A RADIOCARBON ASSESSMENT OF THE PROJECTILE POINT TYPOLOGY FOR THE ARCHAIC PERIOD OF THE NORTHEAST OF NORTH AMERICA.

by

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ABSTRACT

This study compares the established northeastern Archaic period projectile point chronology, based on the stylistic evolution of point types, with the chronology suggested by calibrated radiocarbon dates. The treatment of the radiocarbon data differs significantly from the heavy statistical orientation of the late 1960s and early 1970s. The focus, instead, is on assessments using radiocarbon ranges set by a minimum of a two-sigma standard deviation, and on graphic representations that reflect both the integrity of individual dates and the distribution of their collective ranges. By pointing out discrepancies between the traditional chronology and the radiocarbon chronology, the study suggests a new orientation for further investigation of the Archaic of northeastern North America.

RESUME

Cette présentation a pour but la comparaison de la chronologie établie de la pointe projectile Archaïque du nord-est, fondé sur la évolution stylistique du genre avec la chronologie suggérée par la graduation par moyen de la datation de radiocarbonne. Nous proposons d'examiner la data radiocarbonne d'une manière signifiquement différent de la orientation statistique des vingt derniers années. Nous voudrions concentrer sur l'évaluation critique en utilisant des rangs radiocarbonnes établis par un minimum de déviation moyen de deux sigma et sur représentations graphiques qui montrent l'intégrité des dates individuelles et la distribution des rangs collectives. En indiquant les inconsistances entre la chronologie traditionnelle et la chronologie radiocarbonne, nous voudrions proposer une nouvelle orientation pour l'enquête future de la période Archaïque de l'Amérique du nord-est.

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CHAPTER ONE

INTRODUCTION

For three decades processes borrowed from many fields of science have been used in archaeological research with ever escalating frequency (Dean 1978:223). Time studies have been among the major recipients. Dendrochronology, thermoluminescence, archeomagnetism, and radiometric dating have aided in the development and/or refinement of cultural chronologies unencumbered by stratigraphy or typology and free from comparison to known or exhibited cultural behaviour (Evin 1983:235; Snow 1978:88; Ralph 1971:29; Willis 1963:35). Of the methods available, radiocarbon dating, has been the most popular technique used in late Quaternary studies.

All scientific processes have unique theoretical principles, assumptions, limitations, and inaccuracies. In radiocarbon dating major anomalies are known to complicate precise interpretation: imprecision cross-cuts the theoretical, methodological, mechanical, and interpretive mechanisms. The general reluctance to abide by these constraints, resulting in a tendency to over interpret radiocarbon results in archaeological analyses, has been criticized openly. In many instances chronological frameworks have been developed and incorporated into the literature that far overreach the verifiable limits set by the data. A reluctance to calibrate dates, a reliance on too few dates, over-zealous statistical manipulation, and acceptance and rejection criteria based on traditional time frames have been commonplace, and still persist (Timmins 1984:16; Thomas 1978).

"An integration of ^{14}C dating in archaeology can only be successful if the archaeologist is constantly aware of the subtleties of the method, in the same way he knows the strong and weak points of typology and stratigraphy" (Waterbolk 1983:643). Thirty years of dating research has shown that even elementary comparisons of age measurements are not "straightforward", making complex space and time questions difficult to interpret with anything approaching precision (Chappell 1982:322). The interpretations offered in this study reflect this uncertainty, and thus a more conservative approach to the study of the Northeastern Archaic cultural chronology is presented.

The study has two primary goals: (1) to examine the effect of calibration on the Archaic time span, specifically the effect on the concept of the Early, Middle, Late, Terminal, and Transitional time segments and; (2) to begin a reassessment of the cultural sequences traditionally assigned to the Archaic Period. A total of 490 dates from Ontario, Quebec, Labrador, Newfoundland, Nova Scotia, New Brunswick, Maine, Vermont, New Hampshire, Connecticut, Massachusetts, New Jersey, New York, Pennsylvania, and Rhode Island were compiled for this study.

I have borrowed the term 'temporal container' from the work of Dean R. Snow (Snow 1978, 1980), and adapted the concept to fit my own aims. For the purposes of this study a temporal container is the generally accepted time frame given to each individual segment of the Archaic Period. There are four temporal containers corresponding to: (1) The Early Archaic, 8000-6000 B.C.; (2) The Middle Archaic, 6000-4000 B.C.; (3) The Late Archaic, 4000-1700 B.C.; and (4) The Terminal/Transitional Archaic, 1700-700 B.C. The time designations follow those set by Snow (1980), although variations on this basic scheme appear in the literature (Funk 1978, Stoltman 1978). After calibration the validity of each 'container' is examined, followed by an assessment of the accuracy of the traditional cultural chronology within each time frame.

All dates are graphically represented within their respective temporal containers. Calibrated dates carry a two-sigma standard deviation. The uncorrected time scale is also represented on each graph. These dates carry a one-sigma standard deviation following normal publication practices. Because of the controversy surrounding the correct statistical approach to be used with radiocarbon dates, statistical manipulations have been avoided. As an alternative, floating bar graphs have been used to examine Archaic cultural time patterns. The rationale for this approach is discussed in the next section.

CHAPTER TWO

RESEARCH RATIONALE, SECTION ONE

Meaning of a Radiocarbon Date.

"Radiocarbon dates are estimates of antiquity, the degree of estimation is encapsulated in the 'plus-minus' factor appended to each radiocarbon date" (Thomas 1978:232). The process produces expressions of probability, it does not furnish the archaeologist with absolute dates that correspond to terrestrial years (Watkins 1975:1). These probabilistic statements are based on a purely physical technique "...whereby residual radioactivity in a sample is determined within known limits of accuracy" (Harkness 1975:128). It is a random or Poisson process, repeated measurement of the same sample under similar conditions will not yield precisely the same result. The uncertainty in the measured activity is carried by the standard deviation (Mook and Streurman 1983:37); conversion of this measurement into the familiar AGE ± "ERROR" in years B.P. involves a complicated mathematical manipulation. Because of the nature of this determination, the probability that the real age of the sample is exactly the quoted 'mean' is zero (Ogden 1977:173). Results quoted with a one-sigma standard deviation have a sixty-eight percent (68%) probability that the true age of the sample falls within the limits defined. This probability can be increased to ninety-five percent (95%) if a two-sigma standard deviation is used. At the one-sigma level, one in three dates quoted in Radiocarbon will not bracket the radiometric age: this is reduced to one in twenty if a two-sigma standard deviation is used (Harkness 1975:129).

Before the archaeologist can make accurate comparisons to astronomical or calendrical time scales, radioarbon dates must be (1) corrected to compensate for anomalies in natural ^{14}C production; (2) corrected for the selective uptake of the differing carbon isotopes by living organisms; and (3) corrected to compensate for the uneven absorption of ^{14}C in the global reservoirs. An additional correction factor may be standardized to compensate for the statistical error introduced by calibration (Ward and Wilson 1978:22; Waterbolk 1983a:68). Through all of this it is important to remember that corrected dates are still expressions of probability. The significance of the standard deviation is not decreased.

Problems with Natural Radiocarbon Production.

The major calibration correction is made necessary by anomalies in natural ^{14}C production. Natural carbon consists of two stable isotopes, ^{12}C and ^{13}C, and a third radioactive isotope ^{14}C. ^{14}C is one of several by-products resulting from the collision of particles from cosmic space with atmospheric gas molecules. Once produced, ^{14}C is carried "along all possible trajectories" and absorbed by the three global carbon reservoirs - atmospheric, biologic, and marine. Theoretically, all materials containing carbon can be dated, based on the decay/disintegration of the radioactive ^{14}C component (Mook and Streurman 1983:31; Seigbahn 1970:20).

In the very early years radiocarbon production was thought to have been constant through time. By the 1950s variations in the atmospheric radiocarbon content were reported by DeVries (1958). Since that time a collaborative effort has established the magnitude of the fluctuations and isolated three types of secular variation (Mook and Streurman 1983;33; Wilson 1975; Michels 1973; Michael and Ralph 1971).

Long-term trends in production are accounted for by variations in the earth's magnetic field, which have affected the intensity of cosmic radiation in the atmosphere. All data confirm "...the slowly changing ^{14}C concentration in the atmosphere...forming...a nearly perfect sinusoidal curve with a period of almost 900 years" (Mook 1983:519). One appreciable period of fluctuation occurred at approximately 20,000 B.P., and another at approximately 13,000 B.P. (Dragoo 1974:24; Ralph, Michael and Han 1974). More recently it has been estimated that there has been a ten percent (10%) decrease in cosmic ray ^{14}C in atmospheric carbon dioxide over the past 6000 years (Bruns, Rhein, Linick and Suess 1983:511).

Medium-term trends (Suess Wiggles), brought about by changes in solar activity, have produced changes in ^{14}C production by as much as forty percent (40%) at intervals of approximately one hundred and sixty (160) years. These fluctuations, confirmed with precision for the period 3800 to 3200 B.C., can amount to an apparent change of age in ^{14}C years of a few hundred years within a fifty-year historical period, and can cause a drop of almost two hundred and fifty (250) radiocarbon years during the period from 3400 to 3350 B.C. (Mook 1983:519-520; Dragoo 1974:23).

Short-term changes in ^{14}C production were reported in 1978 by Stuiver. Periods of high solar activity increase the intensity of the earth's geomagnetic field; at this time the atmosphere is shielded more efficiently against cosmic radiation. The decrease in ^{14}C production results in a small age amplitude of approximately twenty-four (24) years (Mook 1983:520).

The major long-term fluctuations at 13,000 B.P., the ten percent (10%) decrease in ^{14}C throughout the last six thousand years, and the mid-term changes at 3800-3200 B.C. all have a direct impact on the Archaic time span. It is the correction of these vagrancies that is addressed specifically by published calibration tables.

Problems with Radiocarbon Uptake.

There is another serious anomaly that lies outside the corrective capacity of the calibration tables. Classical constructs assumed a uniform absorption of ^{14}C in all biological systems, with uniform retention of the ^{14}C content (without further exchange with reservoir carbon) from time of death until time of assay. There are two separate issues contained within that rather large statement: (1) biological systems do not uniformly discriminate between isotopes of carbon, but have varying capabilities (Ogden 1977; Evin 1983); and (2) the oceans and nonterrestrial organisms do not constitute homogeneous radiocarbon reservoirs (Harkness 1983:351).

"For reasons not wholly clear, most organisms are able to biologically select for a relative enrichment or depletion of the ^{14}C isotope over that $^{14}C/^{12}C$ ratio which exists due to the absolute total abundance of the planetary reservoir" (Rippeteau 1973:94). This phenomenon is known as fractionation. "Fractionation, in reference to radiocarbon dating, refers to the relative enrichment or depletion of one isotope of carbon over another in living organisms" (ibid. 1973:93). When assimilating atmospheric carbon dioxide, plants have a slight preference for absorbing the lightest isotope ($^{12}CO_2$ is preferred over $^{13}CO_2$, and $^{13}CO_2$ is preferred over $^{14}CO_2$). In this way, most plants become slightly depleted in ^{14}C by approximately three to four percent (3-4%).

Fractionation would not be a problem if all plant life shared uniform fractionation ratios, but unfortunately the actual ratios are the result of plant-specific photosynthesis cycles (Mook and

Struerman 1983:44; Evin 1983:245). Most plants, including the conifers and most temperate climate hardwoods, fall in the Calvin Cycle. Such organisms (C_3 plants) exhibit the generalized fractionation (depletion of ^{14}C) of three to four percent (3-4%) and yield uniform, reliable dates (Evin 1983:245). In this study, the dates derived from plant materials have come from specimens belonging to this group.

Of comparative interest are the members of the group of plants which fall in the Hatch-Slack (C_4) Cycle. In this group, the heavier ^{14}C molecule is more readily absorbed and stored than is representative of the atomspheric $^{14}C/^{12}C$ ratios. Fractionation favours the heavier molecule (^{14}C) by approximately one percent (1%). "The fractionation of ^{14}C is twice the fractionation of the stable isotope ^{13}C" (Evin 1983:245), and because measurements of stable isotopes are assessed more easily and accurately the $^{13}C/^{12}C$ ratio is the basis for fractionation measurements. The plants most affected are maize, millet, sugar cane, some species of papyrus, and a large group of arid land forms (Stuckenrath 1977:184; Evin 1983:245).

The amount of isotopic fractionation in a given sample can be calculated by measuring "...the concentration ratio of $^{13}C/^{12}C$" using mass spectrometry (Evin 1983:245).

> "This phenomenon of isotope fractionation is defined as the relative difference in isotopic abundance ratios between two compounds:

$$\varepsilon^{13} = \frac{(^{13}C/^{12}C)_{sample}}{(^{13}C/^{12}C)_{reference}} - 1 \; (\times 10^{3} \; ^{o}/oo)$$

Similarly isotopic abundance ratios $^{13}C/^{12}C$ are represented as relative deviations from a standard ratio. The values are generally quoted in per mil ($^{o}/oo$). The internationally agreed standard is PDB, (marine) carbonate from a belemnite collected in the North American PeeDee formation (Craig, 1957):

$$\delta^{13}C = \frac{(^{13}C/^{12}C)_{sample}}{(^{13}C/^{12}C)_{PDB}} - 1 \; (\times 10^{3} \; ^{o}/oo)$$

The equivalent definition for ^{14}C is:

$$\varepsilon^{14} = \frac{^{14}a \text{ sample}}{^{14}a \text{ reference}} - (\times 10^{3} \; ^{o}/oo)$$

Between these two values we have the relation (Craig, 1957):

$$\varepsilon^{14} \cong 2 \, \varepsilon^{13}$$

For example:

"Samples which contain 1 $^{o}/oo$ more ^{13}C (^{13}C = -24 $^{o}/oo$) than the reference ^{13}C value (= -25$^{o}/oo$), originally had 2 $^{o}/oo$ more ^{14}C and they appear to be sixteen (16) years younger (1 $^{o}/oo$ ^{14}C is equivalent to eight (8) years), which must be corrected for."

(after Mook and Streurman 1983:44-45)

Results are normalized against the isotope ratio of wood. The modern standard is equal to 0.95 the count rate of the N.B.S. oxalic acid standard (Mook and Streurman 1983:44; Olsson 1983:280). This represents the ^{14}C level in wood which would have grown in 1950 in the absence of the fossil fuel effect (Chappell 1982:323).

A third photosynthetic pathway, the Crassulacean Acid Metabolism Cycle (CAM), applies to plants adapted to water-stressed environments (cactus, yuccas). These plants are also enriched by ^{14}C and yield dates that are too young. (Browman 1981:272; Evin 1983). This pathway does not affect studies of the Northeast.

The phenomenon of isotopic fractionation also affects bone. Bone collagen is enriched in ^{14}C by approximately one percent (1%) relative to the atmospheric ratio, and can result in dates that appear to be eighty (80) years younger than the vegetable matter consumed by the organism. Collagen will reflect a second fractionation if an organism has fed off plants already enriched in ^{14}C, resulting in dates of an even more recent age. Human ribs have been measured by Vogel and Marais (1971) and found to be enriched by approximately four percent (4%). This can cause deviation from an accurate radiocarbon reading of as much as three hundred years for the maximum range of ^{14}C dating (Evin 1983:248). There are a small group of dates derived from bone or bone collagen in the data base.

Dates of thirty thousand (30,000) years or more are not seriously affected by this type of correction. Samples ten thousand

(10,000) years old or less may require a correction of two hundred and fifty (250) years to four hundred (400) years (Stuckenrath 1977:184). It is now standard procedure to publish fraction-corrected dates, but unfortunately this correction was used sporadically until the late 1970s.

Problems with the Reservoirs.

There is yet another problem, "...sample materials do not necessarily gain all their carbon from the atmosphere. They may form within a 'reservoir' in which atmospheric ^{14}C is diluted by waters containing less or no ^{14}C" (Chappell 1982:324). "The reservoir effect of sea water arises from upwelling of deep ocean water and the limited exchange rate between the atmosphere, the ocean surface, and deep water" (Olsson 1983:277). The mixing or 'upwelling' of the deep, old ocean layers (below 100 metres) which have lower concentrations of ^{14}C than the surface layers (which have decreased ^{14}C concentrations compared to the atmosphere) causes an overall reduction of the ^{14}C content in the 'mixed reservoir'. The reservoir effect is "...usually expressed as an apparent ^{14}C age of the water masses...and must be subtracted from the ^{13}C normalized, ^{14}C age" (ibid. 1983:277). This 'reservoir effect' or 'apparent age' phenomenon can yield dating deviations of marine species from two hundred (200) years to more than two thousand (2000) years in those regions most influenced by the upwelling of deep ocean water (Harkness

1983:351). Both animal and plants existing in, or feeding on organisms from environments with ^{14}C deficiencies will exhibit similar deficiencies.

Because of this problem there have been repeated warnings about the use of marine and terrestrial shell carbonates and submerged plant species. Marine shells collected in eastern Australia appear to be 450 ± 35 years older than anticipated. Shells from this area are now corrected by an 'apparent age' factor of four hundred and fifty (450) years (Chappell 1982:324). An 'apparent age' correction of 430 ± 20 years has been calculated for shell samples collected from Norwegian waters south of latitude 62°N (Harkness 1983:353).

In a study of nineteenth century marine shells gathered from the coastal waters of the United Kingdom, Harkness (Harkness 1983) has established that an 'apparent age' correction of 405 ± 40 years must be subtracted from conventional radiocarbon years. This correction is made necessary because of the mixing of the coastal waters of western Europe by the Atlantic Current (ibid. 1983:353). A comparison of marine shell ages with the ^{14}C time scale indicates that this correction factor should be applied over the past twelve thousand (12,000) years. This correction factor applies only to the coastal areas of the United Kingdom; "...for chronological intrepretation a geographically dependent correction factor must be determined and applied to conventional ^{14}C ages for samples of marine origin" (ibid. 1983:351-352). To the best of my knowledge a correction factor applicable to the northeastern coast of North America has never been established.

There can also be higher concentrations of the heavier isotope in ocean carbonates. "The isotopic fractionation of ^{14}C and ^{12}C results in the heavier ^{14}C being concentrated higher in the ocean carbonate during the exchange reaction between atmospheric carbon dioxide and ocean carbonate" (Dragoo 1974:24). Marine organisms fed by bicarbonate already enriched in ^{14}C exhibit an isotopic compositon that is approximately 3.5% higher in ^{14}C relative to modern wood. "The fact that the observed ^{14}C enrichment is less than the expected value of 5 percent (double that of ^{13}C) suggests the slow carbon dioxide-bicarbonate mixing in regions below the ocean surface" (ibid. 1974:24).

Lakes can also exhibit a 'reservoir age', particularly if they are fed by groundwater containing dissolved bicarbonate derived from old limestone. In these cases the bicarbonate contains very little ^{14}C and as a result the water "will appear aged" as will all organisms within it (Olsson 1983:284). Groundwater can also lose ^{14}C if it flows for great distances without atmospheric contact. This is, in effect, a closed system and can lose ^{14}C "simply by decay" (ibid. 1983:284). It is also possible for samples to appear too young due to <u>in situ</u> contamination from waters enriched with ^{14}C as a result of growing roots, water soluble humic acids, bacterial activity, moving water, and geochemical processes within deposits and sediments (ibid. 1983:278). In fact, <u>in situ</u> contamination from such sources can play havoc in terrestrial environments as well.

There are also discrepancies between the flesh of gastropods and their shell materials. Shellfish meats existing in carbonate enriched environments can produce dates approximately one hundred and fifty (150) years too young, while the shell carbonates can give dates ranging up to four hundred (400) years too young. Other sources quote systematic deviations of five hundred (500) to fifteen hundred (1500) years (Stuckenrath 1977:185; Ogden 1977:170; Evin 1983:257).

Isotopic fractionation and the reservoir effect make dating and comparison of non-terrestrial materials difficult. Completely appropriate correction calculations are still unavailable. At this time some laboratories have more success measuring shell fractionation ratios than do others (Olsson 1983:279). I have been unable to determine the status of the shell dates in this study. (In all probability the dates have not been corrected). As a result, the dates are viewed with caution.

In most instances very little information is available concerning each of the dates in the data base; as a result I have not applied a fractionation correction. Fortunately, the majority of dates have been derived from charcoal, probably from deciduous hardwoods and coniferous softwoods (see Rippeteau 1973:97). Because the fractionation effect in woods is small, it is assumed that: (1) the error within the data base will be small; (2) this error will be consistent and (3); the error will not significantly influence the results.

Yet, the lack of control of isotopic fractionation is recognized as a weakness in this study and one over which there can be little control. Archaic dates have been accumulated over a long period of time. The more rigorous and universally applied interlaboratory standards and procedures were not implemented until the late 1970s, long after publication of the majority of the dates commonly quoted for the Archaic.

Problems Caused By Anthropogenic Errors

From the beginning of this century the natural isotopic balance of carbon in the environment has been subjected to progressive anthropogenic disturbances. The release of large quantities of radioactively dead carbon, the by-product of fossil fuels, has diluted the atmosphere, thereby affecting the natural $^{14}C/^{12}C$ ratio. This 'Suess effect' accounts for a three (3) percent decrease in atmospheric radiocarbon worldwide, and a ten (10) percent decrease in latitude twenty (20) degrees North to latitude forty (40) degrees North. Thermonuclear weapons testing has resulted in a further change in the isotopic ratio. Assessment of this problem has been made difficult because of the as yet undetermined capacity for thermal enrichment of atmospheric carbon dioxide (Ogden 1977:170). The effects of these disturbances on the reliability of dates are still to be determined. We are now faced with the possibility that the nuclear disaster at Chernobyl, which released a huge but undetermined amount of radioactive carbon into the atmosphere, may have rendered the radiocarbon dating method useless for the future (Ikawa-Smith, personal communication).

The "...preservation of the authenticity of archaeological finds is...the responsibility of the investigator" (Evin 1983:272). Correct procedures in the excavation, preservation, handling, and transportation of sample materials are critical to accurate radiocarbon measurements. Paint, grease, hair from brushes, packaging materials, mould, or other bacterial growth introduced at the time of collection, are all potential contaminants (Harkness 1975:128-130). These errors are "insidious" and often cannot be corrected in the laboratory (Evin 1983:272). "The addition of five percent (5%) modern carbon to a 20,000-year-old sample results in a fifty percent (50%) error in age" (Odgen 1977:172). When working with dates within the 10,000-year-old range, "an addition of five percent (5%) drops the age to 9,000 years, ten percent (10%) to 7,500 years, twenty percent (20) to 6,000 years, and fifty percent (50%) to 3,000 years" (Stuckenrath 1977:183).

Problems with the Half-Life of Radiocarbon.

The estimate of the half-life of radiocarbon (5560±30), as originally calculated by Libby, is in error by three percent (3%). A half-life of 5730±40 years (after Godwin 1962) is accepted as a more precise measurement (Michels 1973:150;

Rippoteau 1974:30). This new value was officially sanctioned at the Fifth (1962) and Sixth (1965) International Radiocarbon Dating Conferences. Although the new value was officially recognized, the original value continues to be used as a standard in an effort to eliminate confusion.

The one hundred and seventy (170) year difference can be corrected by multiplying the radiocarbon age by 1.029 (Michels 1973:173). Yet, "...in the range where the application of the 'better' half-life of 5730 years becomes significant (before 3000 BP), the natural ^{14}C trend causes even larger deviations. This makes the use of this half-life instead of the conventional 5568 years superfluous" (Mook 1983:519). As far as can be ascertained all dates used in the data base have been calculated using Libby's original 5568-year estimate. (The calibration table corrects any error introduced by Libby's half-life).

The Choice of Calibration Curve.

The calibration curve used in this study is the result of the **WORKSHOP ON THE CALIBRATION OF THE RADIOCARBON TIME SCALE**, held at Tuscon, Arizona in 1979. The results of this workshop were published in Radiocarbon, volume 24, number 2, 1982 (Klein et al 1982:103-150). One thousand, one hundred and fifty-four (1,154) samples of dendrochronologically dated wood (*Pinus longaeva* and *Sequoia gigantea*) were assayed by the radiocarbon laboratories at the Universities of Arizona, Groningen, California at La Jolla, Pennsylvania, and Yale. It is possible to calibrate dates covering a range of eight thousand (8000) years - from 6050 B.C. to A.D. 1950. This curve is the first in a series of "consensus calibrations" to be updated as improvement is made to the data base" (Klein et al 1982:118). I feel obliged to inform the reader that a new calibration curve, considered superior to this curve, is scheduled for publication in Radiocarbon some time in 1986. It is expected to extend the calibrated time scale to approximately 9050 B.C. (Nelson, personal communication; Switsur 1986:141).

To obtain a calibrated date, a radiocarbon date in years B.P. based on the 5568±30 year half-life is matched to its counterpart in a column located on the left side of the calibration table (rounded to the nearest ten (10) years). The standard deviation carried by the date determines under which of the six sigma columns (20, 50, 100, 150, 200, 300) the new calibrated date range in years B.C. will be located. The new calibrated date carries a two-sigma standard deviation.

Example:

Traditional Date - GX-1748
Neville, New Hampshire
5910±180 B.P. (3960 B.C.)

Calibrated Range - 5245-4425 B.C.

New Standard Deviation - 5245-4425 = 820

$820 \times 1/2 = 410$

New Mean - $4425 + 410 = 4835$
or
$5245 - 410 = 4835$

Calibrated Date - 4835±410

A slightly different calculation is used for dates with standard deviations greater than three hundred (300) years. Sixty (60) years are subtracted from the standard deviation; the result is then added to and subtracted from the mean. The two figures are located separately within the tables: the calibrated date range is obtained by using the extremes of the two intervals located under the sigma = 20 column.

Example:

Traditional Date - C-417

Boylston Fishweir, Mass.
5717±500 B.P. (3765 B.C.)

1. 500-60 = 440
2. 5717+440 = 6157
3. 5717-440 = 5277

Date range of 5277 = 4350 - <u>3880</u>
Date range of 6157 = <u>5295</u> - 4935
Calibrated Range = 5295 - 3880 B.C.
New Standard Deviation - 5295-3880 = 1415

$1415 \times 1/2 = 707.5$ (rounded to 710)

New Mean - 3880 + 710 = 4590

Calibrated Date - 4590 ±710 B.C.

For dates that are beyond the current calibration limits, the mean of the traditional date is used, and the standard deviation is extended to 1000.

Example:

Traditional Date - GX-8204

Johnsen No. 3, N.Y.

9140 ±260 B.P. (7190 B.C.)

Traditional Mean = 7190 B.C.

Standard Deviation = 1000

New Date - 7190 ±1000 B.C.

The curve by Klein <u>et al</u> is the first unified effort in calibration. Prior to this publication fourteen (14) different curves had been published (Browman 1981:255). Of these, the most popular were the MASCA (University of Pennsylvania, 1973) and Arizona (1974) curves. Although all the curves reflected similar long-term changes in atmospheric radiocarbon, controversy continued to surround the calculation of the short-term ^{14}C changes (Klein <u>et al</u> 1982:103). The indecisiveness spawned a negative reaction to calibration among many archaeologists (Stuckenrath 1977:187).

It must be noted that reservations regarding the validity of calibration are still evident, even among physical scientists. Contradictory statements are easily found. One investigator is of the opinion that conventional ages cannot be compared unless calibrated (Chappell 1982:323); another maintains that "...Mutual comparison of ^{14}C dates should..be carried out in the conventional radiocarbon time-scale" (Waterbolk 1983a:68). The disagreement appears to be centred around the magnitude of the statistical error introduced by the calibration.

Despite this negative component, the impetus to calibrate is gaining momentum. Until such time as we are greeted with a new set of tables, the curve prepared from the workshop at Tuscon appears to be our best choice.

CHAPTER THREE

RESEARCH RATIONALE, SECTION TWO

Statistical Treatment of Radiocarbon Dates.

> "The variation in the reliability of ^{14}C datings....is so great that the calculation of an average of all datings relating to a particular archaeological phenomenon is often an unjustifiable procedure."
>
> (Waterbolk 1983a:63)

The subject of averaging and statistical examination of radiocarbon dates in archaeology is nothing if it is not controversial. Straightforward statements are few and far between. Archaeological "mouthtalk" (Thomas 1978) is evident. Fence-sitting is not unpopular.

The traditional argument for averaging has focused on the precision of the standard deviation. Each radiocarbon estimate carries an error term related to: (1) radioactivity (counts per minute), (2) the time the sample is counted, and (3) the performance of the equipment. These errors enter a radiocarbon age calculation in relation to the formula:

$$A = -8033 \ln(N_s - N_b)/(N_m - N_b)$$

where N_s = sample count rate; N_m = modern standard; N_b =

background count rate (Chappell 1982:323). A one sigma error term gives a sixty- eight percent (68%) probability that the age estimate is properly defined by the plus-minus range (discussed on page 5).

By averaging, the number of disintegrations measured is effectively increased, adding to the value of the sigma and thereby yielding a more precise estimate. Averaging tends to reduce the sigma, further enhancing precision (Long and Rippeteau 1974:205; Rippeteau 1973). Although this rationale may be technically accurate, it suffers from two major weaknesses.

To begin with, there is the matter of the sixty-eight percent confidence level. The consistent use of this level of confidence in archaeology "...is virtually unknown in other fields of applied statistics" (Clarke 1975:265; Ward and Wilson 1978:20). Therefore, before all other considerations, the use of the one-sigma confidence level rather than the usual two-sigma or ninety-five percent (95%) confidence level must be discouraged.

Secondly, there is now clear indication that among the over one hundred radiocarbon laboratories there is "systematic laboratory bias" in error calculations (International Study Group 1982:623). Thirty laboratories were invited to date samples selected from one specimen of oak, and were each responsible for a total of eight tightly controlled segments. A total of one hundred and forty-three (143) measurements were obtained (twenty laboratories participated, six data sets were incomplete). Although all results were in "broad agreement", careful examination revealed "considerable variability". Serious disparities were noted in the calculation of the standard deviation, and it became evident that there is a "...lack of a universal method of error calculation...quoted errors were inadequate for the study group as a whole" (ibid. 1982:622). The International Study Group suggests that quoted errors are minimal dates and should be multiplied by a factor between two (2) and three (3). Given this information, there may still be a case for averaging dates from the same laboratory. But at this time, archaeologists cannot seriously entertain the possibility of averaging dates from a cross-section of laboratories. Moreover, although the calibration table used in this study was calculated to include "..an estimate of the systematic errors between laboratories" (Klein et al 1982:103), it cannot be viewed as adequate, given the large discrepancies now recognized.

Systematic Errors Using Wood Samples.

Statistical examination is dependent on accuracy: accuracy in the assessment of (1) degree of contamination, (2) type of contamination, (3) treatment for contamination, (4) sample location, (5) stratigraphic comparisons, (6) collection methods, and (7) closeness of association between the sample and cultural material. If all variables can be precisely evaluated, statistical evaluation is considered justifiable (if one disregards the errors in the calculation of the standard deviation). Yet, wood samples may carry systematic errors that can be impossible to evaluate. These are due to discrepancies between the time of growth, the time of death, and the time the material was used in the (pre)historic event. If the sample came from short-lived species the error may have little significance, but long-lived species can be the cause of large errors (Nydal 1983:110).

Wood dates are an average age of a series of tree rings: this is in contrast to other organisms where the date is a measurement of the time of death (Dean 1978:226). Charcoal samples made up of inner growth rings may produce results in error by hundreds of years; that is, the inner tree rings would be much older than the human event it is intended to date. Outer tree rings would have a much closer association with the event. When several pieces of charcoal are used to make up one sample there then can be a mixture of both young and old tree rings; this results in an average age of all sections of the combined sample, producing a date with little correlation to the artifactual material found in association with it.

There are steps that can limit this error: (1) use of single, large, intact pieces of charcoal; (2) assay of multiple dates for comparison; (3) avoidance of combined samples; and (4) identification of long versus short-lived species. While these measures can help current dating, nothing can be done about the large body of existing Archaic dates. This information is not available in most cases and many of the Maritime Archaic dates from Labrador and Newfoundland come from samples of scattered charcoal. Without control of these data, another factor is weighted against averaging Archaic dates.

Additional Averaging Criteria

There is general acceptance for statistical manipulation on:

1. Replicate dates from the identical sample material. This is completed in the laboratory before results are published.

2. Different segments of the same sample run separately. However, it must be established that the segments are from a "single parent sample".

(Long and Rippeteau 1974:206).

These are "Case I" situations defined as " ... two or more determinations made on the same object or different parts of the same object..." (Ward and Wilson 1978:20). In such cases it can be assumed that the only sources of error lie within the counting procedure - that these errors are comparable - and, therefore, can be subjected to selected statistical procedures (ibid. 1978:20).

The remaining criteria involve highly subjective parameters:

1. Averaging dates from the same stratigraphic unit or living floor.

2. Averaging dates from different sites thought to be coeval.
   a. assemblages of artifacts diagnostic of a sequence
   b. closely grouped radiometric ages
   c. correlations with natural time-partitioning events (floods, volcanic eruptions)
   d. correlation with long-term accumulation events (deposition of loess, floodplains)

3. Averaging dates representative of "clearly sequential but nonrepetitive events (stylistic evolution)"

(Long and Rippeteau 1974:206).

These criteria correspond to Case II situations, "...determinations made upon two or more samples known not be be from the same object or which cannot be assumed to have been derived from the same object" (Ward and Wilson 1978:20). If all variables are considered to be well controlled and averaging appears warranted, a second statistical approach separate from Case I situations is advised (ibid. 1978:20; Wilson and Ward 1981). Existing radiocarbon studies have not differentiated between Case I and Case II situations. This has meant that even in instances where primary data are sufficiently detailed to justify averaging, the wrong set of statistical formulations has been used. [3]The formulae for both Case I and Case II situations are not included in this study, primarily because they are not considered applicable to the Archaic data base. For complete details I refer the reader to Ward and Wilson 1978:19-31; Wilson and Ward 1981:19-39; Chappell 1982:322-335[2]. Provided all other criteria are met, the difference between two sample means can be tested using the Z-statistic, provided the age error is small relative to the age of the sample. The Z-statistic is evaluated using a standard table of cumulative normal distribution.

$$Z = \frac{A_1 - A_2}{(E^2_1 + E^2_2)}$$

(Chappell 1982:332)

It is sometimes stated that although coeval events are not of the same "instant in time", they are "effectively of the same age" (Long and Rippeteau 1974:206). This may be misleading. Medium-term variations in the original ^{14}C content begin with a "sudden injection of radioactivity in the atmosphere". It is possible that "...two samples of charred grain, which are separated by, say, twenty (20) years, may show a difference in apparent age of two hundred (200) years...burnt wood cut in exactly the same years, and each comprising 100-200 tree-rings, will not show a significant difference" (Waterbolk 1983a:69).

Within specific periods of time certain groups of dates appear to be more significant than others when attempting to define the "chronological limits of a cultural stage". The youngest dates appear to be most important for the period between zero (0) and 3000 B.P.; for the older periods (12,000 B.P. to 50,000 B.P.) the oldest dates are most significant (ibid. 1983a:63). Unfortunately, the 'grey area' between 3000 B.P. and 12,000 B.P. is less clearly understood (encompassing virtually all of the Archaic). The investigator is left with little choice other than to give all dates equal weight within this time frame.

Radiocarbon dates are used regularly to establish connections between cultural sequences spread over great distances. Yet the distances involved do not permit accurate intersite correlations between stratigraphy and typology. Stratigraphy and typology have many weaknesses, "typological sequences are ...impressionistic and speculative", and good stratigraphy is "rare". The assessment of the closeness of association of diagnostic materials found within a specific zone is dependent on the "...quality of the stratigraphic observations and may be open to some doubt" (Waterbolk 1983:642).

From groups of dates identified with a specific cultural entity one sample may be more firmly associated and contemporary with the archaeological material than is another. When assessing a group of radiocarbon dates it is often impossible for the archaeologist to determine which date is most closely associated with the manifestation under study. When dates are averaged, the individual or unique character of each sample is lost. The development of accurate regional chronologies requires using large numbers of dates - two hundred (200) to four hundred (400) are suggested (Neustupny 1970:24). Much of the impact of using large numbers of radiocarbon dates is lost by averaging because there is a consequent avoidance of a graphic representation which displays the unique characteristics of all dates employed (Waterbolk 1983a:63-67).

In the preceding two chapters I have provided a somewhat terse overview of two complex issues. Although the material reflects the controversial nature of the subject matter, there is a bias in favour of calibration and against averaging. It is common in the literature of the Archaic to quote dates in years 'B.C.' - in other words to discuss the chronology in terms of the calendrically recorded time scale. But when compared to calibrated dates, the traditional dates are in error by as much as nine hundred and thirty (930) years for the beginning of the Archaic with a slow lessening to approximately one hundred (100) years at the end of the Terminal time frame. Before it is reasonable to discuss Archaic dates in relation to the known historical time scale, a more accurate association with the time scale must be established. Although comparisons still cannot be made with complete precision, the degree of accuracy of the calibration curves so far obtained is such that further avoidance of their use is no longer justifiable.

Of the two issues the statistical question ~~is~~ more contentious. Initially my rationale was wholly intuitive. I have always been uncomfortable with the discussions of the Archaic Period. The student is confronted with a confusing body of data in which many series of overlapping cultures and traditions develop from rather nebulous regional centres. The focus of attention shifts depending upon the particular area of interest of each investigator (Byers 1959:233). Much of the reporting is incomplete, and in some areas contradictory.

The literature is full of arguments attempting to show the temporal priority of one cultural entity over another. In many instances the temporal positioning is dependent on two or three dates separated by considerable geographical distances; insufficient data are available to provide conclusive evidence of strength of association. Upon criticial inspection, I am convinced that the level of precision required to fulfil the criteria to warrant statistical examination cannot be extracted from the thirty-five (35) year old Archaic data base.

CHAPTER FOUR

THE RADIOCARBON DATA BASE

> "For many archaeologists a ^{14}C date is an outside expertise, for which they are grateful, when it provides the answer to an otherwise insoluble chronological problem and when it falls within the expected time range. But if a ^{14}C date contradicts other chronologic evidence, they often find the 'solution' inexplicable."
>
> (Waterbolk 1983:639).

Historical Perspective

Stone tools have been used "...to define the rungs of the ladder of progress of humanity...they came to be used as the markers of paleocultural entities each with it own geographic distribution and time range." (Isaac 1977:5-7). Following this premise chronologies in North America have relied on the direct historical approach and McKern's Midwestern Taxonomic System (McKern 1939). This has resulted in cultural classifications based on shared formal artifact types (Willey and Sabloff 1974). The McKern system did not control the time variable, and instead concentrated on the variables of space and form. However, assumptions about time were built into the system "..two components that were close in space but formally distinct were assumed to be temporally distinct...two components widely separated in space but formally quite similar were assumed to be coeval" (Snow 1978:90). Whole cultural units have been defined by a very few, and at times, on but one artifact type: in the Northeast the dominant artifact form prior to the Woodland periods has been the projectile point.

The Archaic chronology for the Northeast has been based on William Ritchie's projectile point typology (Ritchie 1961;1971). Throughout his long career Ritchie constructed this typology, based on the projectile point categories found within New York State. Only those point types represented within the state boundaries were included (ibid. 1971:6). Gradually all additional point assemblages came to be compared to, and aligned with, the New York sequences. New projectile point forms were sandwiched into the framework to augment Ritchie's over-all picture.

The Archaic was first assigned a seven hundred (700) year time span, between A.D. 300 and A.D. 1000 (Ritchie 1944:10). Later, the Archaic time span was expanded to one thousand (1000) years, from 500 B.C. to 500 A.D. (Dragoo 1974:26), and then revised again to two thousand two hundred years (2200), with a time range between 3500 B.C. and 1300 B.C. based on the first of the radiocarbon dates (Ritchie 1965). The continued accumulation of radiocarbon dates throughout the 1950s and 1960s added more time depth, and gave the Archaic a seven thousand-year history. [The Paleo-Indian period had been accurately placed without radiocarbon, dated between 10,000 and 15,000 B.P. (Dragoo 1974:26)].

The revised Archaic time scale, beginning at 8000 B.C., and its subsequent division into Early, Middle, Late, and Terminal segments, is a pan-eastern scheme, and has been developed from findings in the American Southeast. Placed against this framework, the Northeast was long considered to lack an Early and Middle Archaic period. Until recently, the early cultures were thought to fall entirely within the Late Archaic when compared to the whole of the eastern half of the continent. This traditional point of view is only now undergoing considerable revision (discussed further in the next chapter).

Although there have been warnings against the "...assiduous application of the 'one culture one point style' approach..." (Fitzhugh 1972:3), the concept of a single point style per single occupation or stratigraphic unit is deeply engrained in assessments of the Archaic (Rippeteau 1973:4). This premise moulded Ritchie's typology. An image of distinct but contemporaneous societies using the same site within a very limited period of time (or essentially the same period of time) does not rest well with many students of the Archaic. As a result radiocarbon dates associated with a mixture of point styles are usually viewed with suspicion and set aside in chronological studies. This factor contributes to Ogden's estimate that less than fifty percent (50%) of radiocarbon dates have been accepted in the Northeast (Ogden 1977:173).

Radiocarbon dating did not throw northeastern prehistoric studies (see Timmins 1984) into a state of controversy comparable to that witnessed in areas of the Old World. Chronological sequences were not overturned, long established diffusionist views were not upset, theories of origin were not eliminated (Renfrew 1973:54-58). Radiocarbon "...revealed that archaeologists had grossly underestimated the age of many prehistoric cultures of eastern America", and extended chronologies by several millennia (Trigger 1983:428). This fostered the awareness that changes had occurred slowly, and encouraged internal rather than external explanations for the observed changes in the archaeological record. However, in Europe and the Near East, where parts of chronologies were tied to historically dated events, the discrepancies in regional sequences caused by radiocarbon were readily apparent. Consequently, there has been more emphasis placed on the reconciliation of Old World radiocarbon chronologies and the long established calendrical chronologies. Unfortunately, historically connected chronologies were not available for comparison in the Northeast.

This easy assimilation of radiocarbon dates has been detrimental to northeastern studies in general, and particularly to many aspects of northeastern Archaic studies. Without controversy, without gut-wrenching issues to tackle, the discrepancies between the radiocarbon and calendrical time scales have never aroused a high degree of interest. As a result, most northeastern chronologies are still relative; there have been few attempts to reconcile radiocarbon years with the calendrical time scale. In the Northeast, with the exception of Rippeateau's MASCA calibration of a segment of the Late Archaic in New York State (Rippeteau 1973) and Timmins' examination of the Iroquoian chronology (Timmins 1984), correction of the traditional time scale has not been pursued. I think it is fair to say that, in general, radiocarbon dates are viewed as 'additives' in northeastern studies, and accepted or rejected on the basis of conformity or nonconformity to the established time scales. Radiocarbon evidence is never used as the primary mechanism of investigation in the development of chronological sequences.

The Data Base

A total of four hundred and ninety (490) dates, based on published data, have been compiled for this study. Although it was not the most difficult of tasks, it was a long and tedious process and not without problems. It quickly became apparent that there is a general lack of precision in the reporting of radiocarbon data. In some instances detailed information is available, covering stratigraphic level, zone, feature, estimated strength of association, and designation of tradition, phase, or complex and point type. In other instances there are few data available beyond publication of the laboratory number, name of site, and geographic location. Some dates have been designated 'Archaic' without the benefit of any cultural association or explanation as to why such a designation has been assigned. There are areas of disagreement regarding the numbers and/or types of point forms associated with a specific radiocarbon date. These 'mixed association' assessments are fully accepted in some reports, but assigned 'marginal or dubious' status elsewhere. During the preparation of the data base the prevailing assessments have been accepted without any attempt to reinterpret the data. In cases where discrepancies are evident, a record of the problem has been retained with the data.

All dates found were assembled in chronological order based on the traditional assessments in radiocarbon years B.P., including those dates unequivocally rejected. The dates were then assigned one of three designations: 'A'/Accepted, 'D'/Doubt(ful), or 'R'/Rejected.

1. 'A' dates are:

   (1) those dates fully accepted and incorporated into the literature without negative comment.

2. 'R' dates are:

   (1) those dates completely rejected in the published reports.

   (2) those dates representing an Archaic lifestyle persisting well beyond the Archaic period.

   These may be satisfactory or 'good' dates, but involve an investigation beyond the scope of this study. In several cases, the dates pertain to an enduring Archaic lifeway in the Laurentian Shield geographic zone. (see Wright 1972).

3. 'D' dates are:

(1) those dates derived from shell, bone, bone collagen or scattered charcoal (see chapter 2).

(2) those dates lacking diagnostic cultural affiliation.

(3) those dates lacking sufficient strength of association with the specified cultural materials.

(4) those dates in conflict with established typological sequences and, therefore, viewed with suspicion in the literature.

(5) those dates designated as 'doubtful' by the investigator because of mixed cultural association.

The 'D' category is a peculiar conglomerate. Most dates in this group are neither accepted nor completely rejected. They continue to hang indefinitely in the literature like volcanic ash in the atmosphere. A familiar pattern is usually followed: the 'D' dates are recognized, scrutinized, and then filtered out of chronological studies, particularly those studies attempting to verify a sequence of traditional typologies. In the end we are left with what might be considered the equivalent of a litter of man-made cosmic junk, it simply stays there indefinitely, never eliminated but also never gathered up and re-used.

All 'D' dates are retained in this study; their effect on the temporal range of affected point types is made clearly visible on the bar graphs. Representation by category is as follows:

1. 'A' dates = 262
2. 'D' dates = 162
3. 'R' dates = 66

The number of 'R' dates represents only those that have been published. There is no way of estimating the number of dates submitted and rejected without publication.

Once this initial process was completed, the rejected dates were removed and stored in a separate file. All 'A' and 'D' dates were then calibrated. The data base was then reordered based on the calibrated dates. Four new files were then generated as follows - those dates any part of which (mid-point plus two sigma standard deviation) falls within one of the following time segments: (1) 8000-6000 B.C., (2) 6000-4000 B.C., (3) 4000-1700 B.C., and (4) 1700-700 B.C. Towards the upper reaches of each segment or container, dates overlap into the succeeding section.

Each date, within its allotted section, was then plotted twice, using a Texas Instruments CAD (Computer Aided Design) System. The first set of graphs (5.1-9.1) indicates the amount of correction required to align the traditional uncalibrated time scale to the calibrated time scale (the traditional time scale on the Y axis, the calibrated time scale along the X axis). The second set of graphs (5.2-8.2) provides an overview of all dates within each container. This representation preserves the uniqueness and individual identity of all dates. Finally a series of bar graphs, representing twenty six Archaic projectile point types and one Archaic tradition, were generated to assist in the assessment of the temporal relationships between the point forms.

Finally, the choice of terminology should be addressed. The focus of this study is the graphic presentation of a study of time; a study based entirely on radiocarbon date ranges - the use of the complete radiocarbon unit (calibrated mid-point and two-sigma standard deviation). Because one date cannot be judged of more value than any other in dating a cultural manifestation (see Waterbolk 1983; this paper, page 9), groups of dates are used. If groups of dates must be viewed in a manner that represents their integration into one unit, it is of value to envision them trapped within a box or 'container'. It is for this reason that I have chosen to adopt Snow's concept of a temporal container (Snow 1980:12). Although this may not be an application approved by the originator, I believe that the term 'container' is particularly descriptive of the radiocarbon groupings used in this study. The data are collectively examined in relation to the time containers traditionally assigned to this period of prehistory - Early, Middle, Late, Terminal/Transitional and then broken down into time units for specific point types.

CHAPTER FIVE

THE ARCHAIC AND THE CALIBRATED TIME SCALE

THE EARLY ARCHAIC TEMPORAL CONTAINER

Historical Background

The term 'Archaic' was first applied to northeastern archaeology in 1932 by William Ritchie to describe the Lamoka complex, a preceramic culture centered in New York state. Over time, the Archaic has come to represent "...a simple stage of economic development, nonagricultural and nonceramic, based on hunting, fishing, the gathering of wild plant foods and sometimes of shellfish" (Ritchie and Funk 1973:37). This definition applies "to those cultures that follow in time the Paleo-Indian fluted point cultures" (Wright 1978:59), and are replaced in turn by cultures possessing ceramic technology and/or agricultural subsistence economies. The beginning of the Archaic period is generally placed at 8000 B.C. for the eastern half of the continent, although a date of 7000 B.C. is sometimes favoured (Stoltman 1978:708). The early period is terminated at 6000 B.C.

For a long time few traces of the earliest stages of the Archaic could be found in the area covered by this study. Evidence of Early Archaic Man consisted of nothing more than an extremely small collection of projectile point forms gathered from a thin scatter of surface finds. The point types - Bifurcated-base, Kirk, Palmer, Hardaway, Eva, Stanly, Kanawha - were all diagnostic of the southeastern Archaic, and dated there between 8000 and 5000 B.C. (Funk 1977:25; Dincauze and Mulholland 1977:439). The temporal ranges of the Northeastern representatives were tentatively placed between 6000 and 4000 B.C., which corresponds to the Middle Archaic time span (Tuck 1978:35). Thus, there appeared to be a total lack of continuity between the last Paleo-Indian cultures of the ninth millennium and the thin scatter of early Archaic forms. A second break in the archaeological record appeared to exist between the clusters of southeastern points and evidence of the Lamoka Culture, the first uniquely northeastern Archaic manifestation, dated to 2500 B.C. (Funk 1977:21).

The gaps in the archaeological record were at first without adequate explanation, but gradually hypotheses were formulated to explain this yawning break in the prehistoric continuum. These hypotheses (Fitting 1968, Ritchie 1969, 1971a) suggested severe environmental restriction in the form of dense coniferous forests with low carrying capacities in the Northeast. This contrasted sharply with the "high carrying capacities of the deciduous ecologies of the Southeast" and the preceding "tundra ecologies" of the study area (Ritchie and Funk 1973:38). The severe ecological deterioration resulted in the collapse of the Paleo-Indian big-game subsistence base to the extent that the Paleo-Indian groups either died out altogether or left the Northeast for areas to the south, north or west. The possibility of population movement from the interior to the coastal areas was also considered. There the remnant populations could have exploited the abundant marine mammal species.

By the late 1960s and early 1970s some form of catastrophic population depletion had become the predominant explanation for events in the Northeast, with only a small minority suggesting any form of continuous occupation to bridge the Paleo-Indian and Early Archaic periods (Funk 1978:19). With the accumulation of greater numbers of early point types, indicative of more intensive occupation, and the discovery of very early coastal assemblages from the northerly regions of the Northeast, the outlook has changed somewhat.

More recent discussions have favoured at least partial _in situ_ development and continuity between Paleo-Indian and Archaic populations (Funk and Wellman 1984:81; Snow 1980:157; Wright 1978:59; Fitting 1978:22; Fitzhugh 1972:16). Evidence of "abundant Middle Archaic remains...and scattered remains of Early Archaic populations" has been uncovered in Massachusetts, Rhode Island, and New Hampshire (Bolian 1980:115). From central New Hampshire and northeastern Massachusetts, approximately three hundred archaeological sites, "...representing a cultural continuum from Paleo-Indian through Contact periods...", now augment evidence from the more intensively investigated regions of New York State and coastal Labrador (Kenyon 1983:1; Nicholas 1983:53; Starbuck 1983:25-28; Towle 1983:76; Turnbaugh 1980:61).

In response, at least in part, to the additional evidence, the environmental hypotheses have been closely scrutinized. Some investigators argue that they are "outdated", and too dependent on "macro-vegetational zones" which give an allusion of homogeneity over large areas. Because "...paleoenvironmental dynamics were not static but exhibited considerable variation over large areas...", it is suggested that we focus attention on smaller environmental zones which more accurately reflect the depth of "...range and productivity of the floral and faunal communities..." present in the Northeast (Nicholas 1983:44-52). The paleo-environment probably had a "mosaic character" and the "...presence of biotic mosaics tends to increase resource diversity" (ibid. 1983:52). In the past "the pollen spectra" may have been "...interpreted too simply...statements emphasizing the unsuitably of northern environments premature...carrying capacities higher than in present boreal zones" (Fitzhugh 1972:4).

It is also argued that our data have had a "strong interior bias" resulting from the loss of substantial numbers of sites as a result of coastal submergence, which in turn was the consequence of a rapid rise in sea levels during the Paleo-Indian and Early Archaic periods (ibid. 1972:6, Snow 1980:168). Along drainage systems the majority of Early and Middle Archaic sites were "..either buried, damaged or totally removed by riverine processes" (Nicholas 1983:55). Such destructive forces effectively eliminated evidence of human occupation in the

Northeast, thereby leaving a distorted archaeological record. Yet the number of northern coastal dates now available offers proof of the existence of at least a moderate population living on the northern extremities of the coastal plain throughout the Early Archaic (Tuck 1978:35). This argues well for the entrenchment of similar groups along the more southern coastal zones by the same, if not an earlier, time span. All of these, unfortunately, are lost to the sea.

The coastal dates are among the earliest Archaic ones for the eastern portion of the continent: this record has been preserved for the archaeologist only because coastal Labrador experienced eustatic rebound after deglaciation, while other coastal areas have been submerged. The burial mounds associated with the dates are "...the oldest known anywhere in the world..." (Snow 1980:186). The mortuary practices that flourished in the Northeast within the Late Archaic may have diffused southward from this early tradition (McGhee and Tuck 1975:85-94; Tuck and McGhee 1976). Although it may be impossible to locate the area of origin of the mortuary practices in the Northeast, it is quite possible that such practices began within well established Paleo-Indian societies and were then adopted by contemporaneous Archaic groups.

The coastal dates are subsumed under the 'Maritime Archaic Tradition', a term popularized by James Tuck (1971, 1976, 1976a, 1977a, 1978) to define "...a remarkably uniform group of cultural manifestations as regards environment, economy, technology, art and religion..." that occupied coastal environments from northern Labrador southward into the province of Quebec, Newfoundland, Nova Scotia, New Brunswick, and northern New England (Tuck 1976a:99). Tuck's terminology is an adaptation of Byer's earlier 'Maritime Boreal Archaic', initially used to describe the Red Paint Burial Complex from Maine (Byers 1959:255).

The Maritime tradition is represented by eighty-two (82) radiocarbon dates in this study, with a time span stretching the length of the Archaic (see graph 5.4). Although there is evidence of a stylistic and technological relationship between early Maritime Archaic and Paleo-Indian point types (Renouf 1977:35-37), discussions of the early Maritime assemblages are kept quite separate from the data for other areas of the Northeast. This tendency is less evident for the late Maritime Archaic manifestations. Clarification of the pivotal relationship that may have existed between this coastal adaptation and the emergence of other Archaic populations awaits a comprehensive and integrative study to establish (1) the relationship between early Maritime Archaic point forms and Paleo-Indian point forms, and (2) the relationship between the Maritime Archaic and early southeastern point types. The evolution of the Maritime Archaic over its long time span is not discussed in terms of an evolving point technology. Because of this, it has been impossible to divide the tradition according to point types. Consequently, it appears in the graphic representations as a continuous, undifferentiated cultural manifestation.

Despite the fact that now much more information is available for the Early Archaic, it is still of the same type. Data are still confined to projectile point types diagnostic of the southeastern Archaic, excluding the Maritime Archaic data. There are no recognized cultural complexes, phases, or traditions. Additional information has not altered or significantly clarified our limited understanding of the origins of the Archaic. It still appears that:

1. The Paleo-Indian period ended with a "relatively rapid forced readjustment" in subsistence base as a result of the collapse of the focal adaptation (Snow 1980:157).

2. There was a an abrupt shift in projectile point forms in the Late Paleo-Indian to Early Archaic transition (Funk and Rippeteau 1977:9-11).

3. The absence of point forms unrelated to those from the Southeast still implies a major south to north flow of either population or technology (Fitting 1968; Ritchie 1969a, 1971).

4. The interrelationships between environmental degradation, population reduction, population movement, technologial adaptation, and *in situ* development are still not clearly understood.

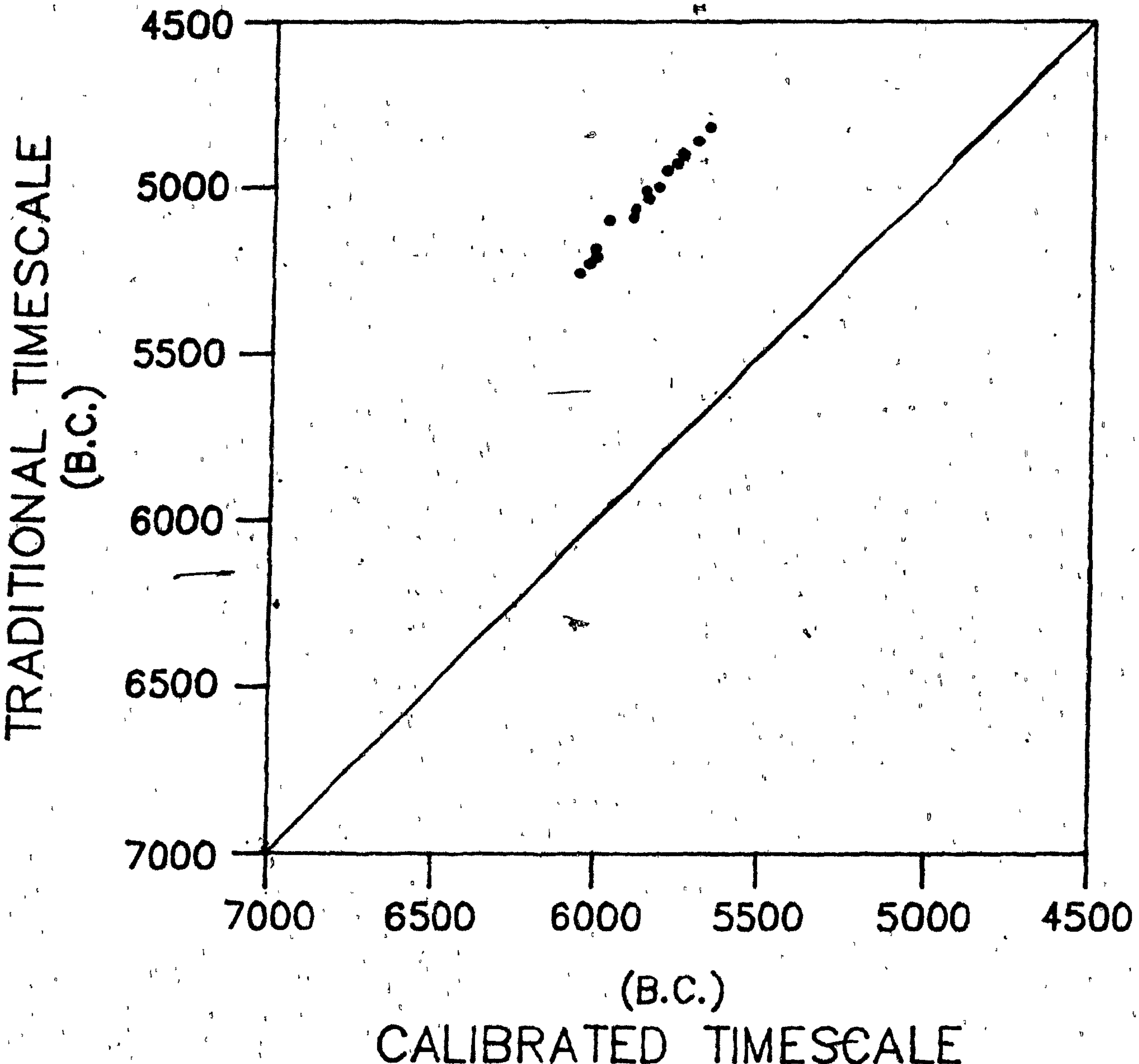
Study Results

The unfortunate fact that only sixteen (16) or thirty-two percent (32%) of the dates in this container are within reach of the calibration tables severely limits some aspects of the results.

The Calibration Correction, which can be applied to the traditional radiocarbon timescale after 7240 B.P.(5290 B.C.), ranges between eight hundred (800) and eight hundred and seventy-five (875) years for the four hundred and forty (440) year period between 5290 B.C. and 4820 B.C. (graph 5.1, page 50). The seventy- five (75) year fluctuation (8.57%) in the correction factor does not exhibit a uniform pattern. Dates up to and including 5260+-300 (SI-2605) on the traditional scale are lowered into the Early Archaic time span. The oldest dates, thirty-four (34) in total, cannot be calibrated. The traditional mid-points are used, to which is added a one thousand (±1000) year standard deviation. Nevertheless, this rough calibration significantly lowers the age ranges of the Early Archaic dates to the point of Paleo-Indian/Archaic overlap. The calibrated radiocarbon estimates are schematically represented in graph 5.2, page 53.

GRAPH 5.1 CALIBRATION CORRECTION, 5290 B.C. to 4820 B.C.

EARLY ARCHAIC TEMPORAL CONTAINER.



16 DATES.

CORRECTION COVERING 5290 B.C. to 4820 B.C.

TABLE 5.1 EARLY ARCHAIC CONTAINER - 8000 B.C.-6000 B.C.

Summary

No. of dates categorized as 'A' = 27

No. of dates categorized as 'D' = 23

No. of Mixed Associations: 7

I-5331	-	Bifurcated-base/undiagn.
Dic-475	-	Kanawha/Neville-like
Dic-473	-	Kanawha/Neville-like
Dic-474	-	Kirk/Neville
I-8315	-	Bifurcated-base/Kirk
I-4512	-	Bifurcated-base/undiagnostic forms
Dic-752	-	Kanawha-like/Kirk-like/ undiagnostic forms.

In such cases, each component is given credit for the association.

Representation by Point Type:

Undiagnostic	= 15
Bifurcated-base	= 4
Kanawha-like	= 3
Kirk types	= 12
Neville, Neville-like	= 5
Stark	= 1
Undiagnostic Stemmed	= 1

Representation by Cultural Affiliation:

Maritime Archaic Tradition = 16

Geographic Distribution:

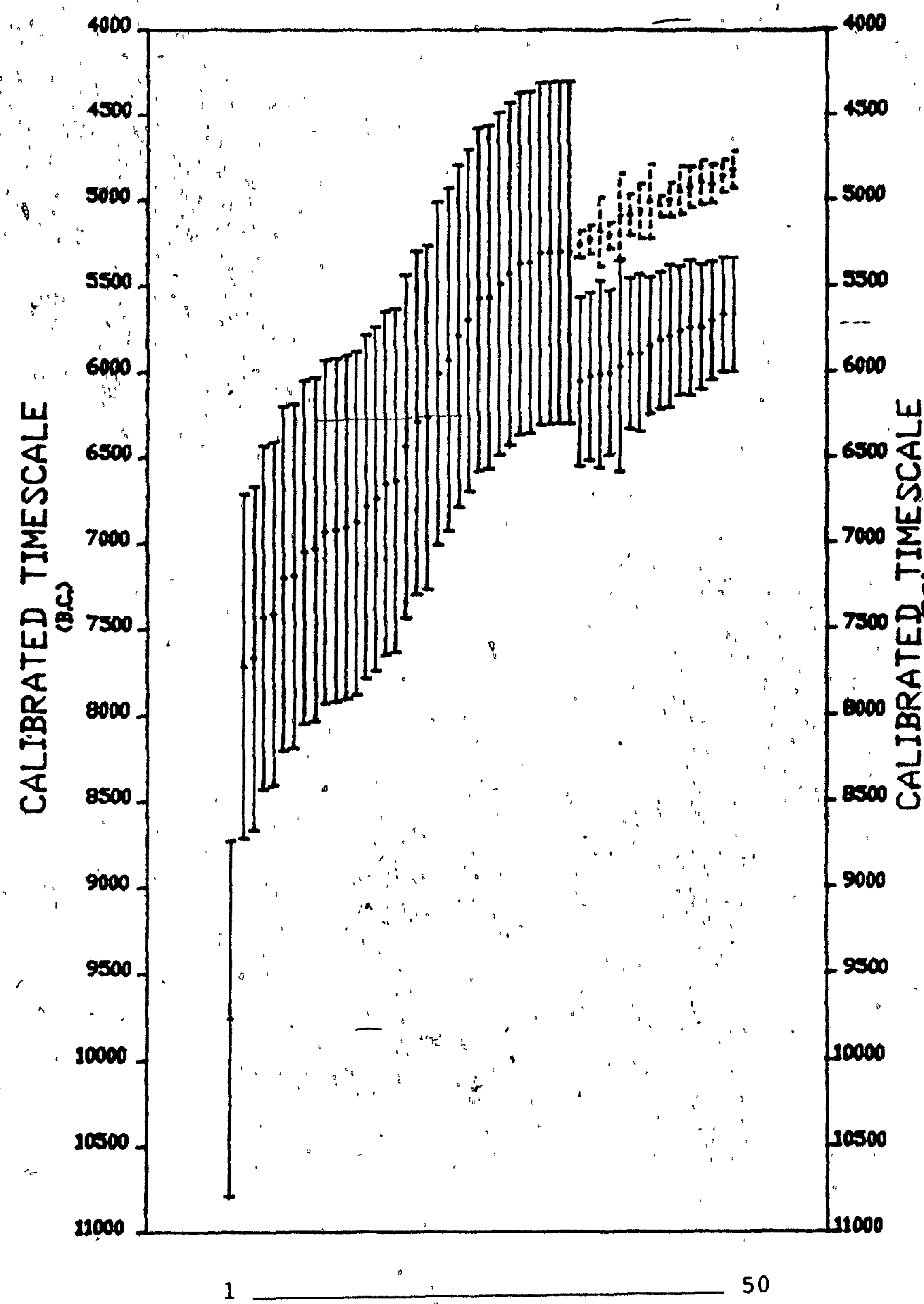
New York	= 21
Labrador	= 16
New Hampshire	= 7
New Jersey	= 3
Pennsylvania	= 2
Ontario	= 1

TABLE 5.2 EARLY ARCHAIC CONTAINER - 8000 B.C.-6000 B.C.

	Lab No.	Cultural Association		Calibrated Date	
1	Dic-476	Undiagnostic	(D)	9760+-1300	N.Y.
2	GX-9311	Undiagnostic	(D)	7715+-1000	N.Y.
3	GX-4567	Undiagnostic	(D)	7665+-1000	N.H.
4	Dic-261	Bifurcated-base	(D)	7430+-1000	N.Y.
5	I-4929	Kirk Corner	(A)	7410+-1000	N.Y.
6	GX-5445	Undiagnostic	(D)	7205+-1000	N.H.
7	GX-8204	Kirk Stemmed	(A)	7190+=1000	N.Y.
8	GX-8224	Undiagnostic	(D)	7050+-1000	N.Y.
9	GX-4571	Undiagnostic	(D)	7035+-1000	N.H.
10	GX-8205	Kirk Stemmed	(A)	6930+-1000	N.Y.
11	M-1909	Undiagnostic	(D)	6920+-1000	PA.
12	SI-2309	Maritime	(A)	6905+-1000	Labrador
13	GX-8223	Kirk Stemmed	(A)	6880+-1000	N.Y.
14	GX-8207	Undiagnostic	(D)	6785+-1000	N.Y.
15	S-1292	Undiagnostic	(D)	6740+-1000	Ont.
16	SI-2606	Maritime(Trian.Pt.)	(D)	6650+-1000	Labrador
17	GX-8225	Kirk Stemmed	(A)	6635+_1000	N.Y.
18	GX-8206	Undiagnostic	(D)	6435+-1000	N.Y.
19	I-5331	Bifurcated-base/etc	(A)	6300+-1000	N.Y.
20	Dic-475	Kanawha-like/Neville	(A)	6270+_1000	N.Y.
21	Dic-473	Kanawha-like/Neville	(A)	6010+-1000	N.Y.
22	Dic-474	Kirk/Neville-type	(A)	5930+-1000	N.Y.
23	GX-1746	Stark	(A)	5790+-1000	N.H.
24	GX-1747	Neville	(A)	5700+-1000	N.H.
25	I-8099	Maritime	(A)	5580+-1000	Labrador
26	I-8315	Bifurcated/Kirk	(A)	5570+-1000	N.J.
27	SI-2310	Maritime	(A)	5490+-1000	Labrador
28	I-6133	Kirk Stemmed	(A)	5430+-1000	N.J.
29	I-6600	Kirk Stemmed	(A)	5370+-1000	N.J.
30	-----	Undiagnostic	(D)	5365+-1000	N.H.
31	I-4070	Broad Stemmed	(A)	5310+-1000	N.Y.
32	I-4512	Bifurcated/Kirk/etc.	(A)	5310+-1000	N.Y.
33	SI-1799	Maritime	(A)	5305+-1000	Labrador
34	SI-2306	Maritime	(A)	5305+-1000	Labrador
35	SI-2605	Maritime(Trian.Pt.)	(D)	6060+- 490	Labrador
36	SI-2602	Maritime	(A)	6030+- 485	Labrador
37	SI-2638	Kirk-Stemmed type	(A)	6015+- 545	N.Y.
38	SI-2607	Maritime-Stemmed	(A)	6010+- 480	Labrador
39	M-1908	Kirk	(A)	5975+- 615	PA.
40	Dic-248RR	Undiagnostic	(D)	5900+- 440	N.Y.
41	GX-1449	Neville	(D)	5895+- 460	N.H.
42	Dic-752	Kanawha-like/Kirk	(A)	5860+- 480	N.Y.
43	SI-1801B	Maritime	(D)	5850+- 400	Labrador
44	L-1381	Undiagnostic	(D)	5820+- 400	N.Y.
45	SI-1800A	Maritime	(D)	5795+- 415	Labrador
46	SI-1801A	Maritime	(D)	5765+- 375	Labrador
47	I-8101	Maritime	(D)	5750+- 395	Labrador
48	I-7505	Maritime	(A)	5745+- 365	Labrador
49	SI-2604	Maritime	(D)	5705+- 345	Labrador
50	SI-1800B	Maritime	(D)	5670+- 330	Labrador

GRAPH 5.2 OVERVIEW

EARLY ARCHAIC TEMPORAL CONTAINER.



---- Dashed lines, Traditional Chronology

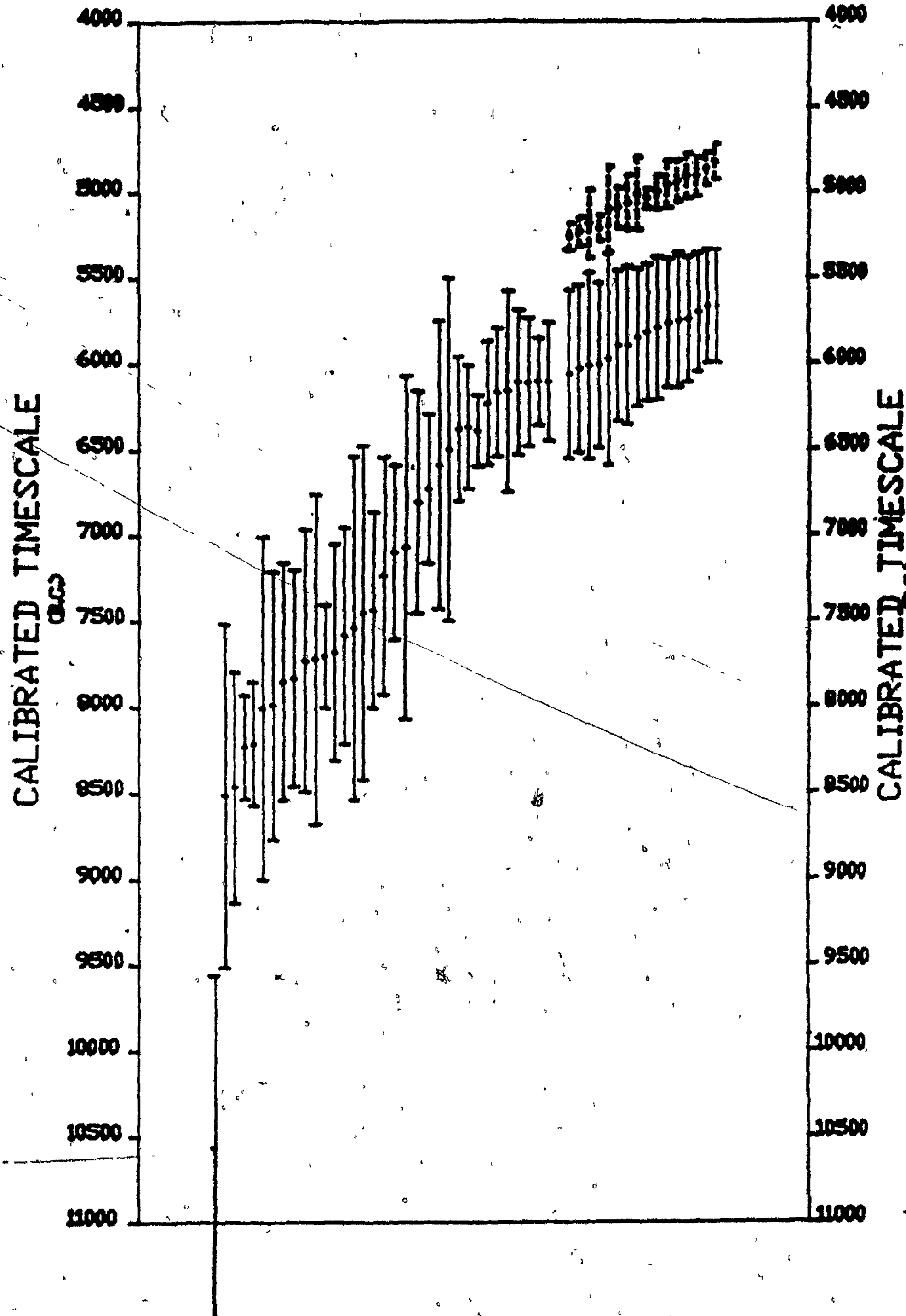
____ Solid lines, Calibrated Chronology

We now have dated evidence of activity in the Northeast throughout the whole time span of the Early Archaic. The datable encroachment into the traditional Paleo-Indian zone stengthens the existing evidence for the association of Early Archaic/Late Paleo-Indian point forms in the Northeast (Wright 1978:72). [Paleo-Indian dates in New England have been averaged to 8500 B.C. based on uncalibrated estimates (Funk and Wellman 1984:87)].

In an attempt to achieve a more balanced overview of the early time span, a hypothetical correction of eight hundred (800) years was applied to the thirty-four (34) dates outside the calibration range. The traditional one sigma standard deviation was tripled (to a maximum of ± 1000) for each individual date (after the International Study Group 1982), to yield fictitious but plausible calibrated radiocarbon units. As can be seen from graph 5.3, page 55, this conservative correcton broadens the range of possible overlap. Obviously, calibration would also affect Paleo-Indian dates: for example, if the one thousand (± 1000) year standard deviation proposed by Klein <u>et al</u> (1982) is added to the New England average of 8500 B.C. (for the roughest of comparisons only), the range would be 7500 to 9500 B.C. This time span partly overlaps the Archaic time span, when the latter is defined by radiocarbon dates corrected by the procedure proposed by the same authors. All northeastern Paleo-Indian radiocarbon estimates should be collected and compared with the Archaic data. This would result in a more accurate assessment

GRAPH 5.3

HYPOTHETICAL CALIBRATION - EARLY ARCHAIC TEMPORAL CONTAINER.



of the extent of overlap.

There is little point in pushing speculative arguments much beyond this stage. Yet it is becoming increasingly clear that the Paleo-Indian/Archaic division, drawn at 8000 B.C., is severely smudged. If we persist in the practice of drawing exact time lines, a date of 9000-10,000 B.C. may be more accurate. The upper end of the Early Container is similarily smudged. In fact, all sixteen (16) calibrated dates overlap into the Middle container. This ranges from a minimum of forty-five (45%) percent of the upper segment of the standard deviation of the first calibrated date to virtually one hundred (100) percent of the last radiocarbon unit represented on graph 5.2. [The extreme of the lower sigma of the fiftieth (50th) date falls on exactly 6000 B.C.]

It was hoped that the radiocarbon chronology would provide a precise overview of the temporal relationship between the point forms, including their time of arrival from the Southeast, and the extent of their temporal spans. However, the inability to use the calibration tables for sixty-eight percent (68%) of the dates in this container has made such determinations more difficult.

At the present time, five (5) broad-bladed, notched point types are available for dating - Bifurcated-base, Kanawha, Kirk, Neville, and Stark. Only the Kirk forms are well represented with twelve (12) dated associations. Assessment of the

Bifurcated-base and Kanawha (a specific bifurcated-base point) types are based solely on mixed associations. The Neville and Stark point forms, which have been considered "Middle Archaic", have been lowered into the early period by the calibration correction. Bar graphs, based on the Klein et al (1982) calibration, have been prepared for each point type (graph 5.4, page 62). The Crosshatched bars are based on 'A' assessments - single point types in association with the radiocarbon date. The Open Dashed bars are based on 'D' assessments - indefinite strength of association between artifact and radiocarbon date, and/or mixed point types assigned to a single date. [Outlined in the preceding chapter.]

In the construction of the bar graphs the problems caused by the dates beyond the calibration tables became obvious. The solution offered by Klein et al creates an inflated estimate of the temporal range for the Kirk and Bifurcated point types. The one thousand-year (±1000) standard deviation affixed to the traditional mid-point of the oldest dates pushes the possible total time span of the uncalibrated dates well beyond the upper limits of the standard deviations of the dates covered by the calibration tables. In an effort to overcome this problem, it was necessary to turn to the hyopthetical calibration a second time. A third set of bar graphs, based on the hypothetical calibration, were generated and appear as Vertically Lined Bars on graph 5.4. The oldest date for each point type has been used in combination with the youngest date, regardless of 'A' or

'D'assessment or mixed association. This combination produces an estimate of the longest possible temporal duration.

The hypothetical correction has little affect on the baselines of the Maritime Archaic Tradition, the Bifurcated-base points, or the Kirk points. In each case the baseline is lowered by less than two hundred (200) years. There is considerably more impact on the Kanawha, Stark and Neville point forms. The baselines are lowered by eight hundred (800), six hundred and forty (640), and eight hundred (800) years respectively. This is due to the fact that in each instance the oldest traditional date carries a large standard deviation, resulting in a maximum one thousand (±1000) year sigma for Kanawha, an eight hundred and forty (±840) year sigma for Stark, and a mamixum sigma of ±1000 years for Neville. According to this scheme, Kirk and Bifurcated points appear by the middle of the ninth millennium (8400 B.C.), the Maritime Tradition, Kanawha and Neville baselines hug the 8000 B.C. mark, and Stark does not appear until the middle of the eighth millennium (7430 B.C.).

With the exception of the Kirk and Bifurcated forms, the hypothetical correction has no affect on the upper limits of the temporal containers. The youngest Kanawha date is calibrated using the correction tables; the upper limits of the Maritime, Stark, and Neville containers are based on dates from succeeding sections of the data base and are similarly unaffected. The upper limit of the Kirk container is shortened by one thousand and five (1005) years, the Bifurcated-base container by one thousand one hundred and forty-five (1145) years. This seems to be a more realistic assessment of the Kirk and Bifurcated time spans.

The following considerations emerge from the calibrated data:

1. The three separate sets of bar graphs, viewed independently, produce a similar picture of contemporaineity. The solid and dashed bars based on the Klein et al calibration procedure adopted here indicate that each cultural manifestation overlapped the other for significant periods of time. The hypothetical correction does not alter this scheme.

2. The acceptance or rejection of mixed associations will significantly alter assessments. Single or 'A' associations define the limits of the Maritime Tradition and Kirk point types (Bars 1 and 2) so their time spans are not affected by this problem. However, the possible time spans for the Bifurcated-base and Kanawha points (Bars 3 and 4) are built from only four (4) dates and three (3) dates respectively, and all are assigned a 'D'or mixed association status. If mixed associations are considered unacceptable, we are left with virtually nothing for two important point types. However, if one takes into consideration the fact that all of the early point types in the Northeast have been found in association with one another, the mixed associations become quite acceptable: nor do they interfere with traditional outlines, the issue of contemporaneity notwithstanding.

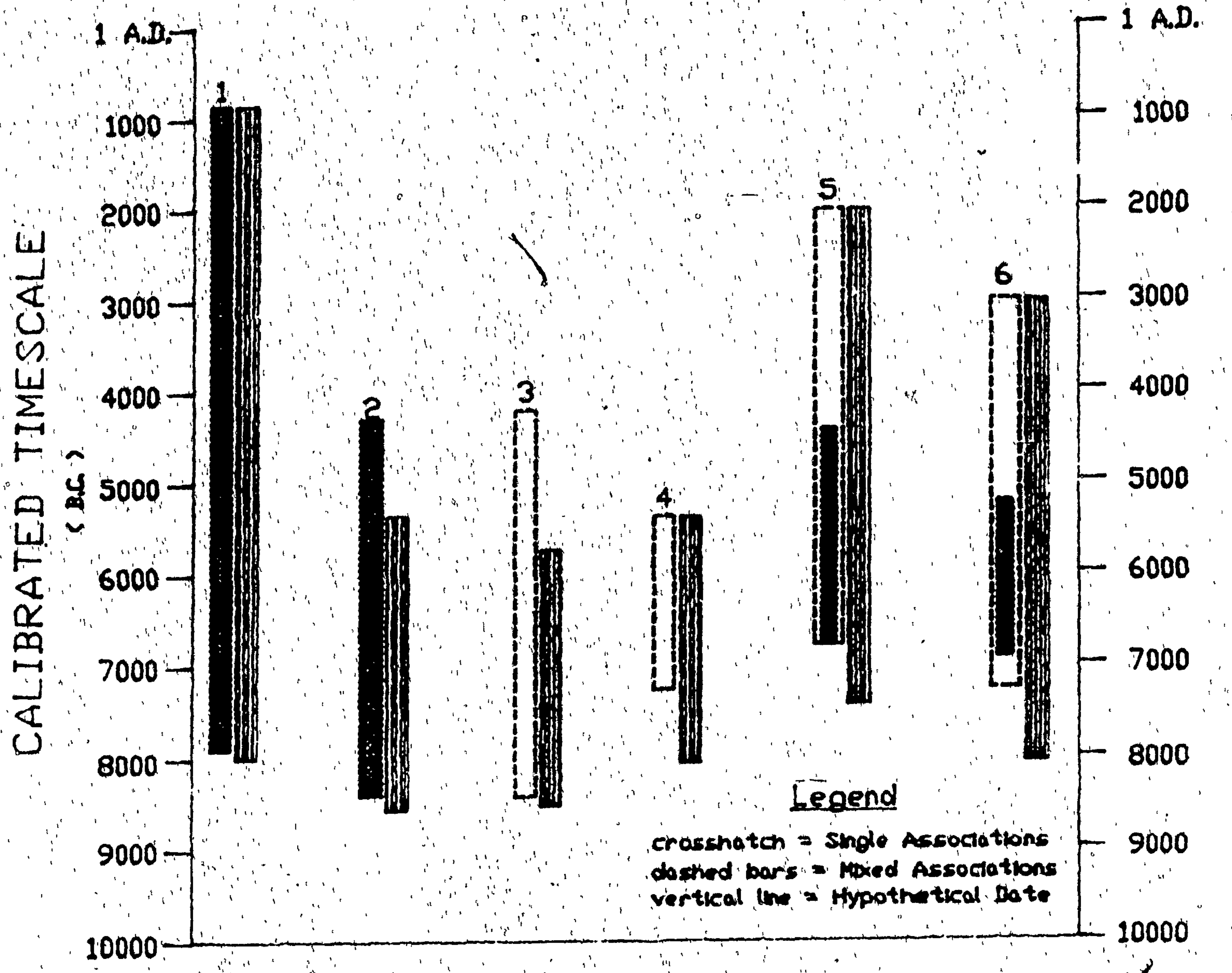
This problem of mixed association becomes more serious in an assessment of the Stark and Neville time spans. Fully accepted dates outline temporal limits (after calibration) spanning 6930 to 5230 B.C. for Neville, and 6790 to 4425 B.C. for Stark. These estimates, although older, are still in basic agreement with the traditional Early to Middle Archaic time lines for these point varieties (Dincauze 1976). But if mixed associations are considered their time spans are lengthened upward to between 3000 and 2000 B.C. This would mean that Stark and Neville points were not confined to the Middle Archaic but had a much longer time span which lasted well into the Late Archaic. This would mean association with Late Archaic point forms and represents a considerable shift from the established chronology. The problems with mixed associations increase significantly in succeeding sections.

3. 'Undiagnostic' dates, of which there are fifteen (15), are an important consideration in the Early Container. The majority of the very early radiocarbon estimates lack diagnostic cultural associations. This is unfortunate because these data are the most important for verification of a Paleo-Indian/Archaic continuum. It is assumed that the investigators had very good reason to assign an 'Archaic' status to these samples, primarily collected from hearth features. But lacking diagnostic artifact associations, there is the possibility that one could argue, with some justification, that the samples could have been assigned just as easily to Late Paleo-Indian manifestations, or

eliminated from consideration altogether.

GRAPH 5.4 BAR GRAPH SERIES

EARLY ARCHAIC TEMPORAL CONTAINER.



BAR SERIES.

1. MARITIME ARCHAIC TRADITION
2. KIRK POINTS
3. BIFURCATED-BASE POINTS
4. KANAWHA POINTS
5. STARK POINTS
6. NEVILLE POINTS

Summary of Early Data

With the increased numbers of early radiocarbon dates we can begin to build a more dynamic picture of the early period in the Northeast. The calibration correction adds depth. Early Archaic dates now occupy a time span once exclusive to Paleo-Indian cultures. A coastal adaptation, with evidence of developed mortuary ceremonialism, was already present in southern Labrador by 8000 B.C. Graph 5.4 suggests that the first of the southeastern point forms (Kirk and Bifurcated-base) may also have been in the study area by the middle of the ninth millennium B.C., followed by Kanawha and Neville at aproximately 8000 B.C., and by Stark at 7500 B.C. Admittedly this scheme is based on the hypothetical framework. Yet even where the procedure proposed by Klein <u>et al</u> (1982) is followed, a similar pattern emerges, placing the arrival of the Kirk and Bifurcated-base points close to the middle of the ninth millennium, the baseline of the Maritime Archaic just after 8000 B.C., Kanawha and Neville at 7270 B.C. (both types were associated with the same date), and Stark at 6790 B.C. (see Graph 5.4).

The Neville and Stark points, diagnostic of the Neville and Stark complexes of New Hampshire (Dincauze 1976), are normally assigned to the Middle Archaic. The Neville point of the Northeast is identical, except in size, to the Stanly point, an early form in the Southeast. The Stark point is related to the Morrow Mountain point, also an early form from the Southeast (Tuck 1978:25).

Their strong affinities to the southeastern points should ease any difficulty with the placement of Neville and Stark in the earlier time frame. It seems reasonable to argue that Middle Archaic cultures developed *in situ* in the Northeast, out of Early Archaic cultures that were already in place by the end of the late Paleo-Indian period. Population movements and diffusion of technologies from the Southeast may also have occurred earlier than were previously supposed.

The most important demonstration of the graphic representation is the evident duration of the contemporaneous association of all point forms. This is reflected by the graphs developed from the Klein *et al* tables using either 'A' associations or 'D'/mixed associations, and by the hypothetical calibration. This finding contradicts the premise (discussed more fully on page 35) that "...each (early) type occupied its own time level and was shared by all contemporary human groups on a regional or areal basis" (Funk 1978:22). Unfortunately, radiometry cannot differentiate between the existence of contemporaneous, homogeneous human groups using mixed point types, and contemporaneous but heterogeneous groups each with its own single point technology.

This is the extent of the temporal overview of the Early Archaic available at this time. There are no real surprises. We are still in a rather 'speculative' phase, plagued by too few dates to build strong arguments for: (1) a Paleo-Indian/Archaic continuum; (2) point type contemporaneity; or (3) the length of the temporal ranges. Our data are also still heavily slanted toward New York State with twenty-one (21) dates and Labrador with sixteen (16). This leaves but thirteen (13) dates to account for prehistoric activity throughout the remainder of a vast geographic area.

CHAPTER SIX

THE MIDDLE ARCHAIC TEMPORAL CONTAINER

Historical Background

The Middle Archaic is assigned to the two thousand (2000) years between 6000 B.C. and 4000 B.C. Almost all chronologies accept this estimate. There is little information that is specific to the Middle Archaic: the problems outlined for the Early Archaic can be reiterated in a discussion of this time span. The sea was still rising, although the rapidity of the rise had slowed (Snow 1980:173). As a result there was a continued loss of coastal sites, contributing to an interior bias in the archaeological record. Because the interior appeared to lack Middle Archaic sites, the 'gap theory' was perpetuated.

The discovery of three new sites in Massachusetts as well as fifty (50) additional find spots containing Middle Archaic material (McManamon 1980:39), and excavations at Neville, Smyth, The Weirs, NH31-20-5, Heard Pond, and Castle Hill in New Hampshire change traditional assessments. There is now evidence of a "flourishing population" in New England by Middle Archaic times (Starbuck 1983:37; Towle 1983:79). However, the nature of the occupation is still unclear. "We are presented with the fundamental paradox that the existence of a sizeable Middle

Archaic population [ca 6000-4000 B.C.] is now finally recognized...even while the period is really no better understood than it was ten years ago" (Starbuck 1980:5).

Despite additional data, we still depend on a very small number of assemblages. The Neville, Stark, and Merrimack complexes, each identified by a point type of the same name, have been identified and typed from excavations at Neville, New Hampshire (Dincauze 1971,1976; Dincauze and Mulholland 1977). These are the most firmly developed manifestations of the period. The similarities between the Neville and Stark points and the Stanly and Morrow Mountain points have already been mentioned. On the strength of their southeastern ties, Dincauze defined an "Atlantic-Slope Macro Tradition" spreading upward from North Carolina (Dincauze 1976:140-142; Dincauze 1972). The Atlantic Stemmed Culture has also been postulated to describe the south to north spread of these and similar point forms (Fitzhugh 1972).

Maritime coastal dates, a total of twenty-eight (28), are the dominant entity of the data base of the Middle Container. At the risk of redundancy, it must be noted again that this material is not integrated well with the southern data. Except for the material from Labrador and New Hampshire, the data are once again confined to point finds.

Study Results

The Calibration Correction applied to dates within the range of the traditional Middle Archaic time span varies from nine hundred and thirty years (930) to six hundred and eighty (680) years. All dates from 5260±80 B.C. (SI-2605) to 2885 ±250 B.C. (GX-7085) are affected. For the period between 5300 and 4800 B.C. the correction ranges between eight hundred (800) and eight hundred and seventy-five (875) years; the correction peaks between 4800 and 4000 B.C., ranging from eight hundred and fifty (850) to nine hundred and thirty (930) years. Thereafter the correction, which ranges from eight hundred and eighty (880) to seven hundred (700) years, slowly decreases. The last date in this segment of the data base slips below the seven hundred (700) year mark to six hundred and eighty (680) years.

The calibrated time scale significantly alters the traditional overview of the Middle Archaic. On the uncalibrated time scale, the Neville complex is dated between 6050 and 4550 B.C., the Stark complex between 5050 and 4050 B.C. (Snow 1980:174). In the traditional scheme Neville, the oldest complex by one thousand (1000) years, and Stark had a period of co-existence: Neville apparently faded in importance and was replaced by the Merrimack complex, dated between 4050 to 2000 B.C., with its own distinctive point form - the Merrimack point. (The Merrimack point is generally similar in appearance to the Neville point, but not similar technologically [Dincauze and Mulholland

1977:442]). Stark has been assigned an intermediate position between the Neville and Merrimack complexes. The primary investigator has presented a "... picture of an evolving culture that adopted and abandoned point types...", and has considered the possibility that Stark was not a distinctive complex (Dincauze 1976:122).

While there is agreement between the uncalibrated and calibrated time scale regarding the chronological ordering of Neville and Stark, the 'intermediate' positioning of the Stark complex between Neville and Merrimack is not substantiated (see bars 5,6,8 on graph 6.3). If 'A' associations are examined (cross-checked bars), the Neville and Stark points partially overlapped in time; Stark, the younger point type, outlasting Neville by approximately eight hundred (800) years. The Merrimack point, with a time span from 3900 to 2315 B.C., does not co-exist at any time with either of the preceding point types, and is exclusively a Late Archaic manifestation. If 'D'/mixed associations are examined, the ordering of Neville and Stark does not change: Neville appears first and is outlasted by Stark, but both time spans are lengthened significantly. Merrimack now co-exists with the older points, outlasts Neville, but disappears before termination of the Stark point. An intermediate status for the Stark complex does not appear to exist in either case. During more recent excavations at Weirs Beach, New Hampshire the Neville and Stark complexes could not be separated stratigraphically, indicating (to the investigator) the co-existence of the two assemblages (Bolian 1980:126). Hoffman has recently speculated on the positioning of the three point types in question, "...we are going to have to accept..the persistence of both Neville and Stark [3]and occasionally Merrimack[2] points in the Northeast throughout the fifth millennium and even beyond it" (Hoffman 1983:46). To this I might add that we may have to accept Merrimack as a Late Archaic point type intergrading in some way with the Otter Creek point of the Laurentian Tradition.

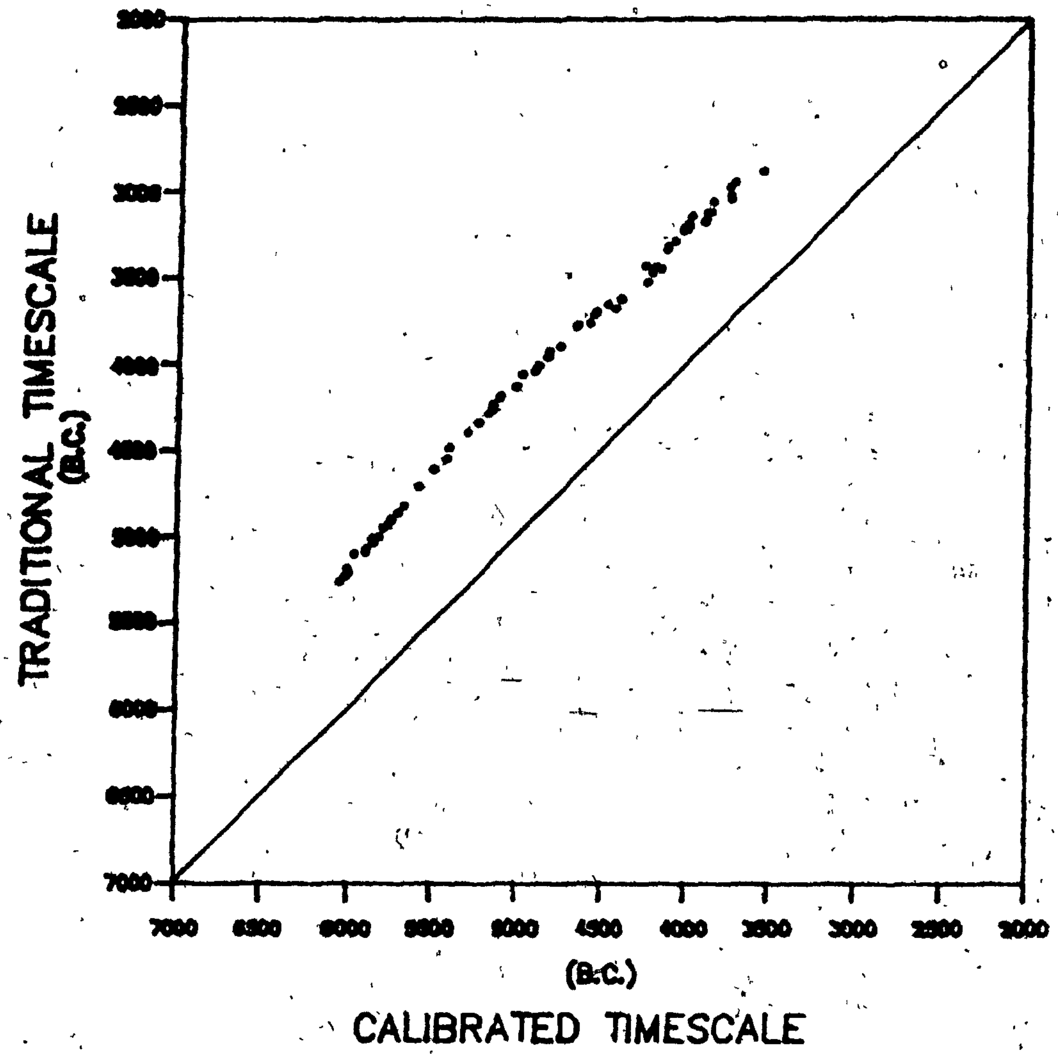
Based on the radiocarbon evidence and newer stratigraphic data, there is a very real possibility that the material has been subdivided too narrowly, resulting in the definiton of one (and possibly two) too many complexes to account for the variation in point types. Obviously an examination of the stratigraphic data in conjunction with the calibrated radiocarbon data is necessary before this issue can be resolved.

There are more discrepancies between the calibrated and uncalibrated time scales. Eight (8) Late Archaic projectile point forms, - Otter Creek, Vosburg, Brewerton, Beekman Triangle, Hunterbrook, Lackawaxen, Small Stemmed, and Squibnocket Triangle, appear in the Middle Archaic. [3]Point types must be represented by a minimum of three dates in the data base to justify generation of a bar graph. The Hunterbrook point is represented by only two dates in the data base and is, therefore, not represented.[2] In addition, there are dates associated with cultural manifestations other than projectile point types (see page 73). Three Late Archaic phases - Frontenac, Lamoka, and

Vergennes - are present; one Late Archaic complex - Moorehead; and two Late Archaic Traditions - Boreal and Laurentian. These dates were not included in the preparation of the bar graphs. I wish only to make the reader aware of this situation and postpone comment until the next chapter.

GRAPH 6.1 CALIBRATION CORRECTION, 5260 B.C. to 2885 B.C.

MIDDLE ARCHAIC TEMPORAL CONTAINER.



76 DATES.

CORRECTION FROM 5260 B.C. to 2885 B.C.

TABLE 6.1 MIDDLE ARCHAIC CONTAINER - 6000 B.C.-4000 B.C.

<u>Summary</u>

No. of dates categorized as 'A' = 38

No. of dates categorized as 'D' = 38

<u>No. of Mixed Associations</u>: 6

I-2599 - Otter Creek/Broad Stemmed
GX-1748 - Stark/Merrimack
GX-3238 - Hunterbrook/Beekman Trian.
GX-2324 - Otter Creek/Squibnocket
GX-1919 - Unspecified Stemmed/Eared
GX-7085 - Beekman Triangle/Small Stemmed.

In such cases, each component is given credit for the association.

<u>Representation by Point Type</u>:

Undiagnostic =	16	
Beekman Triangle =	2	
Brewerton =	2	
Hunterbrook =	1	
Kanawha-like =	1*	(from previous container)
Kirk =	2*	(from previous container)
Lackawaxen =	1	
Merrimack =	1	
Neville =	3*	(1 date from previous container)
Otter Creek =	5	
Vosberg =	1	
Squibnocket Triangle =	2	
Stark =	1	
Non-specific (Stemmed, Eared Notched, Side-notched) =	7	

<u>Representation by Cultural Affiliation</u>:

Boreal Archaic Tradition =	3
Frontenac Phase =	1
Lamoka Phase =	1
Laurentian Tradition =	1
Maritime Archaic Tradition =	28
Moorehead Complex =	2
Vergennes Phase =	1

Geographic Distribution:

Labrador	30
New York	2
Quebec	7
New Hampshire	4
Pennsylvania	3
Maine	3
Massachusetts	2
Newfoundland	1
Vermont	1
Unknown	1

TABLE 6.2 MIDDLE ARCHAIC CONTAINER - 6000 B.C.-4000 B.C.

	Lab. No.	Cultural Association		Calibrated Date	
1	SI-2605	Maritime(Triang.Pt.)	(D)*	6060+-490	Labrador
2	SI-2602	Maritime	(A)*	6030+-485	Labrador
3	SI-2638	Kirk Stemmed	(A)*	6015+-545	N.Y.
4	SI-2607	Maritime	(A)*	6010+-480	Labrador
5	M-1908	Kirk	(A)*	5975+-615	PA.
6	Dic-248RR	Undiagnostic	(D)**	5900+-440	N.Y.
7	GX-1449	Neville	(D)*	5895+-460	N.H.
8	Dic-752	Kanawha-like	(A)*	5860+-480	N.Y.
9	SI-1801B	Maritime	(D)*	5850+-400	Labrador
10	L-1381	Undiagnostic	(D)*	5820+-400	N.Y.
11	SI-1800A	Maritime	(D)*	5795+-415	Labrador
12	SI-1801A	Maritime	(D)*	5765+-375	Labrador
13	I-8101	Maritime	(D)*	5750+-395	Labrador
14	I-7505	Maritime	(A)*	5745+-365	Labrador
15	SI-2604	Maritime	(D)*	5705+-345	Labrador
16	SI-1800B	Maritime	(D)*	5670+-330	Labrador
17	S-1154	Laurentian Tr	(D)	5585+-330	Que.
18	Y-1655	Neville	(A)	5500+-270	N.H.
19	Gak-1276	Undiagnostic	(D)	5430+-360	Que.
20	SI-2305	Undiagnostic	(D)	5415+-235	Labrador
21	SI-2436	Maritime(Stemmed)	(A)	5305+-255	Labrador
22	Dic-218	Otter Creek	(A)	5245+-265	N.Y.
23	I-7612	Maritime	(D)	5240+-300	Labrador
24	SI-2314	Maritime	(D)	5180+-235	Labrador
25	I-7607	Maritime(Stemmed)	(A)	5160+-265	Labrador
26	S-1262	Maritime	(D)	5155+-195	Que.
27	I-7606	Maritime	(D)	5150+-260	Labrador
28	Dic-355	Undiagnostic	(D)	5150+-220	N.Y.
29	R-177	Undiagnostic	(D)	5110+-205	N.Y.
30	SI-2986	Maritime	(A)	5105+-205	Labrador
31	P-687	Boreal A. Tr.	(A)	5015+-265	Labrador
32	I-7506	Maritime	(A)	5010+-270	Labrador
33	SI-2979	Maritime	(A)	4980+-240	Labrador
34	SI-1791	Maritime(Sandy C.)	(A)	4905+-330	Labrador
35	P-688	Boreal A. Tr.	(A)	4905+-330	Labrador
36	I-2599	Otter Creek/Broad Stemmed	(A)	4900+-330	N.Y.
37	QU-347	Undiagnostic	(D)	4890+-325	Que.
38	GX-1748	Stark/ Merrimack	(A)	4835+-410	N.H.
39	Dic-354	Serrated Corner-N.	(A)	4825+-410	N.Y.
40	Y-1315	Undiagnostic	(D)	4760+-310	N.Y.
41	SI-1790	Maritime(Sandy Cove)	(A)	4670+-255	Labrador
42	I-5524	Otter Creek	(A)	4665+-250	N.Y.
43	C-417	Undiagnostic	(D)	4590+-710	MA.
44	Dic-208	Brewerton Ear-N.	(A)	4565+-170	N.Y.

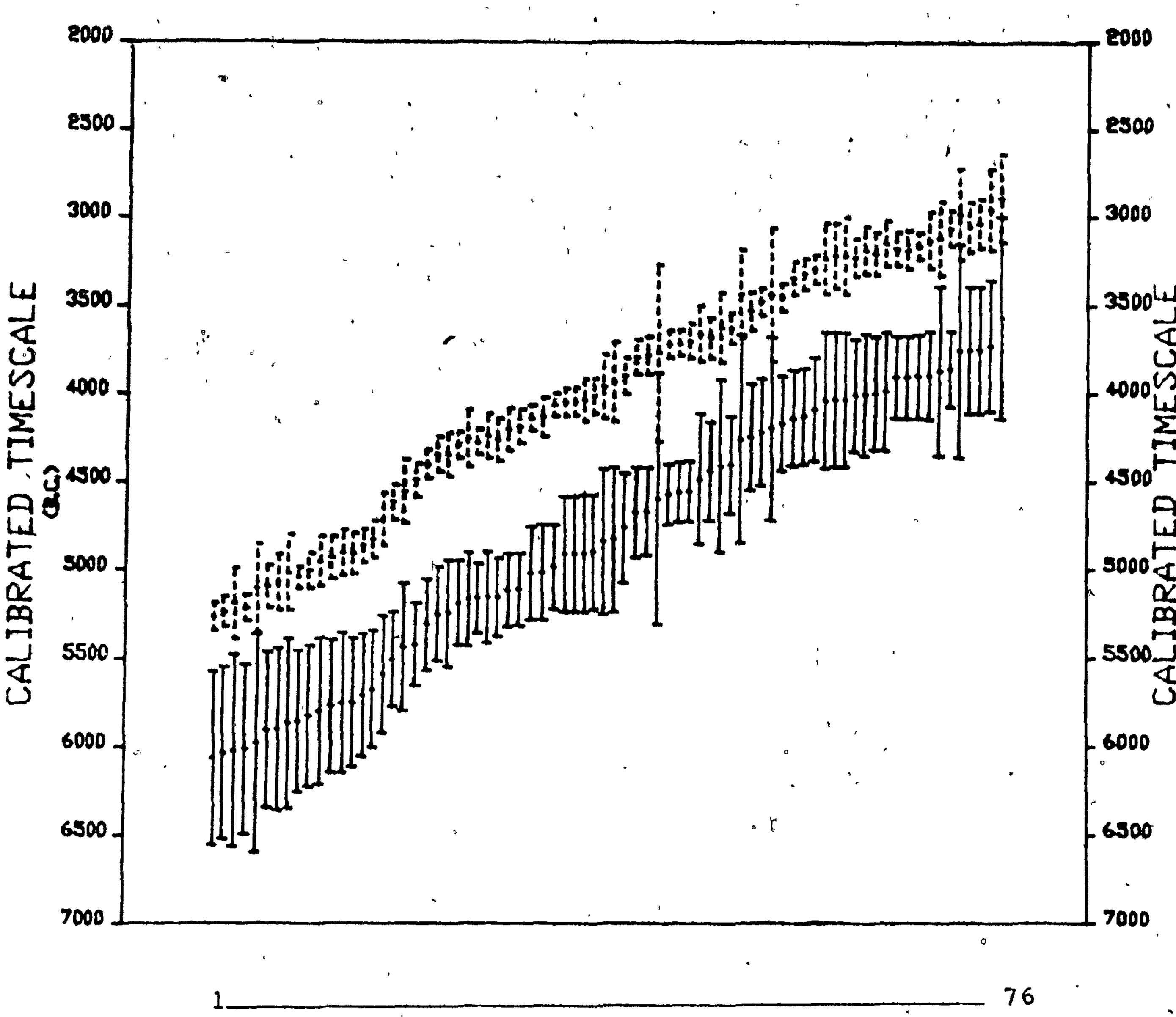
* Overlap from previous container.

45	Dic-356	Side-Notched	(A)	4555+-170	N.Y.
46	SI-2520	Maritime	(A)	4480+-370	Labrador
47	L-1036e	Undiagnostic	(D)	4550+-170	N.Y.
48	Dic-352	Brewerton Side-N.	(A)	4435+-280	N.Y.
49	I-5237	Vosberg	(A)	4405+-490	PA.
50	SI-2526	Maritime	(A)	4400+-275	Labrador
51	C-367	Lamoka Phase	(D)	4255+-590	N.Y.
52	SI-2156	Maritime	(A)	4245+-300	Labrador
53	SI-1277	Maritime(Sandy Cove)	(A)	4215+-305	Labrador
54	GX-1320	Neville	(D)	4195+-520	N.H.
55	P-691	Boreal Archaic Tr.	(A)	4165+-270	Labrador
56	SI-1925	Undiagnostic	(D)	4135+-270	Maine
57	QU-378	Undiagnostic	(D)	4125+-270	Que.
58	S-509	Vergennes Phase	(D)	4085+-295	Que.
59	Y-2479	Lackawaxen	(A)	4035+-385	PA.
60	SI-878	Moorehead Com.	(A)	4030+-380	Maine
61	GX-3664	Squibnocket Triang.	(A)	4030+-380	MA.
62	QC-108	Undiagnostic	(D)	4010+-320	N.Y.
63	GX-3238	Hunterbook/Beekman	(A)	4005+-345	N.Y.
64	GX-1918	Notched	(D)	4000+-320	N.Y.
65	GX-2324	Otter Creek/Squib-nocket	(D)	3985+-335	N.Y.
66	SI-1796	Maritime	(A)	3905+-235	Labrador
*67	SI-1279	Maritime(Sandy Cove)	(A)	3905+-235	Labrador
68	QC-110-1	Undiagnostic	(D)	3900+-235	N.Y.
69	GX-1919	Stemmed/ Eared	(D)	3895+-250	N.Y.
70	I-6349	Otter Creek	(D)	3870+-480	VT.
71	QC-101-1	Undiagnostic	(D)	3860+-215	N.Y.
72	C-191	Frontenac Phase	(D)	3755+-605	N.Y.
73	Y-2624	Moorehead Complex	(D)	3750+-360	Maine
74	S-729	Undiagnostic	(D)	3750+-380	Que.
75	SI-1384	Maritime	(A)	3725+-370	Nfld.
76	GX-7085	Small stemmed/Beekman Triangle	(A)	3565+-570	?

? - A New England locale; exact location unclear in literature.

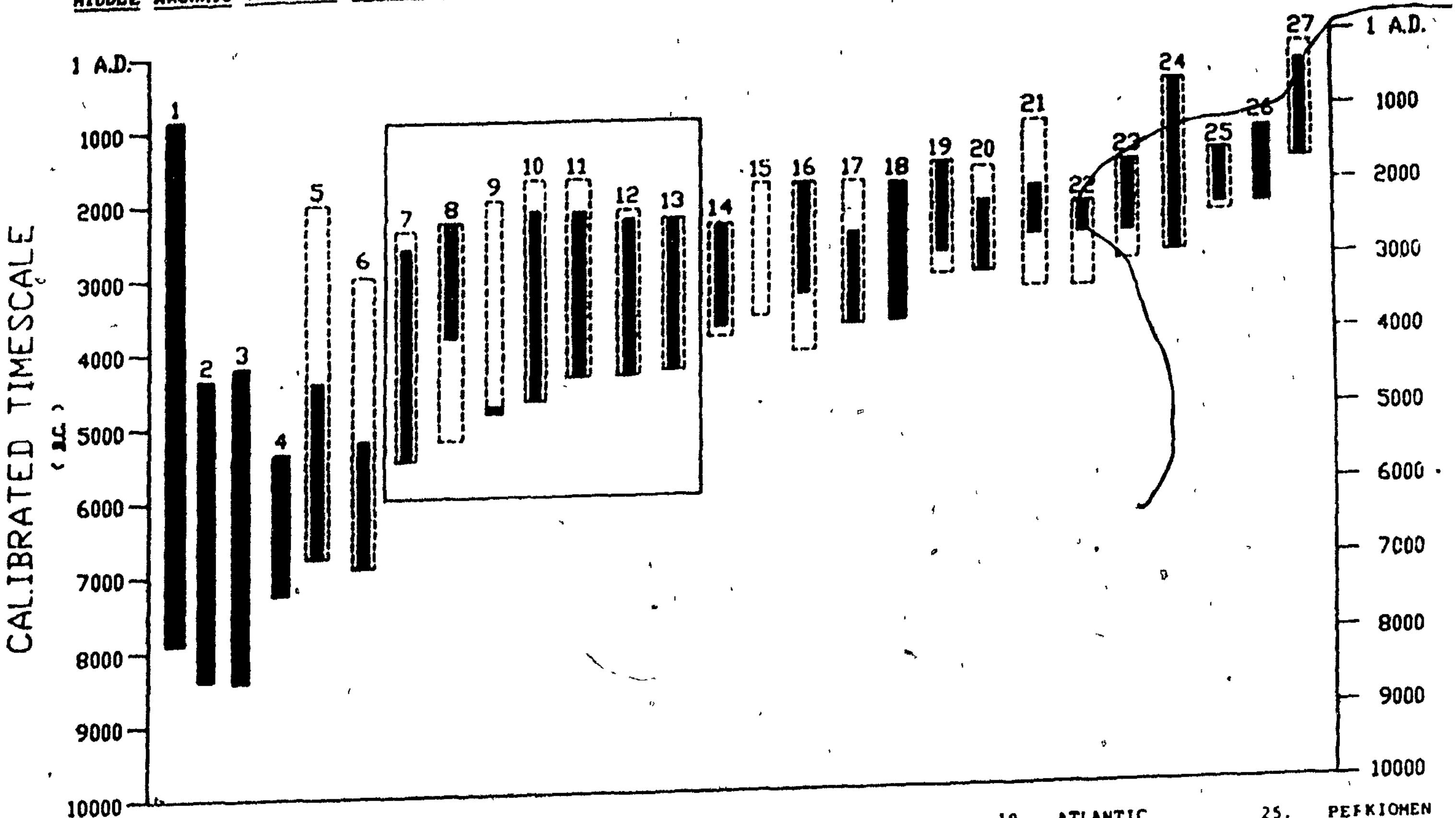
GRAPH 6.2 OVERVIEW

MIDDLE ARCHAIC TEMPORAL CONTAINER.



GRAPH 6.3 BAR GRAPH SERIES

MIDDLE ARCHAIC TEMPORAL CONTAINER



1. MARITIME ARCHAIC
2. KIRK
3. BIFURCATED-BASE
4. KANAWHA
5. STARK
6. NEVILLE
- •7. OTTER CREEK
- •8. MERRIMACK
- •9. VOSBERG
- •10. BREWERTON
- •11. LACKAWAXEN
- •12. SQUIBNOCKET
- •13. BEEKMAN

14. BARE ISLAND
15. WADING RIVER
16. SMALL STEMMED
17. SYLVAN LAKE
18. LAMOKA
19. ATLANTIC
20. LAMOKA-LIKE
21. NORMANSKILL
22. VESTAL
23. SNOOK KILL
24. ORIENT
25. PERKIOMEN
26. SUSQUEHANNA
27. MEADOWOOD

Summary

As outlined, the calibrated chronology contradicts the uncalibrated time scale. From the Early container it now appears that the Neville and Stark point types were contemporary with the earliest known Archaic point forms in the Northeast. They can no longer be viewed as forms exlusive to the Middle Archaic. The established sequence of Neville, Stark, and then Merrimack remains basically unaltered, but placement of Stark in an intermediary role between Neville and Merrimack does not stand up. For most of their respective timespans the Neville and Stark points appear to have co-existed; the relationship, as outlined, between the Merrimack point and both the Neville and Stark points, as well as its positioning relative to the Middle and Late containers, is dependent on the acceptance or rejection of mixed point associations.

The degree of overlap between Middle Archaic and Late Archaic manifestations within the Middle Archaic container produces a very different evolutionary framework and one that may emphasize *in situ* development of Late Archaic manifestations from a Middle Archaic base rather than the introduction of intrusive elements. The changed relationships will be discussed in the next section.

Of the total number of seventy-six (76) dates whose ranges fall within this segment of the data base, only thirty-two (32) lie completely within the time span assigned to the Middle Archaic. Sixteen (16) dates overlap from the previous container, twenty-eight (28) dates from this container overlap into the Late Archaic.

CHAPTER SEVEN

THE LATE ARCHAIC TEMPORAL CONTAINER

Historical Background

There can be no doubt that this portion of the Archaic time frame is one of the most confusing segments in northeastern North American prehistory. We are dealing with a body of data that had its beginnings more than a century ago and has been worked and reworked by a long line of distinguished investigators. With each new interpretation, additional terminology has been introduced into the literature that augments but does not replace older classifications. As a result the same manifestations now appear within many broadly defined cultural headings. This makes the development of a clear overview of the prehistoric record extremely difficult.

I have attempted to provide a simple outline of the material that is pertinent to the data base. As my study of the data progressed, it became apparent that major discrepancies between the calibrated and uncalibrated time scales would appear. I do not pretend to understand the factors that might explain the anomalies, but I believe there are more than temporal mechanisms involved. In my opinion, the Late Archaic data base should be the subject of a major re-assessment. The calibrated chronology would constitute only one segment in a review of classification, terminology, stratigraphy, and geographic distribution of all Late Archaic assemblages. Because of this I offer few explanations beyond the more obvious. I hope that the possibilities and problems that are apparent in this section of the calibrated chronology will stimulate further investigation and prompt new explanations.

The Late Archaic is assigned to the period between 4000 B.C. and 1700 B.C. (after Snow 1980). There are, however, more variations of this time span available than for the preceding periods: 4000 to 1500 B.C. (Funk 1978), 4000 to 1000 B.C. (Fitzhugh 1972) and 3500 to 1300 B.C. (Ritchie 1965) are examples.

Material evidence of the Late Archaic was first discussed in terms that have become traditional to archaeology - focus, complex, phase, aspect, tradition. This terminology, born of the Midwestern Taxonomic System, categorized artifactual evidence according to typological variation. The first of the complexes identified in the modern era (the very early excavations of Moorehead, Willoughby et al. are well documented in historical reviews) was the Lamoka Complex of central and western New York State. Two varieties of a small, narrow projectile point form - the Lamoka point - are diagnostic of this complex (Ritchie 1971:29). Lamoka, the first of a long succession of manifestations defined by William Ritchie, held temporal priority over all other Archaic assemblages for some time, but has since been subsumed by the second of two major cultural divisions.

The Laurentian Tradition, first defined as an 'aspect', is the older of the two major cultural manifestations in the central portion of the study area. It was marked by the appearance of seemingly new and distinctive broad-bladed, side-notched point forms within assemblages containing ground slate tools and polished stone gouges (Ritchie 1940:96; Tuck 1977:31). The Laurentian is subdivided into three major complexes or phases: the Vergennes complex from Vermont; the Vosburg complex from eastern New York and New England; and the Brewerton complex from central and western New York and New England. Distinctive point types are diagnostic of the separate subdivisions of the tradition:

Vergennes Complex	Otter Creek
Vosburg Complex	Vosburg Beekman Triangle
Brewerton Complex	Brewerton side-notched Brewerton eared-notched Brewerton corner-notched Brewerton eared triangle Normanskill**

(Ritchie 1971:16-19,40,55,121).

** see page 87, this section.

Uncalibrated radiocarbon dates for the three complexes range between 5200 and 4000 B.P. Two additional complexes, the Blue Hill from Maine, and the Frontenac from New York, subsumed 'Red

Paint' assemblages known to the archaeological record from the late 1800s.

The early manifestations of the Laurentian Tradition were considered intrusive to the Northeast, having made an appearance from the "...deciduous forest belt bordering the Great Lakes..." (Ritchie 1965:82). The distribution of its assemblages was thought to be confined primarily to the upper St. Lawrence area. This region is variously described as the "...broadleaf Canadian or Transitional Forest or Lake Forest zone of the Northeast" (Tuck 1977:32). Ritchie's overview has become the description of the 'classic' Laurentian manifestation.

Laurentian assemblages have been identified throughout most of the Northeast, many outside the ecological zone with which they were supposedly associated. James Tuck sees the Laurentian Tradition as part of a "...much more widespread entity..." that "...refers to some nebulous group of archaeological cultures..." some of which contain the classic artifact forms while others do not. In some assemblages the characteristic broad-bladed, notched points are replaced by narrow, notched, and stemmed projectiles diagnostic of the Narrow Point Tradition discussed below (ibid. 1977:32).

Tuck's 'Formative Laurentian' moved northward from centres in the south and west. The northward movement resulted in assimilation of the chipped stone complex from the south with the ground slate complex of the Maritime Archaic Tradition, already in place for many millennia along the Atlantic coast and the Gulf of St. Lawrence. It was this melding of two distinct cultures that produced the 'classic' Laurentian assemblages outlined by Ritchie (ibid. 1977:37). We are now burdened with two Laurentians: a 'classic' Laurentian, supposedly diffused from the Great Lakes region, and a 'formative' Laurentian, the result of <u>in situ</u> development from earlier centres in the south.

The Narrow Point Tradition, the second cultural grouping, supposedly moved northward from southern centres into the deciduous forests of southern New England and New York State (Ritchie 1965; Tuck 1977). Later than 'classic' Laurentian by five hundred (500) to one thousand (1000) years, the Narrow Point Tradition dominated the second half of the third millennium B.C., as the Laurentian manifestation waned. The Narrow Point Tradition is also subdivided into major complexes or phases: the Lamoka complex, the Bare Island complex, the Poplar Island complex, the Squibnocket complex, the Sylvan Lake complex, the Vestal phase, the Charlotte phase, the River phase, and the Batten Kill phase. Each subdivision has diagnostic point type markers:

Lamoka complex	Lamoka straight stemmed Lamoka side-notched
Bare Island complex	Bare Island
Poplar Island complex	Poplar Island
Squibnocket complex	Squibnocket Stemmed Squibnocket Triangle Wading River*

Sylvan Lake complex	Sylvan Side-notched Sylvan Stemmed Wading River*
Vestal phase	Vestal notched
River phase	Normanskill**
Batten Kill complex	Genesee***
Additional points of Narrow Stemmed Tr.	'Small Stemmed' Lackawaxen Hunterbrook Nordica

* Wading River points are associated with both the Sylvan Lake and Squibnocket complexes.

** Ritchie (1971:37) considers Normanskill points to be a variant of Brewerton Side-notched points and an element of the Vosburg complex. Rippeteau (1973:152) considers Normanskill diagnostic of the River Phase.

*** Genesee points are designated "...Middle to Late Archaic; part of Laurentian and Frontenac manifestations" by Ritchie (Ritchie 1971:24); assigned to the Batten Kill complex, very Late Archaic by Funk (Funk 1976:261); both the Batten Kill complex and the Genesee point are a part of the early Susquehanna Tradition of the Terminal Archaic according to Snow (1980:236).

Two additional traditions were contemporaneous with, but geographically separated from, both the Laurentian and Narrow Point Traditions. The Shield Archaic (Wright 1972) ranged to the north of 'classic' Laurentian territory and occupied the harsh environment of the Canadian Shield while the coastal zone from New England to the northern reaches of Labrador continued to be the homeland of the Maritime Archaic Tradition.

It is this core of data that has been re-examined many times. Most recently the material has been discussed in terms of major geographical and/or ecological zones, and this has resulted in a further proliferation of terminology. In addition to the terminology already quoted, the list provided below is fairly comprehensive for the Late Archaic:

General Headings:

Appalachian Tradition	(Ritchie 1969)
Atlantic Slope Macrotradition	(Dincauze 1976)
Atlantic Slope Archaic	(Dincauze 1975
Boreal Archaic	(Byers 1959)
Coastal Archaic	(Byers 1959)
Lake Forest Archaic	(Tuck 1978)
Mast Forest Adaptation	(Snow 1980)
Middle Atlantic Cultural Province	(Dincauze 1976)
Mixed Forest Archaic	(Tuck 1978)
Panhandle Archaic	(Mayer-Oakes 1955)
Piedmont Tradition	(Kinsey 1972)
Taconic Tradition	(Brennan 1972)

Additional manifestations:

Moorehead complex	(Rowe 1940)
Red Paint complex	(Moorehead, Willoughby 1913)
Old Copper Culture	(Miles 1951)
Glacial Kame Culture	(Ritchie 1965)
Newfoundland Aberrant	(Harp 1952)
Old Stone Culture	(Strong 1930)

(after Fitzhugh 1972).

The complexes and/or phases and diagnostic point forms of the Laurentian and Narrow Point Traditions follow a chronological hierarchy based on 'favoured' radiocarbon dates from one or two sites where the radiocarbon data reinforce the very limited stratigraphic data available throughout the Northeast that supports the traditional chronology. Working from the bottom of the hierarchy forward in time the sequence for the point types is as follows: Otter Creek, Vosburg, Brewerton and Beekman, Lamoka, Bare Island, Poplar Island, Lackawaxen, Wading River, Squibnocket, Sylvan Lake, Vestal, and finally Normanskill, which closes the Late Archaic. (Rippeteau 1973:33). Within this sequence, one point type per temporal unit is implied.

Study Results

Dates from 3767±500 B.C. (C-417) to 970±300 B.C. (M-363) from the uncalibrated data are within range of the 4000 to 1700 B.C. container. The Calibration Correction ranges between eight hundred and forty (840) years and one hundred and fifteen (115) years. The variation of seven hundred and twenty-five (725) years over the two thousand three hundred (2300) year period is the most pronounced of the entire Archaic time span. From approximately 3700 B.C. to 3000 B.C. (overlapping segment) the correction ranges from eight hundred and forty (840) to seven hundred (700) years; from approximately 3000 B.C. to 2500 B.C. the range is seven hundred and seventy-five (775) to six hundred and fifty-five (655) years; from 2500 to 2000 B.C. the range is seven hundred and thirty (730) years to four hundred and eighty-five (485) years; for the period between 2000 to 1500 B.C. the correction ranges from five hundred and fifteen (515) years to three hundred and five (305) years; and finally from 1500 to 900

B.C. the correction ranges from three hundred and thirty (330) years to one hundred and fifteen (115) years. The discrepancy between the uncalibrated and calibrated time scale decreases rapidly toward the close of the Archaic.

After calibration the range of the Otter Creek point, the first of the Late Archaic point forms, lies between 5510 and 2660 B.C. If only 'A' associations are considered there is significant overlap between the Otter Creek, Kirk, and Stark ranges. If mixed associations are also taken into consideration there is extensive overlap between the Otter Creek, Kirk, Bifurcated-base, Stark and Neville ranges. Although the implications are unclear at this time, the 'A' bar places Otter Creek points squarely between the Neville/Stark/Merrimack triad discussed in the preceding section: the 'D' bar suggests almost complete contemporaneity between the Otter Creek and Merrimack point types.

The ranges of the remaining Laurentian point forms, Vosburg 4895-2035 B.C., Beekman 4350-2305 B.C., and Brewerton 4735-1765 B.C., also slip into the Middle container. They appear to keep their traditional sequence of Otter Creek, Vosburg, and then Brewerton, although there is only one hundred and sixty (160) years separating the baselines of Vosburg and Brewerton.

The bar graph distribution points to a continued evolution of broad-bladed, notched point styles within a 'formative' Laurentian Tradition from an in situ base. "The origins of the limited chipped stone complex (Laurentian) must be in the Middle Archaic...which was part of a widespread cultural manifestation in the Appalachians and middle Mississippi drainage that had in common a chipped lithic complex...of broad-bladed, notched projectile points..." (Tuck 1977:37).

After bar no. 7 (Otter Creek) the range distributions become quite flat. And although the ranges vary, there is somo degree of overlap from bar no. 8 to bar no. 26 affecting all of the Late Archaic and Terminal or Transitional point styles. The amount of overlap increases with the mixed associations, but is still very evident using only 'A' data. The temporal patterning of the point types is also upset as seen on the following page.

Calibrated Position

Otter Creek	5510-2660 B.C.	'A'
	5510-2420 B.C.	'D'
Merrimack	3875-2315 B.C.	'A'
	5245-2315 B.C.	'D'
Vosburg	4895-2035 B.C. (all mixed assoc.)	'D'
Brewerton	4735-2185 B.C.	'A'
	4735-1765 B.C.	'D'
Lackawaxen	4420-2205 B.C.	'A'
	4420-1770 B.C.	'D'
Squibnocket	4410-2310 B.C.	'A'
	4410-2190 B.C.	'D'
Beekman	4350-2325 B.C.	'A'
	4350-2305 B.C.	'D'
Bare Island	3790-2425 B.C.	'A'
	3920-2400 B.C.	'D'
Wading River	3655-1875 B.C.	'D'
Small Stem.	3365-1885 B.C.	'A'
	4135-1885 B.C.	'D'
Sylvan Lake	3785-2555 B.C.	'A'
	3790-1875 B.C.	'D'
Lamoka	3765-1900 B.C.	'A'
Atlantic	2855-1650 B.C.	'A'
	3150-1650 B.C.	'D'
Lamoka-like	3140-2190 B.C.	'A'
	3140-1725 B.C.	'D'
Normanskill	2650-1990 B.C.	'A'
	3350-1130 B.C.	'D'
Vestal	2630-2220 B.C.	'A'
	3350-2220 B.C.	'D'

Traditional Position

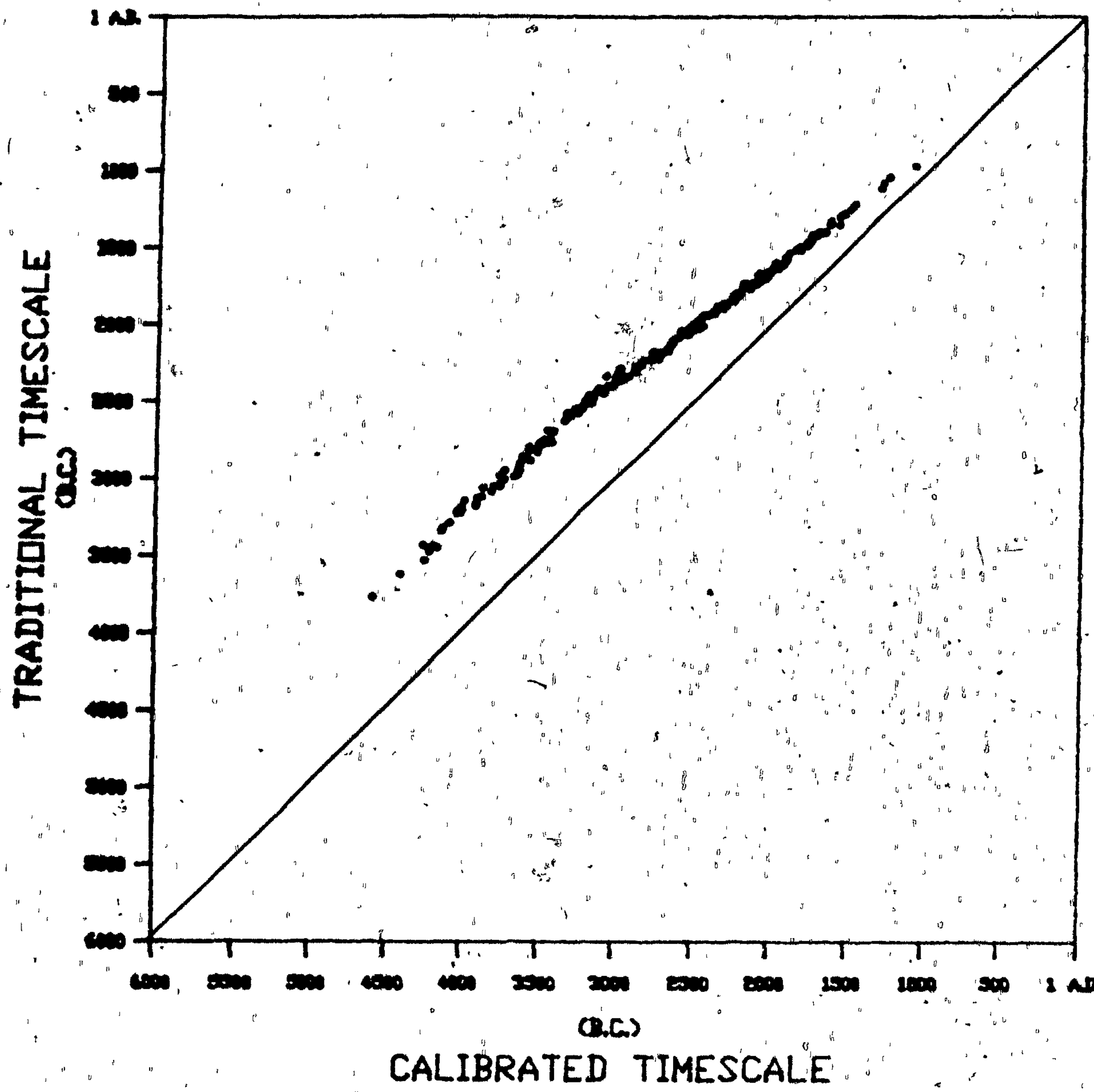
Merrimack	no specific date
Otter Creek	3200 B.C.
Vosburg	2780-2524 B.C.
Brewerton	2750 B.C.
Lamoka	2300 B.C.
Bare Is.	no specific date
Poplar Is.	no specific date
Lackawaxen	no specific date
Wading River	2190 B.C.
Squibnocket	2190 B.C.
Sylvan Lake	2200-1500 B.C.
Vestal	2140 B.C.
Normanskill	1930-1339 B.C.

The placement of the projectile point types in the preceding table follows the 'A' or fully accepted data. The 'D' data would again change the sequence and would be as follows: Otter Creek, Merrimack, Vosburg, Brewerton, Lackawaxen, Squibnocket, Beekman, Small Stemmed, Bare Island, Sylvan Lake, Lamoka, Wading River, Normanskill, Vestal. Only twenty (20) years separate the baselines of the Normanskill and Vestal ranges.

The geographic distribution of point types is clearly of great importance. Histogram evaluation of radiocarbon dates is becoming increasingly popular in archaeological contexts (Gehy and de Maret 1982:158-163). Fortunately, almost all of the Late Archaic point forms are well dated, which makes the preparation of histograms for each point type worthwhile. If there is evident bimodality that can be identified with specific geographic locations, a truly meaningful chronology will be developed.

GRAPH 7.1 CALIBRATION CORRECTION, 3767 B.C. to 970 B.C.

LATE ARCHAIC TEMPORAL CONTAINER.



300 DATES.

CORRECTION FROM 3767 B.C. to 970 B.C.

TABLE 7.1 LATE ARCHAIC CONTAINER - 4000 B.C.-1700 B.C.

Summary

No. of Dates categorized as 'A' = 189

No. of Dates categorized as 'D' = 111

No. of Mixed Associations: 51

GX-3238	-	Hunterbrook/Beekman
GX-2324	-	Otter Creek/Squibnocket
GX-1919	-	Stemmed/Eared
UGA-012	-	Neville/Stark/Bare Is./ Squibnocket
Y-1761	-	Beekman/Bare Is./Sylvan
GX-7085	-	Small Stemmed/Beekman
----	-	Stark/Brewerton/Vosberg
Y-1535	-	Otter Creek/Bare Is./Sylvan
GX-0762	-	Taconic Stemmed/Bare Is.
----	-	Stark/Brewerton/Vosberg
GX-2351	-	Neville/Stark/Merrimack
Y-2499	-	Brewerton/Small Stemmed/ Beekman/Squibnocket
GX-8072	-	Brewerton/Squibnocket
GX-2417	-	Wading River/Squibnocket
BS-225	-	Neville/Merrimack
I-4837	-	Beekman/Madison
GX-2489	-	Small Stemmed/Sylvan
UGA-1236	-	Neville/Brewerton/Vosberg/ Small Stemmed
GX-1749	-	Vosberg/Beekman/Wading R./ Otter Creek/Squibnocket
I-7095	-	Normanskill/Vestal
GX-1104	-	Neville/Stark/Squibnocket/ Small Stemmed
GX-7411	-	Brewerton/Small Stemmed
----	-	Squibnocket/Small Stemmed
Y-1530	-	Brewerton/Otter Creek/ Squibnocket
BETA-4049	-	Brewerton/Vosberg
BETA-4059	-	Atlantic/Small Stemmed
GX-2836	-	Squibnocket/Beekman
Y-1526	-	Brewerton/Vosberg/Sylvan
UGA-386	-	Squibnocket/Small Stemmed/ Bare Is.
UGA-389	-	Small Stemmed/Bare Is.
Y-1529	-	Squibnocket/Wading River/ Snook Kill
UGA-389	-	Squibnocket/Bare Is./Small Stemmed
GX-3213	-	Squibnocket/Beekman
GX-7574	-	Brewerton/Small Stemmed

Dic-183 - Vosberg/Brewerton/Beekman/ Sylvan/Small Stemmed
GX-7471 - Atlantic/Small Stemmed
GX-7090 - Orient/Small Stemmed
BETA-4052 - Squibnocket/Small Stemmed
Y-2345 - Lamoka/Normanskill/Sylvan
GX-7077 - Vosberg/Neville/Stark/ Small Stemmed
Y-2346 - Normanskill/Lamoka/Sylvan
Y-2582 - Sylvan Lake/Wading River
Dic-88 - Normanskill/Vestal
GX-2415 - Wading River/Squibnocket
I-2401 - Normanskill/Sylvan
Y-2587 - Perkiomen/Snook Kill
Y-2342 - Lackawaxen/Macphearson
GX-0568 - Susquehanna Broad/Mansion Inn
I-6641 - Perkiomen/Susquehanna Broad
Y-2341 - Normanskill/Orient Fishtail
Y-2343 - Orient/Dry Brook

In such cases, each component is given credit for the association.

Representation by Point Type:

Undiagnostic = 57
Atlantic = 3
Atlantic-like = 2
Bare Is. = 9
Beekman = 11
Brewerton = 18
Brewerton-like = 1
Dry Brook = 1
Eared = 1
Hunterbrook = 1
Lackawaxen = 5
Lamoka = 18
Lamoka-like = 6
Lehigh Broad = 1
Macphearson = 1
Madison = 1
Mansion Inn = 1
Meadowood = 1
Merrimack = 3
Neville = 8
Notched = 2
Nordica = 1
Normanskill = 12
Orient = 7
Otter Creek = 9

Perkiomen	= 5
Small Stemmed	= 22
Snook Kill	= 4
Squibnocket	= 18
Stark	= 6
Stemmed	= 1
Susquehanna Broad	= 11
Sylvan	= 10
Taconic Stemmed	= 1
Vestal	= 5
Vosberg	= 9
Wading River	= 5
Wayland	= 1

<u>Representation by Cultural Affiliation</u>:

Brewerton Phase	= 5
Boreal Archaic Tr.	= 2
Frontenac Phase	= 2
Genessee Complex	= 1
Glacial Kame	= 1
Inverhuron Tr.	= 2
Lamoka Phase	= 6
Laurentian Tr.	= 3
Maritime Archaic Tr.	= 53
Mattawan Complex	= 1
Moorehead Complex	= 5
Narrow Point Tr.	= 1
Red Paint Complex	= 2
Shield Archaic Tr.	= 1
Snook Kill Phase	= 1
Susquehanna Tr.	= 7
Vergennes Phase	= 4
Vestal Phase	= 2
Vosberg Phase	= 2

<u>Geographic Distribution</u>:

Connecticut	= 9	Quebec	= 11
Labrador	= 46	Vermont	= 1
Maine	= 19	Unknown	= 18
Massachusetts	= 40		
New Brunswick	= 2		
Newfoundland	= 11		
New Hampshire	= 3		
New Jersey	= 10		
New York	= 101		
Ontario	= 13		
Pennsylvania	= 16		

TABLE 7.2 LATE ARCHAIC CONTAINER - 4000 B.C.-1700 B.C.

	Lab. No.	Cultural Association		Calibrated Date	
		Calibrated Date			
1	C-417	Undiagnostic	(D)*	4590+-710	MA.
2	I-5237	Vosberg	(A)*	4405+_490	PA.
3	C-367	Lamoka Phase	(D)*	4255+-590	N.Y.
4	SI-2156	Maritime	(A)*	4245+-300	Labrador
5	SI-1277	Maritime(SandyCove)	(A)*	4215+-305	Labrador
6	GX-1320	Neville	(D)*	4195+-520	N.H.
7	P-691	Boreal Archaic Tr.	(A)*	4165+-270	Labrador
8	SI-1925	Undiagnostic	(D)*	4135+-270	Maine
9	QU-373	Undiagnostic	(D)*	4125+-270	Que.
10	S-509	Vergennes Phase	(D)*	4085+-295	Que.
11	Y-2479	Lackawaxen	(A)*	4035+-385	PA.
12	SI-878	Moorehead Complex	(A)*	4030+-380	Maine
13	GX-3664	Squibnocket Triang.	(A)*	4030+-380	MA.
14	QC-108	Undiagnostic	(D)*	4010+-320	N.Y.
15	GX-3238	Hunterbrook/Beekman	(A)*	4005+-345	N.Y.
16	GX-1918	Notchedd	(D)*	4000+-320	N.Y.
17	GX-2324	Otter Creek/Squib-nocket	(D)*	3985+-335	N.Y.
18	SI-1796	Maritime	(A)*	3905+-235	Labrador
19	SI-1279	Maritime(SandyCove)	(A)*	3905+-235	Labrador
20	QC-110-1	Undiagnostic	(D)*	3900+-235	N.Y.
21	GX-1919	Stemmed/ Eared	(D)*	3895+-250	N.Y.
22	I-6349	Otter Creek	(D)*	3870+-480	VT.
23	QC-101-1	Undiagnostic	(D)*	3860+_215	N.Y.
24	SI-2311	Maritime	(A)	3805+-145	Labrador
25	S-1540	Maritime(Rattlers Bight)	(A)	3795+-155	Labrador
26	C-191	Frontenac Phase	(D)*	3755+-605	N.Y.
27	Y-2624	Moorehead Complex	(D)*	3750+-360	Maine
28	S-729	Undiagnostic	(D)*	3750+-380	Que.
29	QC-110-2	Undiagnostic	(D)	3730+-190	N.Y.
30	UGA-012	Neville/Stark/Squib-nocket/Bare Is.	(A)	3730+-190	MA.
31	SI-1384	Maritime	(A)*	3725+-370	Nfld.
32	QU-227	Undiagnostic	(D)	3665+-290	Que.
33	SI-1278	Maritime(SandyCove)	(A)	3645+-255	Labrador
34	SI-2505	Maritime	(A)	3640+-255	Labrador
35	S-1263	Laurentian Tr.	(D)	3635+-255	Que.
36	-----	Brewerton	(A)	3635+-255	?
37	SI-1787	Maritime(Black Is.)	(A)	3635+-255	Labrador
38	0-1902	Undiagnostic	(D)	3630+-270	MA.
39	SI-2512	Maritime	(D)	3625+-255	Labrador
40	SI-877	Maritime(SandyCove)	(A)	3615+-250	Labrador
41	S-1162	Undiagnostic	(D)	3590+-215	Ont.

42	SI-2514	Maritime	(A)	3575+-220	Labrador
43	QC-101-2	Undiagnostic	(D)	3575+-220	N.Y.
44	SI-2504	Maritime	(A)	3575+-220	Labrador
45	BETA-4056	Undiagnostic	(D)	3570+-220	MA.
46	Y-1761	Beekman/BareIs./ SylvanSide-notched	(A)	3570+-220	N.Y.
47	GX-7085	Small stemmed/ Beekman	(A)*	3565+-570	?
48	------	Stark/Brewerton/ Vosberg	(A)	3520+-375	MA.
49	QC-109	Undiagnostic	(D)	3515+-350	N.Y.
50	GX-2999	Nordica	(D)	3505+-350	N.Y.
51	M-1350	Undiagnostic	(D)	3500+-350	MA.
52	QC-113	Beekman Triangle	(D)	3495+-295	N.Y.
53	Y-1535	Otter Creek/BareIs./ Sylvan Side-notched	(A)	3485+-300	N.Y.
54	GX-0762	Taconic Stemmed/ Bare Is.	(A)	3485+-300	N.Y.
55	GSC-162	Brewerton-like	(A)	3475+-305	Que.
56	--------	Stark/Brewerton/ Vosberg	(A)	3450+-425	MA.
57	GX-2351	Neville/Stark/ Merrimack	(A)	3450+-425	MA.
58	Y-2499	Brewerton/Beekman/ Squibnocket/Small Stemmed	(D)	3450+-305	MA.
59	GX-8072	Brewerton/Squib- nocket	(D)	3435+-360	N.H.
60	S-1028	Undiagnostic	(D)	3420+-530	Ont.
61	SI-2146	Maritime	(A)	3410+-240	Labrador
62	SI-2527	Maritime	(A)	3410+-240	Labrador
63	SI-1789	Maritime(Black Is.)	(A)	3335+-310	Labrador
64	GaK-3794a	Glacial Kame	(D)	3330+-315	Ont.
65	QC-106	Beekman Triangle	(D)	3320+-315	N.Y.
66	S-797	Undiagnostic	(D)	3320-315	Ont.
67	QC-105-1	Otter Creek	(D)	3320+-315	N.Y.
68	SI-1923	Vergennes Phase	(A)	3320+-315	Maine
69	I-5234	Lackawaxen	(A)	3320+-315	PA.
70	M-195	Lamoka	(A)	3320+-445	N.Y.
71	GX-2417	Wading River/Squib- nocket	(A)	3285+-370	N.Y.
72	SI-929	Maritime (Rattlers Bight)	(A)	3280+-375	Labrador
73	Dic-116	Lamoka	(A)	3275+-375	N.Y.
74	O-474	Undiagnostic	(D)	3265+-375	N.Y.
75	I-5249	Maritime	(A)	3240+-290	Labrador
76	Y-1279	Lamoka	(A)	3215+-290	N.Y.
77	M-911	Lamoka	(A)	3215+-330	N.Y.
78	Y-1280	Lamoka	(A)	3210+-295	N.Y.
79	Dic-202	Lamoka	(A)	3210+-295	N.Y.
80	QC-105-2	Otter Creek	(D)	3205+-295	N.Y.

*overlap from previous container.

81	M-287	Vosberg Phase	(A)	3205+-325	N.Y.
82	BS-225	Neville/Merrimack	(A)	3205+-295	MA.
83	I-5411	Lackawaxen	(A)	3195+-325	PA.
84	SI-2307	Maritime	(A)	3195+-295	Labrador
85	O-475	Undiagnostic	(D)	3195+-325	MA.
86	I-4837	Beekman/Madison	(A)	3195+-325	N.Y.
87	SI-2513	Maritime	(D)	3195+_295	Labrador
88	SI-1920	Vergennes Phase	(A)	3175+-290	Maine
89	GX-2489	Small stemmed/Sylvan Lake	(A)	3160+-490	CT.
90	M-26	Lamoka	(A)	3150+-490	N.Y.
UGA-1236		Neville/Brewerton/ Vosberg/Small stem.	(A)	3130+-235	MA.
92	SI-1921	Vergennes Phase	(A)	3130+-235	Maine
93	UGA-932	Undiagnostic	(D)	3115+-250	MA.
94	M-912	Lamoka	(A)	3085+-410	N.Y.
95	GX-1749	Vosberg/Beekman/ Wading R./OtterCreek/ Squibnocket	(A)	3080+-440	N.H.
96	C-288	Lamoka	(A)	3075+-440	N.Y.
97	P-1782	Undiagnostic	(D)	3070+-270	N.J.
98	QC-176	Susquehanna Tr.	(A)	3060+-410	N.Y.
99	GX-2696	Sylvan Lake	(A)	3030+-475	CT.
100	Y-1664	Vosberg Ph.	(A)	3020+-340	CT.
101	SI-1655	Otter Creek	(A)	3015+-345	Maine
102	SI-2308	Maritime	(A)	3005+-350	Labrador
103	I-3788	Maritime	(A)	3005+-350	Nfld.
104	SI-1249	Otter Creek	(A)	3005+-345	Maine
105	M-1906	Brewerton Ph.	(D)	3005+-345	PA.
106	I-7095	Normanskill/Vestal	(A)	3000+-350	N.Y.
107	------	Brewerton	(A)	3000+-350	?
108	M-969	Brewerton	(A)	3000+-365	MA.
109	SI-1274	Maritime (Black Is)	(A)	2995+-350	Labrador
110	------	Undiagnostic	(D)	2990+-350	CT.
111	SI-2517	Maritime	(A)	2985+-345	Labrador
112	W-363	Small Stemmed	(A)	2985+-670	MA.
113	GX-1104	Neville/Stark/Squib- nocket/Small stem.	(A)	2960+-400	MA.
114	GX-7411	Brewerton/Small St.	(A)	2955+-530	?
115	BS-227	Neville	(A)	2930+-715	MA.
116	M-764	Laurentian Tr.	(D)	2895+-465	MA.
117	-----	Squibnocket/SmallSt.	(A)	2890+-480	?
118	I-4380	Maritime	(A)	2885+-485	Nfld.
119	Y-1530	Brewerton/Squibnoc- ket/Otter Creek	(A)	2885+-465	MA.
120	Dic-280	Lamoka	(A)	2860+-300	N.Y.
121	BETA-4049	Brewerton/Vosberg	(A)	2860+-300	MA.
122	C-35	Undiagnostic	(D)	2850+-300	N.Y.
123	BETA-4059	Atlantic/Small St.	(A)	2850+-300	MA.
124	GX-2836	Squibnocket/Beekman	(A)	2840+-515	?
125	I-7098	Lamoka-like	(A)	2790+-350	N.Y.
126	QU-228	Undiagnostic	(D)	2785+-380	Que.
127	GX-2528	Small Stemmed	(D)	2785+-565	MA.

128	Y-1536	Brewerton/Vosberg/ Sylvan-stemmed	(A)	2780+-380	N.Y.
129	I-5236	Lackawaxen	(A)	2775+-570	PA.
130	S-1163	Undiagnostic	(D)	2775+-375	Ont.
131	C-809	Undiagnostic	(D)	2745+-730	?
132	QC-1257	Brewerton	(A)	2740+-310	?
133	UGA-386	Squibnocket/Small stem/Bare Is.	(A)	2740+-310	MA.
134	UGA-389	Small stem/Bare Is.	(A)	2740+_140	MA.
135	I-6809	Bare Is.	(D)	2730+-305	N.J.
136	I-2491	Bare Is.	(A)	2730+-305	PA.
137	Y-1529	Squibnocket/Wading River/Snook Kill	(A)	2715+-300	MA.
138	SI-1789	Maritime(Black Is.)	(A)	2715+-300	Labrador
139	C-36	Undiagnostic	(D)	2710+-295	N.Y.
140	I-7187	Undiagnostic	(D)	2710+-295	CT.
141	SI-1273	Maritime(Black Is.)	(A)	2690+-280	Labrador
142	GX-7640	Merrimack	(A)	2675+-360	MA.
143	BS-226	Undiagnostic	(D)	2675+-360	MA.
144	Dic-201	Vestal Phase	(A)	2675+-240	N.Y.
145	I-7544	Maritime	(A)	2670+-265	Labrador
146	GX-7406	Small Stemmed	(A)	2655+-355	?
147	-----	Brewerton	(A)	2660+-260	CT.
148	I-3918	Undiagnostic	(D)	2660+-260	N.Y.
149	UGA-389	Squibnocket/Bare Is/ Small Stemmed	(A)	2660+-260	MA.
150	I-2347	Lamoka-like	(D)	2660+-260	N.Y.
151	GSC-1863	Undiagnostic	(D)	2655+-240	Ont.
152	SI-1280	Maritime(SandyCove)	(A)	2655+-490	Labrador
153	BETA-4467	Small Stemmed	(A)	2650+-235	MA.
154	GX-3213	Squibnocket/Beekman	(A)	2650+-490	?
155	GX-7574	Brewerton/Small St.	(A)	2640+-490	?
156	QC-177	Susquehann Tr.	(D)	2640+-490	N.Y.
157	I-3730	Lamoka Complex	(A)	2610+-290	N.Y.
158	SI-2149	Maritime	(A)	2610+-290	Labrador
159	I-3103	Squibnocket	(A)	2600+-290	MA.
160	Dic-183	Vosberg/Brewerton/ Beekman/Sylvan Side Notched/Small St.	(A)	2595+-290	N.Y.
161	QC-976	Undiagnostic	(D)	2595+-290	?
162	SI-2515	Maritime	(A)	2560+-230	Labrador
163	I-424	Brewerton Phase	(A)	2560+-455	N.Y.
164	GX-7471	Atlantic/Small St.	(A)	2550+-370	?
165	GSC-1379	Maritime(RattlersB.)	(A)	2550+-370	Labrador
166	C-38	Undiagnostic	(D)	2550+-230	N.Y.
167	GX-7090	Orient/Small St.	(A)	2545+-370	?
168	BETA-4052	Squibnocket/SmallSt.	(A)	2530+-340	MA.
169	Y-2345	Lamoka Complex	(A)	2530+-375	N.Y.
170	I-6568	Lamoka-like	(A)	2530+-340	N.Y.
171	Y-459	Lamoka-like	(D)	2530+-340	N.Y.
172	Y-1273	Brewerton	(A)	2520+-335	N.Y.
173	I-7188	Atlantic	(A)	2520+-335	CT.
174	Y-2345	Lamoka/Normanskill/ Sylvan Stemmed	(D)	2515+-375	N.Y.

175	GX-7077	Vosberg/Neville/ Stark/Small St.	(A)	2510+-480	?
176	GX-7468	Orient	(A)	2510+-380	?
177	I-4678	Maritime	(A)	2495+-385	Nfld.
178	I-4444	Undiagnostic	(D)	2485+-485	N.Y.
179	M-89	Red Paint Complex	(D)	2485+-530	Maine
180	Dic-264	Lamoka Complex	(A)	2470+-310	N.Y.
181	Dic-134	Lamoka	(A)	2470+-310	N.Y.
182	Y-1168	Side-Notched	(A)	2465+-310	MA.
183	I-6734	Lamoka	(A)	2465+-310	N.Y.
184	Dic-110	Lamoka Complex	(A)	2455+-475	N.Y.
185	I-5251	Maritime	(A)	2450+-310	Labrador
186	SI-932	Maritime(RattlersB.)	(A)	2420+-435	Labrador
187	I-6566	Lamoka	(A)	2390+-260	N.Y.
188	Y-1169	Normanskill	(A)	2390+-260	N.Y.
189	Y-2346	Normanskill/Lamoka/ Sylvan stemmed	(D)	2385+-265	N.Y.
190	I-6732	Vestal	(A)	2385+-410	N.Y.
191	GX-7084	Small Stemmed	(A)	2385+-500	?
192	GSC-86	Undiagnostic	(D)	2365+-275	Ont.
193	Y-2618	Lamoka	(A)	2365+-415	N.Y.
194	I-12480	Undiagnostic	(D)	2365+-275	Ont.
195	I-5236	Lamoka-like	(D)	2365+-275	N.Y.
196	GX-8971	Undiagnostic	(D)	2365+-500	?
197	SI-890	Undiagnostic	(D)	2355+-415	Maine
198	GSC-1260	Maritime	(A)	2340+-425	Labrador
199	P-1781	Undiagnostic	(D)	2330+-205	N.J.
200	C-418	Undiagnostic	(D)	2325+-620	MA.
201	SI-989	Moorehead Complex	(A)	2320+-315	N.B.
202	I-6567	Lamoka	(A)	2320+-315	N.Y.
203	I-7509	Maritime	(A)	2320+-315	Nfld.
204	I-3917	Boreal Archaic Tr.	(D)	2310+-320	N.Y.
205	Dic-117	Snook Kill	(D)	2310+-320	N.Y.
206	I-6808	Normanskill	(D)	2310+-320	N.J.
207	I-6730	Susquehanna Tr.	(A)	2310+-320	N.J.
208	Dic-207	Vestal	(A)	2305+-325	N.Y.
209	M-1907	Brewerton	(D)	2280+-515	PA.
210	I-6810	Narrow Point Tr.	(D)	2265+-515	N.J.
211	Y-2582	Sylvan Lake/Wading River	(A)	2255+-290	C.T.
212	Dic-88	Normanskill/Vestal	(D)	2255+-385	N.Y.
213	SI-2516	Maritime	(A)	2255+-265	Labrador
214	I-10313	Genessee Complex	(A)	2245+-295	Ont.
215	I-6351	Vestal Notched	(A)	2245+-295	N.Y.
216	QU-229	Undiagnostic	(D)	2240+-520	Que.
217	Dic-111	Vestal Phase	(A)	2235+-300	N.Y.
218	Y-2608	Maritime	(A)	2235+-300	Nfld.
219	QC-107	Undiagnostic	(D)	2235+-300	N.Y.
220	SI-1285	Maritime(RattlersB.)	(A)	2215+-315	Labrador
221	Y-1923	Undiagnostic	(D)	2215+-315	MA.
222	I-6369	Lamoka	(A)	2215+-315	N.Y.
223	SI-1532	Undiagnostic (Maritime?)	(D)	2215+-315	Maine
224	GX-3371	Undiagnostic	(D)	2210+-420	N.Y.

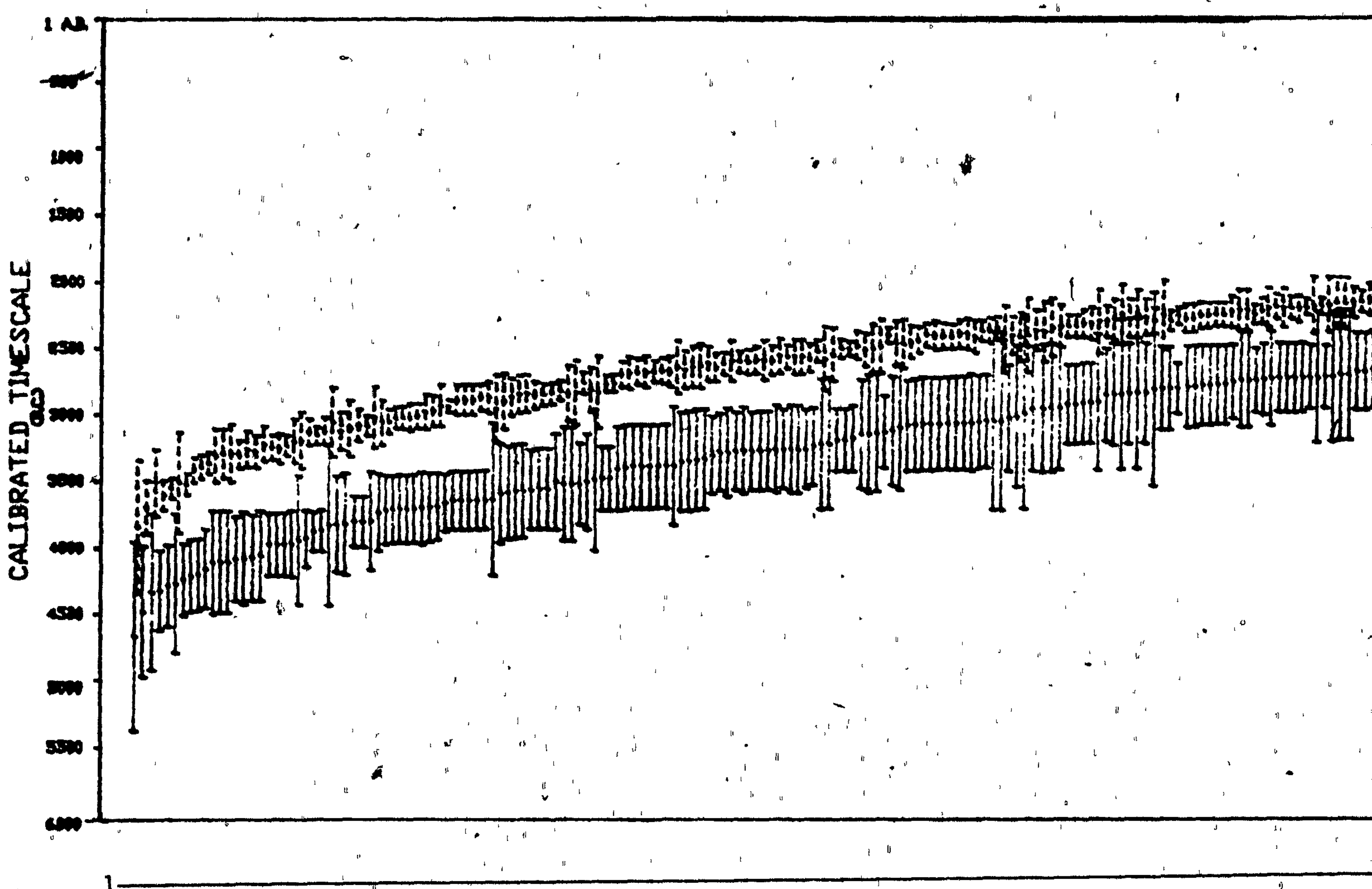
225	GX-2415	Wading R./Squib-nocket	(A)	2195+-320	N.Y.
226	I-2401	Normanskill/Sylvan Stemmed	(A)	2195+-320	N.Y.
227	I-4682	Maritime	(A)	2190+-325	Labrador
228	I-6739	Normanskill	(A)	2190+-325	N.Y.
229	GSC-834	Undiagnostic	(D)	2150+-390	Nfld.
230	RL-368	Undiagnostic	(D)	2140+-395	Maine
231	W-545	Lamoka-like	(D)	2130+-405	N.Y.
232	BGS-35	Inverhuron Complex	(D)	2105+-210	Ont.
233	SI-988	Moorehead Complex	(D)	2100+-415	N.B.
234	SI-888	Moorehead Complex	(D)	2095+-415	Maine
235	I-6733	Snook Kill	(A)	2095+-415	N.Y.
236	I-4267	Undiagnostic	(D)	2085+-310	N.Y.
237	QU-357	Undiagnostic	(D)	2085+-310	Que.
238	Y-1826	Lehigh Broad	(A)	2085+-310	PA.
239	Y-2587	Perkiomen/Snook Kill	(D)	2085+-310	N.J.
240	Y-2342	Lackawaxen/Macphear-son	(A)	2080+-310	PA.
241	P-1779	Undiagnostic	(D)	2080+-215	N.J.
242	SI-1922	Susquehanna Tr.	(A)	2045+-285	Maine
243	SI-2148	Maritime	(A)	2045+-285	Labrador
244	M-1213	Atlantic-like	(A)	2040+-360	MA.
245	SI-1919	Susquehanna Tr.	(A)	2030+-285	Maine
246	Y-1373	Wayland Notched	(D)	2025+-290	MA.
247	I-6368	Normanskill	(A)	2015+-295	N.Y.
248	Y-2344	Susquehanna Broad	(A)	2005+-295	PA.
249	Y-2588	Perkiomen	(A)	2000+-295	N.J.
250	Y-2340	Perkiomen	(A)	1990+-300	PA.
251	GSC-758	Undiagnostic	(D)	1985+-330	Nfld.
252	M-1212	Atlantic-like	(A)	1980+-330	MA.
253	SI-2511	Maritime	(A)	1965+-210	Labrador
254	SI-2519	Maritime	(A)	1935+-250	Labrador
255	Y-1999	Brewerton Phase	(A)	1935+-250	N.Y.
256	I-7096	Susquehanna Broad	(A)	1930+-250	N.Y.
257	S-1541	Maritime(RattlersB)	(A)	1920+-215	Que.
258	GX-1104	Undiagnostic	(D)	1915+-245	MA.
259	SI-1924	Susquehanna Tr.	(A)	1915+-245	Maine
260	P-1780	Undiagnostic	(D)	1910+-210	N.J.
261	I-6751	Susquehanna Broad	(A)	1905+-245	N.Y.
262	I-7094	Susquehanna Broad	(A)	1895+-240	N.Y.
263	GX-0568	Susquehanna Broad/ Mansion Inn	(D)	1855+-315	MA.
264	Y-1961	Brewerton Phase	(D)	1845+-260	N.Y.
265	Y-2478	Perkiomen	(A)	1830+-255	PA.
266	SI-1327	Maritime	(A)	1830+-255	Labrador
267	SI-2433	Undiagnostic	(D)	1825+-155	Labrador
268	SI-789	Susquehanna Tr.	(A)	1790+-360	Maine
269	Y-1756	Brewerton Phase	(D)	1785+-220	N.Y.
270	I-4446	Susquehanna Broad	(D)	1780+-355	N.Y.
271	I-6641	Perkiomen/Susque. Broad	(A)	1775+-215	N.Y.

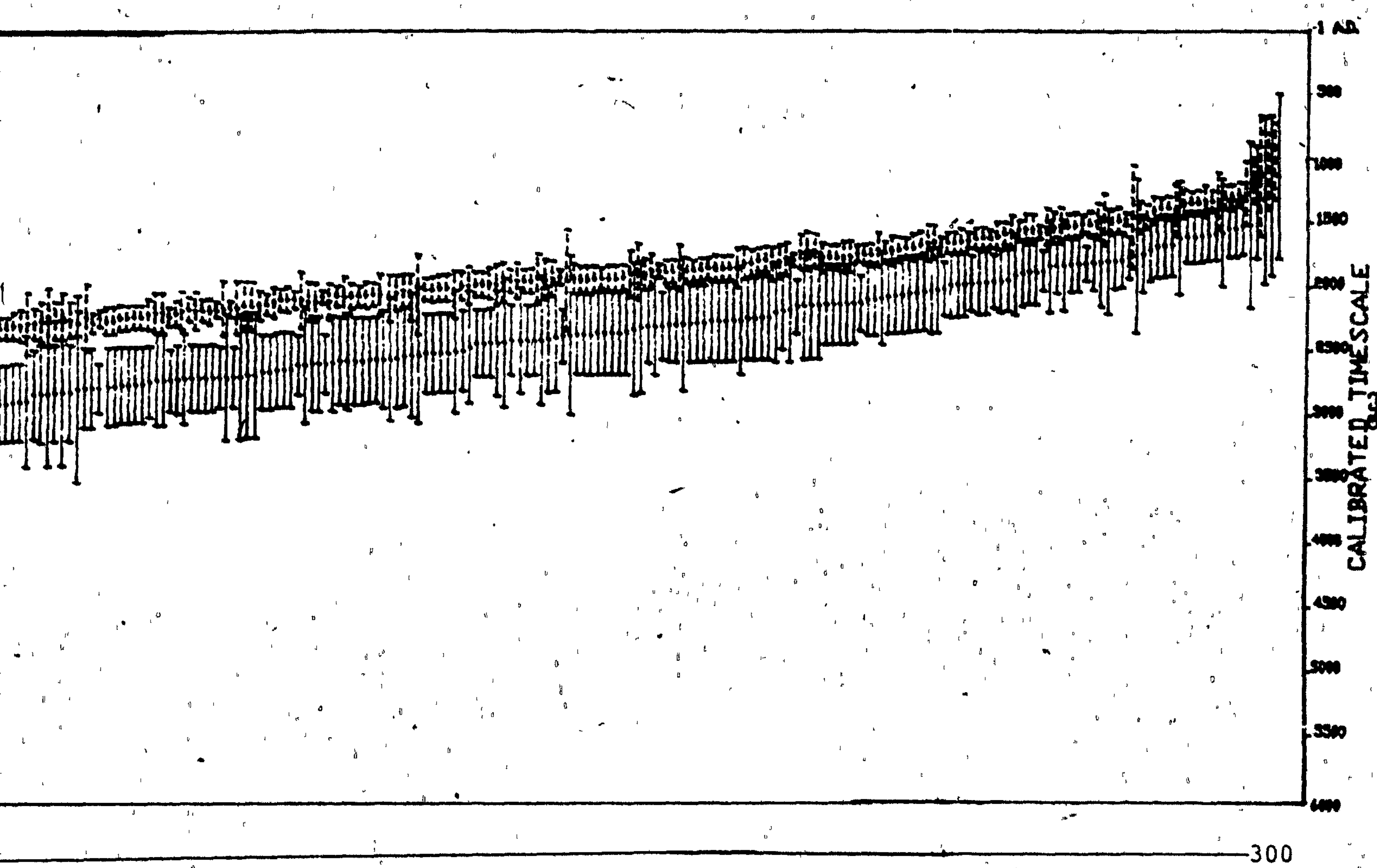
272	Y-1170	Snook Kill Phase	(A)	1770+-215	N.Y.
273	SI-2435	Maritime	(D)	1770+-135	Labrador
274	I-4677	Maritime	(A)	1760+-215	Nfld.
275	M-1537	Shield Archaic Tr.	(A)	1755+-350	Ont.
276	M-1078	Laurentian Tr.	(A)	1750+-410	N.Y.
277	Y-2341	Normanskill/Orient Fishtail	(D)	1750+-215	PA.
278	I-3974	Susquehanna Broad	(A)	1740+-215	N.Y.
279	SI-2518	Maritime	(A)	1720+-160	Labrador
280	M-90	Red Paint Complex	(D)	1710+-600	Maine
281	SI-887	Undiagnostic	(D)	1690+-300	Maine
282	I-6752	Lamoka Complex	(D)	1665+-240	N.Y.
283	I-4364	Normanskill	(D)	1635+-240	N.Y.
284	SI-2987	Maritime	(A)	1630+-240	Labrador
285	I-7097	Susquehanna Broad	(A)	1625+-240	N.Y.
286	M-1187	Normanskill	(D)	1570+-440	N.Y.
287	Dic-192	Frost Is. Phase	(A)	1565+-200	N.Y.
288	S-504	Inverhuron Tr.	(A)	1565+-200	Ont.
289	I-6744	Susquehanna Broad	(A)	1555+-200	N.Y.
290	Y-2343	Orient/Dry Brook	(A)	1545+-200	PA.
291	SI-1326	Maritime	(A)	1545+-200	Labrador
292	I-4380	Maritime	(A)	1525+-420	Nfld.
293	Gak-1254	Undiagnostic	(D)	1495+-220	Nfld.
294	Y-1274	Susquehanna Broad	(A)	1495+-220	N.Y.
295	I-6740	Meadowood	(A)	1475+-225	N.Y.
296	I-10165	Orient Fishtail	(D)	1465+-650	PA.
297	GX-2593	Orient	(A)	1290+-440	CT.
298	QU-226	Undiagnostic	(D)	1275+-650	Que.
299	M-586	Orient Fishtail	(A)	1240+-625	N.Y.
300	M-363	Mattawan Complex	(A)	1085+-645	Ont.

? - New England locale; exact location not specified in literature.

GRAPH 7.2 OVERVIEW

LATE ARCHAIC TEMPORAL CONTAINER




1 AD
500
1000
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2000
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3000
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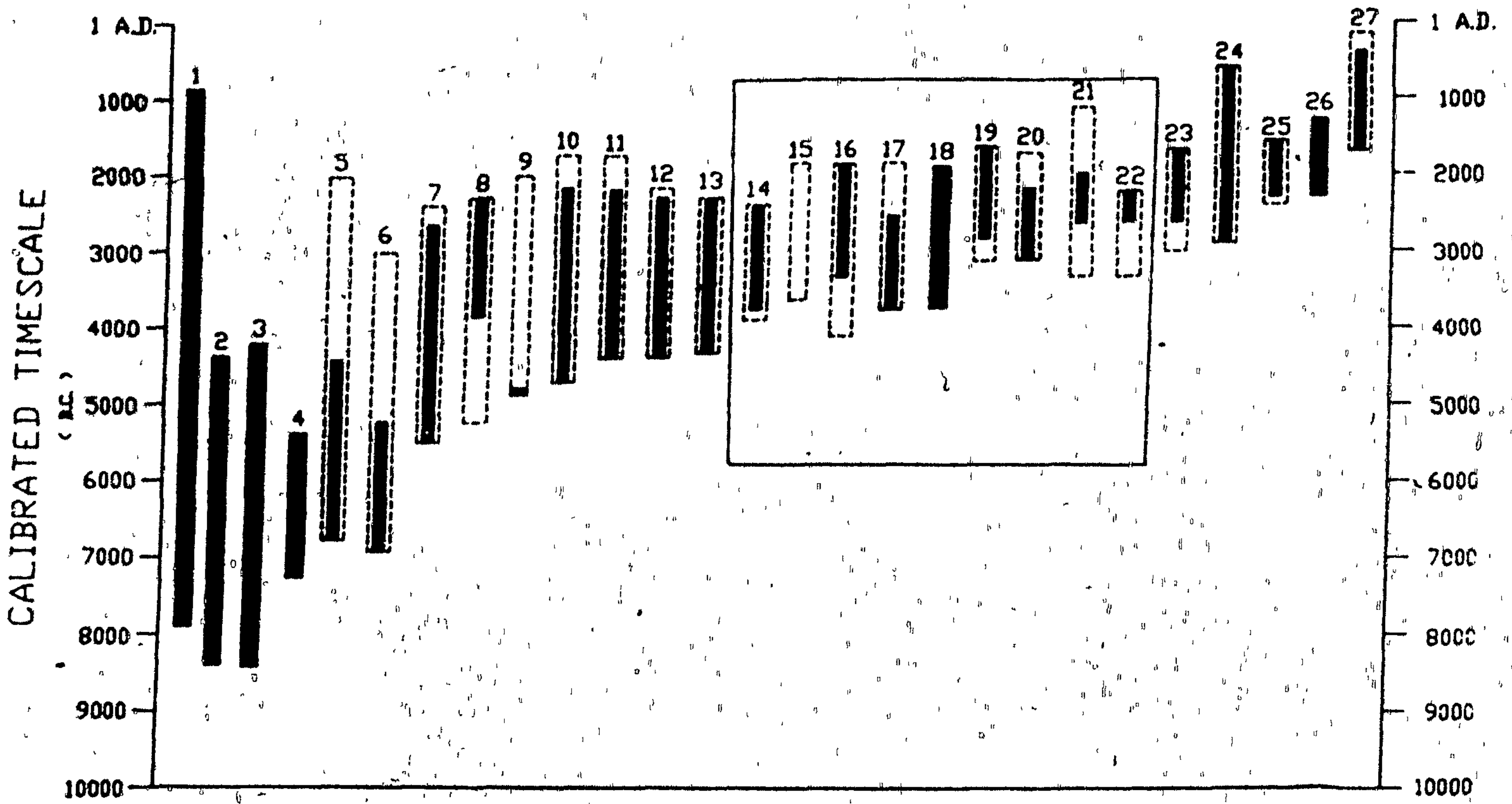
6000
CALIBRATED TIMESCALE
300

GRAPH 7.3 BAR GRAPH SERIES

LATE ARCHAIC TEMPORAL CONTAINER



1. MARITIME ARCHAIC
2. KIRK
3. BIFURCATED-BASE
4. KANAWHA
5. STARK
6. NEVILLE
7. OTTER CREEK
8. MERRIMACK
9. VOSBERG
10. BREWERTON
11. LACKAWAXEN
12. SQUIBNOCKET
13. BEEKMAN
•14. BARE ISLAND
•15. WADING RIVER
•16. SMALL STEMMED
•17. SYLVAN LAKE
•18. LAMOKA
•19. ATLANTIC
•20. LAMOKA-LIKE
•21. NORMANSKILL
•22. VESTAL
23. SNOOK KILL
24. ORIENT
25. PERKIOMEN
26. SUSQUEHANNA
27. MEADOWOOD

Summary

Two major trends seem evident at this point:

(1) There is apparent co-evality of so-called southeastern broad-bladed point types and 'Laurentian' broad-bladed, notched point types.

(2) The extent of the overlap of date ranges suggests that a large number of point types co-existed in the Late Archaic. A clearly defined stylistic or technological evolution is not apparent.

Within the literature there are frequent comments with regard to the similarities of various point types. For example, there is a relationship between Vestal, Brewerton, and Normanskill points (Rippeteau 1973:207); and a similarity between Normanskill and Lamoka points (Funk 1965:144); Merrimack points are comparable to Bare Island points (Dincauze 1976: 38-49); Genesee (not included in bar graphs because of a lack of dates) and Snook Kill points are comparable (Rippeteau 1973:210); Bare Island points are only a larger form of the New England Small Stemmed point (Ritchie 1965:134); Wading River points are related to Squibnocket and Sylvan Lake points (Ritchie 1971:7); and there is a relationship between Vestal and Lamoka points (Ritchie 1971:130). Given the number of similarities one wonders if, over the years, the point types have been differentiated too narrowly, resulting in more terminology than actual point variety. Likewise, with an emphasis on equating one point type with one culture, too many phases and complexes may have been established to accord with the variety of point forms. The extent of the evident contemporaneity, coupled with the large number of point types found in mixed associations with one another (see page 95), suggests that either of these possibilities is worthy of consideration. At the moment there are no easy answers.

Of the three hundred (300) dates involved in this section of the data base, twenty-eight (28) have overlapped from the previous section and fifty-one (51) overlap in the Terminal/Transitional segment.

[The following point types are not included in the bar graphs because of insufficient data: Nordica, Hunterbrook, Mansion Inn, Madison, Macphearson, Lehigh Broad, Dry Brook and Genesee. The Lamoka points were separated from Lamoka-like points and individual bar graphs generated. In retrospect, I think that this was an unnecessary division; the Lamoka-like points would not have significantly changed the Lamoka time range and should have been integrated with Lamoka points. The addition of 'like' to point names seems to be a convenient way of escaping definite type categorization and is a common but unfortunate practice that only obscures issues.]

CHAPTER EIGHT

THE TERMINAL/TRANSITIONAL TEMPORAL CONTAINER

Historical Background

The Terminal and Transitional periods of the Archaic together constitute a stage in northeastern prehistory of "essentially preceramic" cultures (Ritchie 1965:150). It is a technologically transitional period between the preceramic Late Archaic and the fully ceramic Early Woodland cultures (Snow 1980:235). There are those who divide the period into two distinct Terminal and Transitional sections (after Ritchie) and those who lump the two periods together into one Terminal Archaic time span (after Snow). This study uses Snow's unified period corresponding to 1700-700 B.C. If the calibrated chronology is seriously considered, the lumping or splitting of this period is more a question of semantics than of reality.

As the last of the Late Archaic Narrow Point assemblages disappear from the archaeological record, the lithic remains of another major cultural manifestation appear. The arrival of the Susquehanna Tradition from the south, with its distinctive carved soapstone vessels, broad-bladed, broad stemmed, and narrow fishtail projectile point forms marked "...a revolutionary change in the ideas people had about their points' morphological attributes" (Rippeteau 1973:209). This tradition apparently dispersed into the study area from centres "...on the coast of the Middle Atlantic states" and radiated "along the coast and major river systems" (Tuck 1978:37; Turnbaugh 1975). In its final stages, the lithic assemblages of the Susquehanna Tradition are associated with "...plain, thick, poorly made ceramics..."; thus ending the Archaic period as defined by William Ritchie (ibid. 1978:38; Funk and Rippeteau 1977:31).

The Susquehanna Tradition is subdivided, in temporal priority, into the following major complexes and phases, each with distinctive projectile point types:

Major Complexes/Phases	Point Type	
Snook Kill complex	Snook Kill	(N.Y./New England)
Perkiomen complex	Perkiomen	(New York)
Frost Island phase	Susquehanna Broad	(New York)
Orient phase	Orient Fishtail	(N.Y./ New England)
Secondary Divisions		
Atlantic phase	Atlantic	(New England)
Coburn phase	Coburn	(New England)
Watertown phase	Mansion Inn	(New England)

Dry Brook Point - ends Susquehanna Tr. in Susquehanna drainage

Wayland Notched Point - analogue of Susquehanna Broad in New England

Lehigh Broad Point - earliest Susquehanna Tr. point type/Pennsylvania

Koens-Crispins Point - Delaware drainage

There is some difference of opinion with regard to the Orient Phase. In some interpretations the Orient phase is an integral part of the Susquehanna (Ritchie 1965; Rippeteau 1973), but in others the Susquehanna ends with the Frost Island phase of New York state. The Orient phase is seen as a separate entity, with its origins in the Narrow Stemmed Tradition, because of the narrow form of its diagnostic fishtail point type (Dincauze 1975:27). According to this hypothesis, there is evidence in New England of the co-existence of the Narrow Point Tradition and the Susquehanna Tradition. The Coburn phase apparently carries many traits of the Narrow Point Tradition as well as the Susquehanna Tradition. On this basis it is suggested that there was a merger of the two traditions after a long period of separate co-existence (ibid. 1975:28).

Eleven dates for the Meadowood phase (Meadowood points), the first of the Early Woodland manifestions, complete the list of point types dated. Meadowood has been included in the study to compare its time ranges with the last of the Archaic point forms.

Study Results

All uncalibrated dates from 1680±135 B.C. to 385±140 B.C. are within the range of the 1700 to 700 B.C. time span of the Terminal/Transitional container. The Calibration Correction ranges between four hundred and twenty-five (425) years and sixty-five (65) years. From 1700 to 1500 B.C. the range is four hundred and twenty-five (425) years to three hundred and five (305) years; from 1500 to 1000 B.C. the range is three hundred and thirty (330) years to one hundred and fifty (150) years; and from 1000 to 385 B.C. the range is two hundred (200) years to sixty-five (65) years. The discrepancy between the uncalibrated and calibrated time scales closes quickly within this one thousand (1000) year period.

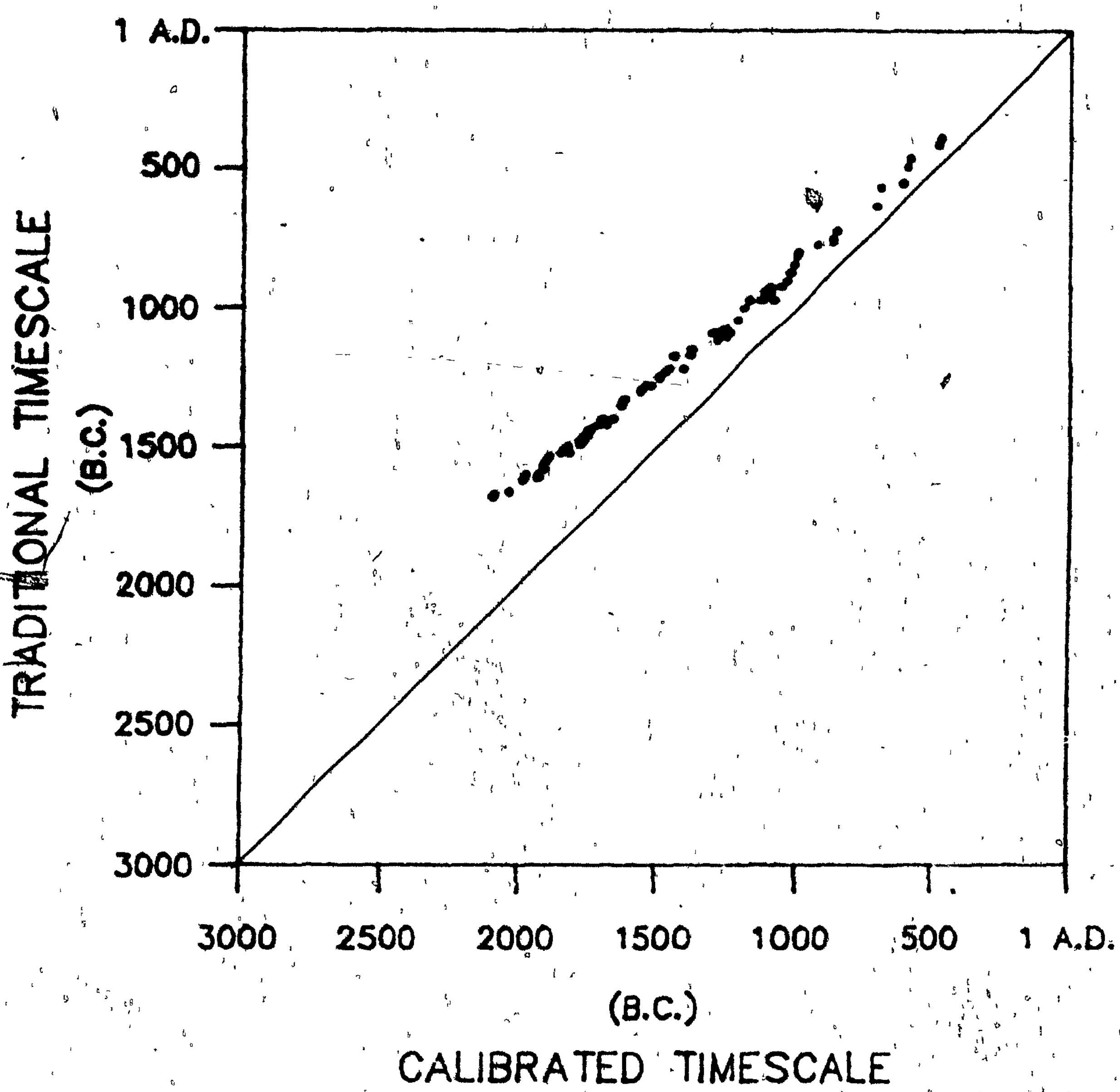
Again, as in the Late Archaic, the traditional sequence - Snook Kill, Perkiomen, Susquehanna, Orient, Meadowood - has been upset. [The Atlantic manifestation (Dincauze 1975) is not included in most general syntheses]. In order to understand the reordering of the Terminal/Transitional Archaic point types it is necessary to review some of the Late Archaic data.

Calibrated Position		Traditional Position	
Sylvan Lake	3785-2555 B.C. 'A' 3790-1875 B.C. 'D'	Squibnocket	2190 B.C.
Lamoka	3765-1900 B.C. 'A'	Sylvan Lake	2200-1500 B.C.
Atlantic	2855-1650 B.C. 'A'	Vestal	2140 B.C.
Lamoka-like	3140-2190 B.C. 'A' 3140-1725 B.C. 'D'	Normanskill	1930-1339 B.C.
Normanskill	2650-1990 B.C. 'A' 3350-1130 B.C. 'D'		
Vestal	2630-2220 B.C. 'A' 3350-2220 B.C. 'D'		
Orient	2890-610 B.C. 'A'	Snook Kill	2200-2000 B.C.
Snook Kill	2630-1680 B.C. 'A' 3350-2220 B.C. 'D'	Perkiomen	1700-1500 B.C
		Atlantic	?
Perkiomen	2295-1560 B.C. 'A'	Susquehanna	1250-1000 B.C.
Susquehanna	2295-1275 B.C. 'A'	Orient	1043-763 B.C.
Meadowood	1700-385 B.C. 'A'	Meadowood	1230-285 B.C.

Using only 'A' associations the sequence is: Orient, Atlantic, Snook Kill, Perkiomen-Susquehanna Broad, and Meadowood. The addition of 'D' dates reorders the sequence to: Atlantic, Snook Kill, Orient, Perkiomen, Susquehanna Broad, and Meadowood. Atlantic points of the Atlantic phase in New England, roughly contemporaneous with Susquehanna Broad points, sit in the Late Archaic sequence. The Orient point, the last of the point types in the traditional chronology, ranks at the beginning of both calibrated sequences; Perkiomen and Susquehanna Broad are virtually contemporaneous in both cases and do not follow the evolutionary sequence of Perkiomen followed by Susquehanna Broad. It is a relief to see that Meadowood still maintains its status as last in the chronology. Of greatest significance is the fact that all of the ranges of all Late Archaic and Terminal/Transitional point types overlap by a wide margin.

GRAPH 8.1 CALIBRATION CORRECTION, 1680 B.C. to 385 B.C.

TERMINAL/TRANSITIONAL TEMPORAL CONTAINER.



93 DATES

CORRECTION FROM 1680 B.C. to 385 B.C.

TABLE 8.1 TERMINAL/TRANSITIONAL ARCHAIC CONTAINER - 1700 B.C.-700 B.C.

Summary

No. of dates categorized 'A' = 56

No. of dates categorized 'D' = 37

No. of Mixed Associations: 6

GX-0568	-	Susquehanna Broad/ Mansion Inn
I-6641	-	Susquehanna Broad/ Perkiomen
Y-2341	-	Orient Fishtail/ Normanskill
Y-2339	-	Orient Fishtail/ Dry Brook
Y-2343	-	Orient/Dry Brook Corner-notched

In such cases, each component is given credit for the association.

Representation by Point Type:

Undiagnostic	= 14
Atlantic-like	= 2
Dry Brook	= 2
Mansion Inn	= 1
Meadowood	= 11
Normanskill	= 3
Orient Fishtail	= 16
Perkiomen	= 3
Snook Kill	= 1
Susquehanna Broad	= 10
Unspecified Small Side/ Corner-notched	= 4

Representation by Cultural Affiliation:

Brewerton Phase	= 3
Frost Island Phase	= 1
Genessee Phase	= 1
Glacial Kame Culture	= 2
Inverhuron Tradition	= 5
Lamoka Phase	= 1
Laurentian Tradition	= 1

Maritime Tradition	= 9
Mattawan Complex	= 1
Moorehead Complex	= 2
Red Paint Complex	= 1
Shield Archaic Tradition	= 1
Snook Kill Phase	= 1
Susquehanna Tradition	= 2

Geographic Distribution:

Connecticut	= 2
Labrador	= 14
Maine	= 6
Massachusetts	= 4
New Brunswick	= 1
Newfoundland	= 4
New Jersey	= 2
New York	= 37
Ontario	= 10
Pennsylvania	= 8
Quebec	= 3
Vermont	= 2

TABLE 8.2 TERMINAL/TRANSITIONAL ARCHAIC CONTAINER - 1700 B.C.-700 B.C.

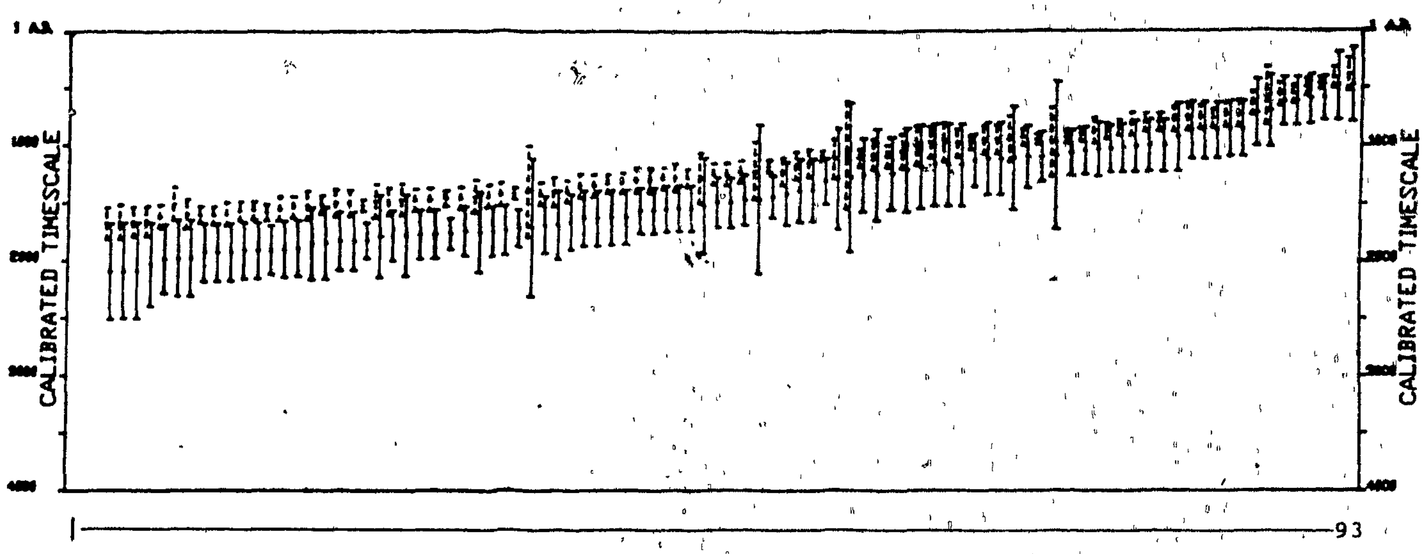
	Lab. No.	Cultural Association		Calibrated Date	
1	SI-988	Moorehead Com.	(D)*	2100+-415	N.B.
2	SI-888	Moorehead?	(D)*	2095+-415	Maine
3	I-6733	Snook Kill	(A)*	2095+-415	N.Y.
4	M-1213	Atlantic-like	(A)*	2040+-360	MA.
5	Y-2340	Perkiomen	(A)*	1990+_300	PA.
6	GSC-758	Undiagnostic	(D)*	1985+-330	Nfld.
7	M-1212	Atlantic-like	(A)*	1980+-330	MA.
8	SI-2519	Maritime	(A)*	1935+-250	Labrador
9	Y-1999	Brewerton Phase	(A)*	1935+-250	N.Y.
10	I-7096	Susquehanna Broad	(A)*	1930+-250	N.Y.
11	GX-1104	Undiagnostic	(D)*	1915+-245	MA.
12	SI-1924	Susquehanna Tr.	(A)*	1915+-245	Maine
13	P-1780	Undiagnostic	(D)*	1910+-210	N.J.
14	[illegible]	Susquehanna Broad	(A)*	1905+-245	N.Y.
15	I-7094	Susquehanna Broad	(A)*	1895+-240	N.Y.
16	GX-0568	Susquehanna Broad/ Mansion Inn	(D)*	1855+-315	MA.
17	Y-1961	Brewerton Phase	(D)*	1845+-260	N.Y.
18	Y-2478	Perkiomen	(A)*	1830+-255	PA.
19	SI-1327	Maritime	(A)*	1830+-255	Labrador
20	SI-2433	Undiagnostic	(D)*	1825+-155	Labrador
21	SI-789	Susquehanna Tr.	(A)*	1790+-360	Maine
22	Y-1756	Brewerton Phase	(D)*	1785+-220	N.Y.
23	I-4446	Susquehanna Broad	(D)*	1780+-355	N.Y.
24	I-6641	Perkiomen/ Susquehanna Broad	(A)*	1775+-215	N.Y.
25	Y-1170	Snook Kill Phase	(A)*	1770+-215	N.Y.
26	SI-2435	Small Side-Notched	(D)*	1770+-135	Labrador
27	I-4677	Maritime	(D)*	1760+-215	Nfld.
28	M-1537	Shield Archaic	(A)*	1755+-350	Ont.
29	Y-2341	Orient Fishtail/ Normanskill	(D)*	1750+-215	PA.
30	I-3974	Susquehanna Broad	(A)*	1740+-215	N.Y.
31	SI-2518	Maritime	(A)*	1720+-160	Labrador
32	M-90	Red Paint Complex	(D)*	1710+-600	Maine
33	M-1078	Laurentian Tr.	(A)*	1690+-250	N.Y.
34	SI-887	Undiagnostic	(D)*	1690+-300	Maine
35	I-6752	Lamoka Complex	(D)*	1665+-240	N.Y.
36	I-4364	Normanskill	(D)*	1635+-240	N.Y.
37	M-1187	Normanskill	(D)*	1635+-240	N.Y.
38	SI-2987	Maritime	(A)*	1630+-240	Labrador
39	I-7097	Susquehanna Broad	(A)*	1625+-240	N.Y.
40	Dic-192	Frost Is. Phase	(A)*	1565+-200	N.Y.
41	S-504	Inverhuron Tr.	(A)*	1565+-200	Ont.
42	I-6744	Susquehanna Broad	(A)*	1555+-200	N.Y.
43	Y-2343	Orient/ Dry Brook	(A)*	1545+-200	PA
44	SI-1326	Maritime	(A)*	1545+-200	Labrador

45	I-4380	Maritime	(A)*	1525+-420	Nfld.
46	GAK-1254	Undiagnostic	(D)*	1495+-220	Nfld.
47	Y-1274	Susquehanna Broad	(A)*	1495+-220	N.Y.
48	I-6740	Meadowood	(A)*	1475+-225	N.Y.
49	I-10165	Orient Fishtail	(D)*	1465+-650	PA.
50	SI-1275	Maritime(Black Is.)	(A)	1445+-185	Labrador
51	Y-2589	Orient	(A)	1415+-275	N.J.
52	Y-2339	Orient/ Dry Brook	(A)	1390+-275	PA.
53	GAK-2851	Inverhuron Tr.	(A)	1385+-275	Ont.
54	BGS-37	Inverhuron Tr.	(D)	1310+_200	Ont.
55	GX-2593	Orient	(A)*	1290+-480	CT.
56	QU-226	Undiagnostic	(D)*	1275+-650	Que.
57	SI-2312	Undiagnostic	(D)	1255+-320	Labrador
58	SI-1284	Maritime(Rattlers Bight)	(A)	1255+-400	Labrador
59	I-4836	Orient	(A)	1240+-320	N.Y.
60	M-586	Orient Fishtail	(A)	1210+-365	N.Y.
61	C-192	Meadowood	(A)	1185+-365	N.Y.
62	SI-889	Undiagnostic	(D)	1165+-360	Maine
63	GAK-3794b	Glacial Kame Cult.	(D)	1165+-360	Ont.
64	M-588	Orient Fishtail	(A)	1165+-360	N.Y.
65	SI-2430	Undiagnostic	(D)	1125+-230	Labrador
66	M-494	Orient Fishtail	(A)	1110+-315	N.Y.
67	M-587	Orient Fishtail	(A)	1110+-315	N.Y.
68	I-4515	Meadowood	(D)	1105+-450	N.Y.
69	S-1061	Glacial Kame Cult.	(D)	1095+-275	Ont.
70	BGS-34	Inverhuron Tr.	(A)	1095+-215	Ont.
71	M-363	Mattawan Complex	(A)	1085+-645	Ont.
72	SI-2429	Side/Corner notched	(D)	1060+-200	Labrador
73	S-60	Inverhuron Tr.	(A)	1040+-205	Ont.
74	I-4835	Orient Fishtail	(A)	1030+-235	N.Y.
75	Y-1654	Meadowood	(A)	1025+-205	N.Y.
76	Y-981	Meadowood	(A)	1015+-210	N.Y.
77	Y-2477	Orient	(A)	1005+-225	PA.
78	Y-1175	Orient	(A)	1000+-225	VT.
79	Y-1157	Undiagnostic	(D)	1000+-225	VT.
80	W-543	Orient Fishtail	(A)	925+-295	N.Y.
81	QU-444	Undiagnostic	(D)	865+-245	Que.
82	Y-2476	Meadowood	(A)	865+-245	PA.
83	Y-1651	Meadowood	(A)	865+-240	N.Y.
84	-269	Orient	(A)	850+-240	N.Y.
85	I-4558	Meadowood	(D)	850+-240	N.Y.
86	Y-1171	Meadowood	(A)	710+-290	N.Y.
87	M-640	Meadowood	(A)	695+-310	N.Y.
88	QC-103	Undiagnostic	(D)	610+-210	N.Y.
89	QU-372	Undiagnostic	(D)	610+-210	Que.
90	SI-2428	Corner notched	(D)	595+-210	Labrador
91	SI-2312	Notched	(D)	585+-190	Labrador
92	I-12481	Genessee Complex	(A)	480+-295	Ont.
93	GX-2488	Meadowood	(D)	470+-320	CT.

* Overlap from previous container.

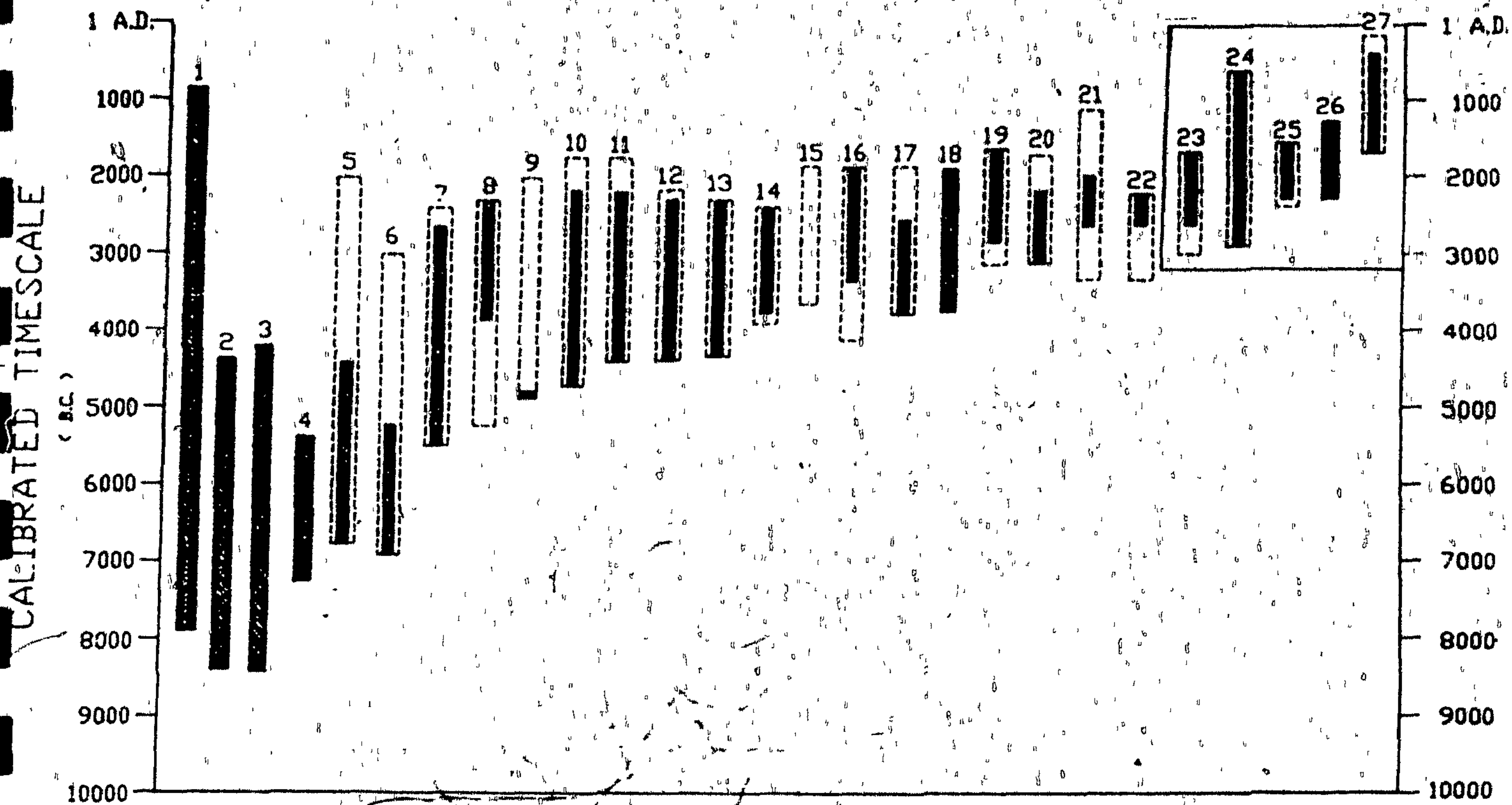
GRAPH 8.2 OVERVIEW

TERMINAL/TRANSITIONAL TEMPORAL CONTAINER



GRAPH 8.3 BAR GRAPH SERIES

TERMINAL/TRANSITIONAL TEMPORAL CONTAINER



1. MARITIME ARCHAIC
2. KIRK
3. BIFURCATED-BASE
4. KANAWHA
5. STARK
6. NEVILLE
7. OTTER CREEK
8. MERRIMACK
9. VOSBERG
10. BREWERTON
11. LACKAWAXEN
12. SQUIBNOCKET
13. BEEKMAN
14. BARE ISLAND
15. WADING RIVER
16. SMALL STEMMED
17. SYLVAN LAKE
18. LAMOKA
19. ATLANTIC
20. LAMOKA-LIKE
21. NORMANSKILL
22. VESTAL
*23. SNOOK KILL
*24. ORIENT
*25. PERKIOMEN
*26. SUSQUEHANNA
*27. MEADOWOOD

Summary

At the moment there is little to summarize; the tendency to speculate becomes almost overpowering. Were there three largely contemporaneous traditions within the Northeast for a great period of time? Have too many traditions been defined? The possibilities are limitless, but empty until each point type, complex, phase, and tradition is carefully re-analyzed using radiocarbon, stratigraphic, geographic, and typological data.

There are ninety-three (93) dates involved in this container, fifty-one (51) of which overlap from the Late Archaic, and twenty-one (21) overlap into the succeeding Early Woodland period. Only twenty-two (21) dates (22%) fall entirely within the assigned time span.

CHAPTER NINE

CONCLUDING REMARKS

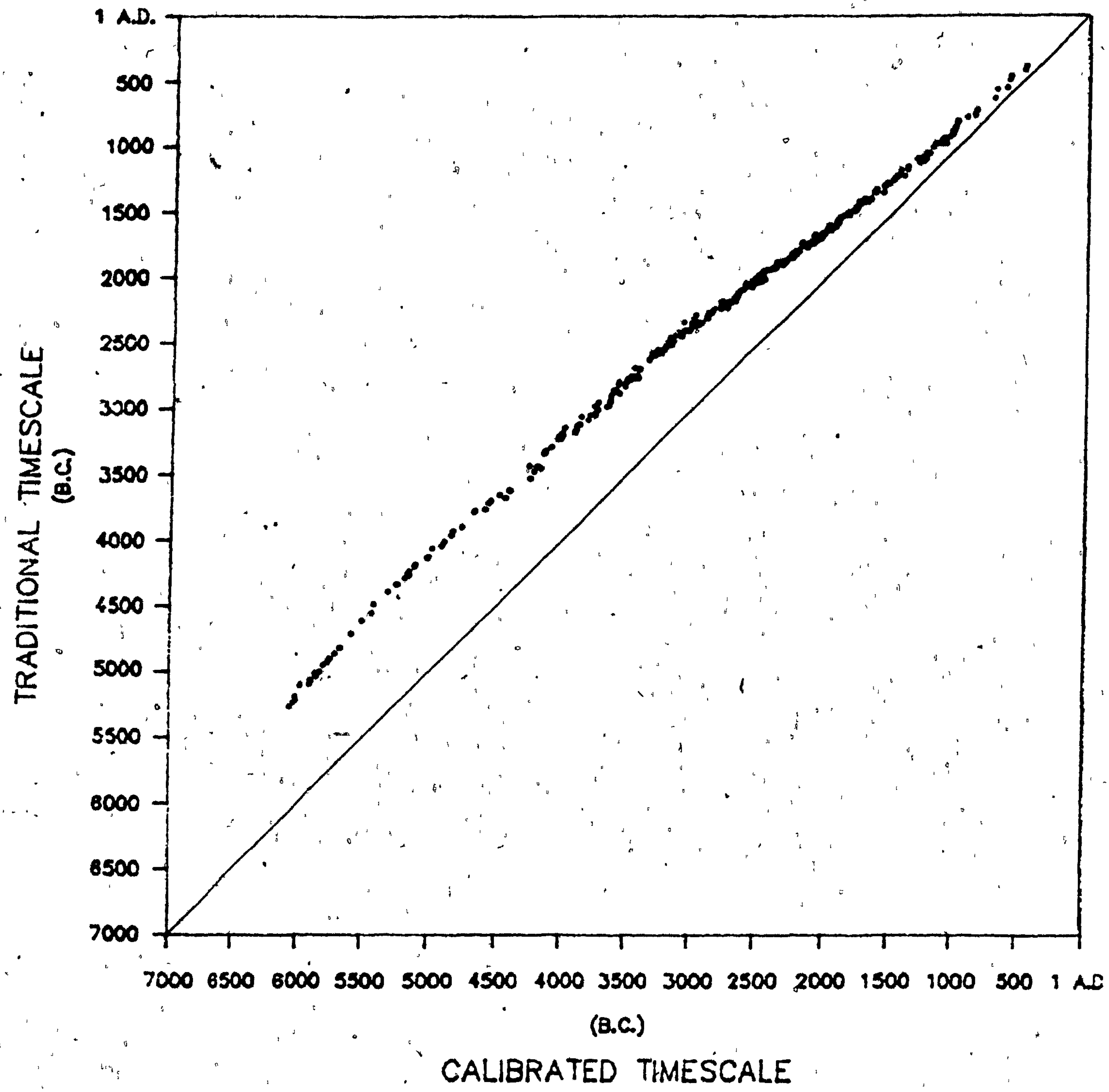
This study provides a corrected time scale of an eight thousand year period in prehistory. It offers an overview of the calibrated Archaic time span, isolates apparent discrepancies between the traditional and calibrated time scales, and thereby pinpoints new directions of investigation. Its very nature prohibits conclusive results.

Graph 9.1, page 123 represents the period between 5260 B.C. and 385 B.C. and provides the correction pattern of the three-hundred and ninety (390) dates that are covered by the calibration tables. Of the original four hundred and ninety dates collected, sixty-six (66) were rejected (see page 38). The remaining thirty-four (34) dates of the four hundred and twenty-four (424) that were acceptable for the study lie outside the range of the correction tables. The graph is simply an aggregate of the data from the individual containers previously outlined.

The treatment of the radiocarbon data has been significantly different from the heavy statistical orientation of the late 1960s and early 1970s. Much of what has been learned over the last ten to fifteen years indicates that in the majority of archaeological contexts statistical manipulation cannot be justified. In most circumstances there is insufficient control

GRAPH 9.1 CALIBRATION CORRECTION, 5290 B.C. to 385 B.C.

AGGREGATE OF ALL TEMPORAL CONTAINERS.



of stratigraphic variables, as well as of the technical and counting variables apparent between laboratories, to justify statistical analyses. Discrepancies in the interlaboratory calculation of the standard deviation are known to complicate accurate assessments; subjectivity slips into acceptance and rejection criteria.

In response to this call for a more cautious approach to radiocarbon evaluation of archaeological data, the emphasis in this study has been on preserving and respecting the integrity of all radiocarbon estimates, and on assessments using radiocarbon ranges set by a minimum of two-sigma standard deviations. The graphic representations attempt to reflect both the integrity of individual dates and the distribution of their collective ranges.

Only those dates that have been directly identified with the projectile point typology of the Northeast have been used in the generation of the bar graphs. Those dates identified less specifically by complexes, phases, or traditions have been set aside in this initial study, although they appear on graphs 5.1 to 9.1 and graphs 5.2 to 8.2. A very different picture of the projectile point typology has emerged as the result of calibration and the use of age ranges.

Based solely on time, the emerging picture of the Early and Middle Archaic containers indicates at least a partial *in situ* evolution of the point types. This development appears to be the result of an outgrowth of Paleo-Indian manifestations impacted upon by populations from the Southeast. Whether this was the result of technological diffusion or population movement is unclear at this time. The positioning of the temporal ranges suggests that the southeastern point forms were contemporaneous in the Northeast. Complications arise in comparing the calibrated and uncalibrated time scale by the close of the Middle Archaic container. The placement of Merrimack and Otter Creek points appears to be reversed by calibration. From there the divergence in placement and the temporal priority of point types becomes increasingly severe. This trend continues to the end of the Terminal/Transitional time scale.

The overlap of the temporal ranges seems to be of particular importance and would seem to indicate the coevality of most of the major point types. Obviously this trend must be examined further and the preparation of histograms should help to sort out temporal and geographic distribution. Yet the possibility definitely exists that several point types were in use at the same time in the same general area. The question of mixed associations seems to be part of this problem as well. Several investigators have already stressed that, "...projectile points do not necessarily occupy short, mutually exclusive time units..." (Snow 1980:162) and that there may have been "...more overall overlap than has been suspected between some phases...which are regarded as distinct..." (Funk and Rippeateau 1977:9) Sites containing a variety of point forms should be expected in the archaeological record. If the calibrated time ranges hold up to further investigation the possibilities for the association of mixed point varieties would be considerable within the Archaic time span. The ultimate resolution of this issue will affect the entire interpretation of the Archaic period. As outlined by Hoffman, when one abandons the necessity to have two major traditions to account for the variety in Late Archaic projectile point forms, "the need for a distinction between the two traditions vanishes... It is possible that the two traditions were not only coeval but were produced by the same population, perhaps for different functions" (Hoffman 1983:44).

Our traditional manner of partitioning large segments of time into smaller fragments, as for instance, Early, Middle, Late Terminal, and Transitional for the Archaic, are of little real value. As indicated at the end of each portion of the data base, the time lines are smudged. Point types cannot be sandwiched neatly into strictly defined containers. If the trends in this study prove accurate, I would think that the Archaic will warrant no more than two loosely divided segments.

The beginning of the Early container would be dependent on the temporal relationship between corrected Paleo-Indian dates and those of the Early Archaic. This container would close somewhere between the fourth and fifth millennium B.C. with the profileration of point varieties. If the concept of an aceramic Archaic is honoured, the late or florescent period would close with the appearance of the fully ceramic technologies. A wholly accepted definition of a 'ceramic' technology is lacking, "...in eastern North America, interpretations of initial ceramic complexes vary considerably from region to region" (Reid 1984:69), and could affect a revised division between the Archaic and Woodland periods.

Finally, one is left to ponder what the bar graphs can realistically explain. They represent the collective ranges of groups of projectile forms judged to be of the same type. But can we sort out temporal priority? The Z-statistic, when warranted (Chappell 1982:326,332), is used to define contemporaneity of dates from the same site or from different sites reportedly to contain the same material. It states "...if radiocarbon dates...differ such that there is no overlap of ranges at a distance of two-sigma from the mean, there is a ninety-five percent (95%) probability that they represent different temporal components" (Hoffman 1983:36). Conversely, if there is overlap we must assume contemporaneity. If we were to apply this criteria to the bar graphs, we would be forced to view almost all of the Middle, Late, and Terminal/Transitional point types as contemporaneous. Therefore, must we ultimately face the fact that although the radiocarbon process can help build broadly defined sequences, it cannot help produce a tightly ordered chronology?

BIBLIOGRAPHY

Bolian, C.E.

1980 The early and middle archaic of the Lakes Region, New Hampshire. In Early and Middle Archaic Cultures in the Northeast.(David R. Starbuck and C.E.Bolian, ed.) pp 115-128 Occasional Publications in Northeastern Anthropology, No. 7. Franklin Pierce College.

Browman, D.L

1981 Isotopic discrimination and correction factors in radiocarbon dating. Advances in Archaeological Method and Theory. (M.B. Schiffer, ed.), volume 4: 241-295. Academic Press.

Bruns M., M. Rhein, T.W. Linick and H.E. Suess

1983 The atmospheric ^{14}C level in the 7th millenium BC. In Proceedings of the First International Symposium ^{14}C and Archaeology. (W.G. Mook and H.T. Waterbolk ed.) PACT 8:511-516.

Byers, D.S.

1959 The eastern Archaic: some problems and hypotheses. American Antiquity 24(3):233-256.

Chappell, J.

1982 Radiocarbon dating uncertainties and their effects on studies of the past. Archaeometry: An

Australian Perspective. (W. Ambrose, ed.), 322-335. Deurden.

Clarke, R.M.

1975 A calibration curve for radiocarbon dates. Antiquity 49:251-266.

Dean, J.S.

1978 Independent dating in archaeological analysis. In Advances in Archaeological Method and Theory (M.B. Schiffer, ed.), volume 1:223-255. Academic Press. New York.

Dincauze, D.F.

1971 An archaic sequence for southern New England. American Antiquity 36(2):194-198.

1972 The Atlantic phase: a late archaic culture in Massachusetts. Man in the Northeast 4:40-61.

1975 The late archaic period in southern New England. Arctic Anthropology XII(2):23-34.

1976 The Neville site 8000 years at Amoskeag. Peabody Museum Monograph 3. Harvard University. Cambridge, Massachusetts.

Dincauze, D.F. and M.T. Mulholland

1977 Early and middle archaic site distributions and habitats in southern New England. Annals New York Academy of Sciences 288:439-456.

Dragoo, D.W.

1974 Radiocarbon dates and the archaeologist. Archaeology of Eastern North America 2(1):21-27.

Evin, J.

1983 Materials of terrestrial origin used for radiocarbon dating. In Proceedings of the First International Symposium ^{14}C and Archaeology. (W.G. Mook and H. T. Waterbolk, ed.) PACT 8:235-276.

Fitting, J.E.

1968 Environmental potential and the postglacial re-adaptation in eastern North America. American Antiquity 33(4):441-445.

1978 Prehistory: Introduction. In Handbook of North American Indians. (B.G.Trigger, ed.), Volume 15:14-15, Smithsonian Institution, Washington.

Fitzhugh, W.

1972 The eastern Archaic: commentary and northern perspective. Pennsylvania Archaeologist 42(4): 1-19.

Funk, R.E.

1965 The archaic of the Hudson Valley: new evidence and new interpretations. Pennsylvania Archaeologist 35 (3-4):139-160.

1976 Recent contributions to Hudson Valley prehistory.

New York State Museum Memoir 22:148-172.

1977 Early to middle occupations in upstate New York. In Current Perspectives in Northeastern Archaeology. New York State Archaeological Association Research and Transactions 17(1):21-29.

1978 Post-pleistocene adaptations. In Handbook of North American Indians. (B.G.Trigger, ed.), volume 15:16-27, Smithsonian Institution, Washington.

Funk, R.E. and B.E. Rippeteau

1977 Adaptation, continuity and change in upper Susquehanna prehistory. Occasional Publications in Northeastern Anthropology 3.

Funk, R.E. and B. Wellman

1984 Evidence of early holocene occupations in the Upper Susquehanna Valley, New York State. Archaeology of Eastern North America 12:81-91.

Geyh, M.A. and P. De Maret

1982 Histogram evaluation of ^{14}C dates applied to the first complete iron age sequence from west central Africa. Archaeometry 24(2):158-163.

Harkness, D.D.

1975 The role of the archaeologist in ^{14}C age and measurement. Radiocarbon Calibration and Prehistory. (T. Watkins, ed.), 128-135. University

Press, Edinburgh.

1983 The extent of natural ^{14}C deficiency in the coastal environment of the United Kingdom. In Proceedings of the First International Symposium ^{14}C and Archaeology. PACT 8:351-364.

Hoffman, C.

1983 Radiocarbon and reality. The fifth millenium B.P. in southern New England. Man in the Northeast 26: 33-53.

Ikawa-Smith, F.

1986 Memorandum, dated July 21, 1986. In possession of author.

International Study Group

1982 An inter-laboratory comparison of radiocarbon measurements in tree rings. Nature 298:619-623.

Isaac, G.

1977 Squeezing blood from stones. In, Stone Tools As Cultural Markers: Change, Evolution and Complexity. (R.V.S. Wright, ed), 5-12. Prehistory and Material Cultures Series No. 12. Humanities Press Inc. New Jersey, U.S.A.

Kenyon, V.B.

1983 Prehistoric archaeology in the Merrimack River

Valley. Man in the Northeast 25:1-5.

Klein, J., J.C. Lerman, P.E. Damon, E.K. Ralph

1982 Calibration of radiocarbon dates: tables based on the consensus data of the workshop on calibrating the radiocarbon time scale. Radiocarbon 24(2): 103-150.

Long, A. and B. Rippeteau

1974 Testing contemporaneity and averaging radiocarbon dates. American Antiquity 39(2):205-215.

McGhee, R. and J.A. Tuck

1975 An archaic sequence from the Strait of Belle Isle, Labrador. Canada National Museum of Man, Mercury Series. Archaeological Survey of Canada Paper 34. Ottawa.

McKern, W.C.

1939 The midwestern taxonomic method as an aid to archaeological culture study. American Antiquity 4(4):301-313.

McManamon, F.P.

1980 Middle archaic chipped stone variation: collections research and hypotheses testing. In, Early and Middle Archaic Cultures in the Northeast. (D.R. Starbuck and C.E. Bolian, ed.) Occasional Publications in Northeastern Anthropology No. 7.

Michael, H.N. and E.K. Ralph

1971 Dating Techniques for the Archaeologist. H.N. Michael and E.K. Ralph, editors. MIT Press, Cambridge, Mass.

Michels, J.W.

1973 Dating methods in archaeology. Studies in Archaeology. Seminar Press, New York.

Mook, W.G.

1983 ^{14}C calibration curves depending on sample time-width. In Proceedings of the First International Symposium ^{14}C and Archaeology. (W.G. Mook and H.T. Waterbolk, ed) PACT 8:517-525.

Mook, W.G. and H.J. Streurman

1983 Physical and chemical aspects of radiocarbon dating. Proceedings of the First International Symposium ^{14}C and Archaeology. (W.G.Mook and H.T. Waterbolk, ed). PACT 8:31-55.

Nelson, E.

1986 Discussion, Archaeology Department, Simon Fraser University, Vancouver, B.C. March 1986.

Neustupny, E.

1970 The accuracy of radiocarbon dating and radiocarbon variations. In Radiocarbon Variations and Absolute Chronology. (I. Olsson, ed.) Nobel Symposium No.

12:23-30, Alqvist and Wiksell, Stockholm.

Nicholas, G.P.
1983 A model for the early postglacial settlement of the central Merrimack River Basin, New Hampshire. Man in the Northeast 25:43-63.

Nydal, R.
1983 Optimal number of samples and accuracy in dating problems. In Proceedings of the First International Symposium ^{14}C and Archaeology. (W.G. Mook and H.T. Waterbolk, ed). PACT 8:107-122.

Ogden, J.G.
1977 The care and feeding of radiocarbon dates: the use and abuse of radiocarbon dating. Annals of the New York Academy of Sciences 288:167-173.

Olsson, I.U.
1983 Dating non-terrestrial materials. Proceedings of the First International Symposium ^{14}C and Archaeology. (W.G. Mook and H.T. Waterbolk, ed). PACT 8:277-294.

Ralph, E.K.
1971 Radiocarbon dating. In Dating Techniques for the Archaeologist. (H.N. Michael and E.K. Ralph, ed.) pp. 1-48, MIT Press, Cambridge, Mass.

Ralph, E.K., H.N. Michael, and M.C. Han

1974 Radiocarbon dates and reality. Archaeology of Eastern North America 2(1):1-5.

Reid, K.C.

1984 Fire and ice: new evidence for the production and preservation of late archaic fiber-tempered pottery in the middle-latitude lowlands. American Antiquity 49(1):55-76.

Renfrew, C.

1973 Before Civilization. Alfred A. Knopf. New York.

Renouf, P.

1977 A late paleo-indian and early archaic sequence in southern Labrador. Man in the Northeast 13:35-44.

Rippeteau, B.

1973 The Principles and Theory of Radiocarbon Chronology and a Radiocarbon Chronology for Lithic-variation in the Northeastern United States during 3000 to 500 Calendrical Years B.C. University Microfilms. Ann Arbor, Michigan.

1974 Using ^{14}C calendrical corrections and conventions. Archaeology of Eastern North America 2(1): 29-37.

Ritchie, W.A.

1944 The pre-iroquoian occupations of New York State. Rochester Museum of Arts and Sciences, Memoir No. 1

1965 *The Archaeology of New York State*. The Natural History Press. New York.

1965a The small stemmed point in New England. *Pennsylvania Archaeologist* 35(3-4):134-38.

1971b A Typology and Nomenclature for New York Projectile Points. *New York State Museum and Science Service Bulletin No. 384*.

1971a The archaic in New York. *New York State Archaeological Association Bulletin* 52:2-12.

Ritchie, W.A. and R. Funk

1973 Aboriginal Settlement Patterns in the Northeast. *New York State Museum and Science Memoir 20*. Albany, New York.

Seigbahn, K.

1970 Address of welcome. Radiocarbon Variations and Absolute Chronology. (I. Olsson, ed.), *Nobel Symposium* No. 12:19-20, Almqvist & Wiksell, Stockholm.

Snow, D.R.

1978 Shaking down the new paradigm. *Archaeology of Eastern North America* 6:87-91.

1980 *The Archaeology of New England*. Academic Press, Inc., New York.

Starbuck, D.R.

1980 The middle archaic in central Connecticut: the excavations of the Lewis-Walpole site. In Early and Middle Archaic Cultures in the Northast. (D.R. Starbuck and C.E. Bolian, ed.), Occasional Publications in Anthropology, No. 7, Franklin Pierce College.

1983 Survey and excavation along the Upper Merrimack River in New Hampshire. Man in the Northeast 23: 25-41.

Stoltman, J.B.

1978 Temporal models in prehistory: an example from eastern North America. Current Anthropology 19(4): 703-740.

Stuckenrath, R.

1977 Radiocarbon: some notes from Merlin's diary. In Amerinds and Their Paleo-Environments in Northeastern North America. Annals New York Academy of Sciences 288:181-188.

Switsur, R.

1986 The 12th international radiocarbon conference. Antiquity XL(229):139-142.

Thomas, D.H.

1978 The awful truth about statistics in archaeology. American Antiquity 43(2):231-245.

Timmins, P.

1984 The Analysis and Interpretation of Radiocarbon

Dates in Iroquoian Archaeology. M.A. Thesis, on file, McGill University, Montreal, Canada.

Towle, L.

1983 Prehistoric site distribution along the Sudbury River: evidence from Wayland. Man in the Northeast 25:1-5.

Trigger, B.G.

1983 American archaeology as native history: a review essay. William and Mary Quarterly 40:413-452.

Tuck, J.A.

1971 An archaic cemetery at Port au Choix, Newfoundland. American Antiquity 36(3):343-358.

1974 Early archaic horizons in eastern North America. Archaeology of Eastern North America 2(1):72-80.

1975 The northeastern maritime continuum: 8000 years of cultural development in the far northeast. Arctic Anthropology XII(2):139-147.

1976 Newfoundland and Labrador Prehistory. National Museum of Man. Archaeology Survey of Canada.

1977 A look at Laurentian. In Current Perspectives in Northeastern Archaeology. New York State Archaeological Association Researches and Transactions 17 (1):31-40.

1977b Early cultures on the Strait of Belle Isle, Labrador. In, Amerinds and Their Paleo-environments in Northeastern North America. Annals of New York Academy of Sciences 288:472-480.

1978 Regional cultural development, 3000 to 300 B.C. Handbook of North American Indians. (B.G. Trigger, ed.), volume 15:28-43, Smithsonian Institution, Washington.

Tuck, J.A. and R. McGhee

1975 Archaic cultures in the Strait of Belle Isle region, Labrador. Arctic Anthropology XII(2):76-97.

Turnbaugh, W.A.

1975 Toward an explanation of the broadpoint dispersal in eastern North American prehistory. Journal of Anthropological Research 31(1):51-68.

1980 Early and middle archaic elements in southern Rhode Island. In, Early and Middle Archaic Cultures in the Northeast. (D.R. Starbuck and C.E. Bolian, ed.), Occasional Publications in Northeastern Anthropology, No. 7, Franklin Pierce College.

Ward, G.K. and S.R. Wilson

1978 Procedures for comparing and combining radiocarbon age determinations: a critique. Archaeometry 20 (1):19-31.

Waterbolk, H.T.

1983 The integration of radiocarbon dating in archaeology. Radiocarbon 25(2):639-644.

1983a Ten guidelines for the archaeological interpretation of radiocarbon dates. In Proceedings of the First International Symposium ^{14}C and Archaeology. (W.G. Mook and H.T. Waterbolk, ed.) PACT 8:57-70.

Watkins, T.
1975 Introduction. In Radiocarbon Calibration and Prehistory (T. Walkins, ed.) University Press, Edinburgh.

Willey, G.R. and J.A. Sabloff
1974 A History of American Archaeology. Freeman. San Francisco.

Willis, E.H.
1963 Radiocarbon dating. In Science in Archaeology. (D. Brothwell, ed.), pp.35-46, Basic Books, Inc. New York.

Wilson, D.
1975 Atoms of the Past. Allen Lane, Penguin Books, London.

Wilson, S.R. and G.K. Ward
1981 Evaluation and clustering of radiocarbon age determinations: procedures and paradigms. Archaeometry 23(1):19-39.

Wright, J.V.
1972 The Shield Archaic. National Museums of Canada Publications in Archaeology No. 3, Ottawa.

— 1978 The implications of probable early and middle archaic projectile points from southern Ontario. *Canadian Journal of Archaeology* 2:59-78.