine were still predominant at 10,000 B.P. with lesser amounts of alder (*Alnus*), small birch (*Betula*), poplar (*Populus*), oak (*Quercus*), and ash (*Fraxinus*); fir and larch (*Larix*) occurred in smaller amounts as well (M. Davis 1976). Hemlock (*Tsuga*) did not arrive in substantial quantity at Rogers Lake for another 1000 years. Beech (Fagus) reached a peak about 4500 B.P. having been present in much earlier times. Following 4000 B.P. hickory increased markedly. Oak was present in small amounts at Moulton Pond from as early as 13,900 B.P. and intermittently thereafter until 10,500 B.P. when it gradually increased to about 5500 B.P., declined to nearly nothing at 2500 B.P. and slowly rose again to the present (R. Davis *et al* 1975).

About 10,000 B.P. a conifer-hardwood forest (the hardwoods being broad-leaved deciduous trees) gained a firm foothold in southwestern New England. This association had been confined at 14,000 B.P. to the latitude of central South Carolina in a band extending west nearly to the Mississippi River. The birches that arrived in this group were probably white birch (*Betula papyrifera* Marsh.) and gray birch (*B. populifolia* Marsh.), and somewhat later, yellow birch (*B. lutea* Marsh.) (Delcourt and Delcourt 1981; R. Davis and Jacobson 1985).

9000 to 3000 B.P.

Around 9000 B.P. a number of remarkable events occurred in southern New England. One of these was the rapid decline of spruce and of the smaller populations of fir and larch, while hemlock and oak increased dramatically. Red maple (*Acer rubrum* L.), sugar maple (*A. saccharum* Marsh.) and chestnut (*Castanea dentata* Borkh) also made an appearance about this time (M. Davis 1976). From 9000 B.P. on, oak dominated the pollen percentages at Rogers Lake up nearly to the present (M. Davis 1969). Further north at Moulton Pond, Maine, however, oak percentages rose from 10,000 B.P. until 8000 B.P. then declined until about 3000 B.P. (R. Davis *et al* 1975).

9000 B.P. was also the time of the beginning of the Hypsithermal interval, marked by increased warmth (Deevey and Flint 1957); it was also the beginning of the Archaic period in Connecticut marked by a change from fluted to bifurcate and certain other kinds of points (Lavin 1984). An earlier date of ca 10,000 B.P. is given by Dincauze and Mulholland (1977) for the beginning of the Archaic and a warm, dry period may have begun at 10,200 (Denton *et al* 1986). Not much is actually known about the Early Archaic in New England (Lavin 1984) and the points from that period are usually only surface finds (Moeller 1984). Although the Hypsithermal was mostly warm and dry, small glacial advances in the world's ice sheets occurred at 7300, 6300, 5600, 4800, 4500, and 3200 B.P. (Denton *et al* 1986). These times can be compared to sea level declines given by Fairbridge (Vargo and Vargo 1986). His data show that a decline in sea level occurred about 6400, a large one about 4400 and a double dip around 3000 B.P., recovering shortly afterward to near present-day levels. Recent research reviewed by Searle and Woods (1986) indicates much smaller fluctuations in world sea levels than those shown by Fairbridge.

A gradual decline of white pine from 8000 – 7000 B.P. at Rogers Lake indicates a warmer and drier forest environment. This climatic change is also evident in the expansion of the prairie eastward between 9500 and 7000 B.P. (Bernabo and Webb 1977). Rising sea levels, shown in Fairbridge's data from about 7400 B.P. with a few minor dips to about 5600 B.P. when it comes nearly to present-day levels, is an indication of a continued warm interval. However, sea levels have risen about 3m in the past 3500 years, rising at .85mm per year (McWeeney 1986 citing Bloom). The filling of Long Island Sound and the change in the southern New England coast line can be compared with the northward progress of oak on maps by Dincauze and Mulholland (1977) for the time from 9000– –6000 B.P. (Early and Middle Archaic periods).

Forest composition can be altered not only by climate, but by the depredations of animals like deer and rodents. As we know from recent times, insects can be even more devastating. The gradual decline in hemlock from about 9000 to the present could have been the result of insect depredation. But a more likely possibility in my opinion is that hemlock's sensitivity to drought could have reduced its numbers and curtailed reproduction.

The reason why spruce declined several thousand years ago might be found in its present predicament in Maine wherein the spruce budworm is causing extensive damage. The budworm is known to thrive in consecutive years of warm, dry periods in summer (Baker 1972:259). This has been recently occurring in Maine and could have occurred centuries ago in more southern locations as the climate warmed. In this connection it is known that the gypsy moth, the caterpillar of which causes enormous defoliation, is limited to southern New England because of the sensitivity of the over-wintering eggs to cold.

How much the Native Americans altered the environment can only be speculated on. It is known that Mesolithic man in Europe practiced burning and may have done it to encourage the hazel (*Corylus*) for its nuts. Although the religion and culture of Native Americans inclined them to protect the environment, there is evidence that they did occasionally use fire to clear the forest shrubbery (e.g., DeForest 1851:2) perhaps for hunting purposes or better visibility in detecting intruders.

Not a great deal is known about the animals from 9000 – 3000 B.P. since bones survive only poorly in New England's acidic soils except in shell heaps with high pH or bogs with low oxygen levels. Around 9000 B.P. the forests of southern New England supported animals such as white-tailed deer, turkey, and moose, as well as predators like lynx, fox, and wolverine (Fagan 1978). Even as late as the 18th century A.D. elk, black bear, mountain lion, wild cat, timber wolf, fisher, otter, beaver, wild turkey, and passenger pigeon could have been found in the hills of western Pennsylvania (Adovasio *et al* 1985).

The broad-leaved deciduous forest that followed the boreal forest somewhere between 10,000 and 9000 B.P. in southern New England should have had a greater carrying capacity both for these animals and for mankind (Ritchie and Funk 1971). Between 8000 and 6000 B.P. (Middle Archaic) well-established communities of hunter-gatherers occurred in New England and their activities anticipated subsistence patterns that followed in the Late Archaic (Dincauze and Mulholland 1977). Around 6000 B.P. at the beginning of the Late Archaic there was an increased gathering activity, the use of food storage, and increased trade (Pfeiffer 1984).

The arrival in large numbers of broad-leaved forest trees not only provided food in the form of nuts, and sometimes lodging for many kinds of animals, but gave humans better materials for their daily living. For example, white birch bark was used in canoes, containers, and hut roofs; elm, tulip poplar, and basswood bark were also commonly used for hut roofs; oak, hickory, and ash wood were popular for tool handles; basswood inner bark was made into cordage and hickory wood strips into binding material; split black ash wood was used in basketry, and oak bark and wood for tanning; the sap of maples and birches was used to sweeten food; and there was much more probably lost in the past (A. C. Parker 1954; J. Kalin, American Indian Archaeological Institute).

With the marked recession of the ice sheet, which had exerted its own effect in lowering temperatures (largely by means of reflection of solar energy), warmer times followed 8000 B.P. as we have seen. At this time the ice had retreated well north into Canada (Hare 1976). By 6500 and into 3500 B.P. drier times are indicated by lower lake levels in the Midwest when precipitation was lower than that of today. This time (about that of the Late and Terminal Archaic) corresponds well to a warm interval when oak savannah as well as charcoal deposits increased. After 3500 B.P. a closed oak forest became general and charcoal deposits decreased, suggesting cooler, wetter weather (Winkler *et al* 1986).

Assuming the Terminal Archaic ended and the Woodland period began about 2700 B.P. (Pfeiffer 1984) in southern New England, then this is nearly the time of the end of the Hypsithermal outlined by Deevey and Flint some 30 years ago.

3000 B.P. to Present

The last 3000 years have been marked by several small advances in the world's remaining ice sheets. These were separated by warm periods, estimated from altitudinal rises in Scandanavian mountain tree-lines, where trees give way to smaller plants. One glacial advance, as measured in Scandanavia, occurred from 2600 – 2000 B.P., another small one about 1400 – 1200 B.P., and one around 800 B.P. lasting to about a century ago (Denton *et al* 1986). World glaciers have generally retreated during the present century.

Forest composition from 3000 B.P. to the present in New England shows little real change although some botanists make a case for certain changes in individual species. After the Contact period, the loss of chestnut was one of the big changes that forms an exception. Some increase in spruce can be seen in the diagrams from Moulton Pond, Maine from 3000 B.P. to the present, something that is much more clearly shown at a site in northern Minnesota indicating a cooler and moister climate in this same period of time (Wright 1976).

As far as the animal population is concerned, there is no particular reason to suppose that it changed much in composition from 3000 until Contact times when some catastrophic changes came about.

By Mid-Woodland times the Late Archaic subsistence pattern of seasonal exploitation of diffuse resources continued in spite of the introduction of the clay pot, celt, bow and arrow, and primitive horticulture (Lavin 1984). With settlements mostly on riverine, lacustrine, and other wetland locations, Native Americans could survive on a variety of foods and still hunt game and gather nuts in the uplands. There was still shellfish in summer, processing of fruits, seeds, and greens in late summer-autumn, and hunting deer, small mammals, reptiles, and birds in various seasons (Lavin 1984). During most of the Woodland period, a settlement pattern of seasonal and temporal camps in the Connecticut River Valley have been revealed by the cultural remains (Juli and McBride 1984). Late Woodland was largely a continuation of the earlier Woodland, although there were by then two distinct ceramic traditions (Lavin 1984). As before, nut collecting, fishing, shellfish collecting, and hunting went on in late summer and early autumn (McBride and Bellantoni 1982). Shellfish, finfish (sturgeon and shark among others), deer, crabs, and hickory shells have been found related to a base camp for spring-fall and possibly year-round hunting and gathering (Lavin 1984 citing Wiegand).

From the time of the Middle Archaic through the Late Woodland there was an ever-increasing size of sites of human settlement (Feder 1984 citing McBride and Dewar). In another study Funk (1984) found that sites in the Paleo-Indian, Early Archaic, and Middle Archaic periods are all weakly represented in comparison to an apparent explosion in numbers of sites in the late Terminal Archaic. In Early Woodland and into Middle Woodland there was a decline, followed by a rise in late Middle Woodland. Funk concluded that these changes might represent population variations.

Not until the Late Woodland did maize appear in the New England record (Juli and McBride 1984, citing Ritchie). Squash, however, was grown some 7000 years ago in Illinois (Conard *et al* 1984) and was thus probably known further east soon afterwards. The time when beans were introduced is uncertain, but other less well-known plants were cultivated in New England before the arrival of Europeans. Such primitive gardening may have favored a population increase in the Late Woodland.

With the massive arrival of Europeans in the time from about 350 - 150 years ago there was a sharp decline, not only in Native Americans, but in the deer and turkey populations (perhaps also in those of raccoons and bears) that used to account for much of the mast crop. Predators declined as well: bounties were offered for wolves, the fur trade boomed, and habitats where wildlife thrived were lost. With the mast crop going begging and fewer predators to bother the nesting sites of many birds, the population of passenger pigeons exploded to reach an estimated three billion (evidently in the northeastern United States) in about 100 years. When the pigeon population collapsed, the squirrel population reached equally unbelievable proportions (Neumann 1985).

Up to Contact times the fundamental economic/technologic/ecological framework remained basically the same throughout prehistory, although various cultures underwent stylistic changes and technological improvements (Lavin 1984). In contrast to present-day North American societies, they maintained virtually a perfect balance with nature and in spite of occasional intertribal warfare, they changed but little through the centuries.

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STONE WALLS, STONE LINES, AND SUPPOSED INDIAN GRAVES

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ABSTRACT

An archaeological survey was recently conducted to determine the nature of so-called "Indian graves" on the MacNaughton property in the town of Granby, Connecticut, because of concern that planned development of this parcel would destroy important links to the heritage of the Indians who had inhabited Connecticut before the Europeans arrived. After an extensive surficial survey and a few arbitrarily placed test pits, the only logical conclusion is that they are not remnants of prehistoric Indian graves, features, or structures. They are clearly the result of historic land clearing.

INTRODUCTION

Of the large number of Indian burials I have excavated and researched from New England, the Northeast, and the Middle Atlantic area, none are cairn (rock-covered) types. Cairn burials are known where burial is not possible in the frozen ground. Placing large rocks on the body prevents dismemberment and desecration by scavenging animals. But the rocks used should not be so heavy that they will crush the body. Because such stacking is being done under adverse conditions when the ground is frozen, the rocks have to be accessible and easily moved. That is not the case here. Because of the paucity of easily accessible rocks, it would be just as difficult to get rocks out of the frozen ground for stacking as it would be to bury the person through the frostline.

The suggestion that the stones were some form of grave marker was made, but that practice is not known for this area. Had there been a body under the stones, some evidence (e.g., a stain, bone fragments, tooth enamel, or even artifacts) should remain. Even given the acidic nature of New England soils, one cannot place a body in the ground, cover it with stones, and leave it for hundreds of years without there being some clues.

SITE SURVEY

During the site visit in November, 1985, the developer and I traversed the entire property and investigated adjacent features to place the so-called graves into a larger framework. The features considered especially important were stone walls, lines of stones that can be mistaken for walls, piles of stones definitely resulting from very recent land clearing, individual stones scattered amongst the leaf clutter, and the "graves" themselves. While all stones and arrangements of stones may look the same to the untrained eye, they are not. Establishing a typology to clarify the differences and similarities among the previously listed features was of prime importance. Within the context of all of the stone features seen on this tract and the immediately adjacent tracts, the "graves" are not unique.

The first stone "wall" we investigated was actually a line of stones which had been removed from a field to facilitate plowing. There was no stacking, no attempt to make straight sides, and no attempt to follow a boundary other than plowable vs. non-plowable land. The open field side of the stone line had good pasturage free of trees. The other side had intermittent trees, very large rocks (probably too large to move by tractor), and surface water. Close by, but perpendicular to the stone line, was a real stone wall with stacking and a clear attempt to make a straight line. The rocks used in both had very similar physical characteristics, except that the wall did not have any stones which could not be lifted by one man.

A nearby open field has stone piles and short lines containing boulders. These stones are much larger than those seen in the stone walls or in other stone lines, but the pattern is similar to the lines seen elsewhere: a single huge stone has smaller ones piled around it at the periphery of the usable portion of the field. Rather than have a single large pile, the smaller piles are connected by lines of smaller stones.

THE "GRAVES"

Noting the physical similarities of the stones in all of the piles and lines to those of the "graves" does not completely answer the question of their origin. The piles, lines, and "graves" have the same kinds of stones since they all came from the same source. If these were actually put there by the Indians to cover bodies or for other reasons, then one would suppose that there would be evidence of this. The only way to address the question is to excavate one. And the only way to know how the "grave" is different from what is normally found in the ground is to dig holes where they aren't. The results were astoundingly clear, but not surprising.

Before excavating, we walked over the western edge of the property within sight of the "graves" noting the number of stones too large to move which were not part of a pile, those of moveable size not in piles, the location of the piles with regard to other topographic features, the general appearance of the piles, and the relative surface area and height of the piles. Although the leaf clutter was very dense, we saw very few moveable stones larger than volleyball-size which were not in piles. There were still a few unmoveable stones lacking piles around them.

Topographically the "graves" in the western section of the property are limited to an area between the boundary with an adjacent tract and the wetlands. There are no piles within the wetlands nor in the pasture of the adjacent tract.

Of eight piles, one was clearly unlike the others. The odd one was very recently stacked judging from the mossy sides of one stone being in the wrong place, dried dirt on the underneath side of a pair of stones resting on the top of the pile, root hairs clinging to the top of a stone which had no earth around it, and the absence of rotted leaves, forest duff, or weathering. The pile was significantly higher than the others and consisted of some large, but many smaller-sized stones. Why someone stacked this so very recently (within a year judging by the absence of rotted leaves among the stones) is unknown.

This may have been in deliberate imitation of the other piles, or it is a continuation of the same practice which resulted in the other piles. Because of the barbed wire fence, wetlands, and dense tree cover bordering this pile, there seemed to be no way for someone to have used a wagon or cart to get the stones onto the property. While there is the possibility that the stones were picked up on the property within an easy walk of the pile, we saw no reason why such a quantity of these sized stones would be in anyone's way or where they could have come from without someone sifting a lot of dirt to get them. There is no doubt that they are of the same types and sizes as found in the soil, but why they should have been placed here is a mystery.

Several of the remaining stacks were examined by removing the leaf clutter to judge the sizes of the stones. Each had a main stone which was too large for one person to lift. Some could not be lifted by two men, but probably could have been dragged by a horse or tractor. All of the remaining stones which we exposed probably could be lifted with little or moderate difficulty. Since there are obviously large open areas lacking unmoveable stones and piles are made around unmoveable ones, the conclusion is that the location of a pile is determined by the presence of an unmoveable stone. This is an important observation supporting land clearing, since graves would not be dug where one cannot dig without hitting huge stones, and the only sensible place for rocks cleared from the land is where one will not be plowing anyway.

The "graves" consist of stones piled within a rough circle approximately seven feet in diameter to a height of less than two feet. The piles were originally at least twice that height judging from the soil surrounding those stones at the bottom of the pile. The piles have sunk through the forest duff into the gray sandy soil below, but not far into the yellow subsoil.

The first pile arbitrarily selected for excavation was the northernmost one closest to the wetlands. The uppermost stone in the center of the pile was the largest one moveable by a single man and weighed about 18 kg (40 lbs). With the exception of the stones at the very bottom of the pile, the ones underneath were significantly smaller or between .5 and 4.5 kg (1 and 10 lbs). A hole 40 cm in diameter was dug through the center of the pile until a stone too large to dig around was encountered. The stack was centered upon an unmoveable stone. Other rocks were placed upon rocks with forest duff, rotted leaves, recent acorn shells, and other evidence of modern rodent activity clearly visible in the spaces in the pile. Stones were still found throughout the dark A horizon soil and into a yellow B horizon, but were smaller in size than those in the forest duff zone.

The second pile was clearly higher than the first, but the pattern was identical. In both piles was a single unmoveable stone with smaller ones stacked adjacent to it. The excavation proceeded with the same results: stones stacked on stones with forest duff filtering in between them, evidence of rodent activity, and sinking of the pile into the soil. The soil zones were thicker in this pile than in the first.

Immediately adjacent to each pile, we dug 20 cm diameter holes to compare the normal soil structure to that seen under the piles. In both instances the results were identical. The color, texture, and thickness of the test area soils were identical to those seen in the piles. Therefore, the piles had been made on the unaltered ground surface.

The kinds of rocks in the piles were also considered. Each pile is composed of the same kinds of stones: the vast majority are a very coarse grained, highly weathered field stone; there are a very few broken stones with quartz inclusions; and a few water-polished stream cobbles. While a geologist or petrologist would tear his/her hair out at these descriptions, a farmer or person familiar with stones in the area would have no trouble seeing the physical similarities.

While most of the stones in the piles are of a size likely to be taken out of a field to be plowed, there are also a lot of small ones (under .25 kg) that no one would have thought necessary to remove. There was also the troublesome water-polished cobbles which had not been seen in our walkover. The thought was expressed that the piles may be containing items that had to be imported to be discarded. This would have meant that there was a more serious functional reason for someone to make the stacks, not just to clear the land. Importing fist- and double fist-sized stones from even a half mile away means that there was an ulterior motive for stacking; that a certain size was needed; that certain types of rocks were needed. The presence of all of the types and sizes of stones had to be explained.

THE TEST PITS

The test pits did explain the small stones, but not the water-polished ones. Stones weighing up to .5 kg were found in the test pits in the gray and the yellow soil zones. This fact added to the identical soil structure and thickness of the layers beneath the stacks and adjacent to them means the piles were placed directly on the surface of the ground. There was no preparation of the spot, no burial, no reason to think anything was placed there first before the stacking was done, and no reason to suggest that something had been removed first. The stones excavated from the piles included not only those that were brought from nearby for stacking, but also those that were already present in the ground.

STONE PILES AND WALLS

I have excavated clearly identifiable human remains more than 1000 years old. Even under conditions of extremely adverse preservation, human remains should still be recognizable for 500 years. The argument can be presented that if there are now no bones, then they could have been placed there more than 500 years ago and have decayed without leaving a trace. To that I can say that there should be no air spaces left amongst a 500 year-old pile of stones. Five hundred years of rotting leaves, frost heaves, rising ground water from the wetlands, animal droppings, growing trees, spreading roots, and all of the other forces of nature should have filled all of those air spaces with soil. A five hundred year-old pile of rocks in the woods should be a very compacted mass. For a good analogy look at bases of 150 year-old, untended stone walls and see how much they have settled into the ground and how compacted and overgrown they are. Since these piles in Granby do not even appear as compacted and overgrown as 150 year-old stone walls, I am contending that they are recent.

To take a slightly different tack to answer the argument that piles of stones in the woods are sheltered from a lot of airborne sediment, that rotting may have been virtually complete, and that rodent activity among the stones could have removed the soil to make this appear to have been present for a shorter period of time, I will counter with another analogy. Assuming these stacks have been here for hundreds of years before the Europeans, then why aren't there old trees growing through them? Some of the stacks appear to have been at the base of trees, but the trees are no more than 40 years old and no older than other trees in this section. This was obviously maintained as a cleared plot for a long time. The consistent age of the trees is an argument in favor of land clearing for pasturage or agriculture. If the stone piles had been there for centuries before the land clearing and the clearing took place carefully enough that the arrangement of the stones was not disturbed, then there should have been evidence of tree growth disrupting the stacks or intruding into the soil horizons beneath the stacks. There is no evidence of such disturbance.

DIRT PILES AND ANOTHER STONE PILE

While leaving the area of the "graves" via the dirt access road to the east, another pile of stones and many other recent piles of dirt were visible. These were clearly associated with clearing and maintaining the road. The mixture of different colored soils in the piles was from the A horizon (gray) and B horizon (yellow) being scraped together. The stone piles had stones of small to medium size, were about the same area at the base, but were higher than the "graves" we had just investigated.

Our attention was diverted to a small stream draining the wetlands about 70 m east of the "graves". This proved to contain the last pieces to the puzzle. The bed of the stream had the full variety of small-sized rocks seen in the piles, including the water-polished ones and those with quartz inclusions. These ARE indigenous. They did not have to be brought in to be placed in the piles. Although they were not seen in the small test pits done near the excavated stone piles, they were here and may well have been closer had we looked farther.

THE DAM

After walking up the stream bed picking up these rocks, I looked up and came face-to-face with the remnants of an old dam. This is the reason for the stone piles and confirms the amount of effort the people of the day were expending for their fields and animals. This structure was sited in the optimal location for holding back the greatest amount of water with the least effort expended for manufacturing the dam. The 5 m wide constriction was filled primarily with stones not moveable by one person. The largest stones were still smaller than the ones seen bordering the open field, but approached the size of the ones in the "graves".

A dam at this location could not have provided sufficient head for water power. Its sole function had to be to provide a year-round water supply. Although this is a wetlands and probably has been one for the recent past (a couple hundred years at least), there is not enough water for a steady flow. Damming would have guaranteed water during the summer and early fall. Late fall and spring would have been wet enough for crops and animals. The pool which would have been created by this damming can be most easily seen in the field, since the contour interval of the maps is greater than 5 feet, but the wetlands boundary is an acceptable approximation for the following arguments. Tracing the boundary of the pool from this dam, one sees that the "graves" are on its immediate periphery. This is the same pattern as all of the stone lines and piles known to be obviously from land clearing: the stack is right at the edge on the usable land. There is no need to clear these sized stones to form a pond, but there is to make an arable field. But there is no reason to drop them into the pond either, especially since this is a very shallow one needed to guarantee year-round water.

Because the dam was a very low technology endeavor, there is no reason to think that the land clearing technology was any higher: either leave the big stones or stack upon the ones that cannot be moved by a man and his horse. Making a lot of piles means moving each stone only the minimal distance necessary to get it out of the way.

CONCLUSION

Given all of the lines of evidence, there can be no conclusion other than that these "graves" are actually recent piles of stones from land clearing. There is no evidence for any cultural activity within the piles or that they were used for anything after they were stacked: no artifacts, no bones, no charcoal, and no burning. What made these piles different from those known to be from land clearing is that there was no immediately observable reason for clearing here. The evidence for a past reason is the dam.

Editor's Note:

The result of this study -- a few piles of stones in Granby are not Indian graves -- is not significant, but I think the process that led to that conclusion is. A day of archaeology and some logical deduction can quash years of uninformed speculation. Less significant, but more surprising to me, is that an account of this process should be rejected for publication in another journal as being too provincial, obvious, and not scholarly.

THE PREHISTORIC CERAMICS OF SOUTHWESTERN CONNECTICUT: AN OVERVIEW AND REEVALUATION

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ABSTRACT

The study of prehistoric ceramics in southwestern Connecticut has advanced little in the past 30 years. This paper synthesizes published and unpublished data from the area and compares recent work to the seminal studies of the 1940s and 1950s. Although the basic ceramic sequence developed by Smith and Rouse for the region is still valid, the results of this survey indicate that ceramic attributes and types for this area can be more variable than initially described. Attribute variability within individual vessels is discussed and brings into question the accuracy of analytic assumptions and methods as currently employed.

INTRODUCTION

The work of Smith (1947, 1950) and Rouse (1947) has provided the basis for ceramic description and classification in the Long Island Sound area for close to 40 years. The recognition of three ceramic traditions and their attendant phases (first referred to as aspects and foci, respectively, by Smith, who used the McKern Midwestern Taxonomic System) in the area has been instrumental in the formulation and interpretation of the regional cultural-historical sequence. Two of these traditions, Windsor and East River, are present within southwestern Connecticut. The third (Shantok) is limited to the southeastern corner of the state.

Smith's cultural sequence, based largely upon ceramic studies, begins with the Windsor tradition, which was present from the lower Hudson River Valley to eastern Long Island and southeastern Connecticut throughout the Early and Middle Woodland periods. Smith (1947) recognized four phases: North Beach, Clearview, Sebonac, and Niantic. The entry of the East River tradition into the western portion of this area in early Late Woodland times was thought by Smith (1950:156) to represent the invasion of the area by peoples to the west, who subsequently replaced the indigenous populations. This view was challenged by Suggs (1957), who claimed that the East River ceramic tradition was a product of the diffusion of ceramic traits from the north via the Hudson River to the coastal area and northern New Jersey, where they were adopted by the local inhabitants. More recently, Salwen (1968) has proposed, on the basis of the presence of ceramic traits of both the Windsor and East River traditions on individual sherds and vessels from the Muskeeta Cove II site on the north shore of western Long Island, that diffusion and possibly some limited population movements are behind the appearance of the East River tradition, which is represented by the Bowmans Brook and Clasons Point phases in southwestern Connecticut and southeastern New York. Snow (1980:330) cites evidence supporting the gradual movement of prehistoric Munsees into the area where the "indigenous population was absorbed rather than replaced by the dominant immigrant communities". This view is supported by the linguistic as well as

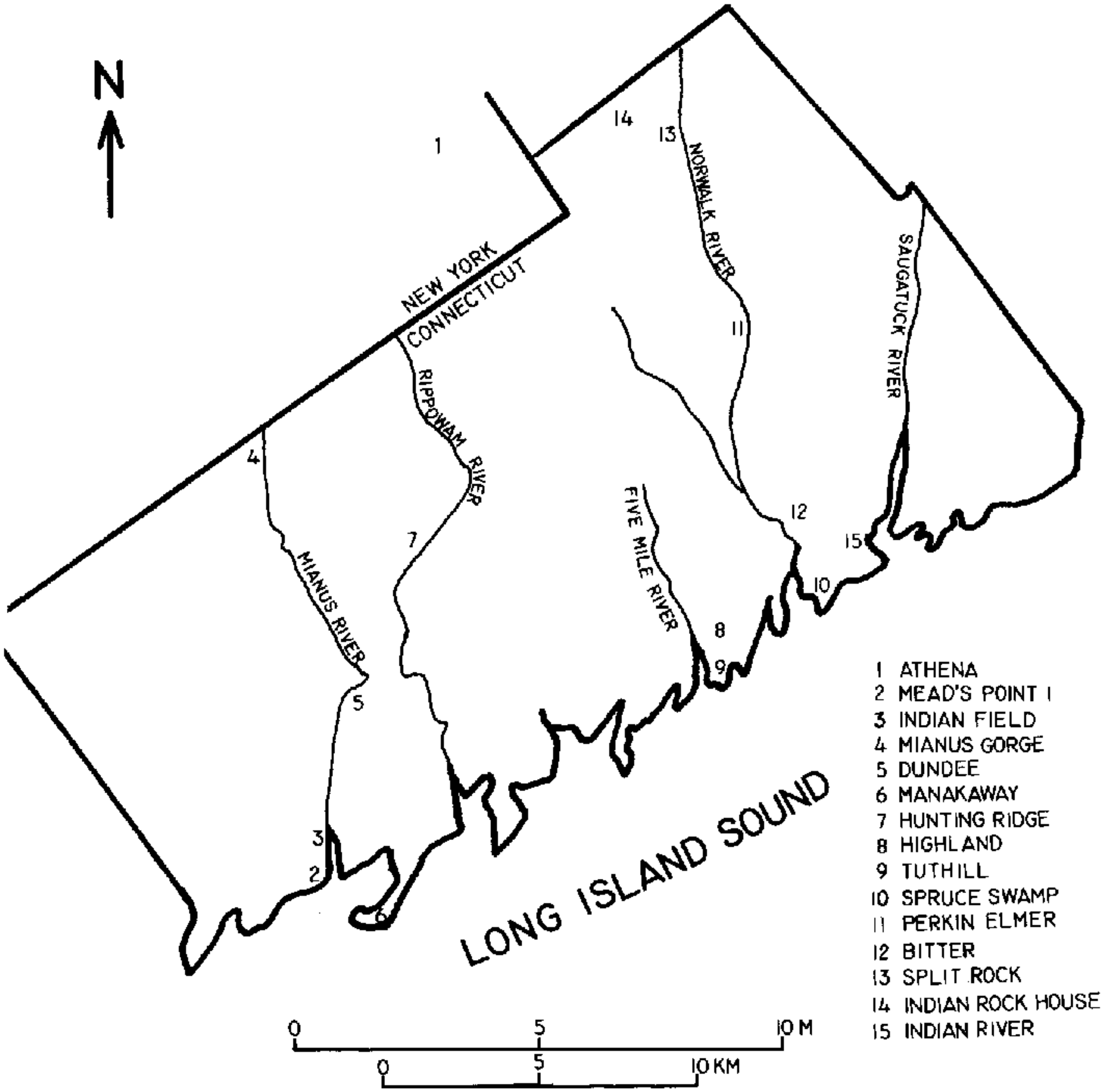

FIGURE 1. Study area.

archaeological evidence (Salwen 1978; Lavin and Morse 1985; Goddard 1978a, 1978b).

In recent years the ceramic sequence for Connecticut and adjacent portions of New York has undergone reexamination in the light of new evidence. New ceramic types have been described, phase/stage changes and additions have been proposed, and chronological revisions have been made (Lavin 1980, 1984, 1985, Lavin and Salwen 1983, McBride 1984, Salwen and Otteson 1972).

Since the work of Suggs (1957, 1958) and Powell (1958) at the Manakaway and Indian Field sites in Greenwich, Connecticut, little work has been done concerning the ceramics of southwestern Fairfield County. This paper synthesizes both published and unpublished data for the area and compares these to the framework developed by Smith (1947, 1950) and Rouse (1947). Special attention is given to those materials which have radiocarbon dated associations and/or possessing good contextual data, which unfortunately constitute but a fraction of the ceramics recovered from the area.

EARLY WOODLAND

ATHENA SITE

The earliest reported ceramics for the area are from this site in nearby Pound Ridge, New York (Figure 1). Here was found the basal section of a thick (10 - 13mm) grit-tempered vessel with a smoothed-over cord-marked exterior and a smooth interior with depressions made as a result of modeling the clay using the pinch pot technique. Although the refitted sherds form only a small section, it appears that the base was conoidal. Most of the sherds were found in association with Feature 8, a rectangular hearth from which charred wood was radiocarbon dated to 3040 $\pm$200 ^{14}C years B.P., 1090 B.C., (GX-3438) (Wiegand 1978). The early date for this vessel places it within the temporal range of the Orient phase of late Terminal Archaic and early Early Woodland times (Ritchie 1980). As only Vinette 1 vessels (typified by cord-marked interior and exterior surfaces) have been reported for this phase (Ritchie 1980), it is premature to suggest that this specimen represents a new type. As several body sherds with interior and exterior cord-marked surfaces were also recovered from the site, it is possible that this example represents a variant of the type or the base of another interior cord-marked vessel. The absence of interior cord-marking on this specimen is neither surprising nor unexpected given the difficulty involved in the application of such a technique to the very base of all but the most conical of bottoms.

INDIAN RIVER SITE

The association of interior/exterior cord-marked ceramics at several shell-filled refuse pits at the Indian River site in Westport, Connecticut, has provided the earliest firmly dated instances of this attribute combination in the study area. Three conjoining body sherds and a single rim sherd with a slightly everted and rounded lip (Figure 2) were found immediately adjacent to Feature 9, which was radiocarbon dated to 2420 $\pm$140 ^{14}C years B.P., 470 B.C., (GX-5096). All are grit-tempered and are believed to represent a single Vinette I vessel. They differ slightly from the type description in that the interior cord-marking on the rim sherd is oriented obliquely. Five conjoining body sherds with cord-marked interior and exterior surfaces were found in Feature 6, which was close to Feature 9, and a similar sherd was found in the area between them.

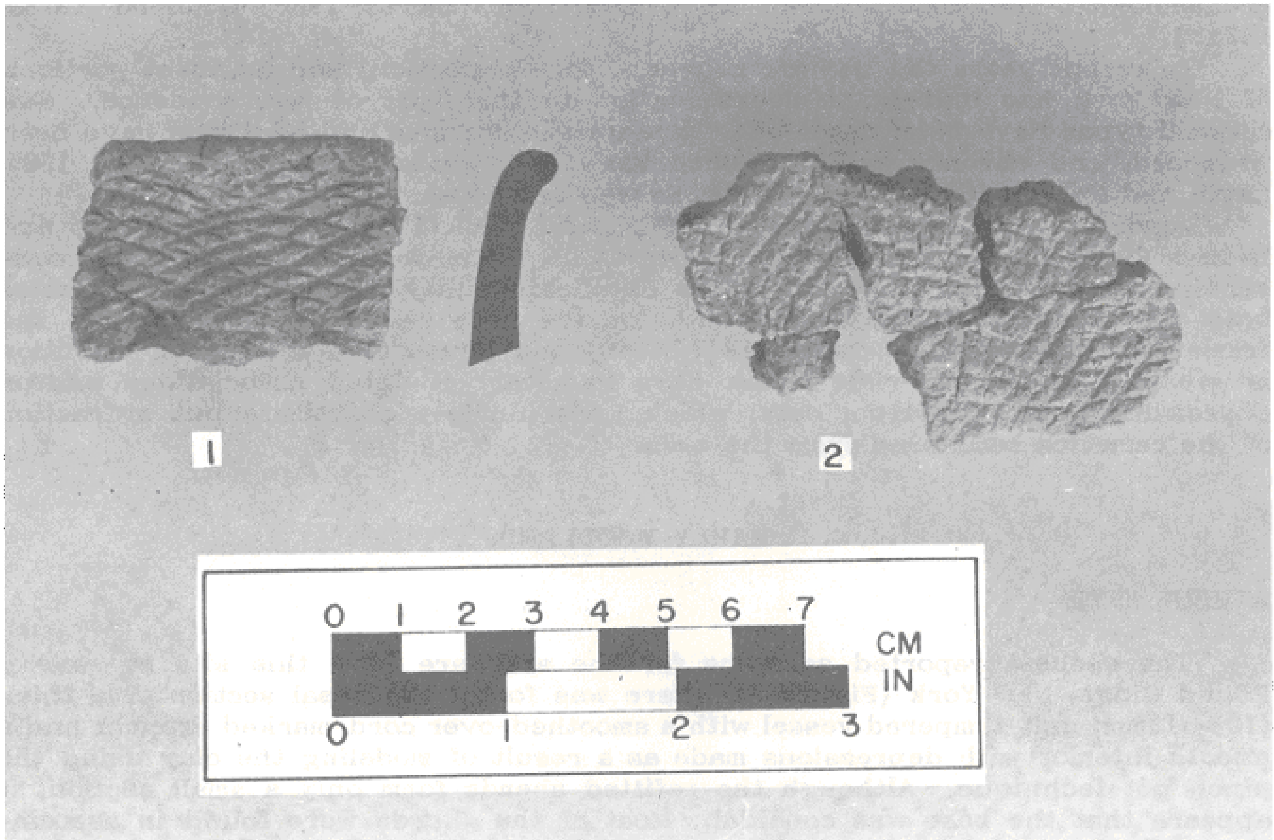

FIGURE 2. Vinette I pottery from the Indian River site: 1. Rim sherd (profile depiction for all figures shows the exterior surface on the right); 2. Body sherds.

Several cord-marked interior/exterior sherds were found in Feature 8, which was dated to 2085 ±135 ^{14}C years B.P., 135 B.C., (GX-7298). They differ from the earlier sherds in that the exterior cord-marking has been somewhat smoothed over. As no rim sherds were found, it is not possible to assign a type designation to them, as several varieties of interior cord-marked ceramics have been reported in the region (Lopez 1957, Salwen 1968).

The presence of Vinette I and other untyped interior/exterior cord-marked sherds at the Indian River site are interpreted as indicative of a North Beach component. The lack of other types assignable to this phase by Smith (1950) may be due to the small sample size, which was a result of the site being stripped by bulldozers, which exposed features, but also removed living floors.

Elsewhere in the study area, small amounts of Vinette I pottery have been found at the Manakaway and Indian Field sites in Greenwich (Suggs 1958a and Powell 1958).

MIDDLE WOODLAND

Ceramics which have been radiocarbon dated to the Middle Woodland period have been found at two coastal sites in the study area: Tuthill in Norwalk and Mead's Point I in Greenwich.

TUTHILL SITE

Here a shell midden which had been partially disturbed through plowing overlaid an earlier component known from a thin scatter of artifacts and several features. Feature 3, a refuse pit, contained shell and bone as well as sherds from two dentate-stamped, grit-tempered vessels. Additional conjoining sherds from these vessels were found in the immediate vicinity of the feature, which was radiocarbon dated to 1830 $\pm$140 ^{14}C years B.P., 120 A.D., (GX-8349). One vessel has several large rim sherds and is characterized by straight walls and a rounded lip which is dentate-stamped perpendicular to the vessel walls. A band of complex dentate-stamping .25mm wide encircles the rim immediately below the lip (Figure 3:1). The exterior surface treatment is smoothed-over cord-marking, which also appears on the lower portion of the interior surface. The upper portion of the interior surface is brushed or channeled with a ribbed mussel shell (Figure 3:2). Although the decorative technique is similar, if not identical to that described for Vinette Complex Dentate (Ritchie and MacNeish 1949), it differs from the type description in both rim form and design motif.

Rim sherds were not recovered from the other dentate-stamped vessel, although several near-rim fragments have been recovered and fitted to a number of body sherds to form a vessel with a conoidal base and straight walls. The decorative technique and motif are the same as for the previously described vessel, although the lip shape and decorative treatment, if any, are unknown (Figure 4:1–2). It is also similar in that the exterior surface treatment is that of smoothed-over cord-marking. The lower portion of the exterior surface has the cord-markings oriented horizontally; above this point they are vertical (Figure 5:1). On the interior the lower portion is brushed or channeled with a ribbed mussel shell, while the upper portion has horizontally oriented cord-marking (Figure 5:2). Evidence that this vessel was made by coil construction can be seen where the upper and lower portions separated along a poorly welded coil, which has regularly spaced finger impressions along the interior surface. The presence of differential interior and exterior surface treatments on the upper and lower fragments point to the probability that the lower portion had been allowed to dry somewhat before additional coils were added to the vessel. Although there is some slight overlap of both the interior and exterior surface treatments in the area between the upper and lower portions, which is indicative of rewetting the clay prior to the addition of more coils, this may not have been done sufficiently to ensure proper joining of the coils.

These two vessels compare closely with some of the "decorated interior cord-marked" types described by Lopez (1957, 1958) for several coastal New York sites. Shared attributes include dentate-stamping with some "dragging and overlapping" (1958:5), cord-marked exterior, and smoothed-over and/or modified (by brushing or channeling with a shell) interior surfaces.

A vessel fragment consisting of three conjoining decorated sherds with similar complex dentate-stamping, resembling rocker stamping, was found in the same area. It has smooth interior and exterior surfaces and grit-temper. Due to its small size, the range and variation of surface treatment, if any, is not known, nor is the shape and complete decorative motif of this vessel.

Two other interior/exterior cord-marked vessels are known from the area immediately under the midden near Feature 3. Both are grit-tempered. One has a conoidal base, straight walls, and a slightly everted lip, which is somewhat flattened and is decorated with notches oriented perpendicular to the vessel walls (Figure 6). The exterior cord-marking is oriented both vertically and obliquely and is crossed over in places. The lower interior portion of the vessel has been brushed or channeled with a ribbed mussel shell while the upper area is heavily cord-marked in some places, but almost completely smoothed-over

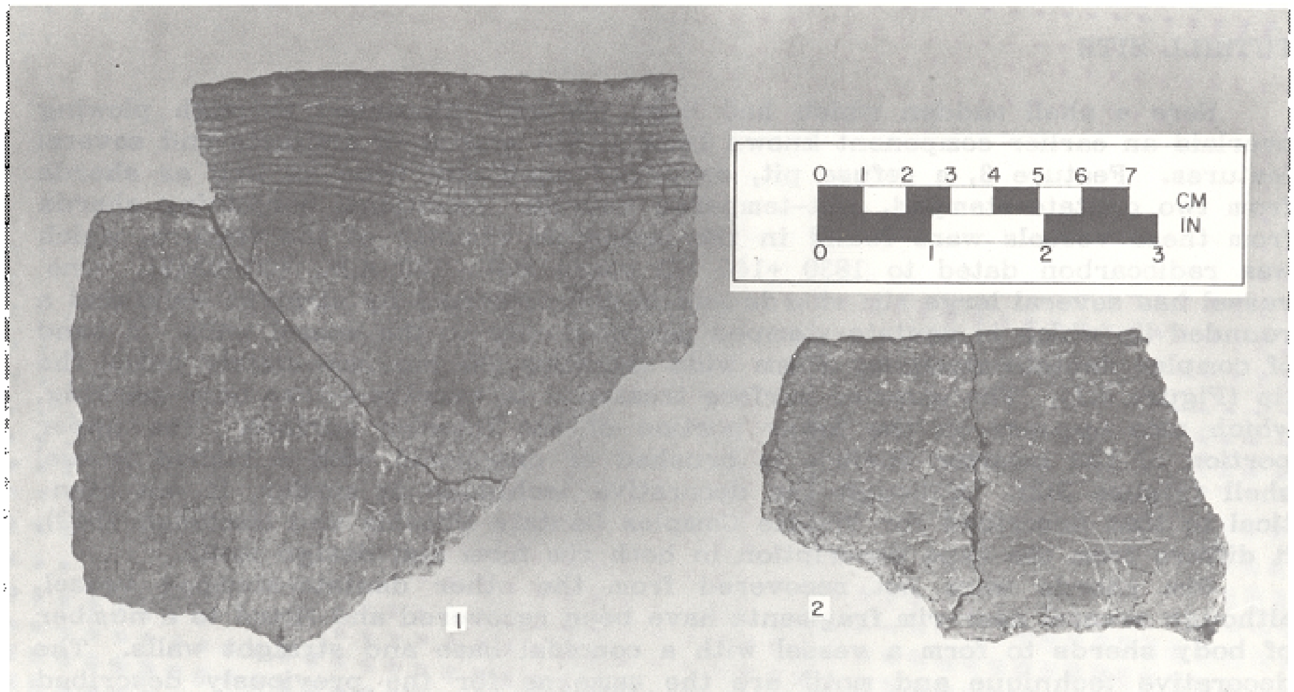

FIGURE 3. Rim sherds with dentate stamped decoration from the Tuthill site. 1. Exterior; 2. Interior.

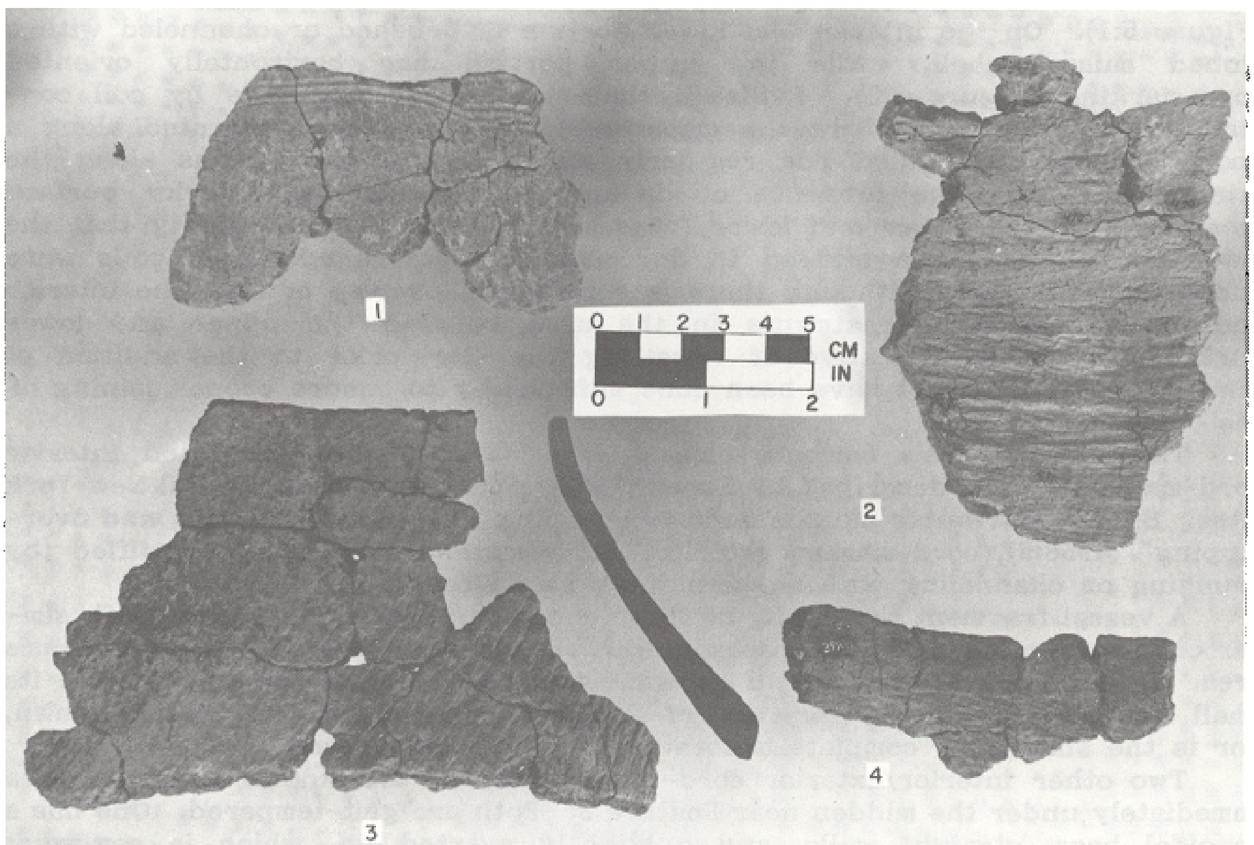

FIGURE 4. Interior-Exterior cord-marked sherds from the Tuthill site. 1, 2. Near rim sherds with dentate stamping; 3. Exterior; 4. Interior

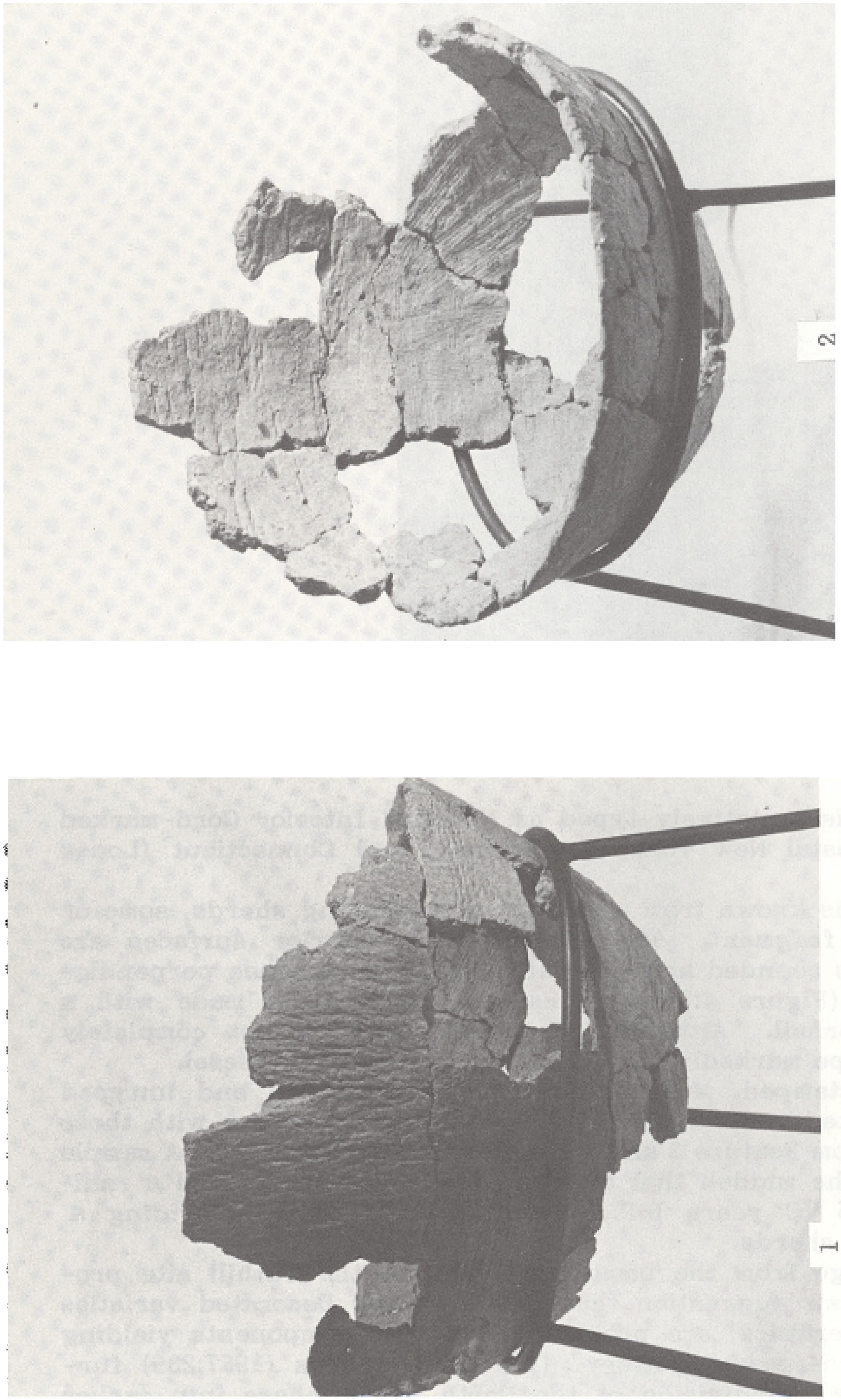

FIGURE 5. Dentate stamped vessel with interior/exterior cord-marking from the Tuthill site. 1. Exterior; 2. Interior

FIGURE 6. Modified Interior Cord-marked vessel from the Tuthill site.

in others. This specimen is tentatively typed as Modified Interior Cord-marked pottery reported from coastal New York, New Jersey, and Connecticut (Lopez 1957).

The remaining vessel is known from a number of conjoining sherds, some of which form a large rim fragment. The interior and exterior surfaces are cord-marked, and the lip is rounded and decorated with thin notches perpendicular to the vessel walls (Figure 4:3-4). These may have been made with a thin-edged shell or fingernail. Although the vessel form is not completely known, the upper walls slope markedly inward to the mouth of the vessel.

The rocker dentate-stamped, Modified Interior Cord-marked and untyped interior-exterior cord-marked vessels are thought to be contemporary with those dentate-stamped vessels from Feature 3 and its immediate surroundings. A sample of shell from the base of the midden that overlays these vessels yielded a radiocarbon date of 1540 $\pm$125 ^{14}C years B.P., 410 A. D., (GX-7884), providing a *terminus ante quem* for the sherds.

The ceramic assemblage from the basal component of the Tuthill site provides confirmation of Lopez's suggestion that "Modified and Decorated varieties (of interior cord-marked ceramics) are probably later than components yielding just Complete Interior Cord-marked pottery" (1957:239). Lopez (1957:239) further predicted the eventual subdivision of the North Beach phase into earlier

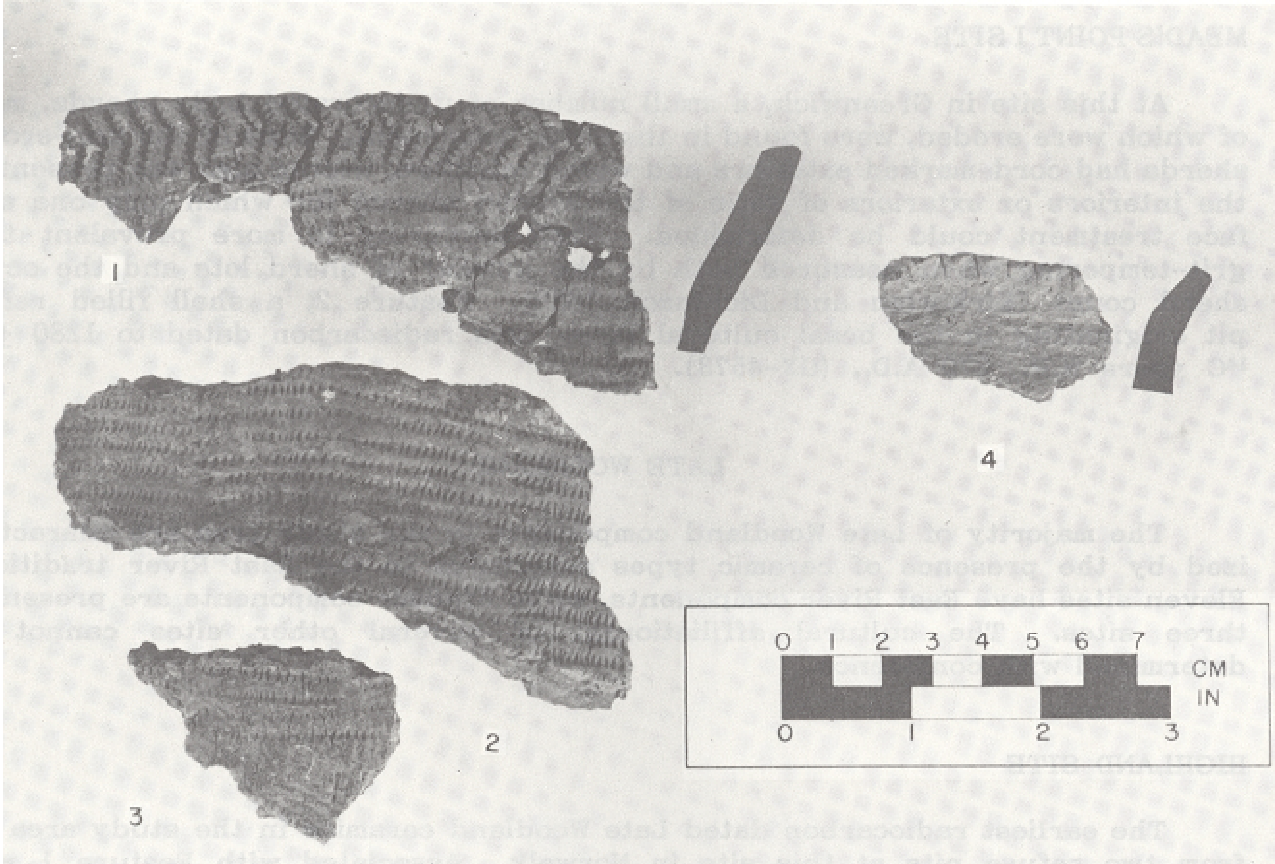

FIGURE 7. Rim and body sherds from the Highland site.

and later subdivisions based upon the temporal sequence of such ceramic attributes, which Lavin (1985) has realized in her proposed "Fastener Stage", based upon the analysis of ceramics from the Tuthill site and the Fastener site in Shelton, Connecticut. At the latter site Lavin (1984, 1985, Lavin and Salwen 1983) found that cord-marked interior surfaces and cord-wrapped-stick decoration were more frequent in the earlier of two components of this stage, while dentate-stamping and smooth interior and exterior surfaces occurred in greater amounts in the later component. If such a temporal distribution of attribute frequencies may be directly compared with the Tuthill materials, it would appear that the earlier Tuthill component dates to the latter portion of the stage.

Despite the coastal location of the site, grit-tempering predominates over shell when measured by both sherd quantities and sherd lots, although shell-tempering is certainly more frequent than at the Fastener site, where shell temper was found in but a single sherd. The later Middle Woodland ceramics at the Tuthill site are associated with the shell midden. The recovery of a single, small, grit-tempered sherd with cord-wrapped-stick decoration applied to a smooth exterior surface from the upper area of the shell midden (which lay within the plowzone) overlying the earlier materials is suggestive of a later date for this attribute. From the edge of the midden, 9m west of the area containing the previously described materials, were found two decorated sherds. One is a small grit-tempered rim sherd with cord-wrapped-stick decoration both on the lip and its smooth exterior surface. The other has punctate decoration and smooth interior and exterior surfaces; cavities in the paste suggest that shell-tempered had been used, but was leached. Shell from the same level was radiocarbon dated to 990 $\pm$120 ^{14}C years B.P., 960 A. D., (GX-8722). This is the earliest date for these decorative techniques in the study area.

MEAD'S POINT I SITE

At this site in Greenwich, a small number of undecorated body sherds, many of which were eroded, were found in the basal component. Some of the non-eroded sherds had cord-marked exteriors and wiped interiors; wiping also was present on the interiors or exteriors of some of the eroded sherds for which only one surface treatment could be determined. Shell-tempering is more prevalent than grit-tempering when measured both by the number of sherd lots and the actual sherd count (Kirkorian and Dickinson 1985). Feature 2, a shell filled refuse pit originating in the basal cultural layer, was radiocarbon dated to 1280 ±105 ^{14}C years B.P., 670 A.D., (GX-4573).

LATE WOODLAND

The majority of Late Woodland components in the study area are characterized by the presence of ceramic types assignable to the East River tradition. Eleven sites have East River components, while Windsor components are present at three sites. The cultural affiliation(s) of several other sites cannot be determined with confidence.

HIGHLAND SITE

The earliest radiocarbon dated Late Woodland ceramics in the study area are from two refuse pits at this site in Norwalk. Associated with Feature 1 were several dozen sherds from a grit-tempered vessel with a smooth interior surface and a cord-marked exterior. Horizontal rows of cord-wrapped-stick impressions encircle a constricted neck and the lower portion of the everted rim (Figure 7:2-3). Above this and just below the lip is a horizontal herringbone motif (Figure 7:1). The lip is flattened and impressed with a single band of cord-wrapped-stick impressions oriented parallel to the vessel walls. The vessel shares many attributes with the Van Cortlandt Stamped type, but is similar to Bowmans Brook Stamped in that it has a decorated lip and everted rim. This specimen may be an early version of Van Cortlandt Stamped. Although the type description states that Van Cortlandt Stamped vessels are collared, Smith (1950:Plate 8:9) illustrates an uncollared example. Shell from the feature was radiocarbon dated at 730 ±115 ^{14}C years B.P., 1220 A. D., (GX-5544).

Associated with Feature 2 was a single grit-tempered rim sherd with smooth interior and exterior surfaces and three horizontal rows of oval dentate-stamped impressions just below the lip, which is notched along its interior edge in such a manner as to create a pie crust effect (Figure 7:4). Five conjoining grit-tempered body sherds with cord-marked exteriors and smooth interiors were found as well and may be from the same vessel. Shell from Feature 2 was radiocarbon dated at 835 ±120 ^{14}C years B.P., 1115 A.D., (GX-5095).

MANAKAWAY SITE

This site on Greenwich Point contained a single vessel of each of the following East River types: East River Cord-Marked, Van Cortlandt Stamped, and Bowmans Brook Incised. In addition two untyped dentate-stamped vessels (one with a curvilinear design motif) were found, as was a miniature vessel similar in form and surface treatment to a Van Cortlandt Stamped vessel, but lacking decoration. Fabric-impressed, stippled, and plain sherds were also found and assigned to the East River tradition on the basis of paste characteristics

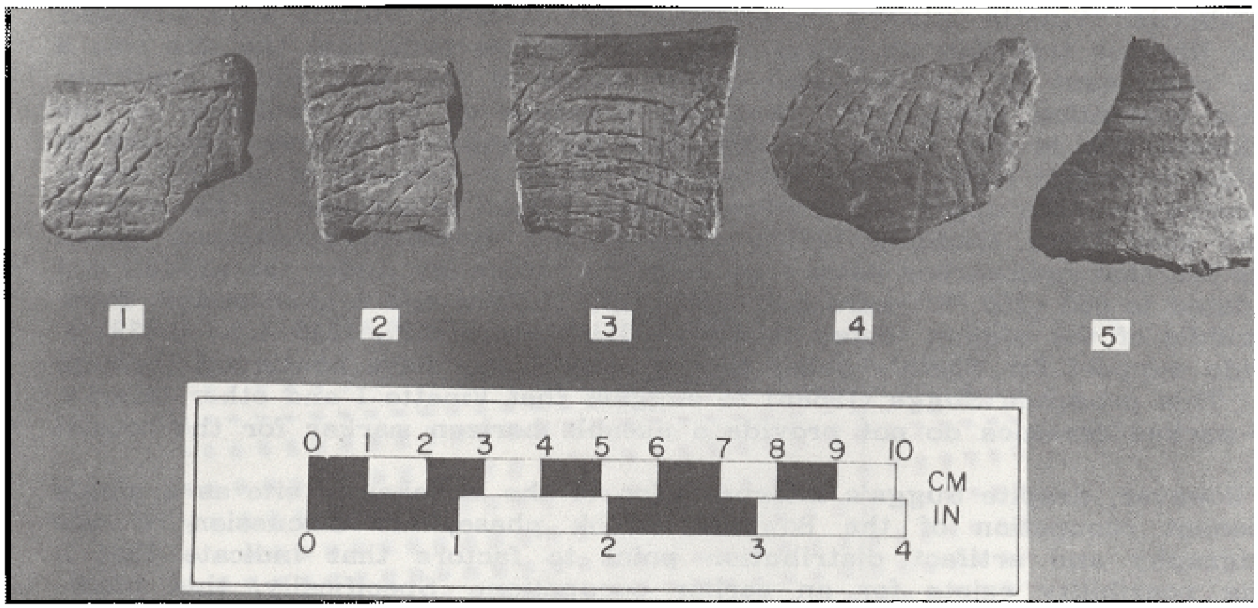

FIGURE 8. Scallop-shell stamped sherds from the Mead's Point 1 site.

FIGURE 9. Incised vessel with incipient castellations from the Mead's Point 1 site.

(Suggs 1958a). All vessels were grit-tempered with the exception of some of the plain sherds. Vinette Interior Cord-Marked and Modified Vinette were assigned to the Windsor tradition by Suggs, who nevertheless feels that the site was a single component of the Bowmans Brook phase of the East River tradition. Smith's contention (1950, 1957) that the presence of both traditions at the Manakaway site is due to its location near the boundary between the two is rejected by Suggs (1957, 1958a, 1958b), who favors a diffusion of ceramic traits southward from the upper Hudson River Valley region to account for the origins of the East River tradition rather than Smith's invasion/replacement model. Suggs felt that radiocarbon dates from Hearth 1 (which lay under the midden and was dated to 650 ±100 ^{14}C years B.P., 1300 A.D., (L339A) and a shell sample from the middle of the midden (dated to 610 ±100 ^{14}C years B.P., 1340 A.D., (L339B)) provide support for Smith's belief that Vinette I may have continued through time. This prompted Suggs (1958b) to suggest that Vinette I and other interior cord-marked ceramics do not provide a useable horizon marker for the coastal area.

However, despite Suggs's interpretation of the Manakaway site as a single component occupation of the Bowmans Brook phase, his discussion of site stratigraphy and artifact distribution point to factors that indicate that a strong possibility exists for an earlier occupation. Specifically, this possibility is supported by the presence of several shell heaps buried by the midden (Suggs 1958a:27), and the vertical distribution of Windsor and East River sherds in unit N30/E50 (1958:Table 3). A large pit (Pit #1) under the midden contained crude and fine dentate-stamped sherds and East River Cord-marked pottery. The dentate-stamped sherds were classed as a variety of Bowmans Brook Stamped by Suggs despite the fact that this type is not dentate-stamped. Suggs reports that these sherds are virtually identical to untyped sherds from the Sebonac site on eastern Long Island which Smith (1950:180-181) suggested may be of the Sebonac focus (phase) of the Windsor tradition. Given the difficulties inherent in the analysis of shell middens (Brennan 1977, Sanger 1981), it is suggested that an earlier Windsor component exists at this site.

MEAD'S POINT I SITE

Elsewhere in the Greenwich area, the upper levels of the Mead's Point I site produced a sample of several hundred sherds of Late Woodland age (Wiegand 1976). Although few were decorated, three rim sherds (one of which is castellated) and an upper neck/lower collar fragment have attributes of both the Windsor and East River traditions (Figure 8:1-4). The interiors are scallop shell channeled, and the exterior surfaces are smoothed by scallop shell channeling (Figure 8:2-4) and smoothed over cord-marking (Figure 8:1) surface treatments. Decoration consists of diagonal as well as nearly horizontal and vertical scallop shell stamping; unfortunately, the small size of the sherds precludes determination of the motif. Two of the rim sherds have flattened lips (Figure 8:2-3) and were found in the same area as the neck/collar fragment. The castellated rim sherd has a rounded lip (Figure 8:1). In surface treatment and decorative technique, these sherds exhibit attributes of the Sebonac Stamped type of the Windsor tradition. The paste is compact, well consolidated, and tempered with finely crushed shell. Collars are not present on Sebonac Stamped vessels, but are known for both the Niantic Stamped and Clasons Point Stamped types of the Windsor and East River traditions, respectively (Smith 1950). A neck/collar sherd of Clasons Point Stamped (Figure 8:5) and a single rim sherd of East River Cord-Marked were also recovered, as were small sherds bearing incised and cord-wrapped-stick-impressed decoration. The interiors are scallop shell channeled.

A large number of sherds from a single vessel were found in a concentration near the base of the upper level of the shell midden. The vessel has a rounded bottom and globular body with incipient castellations above a nearly vertical rim (Figure 9). The decorative technique consists of broad, shallow incisions made in a stab and drag manner. These are arranged into a motif consisting of two horizontal bands of three lines each, one of which is just below the lip. The other is on the shoulder and is connected to the upper band through a series of diagonal bands made in the same manner with open areas left between. The horizontal and vertical bands are not continuous, but are formed by a series of short incisions with small separations between them. The regularity of the spacing of the three lines indicates that a three pronged instrument was used. The lip is flat and has stamped decorations that may have been made with the edge or bottom of the instrument. Surface treatment varies on both surfaces. The exterior is smoothed in the upper areas where the decoration has been applied, and cord-marked in various degrees from extremely distinct to smoothed-over to almost obliterated. The interior surfaces are smoothed from the neck to the base, and wiped or brushed on the upper portion. The vessel shares some similarities with the Eastern Incised pottery of the East River tradition, particularly in regard to paste, exterior surface treatment, and the form of the lower portion of the vessel. However, the decorative motif, lack of a collar, incipient castellations, and diversity of interior surface treatments differ significantly from the type description. Hence, it is considered to be an untyped vessel of the East River tradition. A sample of shell lying immediately under, but in contact with, the sherd concentration was dated to 620 $\pm$105 ^{14}C years B.P., 1330 A.D., (GX-4572). This places the site in close temporal proximity to the Manakaway site.

INDIAN FIELD SITE

This site reported by Powell (1958) is several hundred meters north of the Mead's Point I site. This site has not been radiocarbon dated, but contains ceramics assignable to both the Bowmans Brook and Clasons Point phases of the East River tradition: East River Cord-Marked, Bowmans Brook Stamped, Van Cortlandt Stamped, and Eastern Incised. Other untyped specimens, some of which are of the Windsor tradition, were found, as was a single sherd of Vinette I pottery.

Excavations by the Archaeological Associates of Greenwich (then the Greenwich Archaeological Society) conducted at this site in May, 1975, resulted in the recovery of most of a grit-tempered vessel with cord-marked exterior and smooth interior surfaces (Figure 10). The body is elongate-globular with a conoidal base and a moderately constricted neck. An incipient collar is topped by six low castellations; allowing for missing portions of the rim, there were probably eight castellations originally. This vessel was examined under field conditions by Powell, who compared it to the Van Cortlandt Stamped sherds found during this prior investigations at the site (Powell 1958, 1975).

SPRUCE SWAMP SITE

At this site in Norwalk, Powell (1965a) reported both Windsor and East River ceramics within a large shell midden, but could not elaborate on their specific provenience(s). Recognized types included Windsor Brushed, Windsor Fabric-Marked, Bowmans Brook Stamped, and Van Cortlandt Stamped. Stratigraphic excavations of the site conducted in 1975 by the Southwestern Connecticut Archaeological Community revealed the presence of Sebonac Stamped (Figure 11:1)

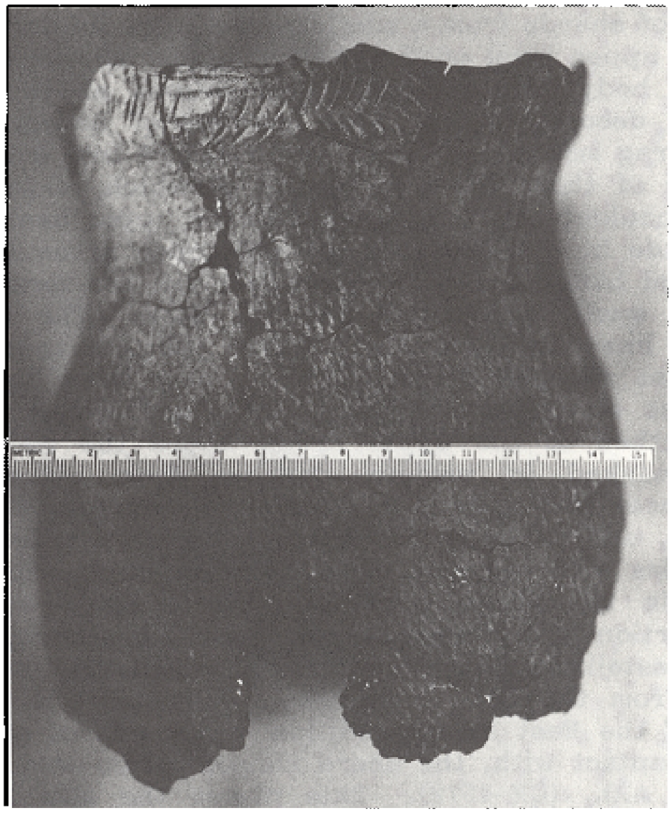

FIGURE 10. Van Courtlandt Stamped vessel from the Indian Field site.

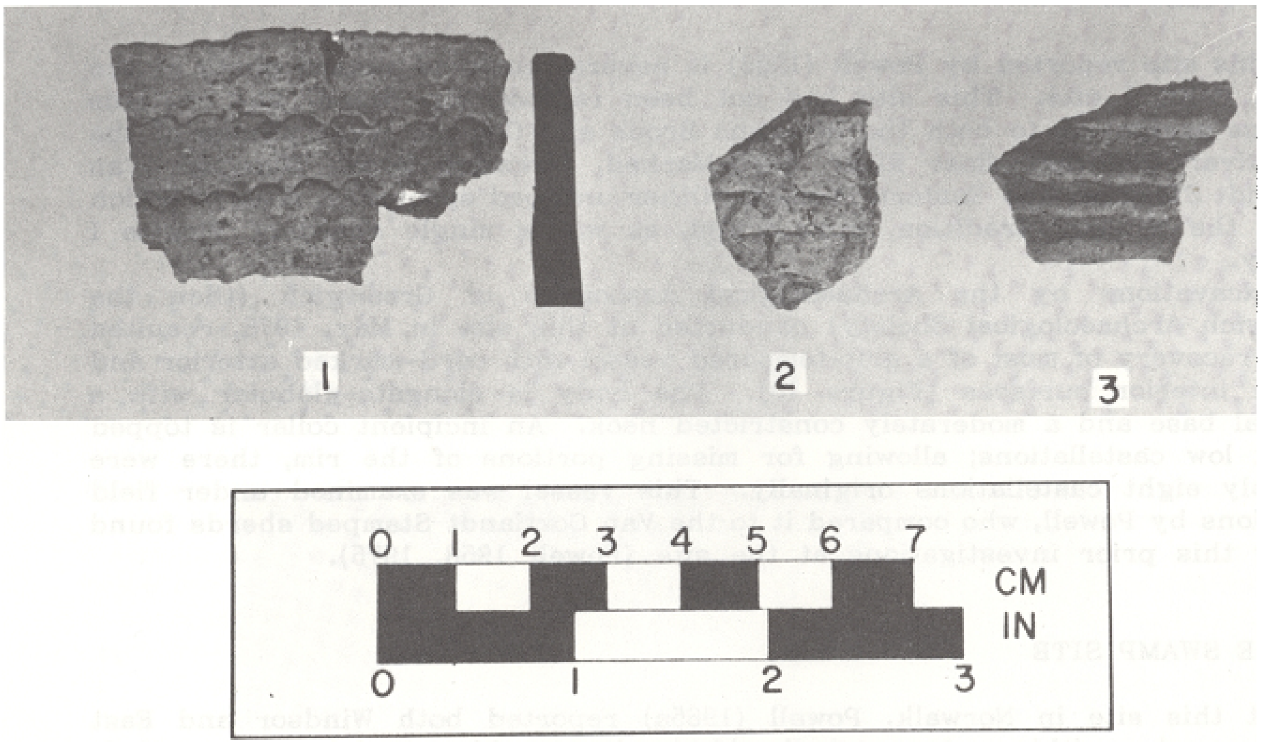

FIGURE 11. Sherds from the Spruce Swamp site. 1. Sebonac Stamped rim sherd; 2. Corrugated body sherds.

and Windsor Cord-Marked, both in the lower portion of the midden. A radiocarbon date of 745 ^{14}C years B.P. was reported for a preserved post originating in the upper portion of the midden (Anonymous 1977).

Two grit-tempered vessels, each known by a single sherd, exhibit smooth interiors and exterior surfaces that consist of raised parallel bands which produce a corrugated effect (Figure 11:2-3). The technique used to produce such a design may have involved dragging a flat instrument along the vessels' outer coil surfaces at an acute angle. Experimentation using this technique reproduced a surface identical to the sherds, including the overlapping of the outer coil edges, which resemble clapboards in cross-section. However, as the same results were obtained on a smoothed surface, coiled construction is clearly not a prerequisite in producing a corrugated surface.

One of the sherds (Figure 11:2) has been further modified by stamping the raised bands with a triangular object at regular intervals. The impressions thus made resemble fingerprints, but are more likely to have been left by some other object, perhaps the end-grain of a wooden stamp or paddle edge, as attempts to replicate the pattern using fingers was unsuccessful. As both sherds were found on the eroded midden face, their cultural affiliations remain unknown, although it is probable that they date to Late Woodland times, as the paste is very compact and well-consolidated. The corrugated surface treatment is, to the best of the author's knowledge, unknown for the region.

The Spruce Swamp site is not alone in having Late Woodland ceramics assignable to the Sebonac phase of the Windsor tradition and the Bowmans Brook and/or Clasons Point phases of the East River tradition. This situation pertains to two rockshelters along the Norwalk River to the north in the town of Wilton: Perkin-Elmer and Split Rock Shelter.

PERKIN-ELMER ROCKSHELTER

Reexamination of the ceramic assemblage from this rockshelter has led to the recognition of a single grit-tempered rim sherd previously identified as Clearview Stamped (Wiegand 1983), which is now considered highly similar to Bowmans Brook Stamped. A single band of diagonal, cord-wrapped-stick impressions is present immediately below the flat, thickened, and cord-wrapped-stick impression covered lip. Below this are horizontal bands of impressions. On the upper inside of the rim, a single band of short, diagonal impressions is present. On the basis of paste, form, decorative technique, and motif, the vessel appears to be a variant of Bowmans Brook Stamped, differing mainly from the type description by presence of a thickened lip.

Other ceramics from the site include Windsor Cord-Marked, which differs somewhat from its type description in having smooth, rather than brushed, interiors, which is an attribute of East River Cord-Marked. A large rim section of an undecorated, grit-tempered vessel with a smooth interior, originally reported as having a smoothed-over cord-marked surface (Wiegand 1983) actually has a fabric-marked exterior. Given these traits, an inward sloping rim, and a rounded lip, it is typed as Windsor Fabric-Marked. Vinette Interior Cord-Marked sherds and several untyped dentate-stamped sherds bearing some resemblance to Clearview Stamped were also recovered. As with the Spruce Swamp assemblage, most of the ceramics were surface finds from the eroded edge of the site.

SPLIT ROCK SHELTER

In this rockshelter were found portions of several shell-tempered vessels resembling Sebonac Stamped, East River Cord-Marked, Eastern Incised, and Windsor

Brushed types. The small sample size, lack of large sherds, and the weathered condition of most of the sherds precluded positive identifications.

ADDITIONAL SITES

Small amounts of identifiable Late Woodland ceramics have been recovered at other sites in the area. Powell (1981:45) reports a single rim-and-shoulder sherd from the Indian Rock House in Wilton as "showing affinity with the type Clasons Point Stamped." At the Hunting Ridge Rockshelter in Stamford he recovered 66 sherds of a single vessel of the Van Cortlandt Stamped type (Powell 1959). Fiedel (1985) reports a single decorated sherd of Bowmans Brook Incised from the Dundee Rockshelter in Greenwich. At the Mianus Gorge Rockshelter in Stamford Powell (1963) found 150 sherds from at least two vessels. Six rim or near-rim sherds had cord-wrapped-stick stamping, which he interpreted as possibly attributable to the East River tradition. Body sherds having wiped or plain and cord-marked exteriors were found. Although Powell suggested that the cord-marked sherds may have been associated with a Windsor tradition occupation, this is difficult to determine on the basis of the data at hand, and it is possible that these may have been body sherds from the decorated vessel.

A large ceramic sample was recovered from the Bitter Rock Shelter in Norwalk. Powell (1965b) reports a single identifiable rim sherd as being of the Bowmans Brook Stamped type. A second Bowmans Brook Stamped vessel from the site was later brought to his attention by a local collector (personal communication 1981). Powell's description of other sherds is suggestive of other Late Woodland types, and a reexamination of the site by Wiegand (1983) resulted in the recovery of a rim sherd of the Bowmans Brook Incised type.

A large number of sherds from a single Windsor Cord-marked vessel were recovered from a probable pit feature at the Indian River site in Westport. The feature was largely destroyed by construction, although enough sherds were recovered to complete a rim-to-base profile of the vessel.

SUMMARY AND CONCLUSIONS

Examination of ceramics from southwestern Fairfield County, Connecticut, sites has demonstrated that although the basic ceramic sequence as developed by Smith (1947, 1950) and Rouse (1947) for the region is still applicable, some changes and additions both to type descriptions and attributes are in order.

The recovery of several varieties of interior cord-marked pottery from the Tuthill site provides further elaboration of three of the four broad classes of interior cord-marked ceramics reported by Lopez (1957, 1958). Vinette I (also known as Complete Interior Cord-marked) pottery has been shown to have lip-notched decoration and both ribbed mussel shell channeling or brushing combined with cord-marked interior surface treatment, some of which has been smoothed over, during the early Middle Woodland period. Such a variety of interior surface treatments applied to the same vessel is also present for two vessels with complex dentate-stamping. Furthermore, the exterior surfaces of both the dentate-stamped vessels and the Vinette I vessel have different degrees of exterior cord-marking on the same vessel. These range from areas with very distinct impressions to those which have been considerably smoothed over. As many ceramic analyses in the region make use of the assumption that surface treatments are mutually exclusive and can thus be used to sort an assemblage into a minimal vessel count, the observation that as many as four or five separate sherd groupings can be made from a single vessel's body sherds is an unpleasant reality that must be addressed in ceramic analysis based upon such sorting techniques (Salwen 1968; Dincauze 1975; Lavin 1980, 1986; Wiegand 1983). In light of this, surface treatment used in type descriptions should be left open to change when the analysis has been based upon the study of small vessel fragments and non-contiguous sherds.

The recovery of an interior and exterior cord-marked vessel with lip notching and an insloping rim at the Tuthill site may represent yet another variety of interior cord-marked pottery, although the form of the lower portion of the vessel is not known. The presence of corrugated surface treatment on sherds from two vessels at the Spruce Swamp site represents the only occurrence of this attribute in the region.

As many of the ceramics from the study area differ to various degrees from early type descriptions, the redefinition of some types to include minor variations in attributes may be in order. With this it may be possible to study not only the range of variation within a type, but, more importantly, to determine the factors governing the selection of various attributes. A good place to start in such an investigation may be with the attributes of paste characteristics, temper, and surface treatment. Variation in the occurrence of such attributes may reflect the availability of raw materials on a local or regional level, shifts in settlement location, or preferences expressed on a number of possible levels (individual, familial, communal, or societal). For example, Robertson (1984) reports intrasite differences in temper, surface treatment, and decorative motif for Incinerator site. These differences were a primary consideration in the delineation of proposed matrilocal residential zones within this Fort Ancient village site in Ohio.

Attribute analysis may prove useful in the study of other problems. For example, the study of the use of shells for both temper and as tools to apply surface treatment and decoration may prove helpful in the delineation of areas exploited by coastal groups as reflected by the distribution of ceramics evidencing such use. It would be interesting to compare such distributions to historically documented boundaries to see if such a correspondence exists.

Once an understanding of the role played by attributes directly affected by resource availability is obtained, it may be possible to determine with a greater degree of objectivity the significance of other attributes such as shape, decorative motif, and decorative technique. For example, type descriptions for both East River Cord-Marked and Windsor Cord-Marked are almost identical in terms of form, exterior surface treatment, and temper, but they differ in that the former has poorly consolidated, laminated paste. If such a distinguishing factor can be demonstrated as resulting from differences in raw materials available to each group, the only remaining difference is the occasional presence of lip notching on Windsor Cord-Marked. That even this difference may be minor or even inconsequential is suggested from Smith's (1950) reporting of the presence of East River Cord-Marked sherds on Sebonac components of the Windsor tradition and the presence of Windsor Cord-Marked sherds on Clasons Point components of the East River tradition. Although he attributes such a distribution to trade, the possibility that these two types are in reality one would provide a useful test case of the above discussed approach.

The distribution of ceramic attributes and types of both the East River and Windsor traditions within the study area during the Late Woodland period shows that the Windsor tradition is most commonly encountered in the eastern area. This pattern lends support to the East River – Windsor boundary at some point between Norwalk and the Housatonic River (Salwen 1978, Lavin 1984).

Although the Spruce Swamp, Perkin-Elmer Rockshelter, and Split Rock Shelter contain Late Woodland ceramics of both the Windsor and East River traditions, the lack of large ceramic samples from secure stratigraphic contexts precludes detailed study of the interaction between peoples of these traditions such as has been done on Western Long Island (Salwen 1968). Nevertheless, the possibility for such analysis is clearly present in the study area.

ACKNOWLEDGEMENTS

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THE WOODRUFF ROCK SHELTER SITE - 6LF126
AN INTERIM REPORT - FAUNAL ANALYSIS AS A MEANS
TO EVALUATE ENVIRONMENT AND CULTURE

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ABSTRACT

The Woodruff Rock Shelter, located in New Preston in northwestern Connecticut, is approximately 100 m south of Lake Waramaug and overlooks the East Aspetuck River. The importance of the site is twofold: excellent bone and shell preservation, a highly unusual occurrence on inland southern New England sites not underlain by limestone-marble deposits, and the fact that the site was largely undisturbed at the time of excavation.

The purpose of this report is to use the large amount of faunal material excavated to reconstruct the environment and life of the Woodland period (ca 1000 BC - 1600 AD) peoples who occupied this rockshelter. The following topics are discussed: faunal resources available; overall environment and various micro-environments present; seasonality of human occupation; human dietary preferences; possible purpose(s) for human occupation of the site; and human food processing, cooking preferences, and butchering techniques.

INTRODUCTION

The Woodruff Rock Shelter (6LF126) is approximately 18m long by 5m wide and is located in Litchfield County, Connecticut on the New Preston Quadrangle. It is on the northeast side of Mt. Bushnell approximately 17m above and west northwest of the East Aspetuck River in the town of New Preston. The site is 100m south southwest of the southern end of Lake Waramaug and its confluence with the East Aspetuck River, the outlet for the Lake (Figure 1).

Geologically the hills in the surrounding area are part of the Waramaug Formation named for Lake Waramaug (Gates and Bradley 1952). They are comprised of two types of gneiss. The first is coarse and intensely folded and contains quartz. The second is less coarse and folded with mica and quartzite. Both are intruded into granite. The valley below is a Woodville Marble. The rockshelter is derived from talus rock plucked and deposited by the most recent Wisconsin Glacier (John Pawloski, Geologist and science teacher, Schagticoke School, New Milford, Connecticut, personal communication, 1985). A number of other similar formations should exist in the area, but so far none have been reported of such a size. The great majority of smaller ones have already been dug by well meaning, but untrained, collectors.

Geographically the area is comprised of wooded hills, lowland swamps, marshy areas, and woods with intermittent meadows. A few ponds and many small and some large streams, including the East Aspetuck and Shepaug rivers, criss-cross the region. In spite of increasingly rapid urbanization the area is still farmed and rich in floral and faunal evidence of the varied resources available to prehistoric man. The steep hills towering above the heavily wooded site protect it from wind and storms.

The rockshelter has an east-southeast exposure 17m above the beginning of a

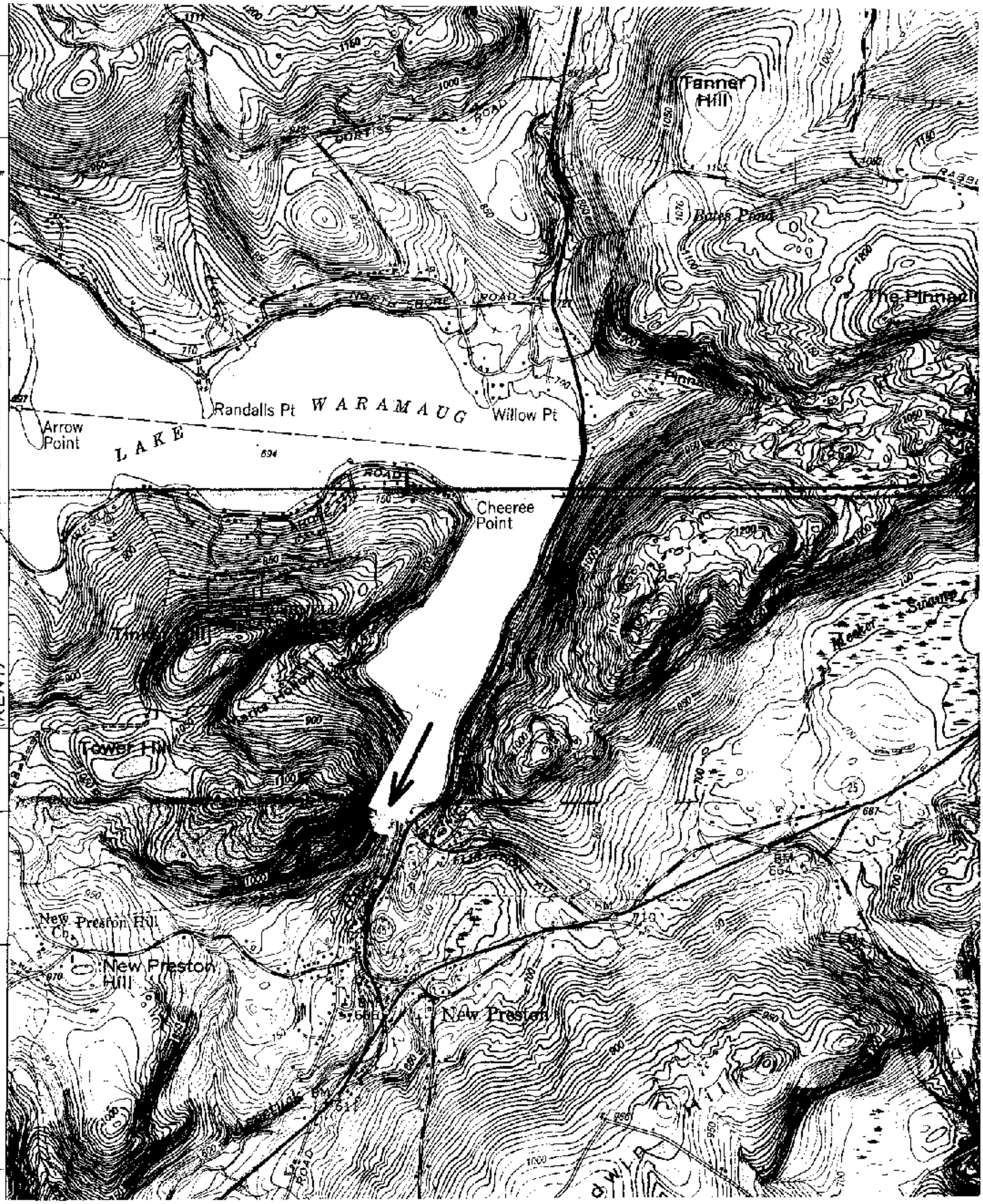

FIGURE 1. Location of the Woodruff Rock Shelter

narrow gorge. The gorge was carved since the last glacier departed some 15,000 years ago by the cutting action of the East Aspetuck River which falls 40m in .5km to the wide, flat, Aspetuck Valley. The valley itself was probably caused by glacial scouring during the time the last glacier was advancing some 40,000 years ago.

PERSPECTIVE

The primary significance of the Woodruff Rock Shelter is that it contains excellent bone and shell preservation, a highly unusual occurrence on inland, southern New England sites not underlain by limestone-marble deposits.

Some inevitable mixing of cultural material from preceding prehistoric and and some recent historic periods has occurred on the site because of: heavy and long human occupation, soil compaction because of this heavy occupation, the natural migration of materials through a living soil, recent sheet erosion, and the slowness of Western Connecticut soil formation (an average of one inch every 300 - 500 years (David E. Hill, soil scientist, Connecticut Agricultural Experiment Station, New Haven, personal communication, 1974). Enough stratigraphic and scientific evidence would appear to be present, however, to make a meaningful analysis possible, particularly of the excavated osteological remains. The osteological material lies almost entirely in Stratum Two of the floor of the rockshelter and adjacent, smaller chambers plus the slope downhill from the shelter.

While a number of post-Contact artifacts had invaded the upper levels of Stratum Two, they all dated from the mid-nineteenth century to the present. However, with one domesticated animal bone fragment found in this stratum and many of the identified animal species already gone from the area and/or not a consequential source of food by the mid-nineteenth century, these osteological remains could not logically have been from this period.

The majority of artifacts excavated throughout Stratum Two were characteristic of the Late Woodland period (ca 1000 - 1500 AD). In addition a deposit of 150 deer bones from Stratum Two, square S50W5, was collagen dated at 256 $\pm$90 years BP (1694 AD) (GX3722). Using the MASCA correction, this is 1530 - 1630 AD or approximately 1580 AD (Rippeteau 1974). Also, the condition of bone artifacts deteriorated rapidly from the surface to the bottom of Stratum Two until they were no more than small calcined fragments as they approached the highly acidic (5.6 pH) Stratum Three subsoil. According to Hill, the osteological remains in all likelihood must have been of relatively recent (Late Woodland) origin to have survived such a soil profile and appear as they did. Stratum Three had few osteological remains because of this high acidity. Those that were excavated were of extremely small size and had lost all identifiable characteristics. All of this evidence would therefore point toward the osteological remains being of Late Woodland origin. However, this is a multi-component site and small numbers of diagnostic Middle and Early Woodland artifacts were found on the lower levels of Stratum Two, and even a few Terminal Archaic items in the Stratum Two - Stratum Three boundary area. Therefore, despite all of the evidence, the author cannot conclude beyond reasonable doubt that all of the bone is Late Woodland, much less from a single Late Woodland occupation. It would seem to be a reasonable assumption, however, that the preponderance of evidence would point to the osteological remains being of Woodland origin at the very least and of a probable Late - Middle Woodland time frame.

Thus the faunal interpretation represents a mosaic cutting across the seasons of the year and econiches being exploited through the Woodland period. Furthermore it could represent one or more groups residing at this site at one or more different times during this period.

HISTORY

American Indian Archaeological Institute (AIAI) teams began research on the site in 1974 and continued during three summers to excavate a line of 5ft squares running east to west and north to south (Figure 2) to learn as much as as possible about this endangered sited. At this time the site was vulnerable because of its location near the center of town in New Preston, its visibility from Route 45, its long history as a picnic spot, increasing vandalism in the area, and potential unscientific digging of the site by collectors.

Before excavation had to be stopped and the site closed, the following history was learned through archaeological and historical research. Based upon diagnostic artifacts, The Woodruff Rock Shelter had been occupied for at least 5500 years (Ritchie 1961, 1969, 1980).

1. Otter Creek and Brewerton-like forms with atlatl weights and semi-lunar knives (ca 3500 - 2900 BC).
2. Sylvan Lake small stem and triangle-like forms and diagnostic quartz tools (ca 2500 - 1700 BC).
3. Snookkill, Susquehanna, and Orient-like forms with steatite bowl fragments (ca 1700 - 1100 BC).
4. Meadowood-like forms of Onondaga flint (ca 1100 - 900 BC).
5. Adena-like forms with a banded slate pendant (ca 700 BC).
6. Fox Creek-like forms with pottery sherds (ca 500 AD).
7. Levanna-like forms with pottery sherds (ca 1000 - 1600 AD).
8. Earlier occupations were suspected, especially given the presence of 10,000 - 8000 year old material in the region, most notably sites 6LF21 (Moeller 1980) to the east in the Shepaug Valley and 6LF1 (Swigart 1974) on the northern shore of Lake Waramaug. However, a very large rockfall that occurred in the Middle- -Early Archaic period prevented researchers from going any lower in the most productive squares.
9. No archaeological evidence was found from the Contact period (1630 - 1744 AD, 1744 being the time the first white settlers arrived). A large number of artifacts dating from 1834 on (broken bottles, blasting caps, batteries, wire, broken clay pigeons) were found.
10. One pig (*Sus scrofa*) bone was the only osteological evidence of a domesticated European animal found at the site.

Historic documents indicate that the first European settlers arrived on New Preston Hill adjoining the site in 1744 - 1745 as part of the North Purchase of the town of New Milford. The East Aspetuck gorge's water power potential was quickly realized, and within 100 years 21 dam sites and adjacent factories were built in the first 1.5km of the river. Somehow 6LF126 was largely spared the wholesale changes in the gorge landscape that occurred during this period, although a series of blast furnaces and factories were built only 75m from the site. The Waramaug Iron Company that opened in 1834 and the Litchfield Iron Co. in 1854 both quickly failed. Oscar Beeman bought the land the site was on in 1875. He demolished what was left of the furnaces and used the rocks to build a combined saw mill and general purpose factory on the site of the old furnaces. (Howell and Carlson 1974).

In 1900 Beeman's son, Henry did seriously affect the site by blasting away over 80% of the original overhang to build fish holding pens for raising bass above and below the old family mill (Robert Woodruff, site owner, personal communication 1974). Slabs of unused rock, abandoned blasting materials, and the furrows the skidded stones made still mar the site and the hill below. From

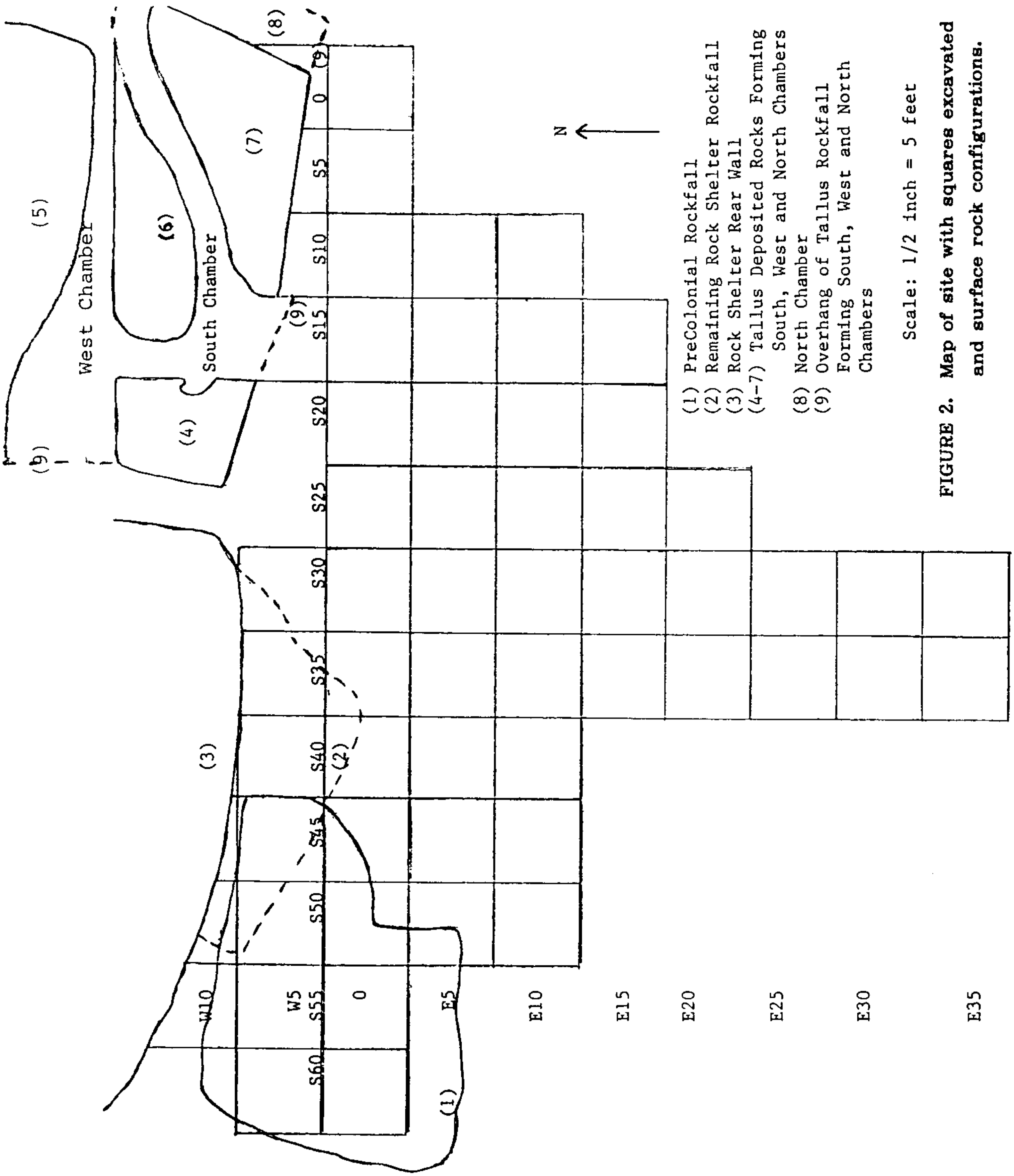

FIGURE 2. Map of site with squares excavated and surface rock configurations.

that time on 80% of the once level rockshelter floor was no longer protected against weather, sheet erosion, and the rapid dissolving of bones and shell in the newly exposed areas began to take place.

Robert Woodruff bought the property in 1941 and operated the mill for ten years (Howell and Carlson 1974). The land was then allowed to return to its natural state.

When the excavation began in the late 1960s by Silas Merrill and his wife, Jane, the area was once again heavily wooded. Having some archaeological training, Merrill quickly realized the significance of the site. After a considerable search for a proper organization to undertake the work he felt was justified, he contacted AIAI in 1974. At approximately the same time, Ted Adams, a fifth grade friend of the author's oldest son, Ted, found some fragments of deer and other bones lying on the top of the ground which he brought to school to have the author identify. Between these two sources, it became evident that this was a potentially important Indian site worthy of immediate attention. Before AIAI could get field teams to the site, an untrained collector discovered Merrill's piles of sifted soil and without landowner permission excavated the entire area under the remaining overhang of the rockshelter. Thus this apparently undisturbed part of the site was lost forever. However, from the work of Silas Merrill in an adjoining area and the nature of rockshelter occupations in general, the meaningful cultural artifacts are normally found adjacent to the immediate living surface as well (Hole and Heizer 1969; Wiegand 1982). Excavation of part of the remainder of the site proceeded on schedule, beginning in 1974 and extending through 1976. Crews from the University of Wisconsin under Dr. Phillip Salken and from Central Connecticut State University under Dr. Fred Warner assisted AIAI teams in this effort during the summer of 1974.

Since operations were closed in 1976, the site has been vandalized to a minor extent, but is still owned and watched over by the Woodruff family.

METHODOLOGY

The metric system was not used in the excavation of this site. Thus, to maintain the integrity of the data, the English system is employed when discussing the archaeological methodology.

A datum point was established on the rockshelter face as E0S0. A series of 76 5ft squares was established from this point on a north - south axis. To delineate the squares, rectangular wooden stakes were driven into the ground to the depth of the original soil surface, or, if over a rock, a cement nail or paint mark was used. String was stretched along the line and fastened to nails driven into the center of the rectangular stakes to maintain square alignment. Pillars or pedestals 6 in in diameter were left at the four corners of each square to maintain depth-below-original-surface control.

All artifacts and features were recorded by measuring south and west from the northeast corner of a square. Depth below surface was measured with a measuring tape and plumb bob, and, during the second and third seasons, with a transit and stadia rod as well. The degree of slope, soil profiles, and consecutive square floor plans were drawn.

Debris from Stratum One, the surface layer, was removed, and, if artifacts were present, they were suitably recorded. Below this stratum all squares were scraped with a trowel. The contour of the stratum surface currently being excavated was followed as closely as possible. No more than 2.5in intervals were excavated before mapping.

Non-diagnostic artifact bags were also established for each 2.5in interval. Diagnostic artifacts were mapped and placed in individual envelopes suitably marked.

All soil was sifted through .25in and .125in hardware cloth to check for materials that might have been missed in troweling, unless the soil was thought to be from a feature (e.g., fire, refuse, or storage pits). In the latter case the soil was bagged and marked for later flotation and more detailed analysis.

Features were first exposed and mapped. Then, during the soil collection process, charcoal samples were removed by trowel, placed in sterile aluminum foil, dried, and placed in sterile glass jars for potential ^{14}C, or in the case of bone, ^{13}C analysis.

STRATIGRAPHY

Three distinct stratigraphic levels (Figure 3) occurred on this site (David Hill, personal communication, 1974). Stratum 1 over the entire living floor and adjacent areas was a typical A horizon soil cross section consisting of surface litter up to 2.5 in thick in undisturbed areas under the remaining overhang and grading to 1 in thick or less on the 25° to 30° downhill slope beyond the original rockshelter living floor. The litter consisted of twigs, leaves, and other recent natural and cultural debris on the surface to decomposing leaves and other organic material (duff), also mixed with cultural debris of recent origin on the bottom.

Stratum Two of the living floor consisted of a largely homogeneous sand - silt layer of very black soil, very greasy to the touch, containing an extraordinary amount of charcoal, extremely fragmented boiled, burned, and unburned bone and other cultural refuse. This Stratum covered the entire living floor of the shelter and even extended 5 - 6m down the steep slope directly below the outside edge of the living floor, where it merged with, and was then replaced by, a more normal, dark brown, sand - silt - loam, typical of an inland New England B horizon soil. The thickness of Stratum Two on the living floor was shallowest along the length of the north (back) wall of the shelter (ca 3 in) and increased steadily to ca 19 in at the southeastern (right front) corner of the shelter floor and ca 9 in at the southwestern (left front) edge. Black soil progressively disappeared 5 - 6m down the slope from its junction with the living floor. The dark brown, sand - silt - loam soil of Stratum Two downhill from the greasy black area, because of hillside sheet and gully erosion, shrank to as little as 3 in before expanding to ca 6 in as the slope decreased approaching the East Aspetuck flood plain. The black layer of Stratum Two had a pH of 8 (alkaline) at the surface and ca 7 (neutral) at the bottom. The pH of the brown sand - silt - loam Stratum Two soils downslope from the shelter was 5.6 (acidic), the normal pH of area soils without a limestone subsurface bedrock. According to Hill, the reason for this unusual pH situation, particularly in the upper regions of the black layer of this stratum, was undoubtedly due to the extraordinary amount of bone and charcoal deposited over the years of Indian occupation. Moreover, the texture of the greasy, black layer of the soil was also a product of this large amount of decomposing bone and great numbers of fires, and was therefore further evidence of heavy site use over a long period of time.

Frequent rock falls, ranging from huge slabs that needed winches to move to very small, thin, scale-like pieces, were scattered throughout Stratum Two, and a large rockfall covered the entire southwestern quarter of the living surface in this stratum.

Stratum Three consisted of an as yet undetermined depth of orange sand - silt C horizon subsoil. Unfortunately an apparent rockfall of clearly defined and immense proportions occurred during the Middle Archaic which prevented further excavation in the test area under the existing rockshelter and

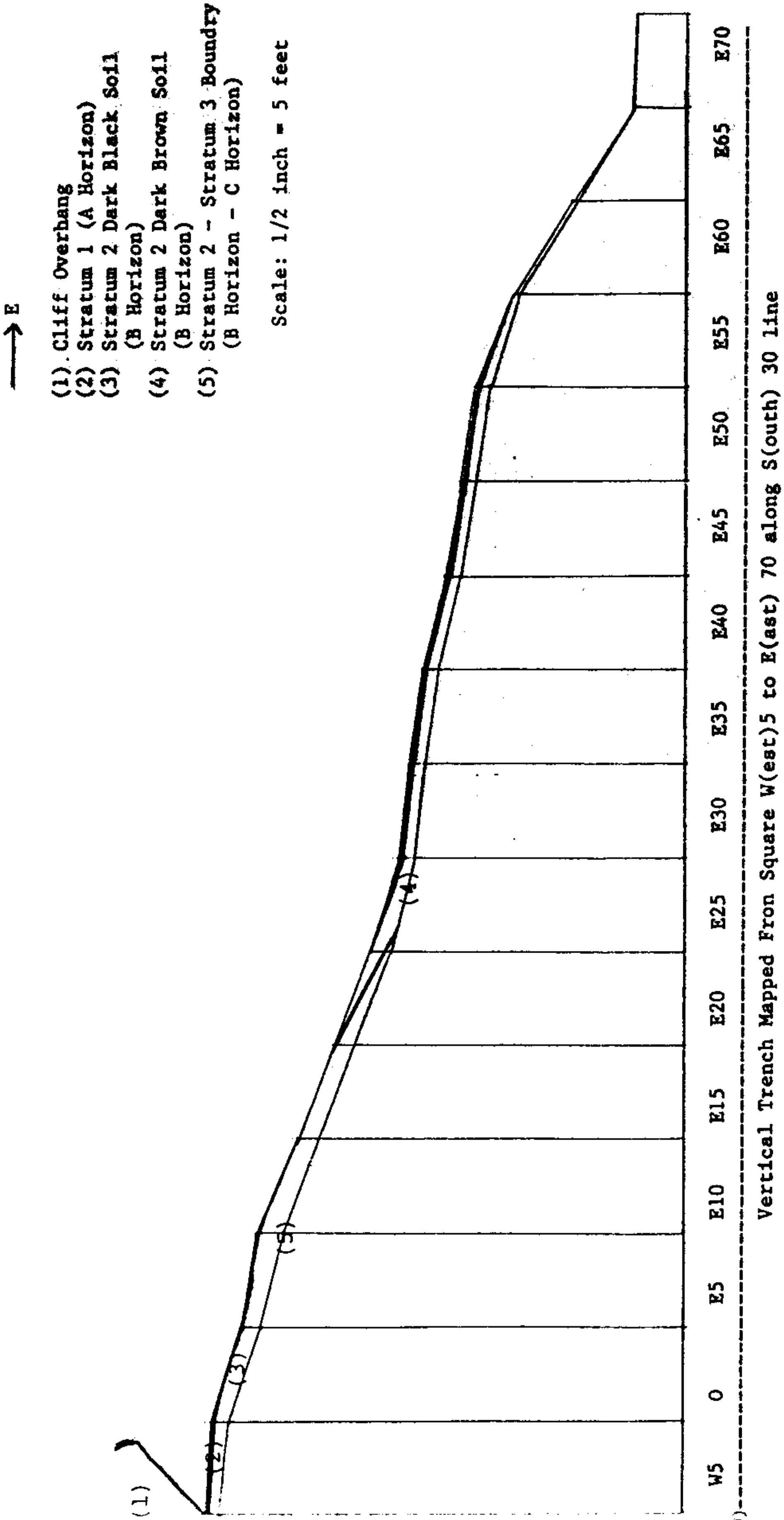

FIGURE 3. Soil and slope profile - Vertical section.

adjacent living surface. In addition, frequent rockfalls of a similar nature to those found in Stratum Two were scattered throughout the few squares where this stratum could be excavated. The pH of the upper levels of Stratum Three was 5.6, somewhat higher than the typical 5 - 5.5 acidic, regional C horizon soils over most non-limestone bedrock areas of interior southern New England because of the 7 - 8 pH soils directly above.

ARTIFACTS AND FEATURES

Stratum One consisted of a mixture of largely unstratified items, including a few mid to late nineteenth and many twentieth century artifacts such as clay pigeon fragments from skeet shooting, broken glass, china fragments, and pieces of metal, plastic, wood, and other materials. Occasionally prehistoric lithic and bone artifacts were found in this stratum as well, but they all came from the heavily eroded southeastern (outside) edge of the living surface and the steep slope directly below. Since the blasting away of most of the rock-shelter's ceiling in 1900 to construct a fish hatchery, this stratum and Stratum Two beneath it had become extremely and increasingly vulnerable to sheet and gully erosion, particularly at the still visible demarcation line between the once relatively level living floor and the steep slope below.

The Stratum Two black soil layer consisted of scattered nineteenth and twentieth century materials to a depth of 3 - 4 in toward the front (southern) edge of the living floor and down the slope toward the East Aspetuck River. In a few isolated instances these materials had migrated to a depth of up to 8 in because of local soil disturbance or soil particle and/or artifact movement.

Mid to late nineteenth and twentieth century artifacts were found dispersed throughout most of the 3 - 5 in Stratum Two brown sand - silt - loam soil running from the black area downslope to the river.

Prehistoric lithic and ceramic artifacts in the black area of Stratum Two were relatively few in number over most of the area toward the back of the remaining undisturbed (outer) section of the original living floor, except for widely scattered, small pottery sherds. Several clusters suggested pots had more than likely been broken in those immediate areas, and, after the majority of larger pieces had been collected and discarded, the smaller sherds were left to be trodden underfoot. Some, from the wide separation of pieces that later were found to fit together, were apparently kicked and thrown about as well. Large concentrations of lithics and pottery, including sizable sherds up to 2 - 4 in in diameter, were found in the crevices of the rear shelter wall and almost filling (ca 2 ft deep) two smaller, low ceilinged (ca 1 ft above debris) chambers and a small interconnecting passage, and up to 3 ft deep in a third small, rectangular, 7 ft high chamber (Silas Merrill, personal communication 1974). These small chambers apparently were used as waste disposal areas. They too appeared to be the result of a glacially plucked talus and rockfall backing upon and adjacent to the northeastern section of the rockshelter's northeast (back right) wall (John Pawloski, personal communication). Large numbers (but not as great as in the rear chambers) of lithics and ceramics were also found toward the outer, southern edge of the rockshelter living floor, and especially the first 3 - 4 ft down the slope from the living floor edge. From that area the material quickly decreased in number until it disappeared, except for a few scattered artifacts, with the end of the black layer. Very few prehistoric artifacts were located in a test trench dug in the brown layer down the slope to the dirt road and then continued on the other side to the river.

The great majority of prehistoric lithic artifacts and all of the ceramics in the black layer were from the Middle - Late Woodland period: Levanna, Fox Creek, and Woodland small stem-like diagnostics. Toward the very bottom of this layer, however, these were mixed with Early Woodland - Late Archaic artifacts including Adena, Orient, Susquehanna (in association with steatite fragments), and Snookkill-like diagnostics. In addition, a few Middle Archaic artifacts were found on the Stratum Two - Stratum Three boundary in the upper levels of Stratum Three. Otter Creek, Brewerton, and Archaic small stemmed and triangular projectile points plus other tools including sections of broken atlatl weights were found. 6LF126 was therefore not a well stratified site in terms of discrete, cultural components.

Very few recognizable prehistoric features were found. The homogeneous, extremely black, bone and charcoal filled layer covering the entire living floor and the adjacent down hill slope made it extremely difficult to discern hearth concentrations. This was because so much charcoal was present and it had been so thoroughly mixed over time. However, there did appear to be some archaeological evidence of a line of hearths associated with fire cracked rocks with considerable carbonized bone and nut debris running parallel and 2 - 3 ft from the northwest (back) wall of the shelter. As a matter of policy, only samples from suspected hearths were collected for future dating. Samples were not collected from the abundant charcoal spread throughout the homogeneous black level, as this was thought to have been associated with a number of different occupations.

Except for two large concentrations of pottery sherds from two individual pits in squares S40E5 and S15E5, pottery on the Stratum Two living floor and the slope immediately below was also widely diffused and in no apparent discrete concentrations, except for the areas in crevices and the three interconnecting chambers. The accumulation of large sherds in these areas are thought to be the result of periodic dumping by the inhabitants. Since small sherds representing far more types and designs than the few types found in the concentrated areas within the shelter were scattered over the living floor, it is evident that a sizable refuse area(s) must have been present near the shelter, but these refuse piles were never found.

Organic material other than bone was found widely scattered throughout the Stratum Two black layer, but with some significant concentrations in the potential hearth areas. Tiny carbonized hickory nut fragments and larger butternut and hazelnut fragments were found. A few acorn outer shell fragments were also excavated. Given the long tradition and extensive usage by prehistoric Indians (Anna Escanaba, Chippewa Indian of Partridge Lake, Wisconsin, personal communication, 1941 and Keewaydinoquay, Chippewa Indian of Beaver Island, Michigan, personal communication, 1984), the abundance of oak in the region for at least the last 6000 years and the presence of oak (northern red, *Quercus rubra borealis*) as early as 10,190 years ago at 6LF21 in the nearby Shepaug River watershed (Moeller 1980), it is surprising more of this potentially important food resource does not turn up on archaeological sites except in California (Driver 1969). Even though acorn outer shells are extremely thin, the soil pH of 7 - 8 and the presence of small fish bones, large numbers of minnow vertebra, and small mammal ribs, carpels, metacarpals, tarsus, metatarsus, and phalanges, should have allowed for the preservation of such organic material at this site and others in the Northeast as well. At the same time all nut shell fragments on the site were heavily carbonized, indicating that they had been cracked, eaten, and the refuse thrown directly into the fire, whereas the small bones were not carbonized, indicating that they had not been directly associated with fire. Thus acorns with their very thin shells, if treated the same way as other nut shells, could have been totally or almost totally consumed in the fire or among the hot coals, whereas the thicker shell fragments of other nuts are not. Subsequent tests conducted by the author have shown that this was a likely possibility. A more remote one is that acorns were shelled at another location and brought fully prepared to the site for use, thus leaving little or no on-site evidence of their presence.

No chestnut shell fragments were found. The chestnut tree (*Castanea dentata*) was a relatively recent addition to northeastern forests (Davis 1969), but it was present in Middle - Late Woodland times. Even though its nut was extremely nutritious, tasty, and easy to gather, store, and prepare, other regional sites have not shown any evidence of the Indian usage of this once abundant food resource either (Swigart 1974). However, with an even thinner shell than the acorn, it could also have been (and is by the author's tests) totally or almost totally consumed in an ordinary fire.

No carbonized or otherwise preserved agricultural products (e.g., corn, beans, squash) were present. This is similar to the results of all the other excavations so far recorded in the Western Connecticut uplands where this site is located. The shortness of the growing season (an average of 90 frost free days) (Kirk 1939) in relation to the maturation process, particularly of the early flint corns in the region (a minimum of 60 - 70 frost free days) (Yarnell 1970), would logically have prevented the practice of agriculture under any but optimum and supplementary conditions. Archaeological evidence from similar environmental regions in the Midwest has indicated that no early agricultural sites containing corn were in a zone of less than 120 frost free days (Yarnell 1970). Thus corn based agriculture existing in the Woodruff site area during Indian times would be highly unlikely, except in a very limited microhabitat situation where a very unusual geographic situation would provide the apparent minimum 100 - 120 frost free day situation Indians needed for corn to become an important staple in their diet (Yarnell 1970). So far no such location has been found in the region.

Flotation of a number of soil samples was conducted. Modest amounts of seeds and other organic materials were recovered, but have not been identified to date.

In Stratum Three five test squares were excavated. These were dug along an east-west trench from the back wall of the rockshelter across the living floor and two squares down the side of the slope. In all but the last square, a massive rockfall was encountered, which was also the subsequent limiting factor in taking down other living floor squares into this stratum at a depth where Middle Archaic artifacts were found. Periodic cracks and fissures in this rock gave evidence that this was indeed a rockfall or a series of rockfalls and not bedrock, and that therefore there might very well be additional cultural material underneath it.

What few artifacts were found in this stratum were from the Early - Middle Archaic. No Woodland period artifacts or ceramics were found in this layer either on the living floor, which once again had relatively few artifacts as the rear wall of the shelter was approached or on the downhill slope, which had concentrations similar to, but fewer in number than, the Stratum Two layer above. No bone, other than a few calcined pieces at the Stratum Two - Stratum Three junction and in the immediate vicinity in Stratum Three, were found in this layer. Although a small amount of fire cracked rock was present, no discrete features including hearths were located. This was in part due to the soil pH of 5.6 which would clearly have dissolved any organic materials over so long a period of time (David Hill, personal communication, 1974). Small charcoal fragments were present in small amounts, but were too widely scattered throughout the stratum to be considered discrete enough to give a meaningful date. Small widely scattered amounts of fire cracked rock were also found scattered throughout the stratum.

TABLE 1. Faunal remains identified from the Woodruff Rock Shelter.

Phylum: CHORDATA
  Subphylum: VERTEBRATA (Notochord replaced by spinal column of vertebra)
    Class: OSTEICHTHYES (Bony Fishes)
      Order: Siluriformes
        Family: Ictaluridae (North American Catfishes)
          Dermethmoid sp (Catfish=Bullhead)
      Order: Perciformes
        Family: Centrarchidae (Sunfishes)
          Percimorph sp (Bluegill-Sunfish)
      Order: Cypriniformes
        Family: Cyprinidae (Minnows and Carps)

    Class: REPTILIA (Reptiles)
      Order: Testudines
        Family: Chelydridae (Snapping Turtles)
          Chelydra serpentina (Snapping Turtle)
        Family: Kinosternidae (Musk and Mud Turtles)
          Sternotherus odoratus (Stinkpot)
        Family: Emydidae (Box and Water Turtles)
          Clemmys guttata (Spotted Turtle)
          Clemmys insculpta (Wood Turtle)
          Terrapene carolina (Eastern Box Turtle)
          Chrysemys picta (Painted Turtle)
      Order: Squamata
        Suborder: Serpentes (Snakes)
        Family: Colubridae (Racers)
          Coluber constrictor (Northern Black Racer)
        Family: Viperidae (Poisonous Snakes)
          Crotalus horridus (Timber Rattlesnake)

    Class: AMPHIBIA (Amphibians)
      Order: Anura
        Family: Ranidae (Frogs)
          Rana spp (True Frogs, i.e., Bullfrog)

    Class: AVES (Birds)
      Order: Anseriformes
        Family: Anatidae (Swans, Geese, and Ducks)
          Anas spp (Duck)
      Order: Accipitirformes
        Family: Accipitridae (Hawks and Eagles)
      Order: Galliformes
        Family: Meleagridae (Turkeys)
          Meleagris gallopavo (Wild Turkey)
        Family Tetraonidae (Grouse)
          Bonasa umbellus (Ruffed Grouse)

    Class: MAMMALIA
      Order: Lagamorpha
        Family: Leporidae (Hares and Rabbits)
          Lepus americanus (Snowshoe or Varying Hare)
          Sylvilagus floridanus (Eastern Cottontail Rabbit)
          Sylvilagus transitionalis (New England Cottontail)

TABLE 1. Faunal remains identified from the Woodruff Rock Shelter (continued)

Order: Rodentia
- Family: Sciuridae (Squirrels)
  - *Marmota monax* (Woodchuck)
  - *Sciurus carolinensis* (Eastern Gray Squirrel)
  - *Tamias striatus* (Eastern Striped Chipmunk)
  - *Tamiasciurus hudsonicus* (Red Squirrel)
- Family: Castorida (Beavers)
  - *Castor canadensis* (Beaver)
- Family: Cricetidae (Mice, Rats, Lemmings, and Voles)
  - *Neotoma floridiana* (Eastern Woodrat)
  - *Ondatra zibethicus* (Muskrat)
- Family: Erethizontidae (Porcupines)
  - *Erethizon dorzatum* (Porcupine)

Order: Carnivora
- Family: Canidae (Dogs, Wolves, and Foxes)
  - *Canis familiaris* (Short Faced Indian Dog)
  - *Canis lupus* (Gray Wolf)
  - *Urocyon cinereoargenteus* (Gray Fox)
  - *Vulpes fulva* (Red Fox)
- Family: Ursidae (Bears)
  - *Ursus americanus* (Black Bear)
- Family: Procyonidae (Raccoons)
  - *Procyon lotor* (Raccoon)
- Family: Mustelidae (Weasels, Skunks, others)
  - *Lutra canadensis* (River Otter)
  - *Mephistis mephistis* (Striped Skunk)
  - *Mustela vison* (Mink)
- Family: Felidae (Cats)
  - *Lynx rufus* (Bobcat)

Order: Ungulata (Hoofed Mammals)
- Family: Suidae (Pigs)
  - *Sus scrofa* (European Boar)

Order: Primates (Erect Mammals)
- Family: Hominidae (Man)
  - *Homo sapiens* (Modern Man)

Order: Artiodactyla
- Family: Cervidae (Deer)
  - *Cervus canadensis* (Elk)
  - *Odocoileus virginianus* (White-Tailed Deer)

Phylum: MOLLUSCA

Class: GASTROPODA
- Family: Endodontidae (Forest Snails)
  - *Triodopsis albolabris* (White-Lipped Forest Snail)

Class: PELECYPODA

Order: Mytilidae
- Family: Unionidae (River Mussels)
  - *Elliptio complanatus* (Filter Mussel)

FAUNAL REMAINS

Large numbers of preserved faunal remains on inland southern New England archaeological sites are rare because of the acidity of the soils. They occur almost exclusively on sites which are located in bogs, over limestone deposits, and in rockshelters and caves. Bogs and limestone deposits in southern New England are rare, and most of the rockshelters and caves being surveyed have already been extensively disturbed by collectors. While some faunal material is usually preserved in a carbonized form in hearths or fire pits on the vast majority of sites that are exposed to the weather the year around, the amounts are generally far too small and too fragmented to yield significant data. Thus the primary importance of the Woodruff Rock Shelter site is that over 15,000 whole or fragmentary bones from recent (Woodland) prehistoric times were present.

Over 1500 bones were identified (Table 1). Those in Stratum Two on the main rockshelter floor and downhill slope were identified by Dr. Joanne Bowen in 1977 - 1978. Previously bones from under the large pre-Colonial rockfall and from similar soil-artifact deposits in the three small adjacent talus-formed chambers at the northeast (back) wall were identified by Dr. David R. Starbuck and the author in 1974 and 1975. Other identifications were made by Dr. Howard D. Friedman, Dr. Phillip Salken, and Dr. Fred Warner during 1975. Their identifications were subsequently corroborated by Starbuck, Swigart, and Bowen, who also identified additional specimens from the slope directly downhill from the shelter floor edge where Stratum Two had been exposed by erosion. The majority of the bones were highly fragmentary. Some of the smaller mammal, bird, reptile, and fish bones were whole, however, and one semi-articulated skeleton of a red fox was found in square S30E35.

FAUNAL REMAINS: INDICATORS OF ENVIRONMENTAL AND ANIMAL FOOD RESOURCES

Through the use of habitat-specific fauna listed in Table 1, the types of environmental resources available to the late prehistoric Indian populations living at the Woodruff Rock Shelter and by inference for the entire inland northeastern region as well can be reconstructed. The result is a view of inland New England different from the one of a vast, almost impenetrable wilderness of unbroken forest recorded by early visitors.

It is little wonder that many early explorers, settlers, and travelers coming from the more densely settled areas of Europe with their open, manicured forests would have made such a comparison. Comments by Wood (1634) of his extensive travels through the "wilderness" of southern New England and by the historian, Edward Johnson, of New England as a "remote, rocky, barren wild, woody wilderness" were typical of the way the majority of early residents saw their new environment. Later, in the 18th century, the famous environmental disruptions of many French and Indian War and Revolutionary War battles (e.g., Braddock's famous defeat "in the wilderness") preserved this idea. Since that time, this concept has been popularized and perpetuated by many poets, authors, and artists including Longfellow (1855), Cooper (1954), and Roberts (1933, 1937).

Fortunately there has been a growing body of evidence in print recently that strongly suggests that this long standing concept of an unbroken, impenetrable wilderness may not have been the case. One of the most recent books on the subject (Cronon 1983) presents an extremely scholarly and well documented case for a different view. The vegetation, habitat types, and general habitat percentages in New England and the United States' northeastern and north central forest lands were in fact very much like those of today, predominantly deciduous forests to the south changing to boreal forests in the more northerly regions. The difference, however, according to cronon, was that there were constantly recurring, sizable natural (by fire, wind, or other weather-related factors) or man made (by fire or clearing) open areas of meadows, bordered and growing to thicket before returning to the largely open woodlands of the time. Thick "impenetrable" forests were found largely in swampy areas, or where open areas had turned to thicket before returning to the more open mature woodlands apparently characteristic of the region and period.

Not only do these data represented by faunal remains from the site help to corroborate this hypothesis of cronon and others, but they also suggest that at least the Lake Waramaug area may have been even more open and park-like than most modern scholars would suspect. A key habitat-indicative species present at the site and, an unexpected one since it had not been archaeologically documented in Connecticut before, is the elk (*Cervus canadensis*), a species of mammal that prefers open, park-like, grassy forest types (Trippensee 1953; Wernert 1982). Not only is it present, but it may have occupied the area in significant numbers as well. However, the extremely minor skeletal differences between immature elk and white-tailed deer (*Odocoileus virginianus*), members of the same Family (Cervidae) (Bowen 1978), have made this final determination of relative numbers of each species difficult. That the elk lived in the area, however, is beyond question. The osteological remains of adult animals from the site were identified independently by everyone who took part in the study.

LAND HABITATS

Open, Park-like, Grassy Woodlands

The presence of elk, such large and far ranging grazing mammals with such an environmental preference, and the fact that elk are in competition with white-tailed deer for habitat and niche territory when their habitats overlap, makes their presence both ecologically and as a food resource of great significance in any meaningful environmental analysis of the site.

Deciduous Hardwood Forest

Connecticut and the Woodruff site are approximately 40% woodland and 30% thicket (growing to woodland) today. Seventy years ago woodlands and thickets covered only 10 - 20% of the land area (William Bader, tree surgeon and historian of the Washington, Connecticut region, personal communication 1985). The rest was farmland which has since been largely abandoned. The oak (*Quercus* sp) - hickory (*Carya* sp) deciduous forest is the major type of forest environment in the vicinity of the Woodruff site today, covering most of the east, west, and south ridges, a majority of the north facing ridges, and most of the valley floors where a forest habitat is present. This type is heavily interspersed with black birch (*Betula lenta*), yellow birch (*B. lutea*), and two maples, sugar maple (*Acer saccarinum*) and red maple (*A. rubrum*), the former being largely on the higher elevations and the latter on the bottom lands.

The majority of animals with environmental preferences (Odum 1953, Trippensee 1953, Wernert 1982) whose bones were identified from the Woodruff Rock Shelter would be found in such a major habitat. Present were large numbers of white-tailed deer (*Odocoileus virginianus*) instead of moose (*Alces alces*) indicative of the northern boreal forest and caribou (*Rangifer tarandus*) of the tundra - northern boreal forest. Also recorded were bobcat (*Lynx rufus*) instead of lynx (*L. lynx*) indicative of the northern boreal forest. The gray fox

(*Urocyon cinereoargenteus*) was also present. These three larger mammals needed sizable territories in which to live. Their presence, and the total absence of the other large boreal forest mammals would indicate that the predominant forest during the late prehistoric times was a deciduous hardwood variety, but with more open, grassy woodlands as part of this forest composition because of the presence of elk. Smaller sized species (e.g., eastern gray squirrel (*Sciurus carolinensis*), eastern woodrat (*Neotoma floridana*), New England cottontail (*Sylvilagus transitionalis*) (now extinct), the varying hare (*Lepus americanus*), plus wild turkey (*Meleagris gallopavo*), ruffed grouse (*Bonasa umbellus*), box turtle (*Terrapene carolina*), and eastern timber rattlesnake (*Crotalus horridus*), all present a similar deciduous forest picture, but on a less broad scale, for their overall territorial needs were substantially smaller.

The precise composition of this deciduous hardwood forest, however, was significantly different from the current one (Bader, personal communication 1985), pollen analysis (Davis 1969), and even current physical evidence still visible in the local forests. Oak and hickory were a significant part of the Woodland period forest as indicated by the evidence cited above and extensive quantities of hickory nut and acorn shells from fire pits (Swigart 1974). However, since its appearance approximately 2000 years ago until the Chinese Chestnut Blight of the early 20th century almost wiped out this species, the dominant deciduous forest tree throughout the region would appear to have been the American chestnut (*C. dentata*) (Harlow and Harrar 1950). The presence of preserved chestnut stumps and chestnut stump sprouts in great numbers in any woodland area in the region that is still relatively undisturbed since their demise is also graphic evidence of the dominance and frequency of this species in the pre-blight Connecticut and northeastern woodlands. Oak and hickory now appear to have taken over the climax forest role apparently previously occupied by the chestnut, with black and yellow birch increasingly becoming a subclimax forest species.

Beech (*Fagus grandifolia*) and sugar maple (*A. saccarinum*) stands in combination with hemlock (*Tsuga canadensis*) occupy northern and some western and eastern ridge slopes, and could have occupied the same habitats in at least very recent prehistoric Indian times, although preserved chestnut stumps in these areas would suggest that even here the chestnut was the dominant species in a number of areas.

Boreal Softwood (Evergreen) Forest

Hemlock would appear to be the new emerging climax tree in the region. Part of a Beech - Sugar Maple - Hemlock type forest community, it is already becoming the major climax tree of the northern slopes and is rapidly expanding its dominance to the eastern and western ridges and even the bottom lands as well. It grows first as a shade tolerant understory in oak, hickory, and maple forests, and then gradually overtops and shades out the hardwoods. The only limiting factors currently controlling this species are its marked susceptibility to total insect defoliation (thereby killing the tree) and fire, natural and man-caused, both of which could have exacted a greater toll in late prehistoric times when insects and fires were largely uncontrolled by man. A replacement evergreen, from historic descriptions of its range and size (the King's mark royal pine for the British Navy) (Carlton 1939) was the white pine (*Pinus strobus*) (Harlow and Harran 1950) which is susceptible, as all evergreens, to the same factors as the hemlock, but seemingly less so.

A much smaller number of animals was identified from boreal - preferred environments, and all of these were smaller creatures needing smaller territories, e.g., red squirrel (*Tamiasciurus hudsonicus*), porcupine (*Erethizon* *dorzatum*), and wood turtle (*Clemmys insculpta*), which also overlap into related but more northern hardwood areas (i.e., maple - beech). No larger animals such as moose or lynx were present that would have required substantial boreal forest zones and a colder climate to replace the deer and the bobcat. Thus the boreal (evergreen) areas must have been of limited size and occupied a relatively small area in the total terrestrial ecosystem, perhaps even smaller than today. The reason for such a hypothesis is the well documented historic and archaeological evidence that lightning and Indians set fires on a frequent, if not regular, basis burning through the undergrowth, cleaning out the buildup of ground level vegetation, duff, and litter (Cronon 1983), and probably retarding the spread of the extremely fire susceptible evergreens. The presence during Indian and Colonial times, particularly of hemlock, would therefore have most likely been limited to gorges, steep sided hills, and other locations where relatively frequent fires were less apt to invade and where the climate, shade, and temperature gave this species a considerable advantage.

Open Field - Thicket - Forest Edge

Connecticut and the Woodruff site region are approximately 30% thicket (largely from abandoned farms) and 30% cleared land, farmed and unfarmed. The major species of the thicket today are gray birch (*B. populifolia*), sumac (*Rhus* sp), and blueberry (*Vaccinium* sp) on the higher, more sterile, drier slopes. Cherry (*Prunus* sp), ash (*Fraxinus* sp), and quaking aspen (*Populus tremuloides*) are on the more fertile lowlands. In the moister areas, red maple (*A. rubrum*), spicebush (*Lindera benzoin*), alder (*Alnus* sp), and willow (*Salix* sp) predominate. Fields are predominantly little bluestem (*Andropogan scoparius*), a western prairie short grass, on the more sterile uplands and a large variety of species, some native and some introduced, on the lower, moister, more fertile open lands. Native and introduced species typically include timothy (*Pleum pratense*), meadow fescue (*Festuca elatior*), and clover (*Trifolium* sp). A number of animals identified from the site would use these two habitats, especially when they were in close proximity to a deciduous forest, e.g., white-tailed deer and red fox (*Vulpes fulva*) as larger species needing larger territories, and woodchuck (*Marmota monax*), eastern cottontail (*Sylvilagus floridanus*), striped skunk (*Mephitis mephitis*), and eastern chipmunk (*Tamias striatus*) of the thicket - deciduous woodland only. The presence and numbers of these animals, plus the presence of elk mentioned earlier, would strongly suggest significant, if not sizable, open areas, and even additional, open, park-like forest areas existed in the Lake Waramaug - East Aspetuck Valley region in the Late Woodland period.

The presence of black bear (*Ursus Americanus*) and timber wolf (Canis lupus), while not indicators of a specific land habitat type, did illustrate a number of useful clues as to the overall environment and the Indian role in it. Both of these species are large predators, needing sizable food reserves and extensive hunting and breeding territories relatively undisturbed by humans. Thus their presence would indicate a low enough Indian population living in the area or an Indian harvesting priority not sufficient to seriously threaten either these predators' food resources (e.g., deer, elk, rabbit, hare) or their ability to carry out their life cycle. Thus extensive forest - thicket - meadowland areas relatively sparsely populated or unaffected by humans must have surrounded the Woodruff site during late prehistoric times.

WATER HABITATS

Lakes

Lake Waramaug today is an 8km long, 1.2km wide, shallow, warm water (distrophic) lake (State Board of Fisheries and Game Lake and Pond Survey Unit 1941). The presence at the site of faunal remains of muskrat (*Ondatra zibethicus*), blue gill - sunfish (*Percimorph* sp), catfish - bullhead (*Dermethmoid* sp), painted turtle (*Chrysemys picta*), and spotted turtle (*Clemmys guttata*), and fresh water mussels (*Elliptio complanatus*), the fact that Lake Waramaug was only 100m north of the site and that it was the only natural lake within a 22km radius, would all indicate that these species not only came from Lake Waramaug, but that the lake was distrophic in late prehistoric times as well. It is interesting to note that the same species of fish and molluscs still exist in the lake today, probably the direct descendants of the ones present in prehistoric times.

Deep, cold water (oligotrophic) lakes would contain different life forms (e.g., salmonoid species, trout) (Odum 1953). No evidence of such species were found on the Woodruff site, nor would they have been apt to have come from Lake Waramaug because of its distrophic nature.

Rivers and Streams

The East Aspetuck River lies 17m down hill from the site. It is a small outlet stream approximately 3m wide. Currently it is a cold water stream supporting a resident salmonoid (brook trout) population with black nosed dace and other essentially cold, fast water fauna.

While a number of minnow vertebra (family Cyprinidae) were identified from the Woodruff site, no further identification was possible to tell if they were from a lake or river or warm or cold water species. In addition salmonoid species (i.e., trout) may not have been found on the site because of the extremely poor preservation of the softer fish bones in relation to birds, mammals, and reptiles or because of recovery techniques not suited for such tiny bones.

Thus, for many reasons, fish remains are rare on archaeological sites (Casteel 1971; Olson 1971). In fact all of the fish bones with the exception of a catfish (bullhead) spine were not found in the excavation process, but in the flotation samples from suspected hearths.

As with the land habitats, the presence of beaver (*Castor canadensis*), river otter (*Lutra canadensis*), and mink (*Mustela vision*), while not indicators of a specific water habitat type, by their continued presence could have also shown a low Indian population and/or harvest pressure and the presence of abundant, alternate resources.

Thus, in summary, the prehistoric Woodland period regional environment of west central Connecticut adjacent to the Woodruff site would appear, from the variety of faunal remains found, to be much like that of today: a nearby distrophic lake surrounded by a predominantly deciduous forest habitat, but with significant meadow and thicket components and interspersed with limited stands of evergreens. Two major items would make this overall environment different from today, the presence of chestnut as a dominant deciduous forest species and the presence of elk indicating that substantial areas of the forests were probably considerably more open and park-like than the thicker growth of today.

SEASONAL HUMAN OCCUPATION OF THE SITE

The commonly held belief by historians and scientists was that Connecticut Indians spent the summers in large settlements on the shore and migrated inland in the winter, breaking into smaller hunting parties (DeForest 1851). How far inland these Indians were thought to have migrated has never been determined.

The list of faunal species with the additional study of whether the animals were mature or not and the presence of carbonized nuts can be used as evidence for a second important evaluation of the Woodruff site area. This analysis would suggest whether the site was occupied throughout the year, or, as previously believed, was part of a seasonal round and was occupied only in the winter. Evidence for the following seasonal occupations exists:

Fall

The various carbonized nut species found on the site would had to have been gathered by Indians in the early fall before competition from other species (e.g., chipmunks, squirrels, deer, and wild turkey) would make them largely unavailable and the quality of the nuts would have deteriorated. Hickory nuts, butternuts, hazelnuts, and acorns must be gathered when available in the region in September and October.

Winter

While there were sizable number of deer (and elk?) bones on the site, none were bones of very young individuals (i.e., fawns) which would have been present in the late spring - summer months, and only a few (less than 20%) were young adults (Bowen 1978). Many of these, however, were very large in comparison with modern deer bones used for identification and could have been immature elk of a relatively similar age, as there were a number of mature elk bones on the site. Hence many, if not all of these animals would had to have been killed in the late fall - winter - early spring if they were young adults, but could have been killed during any season if they were mature specimens. A strong argument for a winter occupation, however, is the presence of antler fragments. If, even by random chance, cultural mores permitting, male and female deer were harvested in equal numbers, there would be some antler found. There were two from deer, but none from elk. Both were made into tools. In addition a fragment of the top of a buck's skull contained two pedicles, the point of attachment for the antlers, but the antlers had been shed. Deer in this area shed their antlers in early winter, usually in January, and begin to grow new ones in April to May (Rue 1981). Thus this particular deer and presumably most of the others, given the lack of antler material and the age of the animal remains found on the site, were killed between January and April - May when the antler resprouting and the fawning season begins in this region.

Of the other mammals, the overwhelming majority also had long bones with fully fused epiphyses indicating mature individuals. There were three individuals that were exceptions, a bear, a skunk, and a muskrat (Bowen 1978). In each instance these were not immature (baby) animals, but young adults, and would also probably have been killed in the fall - winter, but during their first year of life. Adults could have been killed at any season.

Late Spring - Summer - Early Fall

Faunal evidence for this season relies on the availability of only certain species. The number of species of turtle (6), snake (2), and true frog (1), all hibernating animals which could only have been gathered during the late spring - early fall period, are examples. The hibernation period for these species lasts from September to April depending upon the severity and duration of the winter (Harriet Smyth, teacher at Torrington High School and a specialist in amphibians and reptiles, personal communication 1985). These species could have been available from May through August. The harvesting of fresh water mussels must have occurred during this time also, as the gathering of such significant numbers of bottom dwelling molluscs could not have been done when ice covered the lake. In addition, the two species of distrophic lake fish (catfish and blue gill) would most likely have been harvested during ice-free periods as well (between April and November), although fishing through the ice for these species would be possible if the Indians had the technology to do so.

A hibernating land mammal which would also most likely have been harvested during the May to August period is the woodchuck. Other mammals that go into a heavy sleep bordering on hibernation during colder weather would be available later into the fall (October - November) and earlier in the spring (March - April), than the woodchuck, but would be largely unavailable during the late fall - winter - early spring. These would be the black bear, porcupine, and eastern chipmunk (Palmer 1954). The striped skunk would also be unavailable during this period, although they do venture out briefly during warm periods in late winter.

Duck would also presumably be available only during the ice free period of Lake Waramaug (April - November), although ice free areas could have attracted and held ducks for a longer period.

In summary, an evaluation of the variety of species identified from the Woodruff site would suggest a group or groups of people over time occupying the site at all seasons of the year. However, a lack of immature mammal remains, the presence, other than ducks, of only nonmigratory birds (ruffed grouse and wild turkey), and the paucity of fish and amphibian remains could argue for either a limited May - August occupation, or an absence of an early summer residence when the presence of immature animals would occur (assuming that the local Indians' cultural mores permitted the harvesting of immature animals when available). On the other hand, however, the differential preservation of bone, with fish, amphibian, and immature mammals being the most fragile (Casteel 1977, Olson 1971, and Yellen 1974), could account, at least in part, for their relatively low numbers and the apparent problem in the seasonal occupation picture which this engenders.

DIETARY PREFERENCES

Given the variables of bone preservation, possible seasonal occupation, and the likelihood that the bones have passed through a "cultural sieve" where animals could have been selectively hunted, harvested, butchered, and prepared for a number of cultural activities in addition to food, the bones cannot represent a completely accurate dietary record. Zooarchaeologists have used three methods to delineate meaningful subsistence patterns: (1) simple counts of fragments from specific identifiable animals, (2) minimum number of individuals, and (3) dressed weight measurements. The one used most frequently is a list of identifiable fragments per animal species.

According to Bowen (1978),

> Fragments are first identified, quantified, and then percents of the various species are figured on the basis of the total number of

identified pieces in order to determine the relative importance of different animals. The fragment counts are, in themselves, misleading in their representation of the relative importance of animals. Many variables, both cultural and natural interact to create this situation. Cultural activities, such as butchering, also skew the fragment counts. When butchered, larger animals produce more fragments than small ones. Once discarded, the bones are subject to further factors which affect their representation in the fragment count. Those which have had the soft inner tissues exposed are far more susceptible to decay than the hard compact ones. As well, bones which are fragile can be easily broken when excavated, or later in the lab.

If each identifiable fragment is indiscriminately included in the final counts, the final percentages of animals are likely to be very different from proportions of animals actually used. If a complete, or partial animal is excavated and included in the fragment count, the fragments will make up a disproportionate percentage of the total. Likewise, those animals represented by only one or two fragments will show a disproportionate percentage of the total. To make the fragment counts as accurate as possible for the Woodruff Cave site, the bone fragments were first identified, then quantified; fresh breaks which were the result of damage to the bone after it had been excavated, were glued and the fragments counted as one. Bones with weathered breaks, which resulted prior to their deposition, were not.

Keeping in mind these concerns about fragment counts and differential preservation, they were tabulated as one aspect of a meaningful overall analysis of the faunal remains (Tables 2 and 3). Both sets of analyses show deer were the major animal killed (64.6% and 58.6%). Fish (spp) comprised the second most abundant food source (1.5% and 15.5%), but the latter number was clearly inflated by the abundance of minnow vertebra. Gray/red fox combined comprised 2.6% and 3.6%. Because of their tough, stringy, "gamey" meat, these animals along with mink and wolf were likely to have been killed for their fur, although their bones were found unarticulated among other food remains. This would suggest that they too may have been eaten upon occasion. A large percentage of fox bones, however, were found in one small area with bones disarticulated but in nearly articulated form in a curved shape some 5m down the hill in square S30E35. It was as if a fox had been thrown from the living area down the hill (after being skinned?). Thus, a large number of bones apparently from one individual (e.g., the minnow vertebrae and the fox skeleton) could give a false picture of the role of others in the food/other cultural activity picture. The third species which should be handled in a special way is the skunk. The fragment percentages (5.6% and .2% of the total) were distorted by a number of articulated bones found in one small area under a rockfall which could indicate the animal died there naturally. However, additional skunk bones were also found among the food refuse, indicating that they too may have been a food source during Woodland times. Other animal species each represented less than 1% of the total fragment count on both tables.

Considering all bones found in firepits as being dietary is a problem when one considers the accipiters (eagle - hawk). These may have been collected for their feathers (Adelphena Logan, Onondaga Iroquois historian, personal communication 1975; and Keewaydinoquay, personal communication, 1985). Yet accipiter bones were also present in the "food" refuse.

The only human remains found at the site, two complete adult teeth, were found in the "food" refuse. Were these knocked out, pulled, carried as a sacred bundle and accidentally lost, or evidence that local late prehistoric Indians at

TABLE 2: Percentages of bone fragments and meat in the Indian diet: Based upon fragment studies by Starbuck and Swigart on samples from under the pre-Colonial rockfall, in the adjoining chambers and area of Stratum Two exposed by sheet and gully erosion.

ANIMAL	WHOLE	FRAGMENTS	TOTAL	PERCENTAGE
Fish spp	4	4	8	1.2
Turtle spp	0	22	22	3.2
Bird spp	1	1	2	0.3
Wild Turkey	2	6	8	1.2
Rabbit sp	20	7	27	3.9
Woodchuck	28	8	36	5.2
Gray Squirrel	6	0	6	0.9
Chipmunk	1	0	1	0.1
Red Squirrel	3	0	3	0.4
Beaver	4	6	10	1.4
Eastern Wood Rat	10	3	13	1.9
Muskrat	0	4	4	0.6
Porcupine	4	2	6	0.9
Short Faced Indian Dog	2	0	2	0.3
Wolf	8	1	9	1.3
Gray/Red Fox	13	5	18	2.6
Black Bear	2	2	4	0.6
Raccoon	14	3	17	2.4
Otter	3	0	3	0.4
Skunk	34	5	39	5.6
Mink	0	1	1	0.1
Elk	6	1	7	1.0
White-tailed Deer	156	293	449	64.6
TOTALS	321	374	695	100.1

some point and for some purpose ate human flesh? The lack of any other human bones or bone fragments would make cannibalism unlikely.

To put a faunal fragment count as a strictly dietary measurement in perspective, given evidence from other sites, there surely were animals that were killed for a multiplicity of reasons (e.g., deer for food; bones for tools and weapons; hide for clothing; brains for tanning; hooves for glue; and sinew for cordage (Driver 1969).

Therefore, while bone fragment counts do probably give a reasonably accurate general overview of preferred foods, obvious discrepancies do occur based upon other cultural uses (e.g., wolf and fox) and numerically distorted counts (e.g., minnow, fox, and skunk). Thus a second method of analysis is employed in conjunction with the first. After identifying the fragments as to species, bones are then classified by name, the side of the animal from which it came, and the size and age of the animal where possible. This is used to compute the Minimum Number of Individuals (MNI) present. When used in conjunction with the bone fragment counts, the result is a better indication of the relative importance of each animal. High numbers of fragments from a potentially small number of animals (e.g., deer and minnow) or at least partially complete skeletons (e.g., red fox and skunk) then are partially discounted when interpreting the actual food preferences. The MNI figures (Table 3) show deer is still the most frequent with 20.95% of the total, but now turkey (4.84%) ranks far higher than in the total fragment count technique. The use of MNI shows different

TABLE 3: Totals for identified fragments and Minimum Numbers of Individuals (MNI)

	FRAGMENTS		INDIVIDUALS	
ANIMAL	NUMBER	PERCENT	NUMBER	PERCENT
Minnows and Carp	141	14.6		
Catfish - Bullhead	7	0.7	1	1.61
Bluegill - Sunfish	1	0.1	1	1.61
TOTAL	149	15.5	2	3.23
Snapping Turtle	3	0.3	1	1.61
Musk and Mud Turtles	3	0.3		
Stinkpot	2	0.2	1	1.61
Box and Water Turtles	6	0.6		
Spotted Turtle	4	0.6	1	1.61
Wood Turtle	2	0.2	1	1.61
Box Turtle	1	0.1	1	1.61
Painted Turtle	2	0.2	1	1.61
Black Racer	2	0.2	1	1.61
Timber Rattlesnake	1	0.1	1	1.61
TOTAL	34	3.5	8	12.88
True Frogs sp	1	0.1	1	1.61
Duck sp	1	0.1	1	1.61
Hawks and Eagles	2	0.2	2	3.23
Wild Turkey	16	1.4	3	4.84
Ruffed Grouse	2	0.2	1	1.61
TOTAL	21	2.2	7	11.29
Rabbit spp	15	1.5	2	3.23
Rodentia	9	0.9	-	-
Woodchuck	23	2.4	2	3.23
Gray Squirrel	11	1.1	3	4.84
Chipmunk	2	0.2	1	1.61
Red Squirrel	6	0.5	2	3.23
Beaver	2	0.2	1	1.61
Wood Rat	7	0.6	2	3.23
Muskrat	4	0.4	2	3.23
Porcupine	3	0.3	1	1.61
Carnivora	3	0.3	-	-
Short Faced Indian Dog	6	0.6	2	3.23
Wolf	1	0.2	1	1.61
Red Fox	4	0.4	1	1.61
Gray Fox	12	1.2	2	3.23
Gray/Red Fox	23	2.4	-	-
Black Bear	7	0.7	1	1.61
Raccoon	11	1.1	2	3.23
Skunk	2	0.2	1	1.61
Mink	3	0.3	1	1.61
Cats	1	0.1	-	-
Bobcat	3	0.3	1	1.61
Deer	22	2.3	-	-
Elk	12	1.2	2	3.23
White-tailed Deer	563	58.6	13	20.95
TOTAL	755	78.1	43	69.35
GRAND TOTAL	960	99.4	62	98.36

species playing major roles in hunting/use preference and a more diverse, multi-seasonal diet.

These figures, however, may also be misleading because one deer furnishes 20 times the dressed weight of a woodchuck, 10 times that of wild turkey, and about 7 times that of a raccoon (Table 4). For this reason, dressed weight is also considered in measuring food preferences (White 1953). Deer remain the largest single faunal resource with elk a significant second. But this is still not the ideal measure because deer appear to have been killed primarily in winter when few other faunal or floral resources were available. Thus a single food source would have had to play an unusually large role in feeding local populations during one of the four seasons of likely occupation. As a major food source during a specific period of time, this figure might become useful in the future for establishing a general Indian population figure for the site given how much meat the average person consumed per week.

USE OF THE SITE

Another significant finding in the faunal analysis was site function. Archaeological sites have been identified as special purpose camps for game butchering; collecting nuts in the fall or maple sap in the late winter; fishing, quarrying, or other seasonal uses. There are also permanent villages with a year-round population and base camps with a part of the population that is permanent and a part that leaves temporarily to follow a seasonal round of harvesting specific foods from temporary outlying camps.

While faunal and floral evidence could point toward (but not be conclusive evidence for) a year-round occupation at the Woodruff site, there is more substantial evidence that it was not a major permanent village of the late prehistoric period. First, this rockshelter is a relatively small one, but large by local standards, in a heavy woods on a relatively steep hillside in a gorge surrounded by even more precipitous hills, certainly not the typical location for a permanent Woodland period village. Secondly, there is a substantially larger village of the same period on the lake shore on a floodplain 5 km north of the site (Swigart 1974). The proximity of this far more typical permanent village site location (Snow 1980) where local people could live in wigwams rather than clustered in a rockshelter with all of the inherent problems would also tend to cast serious doubt about the site's permanency or even as its role as a major base camp.

Weighing all of these factors, the Woodruff rockshelter was probably a satellite camp of some sort, except for one situation. Historic documents tell of frequent raids by the Mohawk Iroquois from eastern New York through this region (DeForest 1851; Orcutt 1882), and there were even a whole series of mountain top lookouts to watch for and spread the word of such raids. One such lookout was on "The Pinnacle", a mountain top with a 300° view of the surrounding landscape that stands almost directly above the rockshelter some 500 m northeast of the site. Thus, during a period of raiding, the site could have been occupied as its topography and location would have afforded a place of seclusion and defense.

If it were a special purpose satellite camp of the lake's north shore village, what would the tangible evidence be? There is scant evidence of significant lithic reduction, let alone quarrying or even enough for a permanent camp. Large scale processing of seasonally abundant floral and faunal resources is also excluded due to the simultaneous diversity and relative paucity of ecofacts recovered. A more likely, but still untenable hypothesis is that large scale meat processing was occurring.

All skeletal parts of various mammals, especially the major ones judging

TABLE 4: Percentage of meat eaten on the site based on MNI and dressed weight.

ANIMAL	MNI	DRESSED WEIGHT (LBS)	TOTAL WEIGHT (LBS)	PERCENTAGE OF DIET
Catfish - Bullhead	1	1.20	1.20	0.05
Bluegill - Sunfish	1	-	-	-
Turtle spp	7	0.80	5.60	0.23
Snakes	2	0.80	1.60	0.07
True Frogs sp	1	0.50	0.50	0.02
Duck sp	1	1.00	1.00	0.04
Hawks and Eagles	2	-	-	-
Wild Turkey	3	8.50	25.50	1.03
Ruffed Grouse	1	1.00	1.00	0.04
Rabbit spp	2	1.75	3.50	0.14
Woodchuck	2	5.60	11.20	0.45
Gray Squirrel	3	1.00	3.00	0.12
Chipmunk	1	-	-	-
Red Squirrel	2	1.00	2.00	0.08
Beaver	1	38.50	38.50	1.56
Wood Rat	2	-	-	-
Muskrat	2	2.00	4.00	0.16
Porcupine	1	10.00	10.00	0.40
Short Faced Indian Dog	2	30.00	60.00	2.43
Wolf	1	30.00	30.00	1.21
Gray Fox	2	5.00	10.00	0.40
Red Fox	1	5.00	5.00	0.20
Black Bear	1	200.00	200.00	8.10
Raccoon	2	17.50	35.00	1.42
Skunk	1	5.00	5.00	0.20
Mink	1	-	-	-
Bobcat	1	15.00	15.00	0.61
Elk	2	350.00	700.00	28.35
White-tailed Deer	13	100.00	1300.00	52.66
TOTAL	62		2468.60	99.97

from MNI and sheer poundage of potential meat, were present (Table 4). If it had been a butchering site, many bones should have been missing, having been left incorporated in the meat taken back to the main village or collected for other uses. This would be particularly true of the femur (upper hind leg), the humerus (upper front leg), and the ribs of a deer or elk where most of the meat is. Many of these bones fractured for marrow consumption were found in quantity in the food refuse areas suggesting that these choice resources were being eaten at the site.

The extensive amount of pottery could indicate the presence of women, therefore perhaps representing a normal family life style taking place on the site. This would have been unlikely for a satellite meat processing camp where male oriented artifacts are expected.

TABLE 5. Quantities of specific bones.

	Sk	Te	Ma	Ve	Sc	Hu	Ra	Ul	Mc	Cp	In	Fe	Pa	Ti	Fi	Ta
Bony Fishes				135												
Catfish - Bullhead	1															
Bluegill - Sunfish	1															
Snapping Turtle																
Musk/Mud Turtle Family																
Stinkpot Turtle																
Box/Water Turtle Family																
Spotted Turtle																
Wood Turtle																
Box Turtle																
Painted Turtle																
Snakes				3												
N. Black Racer				2												
Poisonous Snake Family				2												
Timber Rattler				1												
True Frogs												1				
Duck spp																
Hawk/Eagle Family						1										
Wild Turkey				1				1		1						
Ruffed Grouse																
Cottontail Rabbit spp	2	3	2			3	1					1		2		
Rodents		9														
Striped Chipmunk		2														
Woodchuck	1		4	7	1	4	2	2				1	1			
Gray Squirrel		2			1	2	1	1				2		1		
Red Squirrel		1	1			3					1					
Beaver		1														
E. Woodrat		1	2	1			1							2		
Muskrat		1						1				2				
Porcupine	2	1														
Carnivores		1	1			1										
Dog/Wolf/Fox Family			1													
Short Faced Indian Dog									2							
Gray Wolf				1												
Red Fox			1				1	1						1		
Gray Fox	1		3	2			1	3								
Red/Gray Fox		1		7	1		1	1				1		1		
Black Bear											2					
Raccoon	4					1							1			1
Mink			1											2		
Striped Skunk							1	1								
Cat Family																
Bobcat									1							
Pig											1					
Deer Family	4	5				3						3		1		
White-tailed Deer	38	42	37	25	10	16	13	11	28	46	14	17	1	14		15
Elk	2	3					1			1		2				
TOTALS	56	73	53	187	13	34	23	22	31	48	18	30	3	24	0	16

Cp	Carpal	Hu	Humerus	Mc	Metacarpal	Sc	Scapula	Te	Teeth	Ul	Ulna
Fe	Femur	In	Inominate	Pa	Patella	Sk	Skull	Ti	Tibia	Ve	Vertebra
Fi	Fibula	Ma	Mandible	Ra	Radius	Ta	Tarsal				

TABLE 5. Quantities of specific bones (continued).

	As	Ca	Mt	Mp	Ph	An	Se	Co	Fu	St	Cm	Tt	Tm	Cr	Pl	Ot	Total
Bony Fishes																6	141
Catfish - Bullhead																7	7
Bluegill - Sunfish																	1
Snapping Turtle														3			3
Musk/Mud Turtle Family														2			1
Stinkpot Turtle														3	2		5
Box/Water Turtle Family														6			6
Spotted Turtle														3			3
Wood Turtle														2			2
Box Turtle														1			1
Painted Turtle														2			2
Snakes																	3
N. Black Racer																	2
Poisonous Snake Family																	2
Timber Rattler																	1
True Frogs																	1
Duck spp								1									1
Hawk/Eagle Family					1												2
Wild Turkey					4			4			2	2	1				16
Ruffed Grouse								1					1				2
Cottontail Rabbit spp		1															15
Rodents																	9
Striped Chipmunk																	2
Woodchuck																	23
Gray Squirrel		1															11
Red Squirrel																	6
Beaver				2													3
E. Woodrat																	7
Muskrat																	4
Porcupine																	3
Carnivores																	3
Dog/Wolf/Fox Family		1			2												4
Short Faced Indian Dog																	2
Gray Wolf																	1
Red Fox																	4
Gray Fox		1	1														12
Red/Gray Fox	4			3	2												22
Black Bear					5												7
Raccoon	1	2		1													11
Mink																	3
Striped Skunk																	2
Cat Family				1													1
Bobcat	1				1												3
Pig																	1
Deer Family			3		2		1										22
White-tailed Deer	14	12	37	12	120		39										561
Elk			1		2												12
TOTALS	20	18	42	19	139	0	40	6	0	0	2	2	2	22	2	13	957

An	Antler	Cr	Carapace	Fu	Furculum	Ot	Other	Se	Sesmoid	Tt	Tibiotarsus		
As	Astragalus	Cm	Carpometacarpus	Mp	Metapodial	Ph	Phalange	St	Sternum				
Ca	Calcaneus	Co	Coracoid	Mt	Metatarsal	Pl	Plastron	Tm	Tarsometatarsus				

Thus, in summary, while no clear cut definition of the site's role in Indian lifeways is possible, it would appear that this was a base camp occupation area for relatively small numbers of men and women for most, if not all, of the year. If and how it was related to the much larger village site on the north shore of the lake cannot be resolved now, nor is there a clear indication of why the site was occupied at all.

FOOD PROCESSING AND COOKING PREFERENCES

Food cooking preferences can be inferred by the appearance of the faunal remains (Table 5). They do not appear to indicate any single method of food preparation, but a number of different ones, with no clear preference discernible. Using deer and elk as the most abundant and easily identifiable example, the following methods were present.

The bone was used for its marrow. All large, marrow containing bones were broken to get at the inner contents. They were broken in several ways. The first was by a spiral fracture break, possible only when the ends of a living "green" bone were twisted violently in opposite directions until it broke in two. The broken pieces have a spiral configuration at approximately a 30° angle (Dr. Peter Dingham, orthopedic specialist, Waterbury Orthopedic Associates, personal communication, 1978). This would be nearly impossible to duplicate with older, dead, dried bones. This characteristic type of break (fracture) is most common today in skiing accidents where a leg on a ski is violently twisted. Two additional types of breaks present on deer and elk marrow producing bones were a "chairback" and a vertical break that went straight across the bone, but did not leave a small section of bone jutting out as in the chairback variety. Both of these breaks were almost unique to older, dried bone. These two methods would suggest that bone marrow was not only eaten when the animal was freshly killed (spiral fractures), but that bones may have been stored and used later, perhaps during times of food shortage or for special occasions to augment the diet.

Bone remains could also be employed to determine meat processing and cooking as well. The larger sections broken when they were either "green" or dried were invariably "raw". They were still naturally colored (red - brown), and there was no evidence that they had ever been boiled (i.e., white) or broiled (blackened from contact with the flames). This would suggest that in these particular cases that the meat from these bones had either been eaten raw or lightly cooked over the fire where the flames never reached the bone, or that the meat had been cut off of or separated from the bone before cooking possibly for boiling in a stew. Strips of boneless meat could also have been skewered on pointed sticks or draped over racks to be roasted, dried, or smoke-dried.

Bones, however, were most frequently found broken into relatively small,thin slivers by one or more of the following methods: burning and boiling as part of the meat cooking process for long periods of time which would leave them brittle and easily broken; by the location of the bone deposits themselves that left them exposed on the floor of the rockshelter to be walked upon, exposed to weather and destruction by animals; or even by striking dried, old bone again and again to pulverize it sufficiently to make sure that when it was boiled every last bit of nourishment would be freed from the bone fragments.

The very large quantities of small (smashed) bone fragments previously alluded to were, from a representative sample), divided as follows: red (raw) fragments made up 32%; white (boiled), 20%; and black (burned either in cooking or by being discarded into the fire after a meal), 48%. The cause of the red bones being discarded in that form has been discussed previously. The white bones indicate that some meat at least associated with these smaller fragments was simply thrown into a pot without bothering to separate it, or that the bone was deliberately broken beforehand and later boiled to dissolve the last vestiges of nutrition from these fragments in the form of a broth or as part of some other dish.

The most common type of bone fragments showed partially blackened or blackened surfaces, and some were carbonized all the way through. Since this could have occurred either by direct exposure to the flames either during the cooking process or by being discarded into the fire, and no definable way could be determined to separate these two processes, it can only be assumed that both probably occurred. Thus faunal evidence of deer and elk suggested that meat was probably eaten raw, boiled, or broiled with no apparent preference identifiable at this time.

BUTCHERING TECHNIQUES

All skeletons, with the exception of one skunk and one red fox, were totally disarticulated, and except for one red fox skeleton and one pile of deer bone in square S50W5, were heterogeneously mixed over the entire living surface. Butchering of the killed animals, especially the bear, elk, and deer was done in such a way that no cut marks were visible at the severed joints. They were separated so skillfully, or in such an efficient manner, that in only one case (the distal end of an elk metatarsal or cannon bone), was there any visible evidence of dissection. In this particular case it appeared as if this large joint had been separated by a heavy, sharp instrument (an axe?) and that someone had missed the joint by 2 cm, severing the left side of the metatarsal, but leaving the right one intact.

The only other butchering marks found on any bone was on the lower mandible of a mature elk where a series of three slashes with a sharp blade had punctured the basal section of the jaw bone, apparently for the removal of marrow.

The extraordinary lack of evidence of butchering marks left on the severed bones simply cannot be explained except as a measure of the people possessing such a high degree of skill that the disarticulation of thousands of bones from large and small animals left no visible marks on the bones.

SUMMARY

This report of material excavated from the Woodruff Rock Shelter has presented faunal remains as an important tool to analyze and interpret prehistoric Indian lifeways. The Woodruff Rock Shelter in New Preston, Connecticut, was a substantially undisturbed multicomponent site representing at least 5500 years of human activity and occupation. Even though the great majority of scientific evidence pointed toward the faunal remains being associated with the Late Woodland period (ca 1000 - 1600 AD), given the significant mixing of components and compaction that had occurred on the site, the material was assigned to the entire Woodland period (ca 1000 BC - 1600AD). This was done so as not to exclude the possibility that at least some of the faunal remains might have been associated with small intrusive amounts of Early and Middle Woodland period material present in the stratum where most of the bone was found.

From the original sample of over 15,000 whole and fragmented osteological remains excavated from the site during the 1974 - 1976 field seasons, over 1500 were able to be identified as to family, genus, and in most cases, species. Three different fish, eight reptiles, one amphibian, four birds, twenty-three mammals, one snail, and one bivalve were recorded, a significantly broad faunal resource base.

Using the habitat and econiche preferences of many of the species, an analysis of the Woodland period environment showed it to be much like that of today, but with several very important differences. During the Woodland period, the large nearby distrophic lake, Lake Waramaug, was surrounded by a predominantly deciduous forest habitat with significant meadow and thicket areas interspersed with stands of evergreens of limited size. The two major differences between the Woodland period's and today's environment would have been the presence of chestnut as a dominant deciduous forest species for much of the period, and, given the presence of elk, the likelihood that substantial areas of the forest were considerably more open and park-like than either the early European descriptions or present day forests would indicate.

Studies based upon faunal (and floral) remains suggests that a group or groups of people over time were living on the site at all seasons of the year.

Food preference based upon bone fragment counts, minimum number of individuals, and dressed weight is consistently for white-tailed deer. Although apparently killed largely in the late fall - early spring, deer were by far the major animal killed and the major meat source (58% of the identified fragments, 20.95% of the MNI, and 52.66% MNI/dressed weight). Deer were followed by reptiles (12.88%) and birds (11.29%) in terms of MNI and elk (28.35%), bear (8.10%), and dog (2.43%) in terms of MNI/dressed weight percentages. All of these figures, however, can be deceptive, given the better long term preservation, the more substantial nature of larger animal bones, and the obvious heavy reliance of late prehistoric populations during the winter upon deer-elk due to the more limited faunal and floral resources available then.

No definition is possible of how the site was used perhaps due to the length of time involved where different uses by different cultural groups could have occurred. However, the rockshelter would appear to have been a base camp of some sort occupied by relatively small (band size?) numbers of men and women for most or all of the year.

Food processing and cooking preferences, based on the analysis of the condition of deer-elk bone fragments suggested that meat was probably eaten raw, lightly cooked, broiled, or boiled with no evident preference being identifiable, statistically, at this time.

The extraordinary lack of evidence of butchering marks on all but two of the severed bones (an elk metatarsus and mandible) simply cannot be easily explained except as a measure of the people possessing such a high degree of skill that the disarticulation of thousands of bones from large and small animals alike was done in a manner that left no visible marks on the otherwise well preserved bones.

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And finally I wish to express my gratitude to Dr. Roger W. Moeller, archaeologist, past Director of Research of the American Indian Archaeological Institute from 1975 - 1985, and currently owner of Archaeological Services for his expert assistance during the preparation and publication of this manuscript.

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ANNOUNCEMENT

This is the last issue of the *Bulletin* that will be edited by Roger W. Moeller. He assumed the editorship from Renee Kra to assist in the completion of *Bulletin* #48 in 1985. Since then *Bulletins* #49 and #50 have appeared on time.

When it became evident that *Bulletin* #50 would be completed nine months prior to the normal expiration of his elected term in April, 1988, the board of directors began a search for a replacement. Since the process of soliciting and preparing manuscripts is a long and arduous one, the board wanted his replacement to have as much time as possible to ensure the continued timely publication of the *Bulletin*.

The board of directors has selected Dr. Lucianne Lavin to fill the unexpired portion of the editor's term. All manuscripts should be sent to her. Dr. Lavin will be announcing soon how she intends to structure the *Bulletin*.

Roger Moeller will continue to be involved with the *Bulletin* by providing all of the necessary production services including typing the manuscripts, providing copies for editor and author proofing, laying out the pages, and carrying the camera ready copy through the printing process.