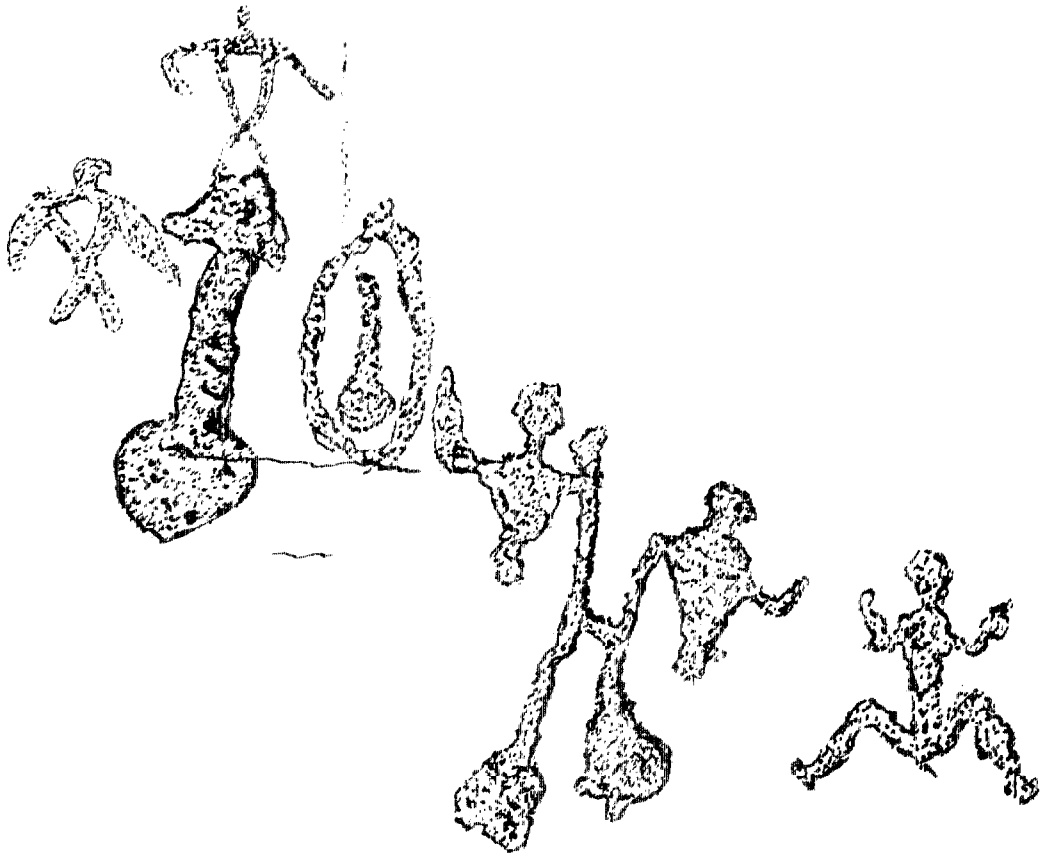
MAINE ARCHAEOLOGICAL SOCIETY INC. BULLETIN



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Permanent Address of the Society:

Maine Archaeological Society, Incorporated
P. O. Box 982
Augusta, Maine 04330

THE MAINE ARCHAEOLOGICAL SOCIETY BULLETIN

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Spring 1985

NOTICE OF SPRING MEETING

The Spring Meeting of the Maine Archaeological Society, Inc. will be held on April 28, 1985. The meeting location is Room C 131 of the Learning Center, University of Maine at Farmington. Program as follows:

10-11 A.M. Arrival and set up of displays. Coffee and social hour.

11 A.M. Mr. Arne Carlson will speak on the Franklin Expedition Archaeological Survey in Central Arctic Canada.

12- 1 P.M. Lunch. Bring your own. Coffee and dessert snacks will be available.

1- 1:30 P.M. Business Meeting.

1:30 P.M.Dr. James B. Petersen will speak on the Brigham Site, a stratified riverine site in Milo, Maine.

Sexuality in Maine Petroglyphs
(Comments on Cover for Spring 1985 MAS Bulletin)

Mark Hedden

The disembodied genitalia and associated designs depicted at the Embden petroglyph site (69.4-See Cover) on the Kennebec River in west central Maine represent an eastward penetration of ideas relating to fertility which were prevalent during the Woodland Period among Central Algonkian and Siouan groups around the Great Lakes. These images along with representations of ithyphallic men (see below) at the site demonstrate an emphasis on the male role which contrasts sharply to the rock art of archaic age where there is no sexual differentiation of human figures and genitalia, if represented at all, is female.

Petroglyphs in eastern Maine (at Machias Bay) lack representations of isolated male genitalia and ithyphallic males. Oral traditions of the eastern (Wabanaki) groups show few traces of the ribald tales that characterize the Central Algonkian groups. The pervasiveness of emphasis on and ideas relating to male sexuality in the Great Lakes area, particularly in the behavior of shamans and in ritual, and its apparent absence on the Maine coast is documented by early sources.

A survey of the rock art literature in North America indicates that dateable examples of sexual differentiation of human forms and representations of ithyphallic males, in particular, were made after the middle of the 1st Millenium B.C. While this is coeval with the development of food production in the Southwest, Mississippi watershed and Great Lakes, the most elaborate surviving development of representations of overt male sexuality seems to be limited to fringe groups who directed their fertility rituals more towards game animals than crops. Some of the broader implications of these connections are examined in the conclusions.

Two triangular-bodied figures on the Embden ledge depict ithyphallic men. One, located on the western or inshore end, is dinted with broad dish-shaped lines 10 to 12mm wide to a maximum depth of 2 mm. The figure, both legs bent at the knees and arms at elbows, runs with left hand pointed at an outsized depiction of female genitalia (a rounded triangular enclosure with a short perpendicular line from the pointed base and meandering extensions from the upper corners). The second figure, located near the eastern extremity of the utilized surface, holds a slightly less active posture with similarly bent arms and legs. Some spalling off of the surface has taken place on the head and in the pelvic area, rendering the genitalia obscure. A descending series of dots issuing from a projecting point of the damaged area suggest an ejaculation is represented but it cannot be determined whether these dots went with the original design or were,perhaps, added at a later date. This detail is unique for prehistoric designs of this genre.

Two other designs that suggest isolated male genitalia appear on the lower third of the most heavily utilized central area of the ledge. The larger of two measures 3.5cm across (at midpoint) by 25cm in length and is dinted with a blunt tool to a depth of 5 mm. The glans has large lobes giving the head an arrowlike silhouette. Testicles seem to be indicated by an expanded rounded base. The depth of the cut and advanced patination of the phallus stands out when compared to shallowly dinted triangular-bodied figures above and to the left, which show a measurable depth of ca. 1mm by 5 mm wide. The feet of the upper triangular-bodied figure overlie the tip of the phallus. A smaller,less deeply dinted phallus appears adjacent right, enclosed within an oval rounding, presumably a vulva. This one lacks the arrowlike lobes of the larger phallus and measures 12 cm in length. The heavy dinting characteristic of the larger figure is closely matched by a large "H" sign 30 cm to the right which has a bulbous (rootlike?) swelling on each base and a figure represented from the waist up connected by one arm to each upper extension (See Hedden 1984a for a discussion of the possible significance of the "H" figure). A seated figure, another 25 cm east of the H form, holds a posture associated with birth and coition in many non-western societies and may represent a woman (Cf Fraser 1966). The execution and formal details of the larger phallus, the H-figure and the seated woman are close enough to attribute them to the work of a single man who operated with a fairly heavy touch and preferred somewhat rounded forms.

Representations of male genitalia seem to be absent from the petroglyphs around Machias Bay in eastern Maine. One simpler version of the vulva on the west end of the Embden Ledge appears on the Main Ledge at Clark Point, Machiasport, but this motif, cut with the more angular conventionalization characteristic of late prehistoric and early historic Algonkian pictography, appears markedly less eroded than earlier more rounded petroglyphs on the same tide washed surface.

The absence of isolate male genitalia and ithyphallic figures in the petroglyphs of Machias Bay is the only distinct break in an otherwise relatively homogenous subject and stylistic continuum. Both site areas share most elements though varying in quantitative emphasis (e.g. moose representations and canoe figures occur at both site areas with moose most frequently depicted at Machiasport and canoe forms more common at Embden).

Sexual imagery similar to that at Embden is even more strongly represented at the Peterborough site in Ontario, Canada (Vastokas 1973:81ff) Areas around natural holes or fissures in the limestone are elaborated into huge female figures and symbolic coition is indicated by serpentine lines from ithyphallic males to the female figures or vulva images. The Vastokas(1973:88) relate the phallic figures to the Central Algonkian culture hero Nanabush who is distinguished by a "huge penis and unbridled sexuality".

In a similar vein, the absence of overt male sexuality at Machiasport might be related to the rather august personality of Gluskabe, hero-transformer of the Eastern or Wabanaki branch of Algonkians, who was "always sober,grave and good; all that the Indians knew of what was wise and good he taught them" (Fisher 1946:22ff).

The Vastokas go on to relate the sexual imagery to the Wabeno shamans among the Ojibway who were "particularly concerned with fertility and sexual practices" in their rituals which "took place in spring, when nature itself signalled new life and rebirth." They were careful to note "the apparent absence of any phallic images in the bark records of the Medas or Jessakkids", the other forms of Ojibwa shamanism(Vastokas 1973:88-89).

THE SEXUALITY OF THE ALGONKIAN SHAMAN

Early accounts of the Jesuits and other observers indicate that at the time of European Contact the power of the Algonkian shaman was limited only by the degree of his supposed access to the spirit world and by the possiblity that misuse of his powers would lead to retribution (i.e. bad luck, illness, death) against his family by invisible agents (spirits, familiars of other shamans). Hallowell (1946) wrote a fascinating psychological study of the Northeast Algonkian personality, finding evidence for a deeply rooted fear of another person's ill will or malevolence bordering on paranoia. This was focused, particularly, on persons believed to have spirit powers (Cf. Landes 1968).

Conversations and observations recorded by the Jesuit Le Jeune between 1633 and 1637 indicate that the spiritual domination of the shaman brought him sexual favors as well:

"They erect for him (Carigonan, a Montagnais "sorcerer") a little cabin distant from the others a stone's throw or two into which he retires to remain there alone eight or ten days , more or less. Now day and night he can be heard crying, howling and beating his drum; but he is not so solitary that others do not go to help him sing, and that the women do not visit him, and it is here that great licentiousness is carried on."

Le Jeune Relations 1897:289

Le Jeune did not ascertain the purpose of this ceremony which may, of course, have had some special significance in relation to fertility; however, whatever the shaman's ostensible purpose, another conversation with Le Jeune suggests that he was not reluctant to press the advantage of his position when the opportunity arose.

"The sorcerer (Carigonan) told me one day that the women were fond of him, for, as the savages say, it is his demon that makes the sex love him." Ibid:255

In a discussion of the generally lewd speech of Carigonan's people whose "lips are constantly afoul with ..obscenities (referring to).."the private parts of men and women", Le Jeune was careful to note that his "eyes are not offended. The Sorcerer alone has been guilty of any brutal action in my presence; the others only offend my ears, but,perceiving that I heard them, they were ashamed." Ibid:253

This special status of shamans in regard to sexual matters seems to have been present into 19th Century Maine, if the list of illegitimate children attributed to Old John Neptune, one of the last of the Penobscot shamans, can be credited (Eckstorm 1946).

However, an early source on the Indians of the northeast portions of the Maine Coast and Nova Scotia, Nicholas Denys, does not note any untoward shamanistic activity of this sort and, in fact, stresses that before extensive contact with Europeans and liquor, the women "lived pure lives; the wives faithful to their husbands, and the girls very chaste."

Denys 1908:415 (See also Ganong's note p 407)

SEXUALITY IN HISTORIC ALGONKIAN AND SIOUAN SHAMANISTIC RITUAL

In early 19th Century spring Ojibway rendevous a special group of shamans known as Wapenos performed "orgiastic" rites at night which featured tricks with fire, mock killings and revivals of initiates and other performances designed to promote fertility, success in love and the hunt (Schoolcraft 1852). Unfortunately, no explicit descriptions of these performances have turned up. The Wapeno shaman group of the Ojibwa seem to have existed in a more formal ceremonial structure with Algonkian groups practicing maize/bean production south of the Great Lakes, such as the Shawnee and Miami (Cf. Callender,1978). Again, details of performances are lost. One ceremony among the Mandan, a Siouan group who cultivated maize and beans in year round villages on the Upper Missouri River in North Dakota and went on seasonal buffalo hunts, was observed and described in detail by George Catlin in the 1830's. In this annual event, designed to bring about the return of the buffalo, initiate young men and celebrate the return of spring, a performer painted black with white circles to indicate his role as "the Evil One" runs into the village and initially pursues the women.

"A small thong encircled his waist. Attached to it, behind, was a buffalo's tail. In front, under a bunch of buffalo hair covering the pelvis, he had an artificial penis, ingeniously carved in wood, of colossal dimensions, pendulous as he ran, and extending somewhat below his knees. This, like his body, was painted jet-black, with the exception of the glans, which was a glaring red vermilion. He carried in his two hands a wand or staff eight or nine feet in length, with a red ball at the end of it, which he continually slid on the ground ahead of him as he ran. By elevating this wand, there was a corresponding rising of the penis, probably caused by some small, invisible thong connecting the two together." Catlin 1975:197

His "desperate rush" towards the women is checked by the "old master of ceremonies" or Okeepa who moves from his post by the "Big Canoe" and thrusting a medicine pipe before him paralyzes the "Evil One" so that the females can escape. The "Evil One" then turns towards a circle of buffalo dancers and mimics the actions of a rutting buffalo bull on them until exhausted. Whereupon he is ridiculed and attacked by the women, his wand broken and he himself chased from the village by the women and girls who beat him with sticks and stones and cuffs until he escapes.

Catlin's description may be all we have to suggest what may have gone on at the "orgiastic" rites Schoolcraft does not detail. While the Mandan lived beyond the nominal Eastern woodlands culture area, certain elements in their ceremony point to close ties with the Algonkians to the east, including the structure called the "Big Canoe". In Catlin"s description the "Big Canoe", standing nine feet tall,"like a large hogshead..on end, made of planks bound with hoops" is a more permanent form of the familiar temporary structure of poles bound together with an opening at the top inside of which the Jesuka shaman lay concealed while summoning the spirits to visit and prophetize.(Cf. Hedden 1984b). The petroglyph styles of the Prairie Sioux and Algonkian groups around the Great Lakes also bear identical forms and motifs in many elements (Cf. Schoolcraft 1851-57).

TEMPORAL ASSOCIATION OF ITHYPHALLIC HUMAN FIGURES WITH THE DEVELOPMENT OF FOOD PRODUCTION IN THE NORTHEAST

The Peterborough site represents the most complex concentration of ithyphallic males and other sexual imagery in prehistoric petroglyphs of the Northeast. The Vaskotas (1973;27) date the site between 900 and 1400 A.D. By this period, food production had been well established along the southern shores of the Great Lakes and in Ontario. Evidence of cultigens originally domesticated in Mexico such as squash and gourd have been radiocarbon dated to ca. 500 B.C. on the southern shores of the Great Lakes (Mason 1981:204). While maize does not appear in the Ohio Valley before 300 B.C. and then not in quantity until after 800 A.D., Mason suggests that the practice of eating the corn in its green or immature stage may contribute to the scarcity of its remains in archaeological sites of the period.

DISTRIBUTION OF PHALLIC IMAGES IN ROCK ART ELSEWHERE IN UNITED STATES

Images of phalloi and ithyphallic men cannot, so far, be traced back prior to about 600 B.C., at the end of the Late Archaic, in prehistoric rock art of United States. In rock art attributed to archaic dates (prior to 1000 B.C.), human figures lack sexual differentiation (Cf. Newcomb 1967;C.Turner 1963; Lothson 1976; Heizer and Baumhoff 1962; T. Turner 1983).

In a recent study of the Late Archaic Red Linear Style of the Lower Pecos River (ca. 600 B.C. to 100 A.D.), Solveig Turpin noted the tone of levity in the diminutive stick figures who engaged in animated group activities with male/female differentiation, phallicism, dancing or marching groups and use of S-shaped human figures to convey the impression of motion. These are contrasted to the older "monumental,costumed, faceless shamans from whom waves of power emanate to magically engulf both human and animal subjects" (Turpin 1984:182,194). Turpin attributes the Red Linear Style to buffalo hunters who entered the Pecos River basin during a brief relatively moist period near the end of the 1st Millenium B.C. when buffalo were available in the locality.

A similar transition from monumentally conceived, frontally oriented sexless costumed shaman figures to smaller, more animated, sexually differentiated figures occurs in Southwestern petroglyphs associated with the integration of horticulture into regular settlement patterns (Pueblo I- Cf. Schaafsma 1963; Turner1963 "Style 4"). Except for the ithyphallic flute-player Kokopelli, human figures in these petroglyphs retain a certain conventional stiffness characteristicof late prehistoric Pueblo art.

Ithyphallic figures are not normally present in the rock art from California and the Great Basin northward to the Columbia Basin (Cf. Heizer and Baumhoff 1962; Grant 1968), though, as the Vastokas indicate (1973:Figure 22), frontally oriented human figures with short perpendicular lines between their legs do have a broad distribution in the Far West. Superimpositions and other evidence indicates that these details on human figures are late prehistoric developments (after 1000 A.D.). Human forms of earlier date, usually represented as small linear hunters with one arm raised or as simpler forms of Archaic style shamans are not sexually differentiated (Cf. T.Thomas 1983:313; Grant 1968).

Summary and Conclusions:

The distribution of ithyphallic male figures in rock art from the area around the Great Lakes to Maine can be tentatively related to 1) a concept of a fool or buffoon who portrays unbridled sexuality in a role intended to enhance fertility; 2) the elaboration of the theme of "unbridled sexuality" and its consequences in oral traditions with an intensive development from the Great Plains to the Great Lakes and 3) the self indulgence of certain shamans who, as authority figures, took advantage of the sexual privilege afforded by ritual practices. If the evidence of rock art is pertinent, this development is coeval with the gradual adoption of horticulture in the Northeast. There is no evidence in the rock art of archaic age in United States for the representation of ithyphallic males.

The Vastokas (1973:86ff) have argued that "phallic images are as old as shamanism and ought to be interpreted in the light of shamanic experience and practices.." They cite, after Eliade,many examples of Siberian shamanistic practice which involve an explicit sexual view of the relationship to spirits. They refer to the Desana of Columbia where the "Master of Animals" is "a phallic being in charge of the fertility of game animals." and finally they conclude that "the female images at the (Peterborough) site might be interpreted as materializations of the manitous or spirits of nature and the male figures as representations of shamans in their capacity as phallic creatures."

The risks in extrapolating back in time from the ethnographic present are manifest here. It is difficult to believe that male sexuality would not appear in archaic rock art if the artists (shamans) envisioned it in so intimate and direct a manner. The real mystery is why are the archaic images essentially sexless? A similar phenomenom appears in some sequences of Siberian rock art (Okladnikov,1970) with shamans distinguished by sexual attributes only during the neolithic and later bronze-iron age period designs. I have no reliable information on Columbian rock art, but, again, given the long and rich cultural history of the area, I would hesitate to attribute great age to the practices of the Desana on the ethnographic level without confirmation through a study of prehistoric art forms.

"Phallic figures" may indeed be "as old as shamanism". Certainly one example in Upper

Paleolithic cave art would seem to confirm the potential (Vastokas1973:Figure 23). What is not established is the continuity of a tradition emphasizing phallicism in prehistoric art from, say, 13,000 to 2500 years B.P. in North America. Female figures and abstract to naturalistic vulva forms do appear frequently enough in the Upper Paleolithic of Eurasia and in archaic rock art of North America to suggest a possible continuity (Cf. Davis 1961:236-238;T. Thomas 1983), but where are the corresponding male figures?

This raises other questions. Can we on the basis of apparent content in rock art argue a congruence with oral traditions? In other words, does the absence of phallicism in rock art mean the ribald trickster stories were also not present? Certainly this is suggested by the correspondence between the rather proper Gluskabe stories and the absence of phallicism in Machias Bay petroglyphs. If this correlation is significant, a similar absence of phallicism in rock art sequences of Europe (cf. Anati,1976) suggest that the ribald tales that distinguish many IndoEuropean and North Asian language groups may not be older than the late Neolithic or early metal using ages.

And what is the significance of the temporal association of phallicism in rock art with incipient horticulture in the Northeast? Women seem to have taken on most of the work associated with raising crops as an extension of their normal gathering activities. The male involvement seems to have stayed minimal beyond, perhaps, clearing new fields. In references to rituals involving ribald performances, the fertility message is directed more towards animals than crops. I suspect that the development of a moderate surplus (through food production, trade,etc.) had the effect of liberating a certain segment of the population (i.e. the male shamans) to pursue their fantasies and games in a manner to which they had not hitherto been accustomed.

In the more highly structured village societies to the south of the Great Lakes, the kind of individualism that characterized the northern hunter/gatherers was probably not encouraged.

NOTE: The fieldwork on which the cover drawing and these comments are based was originally undertaken with the aid of the Maine State Museum in 1977 and 1981 and research sustained with the help of the Maine Historic Preservation Commission and the Maine Archaeological Society which the author gratefully acknowledges.

References

Anati, Emmanuel
1976. Evolution and Style in Camunian Rock Art Archivi, Vol. 6. Capo di Ponte (Italy).

Callender, Charles
1978. Articles on: Miami,Shawnee, Illinois, etc. in Handbook of North American Indians Vol. 15. NORTHEAST Bruce G. Trigger, Ed. Smithsonian Institution. Washington

Catlin, George
1975. Letters and Notes on the North American Indians. Michael M. Mooney, Ed. New York

Davis, Emma Lou
1961. Mono Crater Petroglyphs,California. American Antiquity vol 27 #2 p236-38

Denys, Nicholas
Description and Natural History of the Coasts of North America (Acadia) Wm F. Ganong,Trans. Champlain Society. Toronto.

Eckstorm, F.H.
1945. Old John Neptune and Other Maine Indian Shamans. Portland

Fisher, Margaret W
1946. Mythology of Northern and Northeastern Algonkians. in: Man in Northeastern North America

Fraser, Douglas
1966. The Heraldic Woman. In: The Many Faces of Primitive Art Douglas Fraser, Ed. Prentice-Hall Englewood Cliffs, N.J.

Grant, Campbell, James W. Baird and J. Kenneth Pringle
1968. Rock Drawings of the Coso Range. Publication 4 Maturango Museum China Lake, CA.

Hedden, Mark
1984a. The Form of the Cosmos in the Body of the Shaman. Comment on Cover Drawing. MAS Bulletin Spring.
1984b. The Hunter/Shaman. Comment on Cover Drawing. MAS Bulletin Fall

Heizer, Robert F and Martin A. Baumhoff
1962. Prehistoric Rock Art of Nevada and Eastern California. University of California Press. Berkeley.

Landes, Ruth
1968. Ojibway Religion. University of Wisconsin Press. Madison.

Le Jeune, Father
1897. Jesuit Relations-1634. Volume VI Thwaites Edition. Cleveland.

Lothson, Gordon A.
1976. The Jeffers Petroglyph Site. Minnesota Prehistoric Archaeology Series #2. Minnesota Historical Society St. Paul

Mason, Ronald J.
1981. Great Lakes Archaeology. Academic Press. New York.

Newcomb, W.W.
1961. The Rock Art of Texas Indians. University of Texas. Austin

Okladnikov, A.P.
1970. Yakutia. Arctic Institute of America. Trans. from Russian Sources #8. Montreal.

Schaafsma, Polly
1963. Rock Art in the Navajo Reservoir District. Papers in Anthropology #7 Museum of New Mexico. Santa Fe.
1970. Rock Art of Utah. Papers, Peabody Museum of Archaeology Vol. 65. Cambridge

Schoolcraft, Henry R.
1851-57. History of Indian Tribes of U.S.. Six volumes. Philadelphia.

Turner, Christy II
1963. Petroglyphs of the Glen Canyon Region. Museum of Northern Arizona Bulletin 38. Flagstaff

Turner, Trudy
1983. Rock Art of Gatecliff Rock Shelter. IN: Archaeology of Monitor Valley 2: Gatecliff Rockshelter. Anthropology Papers,Museum of Natural History. New York.

Turpin, Solveig
1984. The Red Linear Style Pictographs of the Lower Pecos River Region, Texas. in Plains Anthropologist vol 29 #105 p181ff

Vastokas, Joan and Romas
1973 Sacred Art of the Algonkians. Mansard Press. Peterborough.

CULTURAL ECOLOGY IN PASSAMAQUODDY BAY, NEW BRUNSWICK

David Sanger

University of Maine, Orono

(Author's note: This paper is the text of an oral presentation, with slides, given at the Huntsman Marine Biology Symposium, St. Andrews, New Brunswick, June 7, 1984. References have been added for inclusion in the Bulletin.)

For the purposes of this paper, cultural ecology represents the relationship between the natural and the cultural systems. The spatial dimension is Passamaquoddy Bay; the temporal context is from 3,000 years ago to the arrival of Europeans, about A.D. 1600. The primary source of data is the abundant shell midden sites of the Quoddy Region.

The presence of shell midden sites in the region was publicized by papers given a century ago. In particular, the presentation by G. F. Mathew (1884) recounting the interdisciplinary excavation at Bocabec in 1883, represented a fine beginning. Unfortunately, over the next 80 years archaeology in the area was underdeveloped, and it was not until the 1960s that any significant excavations took place in the Maritimes.

In the 1960s, the National Museums of Canada began a program of site survey and excavation that culminated in excavations between 1969 and 1972. During that period a number of shell midden sites in the Quoddy Region were located, tested, and excavated. Some information has been published (Bonnichsen and Sanger, 1977; Davis, 1978; Sanger, 1971, 1975, 1981). Much is in unpublished manuscripts and theses (Burns, 1971; Crotts, 1984; Lavoie, 1972; McCormick, 1980; Stewart, 1974).

More recently, in response to concerns about site destruction through erosion, the Province of New Brunswick has continued survey and test excavation in the Quoddy Region (Davis, 1982; Davis and Christianson, 1981).

Prehistoric peoples settled around Passamaquoddy Bay, both on the mainland, and on the West Isles. Sites tend to be located with south to southeast exposures, near mud flats, and close to beaches suitable for launching and landing canoes. Our sample is definitely skewed by the erosion that has taken place as a result of rising sea-levels or, more properly, sinking shorelines.

Part of the study of settlement pattern is a determination of the season of occupation. Using a combination of seasonal indicators, it can be shown that a certain amount of coastal year-round occupation may have occurred in prehistoric times. Sites located around the northern periphery of the Bay tend to reflect cold season occupation; that is, late fall to early spring. Preliminary results suggest summer occupations may have been more common in the West Isles (Black, 1983).

These findings are contrary to the generally assumed pattern of summer residence on the coast and winter residence inland, an axiom brought about by the early historic accounts of the native peoples (Bourque, 1973; Sanger, 1982).

Seasonal indicators fall into two broad classes. The first is the presence of species that are seasonally specific to the area. Assuming that the seasonality pattern has not changed in the past few thousand years, the presence in a midden of winter-only birds provides evidence for a winter kill. More reliable, although not without problems, is the analysis of endogenous changes that may be seasonally dependent. For example, the presence of annual growth rings in clams (Hancock, 1982) or the cementum layers in mammal teeth (Bourque, et. al., 1978) can be employed to estimate season of death.

The study of subsistence, the livelihood of the prehistoric inhabitants, derives from the remains of animal and plant foods brought back to the archaeological sites. It must be remembered that the species present in the middens represent only those captured, gathered, and picked by the local inhabitants. As such, food preferences enter the picture. Some species may have been shunned because of the perceived unfavorable ratio of harvest energy expended for energy gained in consumption. Others may have been purely "starvation foods", or avoided due to taste or even religious taboos. Furthermore, we cannot assume that the ratio of species in the midden directly reflects the actual ratios in the field.

Archaeological collection procedures must also be taken into account. Excavations can recover only those bones discarded in areas that archaeologists dig. Although this may seem obvious at first glance, one should consider that archaeologists do not necessarily excavate everywhere that the bones were originally deposited. For example, bones discarded below the high tide mark will not be represented, neither will bones deposited behind the site where there are insufficient shells to neutralize the acid soil. Site erosion may make it impossible to assess the original number of bones in the site, with the result that the oft-asked question, "How many people lived here?", cannot be answered with any degree of confidence.

Finally, our experience has shown that various parts of any one site may contain different species and elements of those species (Bonnichsen and Sanger, 1977; Sanger and Chase, 1983). House depressions, for example, often contain a disproportionate number of skull bones. Thus, variable sampling techniques can influence the fossil assemblage quite significantly. Small bones will not be retained on the 6 mm. mesh normally used to screen archaeological deposits. While the preservation in the neutral to alkaline shell midden matrix is excellent for bone remains, botanical species are rarely preserved.

In summary, while there are many problems with using the shell middens as paleontological sites, it is a fact that they represent the only fossil bone collections known from the area.

Our work in the Quoddy Region has produced over 50 different vertebrate species (Bonnichsen and Sanger, 1978). To this can be added numerous intertidal shellfish, the most numerous of which is the softshell clam.

Analysis of important food remains, based on actual bone counts and on minimum numbers of individuals (MNI's). shows the relative importance of deer, moose, caribou, beaver, and seal (Table 1). To these must be added the contribution from shellfish which is even harder to quantify.

What we see is a diffuse subsistence strategy based on a combination of species from terrestrial and marine environments. Chance encounter, high risk species, such as moose, occur together with lower yield, but dependable, intertidal shellfish. The lack of specialization is what one might expect of hunters and gatherers foraging in this species rich region.

The faunal remains in the shell middens are of interest to those concerned with bio-geography in the northeast. Two species may be cited as examples.

The first is the white-tail deer, an animal that was scarce or even non-existent in the Quoddy Region during the historic period except for the past century. The spread of the deer into this region is usually ascribed to land clearing and agricultural activities. The relative abundance of deer in the prehistoric middens is a clear indication that the commonly-held notion of a recent range extension brought on by lumbering and farming is questionable. There is a tendency, however, for the latest prehistoric sites, those dating from A.D. 1000 to the historic, to have more caribou and moose than deer, whereas earlier sites show more deer. For example, compare Sand Point site dated at 1500 B.P. to 2000 B.P. with Carson at about 1000 B.P. (Table 1) where the ratios of moose to deer bones are reversed. It may be that the onset of longer winters, brought about by the Neoglacial, or Little Ice Age, of the northern latitudes, resulted in conditions that favored the moose and caribou.

The second species is the now extinct sea mink (Mustela macrodon). To date, this highly distinctive mustelid has not been recognized in bone assemblages from Quoddy Region shell middens, although there is a reported live sighting from Campobello Island in the nineteenth century. Sea mink bones are very common in middens along the coast of Maine from Machias to Casco Bay, in sites dating from 5,000 years ago to the historic period. Two of my colleagues, Arthur Spiess and James Mead, are currently preparing a detailed description of the species and its range based almost entirely on the

TABLE 1

SELECTED FAUNAL ELEMENTS FROM FOUR
PASSAMAQUODDY BAY SITES

Species (1)	Sand Point			Minister's Island			Teacher's Cove			Carson			Totals		
	bones	%	MNI	bones	%	MNI	bones	%	MNI	bones	%	MNI	bones	%	MNI
Beaver (2)	457	21.9	6	351	13.8	12	454	16.0	5	221	16.0	7	1483		30
Deer	166	7.9	6	99	3.9	5	556	20.0	12	20	1.4	1	841		24
Moose	28	1.3	1	150	5.9	3	130	4.7	2	94	6.8	3	402		9
Caribou	12	0.6	2	54	2.1	2	9	0.3	1	7	0.5	1	82		6
Harbor Seal	18	0.6	4	10	0.3	6	1	-	1	3	0.2	1	32		12
Grey Seal	6	0.1	1	27	1.1	2	12	0.4	2	-		-	45		5
Total mammal bones in site	2091			2552			2784			1382					

Notes:

(1) Tabulations based on Burns, 1971; McCormick, 1980; Stewart, 1974
(2) Beaver MNI based on bones only - not teeth which would inflate MNI

archaeological evidence. The sea mink appears to have favored the rocky intertidal zone and is especially prominent in island sites. If the shell midden faunal collections of the Quoddy Region continue to demonstrate an absence of sea mink, it might mean that the cliffs which dominte the shoreline between Machias Bay and Lubec constituted a significant barrier to the spread of this species. To date, the eastern-most well documented collection of sea mink remains comes from the Roque Island area, site 61-17 (Sanger and Chase, 1983).

The cultural ecological perspective to the study of past human societies attempts to place the cultural systems in juxtaposition with the contemporary natural systems. This perspective views the systems as constantly changing with multiple feedback loops. People are not seen as passive actors in the process. The native peoples of the Northeast exercised considerable choice in selection of habitat and resources to exploit. It also seems likely that they were quite capable of profoundly altering their environment, through the deliberate use of fire to achieve desired vegetation, although there is no evidence for this in the Quoddy Region.

It is unlikely that the native peoples were able to have much effect on the marine ecosystem. While over-predation of a sessile species such as the clam was a possibility, most of the clam shells in the middens are of mature individuals, implying a deliberate selection for large specimens, or mud flats dominated by mature clams.

If the clam gathering process involved following down syphon holes with hands ("pickin"), then there could have been a tendency to focus on the larger specimens to the exclusion of the smaller, younger, members of the flat. Experience has shown that with relatively little practice it is possible to gauge the size of the clam from the syphon hole with considerable accuracy. As the larger individuals became increasingly scarce, the time and energy involved in collection would be less and less profitable, until a move to another clam flat was desirable. If this was indeed the exploitation pattern, then there would be a sizeable remnant population of clams for growth to maturity. The large number of sites may be a reflection of this sort of collection strategy, rathern than the result of large human population sizes.

The biological productivity of the Gulf of Maine region is reflected in the number of prehistoric sites. From Casco Bay to Passamaquoddy Bay nearly 2,000 sites have been documented. A major challenge for regional archaeologists is to reconstruct past carrying capacities. To date, relatively little has been done towards this end. If we are to integrate the cultural activities with the biological record, a method must be found to reconstruct past environments. This has not been a research issue of interest to most marine biologists working in the Gulf of Maine.

Fortunately, there has been considerable interest lately in this history of sea-level rise in the Gulf of Maine. That there has been a rise of sea-level is evident to anyone who observes the eroding coasts of this region. What has been much more difficult to establish is the rate of sea-level rise. The rate of rise could be important to modelling the past biological productivity of the Gulf of Maine because studies suggest that the tidal amplitude is a product of sea-level (Grant, 1970; Scott and Greenberg, 1983). A substantially reduced tidal range would presumably decrease the mixing effect and thus lower the productivity of the Gulf. Man would be one of the inhabitants affected by the change.

As a working hypothesis, I suggest that as sea-levels rose the increased tidal range enhanced the carrying capacity of the Gulf of Maine for human populations. As a first step, therefore, a better understanding of the chronology of sea-level rise is important.

Douglas Grant (1970) employed an interdisciplinary model to develop a general sea-level rise curve for the Gulf of Maine. Grant pointed out the utility of archaeology as a contributor to sea-level rise analysis through the use of the age of sites to provide a minimum date for a land surface at or around current sea-level. If it can be shown that people lived on an active shoreline, then the age of the deposit provides a means for dating the age of that shoreline.

There are many problems with the methodology, none perhaps so great as the assumption that prehistoric peoples in the littoral lived on active shorelines. All of the 2,000 known middens are within a few meters of the shoreline. In all too many instances, the sites are actively eroding. A number of sites show some time depth. In the Penobscot Bay area, for example, sites of 5000 B.P. are documented (Bourque, 1976). Some of these sites have more recent deposits stratified over the earlier.

In the Quoddy Region there are no sites which have radiocarbon dates earlier than about 2400 B.P., a determination on the large site on Minister's Island. Several sites, lacking radiocarbon dates, may be several hundred years older. A number of sites are in the vicinity of 2000 B.P., while still others date from 1000 B.P. to the historic period. Within limits, the age and distribution of these sites provides a proxy method of measuring sea-level rise.

A number of different sea-level rise curves have been generated for the Gulf of Maine. None have been totally satisfactory due to several problems, including: measurement errors, inexact chronology, and geographic variability of crustal subsidence within the Gulf. Each cur ve, then, applies only to the region for which it was developed.

Land subsidence in the Quoddy Region is currently measured at a rate of 9 mm. per year (Tyler and Ladd, 1980). This rate of rise is not likely to have been constant for more than a century or two. If the 9 mm. per year rate of rise is extrapolated back 2,000 years, it would suggest that sites currently on the shorelines were first lived on when the shoreline was 800 to 1,000 meters away. Subsequent occupants continued to live on the same spot until the last residents were at the water's edge. For canoe-using people, heavily dependent on shellfish and other marine resources, this scenario makes no sense whatsoever. Other archaeological evidence points to the same conclusion regarding rate of sea-level rise.

There are at least seven sites, out of an estimated 80, that pre-date the arrival of pottery in the region, an event that occurred sometime after 2500 B.P. Three of these underlie more recent shell middens, but the other four do not. None of the four shows any indication of shellfish utilization, yet they are located in the marine zone. In other parts of the world, there is an apparent correlation between the slow down of the sea-level rise curve and the development of large shell middens (Fladmark, 1983). The shell-free sites in the Quoddy Region may be a reflection of rapidly rising sea-levels until about 2500 B.P., when the relative slow-down resulted in formation of mud flats and an enhanced inter-tidal environment for people to exploit. Some shell middens developed in the same spot for close to 2,000 years, until the renewed, rapid, land subsidence caused the current site erosion problem.

Corroborating geological evidence derives from several sediment cores taken in Digdeguash Harbour (Passamaquoddy Bay) with the idea of recovering dateable organics from the drowned valley. If the 9 mm. per year rate is applied, the area cored should have been dry land 2,000 years ago. Instead, we have radiocarbon dates on clams going back to 5000 years B.P. In sum, the evidence suggests that the rate of sea-level rise is much faster now than it was in the past. The archaeological data supports rapid rise up to 3000 or 2500 B.P., followed by a period of limited rise, followed again by the recent rapid rate(Sanger, 1984). Several Bay of Fundy sea-level curves display a change in the rate of rise at around 2500 B.P. (Scott and Greenberg, 1983).

In this brief, but broad, overview of cultural ecology in the prehistory of Passamaquoddy Bay a great many details had to be deleted. What I have attempted to show is that the archaeological shell middens of this area provide a record of human utilization of and adaptation to the changing environments of the Quoddy Region.

References Cited

Black, David

1983. What images return: a study of the stratigraphy and seasonality of a small shell midden in the West Isles of New Brunswick, unpublished M.A. thesis, McMaster University.

Bonnichsen, Robson and David Sanger

1977. Integrating faunal analysis, Canadian Journal of Archaeology, 1:109-133.

Bourque, Bruce

1973. Aboriginal settlement and subsistence on the Maine coast, Man in the Northeast, 6:3-20.

1976. The Turner Farm site: a preliminary report, Man in the Northeast, 11:21-30.

Bourque, Bruce, Morris, K., and A. Spiess

1978. Determining the season of death of mammal teth from archaeological sites: a new sectioning technique Science, 199:530-531.

Burns, James

1971. Report on faunal analysis from istes in Passamaquoddy Bay, New Brunswick. Manuscript on file, Archaeological Survey of Canada, Ottawa.

Crotts, Anita

1984. Pattern and variation in prehistoric lithic resource exploitation in the Passamaquoddy Bay region, Charlotte County, New Brunswick, unpublished M.S. thesis, University of Maine, Orono.

Davis, Stephen

1978. Teacher's Cove: a prehistoric site on Passamaquoddy Bay, New Brunswick Archaeology Series 1, Number 1, Historical Resources Administration, Fredericton, New Brunswick.

1982. Coastal erosion and archaeological sites in Charlotte County, New Brunswick - 1980 survey, In, Archaeological resources in the Maritimes: 1980, (ed. Christopher Turnbull), Historical Resources Administration, Fredericton, New Brunswick, :1-24.

Davis, Stephen and David Christianson

1981. Archaeological resources in the Maritimes: a coastal survey - 1979, In, Report in Archaeology, Number 4, Historical Resources Administration, Fredericton, New Brunswick.

Fladmark, Knut

1983. A comparison of sea-levels and prehistoric cultural developments on the east and west coasts of Canada, In, The evolution of maritime cultures on the Northeast and Northwest coast of America, (ed. Ronald Nash), Publication Number 11, Department of Archaeology, Simon Fraser University, :65-75.

Grant, Douglas

1970. Recent coastal submergence of the Maritime provinces, Canada, Canadian Journal of Earth Sciences (7):676-689.

Hancock, Mary
1982. The determination of archaeological site seasonality using the remains of Mya arenaria (L.), examples from the central Maine coast, unpublished M.S. thesis, University of Maine, Orono.

Lavoie, Jacques
1972. Le site Sandy Point (BgDs:6) et l'origine de la tradition sylvicole dans la gegion de la Baie de Passamaquoddy, Nouveau-Brunswick, unpublished M.A. thesis, University of Montreal.

Mathew, George
1984. Discoveries at a village of the stone age at Bocabec, Bulletin of the Natural Historiy Society of New Brunswick, No. 111.

McCormick, James
1980. Criteria in archaeological faunal analysis: four Passamaquoddy Bay cases, unpublished M.S. thesis, University of Maine, Orono.

Sanger, David
1971. Prehistory of Passamaquoddy Bay: a summary, Bulletin of the Maine Archaeological Soceity, 12(2):14-19.
1976. The earliest settlements: 9000 B.C. to A.D. 1600, In, Deborah Thompson, ed., Maine Forms of American Architecture, Colby College Museum of Art, Waterville, Maine.
1981. Unscrambling messages in the midden, Archaeology of Eastern North America, (9):37-42.
1982. Changing views of aboriginal seasonality and settlement in the Gulf of Maine, Canadian Journal of Anthropology, 2(2):195-203.
1984. Sea-level rise in Passamaquoddy Bay: archaeology and sediment cores, In, Thompson, W. B. and Joseph Kelley, eds., New England seismotectonic study in Maine during fiscal year 1983, Augusta, Maine, Maine Geological Survey report to Nuclear Regulatory Commission.

Sanger, David and Thomas Chase
1983. An introduction to the archaeology of the Roque Island group, Maine., Paper read at the Canadian Archaeological Association Meeting, Halifax, Nova Scotia.

Scott, David and David Greenberg
1983. Relative sea-level rise and tidal development in the Fundy tidal system, Canadian Journal of Earth Sciences, 20(10):1554-1564.

Stewart, Frances
1974. Faunal remains from the Carson site (BgDr:5), New Brunswick, manuscript on file, Archaeological Survey of Canada, Ottawa.

Tyler, David and J. Ladd
1980. Vertical crustal movement in Maine, In, Thompson, W. B. ed., New England seismotectonic study activities in Maine during fiscal year 1981, Augusta, Maine, Geological Survey of Maine report to Nuclear Regulatory Commission, :99-153.

AN INTERTIDAL ARCHAEOLOGICAL SURVEY OF THE SCARBOROUGH MARSH

Brian S. Robinson

INTRODUCTION

The survey of the Scarborough Marsh reported herein is directed toward intertidally submerged prehistoric and historic period sites. Over the past six to seven thousand years, prehistoric archaeological sites have been innundated by the relative rise of sea level (coastal submergence). Although the rate of coastal submergence varies for different areas of the New England coast, the general pattern for Massachusetts, New Hampshire and at least Southern Maine is as follows. Middle Archaic sites (6,000-7,000 years BP) may be 30 to 40 feet below the present high tide mark (Keene, 1970:65). Late Archaic sites (about 4,000 years BP) that were originally 5 to 10 feet above high tide are now at intertidal elevations. Late Archaic occupation levels have been found below layers of salt marsh sod at sites in Massachusetts (Dincauze, 1972; Johnson and Raup, 1974; and Robinson, in press) and New Hampshire (Robinson, in press). Woodland and Historic Period occupation sites are likely to be found on dry land, but even they may extend into wet areas that would not now seem like favorable areas for occupation. In addition to submerged occupation sites that once existed on dry land, intertidal areas preserve the remains of water-oriented activities such as prehistoric and historic period fish weirs, boat remains, colonial tidal mills, and wharf remains.

Although changing coastal geography has confused the situation, there are a few positive effects of submergence. Submerged sites in sheltered embayments may be well preserved below their protective layer of marsh sod. The Seabrook Marsh site (Robinson, in press) was submerged 3,400 years ago, leaving a Late Archaic site free of mixing and disturbance by later Woodland and Historic Period activities. In addition, anoxic, water-saturated conditions are ideal for the preservation of organic soil horizons, faunal remains, and even uncharred vegetal remains.

The problems encountered during excavation of an intertidal site are amply compensated by the advantages presented by some submerged sites, as long as drainage channels are near at hand. It is probable that sumberged sites exist that have such good organic preservation that artificial drainage or underwater excavation would prove rewarding. Late Archaic fish weirs (Johnson, 1942) or Middle Archaic occupation sites (Spiess, Bourque and Cox, 1983:93) may be 15 to 30 feet below mean sea level, but the cultural information they contain may also be unique. Such sites may be encountered during dredging, fishing activities, or construction in wetland areas.

In short, different elevations and marsh environments have different archaeological potential. Coastal archaeological surveys restricted to dry land testing may be selective toward Woodland Period sites. In contrast, the present survey is directed primarily toward Late Archaic occupation sites and more recent riverine activities in the intertidal zone. Eight days of fieldwork were spent in search of prehistoric occupation areas and submerged terrestrial soil horizons while noting more recent remains of marsh activities. The methods presented here should be applicable to similar environments along the New England coast wherever the history of coastal submergence has been generally similar.

THE SEABROOK SITES-SETTLEMENT PATTERN

The Rocks Road, Hunts Island and Seabrook Marsh sites represent two predominantly late period dry sites and an Archaic Period submerged site in the Seabrook/Hampton Estuary of New Hampshire. The Rocks Road site (University of New Hampshire excavations directed by Charles Bolian) is situated on the southern slope of a

peninsula that extends well into the estuary toward the mouth of the bay. The Hunts Island site (University of New Hampshire excavations, Billee Hoornbeek) lies further to the east, centrally within the marsh. The Seabrook Marsh site lies still closer to the estuary mouth on a piece of submerged land that may once have been connected to Hunts Island. Preliminary faunal analysis from the Rocks Road site indicates extensive use of land mammals, soft shell clam and large codfish. At the Seabrook Marsh site there is frequent occurrence of land fauna with a more diverse assemblage of marsh birds, estuarine fishes and deep water fishes, including swordfish. If soft shell clam was utilized at the Seabrook marsh site the shells have dissolved during 3,000 years of submergence.

Although the subsistence orientation and seasons of occupation appear to have differed at the these sites, the choice of site location seems to be similarly based. Generally, the locations are protected from the open sea while providing easy access to the resources of three major environments: inland woods, the estuary and the open sea.

The most important factors encouraging repeated occupation of a site in this type of marsh environment would appear to be proximity to central estuarine areas, the estuary mouth and the open sea. In the Seabrook Marsh the landforms projecting into the marsh pinch out and then often reappear as islands further into the marsh. This landform pattern probably helped to concentrate the number of occupations, since the available land mass became smaller as the estuary mouth was approached. Using artifact density and the thickness of midden as indicators of site concentration, the Rocks Road site to the west was the least densely occupied, while Hunts Island and the Seabrook Marsh site to the east or seaward, were more densely occupied.

Neither the Seabrook nor the Scarborough Marsh has any major fresh water rivers emptying into it. Both have numerous seasonal fresh water streams and a few small permanent streams. At least one site is recorded in the Seabrook Marsh that is associated with a small fresh water stream at the source of an intertidal marsh creek. It is notable, however, that none of the three sites from Seabrook described here are near significant fresh water streams. It is possible that the abundance of small fresh water sources, such as intermittent streams and upwelling ground water at the marsh edge, make fresh water a common commodity and, therefore, not an important factor in the concentration of sites.

Numerous other factors would have influenced specific settlement location including steepness of slope, slope orientation, presence of bedrock windshelter, and the presence of maintained or natural clearings. The importance of many of these factors is not easily determinable in an intertidal survey, since the submerged land forms are visible only as a profile in a marsh bank. Therefore, for the present survey a simple model of settlement pattern is used, suggesting that prehistoric occupations are concentrated on land masses that are accessible to central estuarine resources and to the open sea.

SCARBOROUGH MARSH SURVEY-OBJECTIVES

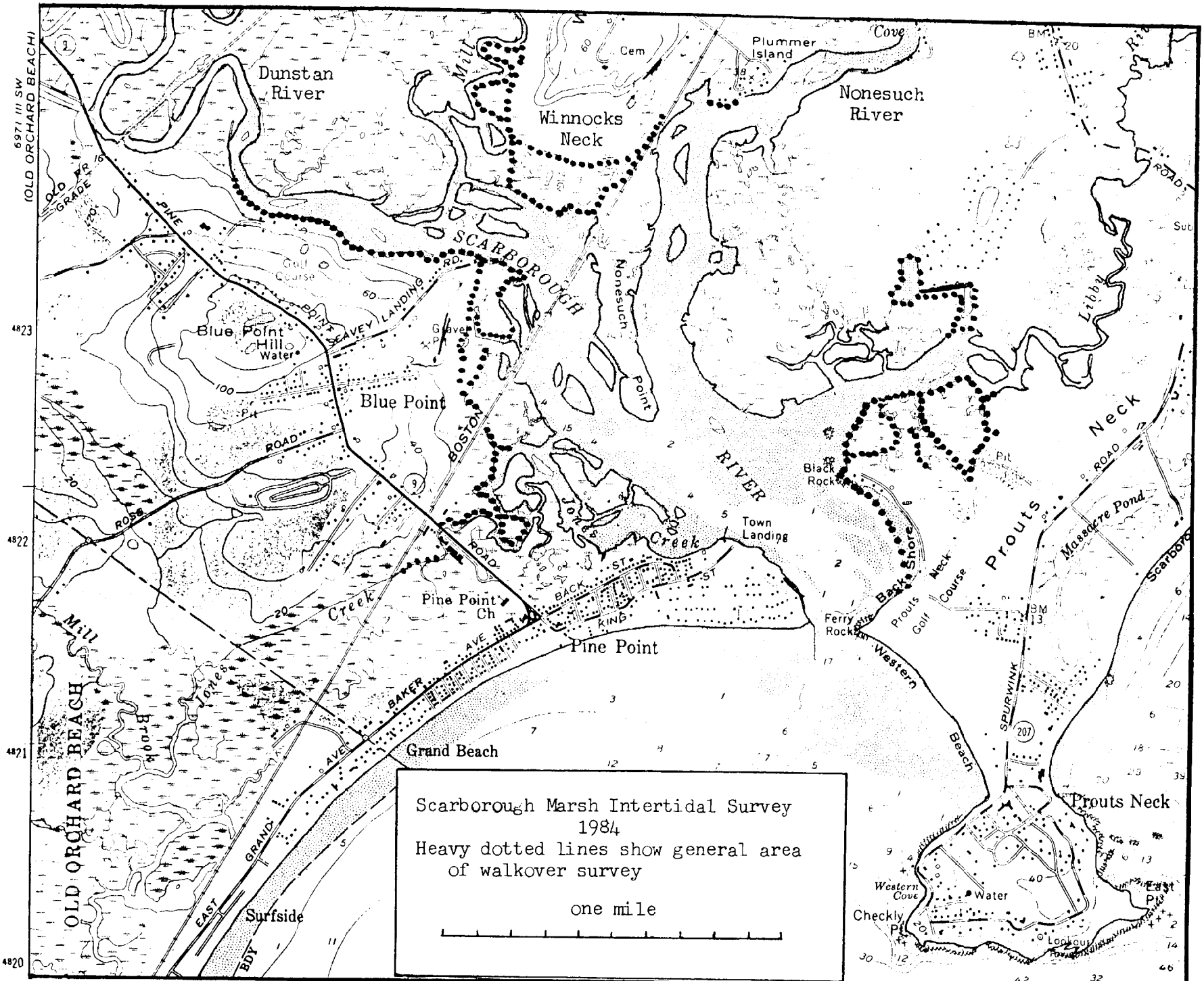
The Scarborough Marsh Intertidal Survey (Figure 1) was directed toward locating cultural sites in the intertidal zone within areas of expected site concentration. It is not intended to define the distribution of sites within the estuary. Nor does it define sites relating to differing subsistence activities except for the coincidence that Archaic dry land occupation sites now exist at the same elevation as more modern river activities such as fish trapping and boat wharfing. The survey is restricted to those areas of the marsh with subsurface visibility such as creek banks and artificial ditch walls. It is, therefore, only somewhat more thorough than a surface walkover in the woods looking for tree throws and rodent burrows. The search itself will, however, provide examples of the numerous processes of submergence that account for the excellent preservation, and the destruction, of intertidal sites.

SUBMERGENCE AND SITE PRESERVATION

In order for surface sites to be preserved,

Figure 1

Scarborough Marsh Intertidal Survey, 1984. Heavy dotted lines show general area of walkover survey.


6971 III SW
(OLD ORCHARD BEACH)
Dunstan River
Mill
Winnocks Neck
Cem
Plummer Island
Cove
Nonesuch River
BM
OLD GRADE
PINE
SCARBOROUGH
RD.
Golf Course
SEAVEY LANDING
Gravel Pit
Blue Point Hill
Water
Blue Point
ROAD
BOSTON
Nonesuch Point
RIVER
Libby
Black Rock
Pit
Prouts Neck
Massacre Pond
Town Landing
Creek
Jones
ROSE
Pine Point Ch
BACK
ST
KING
AVE
Pine Point
Back Shore
Prouts Neck Golf Course
Ferry Rock
Western Beach
SPURWINK
207
Mill
Brook
Jones
BAKER
GRAND
EAST
BDY
Grand Beach
Surfside
OLD ORCHARD BEACH
Western Cove
Water
Checkly Pt
East Pt
Lookout
4823
4822
4821
4820
Scarborough Marsh Intertidal Survey
1984
Heavy dotted lines show general area
of walkover survey
one mile

innundation must take place in a relatively calm environment or during a period of rapid deposition. (Sites directly adjacent to major tidal channels may be eroded by tidal wash resulting in secondary deposits of lithic debris.) The stratigraphy of a submerged intact occupation site will reflect the dry land soil development prior to submergence, and therefore, help to distinguish intact deposits from secondary beach gravels mixed with artifacts. The activity of a marsh channel may often be judged by the present border between the upland and the marsh edge. An abrupt slope or bank at the marsh edge may indicate that the upland border has been eroded back to its present position and then filled in by developing marsh sod. A relatively gentle transition indicates a gradual overtaking of the land by peripheral marsh grasses.

The maximum depth of marsh sod in the Seabrook/Hampton marsh indicates that it has been grass covered for only about 4,000 years (Keene, 1970:69-70). Prior to this time the rate of sumbergence was too great to allow the grass to establish itself, and the estuary was characterized by mud flats toward the periphery and sand flats toward the center. Evidence from the Scarborough Marsh indicates that this and similar marshes are filled by sediments washed in from the sea, so the rate of filling is not dependent on riverine sedimentation (Farrell, 1970). Occupation sites innundated prior to 4,000 years ago would likely be overlain directly by mud and sand. Those sites presently at intertidal levels were innundated less than 4,000 years ago and are, therefore, often directly overlain by marsh sod with marsh grass roots permeating deeply into the old land surface (40 to 50 cm). At the Seabrook Marsh site, the presence of a salt grass root mat on top of artifacts in the old occupation layer provided evidence that the artifacts had not been disturbed in recent times, even though they were near an eroded surface.

Old submerged land surfaces may also be covered by a layer of sand blown in from a nearby beach or from the sand flat surface. Wind blown sands also create dunes behind which fresh water lagoons may develop, leaving a layer of fresh water peat on top of an old dry surface. Peat layers are also frequently associated with low flatlands close to the marsh edge that are kept fresh by groundwater and upland runoff. There are no doubt many other possible innundation sequences that would result in different stratigraphic sequences in submerged sites.

ORGANIC PRESERVATION IN SUBMERGED SITES

As previously noted, permanent saturation is an excellent preservative of many organic substances including organic soil horizons, wood and sometimes bone. It is, therefore, possible to find preserved cultural remains that are rarely found in an uncarbonized state on dry sites. Generally, however, occupation sites are dry at the time of occupation and most organic artifacts disintegrate before the site becomes permanently saturated. For example, an apparent post from a late period of occupation (3,400 years BP) was the only cultural item of wood preserved at the Seabrook Marsh site, and this may have been related to a waterside activity rather than a dwelling. It is notable that at the Seabrook Marsh site, no preserved tree stumps were found in place, only a few badly disintegrated roots at considerable depth. This suggests that perhaps the site may have been clear of trees at the time of submergence, possibly from cultural activity. Another possibility is that upland dwelling species of trees on a well drained site will be killed by salt water intrusion, and the upper trunk portion disintegrated prior to permanent saturation. If the latter case is true, it suggests that occupation sites are not likely to be found in submerged soil horizons that are associated with an abundance of well preserved tree stumps. At submerged forest sites in the Scarborough Marsh and at Odiornes Point in New Hampshire (Harrison and Lyon, 1961), large well preserved trunks and fallen logs are often associated with thick peat layers containing well preserved branches, leaves and pine needles. The lagoon or swamp environment that produced the peat layer would not have been an inviting spot for habitation. Although these submerged forests may never have been inhabited, a nearby dry knoll may have. Refuse deposited on the edge of a knoll site or the remains of a kill site may become incorporated into a swamp peat level, thereby keeping the dream alive that preserved woody cultural remains will someday be found in the Northeast as they have on the Northwest Coast. However, the probability remains that the vast majority of typical occupation sites will be found in relatively woodless submerged levels having had a dry land soil development sequence.

BONE AND SHELL PRESERVATION

Bone from the Seabrook Marsh site was in an excellent state of preservation although somewhat fragile while still wet. After submergence the bone was preserved due to a moderate pH (about 6), an anoxic condition and the absence of mechanical disturbance. The prerequisite for bone preservation is that the bone remained well preserved until the time of submergence. At Seabrook, bone was well preserved for as long as 1,000 years prior to the time of submergence, although no shell presently exists in the midden; thus, the 40 cm thick midden may have had enough organic debris in it to produce an environment conducive to the preservation of bone. It is believed, however, that shell may be dissolved by prolonged submergence, at least in the soil environment of marsh peat (Robinson, in press).

An example of dissolving shell was noted in the Scarborough Marsh near Seavey Landing. A natural rivulet in the marsh sod had become filled with debris including periwinkle shells, clam shells, and wood, and then became sealed by marsh sod. Although perhaps only a few centuries old, the shell fragments remaining in the marsh bank had become thin and chalky, being easily crushed between the fingers. It is possible that an old submerged shell midden would have its shell dissolved away, leaving the bone to be preserved by permanent saturation.

SITE LOCATION

Locating sites in intertidal areas is dependent largely upon finding areas where modern erosion or ditch cutting intrudes upon an old activity surface that was covered and preserved by expanding marsh sod. Erosion banks close to presently dry land have the greatest potential for revealing shallow submerged sites, but there is a degree of unpredictability in relying on such exposures, since former low islands may now be completely disguised. Although dry land sites are stressed in this survey, old beach and riverine activities may also have become covered and preserved in the same manner as dry sites. Thus, the potential area attractive to site survey may include virtually any eroded bank within the marsh if evidence of a broad range of activities is sought.

In the search for old surfaces, eroded gravel is the most obvious indicator that old terrestrial soils are near at hand. Gravel in a marsh creek bed can usually be traced to a nearby bank, since the carrying capacity of intertidal streams usually does not exceed fine sand particles. Although gravel is the first and most obvious indicator of old soils, it very often is not related to an old land surface. Eroded soil deposits and secondary concentrations of gravel are frequently encountered, as well as fill from historic marsh roads and wharfing areas. Gravel and rocks are also spread over the entire estuary, in low concentration, by ice rafting when ice freezes against a gravel rich bank and then is lifted by the tide and deposited elsewhere. Each gravel source must therefore be identified. The presence of a developed organic soil horizon on top of a sand and gravel exposure indicates an area of potential site location.

The use of gravel as a site indicator naturally depends on the gravel content of the local soils. At Seabrook the glaciofluvial soils have a low gravel content and soils are generally thin over bedrock. This is perhaps an ideal situation because where soil is exposed it is often thin and therefore retains its topsoil cover. More importantly, where gravel is present at Seabrook it is not so concentrated as to obscure the presence of cultural lithic debris that may be incorporated into it. At the Seabrook Marsh site nearly every rounded cobble was carried in by the Late Archaic occupants. The situation at Scarborough was less ideal because gravel was abundant, and much of the local bedrock has shattered with a slatey fracture which can obscure flakes. In general it can be said that intensely occupied sites, comparable to the Seabrook Marsh site, would be readily recognizable against the high gravel content of the Scarborough soils, but low density sites may often be missed by walkover surveys such as this one.

Bedrock outcrops can also serve as indicators of old land surfaces. At Seabrook where soils are generally thin, the bedrock often "defends" the old land surface, thereby protecting the archaeological site from erosion. The Seabrook Marsh site was preserved by bedrock outcrops that prevented Hunt's Island Creek from eroding further into it. Again at Scarborough the situation is less ideal, because the sand and gravel overburden is much thicker and bedrock is often not exposed until the old land surface is long gone. This pattern of erosion leaves the characteristic rocky coast of Maine with sandy banks far above it. Nevertheless, bedrock

outcrops in Scarborough are still worthy of inspection since they may lie in close proximity to old hillside slopes.

The final obvious indicator of old land surfaces is the presence of submerged tree stumps. As previously noted, an abundance of tree stumps probably indicates an old wet area that was not suitable for habitation, but one that may have been in close proximity to a more suitable piece of land. Tree stumps are also very obvious when they occur, and can indicate old land surfaces in unexpected areas. For example, on the Back Shore at the mouth of the Scarborough River near Prout's Neck, several tree stumps protrude from the heavily scoured sandy beach at about mid-tide level, indicating an old land surface now covered by beach deposits and sand dunes.

Gravel, bedrock and preserved tree stumps are among the obvious indicators of old, preserved land surfaces. They provide the intertidal surveyor with what the dry land surveyor usually starts with, namely, a land surface. The identification of a habitation site then follows through knowledge of settlement pattern, luck, and the presence of cultural remains. In a wetland environment characterized by excellent preservation, stability, rapid erosion, and rapid deposition, surprises are sometimes as common as the expected. A leather shoe on a beach may be this year's loss, or centuries old.

A BRIEF SCARBOROUGH GEOMORPHOLOGY

Overlying the metamorphic bedrock of the Scarborough area is a thick bed of silty clay (the Presumpscot Formation) that was deposited during the period of late glacial coastal submergence approximately 12,000 years ago. Evidence related to the Presumpscot Formation and relative sea level change can be found in Bloom (1963:869-872).

On top of the Presumpscot silty clay are variable thicknesses of sand and gravel outwash, locally called the Hinckley Series or the Scarboro Series depending on drainage (the former being higher and drier). General descriptions of these soils can be found in the Cumberland County Soil Survey. The representative profiles of the two series are similar to profiles observed during this survey in both upland areas and in submerged soil horizons. Both soil types are considered to be thick, or deeply underlain by bedrock, which has several important implications. Related soil types also occur in and around the marsh that in some cases may be more appropriate than the types cited here. For the purpose of this report, however, Hinckley and Scarboro are representative dry and wet soil types.

The great depth of soil over bedrock in the Scarborough Marsh has probably influenced the lobate appearance of the points and necks that extend into the marsh. In contrast, the Rocks Road Peninsula in Seabrook Marsh thins out to a narrow bedrock ledge, and bedrock islands occur frequently throughout the marsh. This situation may have influenced the concentration of occupation areas in the Seabrook Marsh, as previously noted. The thick unconsolidated sand and gravel of Scarborough is also easily eroded, so that high, eroded banks are frequently seen at the marsh edge near creeks meandering between the various points of land. It is probable that no submerged sites are preserved below the marsh that are adjacent to steeply eroded banks at the marsh edge. Gently sloping banks that grade evenly into the marsh sod have greater potential. Naturally these gentle transitions occur in less actively eroded areas and, therefore, are often not exposed by marsh creeks. "Surface hunting" in these areas is often limited to modern drainage ditches cut to drain the salt ponds on the high marsh surface.

KNOWN SITES IN THE SCARBOROUGH MARSH

Scarborough was settled by Europeans in about 1636, abandoned for a while during the Indian Wars of the late 1600's, and then resettled in the early 1700's (Figure 2). Two historic Indian villages are recorded at Pine Point and Winnock's Neck (see the historic map of Blue Point and Dunstan). Archaeological sites from early historic and prehistoric times may be expected. A Contact Period Indian burial ground with 13 individuals was excavated in the late 1800's on Prout's Neck (Moulton, 1924:118-120). An Indian shell midden is recorded from Winnock's Neck (Moulton, 1925:38) and artifacts have been picked up from plowed fields at Seavey Landing. Limited excavation was done at the last two locations by Richard Doyle, Jr. in the 1970's. The following site information was provided by him.

Winnock's Neck

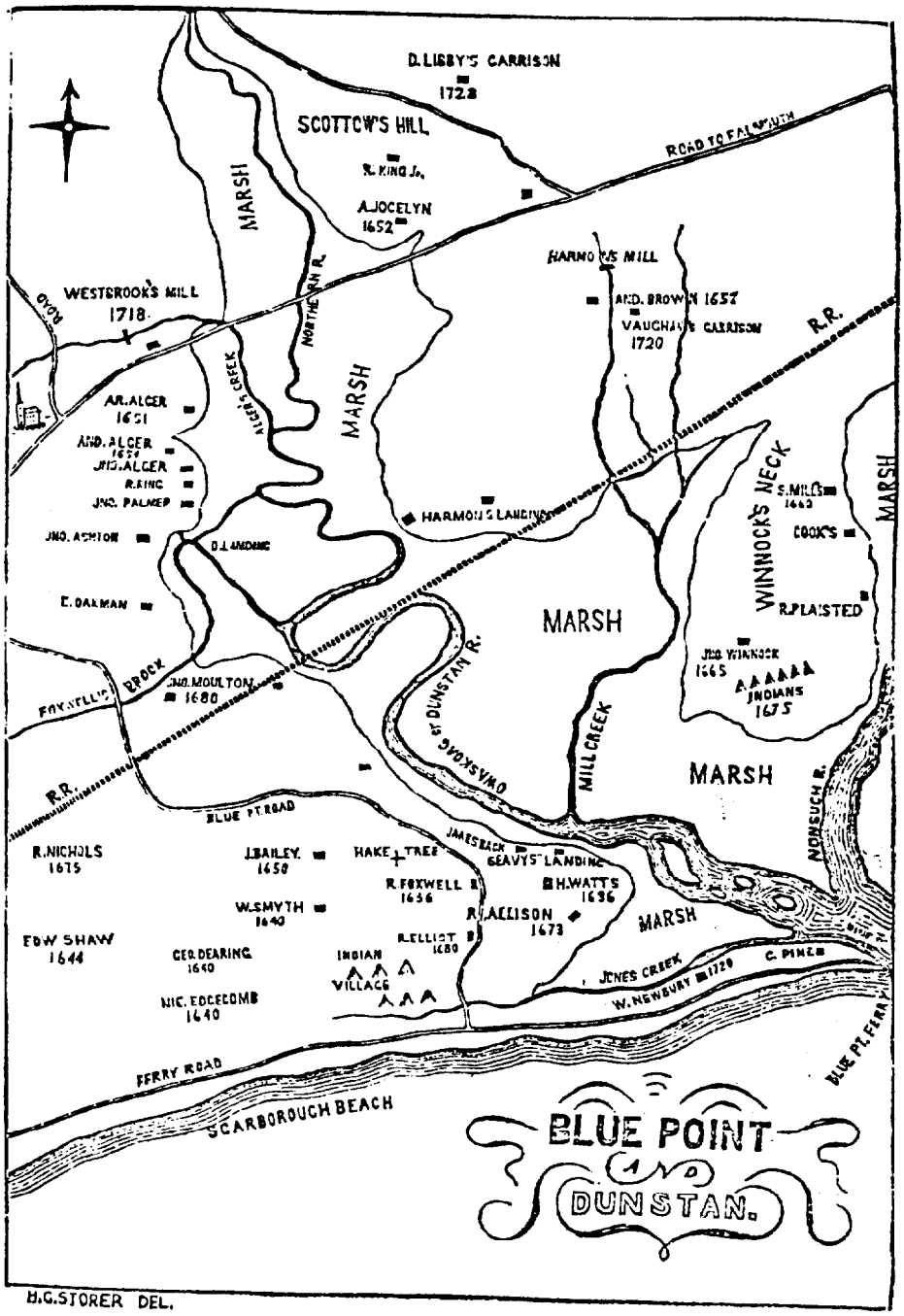
A shell midden with animal bones was present on the second terrace above the salt marsh. A few thin body sherds and shell tempered sherds of late prehistoric or historic Indian pottery were found by Richard Doyle, Jr. on the first terrace.

Seavey Landing #1 Site

The Seavey Landing #1 Site is located just south of the old gravel pit south of Seavey Landing Road. A small area was excavated that was being destroyed by bulldozing. Some disturbed soil was passed through a screen, along

Figure 2

From "The History of Scarborough from 1633 to 1783" by William Southgate.



with the plow zone and what was left of the thin intact deposits. Ten pit features were found. One excavated area measuring 3x4 meters had five features ranging from 25 to 50 cm in diameter. It is noted, however, that simple midden-filled depressions (features) can result from both human and animal disturbances. Some of the pits were filled with dark soil and clam shell, others were concentrations of rock below the plowzone that contained no shell. The plowed midden had a light scatter of shell throughout.

Woodland Period artifacts include a relatively large quantity of Middle Woodland dentate stamped pottery and lesser quantities of later Woodland shell tempered and cord-wrapped-stick impressed pottery. Probable Woodland period lithics include a small side-notched point, a triangular point, and several steeply flaked unifacial scrapers (one made of a fine translucent white quartzite). Late Archaic artifacts (Figures 3 & 4) include two Susquehanna drills, an Atlantic Phase stemmed blade that was a surface find from the nearby gravel pit, a notched stone axe, two small stemmed points (one of quartz, the other of felsite) and four pecked stone plummets (see artifact drawings). Without quantification, the impression gained from this site is that of sporadic occupation throughout the Late Archaic and Woodland periods with little concentrated activity at any one time. A nearby intermittent stream may have served as a minor attractant, but the pattern of mixed light occupation may be considered characteristic of the marsh border. The Seavey Landing #1 site was also apparently not a major lithic flaking station, since it yielded a relatively small number of flakes relative to artifacts. This fact increases the difficulty of site location since lithic flakes are often the identifying factor in a site survey. In general the variety and density of artifacts, along with the environmental setting of the Seavey Landing #1 site, makes it quite similar to the Rocks Road site in Seabrook. With respect to an intertidal survey, the presence of a number of Late Archaic artifacts confirms that occupation areas should be present at intertidal levels where the land sloped gently enough from the present marsh edge to provide additional occupation area toward the central estuary. This proved to be the case with the Seavey Landing #1 site. Notably, the two small stemmed points and four plummets from the Seavey Landing #1 site resemble those of the major component of the Seabrook Marsh site.

SCARBOROUGH MARSH INTERTIDAL SURVEY: RESULTS

The following areas were recorded during the walkover survey. They are keyed on the "Natural and Cultural Points of Interest" map (Figure 5).

Submerged Tree Stumps (T)

(T1) - Numerous roots and stumps are visible here within a developed A-Horizon below variable thicknesses of marsh sod and extending into modern tree growth. The exposure is on the banks of a large, recent gravel pit related to a modern housing development. Abundant gravel.

(T2) - Tree stumps on both sides of a large gravel pit/boat landing area. One large stump on the east side is below two to three feet of fresh -water peat (Plate 1).

(T3) - Extensive lowlying forest is exposed in a long artificial ditch. The stumps are associated with a thick layer of peat with well preserved forest litter and entire fallen logs now completely capped by salt marsh sod.

(T4) - A single tree stump and another group of three or four stumps projecting from a well-scoured beach at about the mid-tide level (Plate 2). Located along the middle of the Back Shore area and below a modern boat house near the parking lot. Some lithic spalls of quartz and felsite were found on the beach near these sites but they are not of convincingly cultural origin.

(T5) - One tree stump noted eroding from marsh sod in a heavily scoured gravel beach area on the southwestern end of Plummer Island.

(T6) - Numerous roots and stumps in what is probably a developed A-Horizon with leached white sand below. Exposed in a drainage ditch parallel to the Boston and Maine Railroad track southeast of Winnock's Neck.

Gravel Exposures (G)

G1, G2 and G3 represent extensive sand and gravel beaches where marsh channels are currently eroding against upland soil deposits. Although cultural debris may be incorporated into the gravel, most intertidal level sites are probably already destroyed.

G4 and G5 are gravels eroded from below marsh sod, although no developed A-Horizon could be found related to them. Additionally, varying quantities of gravel are found related to all of the preceding tree stump areas.

Natural Phenomena (N)

(N1) - This is a large area including two

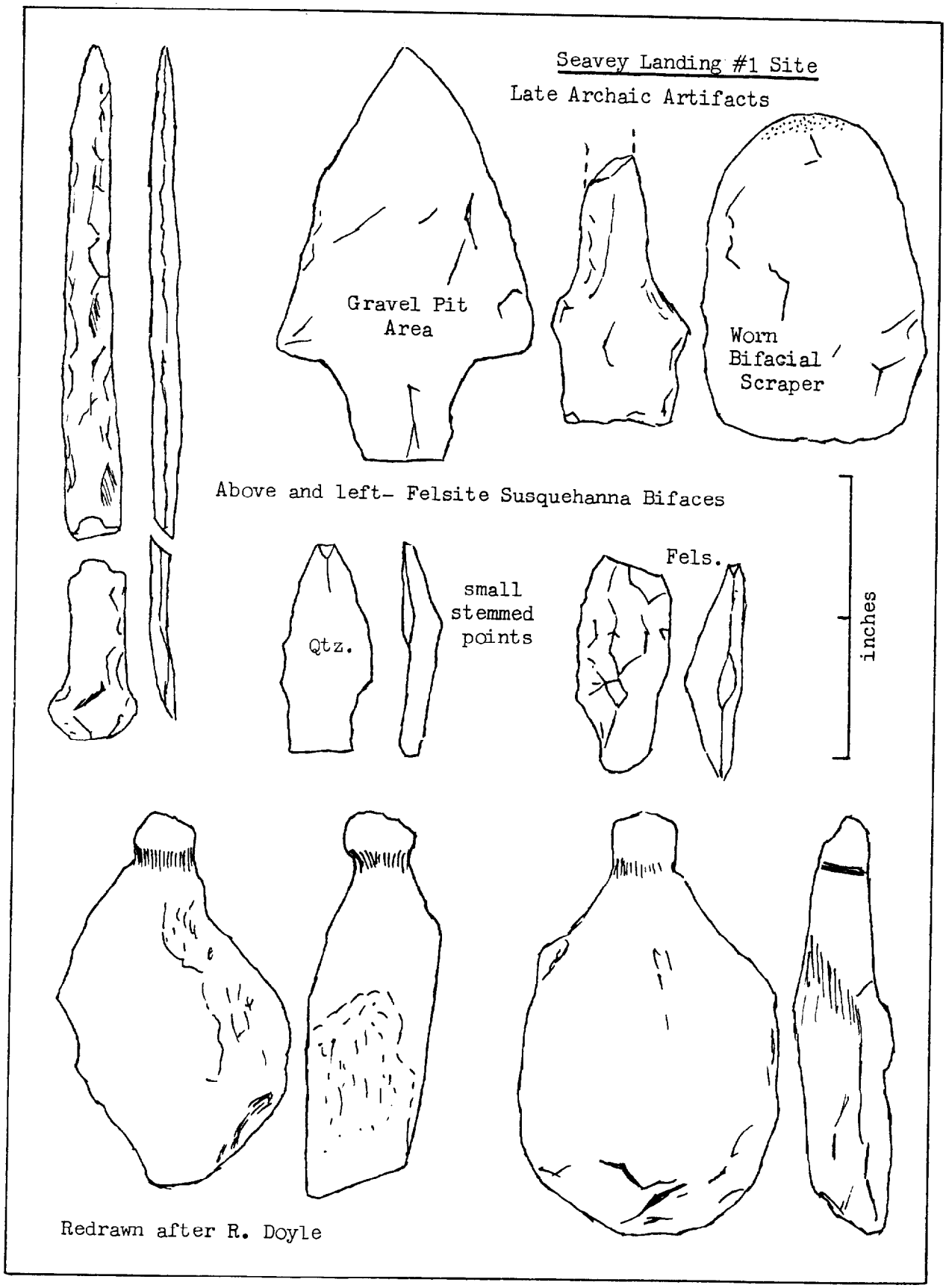
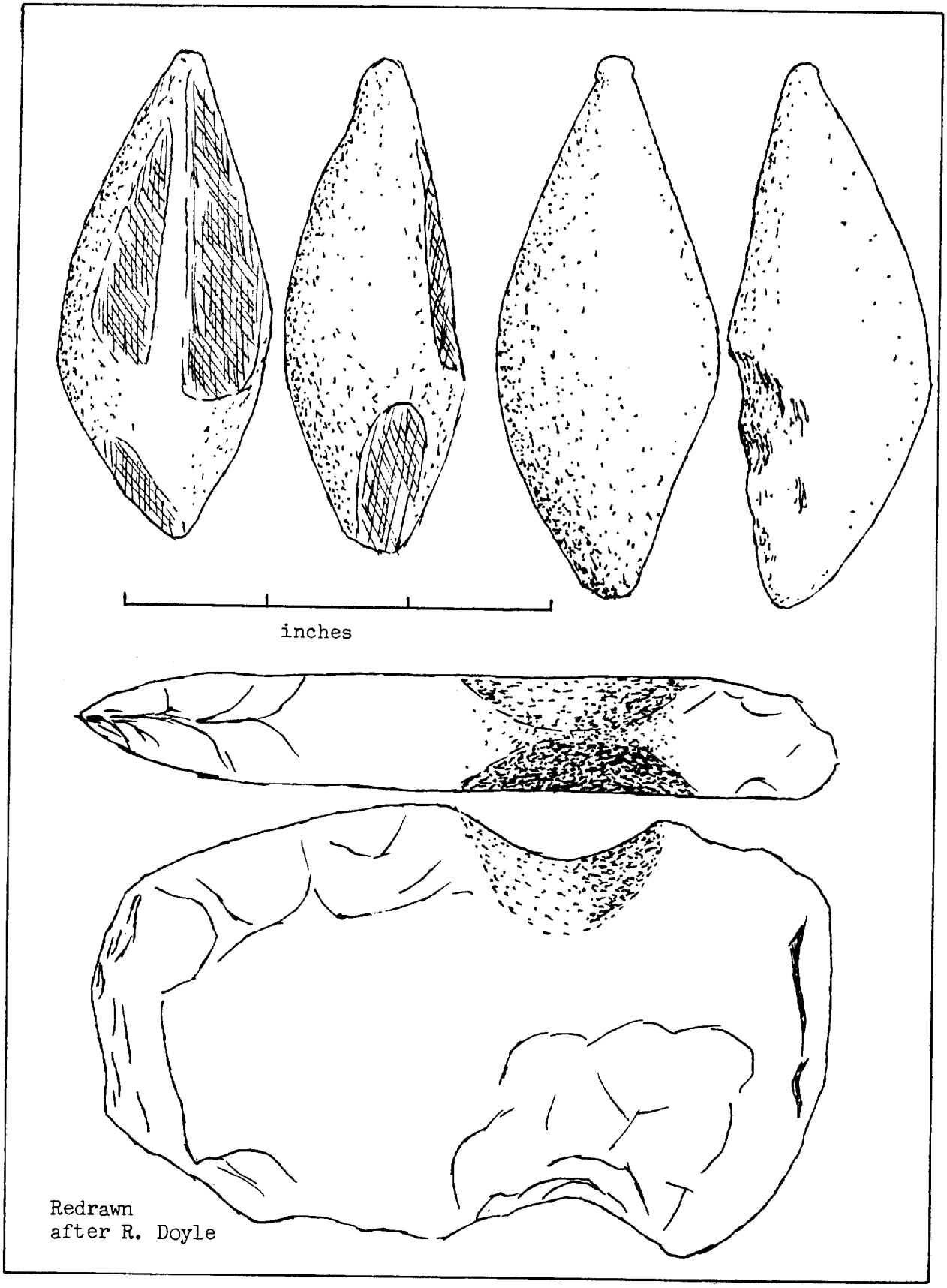

Seavey Landing #1 Site
Late Archaic Artifacts
Gravel Pit Area
Worn Bifacial Scraper
Above and left- Felsite Susquehanna Bifaces
Qtz.
small stemmed points
Fels.
inches
Redrawn after R. Doyle

Figure 4

Seavey Landing #1 Site - Late Archaic Artifacts



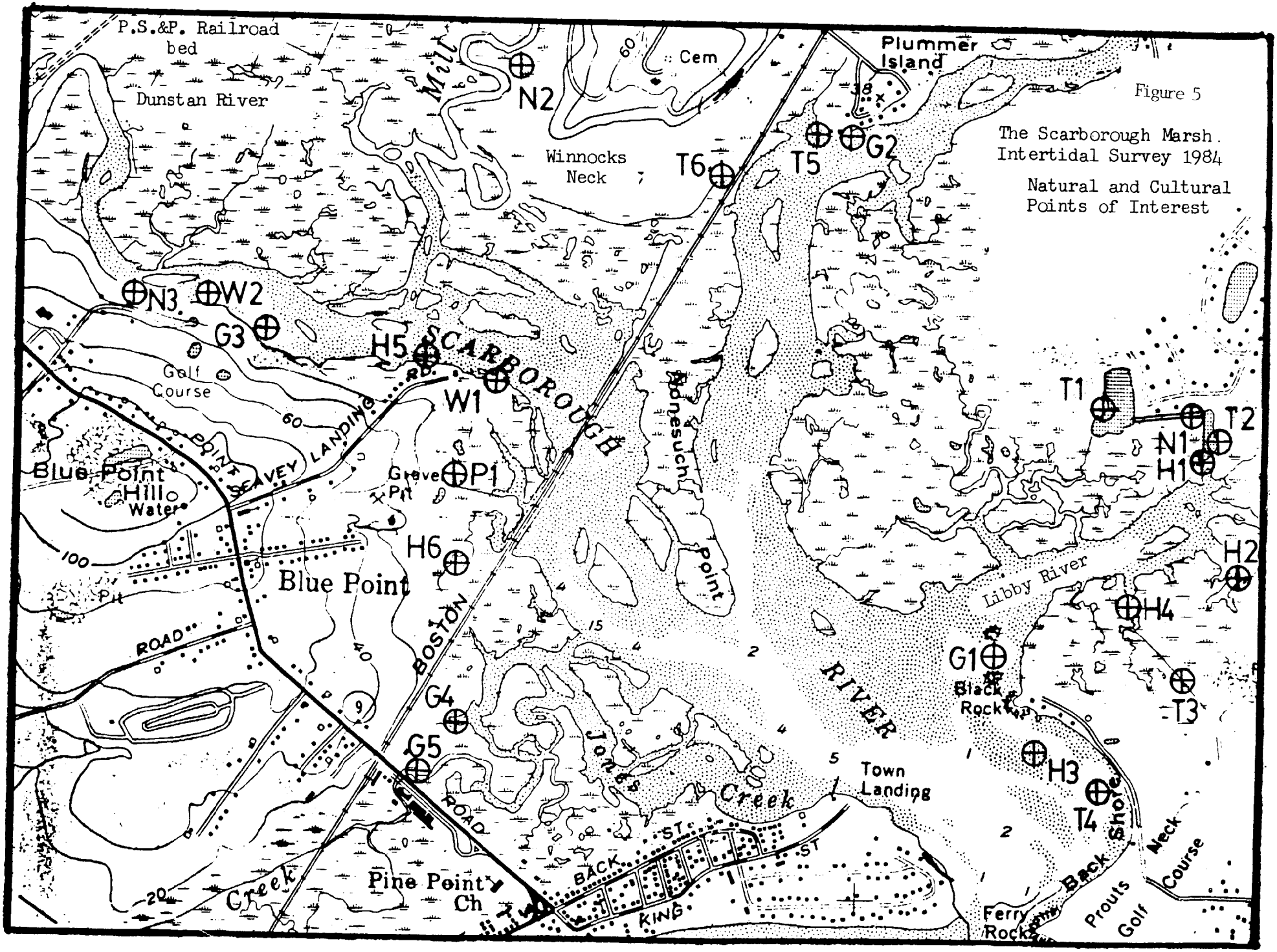


Figure 5

The Scarborough Marsh Intertidal Survey 1984

Natural and Cultural Points of Interest

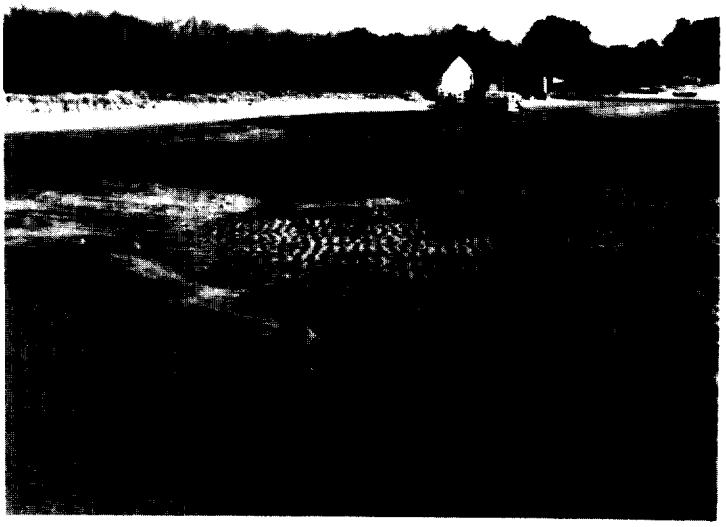
Plate 1
Scarborough T2
Tree stump below fresh water peat and salt marsh sod.

Plate 2
Scarborough Area T4
Isolated tree stump in scoured beach.

gravel pits and the artificial channel that connects them. It exhibits deep, freshly cut soil exposures showing developed upper soil horizons, underlain by crossbedded deltaic sand and gravel and a basement of grey silty clay (the Presumpscot Formation).

(N2) - The west side of Winnock's Neck has steep escarpments as high as two meters representing ancient channel erosion. Present channel loops cut deeply into the marsh near the land without encountering terrestrial deposits, indicating that the old erosion was deep and widespread, destroying old land surfaces at intertidal levels.

(N3) - (Location approximate) The north side of the Seavey Landing Road area is a steeply cut escarpment several meters high. Erosion occurs by undercutting the bank at high tide levels with slumping of the upper deposits. In one area a block of several tree stumps slumped from a



higher elevation to the level of upper beach gravels. The stumps are still upright and are now being incorporated into a narrow zone of marsh sod at an elevation that has not supported large tree growth for many years. This occurrence suggests that all waterlogged stumps may not be at their original elevation, especially when near areas susceptible to slumping.

Historic Remains (H)

(H1) - Remnants of a boulder and gravel road bed are visible on both sides of the tidal channel. The road originates from the mainland to the northwest.

(H2) - Probable wharfing remains associated with an old gravel beach that is now partly grown over by marsh sod. Large hewn beams and boards present with ax cut wood chips incorporated into the beach layer.

(H3) - A line of small cut stakes along the edge of the mud flat at low tide level may represent a short-lived fish weir or netting activity in the Back Shore area.

(H4) - On the north side of Prout's Neck, in a small marsh channel extending south from the Libby River channel, is the remains of a gravel and brushwork road. The road extends only to the east side of the small channel, not crossing over to the west bank. The brush is laid perpendicular to the road axis and is now covered by a one-foot thickness of marsh sod. This thickness indicates how quickly the sod can build up. In the bottom of the channel at the end of the road are two parallel rows of 7-9 cm. thick split stakes with ax-cut tips. The stakes seem too small to represent a bridgework of any type, although a walkway to a small boat mooring is possible. A fish trap or pen of some sort is another possibility.

(H5) - On the north side of Seavey Landing Road the beach is littered with modern clam shell dumping and late 19th to early 20th century ceramics and trash. At the water's edge at low tide are a few large hewn timbers and stakes embedded in an organic layer that extends below the more modern trash. Several fragments of lead glazed redware associated with this bed suggest an 18th or 19th century activity. The timbers are interpreted as Seavey Landing wharfing remnants. Of special interest are two trunks of palm wood (Plate 3) probably related to early Dunston River shipping activity.

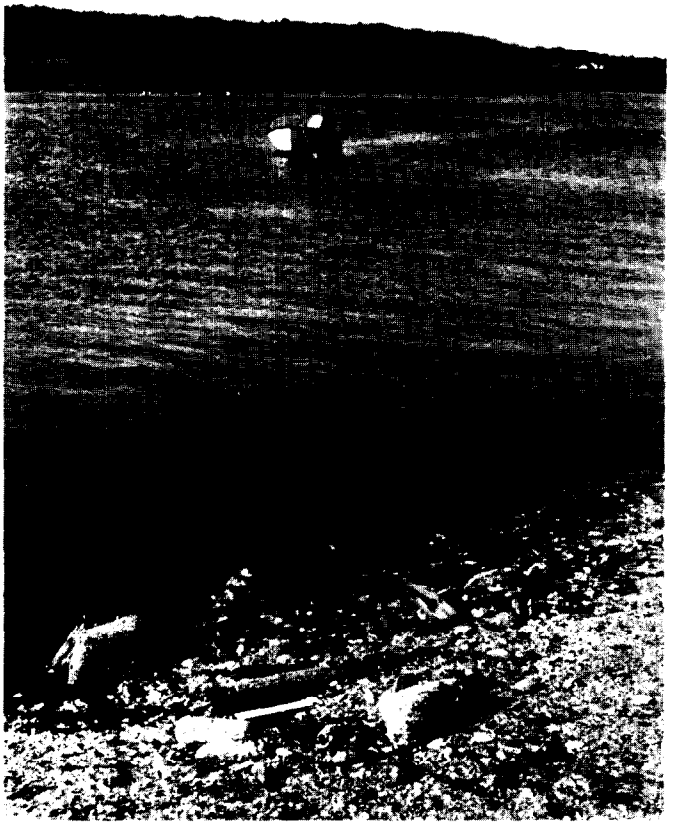


Plate 3
Scarborough H5
Seavey Landing probable wharfing remains with included palm log (at ruler)

(H6) - Throughout this area, east of Blue Point and west of the Boston and Maine Railroad are abundant timber and brushworks of historical origin found in the bottom of the numerous small ditches and tidal stream cuts. There is also a gravel road extending into the marsh that is surrounded by 19th century trash.

Historic Fish Weirs (W)

(W1) - Fish Weir 1 (Ffigure 6, Plate 4) is located to the east of the end of Seavey Landing Road. It runs from the marsh bank across the narrow beach into the channel. It is comprised of a single line of vertical stakes at 80 to 90 cm. intervals with ax cut brush (mostly small fir

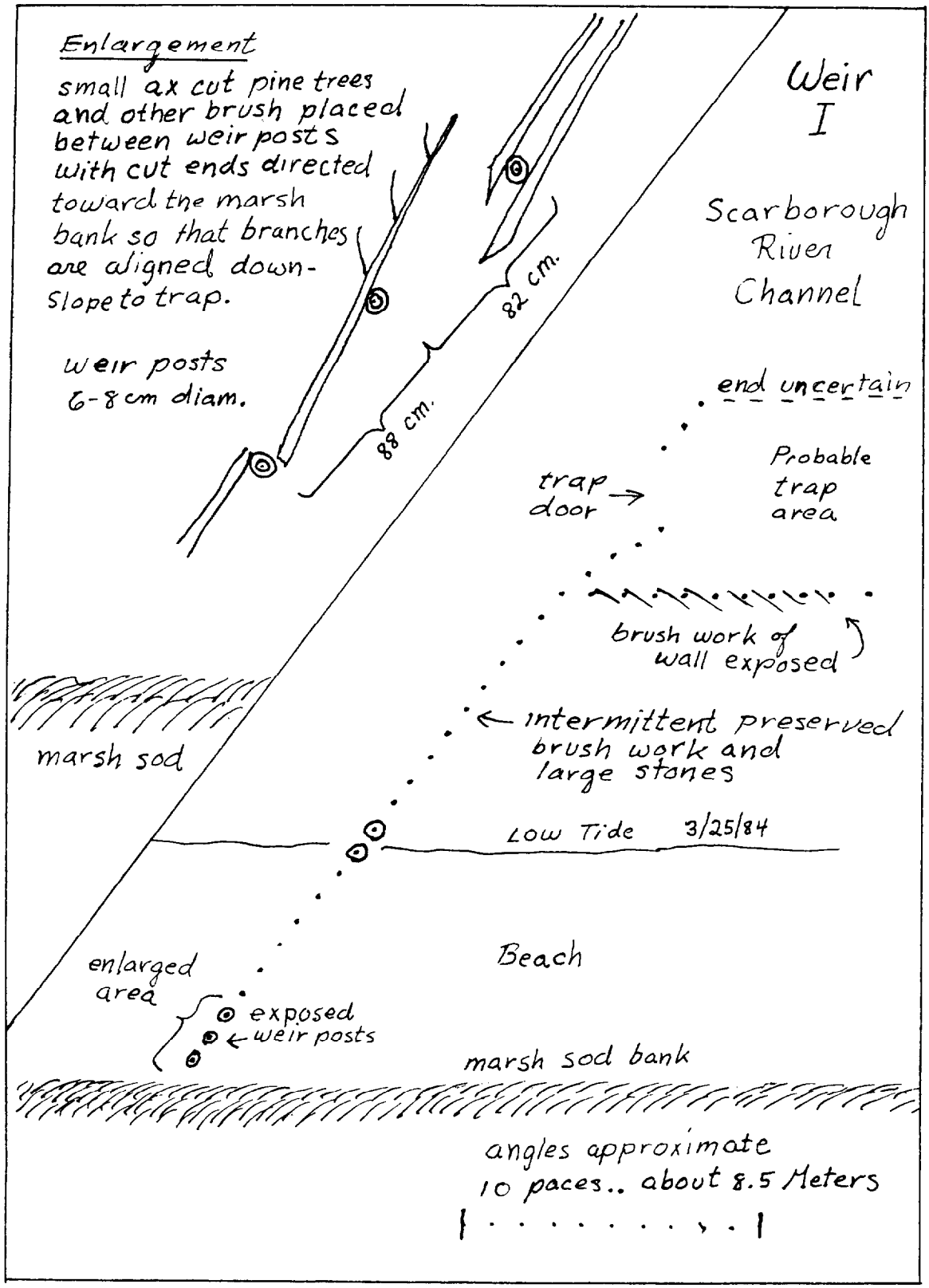


Figure 6

Enlargement - Small ax cut pine trees and other brush placed between weir posts with cut ends directed toward the marsh bank so that branches are aligned down-slope to trap.

trees) forced between them. At the channel end a brush wall runs parallel to the channel and an apparent opening suggests the door to a fish trap. The weir does not appear to have been used over a very long period and is of relatively fresh appearance.

(W2) - Fish Weir II is located approximately one half mile up river from Fish Weir I on the Dunston River (Plate 5). This Weir is a much older, much more heavily repaired weir, represented by hundreds of densely packed, eroded weir posts and rocks in a straight line approximately one meter wide by thirty meters long, running perpendicular to the shore (Plate 6). It is not visible on the opposite shore. Only a few horizontal pieces of brush remain, indicating that the stakes have been eroded below to a former beach level. The stakes have long ax-cut points (Plate 7). Porous brick fragments are incorporated into the stones surrounding the base of the weir (Plate 8). Otherwise, there is little historic debris. A few pieces of modern glass and brick are present along with several lead glazed redware fragments. An unglazed redware rim sherd was found within a meter of the southern end of the fish weir. This sherd is from the collar of a Tamarind jar made in the West Indies, probably during the 18th century.

Plate 4

Scarborough W1

Fish weir I with collected sea weed in foreground.

Plate 5

Scarborough W2

Profile of Weir 2 looking from east. In foreground is a section of an early wood boat.

Plate 6
Scarborough W2
Fish Weir 2 looking north.

This piece is another remnant of the period of Dunstan River shipping. East of the fish weir lies the side or bottom of a large wooden boat consisting of closely spaced and butted frames, treenails, and exterior planking with no apparent metal fittings.

Prehistoric Site (P)

(P1) - This site has been named the Blue Point Marsh site as a matter of convenience to distinguish it from the dry land sites that run continuously along the marsh edge south of the Seavey Landing Road. In actuality, this submerged site is probably part of an uninterrupted scatter of low density sites extending from the mainland out under the salt marsh sod.

The Blue Point Marsh site is located in a modern L-shaped drainage ditch east of a 19th century sand and gravel pit (see Figure 7). The site datum stake is located approximately 50 feet north of the bend in the "L". The site is identified as a cultural site only by a distinct concentration of unmistakenly fire shattered cobbles in an old developed A-Horizon (see Figure 8, Plate 9). The stones of this hearth (Feature 1) are all water rounded cobbles shattered in place, confirming that they were not secondarily deposited (Plate 10). The nature of the A-Horizon and the marsh root mat on top of the cobbles conforms closely to the occupation zone at the Seabrook Marsh site. Feature 2 is a depression of the A-Horizon into the level below, with a sharply defined lense of relatively pure

Plate 7
Scarborough W2
Detail of Weir 2 stake. Ax cut, four sided, sharply pointed.

Plate 8

Scarborough W2

Fish Weir 2 detail. Weir posts and rocks. Small horizontal fir (?) trees to right may be one of the few remaining pieces of brush work held in place by lower branches buried in the sand.

silty clay within it (Plate 11). The gray silty clay is similar to that of the underlying Presumpscot Formation. Below the clay lense is a silty black level, continuous with the A-Horizon, that contained a high concentration of charcoal. A sample of this charcoal was collected by waterscreening with 1/8 inch screen and carefully floating off an abundance of Spartina patens rootlets. The feature is not clearly of cultural origin and may represent a collection of charcoal and clay that settled into a depression in the land surface. A following section, relating Feature 2 to a Scarborough Series soil profile, infers that Feature 2 is indeed natural.

The Blue Point Marsh Site - stratigraphic profile exposed in the east wall of a modern drainage ditch.

Level 1 - Sixty cm. of brown marsh sod. The surface of this layer is at approximately plus or minus one foot of mean high tide.

Level 2 - A dark brown to yellow brown layer of coarse sand with gravel that is a secondary deposit probably derived from Levels 4 and 5 sands and gravels eroded away to the south. A light to non-existent root mat on top of included cobbles suggests that Level 2, as deposited and grown over by Level 1, is considerably younger than Level 3 below.

Level 3 - A dark brown to black sandy loam with little gravel that is believed to represent a well developed A-Horizon from the presubmergence land surface. This level becomes increasingly thinner, and then disappears to the south due to erosion, probably from tidal currents. The erosion occurred long after Level 3 had been submerged and grown over by a layer of marsh sod. Level 3 is believed to be more intact where it slopes downward to the north. Root mats of thin marsh grass roots of Spartina patens covered the tops of the fire-cracked rocks of Feature 1. Charcoal occurred through Level 3 being especially heavy below the clay lense of Feature 2.

Level 4 - A grey layer of mixed coarse sand with little gravel representing the zone of leaching below the organic A-Horizon.

Level 5 - A rusty brown layer of coarse sand with increased gravel content. It is an old level of accumulation for iron oxide. This level rises in elevation and is eroded away further to the south to expose the grey silty clay of the Presumpscot Formation.

No artifacts, cultural lithic debris, or calcined bone were recovered from sifted samples of the A-Horizon, although only about 1/16 to 1/8 of a square meter of the level was excavated while clearing the side wall. The designation of the hearth as prehistoric is relatively certain, however, based on the depth below the marsh surface and the presence of the hearth in a terrestrial soil type. A Late Archaic or very early Woodland Period of origin is likely.

It is important to note that the depth below

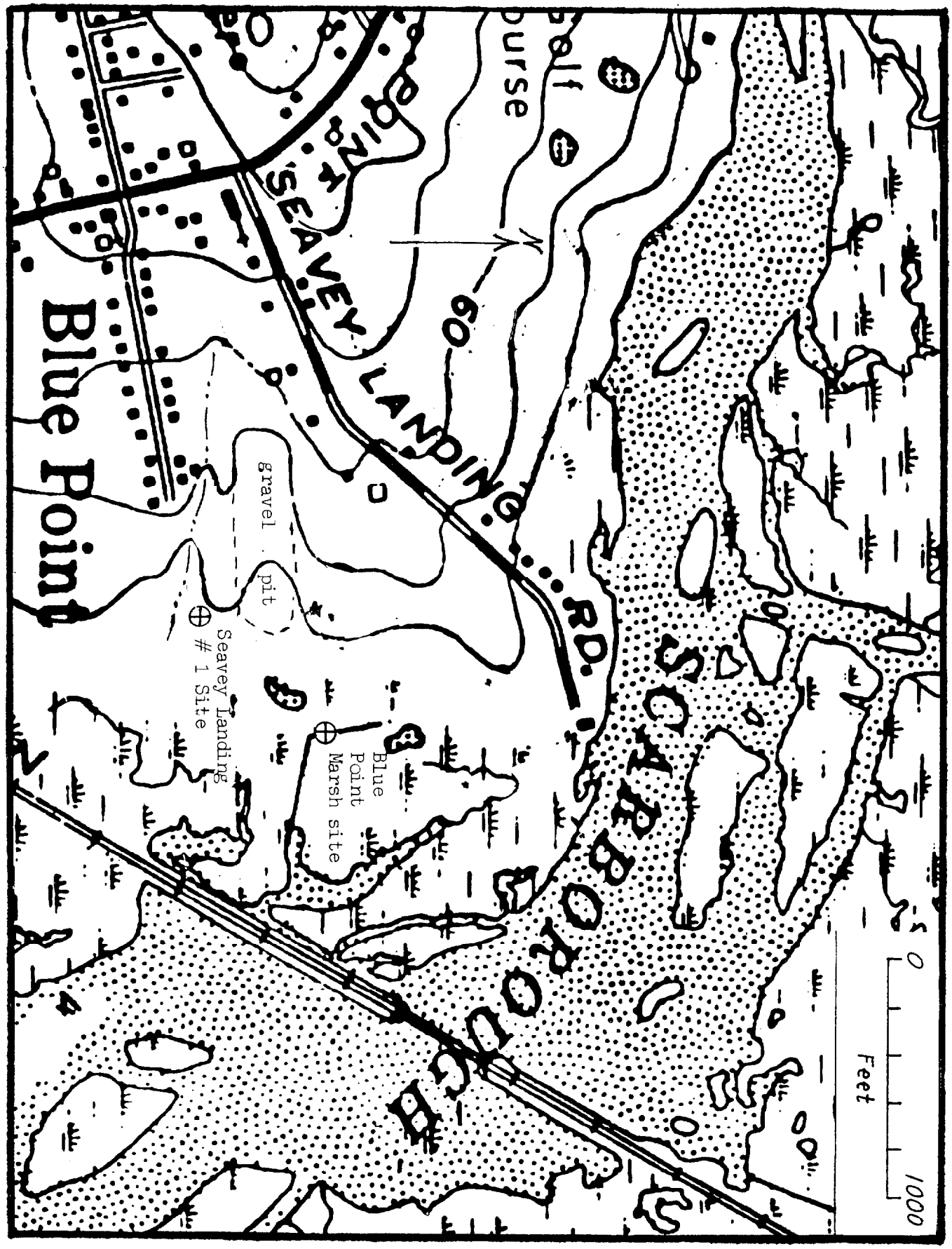


Figure 7

Prehistoric Site Location Map

Plate 9

Scarborough P1

The Blue Point Marsh site. Fire-cracked rocks of Feature 1 at base of dark A-Horizon.

Plate 10

Scarborough P1

The Blue Point Marsh site stratigraphy below marsh sod and horizontal string.
Feature 1 to left.
Feature 2 to right.

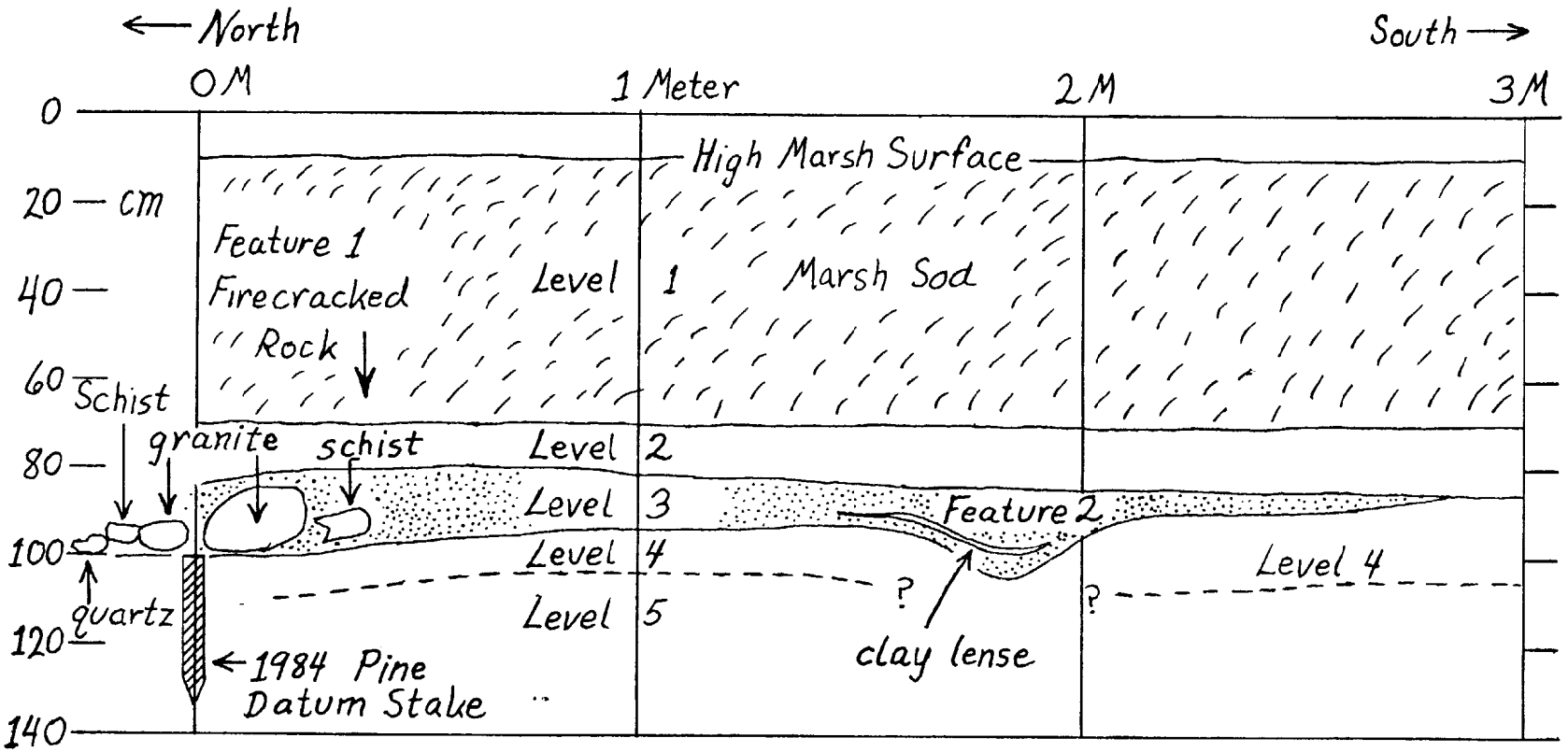


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Plate 11

Scarborough P1

The Blue Point Marsh site Feature 2. Crisply defined layer and bottom outline suggest this to be a naturally stratified pit fill. Clay lense visible with feature.

the marsh surface, alone, is not sufficient to designate a site as prehistoric in origin. Several feet of marsh sod can grow in a relatively short period of time as is indicated by historic artifacts fround in the marsh at depths of one to two feet below the surface. Many of these deposits of century old debris include preserved wood that was clearly deposited in a wet environment, thus distinguishing the deposit as a late, post-submergence activity rather than an early dry land one. Also, the fast growing marsh sod layers above recent disturbances are usually composed of Spartina alterniflora roots which are 1/8 to 1/4 inch in diameter and are easily distinguished from the 1/16 inch Spartina patens roots (Keene, 1970, 28-30). Spartina alterniflora has a greater tolerance to salt water immersion and therefore establishes itself at lower tidal elevations than does Spartina patens, filling in depressions to an elevation where the latter can become established.

Although the buried A-Horizon of the Blue Point Marsh site is certainly of prehistoric origin, the secondary deposit of sand and gravel above it is much more recent and may possibly be as late as the 19th century gravel pit operations located to the west. The stratigraphic profile of the Blue Point Marsh site indicates that the old land surface was sloping downward to the north of Feature 1 and upward to the south where it is eroded away. It is probable that uneroded sections of occupation zone occur to the north, below the bottom of the present drainage ditch exposure.

The thick leached zone (Level 4) below the A-Horizon of the Blue Point Marsh site is not present at either the Seavey Landing #1 site or the Seabrook Marsh site. This leached layer is a characteristic of Scarborough Series soils that is absent from the better drained Hinckley Series. Thus, this small area of the Blue Point Marsh site was low and wet for a lengthy period of time prior to salt water submergence. As sea level rises, areas of previously well drained land may become wet by a rise in the fresh water table. This transition, over time, would turn a Hinckley soil into a Scarborough soil. It is believed that this change in soil type would occur only on relatively low, level ground. A Hinckley soil on a moderate slope can become immediately submerged without passing through a poorly drained Scarborough Series phase (example area N-1).

The local environment in which the stone lined hearth (Feature 1) was used depends on its age and whether a well drained Hinckley soil had changed into a wet lowland. It may not be possible to determine this history now, but several conclusions can be made about cultural levels that have a Scarborough Series profile. If a site was inahbited on dry Hinckley soil which later became saturated by fresh water, the development of the grey leached layer would severely affect the preservation of organic cultural remains, including bone and organic soils. Therefore, the preservation of feature outlines in a submerged Scarborough soil would probably be worse than on an average, well drained site. Hence, much of the previously touted advantages found in submerged sites would not exist. The Blue Point Marsh site apparently falls into this disadvantaged category, at least in the very small area observed. With the expectation of severely leached soil below the A-Horizon in the Scarborough Series, the sharp outline and crisp internal structure of Feature 2 suggests that this pit was very late in the development of the soil and therefore was formed in a wet environment, probably by natural processes. Feature 1 is thus logically the only truly cultural feature found below the marsh on this survey.

SUMMARY AND CONCLUSIONS

The estuarine environment includes areas that are very stable, alongside dynamic areas of erosion and regrowth. When erosion or artificial disturbance cuts into a previously stable environment, there is potential for exposing very well preserved, ancient cultural remains. Two mutually exclusive kinds of cultural remains may be expected at intertidal elevations. Late prehistoric and historic remains may be expected to be related to riverine activities, that is, the activity would take place in a wet environment. Earlier prehistoric sites, particularly from the Late Archaic Period, would consist of former dry land activities such as occupation sites. Below intertidal elevations may be found the riverine activities of any time period, and the dry land activities of times preceeding the Late Archaic. These sub-sealevel remains may be exposed during excavation, such as dredging or construction, done in previously stable environments.

No prehistoric riverine activities were identified during this survey. The earliest remains which might be expected from both prehistoric and historic times would be of fish weirs and boats. Ppreservation of ancient wood in the marsh may be extremely good, making age determination difficult, especially in regard to fish weirs which changed little over time and may have been in use for generations (Johnson, 1942:197).

Early colonists are known to have taken over and maintained Indian fish weirs. Fish Weir II on the Dunstan River is probably the earliest riverine site noted on this survey. The weir is believed to date from at least the early 19th or the 18th century on the basis of redware, including brick fragments, and the development of different river activities. The weir was well used and may date from an earlier time. It is relatively close to the homes of the earliest colonists to settle at Blue Point, R. Foxwell and H. Watts. Jane Hannup, the daughter of a local Indian Sagamore, also lived near this area until 1675 (Southgate, p. 101).

Evidence of changing economic patterns is visible on the Dunstan River. From an early farming and fishing community the Dunstan River became an important lumbering and shipping center in the 18th century. "In the years before the Revolution, lumber and dried and pickled fish were shipped in large quantities directly to England, the West Indies, and other countries" (Libbey, 1955:46). The trunks of palm trees incorporated into wharfing remains at Seavey Landing (H5) and a fragment of Tamerind jar (W2) may have come from the West Indies trade.

With the coming of the railroad, both fishing and shipping on the Dunstan were drastically changed. In 1876 a dyke was built to shut out the tide water from the marshes above the old Portland, Saco and Portsmouth Railroad, now abandoned (Moulton, 1925:45-47). The intent was to create more drained land for salt hay. Although the attempt failed, it no doubt rendered Fish Weir II useless and closed off the Dunstan Landing from the sea. The two railroad beds running across Scarborough Marsh have undoubtedly affected patterns of marsh development, perhaps accelerating the rate of marsh growth over more recent historic remains.

Returning to the dry sites of 4,000 years ago, only one prehistoric site was discovered below the marsh sod. The Blue Point Marsh site had to be there, in a sense. It is located east

of a relatively gentle transition to the mainland in front of a known Late Archaic habitation site, the Seavey Landing #1 site. It is not much of a coincidence that the submerged site was located in an artificial ditch rather than a natural marsh bank. In order for a site to survive for thousands of years below the marsh it must be located in a stable environment, a condition that contrasts with the banks of a tidal channel. The apparent scarcity of submerged sites in the Scarborough marsh is probably because they are safely tucked away in stable areas, rather than hanging out of marsh banks.

Evidence from the upland sites suggests that an abundance of artifacts should not be expected even when an intact site is being eroded. The settlement pattern of the Scarborough Marsh may be considered to be broadly scattered abundance, rather than concentrated abundance. The evidence is meagre, however.

With only a single stone hearth discovered, the conclusion is reached that, at a minimum, many small dispersed sites exist below the Scarborough Marsh surface. Evidence of intact submerged terrestrial soil horizons is plentiful, as is evidence of human habitation at the marsh edge. Areas of high potential include: east of Blue Point, south and southeast of Winnock's Neck, and areas south and west of the mainland north of the Libby River (areas around T1 and T2). At the same time, deposition of a relatively thick layer of unconsolidated sand over Presumpscot silty clay has resulted in the destruction of many sites by erosion. Severe leaching has removed the organic soil structure of many more. At a minimum, the inter-tidal archaeological potential of the Scarborough Marsh is that there are many small sites below the marsh, few of which have much value beyond a simple lithic scatter. Even at a minimum, however, the potential for finding interesting preserved remains of riverine activities is high. In a more moderate assessment, the chances of there being a submerged occupation level with a shell midden or former shell midden are reasonable, yielding bone preservation such as at the Seabrook Marsh site. In a maximum potential assessment, there are probably few day dreams of good organic preservation that are not possible within the dynamics and the stability of a salt marsh estuary. An awareness of the conditions under which different sites may be found will increase the chances that they will not simply be destroyed by the natural processes and human activities that uncover them.

EDITOR'S NOTE

This survey was the result of conversations between Dr. Arthur Spiess of the Maine Historic Preservation Commission and the author concerning the similarity of the Seabrook Marsh in New Hampshire to the coastal marsh landforms along southern coastal Maine. The work was accomplished on a small contract from the M.H.P.C.

REFERENCES CITED

Bloom, A. L.
1963. The late-Pleistocene fluctuations of sea-level and post-glacial crustal rebound in coastal Maine. American Journal of Science, 261:862-879.

Dincauze, Dena F.
1972. The Atlantic Phase: A late Archaic Culture in Massachusetts. Man in the Northeast, 4:40-61.

Farrell, Stewart C.
1970. Sediment distribution and hydrodynamics, Saco River and Scarboro estuaries. University of Massachusetts, Department of Geology, Contribution No. 6-CRG; Amherst, Massachusetts (Cited in Harvey ed., 1977).

Harrison, W. and Lyon C. J.
1965. Sea-Level and Crustal Movements Along the New England-Acadian Shore, 4,500-3,000 B.P. Contribution No. 113 from the Virginia Institute of Marine Science (as cited in foot note).

Harvey, Richard, ed.
1977. The Scarborough Marsh: A Roundtable Discussion. The Research Institute of the Gulf of Maine (TRIGOM), South Portland, Maine.

Johnson, Frederick, et. al.
1942. The Boylston Street Fishweir. Papers of the Robert S. Peabody Foundation, Vol. 2, Andover.
1949. The Boylston Street Fishweir II. Papers of the Robert S. Peabody Foundation, Vol. 4, Andover.

Johnson, Frederick and H. M. Raup
1947. Grassy Island: Archaeological and Botanical Investigations of an Indian site in the Taunton River, Massachusetts. Papers of the Robert S. Peabody Foundation, Andover. 1:2.

Keene, Howard W.
1970. Salt Marsh Evolution and Postglacial Submergence in New Hampshire. Unpublished Masters Thesis, University of New Hampshire.

Libbey, Dorothy S.
1955. Scarborough Becomes a Town. F. L. Tower Company; Portland, Maine.

Moulton, Augustus F.
1924. Old Prout's Neck. Portland, Maine.
1925. Grandfather Tales of Scarborough. Augusta, Maine.

Robinson, Brian S.
The Nelson Island and Seabrook Marsh Sites; Late Archaic, Marine-Oriented People on the Central New England Coast. Occasional Publications in Northeastern Anthropology, Vol. 9. In press.

Southgate, William
The History of Scarborough from 1633 to 1783.

Spiess, Arthur E., Bruce J. Bourque and Steven L. Cox
1983. Cultural Complexity in Maritime Cultures: Evidence from Penobscot Bay, Maine. In The Evolution of Maritime Cultures on the Northeast and the Northwest Coasts of America. Ronald J. Nash, ed., Pub. No. 11, Department of Archaeology, Simon Fraser University.

U. S. Soil Conservation Service
1974. Soil Survey, Cumberland County, Maine. United States Department of Agriculture, Soil Conservation Service; Washington, D. C.

A Late Archaic Shell Midden on Great Moshier Island, Casco Bay, Maine

by

Richard A. Doyle, Jr.
University of Southern Maine

James B. Petersen
University of Maine, Farmington

Nathan D. Hamilton
Colby College

Introduction

Late Archaic period archaeological sites, ca. 3,000-1,000 B. C., are rare on the Atlantic Coast throughout the Gulf of Maine. This condition is most likely due to marine inundation and erosion, which have apparently damaged or destroyed most such sites and those of greater antiquity (cf., Sanger, 1979), except in rare cases (e.g., Bourque, 1975; Robinson, 1984).

The identification and preliminary assessment of one such Late Archaic period site in Casco Bay, Cumberland County, Maine, is correspondingly of great importance. This site, known as Great Moshier Island site B for its location on Great Moshier Island, has yielded a small number of diagnostic Late Archaic tools, a variety of other materials and a radiocarbon date attributable to the Late Archaic period, all from an eroding shell midden context. These remains and their possible significance are summarized here.

Environmental Setting

Great Moshier Island is located in north central Casco Bay in Cumberland County, Maine. Casco Bay, centrally located within the broader Gulf of Maine, contains several hundred rocky islands of variable size, which are remnants of glacially scoured bedrock ridges that trend in a northeast-southwest direction. Casco Bay is the first major embayment in the Gulf of Maine north of Boston Harbor (Figure 1, see Yesner 1984a, 1984b, various). Great Moshier Island is one of the more landward islands in Casco Bay, being situated 3.5 km. south of the Harraseeket River (roughly the closest point on the mainland), 6 km. due east of the mouth of the Royal River and 10 km. north of the modern city of Portland. Relatively deep submarine channels lie to north, east and south of the island and, thus, the site lies on the seaward margin of the shallow inner bay.

Great Moshier Island (Figure 2) is 1.4 km. long, maximally 27.7 m. above mean sea level (m.s.l.), with an overall area of some 0.5 km. Most of the island margins are steep and rocky, with sandy beaches largely restricted to the notable southern cove and a tidal flat between Great Moshier and Little Moshier Island to the west. The tree cover consists of mixed conifers and deciduous species, including spruce, white birch, sugar maple, and hemlock. Vegetation on Great Moshier Island site B specifically includes juniper, alder, milkweed, thistle, wild rose, sumac, bayberry, wild mustard, daisy, and various other grass and herb species.

General climatic data for the Casco Bay region include a record low of -5.3 degrees C. in January, a record high of 20.1 degrees C. in July and a yearly mean of 7.5 degrees C. The frost free season is about 160 days. A total of 108 cm. of precipitation falls in one year on the average and is generally spread evenly throughout the year (Fobes, 1946; Hamilton, 1984).

History of Research

Although archaeological research in Casco Bay was first conducted in the 19th and early 20th centuries (e.g., Loomis and Young, 1912; Wyman, 1868), more systematic research was only initiated there in 1978. Dr. David Yesner and Robert French of the University of Southern Maine (USM) instituted a study of the archaeological site configuration and biogeography in Casco Bay (Yesner, 1978, 1980, 1983, 1984a, 1984b, various). In the first few years, general site survey was conducted across much of Casco Bay. This survey located or revisited a total of three sites on Great Moshier Island in 1979. One of these sites, Great Moshier Island site C, had been recorded in 1975 as ME 14-9 in the Maine site survey file when the landowner reported eroding burials to Dr. Bruce J. Bourque at the Maine State Museum. Bourque and his assistant, Robert Lewis, subsequently recovered portions of two human burials. A USM field crew salvaged ten human burials from a small ossuary at Great Moshier Island site C in 1979 (Hamilton, n.d.).

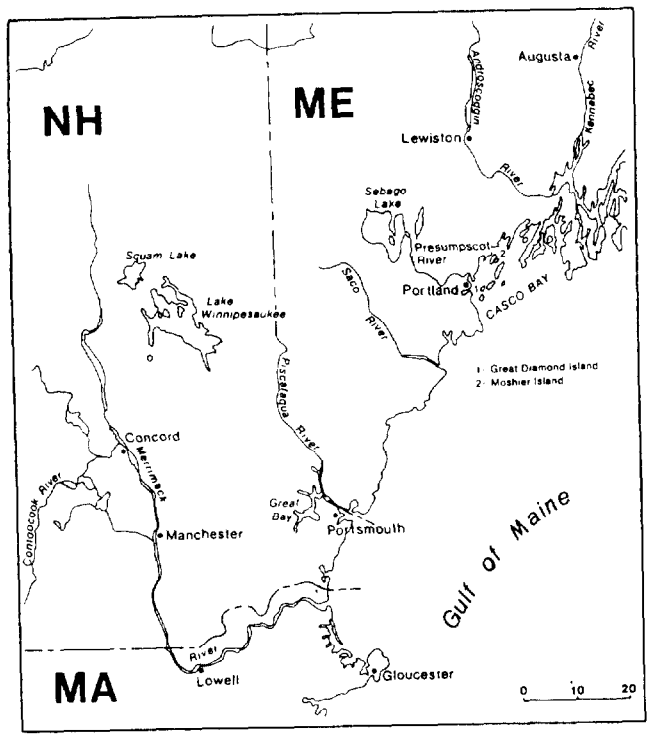

Figure 1. Region of southwestern Maine.

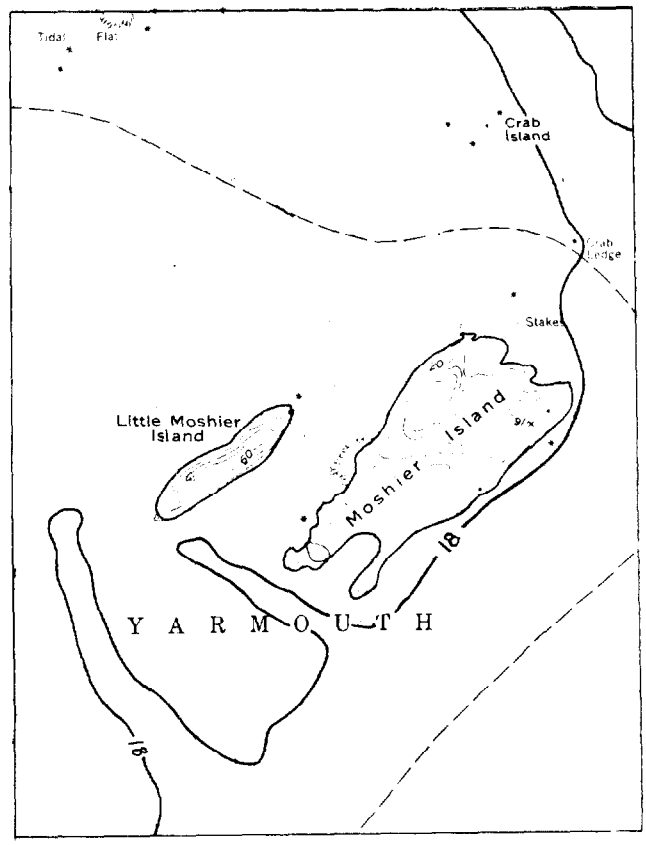

Figure 2. Great Moshier Island in northern Casco Bay.

The other Moshier Island sites, A (ME 14-18) and B (ME 14-73), were recorded by USM in 1979, although site A was first visited in 1975 by Richard Doyle. After examination of Doyle's collection from the eroding seaward fall of the site, site A was intensively excavated by USM under the direction of Dr. David Yesner in 1980 and 1981 (Yesner, 1983, 1984a, 1984b). Basic data for site B were recorded in 1979 and a small circular test pit, ca. 70 cm. in diameter, was excavated with no diagnostics recovered. As determined by USM, the length of the site is about 76 m., the width is 6 m. and the depth of the cultural deposit is about 0.35 m., with an area of 415 m.2 and a volume of 145 m.3 Distance from the eroding seaward face of site B to mean high tide is 5.5 m. and elevation of the modern surface above mean high tide is about 1 m.

Richard Doyle independently visited site B in 1979 and recovered diverse cultural remains as described below. A radiocarbon sample (87.9 g.) of quahog (Mercenaria mercenaria) shells was collected by Doyle in 1980 from the basal

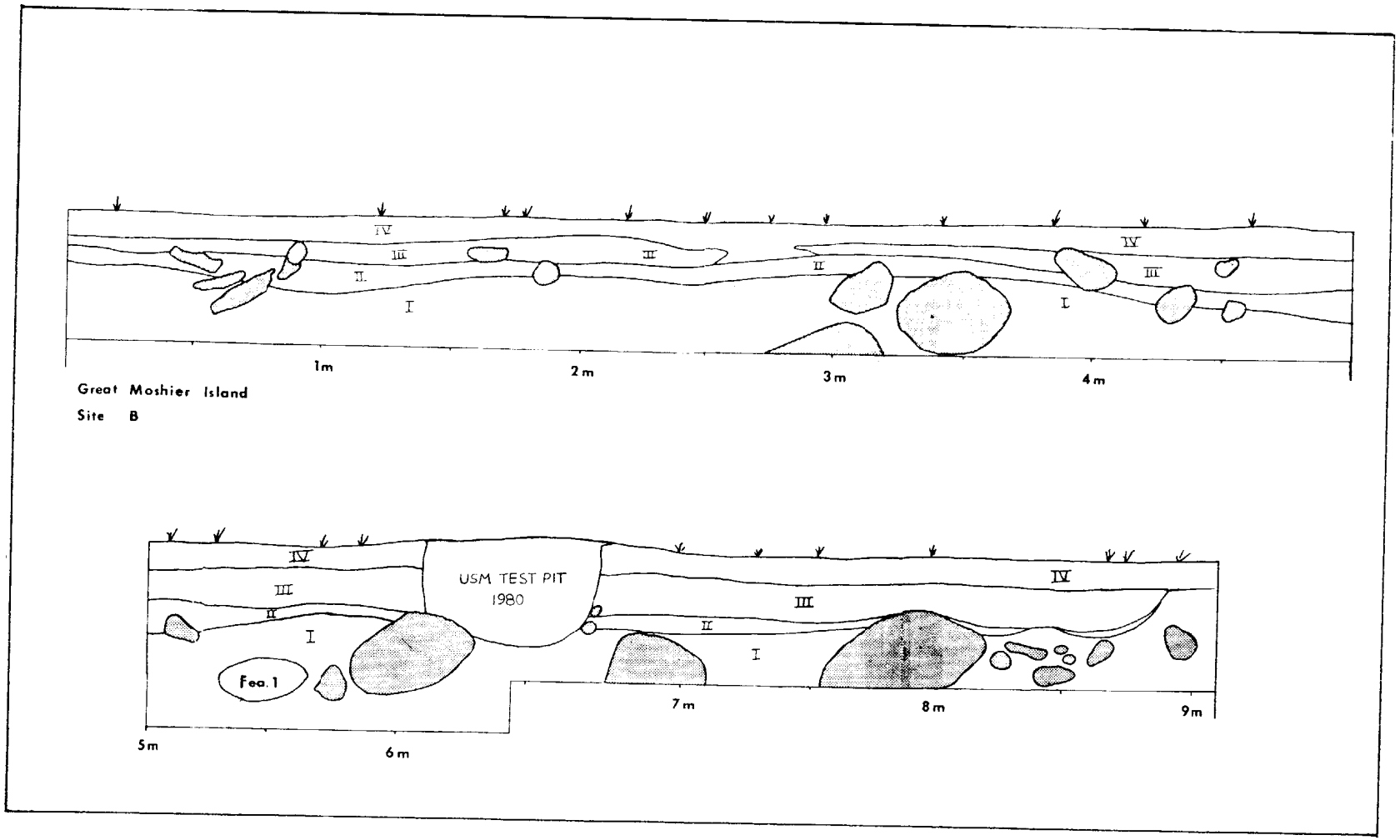

Figure 3. Profile of Natural Stratigraphy at Great Moshier Island, site B.

cultural deposit (Stratum I/II interface). This sample was submitted by Hamilton and Dr. J. M. Adovasio at the University of Pittsburg to Dicarb Laboratories in 1981 for radiocarbon analysis. A resultant date of 3,420±50 B.P. (1,470 B. C.) was returned (Dic-2428, uncorrected).

In 1982, Doyle and Petersen returned to Great Moshier Island site B to systematically map a 9 m. section of the eroding face of the site (Figure 3). A small number of lithic artifacts were recovered during the course of this visit.

Stratigraphy and Features

A total of four natural strata (Figure 3) were distinguished during the profiling of Great Moshier Island site B. In addition a single fire pit feature was isolated. The following are brief descriptions of the natural strata.

Stratum I: This stratum consisted of glacially deposited till and underlies all strata at the site. The till varies in thickness from 1.2 m. to 60 cm. at the site. Feature 1, a charcoal hearth was uncovered some 25 to 40 cm. below the top of stratum I.

Stratum II: This stratum consisted of compact shell and humus. Shell species include quahog (Mercenaria mercenaria) and soft-shell clam (Mya arenaria) as dominant forms and oyster (Crassostera virginica) and scallop (Pecten irridanis) as a relatively minor percentage. This stratum averaged 10 cm. in thickness.

Stratum III: This stratum consisted of compact humus and minor amounts of shell fish remains. Soft-shell clam was relatively abundant although scant in comparison with Stratum II. This stratum varied in thickness from 10 to 20 cm.

Stratum IV: This stratum consisted of mixed humus and beach wash. No cultural remains were recovered from Stratum IV. This stratum varied in thickness from 10 to 15 cm.

Materials Recovered

The cultural remains recovered from Great Moshier Island site B are diverse, although relatively few in number. Most of these materials are best summarized in Table 1, but a few of these merit additional comment.

A single stemmed rhyolite projectile point (Figure 4), is generally similar to various Late Archaic period stemmed points (e.g., Borstel, 1982; Bourque, 1975; Bourque and Cox, 1981; Moorehead, 1922; Snow, 1975). However, we cannot specify precise analogies for this specimen.

The groundstone artifacts (Figure 5), including a gouge, celt and plummet, are likewise generally similar to various other Late Archaic period assemblages (e.g., Borstel, 1982; Bourque, 1975; Hamilton, et al., n.d.; Hamilton, 1984; Moorehead, 1922; Sanger, et al., 1977; Snow, 1969). These artifacts further strengthen the association of some, or all of the extant collection from Great Moshier Island site B with the late Archaic period.

Correlations

The Late Archaic period diagnostics from Great Moshier Island site B permit general comparison with various other contemporaneous evidence in local and broad regional contexts. In local contexts, the Great Moshier Island site A has produced the best evidence of the Late Archaic period. A date of 4225 B.P. (2,275 B.C.) and diverse cultural remains are known there as summarized elsewhere (Yesner, 1984a, 1984b). Other sites with more scant Late Archaic period materials include Great Diamond Island, Upper Flag Island, Long Island, and Marine Hospital (Hamilton, 1984).

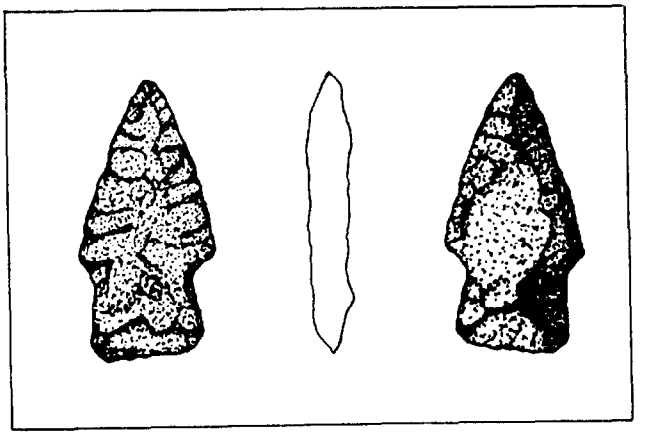

Figure 4. Flaked Stone Projectile Point from Great Moshier Island, site B (shown 64% original size).

TABLE 1

Distribution of Flaked Stone and Groundstone Remains
by Stratum from Great Moshier Island, Site B

ARTIFACTS	STRATUM I	II	III	IV	UNK.	TOTAL	PERCENT OF TOTAL
Flaked Stone Remains							
Projectile Point	-	—	---	—	1	1	1.0
Utilized Flakes	-	--	---	—	2	2	2.0
Core	-	--	---	—	1	1	1.0
Debitage (Waste Flakes)	-	33	---	—	55	88	88.0
SUBTOTAL	-	33	---	—	59	92	92.0
Ground Stone Remains							
Abrading Stone	-	1	---	--	---	1	1.0
Celt	-	1	---	—	---	1	1.0
Hammerstone	-	—	---	—	4	4	4.0
Gouge	-	1	---	—	---	1	1.0
Plummet	-	--	---	—	1	1	1.0
SUBTOTAL	-	3	---	--	5	8	8.0
TOTAL	-	36	---	--	64	100	
PERCENT OF TOTAL	-		---	--			100.0

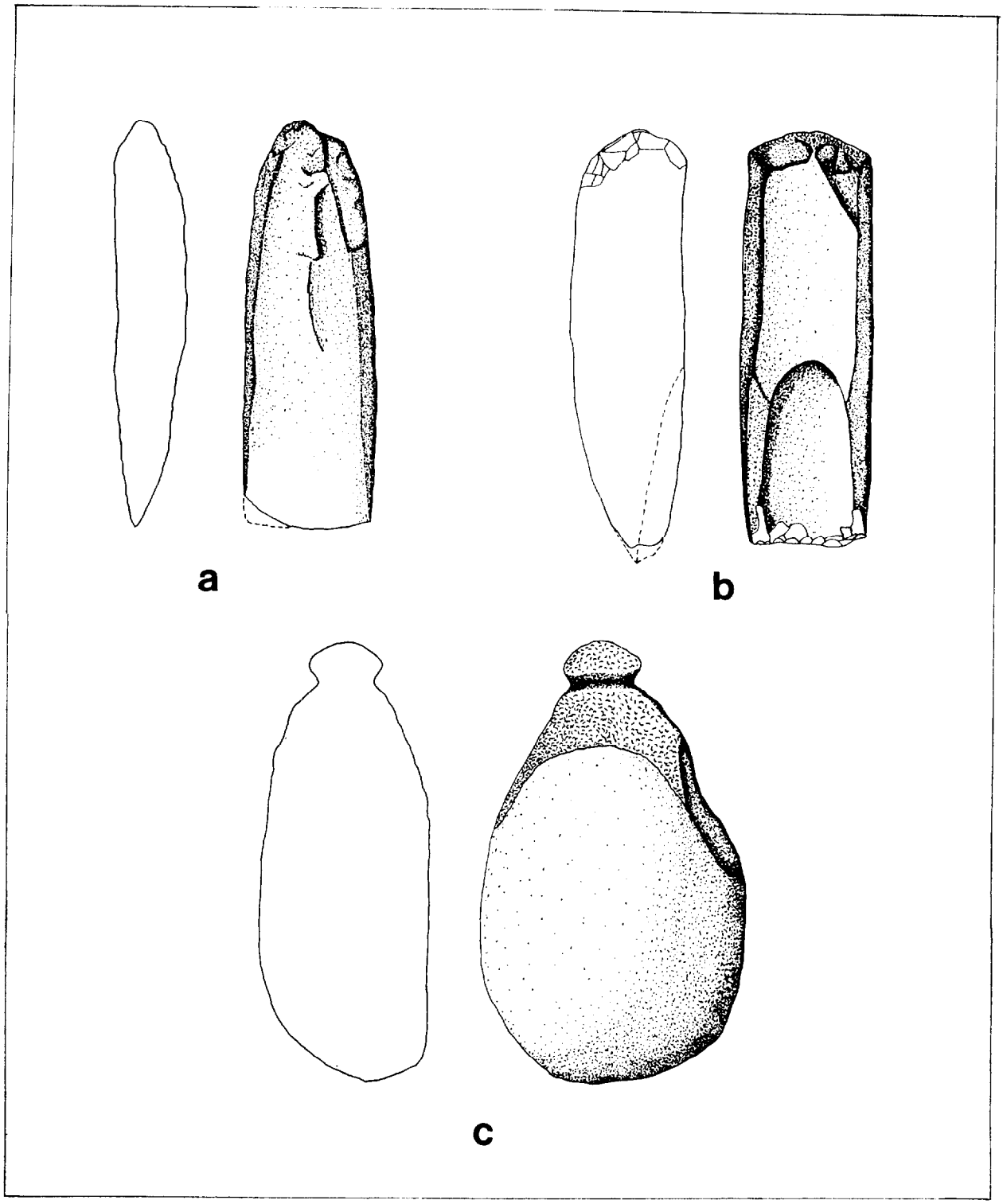

Figure 5. Ground Stone Artifacts from Great Meshier Island, site B, a Celt, b Gouge, c Plummet (shown 50% original size).

With the exception of rare sites in the Gulf of Maine, such as Turner Farm (Bourque, 1975), Goddard (Bourque and Cox, 1981), and Seabrook Tidal Marsh (Robinson, 1984) Great Moshier Island site A, and evidence elsewhere (e.g., Ritchie, 1969; Tuck, 1976), very few data are available to document Late Archaic maritime adaptations in the broad Northeast. Most evidence from coastal or near coastal Late Archaic sites is fragmentary, either isolated or poorly preserved (e.g., Barber, 1982; Hamilton, 1984; Johnson, 1947; McManamon, 1984; Sanger, 1982; Sanger and Chase, 1983). Evidence of Late Archaic period manifestations is more common in non-coastal interior settings adjacent to the Gulf of Maine, but these representations suffer from a like set of problems, most notably poor preservation of susistence remains (e.g., Bullen, 1949; Byers, 1959; Hamilton, et al., 1984, n.d.; Moorehead, 1922; Sanger, 1973; Sanger, et al., 1977; Snow, 1975; Yesner, et al., 1983).

The few well preserved Late Archaic period sites across the region, both coastal and interior, thus take on great significance for the wealth of data they provide for the study of Late Archaic adaptations in general. It seems clear that coastal populations were well adapted to the usage of marine (and terrestrial) resources by this period, and probably long before (see Bourque, 1975; Petersen, et al., 1984; Ritchie, 1969; Spiess, et al., 1983; Tuck, 1976). In point of fact, these sites reflect such an apparent emphasis on marine resources that we can speak of a Marine Archaic tradition across the region in the period minimally from ca. 3,000-1,000 B.C. (e.g., Bourque, 1975; Spiess et al., 1983; Tuck, 1976).

While it seems quite clear that Great Moshier Island site B may be related to the Late Archaic period, we need more information to better assess its relationship with the various Late Archaic manifestations across the Northeast.

The association of a radiocarbon date, various diagnostic artifacts and a demonstrable stratigraphic context provide evidence of a Late Archaic period shell midden in Casco Bay, Maine. As noted above, such associations are relatively rare in coastal settings throughout the Gulf of Maine. Although it is possible that the shell midden at Great Moshier Island site B may represent several (or many) sequent occupations, we feel that the absence of any artifacts clearly attributable to the Woodland (Ceramic) period ca. 1,000 B.C.-A.D. 1600 is of great possible significance. The identification of Archaic period sites of any age in coastal settings is of obvious importance and the identification of those attributable solely to the Archaic period correspondingly takes on even greater importance. We expect that future work at the Great Moshier Island site B will minimally provide a fuller inventory to better assess the nature of site usage and may in fact help us confirm its placement of relatively unique attribution to the Late Archaic period in local and broad regional contexts.

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References Cited

Barber, Russell J.
1982. The Wheeler's Site. Peabody Museum Monographs, No. 7, Harvard University.

Borstel, Christopher L.
1982. Archaeological Investigations at the Young Site, Alton, Maine. Occasional Publications in Maine Archaeology 2. Maine Historic Preservation Commission, Augusta.

Bourque, Bruce J.
1975. Comments on the Late Archaic Population of Central Maine: The View from the Turner Farm. Arctic Anthropology VII(2): 35-45.

Bourque, Bruce J. and Steven L. Cox
1981. The Maine State Museum Investigations of the Goddard Site, 1979. Man in the Northeast. 22:3-27.

Bullen, Ripley P.
1949. Excavations in Northeastern Massachusetts. Papers of the R. S. Peabody Foundation for Archaeology Vol. 1, No. 3.

Byers, Douglas S.
1959. The Eastern Archaic: Some Problems and Hypothesis. American Antiquity 24 (3): 233-256.

Fobes, Charles B.
1946. Climatic Divisions of Maine. University of Maine Technical Experiment Bulletin 40.

Hamilton, Nathan D.
1984. Maritime Adaptation in Western Maine: The Great Diamond Island Site. Unpublished Ph.D. Dissertation. University of Pittsburgh, Pittsburgh, Pennsylvania.
n. d. Excavation of Great Moshier Island, site C. Unpublished M.S. Department of Geography and Anthropology, University of Southern Maine.

Hamilton, Nathan D., Jack A. Wolford, Richard A. Doyle, and James B. Petersen
n. d. Archaeological Survey and Test Excavations in the Sebago Lake Region, Cumberland County, Maine. Unpublished M.S. Department of Anthropology, University of Pittsburgh.

Hamilton, Nathan D., James B. Petersen and Richard A. Doyle
1984. An Aboriginal Cultural Resource Inventory of the Greater Moosehead Lake Region, Northwestern Maine. Bulletin of the Maine Archaeological Society 24(1): 3-43.

Johnson, Frederick and Hugh M. Raup
1947. Grassy Island. Papers of the Robert S. Peabody Foundation for Archaeology Vol. 1, No. 2.

Loomis, F. B. and D. B. Young
1912. On the Shell Heaps of Maine. American Journal of Science 34: 17-42.

McManamon, Francis P.
1984. Chapters in the Archaeology of Cape Cod, I, Volumes 1 & 2. Division of Cultural Resources, North Atlantic Regional Office, National Park Service, Boston, Massachusetts.

Moorehead, Warren K.
1922. A Report on the Archaeology of Maine. Andover Press, Andover, Massachusetts.

Munn, Henry
1956. The Shell-heaps of Casco Bay. Maine Field Naturalist 12: 34-40.

Petersen, James B., Nathan D. Hamilton, J. M. Adovasio, and Alan L. McPherron
1984. Netting Technology and the Antiquity of Fish Exploitation in Eastern North America. Midcontinental Journal of Archaeology 9(2): 199-225.

Robinson, Brian
1984. The Nelson Island and Seabrook Marsh Sites. Occasional Publications in Northeast Anthropology, Man in the Northeast, Georges Mills.

Ritchie, William A.
1969. The Archaeology of Martha's Vineyard. Natural History Press, New York.

Sanger, David
1973. Cow Point: An Archaic Cemetery in New Brunswick. Archaeological Survey of Canada Paper 12. National Museum of Man, Ottawa.
1979. Some Thoughts on the Scarcity of Archaeological Sites in Maine Between 10,000 and 5,000 Years Ago. In: Discovering Maine's Archaeological Heritage, pp. 23-34. D. Sanger, Ed. Maine Historic Preservation Commission, Augusta.

Sanger, David and Tom Chase
1983. An Introduction to the Archaeology of the Rogue Island Group, Maine. Paper presented to the Canadian Archaeological Association.

Sanger, David, Ronald B. Davis, Robert C. MacKay, and Harold Borns
1977. The Hirundo Archaeological Project - An Interdisciplinary Approach to Central Maine Prehistory. Annals of the New York Academy of Sciences 288: 457-471.

Snow, Dean
1969. A Summary of Excavations at the Hathaway Site in Passadumkeag, Maine, 1912, 1947 and 1968. Department of Anthropology, University of Maine, Orono.

Tuck, James A.
1976. Ancient People of Port au Choix. Newfoundland Social and Economic Studies No. 17, Memorial University of Newfoundland.

Wyman, Jeffrey
1868. An Account of Some Kjoekkenmoeddings, or Shell-heaps, in Maine and Massachusetts. American Naturalist 1(11): 561-583.

Yesner, David R.

1978. Archaeological Site configuration and Biogeography of Casco Bay. A proposal submitted to the State Historic Preservation Officer, Augusta, Maine.

1980. Preliminary Report on 1979 Casco Bay Archaeological Survey. State Historic Preservation Office, Augusta, Maine.

1983. Points, Pots and People: Cultural Continuities Across the Archaic-Woodland Interface in Southwestern Maine. paper presented at the Northeast Anthropological Association, Syracuse University.

1984a. L'evolution de la Peche Prehistorique Dans la Region Sud-Ouest du Maine. Recherches Amerindienne au Quebec 14(1): 34-44.

1984b. Population Pressure in Coastal Environments: An Archaeological Test. World Archaeology 16(1): 108-127.

Yesner, David R., Nathan D. Hamilton and Richard A. Doyle

1983. "Landlock" Salmon and Early Holocene Lacusterine Adaptation in Southwestern Maine. North American Archaeologist 4(4): 307-333.