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A POLYNESIAN ADZE FROM MARTHA'S VINEYARD

Howard R. Sargent

In the interpretation of cultural material from aboriginal sites, the archaeologist is occasionally confronted with the problem of dealing with intrusive objects. Usually, however, such intrusive material can be recognized as having come from a fairly close neighbor. For that reason the subject of this article requires special attention because it has come not only from a remote culture area, but also from a totally distinct region with no historical connections whatsoever.

The adze (Fig. 11) was in a collection of Indian artifacts purchased by the writer several years ago. The collection had been made at the end of the 19th century and was a hodge-podge of specimens from numerous sites in eastern Massachusetts. The only information available on the adze was that it had been found at Cottage City (now Oak Bluffs), Massachusetts. Whether or not other intrusive artifacts have been found at that locality is not known to the writer, but information from readers concerning any will be appreciated.

The adze is made of black aphanitic basalt and is highly polished over its entire surface. No special note was made of the specimen until recently when a similar though somewhat larger adze was found illustrated in Volume 1 of Moorehead's book, "The Stone Age in North America" (Fig. 246, page 285). That specimen (Fig. 12) was in a collection in Rhode Island and presumably came from a site in that area although no mention was made of the locality. The occurrence of two specimens of such an obviously intrusive nature in New England Indian collections made the subject seem worthy of special consideration.

The identification of the adze as of Polynesian origin came essentially through comparative studies of adzes known to have come from that region. One such specimen was purchased by the writer in Honolulu. It is very similar in shape (though about twice as long) to the adze under consideration, but it received less care in its manufacture and apparently was used in the practical tasks of canoe-building and other forms of woodworking. Another adze of about the same size as the Martha's Vineyard specimen
is to be seen in its original ceremonial hafting in the Yale Peabody Museum (such specimens are quite common in Polynesian exhibits).

The presence of the adze in an Indian site seems best explained by the trading activities of early whalers who sailed to the Pacific from New England. From this it is inferred that the site which produced this specimen was historic, but unfortunately information is lacking concerning the cultural identity of the site. The most that can be stated with certainty is that the artifact is of Polynesian manufacture. That it was found in an Indian site seems inherent in the available information and also in the fact that a similar specimen was treated by Moorehead, as mentioned above.

Sargent Museum
George's Mills, New Hampshire
July 29, 1950
TOMAHAWKS OF CENTRAL NEW ENGLAND
William S. Fowler

PREFACE

Archaeological reports dealing with the Northeast during the past century have said little or nothing about the existence of stone blades which might have been used as weapons in time of war. However, recent research has uncovered many stone implements that seem to belong in this category, and an investigation of them now appears opportune. Historical evidence leaves little doubt that in Colonial days some sort of hand clubs were used as weapons, and it is probable that the source of such a war-like trait reaches back into prehistory. The apparent importance of fighting clubs to aboriginal peoples as reported by many historical accounts has inspired this report, and it is presented in order that a better understanding may be had of the different forms of war clubs, which probably existed in prehistoric central New England.


Illustrations are by the author, and represent faithful copies of actual specimens with due regard to all important details.

HISTORICAL EVIDENCE

Clubs of many different shapes have been used as weapons in combat from the earliest days of man's struggle for existence. No archaeological evidence seems more important than that which has to do with stones of various sizes and shapes, which appear to have been variously hafted and used to preserve human life. Whether they are referred to as clubs, battle axes, maces, war clubs, hatchets or tomahawks, there are probably few people today who will deny the existence of some sort of fighting clubs in prehistoric ages.

Ethnological investigation of western tribes of North America during the past century has revealed man's prevailing dependence upon some form of club for combat use. For example, several different kinds of clubs have been reported among the Indians of the Columbia River basin, such as the Okanagon, Coeur d'Alene and Thompson tribes. These peoples made general use of round or oval stones wrapped in rawhide and attached to handles in various ways. They also employed an antler or stone spike sunk and secured with pitch into the upper end of the face of a wooden handle as another form of club.

It is not strange, therefore, to find Algonkians of the Atlantic seaboard using war clubs in Colonial times and referring to them in their tongue as tomahawks although the name is pronounced variously in their different dialects. The "Handbook of American Indians" of the Bureau of American Ethnology gives the derivation of the name as follows:

"The name (tomahawk) is applied to a weapon or a group of weapons in common use among the Algonquian tribes of the United States. The early writers in Virginia cite the word from the dialects of that region as tommahick, tomahack, tomohake, tamahaac (Strachey, 1612); other early forms are tommyhawk and tomhog (Church's Philip's War, 1716) - A common conception of the tomahawk is that it was the nearest aboriginal representative of the European hatchet, although the term was early applied to various forms of the club."

When the Explorers and Colonists arrived in New England they found the natives using clubs of different kinds. Some refer to them as war clubs and others as tomahawks. In 1604, Samuel de Champlain sailed down the coast of New England and wrote of his voyages. He speaks only of a war club made entirely of wood that has an oval wooden knob at one end of the handle. He illustrates it by means of a rough sketch which is reproduced here for purposes of comparison (Fig. 13).

Other early commentators have given reports of what they saw, and their descriptions of war clubs, varying somewhat in detail, suggest that there was no set pattern for a fighting club among the different tribes. Rogers relates as follows:

"Another instrument of great esteem and importance among them is the tomahawk. This weapon is much like a hatchet, having a long stem or"

handle; the head is a round ball or knob of solid wood, well enough calculated to knock men's brains out, which on the other side of the stem terminates in a point where the edge would be, if made a hatchet, which point is set a little hooking or coming toward the stem; and near the center, where the stem or handle pierces the head, another point projects forward of a considera­ble length, which serves to thrust with like a spear or pike pole.3

Apparently the wooden knob did not always have two spikes as described by Rogers, for another writer gives a slightly different account of it. McCulloh states:

"The tomahawk was most commonly of a stout stick about three feet in length, terminating in a large knob, wherein a projecting bone or flint was often inserted."4

Evidently a long handled club was sometimes used as McCulloh states, which suggests a rather heavily weighted club that was probably wielded with both hands. Another early commentator, reporting to business interests in England concerning prospects for settlement in New England, also reports the use of a long handle. In 1634, William Wood writes about weapons used by the Mowhackes,

"Tomahauks be staves of two foote and a halfe long and a knob at one end as round and bigge as a football." (This may have been no bigger than a hand ball which has sometimes been referred to as the Indian football.)5

Exploration and Colonial expansion as a result of barter put articles of European manufacture into the hands of the natives. Among the most favored of these goods were iron hatchets. In Colonial days they served the Indians not only as wood cutting hatchets, but also were used quite generally as weapons, and became synonymous with tomahawks in the minds of the Colonists. From then on, both names were used interchangeably, and a tomahawk came to be regarded as a cutting hatchet. Historical evidence suggests that the word hatchet may have had a Canadian French derivation as is pointed out by Henry M. Dexter in 1867. In his reprint of Church's "Philip's War," 1716, he says that the word "Hatches," as used by Church, is derived from the French word hache, meaning a little ax. Church says in part:

"41y. That there be 100 large Hatches or light axes made pretty broad."6

Dexter comments that in this sentence Church has apparently used the common Canadian name, not a misprint of hatchets, but plural of the French word hache. It should be noted that in Church's account, the "100 large Hatches" were specified large since they were to be used in cutting trees for firewood and like uses during his northern campaign. Undoubtedly, in Canada, a hache was also synonymous with a tomahawk, since the word means a little ax, or in other words a hatchet.

From these accounts it may be deduced that a tomahawk could be either a long handled heavy club or a short handled light weight implement, probably depending to a great extent upon the desires of its owner. Certainly, a weapon of such importance would be subject to some variation in form as might be dictated by individual whims, and yet be made to conform to an accepted pattern. That such patterns may have varied as related to time, location or tribe is quite possible from these historical reports, but it should be remembered that they are dealing only with clubs that were in use during the 16th and 17th Centuries. Some reports state in substance that with the introduction of metal hatchets, the Indians found them so useful - probably for cutting wood as well as for weapons - that they soon discarded those formerly made of stone and accepted the new substitutes whenever they could obtain them.

Iron hatchets were generally molded with a hole through the head for insertion of the handle, although sometimes the blade was made solid. Also, at times, smaller blades were probably made by the natives from English iron or copper stock without perforation, to be hafted in the same manner as stone blades (Fig. 14, #2, 3). As evidence of the use of iron hatchets for tomahawks, history recounts how in March 1697, Hannah Dustin was made captive and while en route up the Merrimack River with her Indian captors, surprised them one morning as they slept and killed several with an iron hatchet, which she grabbed from the first Indian. She escaped and brought back the hatchet with her as proof of her exploit together with ten scalps taken from her victims. The hatchet, weighing one pound, is now in the possession of Dustin descendants (Fig. 14, #1).

The two small metal hatchets (Fig. 14, #2, 3) weighing 4 and 5 ounces respectively are from Connecticut Valley camp sites, and amply justify the belief that small light weight clubs were being used in Colonial times, as well as heavier ones. That light weight hatchets were often most useful may be seen from the following historical account during the Pequot war. A Pequot messenger to the English in 1636 was said by Underhill, a military leader of the day, to have recounted how a certain Englishman by the name of Captain Stone had been killed:

"---we went quietly on board their vessel. The son of our murdered sachem staid in the cabin with Captain Stone, until the captain, having drank more strong water than was good for him, fell asleep. Our Sachem then took a little hatchet from under his robe and knocked him in the head ---"

Such instances as this tend to show with what importance the tomahawk, frequently of small proportions, was held by Indians of Colonial days, and leads to the belief that similar regard for some kind of club had always existed. However, this does not mean to imply that wood cutting axes in general should be included in a classification of war clubs. While it has been thought by some that axes were used to fight with on occasion when more suitable weapons were not obtainable, it is probable that this was not often the case. Axes usually weigh a pound or more and are made with an edge that is sharpened by grinding or chipping. Evidently, they were intended for cutting something harder than human flesh. As a matter of fact, a blow from a dull implement will more surely effect sudden death by concussion than will a glancing cut from a sharp blade hastily aimed. Nevertheless, whether or not sharp bladed small stone axes were formerly used as tomahawks, it is certain that sharp edged metal hatchets supplied by the French, Spanish and English were used as such by the natives in Colonial engagements, and appear to have been preferred at that later date.

With all this historical evidence available, it seems paradoxical that such writers as Charles C. Willoughby in his "Antiquities of the New England Indians" avoid inclusion and classification of tomahawks. Willoughby merely mentions the existence of a unique monolithic club. This specimen is on exhibition in the King Philip Museum at Mount Hope, Rhode Island and is reputed to have been recovered from a New England farm site. It weighs several pounds and seems to simulate a wooden club made from the stub of a small tree with proper root development. Why attention is called to this questionable object, and nothing is said about other prevailing stone artifacts that have quite obvious affinities to war clubs is difficult to understand.

After completing an extensive investigation of available lithic artifacts from central New England regions, stone tomahawks seem to fit into five classifications. From this evidence has been excluded all specimens, no matter how small, that have ground or chipped edged blades with shapes that would preclude them from use as tomahawks. Investigation has been aided by prolonged experimental operations by the author in which many stone blades were hafted with wooden handles, fashioned by the help of aboriginal

7. De Forest, 1851, p. 95.

FIGURE 14. Metal Hatchets. 1, Iron hatchet snatched from Indian captor by Hannah Dustin; 2, copper blade, Northampton; 3, iron blade, Hatfield.
stone woodworking tools retrieved from habitation sites. While there is no way to justify the conclusions reached except by logical analysis there are too many specimens involved from each class of clubs not to attempt a classification of the evidence. Moreover, the shape of these artifacts is such as to make them seem more suitable for tomahawks than for other kinds of implements.

In this group of about 50 specimens are found blades that resemble metal trade hatches of the Colonial period. They are made of rather thin slabs of basalt and have come from Connecticut Valley sites located at Ragged Mountain, Agawam, Westfield, Northampton, Hadley, Hatfield and Deerfield. Suitable basalt fragments spalled by erosion from escarpments in this region were readily available for aboriginal use. In some cases like those illustrated, they are chipped so as to form a tapering or pointed head. Each illustrated specimen weighs about 1/2 pound or less, and common to all of these artifacts is a sharp cutting edge produced by meticulous grinding on both faces. These ground surfaces sometimes extend more than an inch up each face, but to a diminishing degree, Experiment has demonstrated that similar ground results may be obtained by abrasion with another stone, but not from friction in the soil were they to have been used as cultivating hoes as is thought by some. While a few heavier specimens in this class may have been used exclusively for axes when weighing a pound or more, it is unlikely that any of these blades were used as cultivating hoes, as has been suggested by Willoughby. There are too many specimens that show unmistakable evidence of having been intended for side hafting to consider the hoe hypothesis tenable.

A most carefully made blade (Fig. 15 #1) is from Deerfield. It has been hafted for exhibit, and is now on display in the Indian Room, Memorial Hall, Deerfield. It has almost perfect symmetry with a slightly wider notch on one side than on the other in order to more readily engage the handle. Nearly all blades as shown have a slightly extended heel below the point of contact with the handle, as is also customary with metal hatchets. Because of this and other similarities, it is possible that the invention and development of these stone tomahawks may have been inspired by early European metal trade hatchets in the 16th Century when the supply was not sufficient to meet the native demand. At least, it is self evident that these ground edged blades were designed for side hafting, and in the case of those of light weight for a relatively short handle. Furthermore, their sharp cutting edge seems intended for cutting some required material - probably wood - while their overall shape conforms to that of metal hatchets. Undoubtedly, they played dual roles on war expeditions both as fighting clubs and as woodcutting hatchets. An excavated specimen of these blades from the Ragged Mountain site in the Peoples State Forest, Connecticut, has been assigned to the site's upper zone in which appear clay potsherds. Because of this associated ceramic evidence that is found to belong to the relatively late agricultural period, ground edged stone hatchets probably represent an invention of this later age. This supports the hypothetical conclusion that they are a product of the last cultural stage, possibly the 16th Century.

FIGURE 15. Ground Edged Stone Hatchets. 1,2,3,5, Deerfield; 4,6, Westfield.

Confirmation with similar deductions comes from recovered evidence in the Powder-Mill brook valley at Westfield. Here has appeared several of these blades as a part of grave goods from burials, in which also occurred ceramic pots and certain skeletal remains suggestive of a late deposition.


This class of clubs is amply represented by hundreds of chipped stone prongs, weighing from 1 to 3 ounces. Several specimens are to be found in almost every private collection throughout the central New England area. Referring back to historical reports appearing in the first part of this paper, this type of club was in general use at least during the first part of the 17th Century. A stone prong similar to those illustrated was sunk into a deep groove made along the side of a heavy stick near one end and sealed in with pitch. Bureau of American Ethnology Reports advance a further probability that rawhide was also used about the prong to help keep it from working loose in the haft. Probably the handle was then cut away on the lower side and toward the handle end to produce a better grip and to effect a more suitable balance.

Club prongs are usually made from strong durable stones, such as felsite, quartzite, and quartz. They are chipped to a well defined point at one end. Their body is left relatively thick, which produces a chunky effect that would no doubt withstand heavy blows without breakage. It is easy to confuse these artifacts with triangular turtlebacks, or those chipped forms that are thought to represent a preliminary stage in the manufacture of triangular projectile points. However, it will be found on comparison that club prongs have carefully flaked edges which form the point, whereas with turtlebacks chipping is coarser with less apparent regard being paid to producing a specialized shape.

Doubt as to the antiquity of this form of tomahawk is to be found in its absence from excavated evidence associated with cultural periods underlying the ceramic age. Instead, other club forms have appeared with such earlier archeaic evidence, which suggests assignment of stone pronged wooden clubs to the later Woodland ceramic period.

Under this heading, clubs appear infrequently that have rounded heads, either single or double bitted. In general, these stone clubs are relatively heavy artifacts weighing from 3/4 - 1 1/2 pounds. Heavier clubs like (Fig. 15,#2) probably were hafted with a long handle as reported by William Wood, and may have been wielded with two hands. In most cases, these weapons are well shaped by pecking and are usually made from granite cobbles. Grooves for hafting are always well defined and often the rounded head has been pecked all over to give it some desired shape. These clubs show no evidence of having been used as hammerstones or mauls.

Specimen (Fig. 17, #1) in its original haft is thought to be of Indian make. It was found in Connecticut, and has fortunately been preserved in good condition as a part of the Norris L. Bull collection. It is a double ball-headed club of dark colored stone with rather small proportions. The stone head is attached to a wooden handle by means of gut or rawhide thongs wound around a deep central groove. To these is sewed the end of a piece of rawhide covering that is stretched over the handle. This is held together by sewing that extends its entire length. At the handle end, the rawhide covering has been left long, apparently to provide a loop to pass around the wrist although only a part of it is now preserved. The thread used in sewing the cover is quite fine having the color and appearance of hemp. The handle is about fifteen inches long with a slight taper toward the club end. This unusually fine specimen of
primitive hafting was found about a foot underground. It had been carefully laid away in a small chamber completely encased with stones. The skin and thongs at first appeared ready to fall apart, but when dried and treated with preservative became sufficiently strong again to hold the artifact in its haft. It may be remembered from previous references that clubs of this kind appearing in various forms, some with rawhide stretched over the stone as well as the handle, were in general use among western tribes where they may have originated. This probability may tend to explain the reason why such clubs are relatively scarce in the Northeast. It may further suggest a chronological position for them in the Ceramic period when economic contacts with the West had probably become more frequent than may have been the case in earlier archaic ages. Of course, the fine thread sewing and preservation of rawhide covering of the Norris Bull specimen suggests a rather late age for this club at least, possibly middle 18th Century.

Unlike stone prongs for wooden clubs, this group of pronged tomahawks contains artifacts that exhibit well defined side notches in the middle or top areas of the blade. These implements were probably attached to a normal sized handle by means of thongs. The six specimens of this classification all bear signs of having been chipped or pecked into shape with great care. The bit end is shaped to a dull prong symmetrically placed, while the head is usually nondescript in form. Their weights range from 4 to 5 ounces, and they are made of rough stone material such as basalt, basonite, quartzite, quartz or pegmatite.

No mention by early commentators is made of such tomahawks, and it is probable that they had gone out of use long before the discovery of America. That
they belong to an earlier age may be postulated from the appearance of a well made specimen (Fig. 18, #4) in tailings at the Wilbraham steatite quarry. This club is meticulously made with perfect symmetry and exhibits better workmanship than is the case with most quarry picks. It is thought, therefore, to be a club and not a pick. Furthermore, it is made of basalt and may have been brought to the quarry from some Connecticut Valley camp site where this stone is readily procurable. It shows little or no wear as contrasted with most quarry picks. It weighs 5 ounces, has well defined chipped notching for a side haft, and probably represents a tomahawk of the Stone Bowl period that had become lost at the quarry. Further research may also place pronged blades in the Ceramic-Agricultural period that followed.

**Figure 19. Chipped Hatchets.** 1,2,4,5, Connecticut Valley; 3, Potter Pond, R.I.; 6, Taunton; 7, Tiverton, R.I.

### Chipped Hatchets

This kind of tomahawk is frequently encountered in most collections and seems to have been a prevailing type during perhaps a long period of cultural development. Evidence is based on 43 specimens most of which weigh from 3 to 8 ounces, although there are several which are somewhat heavier. They are usually made of either basalt, fine grained hard granite, felsite, basonite, quartz, quartzite or pegmatite. In some respects, their shape resembles that of ground edged stone hatchets as well as of metal ones. Trait resemblances are to be found in relatively wide, somewhat convex edged blades with either pointed or tapering heads. They usually have small proportions, but with sufficient weight to ensure an efficient short handled club. Of particular note is a large well-shaped specimen made of red felsite that weighs a pound or more. It forms a part of the Richardson collection, has deep side notches for hafting centrally located, and seems to have the appearance of a club that may have been used as a battle ax. Some clubs from this class, as in exhibits (Fig. 19, #3-5) are made of stones with natural shapes so near to that desired as to have required but little chipping. The cutting edge of all these clubs is left dull, apparently with the idea of killing by concussion and not by incision.

Only one specimen from the chipped hatchet evidence was recovered by excavation (Fig. 19, #3), and this appeared at the Potter Pond site in Rhode Island in the upper cultural zone, accompanied by ceramic and agricultural traits. Since accumulated stratified evidence is not yet available, and since surface finds represent nearly all recoveries up to date, it is obviously too early to try to assign chipped hatchets to any particular age. However, the Potter Pond excavated specimen as well as surface finds that are frequently encountered associated with material from the Ceramic-Agricultural period suggest coexistence with the last cultural era.

In the Richardson collection are 17 small artifacts, which have the appearance of having been shaped to resemble tomahawks, but which neither have the weight, quality of stone, nor the workmanship to justify their inclusion with mature war clubs. The five illustrated specimens weigh only 1 to 2 ounces a piece, while all others in this group of artifacts are likewise relatively light weight with only a few exceptions. Chipping technique is rudimentary, while shapes simulate those of larger and better made clubs. Stone material from which they are made is confined to rocks of a somewhat friable nature, such as sandstone, shale, schist, unselected granite, and fire hardened clay. Side notches are of small proportions as if to accommodate small sized handles.

When collections are classified, care should be used to differentiate between these small ineffective clubs and those with more mature traits. The former should probably be considered as toy clubs.
that may have been made as playthings for children. In fact, those weighing only an ounce a piece would have been more suitable, it would seem, for very young rather than for older children. The existence of such toy clubs should prove of considerable interest, since it suggests that they were probably inspired by a war conditioned society in whatever age they were made.

CONCLUSIONS

This investigation has attempted to correlate historical and archaeological evidence. The result purports to show the existence beyond a reasonable doubt of stone war clubs of various kinds, which were referred to in historic days as tomahawks by Algonkian peoples of the Atlantic seaboard. Seven different types have been delineated in this paper with some reference being made to their probable chronological position in cultural sequence. However, more work in the field must be done before reliable cultural relationships may be established.

In approaching this research, it has been necessary to acknowledge the existence of stone clubs that display traits differing from those of axes. The latter, it would seem, have characteristics that fit them more for cutting wood than for use as war clubs, and historical evidence lends support to this belief. In 1634, William Wood speaks of small stone axes being used for cutting wood, namely that of trimming the outside of logs when making dugouts:

"Their cannows be made either of Pine-trees, which they burn hollow, - cutting their outsides with stone-hatchets." 11

Hence, small stone axes, which in Wood's day were called hatchets, were wood cutting implements. No mention is made by Wood or others of stone tomahawks. Nevertheless, history is clear in acknowledging the existence of certain kinds of clubs that were used as weapons, but only those that were in use when Europeans first arrived. From this it should follow that people who fought with clubs in the 16th and 17th Centuries, did so probably because it was a well established custom handed down as a cherished heritage from earlier days. Hence, it seems probable that stone implements, revealed by archaeology as tomahawks did exist in prehistoric days although they have not been specifically identified in the past.

From excavation information that has reached the author's attention, tomahawks first occur in the Stone Bowl age, in which one has appeared with a pronged blade. Pronged tomahawks may have been followed by chipped hatchets that appear in the Ceramic-Agricultural era. By then, trade contacts with the West had become more numerous with some infiltration of western ideas. Stone ball-headed clubs could have originated from such contacts and might have been used to some extent in the age preceding the coming of Columbus. However, when European explorers finally arrived this type of club had apparently gone out of use. To judge from early historical reports, it had been replaced in those days by stone pronged and plain wooden clubs with a wooden knob at the end. With the introduction of European iron hatchets in the 16th Century, probably in small amounts to start with, Connecticut Valley natives developed what appear to be stone imitations made from small thin basalt slabs indigenous to that region. These ground edged stone hatchets apparently served so well as substitutes that they became prized possessions and sometimes were buried with the dead. Weather spalled basalt, often in nearly the desired shape, probably inspired this invention after the shape had once been set by European hatchets. The Colonial period followed with quantities of iron hatchets of English, French and Spanish make finding their way into the hands of the Indians. As was universally the case with most European trade goods when supplied in quantity, iron hatchets quickly replaced other types of stone and wood tomahawks. They soon became the recognized war club for those natives who lived close enough to be influenced by early Colonial contacts.

Toy clubs simulating various shapes of tomahawks, were evidently made as playthings for children, who

TOMAHAWKS OF CENTRAL NEW ENGLAND

probably aped the actions of their elders. Only a few ounces separate these toys from mature war clubs, which many times seem to have been preferred in light weights. However, toy clubs may be identified by their small proportions, rude manufacture, and friable stone from which they are usually made.

While the high frequency of light weight tomahawks found in various collections would seem to indicate preference for small sized clubs, heavy weight blades were sometimes used. Whatever the weight, a weapon of such importance as the tomahawk that could mean life or death by a mere twist of the wrist would undoubtedly have been carefully constructed to meet certain requirements depending upon its end use. For this reason, fighting clubs that were intended for action in war may have had small proportions to permit them to be swung here and there without fatigue, while for ceremonial purposes larger clubs or more elaborate maces might well have been used.

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AN UNUSUAL BURIAL AT PLYMOUTH

Charles F. Sherman

While digging several test pits on the property of Mr. William Armstrong on Nook Road, Plymouth, Mass., three members of the Massasoit Chapter, Messrs Charles Sanderson, Richard Bent and William Whiting, came upon the lower bones of a human skeleton. The test pits was immediately refilled and marked for future attention.

On April 3rd, the Chapter Chairman Charles F. Sherman, and Mr. Jesse Brewer repaired to the site prepared to excavate the burial in a proper manner. Control was established by staking a square seven feet on each side so as to include the burial shaft.

At a depth of thirty inches from the present surface the skeleton of a young adult (30 to 35 yrs) was found in a flexed position. The skeleton was orientated in a north-south line, the crania to the north facing west. The upper arms were close to the rib cage with the hands close to the facial bones, the legs had been so flexed that the bones of the feet lay near the pelvis. The upper bones of the skeleton, including

FIGURE 21. Photograph of burial.
the crania, were in fair to good condition, the smaller bones including the vertebrae were in an advanced state of disintegration. Dentition was very complete, the lower incisors being malformed and twisted in their sockets.

Three inches to the east of the occipital of the first crania were found several lumbar vertebrae of a second skeleton. This burial had been greatly disturbed by the digging of a post hole. The mold of this post was very distinct, about six inches in diameter, extending from a point eight inches below the present surface to a point below the level of the burials. Two human teeth were found in the fill about the post mold.

Twelve inches from the pelvis of burial one, parts of a third skeleton was discovered. This burial was of the type rare in this section of New England, a partially cremated bundle burial. The long bones of the skeleton had been placed in the grave shaft much as one would place the sticks in laying a camp fire, at a depth of thirty inches from the present surface. Above these were the pelvis, crania, and other large bones. All were badly charred by fire, several badly worn teeth, presumed to have come from this skeleton, indicate the age of the individual as middle or old adult.

The fill removed from these grave shafts contained a number of European contact materials, sherds of glazed pottery, glass and the like. Approximately thirty inches from the graves a trench-like pit, filled with clean white sand, was discovered. From this pit were recovered several stone projectile points, fragments of clam shell, and several hand forged iron nails.

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POTTERY TYPES OF CENTRAL NEW ENGLAND
William S. Fowler

(Read before a Meeting of the Eastern States Archaeological Federation Oct. 14, 1950)

Because of this somewhat interrupted homogeneity of ceramic growth, pottery types probably persisted longer in some regions than in others. For this reason, only stylistic changes that are found to be significant factors in pottery development throughout the area should probably be considered diagnostic. While design elements are contributing indices, throughout a changing habitat of seashore and uplands they vary somewhat with the environment and fail to provide reliable evidence for chronological groupings.

In 1948 Ripley P. Bullen classified pottery types of eastern Massachusetts with particular reference to evidence from certain Andover sites, (American Antiquity, Vol. 14, No. 1). Subsequently, the Massachusetts Archaeological Society published its conception of a classification of some Massachusetts pottery, (Massachusetts Archaeological Society, Bulletin, Vol. 10, No. 1). In view of these classifications already accomplished in some completeness, the question may well be raised at this time as to what more can be added.

Aside from any personal views which may disagree with those formerly presented, two recent excavations - the Ragged Mountain site in Connecticut and the Potter Pond site in Rhode Island - have produced new evidence that may now be used in the classification of pottery. Accordingly, an effort has been made not only to clarify past procedure so that it will conform to recent discoveries, but new traits have been added with emphasis placed on major rather than minor variations as determinants of temporal changes.
It should be stated here that pottery types from South Windsor and Ragged Mountain are so similar to those of the Connecticut Valley of Western Massachusetts as to justify inclusion of these sites in this report. Further, it may be stated that Potter Pond site exhibits comparable pottery traits to those of Massachusetts shore sites and therefore has also been included. When taken together, both inland and coastal pottery types have some traits in common, which are the basis of this report.

In the light of Potter Pond evidence, there is no longer any doubt as to the chronological position of that kind of pottery that is maleated both sides and resembles Ritchie's Vinette I of New York State. At this Rhode Island site it occurs at the lowest ceramic level in crushed shell. This overlies black habitation accumulation heavily laden with fragments of steatite bowls, among which appear relatively small implements clearly identifiable as steatite working tools comparable to finishing tools from steatite quarries. A small percentage of steatite sherds, most of which have perforations for repair strapping, occur in the crushed shell in association with early pottery sherds but without steatite working tools. This trait association of the two wares seems to suggest for the crushed shell zone a transitional period between steatite and ceramic economies, when with the introduction of pottery, stone bowls ceased to be manufactured but continued in use as heirlooms. Between this early ceramic zone and the top of the shell where pottery of Mohawk influence appears is an intermediate horizon from which a large majority of all recovered sherds have come. These furnish valuable evidence of the middle periods and exhibit contemporaneous designs, surface treatments, body shapes, and base styles.

While these events were taking place in Rhode Island, Ragged Mountain site in northern Connecticut was yielding typological ceramic evidence that has contributed somewhat toward the establishment of pottery types for central New England regions. Ceramic evidence from this site consists of sherds from six small pots, four from the second and two from the third ceramic period. It comes from the upper zone as at Potter Pond, and none occurs in the lower zone in association with steatite domestic traits.

A synthesis of these finds with other available evidence previously studied suggests four stages of pottery development attended by significant modifications in vessel construction, styling and embellishment. These three major indices when taken together typify the activities of each respective stage. For every stage there undoubtedly is an early and late aspect when potters altered techniques and design treatments to conform to new inventions or diffusive ideas. Therefore, in this report these aspects are treated as modifying trends and not as important period criteria. Classification and identification of pottery types for the regional New England area as outlined in this paper would seem to fall within four well defined evolutionary stages: Early, Intermediate, Late Prehistoric, and Historic, which now will be discussed in relation to ceramic traits that appear most diagnostic in each period.

The Early stage embraces pottery, probably the earliest in New England, which seems to have replaced steatite stone ware (Ref. Potter Pond site evidence). Ceramic pots of this period have conoidal bases, straight necks with occasionally slight constriction, roughly rounded rims, thick ware with coarse mineral temper, coiled construction, and walls that are maleated both sides with cord-wrapped paddling. No designs are present, and traits appear to simulate Vinette I pottery. When constricted necks occur, they are not without precedent for a steatite thin walled neck sherd with well defined constriction has appeared at the Oak Lawn steatite quarry in Rhode Island. Apparently, stone vessels with constricted necks were made on occasion by stone cutters of the preceding stone bowl age. This evidence seems to support the belief that a genetic link exists between the stone bowl and ceramic periods.

In the Intermediate stage, which probably lasted a long time, appears evidence that connotes inventive ability with much design variation. This age seems to have been one in which the conception of pottery utilization was the same as at first. However, there appears to have developed a determined effort to produce more beautiful vessel shapes by increasing neck constriction and at times by undercutting bases more sharply. Of particular note is the wide use of designs for neck adornment as well as the diversification of design elements, partly due perhaps to environmental conditioning of pottery marking equipment.

While there is some evidence to suggest the existence of an attempt to conform to set designs, it is probable that competition between potters produced variation to a considerable extent. Therefore, when classifying pottery types, attempting to establish design sequence seems inadvisable. Nevertheless, in this stage it is important to recognize the widespread creative effort that conditioned potters for the stylistic improvements that were to come. Vessels of the second period have conoidal bases, and either straight or constricted necks usually with flattened rims that are decorated, sometimes rounded, and occasionally with projecting lips. Ware is from 1/4 to 3/8" thick, medium to coarse mineral or shell temper with coiling sometimes indicated. Body walls are now and then finished smooth both sides, at other times, interiors are smooth or stick-wiped with exteriors cord-wrapped paddled. Sometimes both sides are stick-wiped while necks are usually left smooth under design treatments in most cases. Occasionally bodies are shortened by
sharp undercutting below shoulders. However, all vessels small and large, so far as is known, have conoidal bases in spite of body shortening. Characteristic designs that customarily adorn the upper part of the neck include the following motifs: rocker-stamp (infrequent); dentate jabs repeated in lines made with a toothed marker to form overall effects; dentate single horizontal rows, sometimes under a row of punctate impressions; push-and-pull horizontal linears, and four to six line vertical linear trailings probably made with a toothed stick that is also employed at times to wipe the inside or outside walls; scallop shell horizontal bands, or irregular markings; finger nail jabs (infrequent); cord-wrapped-stick overall impressions from coastal sites; single herringbone dentate horizontal band from Connecticut Valley sites.

In the Late Prehistoric stage semi-globular bases are introduced although conoidal bases are still in evidence to a diminishing extent. It is at this time that Owasco design elements from New York State are discernible at several locations, notably in the Connecticut River Valley, although they are by no means confined to this area. Vessel construction embraces ware 1/4” thick or less with fine mineral or shell temper, and apparently without coiling. Necks are seldom straight, more frequently constricted, sometimes to an extreme degree, with rims rounded or flattened, usually with projecting lips and decoration. At times, dentate stamping is used to form incipient collars by means of pressure. Body walls are smooth inside and usually are maleated outside by cord or fabric-wrapped paddling while necks are generally smooth. Design embellishment has the following motifs: incised two line linear “Vs” sometimes with horizontal incised linear bands; incised cross-hatch; cored-stick plats running obliquely under or between cored-stick horizontal linear bands; closely spaced up-to-10 teeth dentate vertical impressions deeply pressed into the neck to form an incipient collar above, which is also ornamented; and compact dentate herringbone motifs (infrequent). Evidence from the third stage is relatively sparse compared with the first two stages. This suggests either limited activity or a short time span before ceramic art flowered out into the fourth and final stage when Mohawk-Iroquoian technique exerted a marked influence over the work of New England potters.

In the Historic fourth stage, pottery types show the effect of Mohawk styling and technique. However, except for Deerfield, Westfield and one or two other Connecticut Valley sites that lie in the vicinity of two well known overland Indian trails to Mohawk territory, other sites have not produced pure Mohawk pottery, so far as is known. The stated exceptions with sherds of typical Mohawk pottery may suggest Mohawk occupation for extended intervals at these places. From these contacts could have stemmed some of the diffused Mohawk influence noted in pottery from adjoining regions. Most pots of this last period have collars, some deeply undercut and others with less pronounced neck constriction. Imitation of Iroquoian pottery traits is suggested but with deficiencies of workmanship in some particular not ordinarily found in pure Mohawk ware. Furthermore, native design elements tend to include variations and do not seem to hold to set patterns as do their New York State prototypes. Historic native ware is relatively thin, apparently not coiled, and with fine mineral or shell temper. Pots have globular bases and often are capped with collars either narrow or broad with moderately undercut necks, and sometimes with castellations. Decorated nodes may have been used by native potters at times, although usually this type of decoration is absent. Body walls are smooth on both sides with decorations covering the collars, although occasionally ornamentation extends on to the necks. Decoration is frequently by incision with a stylus, although at times it seems to be made by a rough thin edged tool that is repeatedly pressed into the paste to form lines. Design elements embrace motifs that are placed below or between two and three line horizontal linears in some cases. They include chevron and diamond variations, sometimes with filled-in incised horizontal lines, also numerous geometric figures, which often appear in some confusion. Fine examples of native historic pottery in restorable condition have been recovered not only from the Connecticut Valley but also from the coastal area of Cape Cod. These vessels exhibit a high degree of manufacturing skill and closely simulate Mohawk technique.

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This paper has a threefold purpose: (1) to give a brief review of the mutually beneficial relations between archaeology and geology, (2) to discuss briefly the aids which geology brings to archaeology, and (3) to mention the role that geology is playing in the unraveling of the problem at the Titicut site.

The heart of geology is stratigraphy, the detailed study of sedimentary deposits, the determination of the natural sedimentary units, their geographic distribution, and their relative ages and relations to other formations. The best places to study stratigraphy are in the trenches cut by earth processes, valleys, ravines, gorges, Grand Canyons. Here the geologist finds a cross section of the earth’s history revealed; here the geologist can study the composition of the rocks, can interpret their mode of deposition, and can draw conclusions about the environment of past ages. From any one place which has been thoroughly studied in all of its aspects—paleontology, lithology, structure—the geologist can extend his studies to other localities. Eventually, through the efforts of many workers over many years, a sequence is built up which can be recognized elsewhere, where rocks of any one age can be correlated with rocks of similar age and their relationships noted.

The analogy to archaeology is immediately apparent. The archaeologist, however, like the Pleistocene geologist, must depend on himself to provide the trenches with that peculiarly Pleistocene implement—the shovel. Even though the archaeologist’s primary interest may be in the artifacts present in the site, he must study carefully the stratification present in the walls of his trench. That is to say, he must study the stratigraphy of the site, choosing carefully the limits between different soil types, noting the composition and grain size of the soils and underlying deposits, tracing the limits of the various soil units, and attempting to interpret the past archaeological environment.

The prehistoric archaeologist is the one with which we are mostly concerned here, that is, one whose efforts are directed to a study so far back in time that the records and traces of ethnology have been erased and all that is left is what a paleontologist would call the “hard parts,” the virtually indestructible tools, and with luck, hearths and fireplaces.

The prehistoric archaeologist has time as his major problem—the establishing of a relative or absolute chronology. At present the only approach to such a chronology is through geology and closely allied sciences such as geophysics and geochemistry. A detailed geologic study of the Pleistocene geology in a given area is basic and essential to fixing the age of a given cultural horizon.

The study of the stratification, or stratigraphy, of a site is one of the means of control for the relative dating of artifacts. The archaeologist is capable of noting changes in color, textures, and structure of the materials exposed in his trench, but from this point on he runs into the fringe area between the geological sciences and archaeology. Fossil pollen, fossil mammals, fossil invertebrates, and charcoal all present problems for the specialist in these particular studies. Indeed, the study of sediments is particularly the field of the geologist, in particular of that one branch of geology called sedimentary petrography.

At this point the archaeologist becomes part of an interdisciplinary group which aims at one point—the environment of the past. The geologist is perhaps the most generally useful member in this study because his science is founded on most of the other basic sciences, but many natural science disciplines are necessary.

An example of such an interdisciplinary work familiar to all of us was carried out under the direction of F. Johnson, of the Peabody Foundation for Archaeology, in the writing, editing, and publication of the two papers on the Boylston Street Fishweir. It is surprising to note that seventeen workers collaborated on those two reports, not including those who were consulted but did not participate in the writing of the report. These seventeen workers represented five major branches of endeavor, geology, zoology, botany, chemistry, and archaeology.

One of the pitfalls of this cooperative type of study has become apparent in the last year or so. If any one technique of dating is too complex for the ordinary worker, then a super-specialist must be called in to render service. If this process is peculiarly technical in that it requires a man of high intelligence and learning to operate it successfully, then this one process is relegated to the part of a servant instead of a contributor. There must be a reciprocal relationship or the group work will fail.

To be of the greatest value, geologists and archaeologists should work together, so that one may
check the excesses of the other. If an inferred geological date appears quite unreasonable, or is unsatisfactory to the geologist, then perhaps the typology known by the archaeologist to exist in neighboring regions may help in solving the problem.

But the geologist should beware of depending solely on artifacts which appear to be dated and correlated. As Dr. Hallam Movius has stressed in a recent paper, man's artifacts are the imperishable parts of a complex culture and are social rather than natural phenomena. Hence a geologist cannot use man's cultural objects as he uses fossils for relative dating and correlation, for artifacts are not fossils, although they seem to have much in common with them.

In a joint study of a prehistorical site an archaeologist should accept the geologist's chronology. If the geologist is a well-trained man, the archaeologist cannot consider himself qualified to assess the geologist's results. Having received the age of a culture horizon from the geologist, the archaeologist should use this age as a basis in interpreting his material. This does not say that the geologist is infallible, but merely points up the fact that each is best in his own profession.

The portion which follows will attempt to mention some of the methods used in geological-archaeological problems elsewhere, and which are in use in the local problem, Titicut.

In the Old World geologists and prehistorians have worked together for a long time. In the New World not many studies have been published in which there is a cooperative effort between the two disciplines, geology and archaeology. Perhaps the late Kirk Bryan of Harvard was the leading exponent and chief geological practitioner of the art; others have made similar studies, and many of these have been students of Bryan.

In France these cooperative studies have been carried out for a very long time. Most of the chronologic information has come from vertebrate paleontology, especially the study of mammals. Further paleontologic studies being pressed at the moment which are of practical interest to the archaeologist include Foraminifera, Diatoms, and Paleobotany, especially pollen analysis.

Pedology, the study of soils, has received much attention, especially since the study of clays by x-ray and thermal analysis has been introduced.

Sedimentary petrology has proved of great importance in France under the leadership of Andre Gallieux. His studies include all manner of unconsolidated sediments, from gravels to clays. He finds that the wind, glacial ice, rivers, waves, and solifluction flows all leave a characteristic imprint on the deposit they make. The measurement of length, width, and thickness of a pebble and the calculation of a ratio from these measurements has provided an index which will show whether pebbles are marine, glacial, or fluvial in origin. Orientation of the long axes of the pebbles in a deposit, and the angle of inclination of the long axes also provide a means of differentiating between the various agents of sedimentation.

The methods of study of pebbles as outlined above are simple, requiring only simple instruments, but the study of sands and smaller grain sizes requires special devices, such as optical microscopes, sieves, balances, etc. Since some period of training in the use of these instruments is necessary, the archaeologist must turn to the geologist or his laboratory assistant for help in analysis, after which a geologist or sedimentologist must aid in the interpretation of the derived facts.

There are many avenues of approach to the study of the finer-grained sediments. The mineral composition of sands gives their provenance or place of derivation. Heavy mineral studies present a further refinement of provenance studies. Granulometry, as it is termed in Europe, is the study of the distribution of the various grain sizes in the sample. Here we call it mechanical analysis and find it useful in the interpretation of the environment of deposition. With statistical indices derived from graphic plots of mechanical analyses we are enabled to compare large suites of samples for a common origin. The study of quartz grains in the sand will show whether or not the wind played a large part in the formation of the deposit. Inclusions in quartz and other minerals may play a part in provenance studies in the future.

Leaving the methods used by geology in the study of the environment of deposition of sedimentary deposits, we turn to the general conditions necessary for dating an archaeological site.

As noted in the Lindenmeier report by Bryan and Ray, a number of conditions must be met if a cultural horizon is to be dated by geologic means: (1) the cultural objects must be associated with a definite bed or beds; (2) these beds must be related to some definite geologic event; (3) this event must be related to other events or be of wide geographic extent; (4) this event and related events must also be related to some known geologic chronology.

These conditions seem to be fulfilled at the Titicut site, for here the culture horizon is associated with a white sandy layer which is overlain by a yellow sand divided into two portions on the basis of color.
The horizon on which the culture rests—the white sand—must be traced to or in some manner correlated with some local geologic event. This local chapter in the history of the region must be correlated with some event of a larger nature—the regional glacial history of the area. The ultimate limit to the work at Titicut depends on how far afield the culture layer or time equivalents of the culture layer can be traced. Unless the important culture horizon can be correlated with larger events in the area, the dating of the site will be very loose.

Tying in a sequence from a site in New England to a larger sequence involves many assumptions which are generally assumed to be true, but which are not strictly proven. This refers especially to the assumed world wide contemporaneity of glaciation. Most authorities agree that the larger stages of the Pleistocene are essentially synchronous; that is, that the North American stages Nebraskan, Kansan, Illinoian and Wisconsin are equal to the European Günz, Mindel, Riss, and Würm. But man in North America appears to fit into the various substages of the Wisconsin; these substages are more or less dated in Europe by varve counts and pollen work, but are not as well dated in North America. One of the leading glacial geologists, Flint, refuses to admit that the substages of the Wisconsin in Europe can be proved to be synchronous with the substages of Wisconsin on this side of the Atlantic. However, Bryan and Ray have discussed the problem of correlation of the last substages of the North American and European glaciations and come to the conclusion that it is possible to correlate them.

Here, in the abstract and the general, is the way in which geology and archaeology work together to decipher the prehistory of man. From the abstract let us go to the specific to discuss an area in which the above mentioned conditions are nearly fulfilled, where a coalition between the two sciences is at work, Titicut.

The excavation of materials from the site at Titicut was as expected at first. Artifacts were found in the loam and in the layer known as the yellow soil, along with hearths, a house floor, pits, and other evidence of human occupation. This material was normal and posed no new problems concerning chronology.

The finding of material lower in the glacial sequence was quite unexpected. Arrowpoints, bits of charcoal, and hearths were found sparsely distributed on or very near the surface of the white sand. This material was separated from that in the upper level by a sterile layer from 6-20" thick. There was no indication of any interruption of the overlying layers and it is impossible to hold that the artifacts are not in situ. Probably the most conclusive evidence is the hearths which are resting upon the white sand and are covered by a sterile layer.

The location and distribution of the material is such that it indicates to the archaeologists that the level on which the hearths were found was once an exposed surface. F. Johnson believes that the archaeologists will be able to show that the lower level is a buried horizon, and that the material from the lower level has certain typological peculiarities which set it off from the materials in the upper level.

The problem submitted to the geologist is three-fold; the identification of the surface, the determination of the process which resulted in the burial of the surface, and the geologic stage during which the surface was exposed.

From the evidence which has been gathered thus far, it seems that the means of solving the problem are present. The job is gathering the proper and necessary items and interpreting them correctly.

The methods which are being employed at the moment are primarily those of glacial geology and sedimentation. First is field work to gather the facts and next is laboratory and office work to supplement these facts and to interpret them. The field work involves the mapping of the various kinds of glacial and glacial-fluvial-lacustrine deposits, such as till, gravel, sand, and clay, and also mapping their mode of deposition or morphological expression, such as esker, delta, kame, etc. When all the facts have been gathered an attempt can be made to synthesize the material and build up a logical sequence of events in the area, which includes the area between Taunton and Middleboro on the south, and between East Bridgewater and the west end of the Hockomock Swamp on the north.

The general glacial geology of the area is being studied so that the relation of the sequence at the site to the general picture can be determined. A brief description of the glacial geology around Taunton and to the west of the site may be enlightening. The area to the west of the site was chosen for the first work because it is generally known that the ice sheet approached from the northwest, hence it was believed that more vital information concerning the site lay to the west.

There are a few bedrock outcrops in the area. These outcrops are of a dark gray conglomerate or sandstone, the sandstone containing pebble bands which help to determine its structural attitude. It is believed that the bedrock may be holding up some of the hills of till in the area. There is one quarry where till has been removed from the surface of the bedrock; on this bare surface are found striations, large grooves left by the ice in its southward journey.
The direction of the grooves is roughly northwest--southeast, or in alignment with the eskers and drumlins which are found in the area.

The glacial deposits in the area have been classified as follows: direct deposits from the ice, ice contact deposits, fluvial deposits, and eolian deposits and associated features.

The direct glacial deposits are those which were laid down by the ice itself. The only deposit of this kind is till. Till is an unsorted sediment, consisting of an extremely heterogeneous mixture of particle sizes ranging from clay to boulders as large as a small cottage, its composition reflecting all the rocks which the ice has passed over in the area to the north, with the nearest rocks contributing the most material. The till grades into material which has been washed by running water in the process of deposition, and thence into fluvial deposits. The gradation is gradual from till untouched by meltwater to the gravels which are laid down in the streams running from the melting ice. In the middle of the gradational series there is an area where it is difficult if not impossible to know what to call the material. The till of the Taunton region is mostly blue gray to gray, sandy, and somewhat coarse, with an apparent dearth of clay size materials except where the till is laid down close to present day outcrops of bedrock. The till then appears blue-black and clayey.

The till occurs in four types of features. It appears in drumlins or drumoidal hills which are similar in composition and origin to the hill appearing all through the Boston Basin. These are elongate hills, probably with a bedrock core, their long axes are oriented in the same direction as the striations mentioned above. The second feature in which till appears is in the long low hills which appear to have been covered with water laid material deposited after the hill. An example of this is the small elevation which starts where Route 138 rises out of the Hockomock at the Raynham Dog Track. There is ground moraine between the drumlins and in the southwestern part of the area, west of Taunton. This hill is covered by a sandy material thought to be a windblown deposit. The last and most unusual occurrence of the till is in several sand and gravel pits south and east of Taunton, where the till can be found overlying bedded sand deposits.

The next major group of deposits includes the ice contact sediments. These sediments were laid down next to or under the ice, not compressed by it, but formed by the agency of running water. During formation of ice contact deposits the sediments have ice walls on one or more sides.

One of the interesting types of ice contact deposit is the esker, a long narrow winding ridge consisting mostly of gravel and sand. In general aspect it resembles a railway embankment. It is more or less agreed by geologists that eskers are the deposits of glacial streams confined by a wall of ice in tunnels and left as ridges when the ice disappears. The most common mode of origin is in tunnels formed at the base of the glacier, during a late phase in the deglaciation when the ice is relatively thin and nearly stagnant. Since they are formed by streams it is not surprising to find that the eskers, which represent the bed load, have a stream pattern with tributary streams running into a major stream trending parallel to the direction of ice movement. In the area studied thus far there are three chains of eskers. The most easterly chain studied is the one which culminates in the ridge to the west of the Titicut site. There appears to be a curious relationship between the eskers and the land immediately to the west of each esker. The sandy sediments west of each esker chain appear to be banked up against the esker in a peculiar fashion, so that whereas the west side of the esker may be only ten feet above the surrounding land, the east side of the esker may be from ten to thirty feet high.

Kames are mounds or hillocks of sand and gravel, stratified material, sometimes deformed, which appear to be produced by the debouching of streams into standing bodies of water appearing between stagnant and broken ice blocks. They mostly occur as isolated hills. There seems to be two distinct lines of kames present, one just south and one just north of the town of Taunton, running northeast-southwest. The largest hill of the kind is Prospect Hill, 210 feet high, which overlooks Lake Sabbatia and is composed of sand and gravel all the way to the top. The crest of Prospect Hill gives us a minimum figure for the height of the ice sheet at this point.

There is one outstanding and perfectly formed delta, on the east side of Pine Swamp, just north of Taunton. It has a very steep slope on the back or north side, an ice contact slope, and a lobate front with foreset beds dipping about 25°. An ice block seems to have been standing for a long time in the area now occupied by the Pine Swamp, and a lake whose surface was about 80 feet above present sea level and whose area is at present unknown must have occupied the area to the south and east. One of the eskers described above approaches the delta from the rear but does not reach it; it is possible that this is the stream which formed the delta.

In support of the statement that the feature is really a delta are the lake beds found in the lowland in front of it. The town of Raynham installed a water supply system and the pipe ditches showed many cross sections of the lake bottom. It is composed of a clayey-silty material with overlying coarse and fine sand.
To the south of the lake bottom some varved clays are found. These clays have annually recurring layers of coarse and fine material and require fresh water for their formation. They may be the southward extension of the lake. These clays are also overlain by sands which have southward dipping bedding. There are other laminated clays underlying the area to the east, and these can be traced up the Taunton River to the Titicut site itself.

The fluvial deposits are indicated by the gravels and sands which show distinct signs of current bedding, and these overlap into the kames mentioned above. When all available information about size of materials and distribution of the gravels and sand has been collected in the field, then the laboratory work begins and profiles of the kames and gravel outcrops are drawn so that stream grades may be reconstructed and the path of the ancient glacial streams made known. These maps of the ancient stream patterns are then employed in an attempt to decipher the history of the region.

The wind-blown deposits and ventifacts of the region indicate the last events prior to recent incision of the present day streams.

In the classic definition loess is a nonstratified, loose, porous, sedimentary deposit consisting dominantly of particles of silt size. It is derived by the wind from the outwash plains in front of glaciers. The wind picks up the material after the daily floods have gone down and spread the dust over the landscape in the direction of the effective prevailing wind. In the Taunton area the loess-like material is modified by several agencies. According to the few analyses made the material is mostly sand and very little silt. This means that the source of the material was very close by, and that the mode of retreat of the ice was such as to preclude long transport and sorting of the material. Moreover, the wind-borne material has been mixed with the glacial fluvial material beneath and the silt size proportionally diluted. Wind-carved pebbles, the ventifacts, are found in this wind-borne material.

The ventifacts are found in the loess-like material, in the till, and in the sands of the site itself. None of the ventifacts collected show the beautiful faceting which is characteristic of some of the Cape Cod ventifacts, but many show the peculiar cellophone-like polish given by wind blasting, others especially the coarse-grained pink granites, show excellent differential etching in which the hard glassy quartz stands well above the softer feldspar which has been more readily removed by the wind-borne dust.

At the site itself much information has been collected, both by the members of the Massachusetts Archaeological Society who have regularly carried out excavating there and by the geologists. However, most of the material is not yet synthesized, and until it is most of the information is valueless. Samples of the material have been taken and analysed for grain size and various statistical methods used in their study. The study of the glacial materials is far from finished. Even the relation of the sequence at the site to the general glacial sequence is unknown.

A few things are known, however. With no knowledge of the typology or prehistory of New England, and ignorant of the date when the first human beings are supposed to have come into the area, I find myself without prejudice in attempting to put a geological date on the site. From the data so far collected, and especially from some facts gathered at the site I am led to think that the site will prove to have been inhabited at a very early date. I am sure that the climate at the time of occupation was different from that of the present, or was closely followed by a radical change in climate. The one set of facts which makes this a plausible statement is the presence of large and undoubted ventifacts in the upper horizons of the terrace at Titicut, lying on the culture horizon. This must indicate a much colder and drier climate than that which exists in the area today, for at present no stones are being cut, no sand is being blown about. The people who inhabited Titicut must have lived there prior to or contemporaneous with a foul and bitter climate. The last episode during which this occurred is at least many thousands of years ago.

BIBLIOGRAPHY


4. This paragraph and the three following are extracted from a letter to the author from Frederick Johnson of Peabody Museum, Andover, 1948.