PREHISTORIC DIET AT NANTUCKET ISLAND, MASSACHUSETTS.

by Elizabeth A. Little

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Professor George Armelagos
University of Massachusetts, Amherst MA
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PREHISTORIC DIET AT NANTUCKET.

Ancient human diets have been reconstructed from botanical and zoological lists of available foods, ethnohistoric reports, or analyses of floral and faunal remains in archaeological deposits. Recently, the variation of stable isotope ratios and trace elements in human bone has been related to dietary differences. While I advocate the preservation of burials in situ when possible (Mass. Acts and Resolves 1983, Chapter 659), in this paper I seek to define and evaluate the potential of scientific studies on bone collagen from culturally and legally permitted salvage excavations.

THE USE OF STABLE ISOTOPES AS DIET INDICATORS.

The Stable Carbon Isotope, ^{13}C (C-13). Archaeologically anomalous radiocarbon dates for maize (*Zea mays*) originally called attention to a variation in isotopic fractionization among carbon isotopes in plants (Figure 1), which may become an extremely useful tool in studying the effects of various diets. Botanists searching for the cause of the anomalous maize ^{14}C dates found that there are three metabolic pathways used by plants, the C3 or Calvin-Benson pathway, the newly discovered C4 or Slack-Hatch pathway, and the CAM or Crassulacean Acid Metabolism pathway, each of which discriminates differently against the heavier carbon isotopes, ^{14}C and ^{13}C.

Most temperate North American plants use a C3 pathway, and most plants using a C4 (maize for example) or CAM (succulents for example) pathway are found in the tropics. However, there are some interesting and significant exceptions. Some temperate zone C4 plants mentioned in the literature are

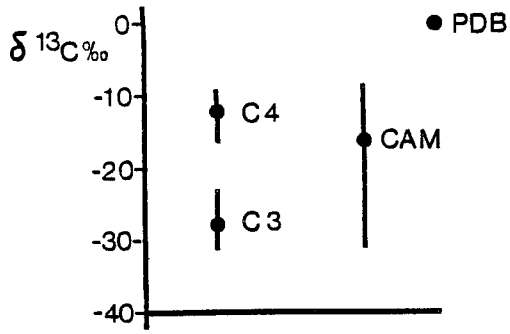


Figure 1. Carbon isotope ratio, $\delta^{13}C$ o/oo, for C3, C4, and CAM land plants (Lerman 1975, in Browman 1981:270; Stuiver and Polach 1977:358). The ^{13}C content of a sample is measured relative to the ^{12}C content by a mass spectrometer, and is expressed as

$\delta^{13}C = ([(^{13}C/^{12}C)$ sample / $(^{13}C/^{12}C)$PDB standard] - 1) x103 per mil.
The standard is a sample of Peedee (South Carolina) belemite (marine limestone).

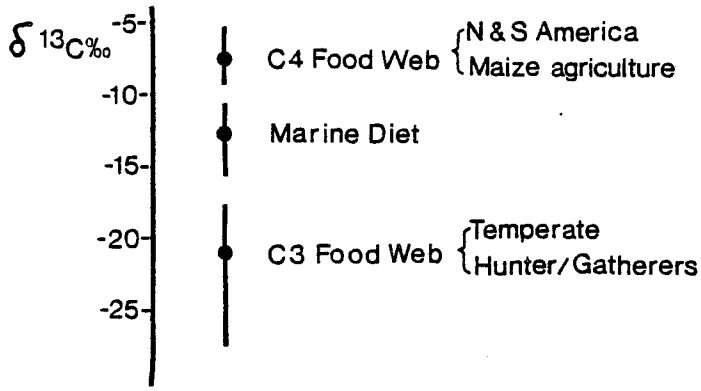


Figure 2. $\delta^{13}C$ in samples of human bone collagen for several terrestrial and marine diets in North and South America and Europe, showing the differences between maize, non-maize, and marine diets (Bender et al. 1981; Vogel and van der Merwe 1977; Chisholm et al. 1982; Schoeninger et al. 1983; Tauber 1981).

Panicum virgatum, Chenopodia , Setaria sp., Amaranthus sp., sugarcane, sorghum, and other plants with a "Kranz" anatomy (Vogel and Van der Merwe 1977; Van der Merwe and Vogel 1978; Browman 1981:273). Although CAM plants are succulents adapted to the xerophytic conditions usually found in the tropics (Vogel and Van der Merwe 1977:239), some, such as Opuntia compressa (prickly pear cactus) and Salicornia sp. (Glasswort), do in fact occur on the coast in the northeast.

Studies of the carbon isotope ratios of the whole bodies of insects, mice, etc., fed a diet with a known carbon isotope ratio, show that the carbon isotope ratios of the diets are preserved in the organisms (DeNiro and Epstein 1978a). However, detailed studies on larger animals show that the various tissues discriminate differently against isotopes of differing mass. Thus (Figures 1 and 2), while the flesh and fat of an animal eating C3 plants may have averaged δ= -27 o/oo, the bone collagen available to the archaeologist will have δ=-ca.21 o/oo, or 5 to 6 per mil higher than the diet (Van der Merwe and Vogel 1978). If the diet includes C4 plants, the δ of bone collagen could approach -5.0o/oo (Vogel and Van der Merwe 1977; Bumsted 1984). With the assumption of a linear relation between the carbon isotope ratio in the diet and in bone collagen, a number of researchers have deduced from the carbon isotope ratios of bone collagen the proportions of C4 to C3 plants in the carbon food web (which includes herbivores as well as plants) of prehistoric humans (Figure 3).

Bumsted (1984) has called attention to the many assumptions in published studies of stable isotopes in relation to diet, and has shown the need for careful studies of ^{13}C in foods and its variation in different human tissues in order to understand the variations in ^{13}C in prehistoric human populations. Future studies must define carefully the population being studied, the relationship between diet and the human tissues studied, and

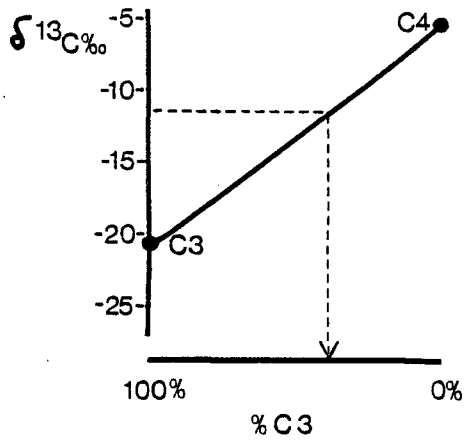


Figure 3. Dashed line to arrow head gives an example of the derivation of the percentage of C3 dietary carbon from a $\delta^{13}C$ measurement, when the only variables are the relative amounts of C3 and C4 plants in the food web. The food web includes plants and the flesh of plant eaters, which has $\delta^{13}C$ values similar to those of the dietary plants (Van der Merwe and Vogel 1978). There are assumptions here which need testing (Bumsted 1984).

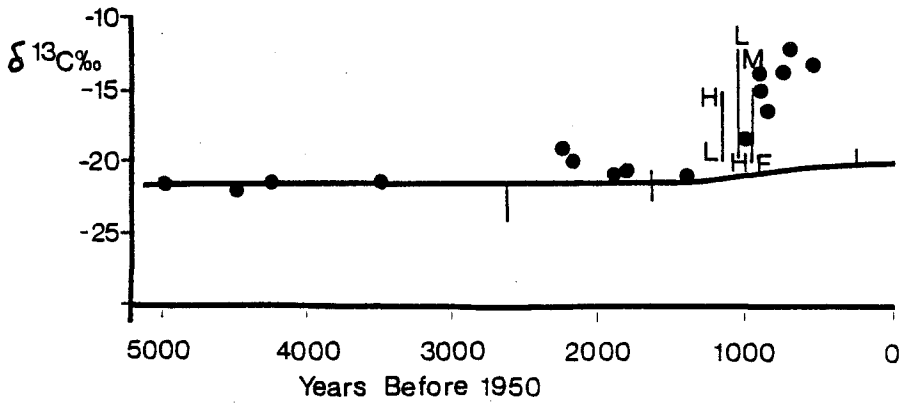


Figure 4. Use of bone collagen $\delta^{13}C$ studies to analyze chronological and social effects of maize horticulture in New York State, Ohio, Illinois, West Virginia, and Wisconsin (Vogel & van der Merwe 1977; van der Merwe & Vogel 1978; Bender et al. 1981). Note the indications for commencement of intense maize consumption about 800 A.D., and variations in maize consumption among males (M), females (F), high (H) and low (L) status individuals.

ecological relations among human, animal, and plant populations, with respect to the diet and to environmental and cultural influences (Bumsted 1984; Kreuger and Sullivan 1983; Sullivan and Kreuger 1981; Schoeninger and DeNiro 1982).

In spite of the many unknown details, a tropical C4 plant such as maize, if suddenly introduced into the diet of North Americans who had previously eaten only C3 plants and C3 plant-eating animals, should markedly raise the bone collagen $\delta^{13}C$ of this population. Vogel and Van der Merwe (1977) and Van der Merwe and Vogel (1978) tested this assumption on samples from New York, Illinois, Ohio, and West Virginia (Figure 4). Bone collagen from individuals who lived between 3000 B.C. and 600 A.D. (diet chiefly from C3 food web) showed a $\delta^{13}C$ of -21.9 to -18.9 o/oo. On the other hand, individuals living between 1000 A.D. and 1450 A.D., when maize horticulture was well developed in the Northeast, showed a $\delta^{13}C$ from -18.1 to -11.0 o/oo, which represents a maize carbon component of up to 69% of the carbon intake in their diet. Bender et al. (1981) also found differential access to maize on the basis of sex and status (Fig. 4). These data represent a significant contribution to our still imperfect understanding of the pace of introduction, the unexpectedly late and strong intensification, and the social contexts of maize horticulture in the Northeast. Dietary maize intensification has had nutritional penalties (Huss-Ashmore, Goodman, and Armelagos 1982:455). One of the assumptions in need of testing is that no other C4 or CAM plant or marine food, was involved in the change in $\delta^{13}C$.

<u>Marine Foods</u>: Reflecting the isotopic difference between oceanic and atmospheric carbon, $\delta^{13}C$ ratios for marine resources have been found to be + ca. 8 o/oo higher than those for terrestrial foods. Since this difference is passed on to human consumers, $\delta^{13}C$ measurements of human bone can

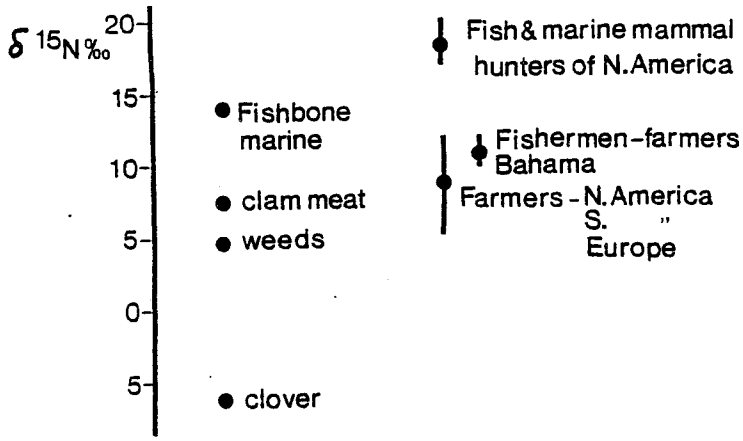


Figure 5. $\delta^{15}N$ values for selected foods and for human bone collagen for terrestrial and marine diets (Hoering 1955; Schoeninger et al. 1983; Chisholm et al. 1983)

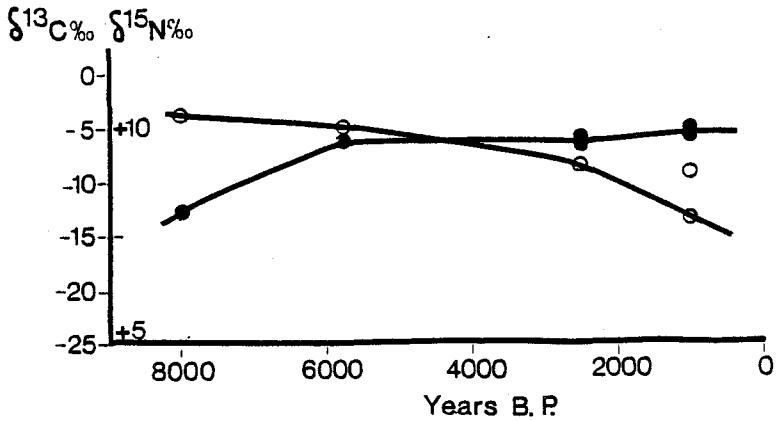


Figure 6. $\delta^{13}C$ and $\delta^{15}N$ for human bone collagen, Tehuacan Valley, Mexico (DeNiro and Epstein 1981). The data may reflect the introduction of maize and beans before 6000 B.P. (C:solid & N:open dots).

indicate the relative amount of marine and terrestrial foods in prehistoric non-maize diets (Fig. 2). On the other hand, since maize and marine foods both increase the carbon isotope ratio, a study of coastal dwellers who may also eat maize will require careful analysis.

Additional studies by DeNiro and Epstein (1978b), Burleigh and Brothwell (1978), Ericson and Berger (1974), and Van der Merwe, Roosevelt, and Vogel (1981) explore the use of carbon isotope measurements for archaeological questions.

Stable Nitrogen Isotopes.

Studies similar to those for the dietary effects of ^{13}C have been recently carried out for an isotope of nitrogen. DeNiro and Epstein (1981) showed that for small animals, $\delta^{15}N$ measurements in bones can reflect the relative ^{15}N content of the diet. ^{15}N is strongly enriched in most marine foods, as well as in fresh water protein (Chisholm et al. 1983). Figure 5 illustrates that the relative ^{15}N content of human bone collagen can be used to reconstruct the relative amounts of marine and terrestrial foods in historic and prehistoric diets (Schoeninger, DeNiro, and Tauber 1983; Chisholm et al. 1983). Since many populations use both fresh and salt water fish, land plants, and legumes in their diets, most $\delta^{15}N$ values will fall between the two extremes shown in Fig. 5. Low Bahamian $\delta^{15}N$ readings (Schoeninger et al. 1983) were attributed to nitrogen fixing in coral reefs.

Plants which can fix nitrogen such as legumes tend to have a reduced $\delta^{15}N$ value and may have left a record of their introduction into the diet of a people in the bones of those people. Although the authors state that diagenetic processes (soil contamination) may have operated at the site, the results of an isotope study in Mexico (Figure 6) suggest that maize and beans were introduced 7000 years ago (DeNiro and Epstein 1981).

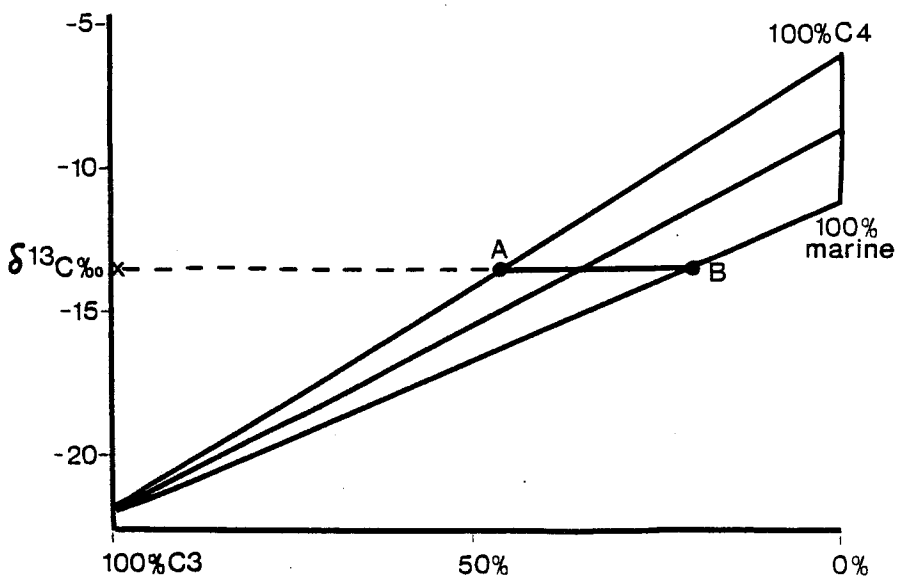


Figure 7. Example showing the effect of three variables on the analysis of diet from a ^{13}C measurement (x). If marine foods are added to a continental C3-C4 diet, all points on the line segment AB are solutions to the possible diet. A similar schematic represents the contribution made to ^{15}N by marine or terrestrial proteins and nitrogen-fixing plant foods (Bumsted 1984; Schoeninger et al. 1983; Chisholm et al. 1983, 1982; Tauber 1981; Vogel and Van der Merwe 1977; Van der Merwe and Vogel 1978; Bender et al. 1981; DeNiro and Epstein 1981).

TRACE ELEMENTS AS DIET INDICATORS.

If trace elements are not soil contaminants, they may offer useful data on diets or pathologies (Gilbert 1977). Toots and Voorhies (1965) showed that it was possible to distinguish between fossil Pliocene carnivores and herbivores from measurements of bone strontium. Brown (1974) applied this technique to a certain prehistoric Mexican population and found that relative access to animal protein could be related to status. In another trace element study in Mexico, Schoeninger (1979) confirmed the association of grave goods with high status and substantial protein in the diet. In connection with coastal diets, it should be noted that salt and fresh water fish skeletons and mollusc and crustacean flesh concentrate strontium (Schoeninger 1979:297; Schoeninger and Peebles 1981).

SUMMARY AND PROBLEMS.

Diet can vary with age, sex, cultural and social differences, as well as with historical processes, and its variation is recorded in the bones of a human population. It is crucial to recognize that chemical analysis alone cannot identify the foods in a diet. The importance of experimental dietary studies, their analysis, and the formation and testing of hypotheses (Platt 1964), for the reconstruction of prehistoric diets from bone collagen measurements cannot be overemphasized (Lambert, Szpunar, and Buikstra 1979; DeNiro and Epstein 1981; Gilbert 1977; Bumsted 1981, 1984; Bumsted et al. 1983; Kreuger and Sullivan 1983).

Since my intent in this paper was to focus on the potential of chemical methods for studying coastal diets, the time has come to emphasize that foods available at Nantucket add a third variable to each of the three methods of

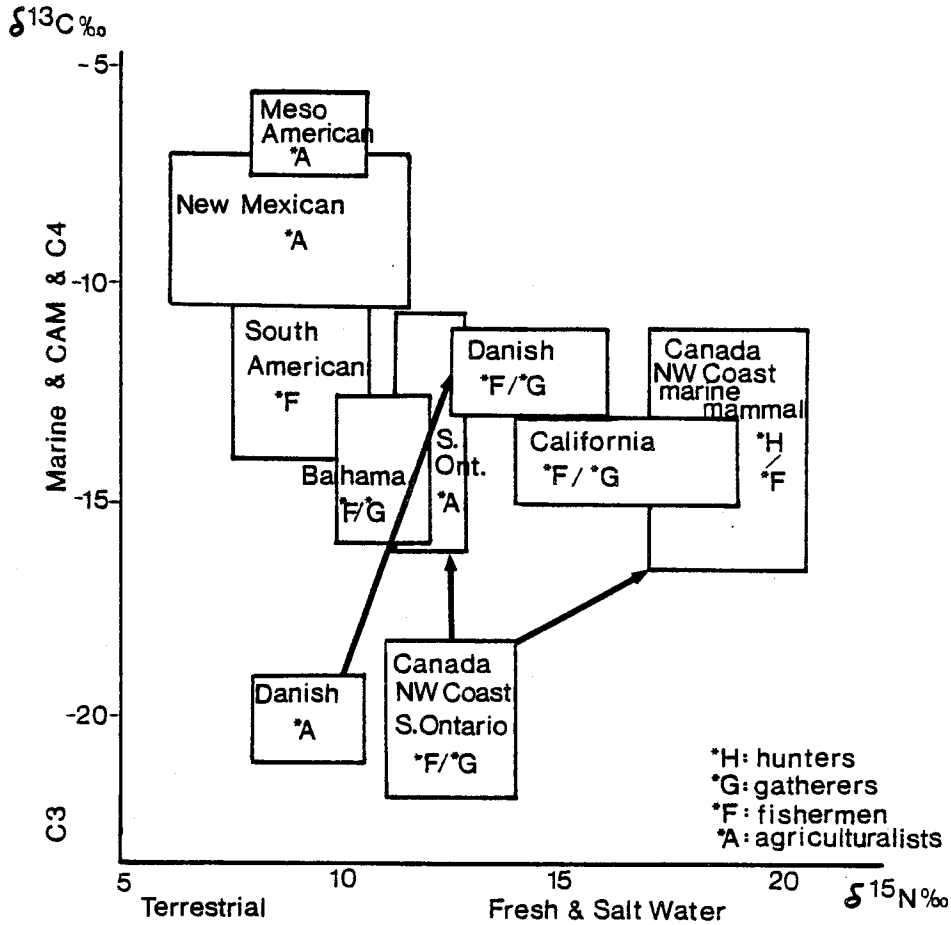


Figure 8. Schematic layout of ^{13}C versus ^{15}N for bone in prehistoric populations where both variables have been measured (Schoeninger et al. 1983; Chisholm et al. 1983; Schwarcz et al. 1983). Both ^{13}C and ^{15}N increase with increasing percentage of marine foods. Increased C4 or CAM foods would move a population up along the ^{13}C axis, and increased freshwater protein would move the population to the right on the ^{15}N axis.

testing, ^{13}C, ^{15}N, and Strontium, discussed in this paper. Since the tests were designed to handle only two independent variables, a third variable adds indeterminancy to the results. For example, the addition of marine food to a C3-C4 diet causes the linear relation between ^{13}C in bone and percentage of C3 foods in the diet to become a triangle with 100% of each dietary constituent at a different apex (Figure 7). Although three different tests could be adequate to measure three variables, each of the tests presently used measures different and not wholly independent variables.

Because of the complexity introduced by coastal foods, analysis of both Carbon and Nitrogen isotopes may provide useful information for coastal diets. For instance, provided that all the other variables stay constant, changes in one dietary variable with time such as the introduction of maize (C4) or a change in the use of marine resources is clearly discernable in Figure 8. We shall need to ask our questions very carefully.

In order to devise the questions for which answers could help establish the diet of prehistoric Nantucketers, first we need a solid archaeological foundation.

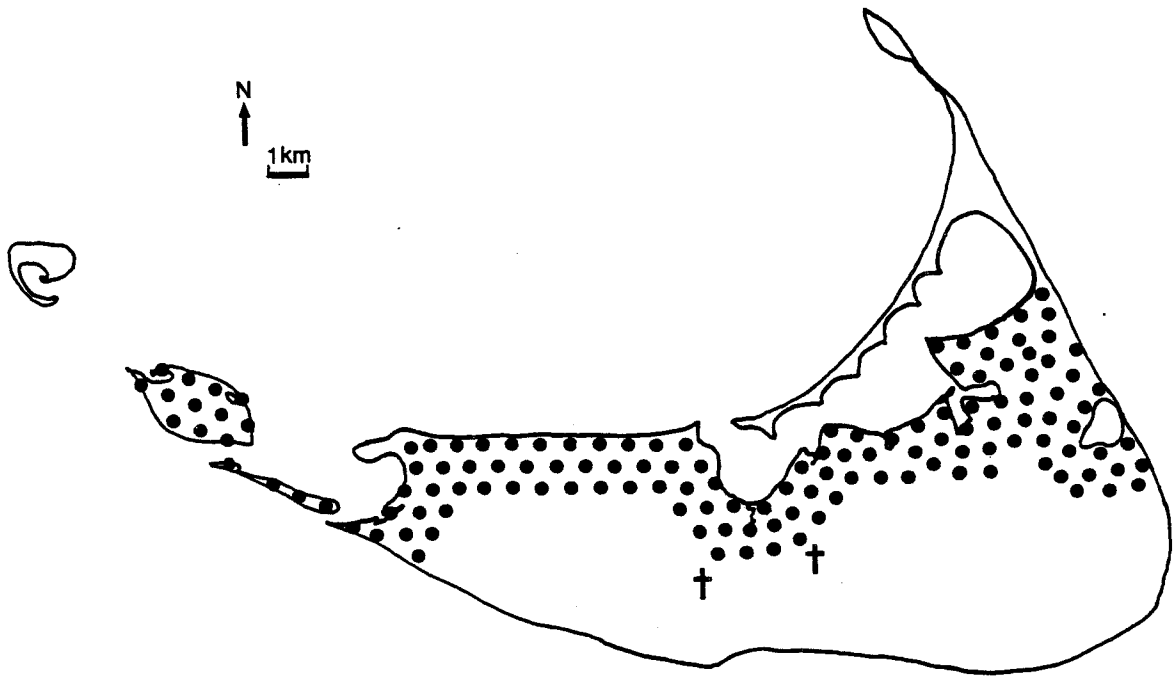


Figure 9. Zone (indicated by dots) at Nantucket for which we have reports of discoveries of 35 prehistoric (?) burials (Appendix 1; map redrawn from Little (1983a)). Crosses indicate a cemetery with eight Christian (?) Indian burials and the Miacomet Christian Indian cemetery.

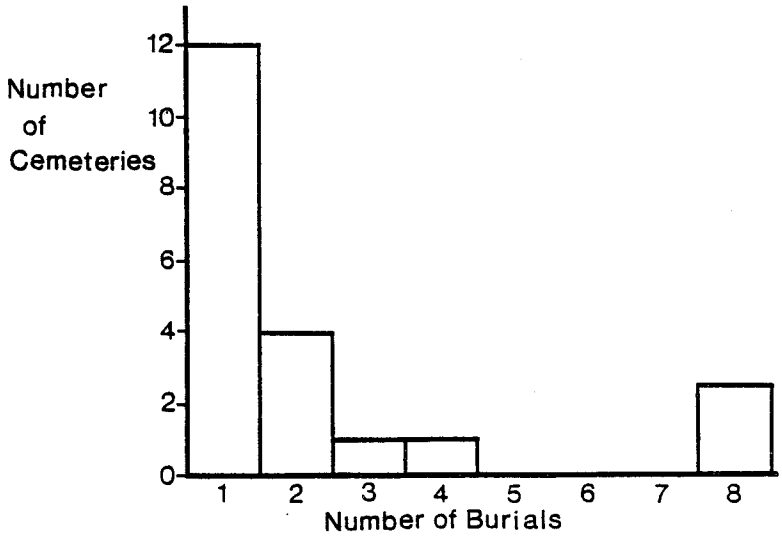


Figure 10. Number of Indian cemeteries of various sizes reported at Nantucket (Appendix 1). Most cemeteries contain a single burial.

ARCHAEOLOGICAL DATA ON PREHISTORIC DIETS AT NANTUCKET.

Population.

In order to study the record of prehistoric diet in bone at Nantucket, which has a prehistory extending over 10,000 years, dated populations of bones would be required. A site inventory obtained from newspaper clippings, published reports, and interviews (Little 1979,1982), includes reports of 43 burials, all but 8 of which were located in areas containing shell middens adjacent to modern shellfish habitat (Figure 9; Little 1983a). Because of the Holocene transgression of the sea and the bone preservation, I assume that these archaeological remains date to some time after 3000 B.P.

Since no reported Nantucket burials had diagnostic grave goods and none have been radio-carbon dated, at present one must rely on patterns to discover chronological differences. Figure 10 shows the number of cemeteries which contained various numbers of burials. The two groups of eight are anomalous, one, described as Christian by informants, located some distance from shell midden, and the other containing both primary and secondary burials. Otherwise, the cemeteries seem to have contained predominantly single burials.

All of the Nantucket burials were located on hillsides or hilltops. If we exclude the 8 "Christian" burials, we have left 35 burials, of which 33 were described as overlooking a shell midden less than 100 m away. The predominantly southeasterly aspect for burials (Figure 11) may be due to their association with shell middens which predominantly have SE aspects on Nantucket (Little 1985).

Stockley (1964) reported that the orientation of Indian burials at Nantucket was random and they were accompanied by few or no grave goods. The data I've been able to locate supports this (Appendix 1; Figure 12).

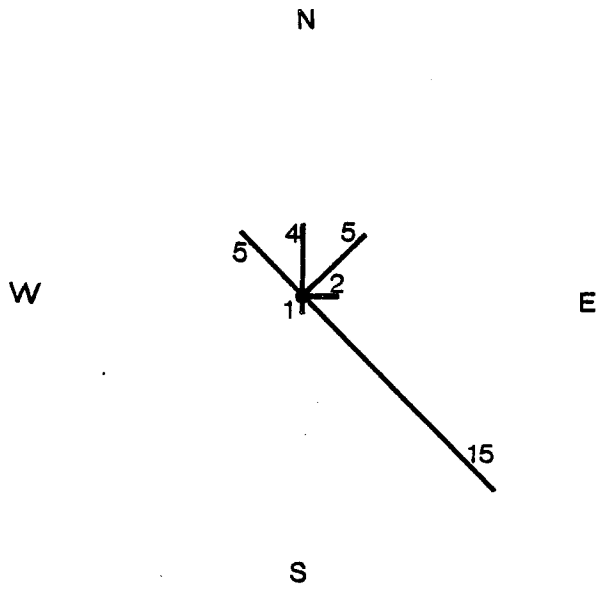


Figure 11. Number of reported prehistoric Nantucket burials with aspects as indicated. The burial sites predominantly have SE aspects.

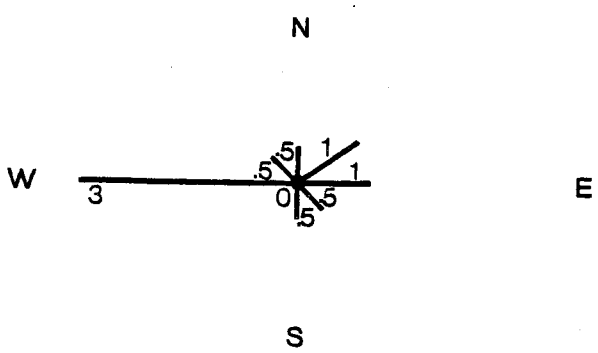


Figure 12. Head orientations in Nantucket Indian cemeteries (Appendix 1).

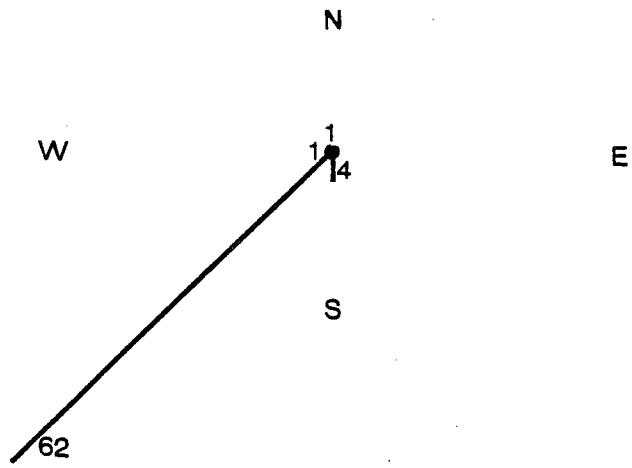
Most Contact/Historic Period Indian burials (dated by European grave goods) in New England have been found in sizeable cemeteries and have exhibited almost a 100% orientation toward the southwestern location of both the after life and the source of maize and beans (Figure 13a; Robbins 1959; Simmons 1970:64; Williams 1973:86). However, a number of small cemeteries (mainly single burials) in New England have been reported for which no preferred orientation and no grave goods were the common attributes (Figure 13b; Haaker 1984). Lending support to a proposal (Bradley et al. 1982:57) that these burials were prehistoric is Fowler's (1956) C-14 date of 800 ±80 B.P. for one such cemetery in Rhode Island.

With no consistent orientation towards the southwest, few or no grave goods, and mostly single burials, Indian cemeteries (excluding Christian) at Nantucket resemble those of the prehistoric rather than the Contact/Historic Period on the Mainland. Do we have evidence to support the suggestion that the 33 reported Nantucket burials predate the Historic Period? The shell middens usually contain prehistoric artifacts, and in 7 instances, Early, Middle, or Late Woodland Period artifacts have been reported near the burials or in grave fill, but the excavators have not been convinced these were grave goods. In a review of the reports, I find 11 instances of whelk shells, either single, worked into curious shapes, or many in a layer, associated with burials. This group may be chronologically related, but at most we can say only that the Nantucket burials probably date to somewhere after 3000 B.P.

An interesting attribute of some of the reported burials on Nantucket is a lack of caries, which suggests that they date from a pre-maize period (Little 1982; Trinkhaus 1982; Clabeaux 1973).

Although a prehistoric date is reasonable, we cannot exclude the possibility that we are dealing with a style of historic burial which was an

a) Head orientation in Mainland cemeteries with Contact/Historic Period grave goods.



b) Head orientation in Mainland cemeteries with no European grave goods

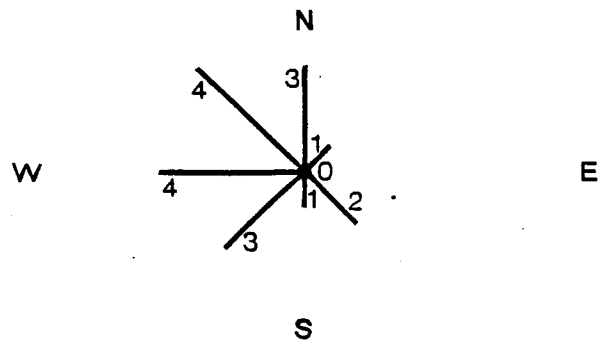


Figure 13. Head orientations in burials in Southeastern New England (Appendix 1).

alternative to large, aligned cemetaries with grave goods. Edward Winslow of Plymouth (1841:363) reported in 1623 that, while a Sachem was buried with his riches within a "pale", an ordinary Indian was buried in or near his wigwam, which was then abandoned. In addition, the absence of dental caries resulting from dietary maize cannot be used as evidence for a date, because the cultivation of maize at Nantucket before 1659 can be challenged (Ceci 1982).

In summary, I have recorded 35 reports of burials at Nantucket most of which have been found singly on hills overlooking shell midden, with few or no grave goods, and no preferred orientation. The contrast between this simple burial style and large historic cemeteries suggests that most of these burials may date to a prehistoric period, but I have shown that neither the burial place and style of burial, nor data from non-existent grave goods or the lack of caries, give us evidence for excluding the historic period. Some ^{14}C dates are clearly needed to solve this puzzle.

Diet.

Since we have identified 33 burials associated with shell midden, it is a logical step to examine the contents of shell middens for prehistoric foods at Nantucket. Four tables in Appendix II show all the reported archaeological data on prehistoric Nantucket foods. Table 1 gives a detailed list of the contents of the Quidnet (Locus Q-6) Site midden, which was dominated by deer and oyster, with many other shell fish species, an occasional turtle, fish, marine mammal (seal), and bird. Table 2 summarizes data on mammal remains identified in middens at Nantucket and Martha's Vineyard. The short list of mammals at Nantucket may be due to its insularity or to under-reportage. Table 3 summarizes the identified species of birds, fish, turtle, and snails (possible midden inhabitants) from Nantucket middens, and Table 4 is a list of a few plants identified in archaeological context, together with a

preliminary list of common edible plants on the island.

These foods fall into four groups, terrestrial protein (deer, dog, raccoon, fox, muskrat, vole, and land birds), marine protein (mammals, shellfish and crustaceans, seafowl, and fish), terrestrial plants, and marine plants. The latter two kinds of food have not been adequately recovered from middens, but dietary data on flora might be recoverable from $\delta^{13}C$ and $\delta^{15}N$ measurements on deer bone from middens. Note in Table 4 the number of nitrogen-fixing plants which might have been eaten by deer or by people. There are also native CAM and C4 plants at Nantucket. Based simply on the availability or use of foods shown in Appendix II, the diet of Nantucketers cannot be described or evaluated at present.

CONCLUSIONS.

There are cultural issues involved in the study of human remains, and I strongly advocate the preservation of burials in situ when possible. However, if human remains became available as a result of archaeologically and culturally permitted salvage excavations, their scientific study could produce insights into human prehistory. My purpose here is to help define possible insights to be sought. With ^{14}C dates on prehistoric Nantucket burials, we would be able to ask what role, if any, maize horticulture played on the island during the last two millenia? How did a Contact Period Nantucket diet compare to that of coastal maize farmers such as Narragansett Indians, especially as regards nutrition and health? Recent advances in chemical analysis offer the potential to answer such questions.

Acknowledgements: I am grateful to Professor George Armelagos for a broad and challenging introduction to human biology.

APPENDIX 1.

ORIENTATION OF BURIALS (excluding cremations) IN SOUTHEASTERN NEW ENGLAND, FROM REPORTS IN M.A.S. BULLETIN.

Place (reference), (# of burials), head orientation:

A) Cemeteries with no (or few undiagnostic) grave goods:

Martha's Vineyard (Stockley 1970)	(1)	NW
Rhode Island (Fowler 1956)800±80 BP	(8)	"no uniformity"
" (Robbins 1949)	(1)	SW
Cape Cod (Schamback & Bailet 1974)	(6)	NE(1),NW(1),SW(1),W(1)
" (Moffett 1949)	(1)	W
" (Moffett 1953)	(1)	N
Plymouth (Sherman 1951)	(3)	N(1)
" (Brewer 1956)	(3)	N(1)
Berkley (Staples & Athearn 1969)	(1)	W
Wapanucket (Robbins 1959)	(2)	SW(1)
Swansea (Robbins 1956)	(1)	S
New Bedford (Robbins & Bullen 1945)	(1)	W
Peabody (Bullen 1950)	(5)	NW(2),SE(2)

Cape Cod Ossuary (Bradley &c 1982) (47 individuals plus 9 cremations), 915±120 and 935±125 B.P. No preferred orientation.

Total # Sites:	# Burials:	Orientations of Heads:
14	90	N(3),NE(1),SE(2),S(1),SW(3),W(4),NW(4)

(Comment: for cemeteries with few, undiagnostic, grave goods, single burials predominated; the ossuary seems exceptional; orientation not patterned).

B) Cemeteries with some European grave goods:

Titicut (Robbins 1959)	(29)	SW(12),S(2),W(1),N(1)
Rhode Island (Simmons 1970)	(59)	SW(47),SSW(1),S(2)
Bristol Co.(Byers (1955)	(2)	SW(2)
S. Swansea (Phelps 1947)	(5)	?
Middleboro (Fowler 1974)	(2)	?
Bridgewater (Taylor 1970)	(21)	?

Total # Sites:6; # Burials:118; Head Oriented: SW(62);S(4);W(1);N(1).

(Comment: Cemeteries with European grave goods were usually large cemeteries, most (but not all) burials had grave goods, especially copper; strong SW orientation pattern. Assumptions that all Cu is European and that all burials in these cemeteries are Contact/Historic, need testing).

C) Nantucket Burials, excluding Christian cemeteries (Walker 1979; Stockley 1968; Little 1979,1982; Bullen & Brooks 1948; Turchon 1979).

Tuckernuck (2 are bundle burials)	(8)	E(1),W(1),(no pattern)
Long Pond	(3)	NE(1)
Capaum Pond	(1)	WSW(1)
Abram's Point	(1)	NW or SE (1)
Quaise	(2)	N or S (1),W(1)
Glowacki's Pit	(8)	no particular direction
Miscellaneous	(20)	?

Total # Sites:20; # Burials: 43; Head Orientations:
E(1);W(3);NE(1);NW(.5);SE(.5);N(.5);S(.5).

(If the orientation, "facing east", means the head either points north or south, I assign .5 to both north and south, etc.)

(Comment: There is neither a consistent pattern in the direction in which Nantucket burials are oriented, nor are grave goods commonly found in Woodland Period graves on Nantucket (Stockley 1968)).

(Additional MAS Bulletin References: Brewer 1956 (MASB 17(2):17); Bullen 1950 (MASB 11(2):37); Byers 1955 (MASB 16(4):77); Fowler 1974 (MASB 35(3&4):14); Moffett 1949 (MASB 11(1):10); 1953 (MASB 14(2):69); Phelps 1947 (MASB 8(3):33); Robbins and Bullen 1945 (MASB 6(3):44); Robbins 1949 (MASB 11(1):1), 1956 (MASB 17(2):22); Sherman 1951 (MASB 12(3):37); Staples and Athearn 1969 (MASB 30(3&4):1); Taylor 1970 (MASB 31(3&4)).

APPENDIX II.

TABLE 1. CONTENTS OF SHELL MIDDEN, LOCUS Q-6, SITE M52/65 (LITTLE 1983b) (prepared with the help of M. Noblick, R. O'Hara, and J.C. Andrews).

Crassostrea virginica (Oyster), 90% by weight.

Mercenaria mercenaria (Quahog), 10% by weight.

Miscellaneous, less than 1% by weight, in order of weight:

Odocoileus virginianus (white-tail deer)

Mya arenaria (soft shell clam)

Pectens irradians (scallop)

Spisula solidissima (surf clam)

Busycon caricum (knobbed whelk)

Urosalpinx cinerea (oyster drill)

Crepidula fornicata (boat shell)

Callinectes sapidus (blue crab)

Halichoerus grypus (gray seal)

Phoca vitulina (harbor seal)

fish: perch?, cod

barnacles

bird (unidentified)

turtle (unidentified)

APPENDIX II.

TABLE 2. MAMMALS IDENTIFIED AT 6 MARTHA'S VINEYARD SITES (M.V.), AND 6 NANTUCKET SITES (Squam Pond (M52/1), Herracator Swamp (M52/3), Quidnet (Q-6), Quaise, Ram Pasture I (RP-I), and Pocomo (Thompson) (Ritchie 1969; Waters 1965); Stockley 1964; Little 1983b; Bullen and Brooks 1947, 1949; Turchon 1979).

	M.V.	M52/1	M52/3	Q-6	Quaise	RP1	Thompson
White-tailed Deer	+++++	+	+	+	+	+	+
Gray seal	++++	+		+			
Harbor seal	++++			+			
Blackfish		+				+	
Humpback Whale			+				
Raccoon	++++		+			+	
Indian Dog	+++++		+			+	
Gray Fox	++					+	
Red Fox	+++				+		
Muskrat	++++					+	
Meadow Mouse/Vole	++		+	+		+	
Norway Rat							+
Caribou ?					+		
Elk ?					+		

- -

Black Bear	+
Sea Mink	++
Mink	+
Otter	++
Gray squirrel	++
Beaver	+++

APPENDIX II.

TABLE 3. BIRDS, TURTLES, SNAILS, and FISH, FOUND IN ARCHAEOLOGICAL SITES AT MARTHA'S VINEYARD (Ritchie 1969) and NANTUCKET (Bullen and Brooks 1947, 1949; Waters 1965; Stockley 1964; Turcheon 1979; Luedtke 1980; Little 1983b). Latin names for fish from J. C. Andrews (1986, 1973).

	M52/1	M52/3	Q-6	QUAISE	RPI	THOMSON	M.V.
Birds:		+	+	+			
Loon (*Gavia immer*)	+	+		+			+
Gavia stellata							+
Gull (*Larus atricilla*),		+					
Larus argentatus							+
Duck,					+		
Eider Duck (*Somateria mollissima*),		+			+		+
Mallard (*Anas platyrhynchos*)							+
Merganser (Mergus sp.)							+
Black Duck (*Anas rubripes*)							+
Greater Scaup (*Aythya marila*)							+
Cormorant (*Phalacrocorax carbo*),		+					
Brant (*Branta bernicla*),		+		+			+
Canada Goose (*Branta canadensis*)		+					+
Whistling Swan (*Cygnus columbianus*)							+
Eskimo Curlew (*Numenius borealis*)						+	
Teal (*Anas* sp.),		+		+			
Great Auk (*Plantus impennis*)							+
Turkey (*Maleagris gallopavo*)							+
Heath hen (*Tympanuchus cupido*)							+
Turtle:	+		+	+			
Box turtle (*Terrapene carolina*),						+	
Painted Turtle (*Chrysemys picta*)							+
Redbellied Turtle (*Pseudemys rubriventris*)							+
Snails:							
Marine: *Nassarius trivitata*,	+						
Polygyra thyroidus,	+						
Land: *Anguispira alternata*.	+	+	+				
Ilyanassa obsoleta,			+				
Fish:	+	+	+	+			
Sturgeon (*Acipenser oxyrhynchus*),		+		+	+	+	+
Sculpin		+					
Sand shark (*Carcharias taurus*),					+		
Sea catfish,						+	
Sea Robin (*Prionotus carolinus*),					+		+
Ray (*Dasyatis americana*),				+			
Cod (*Gadus morhua*)			+	+			+
Spiny dogfish (*Squalus acanthias/evolans*)				+			
Striped Bass (*Roccus saxatilis*)							+
Bluefish (*Pomatomus saltatrix*)							+
Scup (*Stenotomus chrysops*)							+
Tautog (*Tautoga onitis*)							+
Goosefish (*Lophius piscatorius*)							+
freshwater fish,		+	+				

APPENDIX II.

TABLE 4. EDIBLE PLANTS AND VEGETABLES AVAILABLE OR UTILIZED ON NANTUCKET.

Archaeological Botanical Specimens identified at Nantucket :

Walnut #
Hickory nut *
Oak #
Beach Plum (Prunus maritima) *
Cherry (Prunus serotina) *

*RPI (Stockley 1964)
#M52/3 (Bullen and Brooks 1949).

List of Edible Flora at Nantucket (Noblick 1977).

Blackberries
Grapes
Dew Berries
Rasberries
Blueberries
Huckleberries
Cat tails
Beach Peas (Lathyrus japonicus & palustris) (Legume)
False Indigo (Baptisia tinctoria) (Legume)
Ground nut (Apios americana) (Legume)
Legumes: Lespedeza, Cassia, Coronilla, Cytisus, Desmodium, Medicago, Melilotus, Taphrosia, Vicia)
Bayberry (Myrica carolinensis) (nitrogen-fixing)+
Sweet Gale (Myrica gale) (nitrogen-fixing)+
Alder (Alnus incana) (nitrogen-fixing)+ (uncommon)
Sea weed
Cactus (prickley pear, Indian Fig)(Opuntia compressa)
Hazelnut (Corylus americana, cornuta).
Beechnut
Sassafras
Cranberries
Amaranthus retroflexus, albus, graecizans, hybridus, paniculatus
Panicum virgatum
Setaria
Chenopodium (Atriplex: Orach); Chenopodium many species,
Glasswort (Salicornia) Succulent, in salt marsh (high in N-15 (Schoeninger, DeNiro, and Tauber 1983)).
Saltwort(Salsola), Sea-Blite(Suaeda),
Cladonia (reindeer lichen, many species at Nantucket).

American chestnut, doubtful
Acorns, few

+ Dr. Wesley Tiffney, U.Mass. Field Sta., Nantucket, MA., personal communication 12/8/1983.

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