10.2 Delaware American Indian Ceramics Radiocarbon Dates by Daniel R. Griffith

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Delaware American Indian Ceramics

Radiocarbon Dates

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Introduction to Radiocarbon Dating

Radiocarbon dates provide a universal measure of time, independent of cultural-historical viewpoints and associative reasoning (van der Plicht and Bruins 2001:1164). The practical temporal limits of radiocarbon dating are approximately 55,000 to 60,000 calendar years (Higham 1999). As known human occupation in Delaware is well within those limits, radiocarbon dating is the absolute dating method best suited for chronological placement of American Indian ceramics in Delaware.

The evaluation of Delaware radiocarbon dates associated with American Indian ceramics is critical to an understanding of origins and technological developments of ceramics as well as placing the associated cultural components in a temporal framework. Once accomplished, this tool permits the investigation and description of culture history and dynamics ranging from inter-group interaction, population movement at different scales, conflict and adjustment, social and political structure, the entire range of shared values, beliefs and knowledge that contribute to the understanding of American Indian cultures in Delaware through time.

Radiocarbon dating is based on the physical properties of the radiocarbon isotope ^{14}C. Generally, any material from a once living organism containing carbon can be used to obtain a date. In Delaware, the most commonly used material has been wood charcoal, marine shell and bone. Short-lived samples, like seeds and nuts, are of key importance, but multi-year charcoal or shell remains important (van der Plicht and Bruins 2001:1161). The half-life of ^{14}C is used as the standard for calculating the conventional radiocarbon age (CRA). There are three principal techniques used to measure the ^{14}C content of any given sample; gas proportional counting, liquid scintillation counting and accelerator mass spectrometry. Gas proportional and liquid scintillation counting count the products of ^{14}C radioactive decay known as beta particles. The accelerator mass spectrometry method (AMS) counts the actual ^{14}C content of the sample relative to the ^{12}C and ^{13}C present in the sample. The Delaware radiocarbon dates for this study were derived from all three methods. The tables listing the radiocarbon dates for this study describe the analysis as either “Radiometric” (gas proportional or liquid scintillation counting) or AMS (Accelerator Mass Spectrometry).

Both radiometric and AMS dating can provide very accurate dates. Accurate dates are those dates with small standard deviations. The sample size available for dating influences the choice of dating technique. Accurate radiometric dating requires sample sizes no less than 20 grams dry weight for charcoal and 50 grams dry weight for wood charcoal and shell. Accurate AMS dating requires no less than 10-50 milligrams for wood charcoal and 20-50 milligrams for shell (Beta Analytic 2011). There are, however some caveats in making the choice between methods. “There can be a tendency to collect and submit isolated flecks of charcoal for AMS dating “(van der Plicht and Bruins 2001:1160). The dating of small, isolated samples should be discouraged, as the possibility of dating erratic, post-depositional or even contemporary influences on the deposition of the sample is likely. “It is a ‘myth’ that AMS dating is better than conventional ^{14}C dating; standard deviations are not smaller” (van der Plicht and Bruins 2001:1160). The best use of the AMS dating technique is to derive dates from organic residues on artifacts or the direct dating of carbon-bearing artifacts as the carbon sample size required is quite small and would not damage the artifact.

Radiocarbon labs report dates as a Conventional Radiocarbon Age (CRA). This is the raw measured value of the age of the sample based on the analytical technique used. The discrepancy between a measure value and a “true value” is expressed as a standard deviation (1 sigma), which corresponds to a 68% probability that the “true value” falls within the 1 sigma range. A 2-sigma range generally represents a 95% probability, though calibration programs may calculate the probability more precisely. The variation in the 1 sigma and 2 sigma calibrated dates from the statistical normal of 68% and 95% is due to the variations in the calibration curves. The Conventional Radiocarbon Age never changes; it is the calculated date of a sample resulting from a specific laboratory technique. The interpreted calendar age dates and ranges though have changed through time as different calibration techniques were applied to the CRA’s. In reporting a CRA, the following conventions are used:

1) ^{14}C half-life is 5568 years
2) Oxalic Acid I or II as the modern standard
3) $^{12}C/^{13}C$ isotope corrected to 25.0 mille
4) AD 1950 as 0 Before Present (BP)
5) ^{14}C reservoirs have remained constant

In calculating the CRA, radiocarbon labs must take into account the fractionation effects of carbon isotopes. Bio-chemical processes create a certain degree of variability in the $^{14}C/^{13}C/^{12}C$ ratios that has the potential to effect radiocarbon dates if not taken into account (Thomas 2008:345). While most reports used for this study did not report isotope fraction, conventional radiocarbon lab procedures normalize the isotope fractions to a common scale (Reimer 2011). For the purposes of this study, it is assumed that all reported CRA's have taken into account and normalized the effect of isotope fractionation based on well-established measured or estimated values.

The two largest ^{14}C reservoirs are the atmosphere and the oceans. Living organisms from the two different reservoirs take in ^{14}C differently. The Delaware radiocarbon dates from wood charcoal and bone samples were from organisms that absorbed ^{14}C from the atmospheric reservoir, while radiocarbon dates from marine shell samples were from organisms that absorbed ^{14}C from the marine reservoir. Potential differences in radiocarbon dates from different reservoirs are compounded by the fact that atmospheric ^{14}C has not remained constant (Stuiver and Braziunas 1993:137). In order to determine the "true" calendar age of a sample, the CRA is calibrated against a dataset that associates the CRA with a calendar date. The first internationally agreed upon calibration was published in 1982 (Klein et. al. 1982). Since that time, calibration datasets for both the atmosphere and marine reservoirs have been refined. It is not the purpose of this study to elaborate on the history of deriving atmospheric and marine calibration curves. However, it is important to discuss the issue of dates relating to marine shell as they represent 20% of the radiocarbon dates associated with ceramics in this study and in some cases provide the only radiocarbon dates available for specific ceramic types.

As early as 1977 in the literature reviewed for this study, there was some concern that radiocarbon dates derived from marine shell were not accurately representing the "true" calendar age of the sample. Daniel Griffith noted that a radiocarbon date on shell from the Bay Vista site (UGa-1440) did not conform to its expected temporal range based on Townsend ceramic design motif seriation (Griffith 1977: 108). This issue was more explicitly addressed in the report on the Bay Vista and Cole sites in Sussex County, Delaware where the authors state that there are problems with shell dates on the Delmarva Peninsula (Doms, Custer, Davis and Trivelli 1985:23). Recently this issue has been examined for the Chesapeake Bay and corrections developed (Colman, Baucom, Bratton et. al. 2001 and Rick and Lowery 2011). There are a number of advantages in deriving radiocarbon dates from marine shell (Highman and Hogg 1995:409). In Delaware, shell remains are widespread in the southern two-thirds of the state. Shell also has the potential to date an event closely as shellfish are typically processed close to where they are collected. For the purposes of determining a calendar age, radiocarbon dates on marine shell benefit from the fact that the marine calibration curve is smoother than the atmospheric calibration curve with fewer intercepts and narrower calibrated ranges. Perhaps most importantly, the association of shell with the artifacts and components to be dated is more reliable than loose charcoal in a given context. With respect to the Delaware radiocarbon dates on shell, shell was used even when charcoal was available because the association between the shell and the ceramics to be dated was more certain. In the case of the Wolfe Neck site, ceramic sherds were sandwiched between the shells submitted for radiocarbon dating (Griffith and Artusy 1977).

Research in the last twenty-five years has shown that apparent ^{14}C age differences occur when contemporaneously grown samples of different reservoirs are dated (Stuiver and Braziunas 1993:137). In other words, dates on shell where the ^{14}C originates from the marine reservoir produced different conventional radiocarbon ages as compared to contemporary wood charcoal where ^{14}C originates from the atmospheric reservoir. The 19th century reservoir age of the global ocean, relative to the atmosphere, is estimated at 400 ^{14}C years (Stuiver, Reimer and Braziunas 1998:1131). That is, marine shell CRA's tend to be approximately 400 years earlier than contemporary wood charcoal dates. However, variations in ^{14}C do occur in the marine environment and the world average of 400 years does not take into account regional variations in upwelling of ^{14}C deficient waters or regional atmospheric variations (Stuiver and Braziunas 1993: 138).

For the purposes of archaeological research, it is generally not advisable to subtract 400 years from the shell CRA to derive a "corrected" CRA. First, an independent estimate of the calendar age of a sample is needed to determine a model-generated ^{14}C age. This age can be compared to the conventional marine radiocarbon age (CRA) of the sample for a given location. The difference between the two ages is known as ΔR (i.e. change in reservoir age), an assumed time-constant offset that should be removed from sample ^{14}C ages before the application of the marine calibration curve (Stuiver and Braziunas 1993:152). As the ΔR is measuring regional offsets, the ΔR value used must be derived from data in the study area. For example, due to different oceanic processes and the effect in estuaries of the mixture of materials from different watersheds, the ΔR value for the Delaware Bay and near-shore Atlantic Coast may be different from the ΔR value for the Chesapeake Bay. In fact, recent studies have shown there are differences in ΔR values within the Chesapeake Bay ranging from $\Delta R = 129 \pm 22$ on the western shore to $\Delta R = -88 \pm 23$ on the Eastern Shore, while Maryland's Atlantic Coast values range from $\Delta R = 106 \pm 46$ to $\Delta R = 2 \pm 46$ (Rick et. al. 2011).

There are two methods for deriving the ∆R value. The first is to obtain radiocarbon dates on historic shell collected from a known location and on a precise calendar date (Rick and Lowery 2011; Thomas 2008:349). This is a highly reliable method as the true age of the dated shell is known and provides the basis from which to calculate the ∆R value to be applied to the conventional radiocarbon ages derived form the radiocarbon dates on the shell. The second method is the paired sample method. In the paired sample method, a sample of shell and a sample of wood charcoal from the same context are dated and the resulting CRA's compared. In the case of contemporaneous wood charcoal and shell samples from the same context, the reservoir deficiency (∆R) may be estimated without direct calibration to the calendar time scale by using a curve, which models marine conventional radiocarbon ages plotted against atmospheric conventional radiocarbon ages (Stuiver and Braziunas 1993:154). Using the curve provided by Stuiver and Braziunas (1993:154) a good estimate is provided, but I attempted to use the more accurate method of calculating the Modeled Marine Reservoir Age using a series of iterations until the Modeled Marine Reservoir Age matched the re-calibrated wood charcoal sample age at the 2 sigma range. The ∆R value and its standard deviation (∆R error) may also be calculated by subtracting the Modeled Marine Age from the calibrated age of the charcoal sample (Deo, Stone and Stein 2004:771; Bourke and Hua 2009:182).

The disadvantage of the paired sample method is one must assume that the shell and wood charcoal samples are contemporary. As charcoal is long lasting and more mobile in the soil profile, it may be difficult at times to be certain that the samples are contemporary. The best method to control for contemporary contexts is to choose samples from single component contexts and to be very certain during the collection of the samples in the field that there is a high probability that the samples were deposited at the same time.

In order to produce a reliable ∆R value and ∆R Error, both methods require a sizable number of radiocarbon dates. For example, research on St. Catherine's Island, Georgia used eleven paired dates (22 samples) and twelve dates on known-age shell to derive a ∆R value (Thomas 2008:360). Unfortunately, for this study, no research has been published that was designed to calculate a ∆R value for the Delaware Bay or near-shore Atlantic Coast. However, research for this study located three paired dates from Delaware as follows:

Wolfe Neck Site (7S-G-141),Feature 1(Hoffman, Wagner, Rouse, Classen and Moeller 1997)

Beta 77642 - wood charcoal

CRA 1840±70 B.P.

Beta 77643 - marine shell

CRA 2180±60 B.P.

Island Field Site (7K-F-17),Feature 119 (Custer, Rosenberg, Mellin, Washburn 1990)

Beta 29737 - wood charcoal

CRA 710±60

Beta 29738 - marine shell

CRA 800±70

Gray Farm Site (7K-F-11), Feature 10 (Diamanti, et. al. 2012)

Beta 307300 - wood charcoal

CRA 330±30 B.P.

Beta 307301 - marine shell

CRA 790±30 B.P.

The ΔR value calculated from the Wolfe Neck paired dates is ΔR = 12±93 at the 2 sigma level. The value calculated from the Island Field paired dates is ΔR = -296±84, while the value for the Gray Farm pair is ΔR = 30±45 at the 2 sigma level. The calculations of the ΔR values from the Wolfe Neck, Gray Farm and Island Field sites appear in Appendix 1. The ΔR value calculated from the Island Field paired dates is well beyond the range of ΔR values for the Middle Atlantic. The ΔR value for the near-shore Atlantic Coast at Atlantic City, New Jersey is 170±50, while the value for Shark River, New Jersey is 130±60 (Stuiver and Reimer 1993). Delta R values in the Chesapeake Bay range from 129±22 to -88±23, which emphasizes the need to take sub-regional differences into account (Rick et. al. 2011). The large negative ΔR value from the Island Field site likely resulted from shell and charcoal samples that were not contemporary. It is likely that "old" charcoal contaminated the sample submitted, which would not be unexpected at the Island Field site as Feature 119, a Woodland II

Townsend ceramics bearing context, overlapped the Woodland I Webb Phase cemetery. It is highly probable that charcoal originating from one of the earlier components at the site was incorporated into the sample submitted for dating. An additional clue that there may be something wrong with the paired dates at the Island Field site comes from the fact the shell and charcoal radiocarbon dates are statistically the same at the 95% confidence limit; in most cases they should be different. The radiocarbon samples submitted were from two different ^{14}C reservoirs that research has shown produce significantly different dates. In contrast, the paired dates at the Wolfe Neck and Gray Farm sites are statistically different at the 95% confidence limit, a result that conforms to expectations. The Wolfe Neck and Gray Farm sites ΔR values produce corrected marine shell radiocarbon dates that are statistically the same.The Wolfe Neck samples are from an isolated, single component, sealed shell midden containing only Coulbourn ceramics, while the Gray Farm samples are from a single feature that contained only late Townsend and Killens ceramics. Based on the nature of the context alone, it is highly probable that the shell and charcoal samples were contemporary at Wolfe Neck and the Gray Farm.

While it is tempting to use the ΔR value calculated from the Wolfe Neck and Gray Farm paired dates to re-calibrate the Delaware radiocarbon dates from marine shell, it is not statistically valid to rely on two pairs of dates. Using the Wolfe Neck and Gray Farm ΔR values may not produce reliable results. A larger sample of paired dates, or dates on known-age shell, is required to establish a statistically valid value for the Delaware Bay and near-shore Atlantic Coast. The Wolfe Neck and Gray Farm paired dates, along with other paired dates or dates on known-age shell that may be obtained in the future, will contribute to a database that will allow for the calculation of a reliable ΔR value. For the purposes of this study of radiocarbon dates in Delaware associated with American Indian ceramics, I will simply recalibrate all the marine shell dates using the current marine model curve without a ΔR correction. As The Gray Farm and Wolfe Neck ΔR values are in the low positive range, the error introduced by not calculating a combined value is likely only twenty years. When a reliable ΔR value is developed, it would be simple matter to recalibrate the shell dates using that value. As will be seen in the analysis, the recalibrated shell dates associated with the several ceramics types using the current marine model curve fall within the 2 sigma calendar age range of the types in question and do not produce any obvious outliers between dates derived from marine shell and dates derived from wood charcoal.

There is a slight tendency for the calibrated shell dates for Mockley, Hell Island and Townsend ceramics to be at the more recent end of the temporal range for the types. At least for the Townsend dates, however, the shell dates are primarily associated with ceramics which seriation studies have shown are at the more recent end of the Townsend sequence. Still, this pattern may argue for a negative ∆R value for the Delaware Bay and near-shore Atlantic coast, though the ΔR for the Gray Farm site suggests this is not the case. However, the calibrated shell dates for Coulbourn and Wolfe Neck ceramics are embedded within the range of the wood charcoal dates. This pattern suggests that using the marine model curve with little or no ∆R adjustment is appropriate. It is also possible that the ∆R value may change through time. Coulbourn and Wolfe Neck ceramics are earlier than Mockley, Hell Island or Townsend ceramics and perhaps the ∆R value becomes more negative the more recent the calibrated shell date. However, the ΔR value for the Gray Farm Site associated with late Townsend and Killens ceramics is in the low positive range. Clearly more research is necessary to establish a reliable ∆R and ∆R Error for the study area that takes into account geographic and temporal changes in the value.

Calibration of Delaware Radiocarbon Dates

The calibration program used in the study is CALIB 6.0.1 (Stuiver and Reimer 1993). The calibration datasets used by the program to derive the recalibrated calendar dates are "intcal09.14c" for wood charcoal dates and "marine 09.14c" for marine shell dates. These are the most current datasets available for this program. Some radiocarbon labs (e.g. Beta Analytic) use proprietary calibration programs in reporting calendar ages. In order to assure comparability of the data for this study, all reported CRA's are re-calibrated using CALIB 6.0.1 using the datasets cited. In addition, while there is some evidence of systematic differences in the calculation of CRA's between some radiocarbon labs in Europe, studies show that it is not a widespread phenomena (Scott et. al. 1998). For the purposes of this study, I will assume that the radiocarbon labs cited produced accurate conventional radiocarbon ages. It should be noted that radiocarbon labs no longer report intercept dates for calibrations as it is statistically misleading (Telford, Heegaard and Birks 2004:296). The "true" date has an equal chance of falling anywhere within the 1 sigma (68%) and 2 sigma (95%) calibrated ranges.

The question of "good" dates versus "bad" dates also needs some discussion. There are a number of instances in the literature reviewed for this study where the authors identify a radiocarbon date as being outside the accepted range for the ceramics types in question (cf. Custer, Watson and Silber 1995:243). Such dates are often referred to as "bad" dates, while "good" dates tend to cluster with other dates for the same artifact class or component. Is there anything wrong with "bad" dates? There is a difference between the accuracy of a date and its precision (Higham 1999). Accuracy refers to the date being a true estimate of the age of the sample within the range of statistical limits, or standard deviations, of the date. Precision is the degree to which an accurate date actually reflects the time period of components or associated artifacts within a given context. The latter concept is particularly critical where the period, components or artifacts are dated by association with a dated radiocarbon sample as opposed to cases where carbon-bearing artifacts are dated directly. Archaeological recovery methods and archaeological laboratory handling of samples have the greatest effect of the precision of a date. In other words, a radiocarbon date that is older or more recent than expected is not likely a radiocarbon lab accuracy error, rather the age of the dated sample is simply older or more recent than the archaeological context within which it is found (van der Plicht and Bruins 2001:1160). Most "bad" dates are accurate in the sense defined above, but are not precise as the result of low quality association of the recovered radiocarbon sample with the context dated.

Radiocarbon dates that are "outliers" from the expected range of dates should not be quickly dismissed. They may lead to new interpretations. Assuming a date is accurate and precise; an outlier may indicate that a certain phase or artifact type continued beyond the accepted temporal range of a type or component indicating a type of lag effect in the replacement of one phase or type with another. If this is true, the outlier may show differences in geographic distribution at some scale. There should also be repeated outliers that exhibit the same pattern. The analysis of Delaware radiocarbon dates considers these concepts.

Delaware ^{14}C Dates Associated with American Indian Ceramics

In preparation for this study, I examined the following sources:

1) Bulletin of the Archaeological Society of Delaware

2) The Archaeolog – Bulletin of the Sussex Society of Archaeology and History

3) All Delaware Department of Transportation Phase II and Phase III reports either on file at the Delaware Division of Historical and Cultural Affairs in Dover or on-line at deldot.gov/archaeology

4) Radiocarbon lab correspondence files at the Delaware Division of Historical and Cultural Affairs in Dover

5) Published syntheses of Delaware and Delmarva Peninsula Prehistory

6) Phase III data recovery reports at the Delaware Division of Historical and Cultural Affairs not associated with undertakings of the Delaware Department of Transportation

7) Correspondence with consultants on unpublished Delaware projects (e.g. Versar 2011 – Blackbird Creek site)

8) Regional journals containing articles on Delaware prehistory

9) The Gray Farm Site (7K-F-11 and 7K-F-169) Data Recovery report (Diamanti et. al. 2012).

The reader should refer to the report bibliography for exact citations for radiocarbon dates associated with American Indian ceramics. The summary tables of radiocarbon dates also list the specific sources cited for each date. Only radiocarbon dates with clear association with American Indian ceramics were included in this study. A number of other radiocarbon dates from sites where ceramics were recovered are reported in the literature, but in most instances the authors state that the association between the radiocarbon dates and the ceramics is not reliable (e.g. Petraglia et. al. 1998; Heite and Blume 1995). I considered these dates low in precision and more likely to confuse interpretation that aide it.

In gathering the radiocarbon dates, I made two assumptions. First, the conventional radiocarbon ages (CRA's) reported are accurate. That is, the CRA's did not contain any radiocarbon lab errors. Second, I assumed the authors of the reports correctly identified the American Indian ceramic types associated with the dated sample. The only way to verify the identification of ceramics would be to re-analyze all the collections, a task well beyond the scope of this study. I did examine the Frederica North Phase I/II ceramic collection and verified or modified the ceramic type identifications so the data could be incorporated into the ceramic distribution data obtained during the Phase III investigation. In reviewing the literature, there are very few instances where there may be cause to question the ceramic type identifications associated with radiocarbon dates. Where this occurs, I will discuss the issue in the following analysis.

Radiocarbon dating of samples associated with American Indian ceramics in Delaware first appeared in the literature in the 1970's (Griffith and Artusy 1975). The Delaware radiocarbon dates from the 1970's and early 1980's were not calibrated to a calendar age, as the first internationally recognized calibration curve was not available until 1982 (Klein et. al. 1982). Consequently, the calendar dates reported for the associated ceramics from the 1970's and early 1980's were derived by simply subtracting the CRA from AD 1950 (0 B.P.). These dates were not true "intercept" dates either as intercept dates implies calibration. Since the mid-1980's, the reported 1 sigma and 2 sigma date ranges were the result of calibration. However, since the calibration curve for both the atmospheric and marine reservoirs are continually refined, the reported calibrated radiocarbon dates were calibrated against slightly different data sets. The fact that some dates in the literature are uncalibrated while others were calibrated by different data sets complicates the comparison of calibrated calendar year ages between the dates and associated ceramics.

This study presents a summary in two formats of Delaware radiocarbon dates associated with American Indian ceramics. Table A lists all radiocarbon dates and associated data as it is found in the literature sorted by ceramic type. In the case of the Gray Farm Site (Diamanti, et. al. 2012), the calibrated dates in Table A are the calibrations provided by Beta Analytic, Inc. Table A includes the following information arranged in columns:

Lab Code	-	the radiocarbon lab sample identification number
Excavation sample	-	site number and excavation context for the sample
Site name	-	the name of the site reported in the literature
Material (species) dated	-	the sample material submitted for dating; species listed where known
Analysis	-	the technique used by the lab to derive the CRA
Conventional Radiocarbon Age (CRA)	–	the calculated years and standard deviation (1 sigma) before radiocarbon present (cal AD 1950)
Isotope Fraction	-	The $^{13}C/^{12}C$ ratio; where reported
Calibration	-	The calibration data set used; where applicable
Reported Date	-	In some cases, the reported date is the calibrated intercept date (BOLD), while in other cases it is the CRA subtracted from cal AD 1950. In some reports, a specific date is not reported (NR).
2 Sigma Range	-	The calibrated 2 standard deviation calendar date range; where reported. Otherwise Not Reported (NR).

Ceramic Association	-	The American Indian ceramics reported to be associated with the radiocarbon date
References	-	The bibliographic reference for the radiocarbon date and ceramic associations
Notes	-	Comments regarding the radiocarbon date and its ceramic associations

The second summary table (Table B) lists the re-calibrated dates using the CALIB 6.0.1 calibration program. The calibrated date ranges for the Gray Farm Site in Table B are calibrated using CALIB 6.0.1 to be compatible with the other calibrated dates in the table. In addition to the data fields defined above, Table B adds three fields as follows:

Delta R	- The marine reservoir correction for the Delaware Bay and the Delaware Atlantic coast. Not reported for this study.
Delta R Error	- The standard deviation of the Delta R value. Not reported for this study.
Probability	- The probability that the "true" calendar age of the sample is within the 2 sigma range. The CALIB 6.0.1 program calculates this probability.

Since relying solely on the ΔR value calculated from the paired dates at the Wolfe Neck and Gray Farm sites has been questioned, these columns are blank. However, these columns should always appear in a report of radiocarbon dates on marine shell, as in the future there will be reliable value for ΔR. Table B drops the data field for "Reported Date" shown in Table A, as a single calendar year date is statistically misleading after recalibration. Recalibration of the reported radiocarbon dates was undertaken to insure that analysis and interpretation of the calendar year date ranges is based on comparable data. The following analysis of ceramic types is based on the data in Table B and the accompanying scatter plots in Figures 1-14.

Delaware American Indian Ceramic Types Associated with Radiocarbon Dates

Before conducting detailed analysis of the ceramic type recalibrated date ranges and implications of those date ranges, it is necessary to define the types identified in this study. The type definitions below list the defining criteria for each type and bibliographic references for its definition. The majority of the types defined in the Middle

Atlantic are temporal types in that the defining attributes were chosen that most reliably changed through time, thereby providing a tool to place the ceramics and associated phases in a temporal framework. The attributes in the definition that are most sensitive to changes through time are temper and surface treatment. In Delaware, the reliability of using temper and surface treatment as temporal markers was demonstrated in a report of a stratified shell midden at Wolfe Neck (Griffith and Artusy 1977). The following list represents only those types where radiocarbon dates are reported in the literature. Other types defined in the literature are found at sites in Delaware (e.g. Minguannan) for which radiocarbon dates have not been reported.

Accokeek	-	Temper – sand and/or finely crushed quartz
		Surface Treatment – cord marked
		Reference - (Stephenson and Ferguson 1963)
Coulbourn	-	Temper – clay nodule/grog
		Surface Treatment – cord marked or net impressed
		Reference – (Wise 1974)
Dames Quarter	-	Temper – black stone (hornblende? Goethite?)
		Surface Treatment – smoothed or cord-marked
		Reference – (Lewis 1972; Wise 1975)
Hell Island	-	Temper – crushed quartz and mica
		Surface Treatment – cord marked or fabric impressed
		Reference – (Wright 1962; Thomas 1966; Custer 1989)
Keyser Farm	-	Temper – fine shell
		Surface Treatment – cord marked
		Reference – (Manson, McCord & Griffin 1944)
Killen’s	-	Temper – fine shell and very fine grit
		Surface Treatment – smoothed or fabric impressed
		Reference – (Wise 1984; Blume, Clark and Scholl 1993; Custer, Hoseth, Silber, Grettler and Mellin 1994)

Marcey Creek-	Temper – steatite
	Surface Treatment – smoothed; plain
	Reference – (Manson 1948)
Mockley -	Temper – shell
	Surface Treatment – cord marked; net impressed; fabric impressed (minor)
	Reference – (Wright 1973; Robinson and Bulhack 2005)
Nassawongo -	Temper – crushed quartz and clay nodules/grog
	Surface Treatment – cord marked; net impressed
	Reference – (Wise 1974)
Potomac Creek -	Temper – crushed quartz/coarse sand
	Surface Treatment – cord marked
	Reference – (Stephenson, Ferguson and Ferguson 1963)
Selden Island -	Temper – steatite
	Surface Treatment – cord marked
	Reference – (Slattery 1946)
Townsend -	Temper – shell
	Surface Treatment – fabric impressed or smoothed
	Reference – (Blaker 1963; Lopez 1971; Griffith 1977)
Wilgus -	Temper – clay nodules/grog and shell
	Surface Treatment – cord marked; net impressed
	Reference – (Custer 1983)
Wolfe Neck -	Temper – crushed quartz
	Surface Treatment – cord marked; net impressed
	Reference – (Griffith and Artusy 1977; Lewis 1972)

Analysis of Radiocarbon Dates by Ceramic Type

The analysis of the calendar date range of each ceramic type is illustrated by a scatter plot of the calibrated radiocarbon dates for each type. The points plotted for each radiocarbon date are the mid-points of the calibrated 2 sigma range for the date. The weighted average of the probability distribution function provides the best central point estimate (Telford, Heegaard and Birks 2004). While calculation of the “mid-point” in this fashion may adjust the location of the points on the scatter plot, it does not change the 2 sigma range of the date. Accordingly, to arrive at the mid-points for the scatter plots I simply added the early end and late end of the 2 sigma distribution and divided by two. In the case of 2 sigma date ranges crossing the cal BC/cal AD mark, I subtracted the result from the more recent end of the 2 sigma range to obtain the mid-point. The maximum 2 sigma range for all the dates associated with each ceramic type is also cited for each chart. The maximum 2 sigma range was determined by using the most recent and oldest ends of the 2 sigma distribution for each type. Samples with large standard deviations in the conventional radiocarbon date (CRA) stretch the 2 sigma calibrated range (e.g. UGa – 3439). For the purposes of discussing the calendar date range of each ceramic type, all calibrated radiocarbon dates are used. In the summary analysis for each type and in establishing a reliable 2 sigma range for the type, the conventional radiocarbon ages (CRA’s) with a standard deviation of ±100 or more are scrubbed from the analysis. The reason for doing so is that large standard deviations are typically due to radiocarbon sample sizes smaller than recommended for the lab technique used. This situation calls into question the accuracy of the date in question.

Accokeek

One radiocarbon date is reported for Accokeek ceramics (Beta-52096) from the Island Farm site in Kent County (Custer, Watson and Silber 1995:244). The calibrated 2 sigma date range is cal AD 23 to cal AD 223 (Figure 1). This date falls within the more recent end of the accepted range for the type (Dent 1995:226). The standard deviation for the date is ±140 years. A large standard deviation is usually caused by a small radiocarbon sample size, which diminishes the accuracy of the resulting date. As this is the only date for Accokeek ceramics in Delaware, it is retained in the summary analysis of the radiocarbon date range of Delaware American Indian ceramics. Accokeek ceramics are rarely reported in Delaware. The calibrated calendar dates overlap significantly with the calibrated calendar dates of Wolfe Neck and Coulbourn ceramics. It is possible that Accokeek ceramics, abundant in the Chesapeake Bay coastal plain, represent a type that is occasionally traded into Delaware or brought to Delaware by small groups or individual potters who became part of the resident American Indian community.

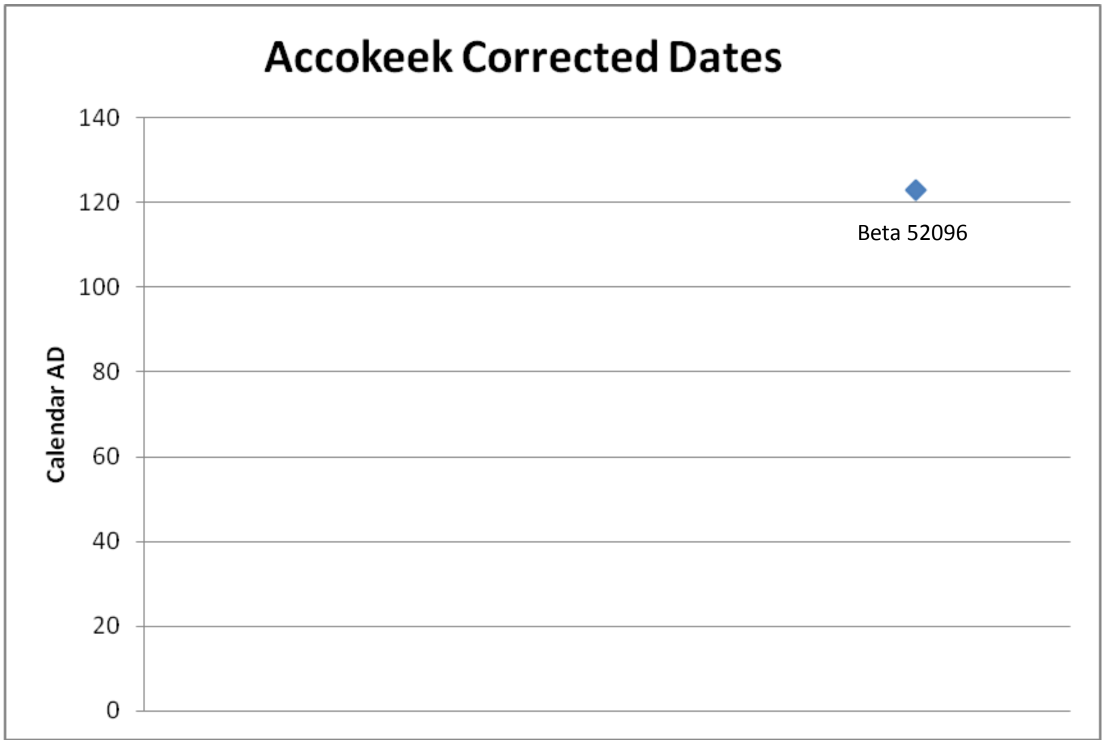

Figure 1

Coulbourn

Twelve radiocarbon dates are reported for Coulbourn ceramics. The scatter plot shows two clusters of dates (Figure 2). The cluster labeled “Accepted Range” encompasses six radiocarbon dates where Coulbourn ceramics were the only ceramics in the dated context. It is probable that this cluster represent the temporal range of Coulbourn ceramics. The cluster exhibits a calibrated 2 sigma date range from cal BC 55 to cal AD 349. The second cluster of dates comes from contexts where Mockley ceramics are also present in the dated context (SI-4942, UGa-1762, Beta 76644 and Beta-76838). The dates fall well within the known date range of Mockley ceramics and it is likely that the Coulbourn ceramics were re-deposited into a Mockley bearing feature when it was filled. It is not uncommon for older ceramics to be re-deposited by later occupations. I consider these four dates to be precise Mockley dates and they are incorporated into the Mockley analysis and scatter plot. The discussion of Mockley dates allows for the possibility that the dates could be associated with Coulbourn ceramics as well.

One date (Beta-76842), noted as an outlier with a calibrated calendar date of cal AD 649 to cal AD 897, is from a context also containing Coulbourn ceramics. The authors of the Island Farm report note that the date is too recent for Coulbourn ceramics (Custer, Watson and Silber 1995:146). This date could have resulted from sample contamination by more recent wood charcoal or the date is correct for a Mockley component feature, but no Mockley ceramics were deposited in the feature. This date falls within the range of Mockley ceramics, but without a clear association it cannot be considered a date for these ceramics. It is also possible that the ceramics were misidentified. This date is dropped from further analysis of Coulbourn and Mockley ceramics. Another date from the Gray Farm Site (Beta-304999) is an early outlier with a 2 sigma mid-point of cal B.C. 932. The context associated with this date also included Wolfe Neck and Selden Island ceramics, with Selden Island ceramics dominant. The radiocarbon date likely represents the Selden Island component.

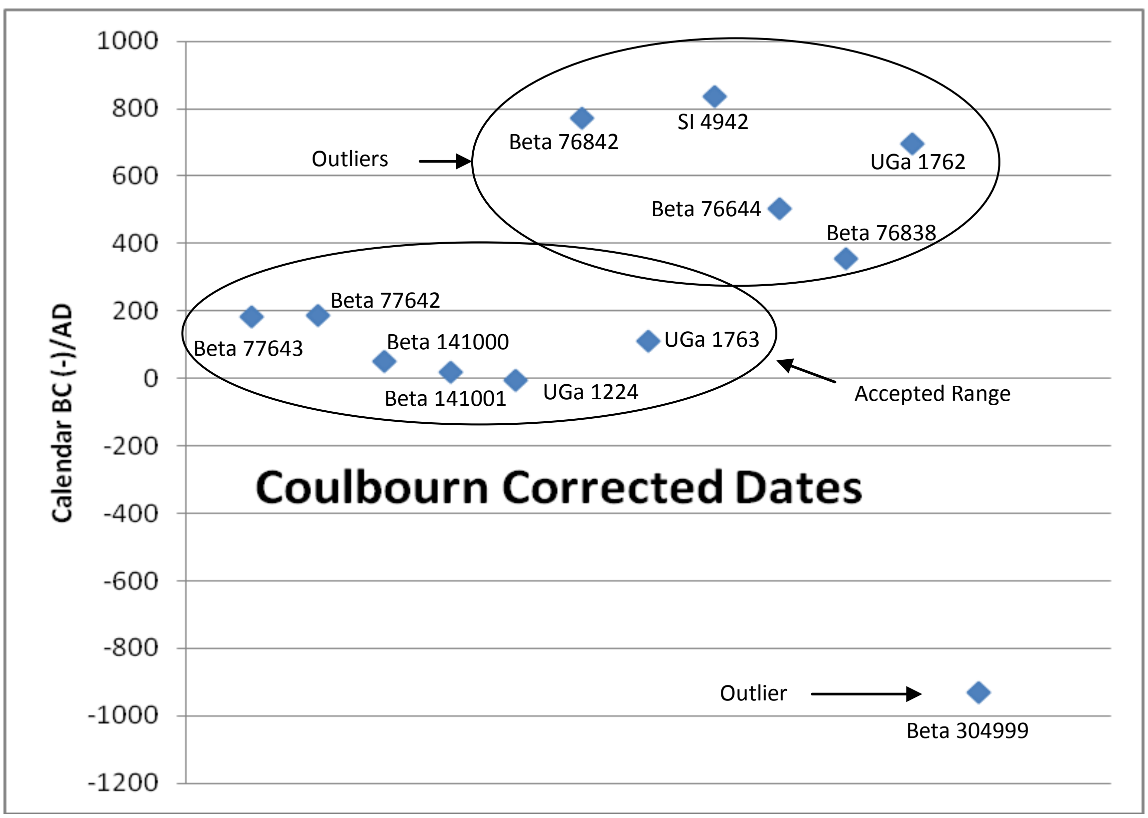

Figure 2

Dames Quarter

Nine dates are reported for Dames Quarter ceramics. The dates are tightly clustered in the calibrated mid-point scatter plot and appear to be both accurate and precise for the type (Figure 3). The maximum 2 sigma calendar age range for Dames Quarter is cal BC 1419 to cal BC 970.

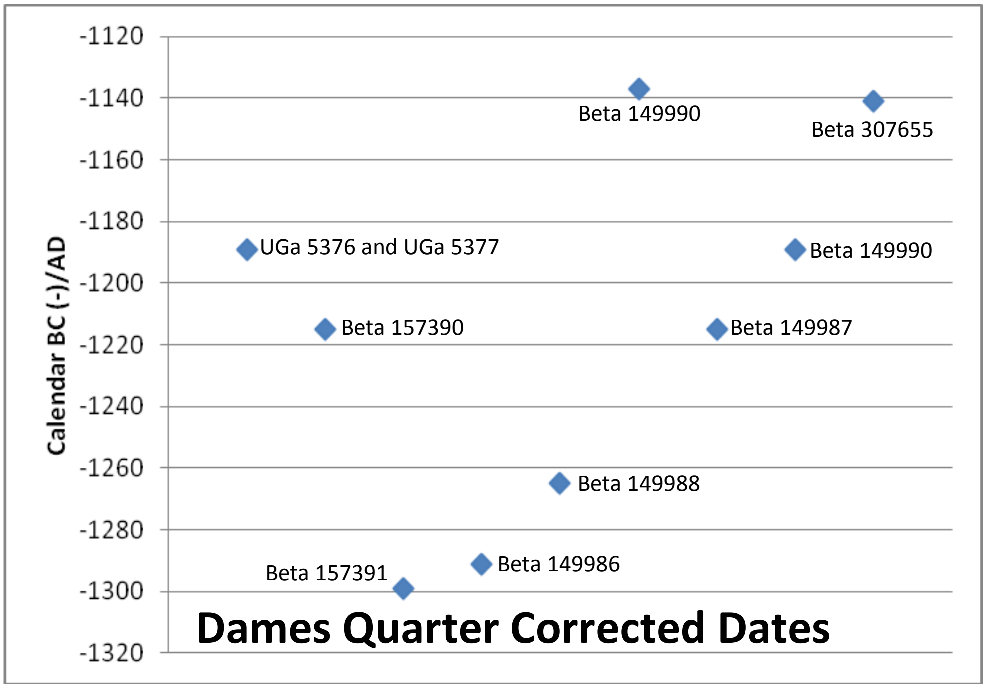

Figure 3

Hell Island

Ten dates are reported for Hell Island ceramics. The calibrated mid-points of the dates are tightly clustered on the scatter plot (Figure 4). One date (Beta-56361) was from a context containing both Hell Island and Marcey Creek ceramics. The authors of the report note that the date is too recent for Marcey Creek ceramics, but consistent with Hell Island ceramics (Custer and Silber 1995:103). One date (Beta-128586) is in the more recent end of the scatter plot, but within the accepted range for the type. Three dates (UGa-3437, UGa-3439 and Beta-42881) exhibit standard deviations exceeding ±100, which compromises the accuracy of the resulting date by the standard I have adopted. It is likely that these dates were derived from wood charcoal samples that were smaller than the recommended size. The large standard deviations stretch the 2 sigma ranges for the type as a whole. The 2 sigma range for Hell Island ceramics based on all the reported dates is cal BC 181 to cal AD 1408. The 2 sigma range without the three dates with large standard deviations is cal AD 526 to cal AD 1230. The conservative range for Hell Island ceramics is likely more precise and those seven precise dates are used to create the ceramics type date range summary (Figure 15).

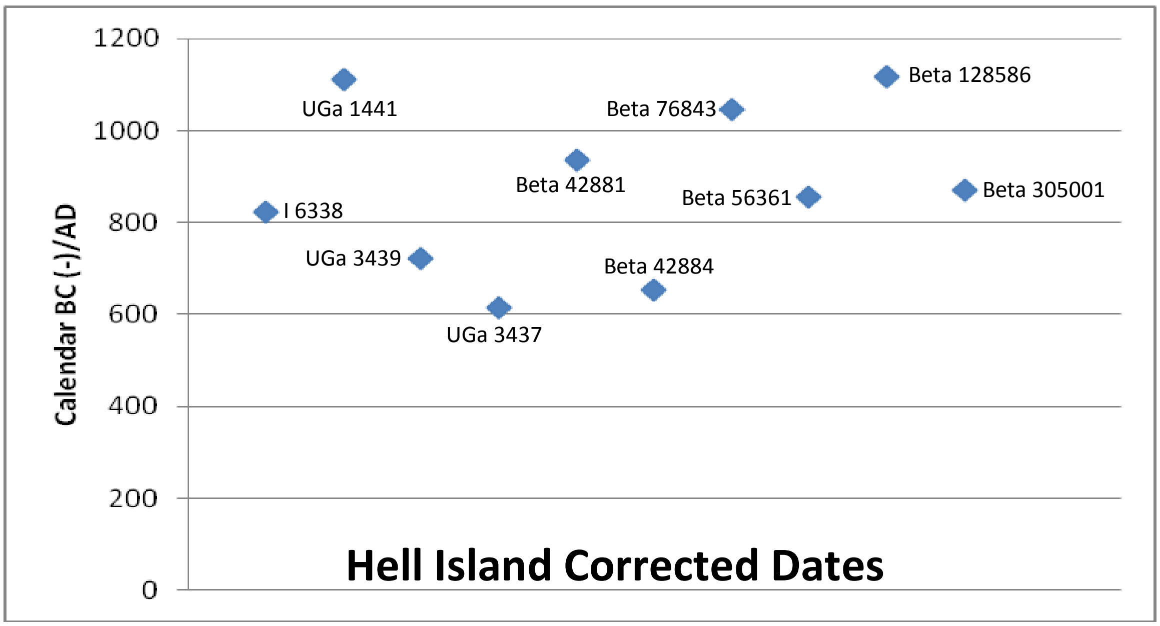

Figure 4

Keyser Farm

There is one reported date for Keyser Farm ceramics (Figure 5). The calibrated 2 sigma date is cal AD 1466 to cal AD 1664, which is well within the accepted range for these ceramics (Wall 2001). The type is very rare in Delaware occurring only at the Robbins Farm site in southern Kent County (Stocum 1977). Its presence likely represents the relocation of a small group or family moving into the area in the 16^{th} century AD. The presence of the ceramics is not likely the result of trade, as trading relationships between western Maryland and central Delaware should be manifested at more than one site and in more ways than a single artifact class.

Figure 5

Killens

There are six reported dates for Killens ceramics (Figure 6). One date (Beta-42882) has a standard deviation of ±170, which calls into question the accuracy of the date. The large standard deviation was likely caused by a wood charcoal sample smaller than the recommended size for the analysis. Another date from the Gray Farm site (Beta-307304) has a CRA = 3270±30 producing a 2 sigma date range of cal B.C. 1622 to cal B.C. 1458. The one Killens sherd in the context is likely an intrusion into a much earlier feature and this date is not used in the scatter plot (Figure 6) or the calibrated ceramic type date range summary (Figure 15). The 2 sigma range of the remaining four dates is cal AD 1286 to cal AD 1706. Killens ceramics is a late Woodland II ware contemporary with Townsend ceramics in central and southern Delaware.

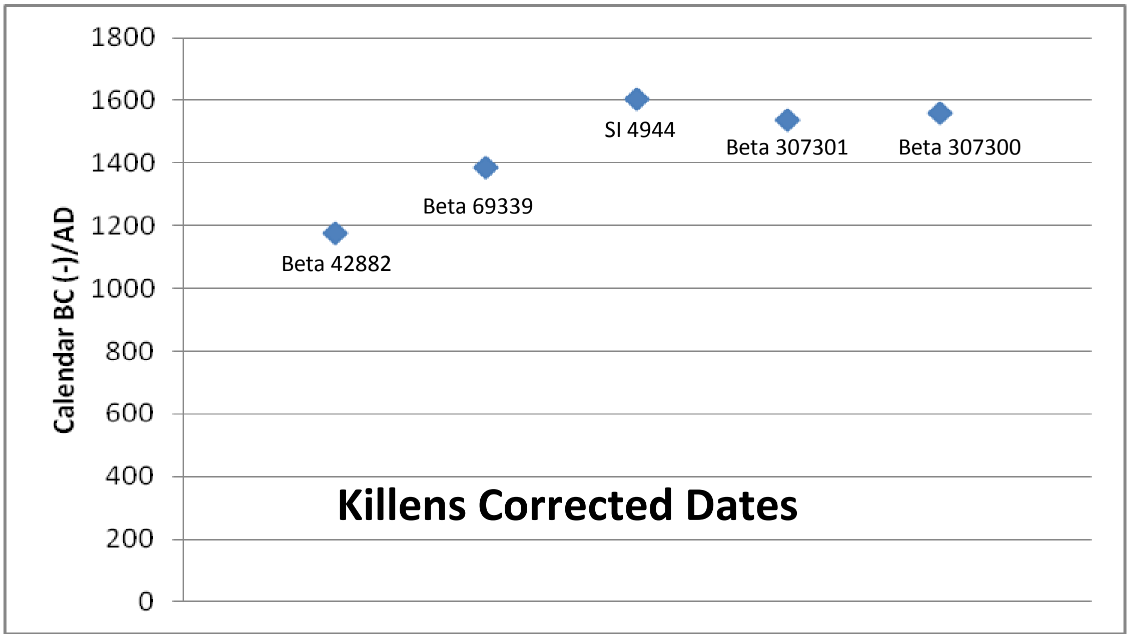

Figure 6

Marcey Creek

Seven dates are reported for Marcey Creek ceramics. The scatter plot shows two clusters of dates without a 2 sigma overlap (Figure 7). The authors of the report containing Beta-56360 and Beta-56361 state that the dates are too recent for Marcey Creek ceramics (Custer and Silber 1995:103). It is likely that wood charcoal from more recent components was incorporated into the sample submitted for analysis. The dates are more consistent with dates for Mockley and Hell Island ceramics, but there is no evidence these types were present in the dated contexts. It is possible that the ceramics were misidentified, but it is not likely as Marcey Creek ceramics have distinct defining attributes.

One date, Beta-149987, falls within the accepted range of Marcey Creek ceramics. The 2 sigma date range is cal BC 1319 to cal BC 1110. This range is consistent with the radiocarbon date range in the region (Dent 1995:226). Two other dates (Beta-128589 and Beta-117149) from the Hickory Bluff site are at the more recent end of the accepted range, overlap the range of dates for Selden Island ceramics and may represent the end of Marcey Creek manufacture in the area. Two dates from the Gray Farm Site (Beta-304997 and Beta-307658) are at the very early end of the accepted range in the region for Marcey Creek ceramics. The earliest date (Beta-307658) is a direct dating of the ceramics by bulk sherd organics and is considered accurate and precise. The two dates are included in the scatter plot (Figure 7) and the ceramic date range summary (Figure 15) as references for further discussion.

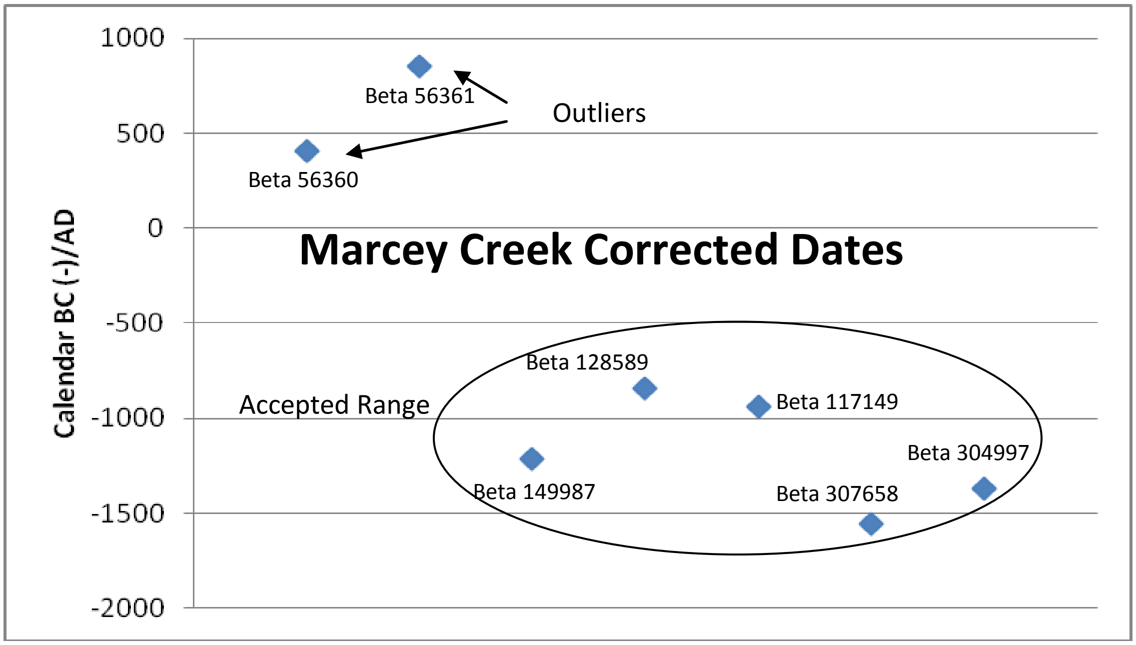

Figure 7

Mockley

Eighteen dates are reported for Mockley ceramics. The scatter plot exhibits a consistent cluster of calibrated dates with a 2 sigma range for the type from cal AD 47 to cal AD 1106 (Figure 8). Ruling out two dates with large standard deviations (UGa-1273b and Beta-42883), the resulting 2 sigma range for the type is cal AD 47 to cal AD 993.

Five dates (SI-4942, UGa-1762, Beta-76644, Beta-309416 and Beta-76838) were from features where Coulbourn ceramics also occurred and for UGa-1762 Coulbourn and Wilgus ceramics were in the same context with the Mockley ceramics. In reviewing the published reports for these dates, it was noted that for UGa-1762 Mockley ceramics were dominant in the context. I consider UGa-1762 a precise Mockley date and it is included in the ceramics type summary. The context for the Gray Farm Site producing the radiocarbon date (Beta-309416) also included Coulbourn and Townsend ceramics. As the context is mixed and Coulbourn ceramics are dominant, it is likely the date was derived from a blend of charcoal and it is not used in the scatter plot (Figure 8) or the ceramic type date range summary (Figure 15). In discussing the three other dates, the reports simply note that Mockley and Coulbourn ceramics were found in the dated context. It is possible that Mockley and Coulbourn ceramics were contemporary and these three dates represent a later expression of Coulbourn ceramics. It is equally likely that the dates represent Mockley producing components where earlier Coulbourn ceramics were incorporated into the feature when filled. A re-analysis of each context may or may not answer this question. Future excavations of Mockley-bearing contexts should be open to either hypothesis and field strategies designed to answer this question. For the purposes of the Mockley chronological summary chart, these dates are included as Mockley ceramics were clearly present in the dated contexts.

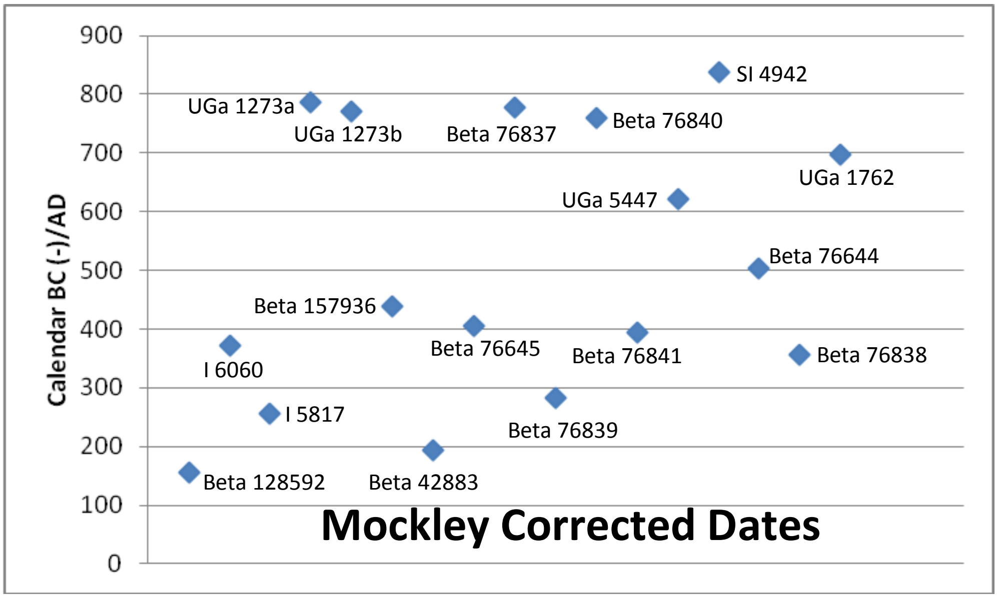

Figure 8

Nassawongo

Two dates are reported for Nassawongo ceramics. The authors of the report containing the dates state that both dates are too recent for the type (Custer, Watson and Silber 1995:243). Nassawongo ceramics have an expected date range around cal BC 500 (Custer 1984:183), while the reported dates from Delaware have a combined 2 sigma range of cal AD 501 to cal AD 1817 (Figure 9). In addition, the standard deviation of the CRA's for these dates is great than or equal to ±100, which calls into question the accuracy of the dates. These dates are considered neither accurate nor precise. Consequently, a Nassawongo ceramics type chronological summary is not included in this report.

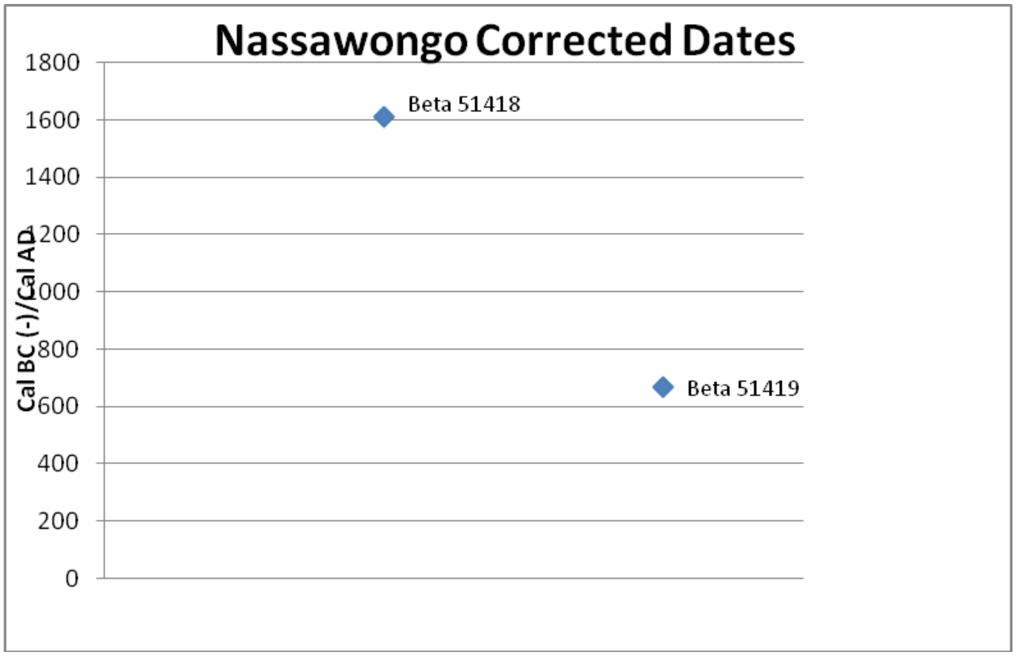

Figure 9

Potomac Creek

There is one reported radiocarbon date for Potomac Creek ceramics (UGa-1761). The calibrated 2 sigma calendar date range is cal AD 1446 to cal AD 1664 (Figure 10). This date range is well within the reported date range for Potomac Creek ceramics in the Middle Atlantic (Dent 1995:246). Keyser Farm ceramics were also present in the dated context and the two types should be considered contemporary. Potomac Creek ceramics, like Keyser Farm, are very rare in Delaware. Their presence is likely the result of the relocation of a small group or family from the central western shore of the Chesapeake Bay sometime during the 16th century AD.

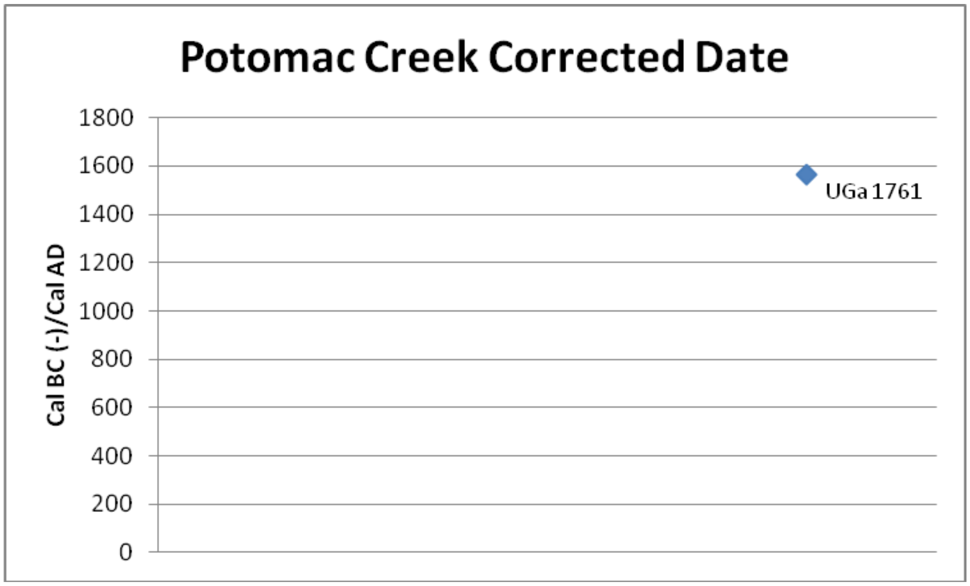

Figure 10

Selden Island

Five dates are reported for Selden Island ceramics. One date (Beta-52097) has a 2 sigma calibrated date range is cal AD 209 to cal AD 652. The published report states that the date is too recent for the type (Custer, Watson and Silber 1995:243). The standard deviation for the date is ±120, which calls into question the accuracy of the date. The reported date is well beyond the accepted date range from cal BC 1000 to cal BC 700 (Artusy 1976). This date is not used in the Selden Island scatter plot (Figure 11) or in the date range summary for Selden Island ceramics in Delaware (Figure 15). Four dates for Selden Island ceramics were obtained from the research at the Gray Farm Site. One date (Beta-304998) has a calibrated age range of cal B.C. 2872 to cal B.C. 2577 and is well beyond the accepted range for the type and likely resulted from Selden Island ceramics intruding into a much earlier feature. Three dates (Beta-307657, Beta-307656 and Beta-304999) form a consistent cluster in the scatter plot. Two dates (Beta-307656 and Beta-307657) are from bulk sherd organics and are considered accurate and precise. All three dates are used to produce the ceramic type summary chart (Figure 15). The 2 sigma calibrated date range for Selden Island ceramics is cal B.C. 1195 to cal B.C. 811.

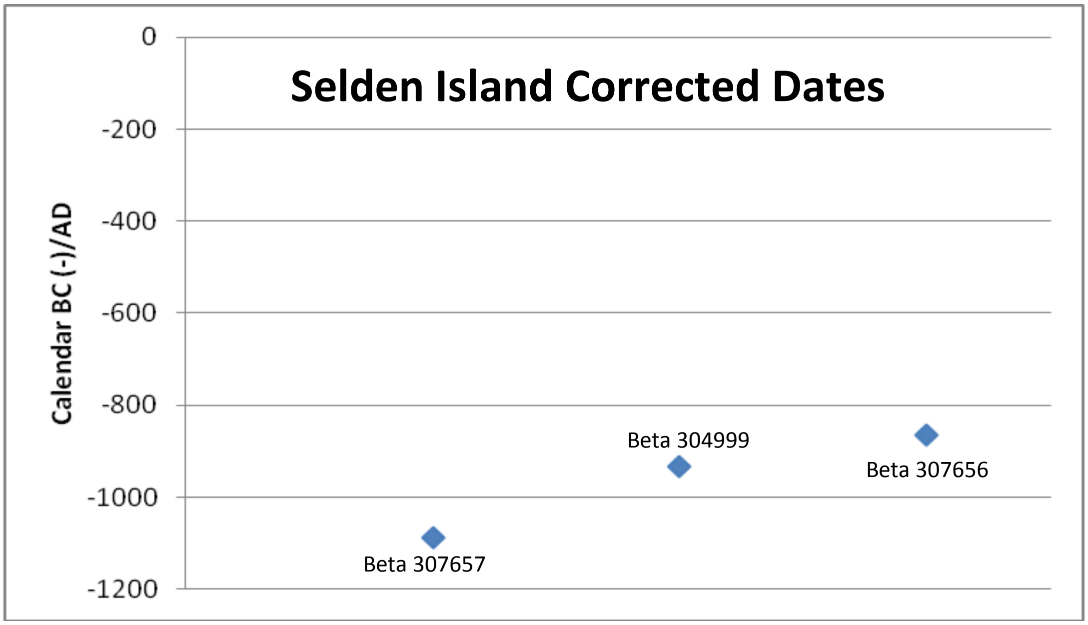

Figure 11

Townsend

There are fifteen reported dates for Townsend ceramics (Figure 12). The mid-points of the calibrated dates cluster tightly with a combined 2 sigma date range of cal AD 941 to cal AD 1706. The standard deviations of all dates are less than ±100, which leads to the conclusion that the dates are highly accurate. The lack of other ceramic associations in the dated contexts, with three exceptions, indicates the dates are precise in dating the temporal range of Townsend ceramics. The three exceptions (SI-4944, Beta-307300 and Beta-307301), contain Killens ceramics in the same context. One date is from the Slaughter Creek site (Custer 1989:353), while the remaining two are from the Gray Farm Site. As Killens ceramics are contemporary with Townsend ceramics, and may be considered a regional variant of Townsend, this date can be considered precise for both Killens and Townsend ceramics. The Townsend date on wood charcoal from the Island Field site (Beta-29737) was questioned in comparison to the shell date (Beta-29738) in the same context. While it seems that the wood charcoal sample may have been contaminated by earlier charcoal, the resulting calibrated 2 sigma date range is well within the range for Townsend ceramics. As the date may be both accurate and precise, it will be retained for the summary analysis. All reported Townsend dates are used in producing the chronological summary for the type.

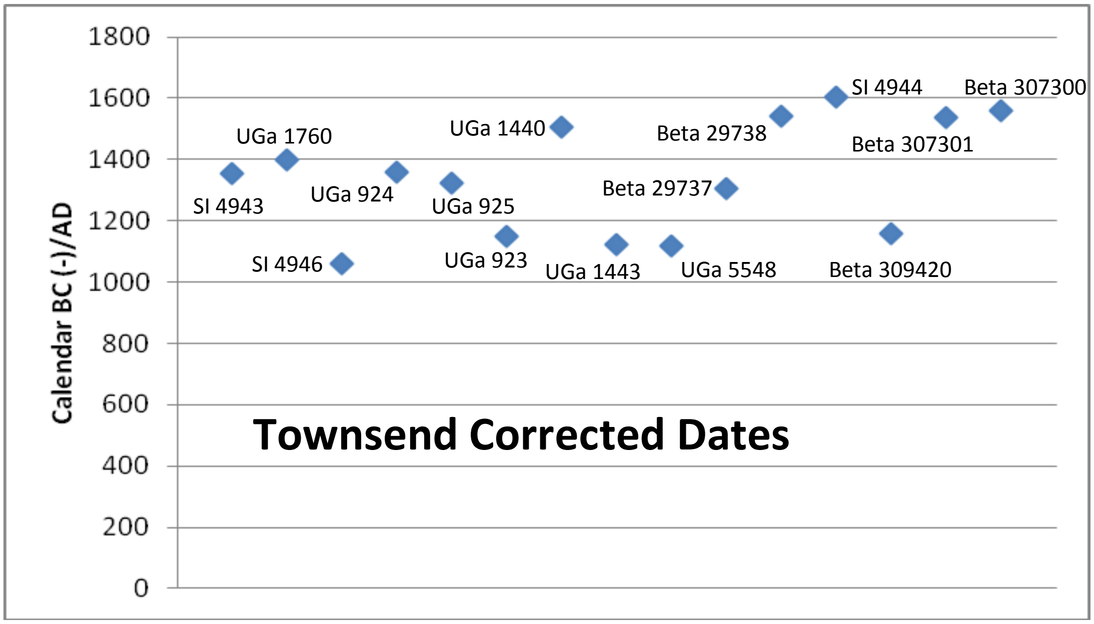

Figure 12

Wilgus

Two dates are reported for Wilgus ceramics (UGa-1762 and UGa-1763). The report notes that both dates are too recent for Wilgus ceramics (Custer 1983:39). However, the dominant ceramic type in the UGa-1762 context was Mockley while the dominant ceramic in the UGa-1763 context was Coulbourn. It is likely these dates are precise for those types. Wilgus ware is a cord marked or net impressed ceramic tempered with clay nodules/grog and shell, while Mockley is tempered with shell only and Coulbourn is tempered with clay nodules/grog only. Wilgus ware has been offered as a transitional type between Coulbourn and Mockley (Custer 1983:39). While this is possible, it is equally likely that Wilgus ware is simply a variant within Coulbourn and Mockley wares and not a separate type with a distinct geographic distribution and temporal range. The two reported dates suggest the latter interpretation (Figure 13). The temporal framework summary does not include Wilgus ware for these reasons.

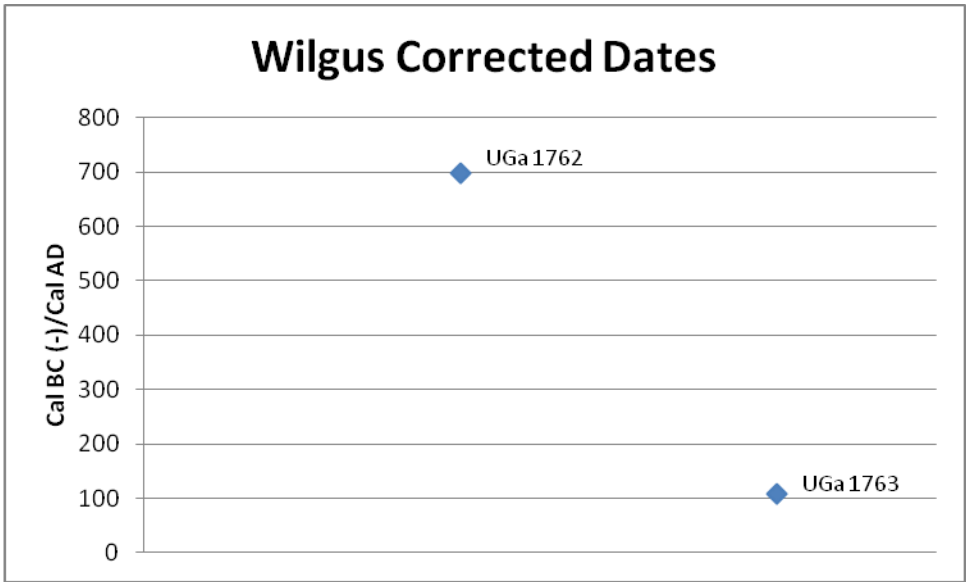

Figure 13

Wolfe Neck

There are eight reported radiocarbon dates for Wolfe Neck ceramics (Figure 14). The scatter plot of the calibrated mid-points exhibit a cluster of five dates that likely represent the temporal range of Wolfe Neck ceramics (Beta-141542, I-6891, UGa-1223, Beta-309419 and Beta-42879). The 2 sigma calibrated range for Wolfe Neck ceramics based on these five dates is cal BC 782 to cal AD 74 (Appendix 2). Three reported dates, UGa-1763, Beta-304999 and Beta 52097, appear to be outliers. A re-analysis of the context containing the date for UGa-1763 reveals Coulbourn ceramics as the dominant type. This date is incorporated into the discussion of Coulbourn ceramics. It is possible that Wolfe Neck and Coulbourn ceramics were briefly contemporary, but further research is needed, as this is the only reported case of this association. The date for UGa-1763 is not used in producing the temporal summary for Wolfe Neck ceramics. Beta-52097 is reported to be too recent for Wolfe Neck (Custer, Watson and Silber 1995:243). The standard deviation for the date is ±120, which indicates that the date is not very accurate for reasons previously stated. Beta-52097 is not used in producing the chronological summary for Wolfe Neck ceramics. Beta-304999 from the Gray Farm Site is from a context that includes Selden Island ceramics and the associated radiocarbon date likely represents that component. This date is not used in the Wolfe Neck scatter plot (Figure 14) or in the ceramic type date range summary (Figure 15). Beta-309419 is from a cultural feature at the Gray Farm site and is considered both accurate and precise for the type.

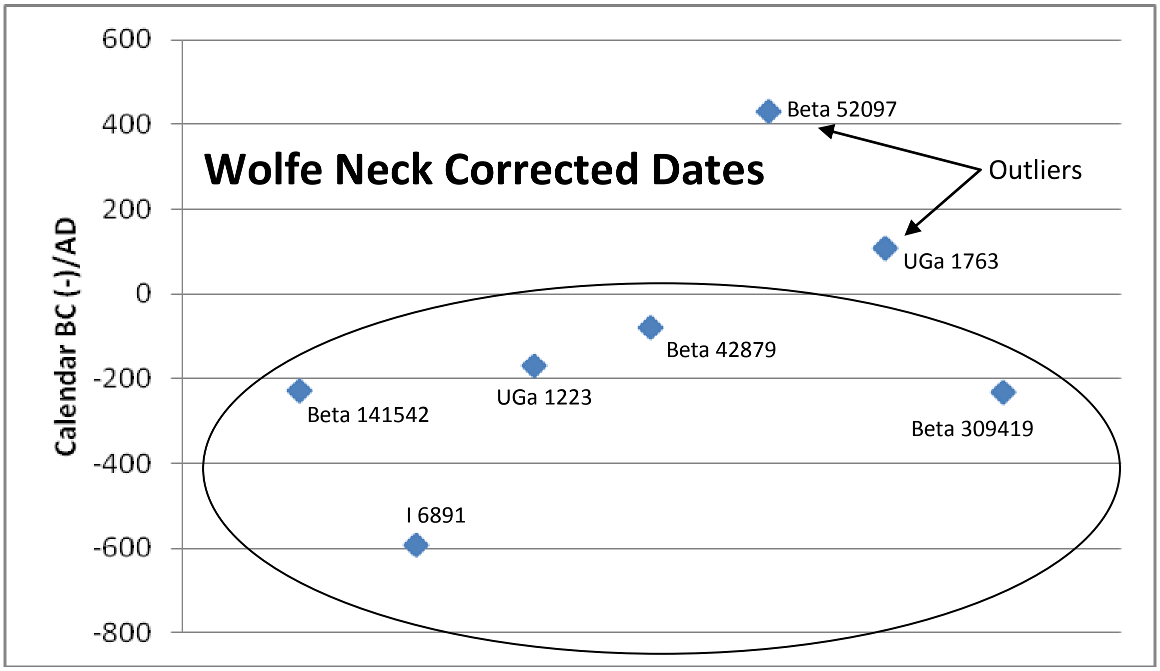

Figure 14

Temporal Range of American Indian Ceramics in Delaware

The temporal ranges for radiocarbon dated American Indian ceramics is illustrated by a summary chart (Figure 15) and associated data table (Appendix 2). The temporal range for each type is established using the combined 2 sigma date ranges of the component types that are considered both accurate and precise. The chart also plots the earliest and most recent mid-points of the 2 sigma range for each type, where there is more than one date for the type. Radiocarbon dates with standard deviations greater than or equal to ±100 or where the precision of the date has been questioned were not used to produce the summary chart or included in the associated data table in Appendix 2. The data for the chart is in Table B, Figures 1-14, Appendix 2 and the accompanying text for each ceramic type.

The geographic location of sites producing radiocarbon dates associated with American Indian ceramics is illustrated in Figure 16.

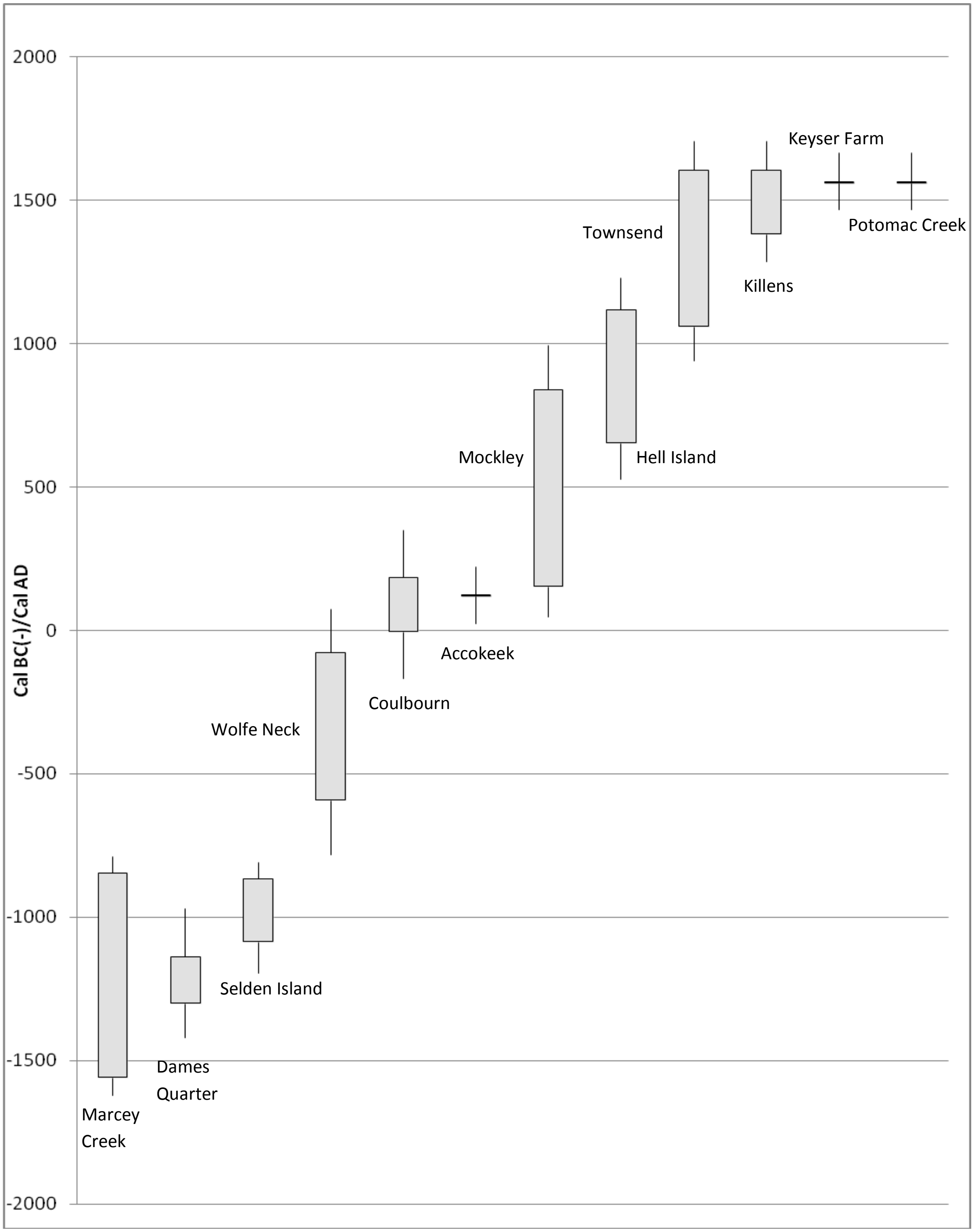

Figure 15 Delaware American Indian Ceramics Calibrated Date Range Summary

(Shaded areas are the mid-point ranges; extensions are the maximum 2 sigma ranges)

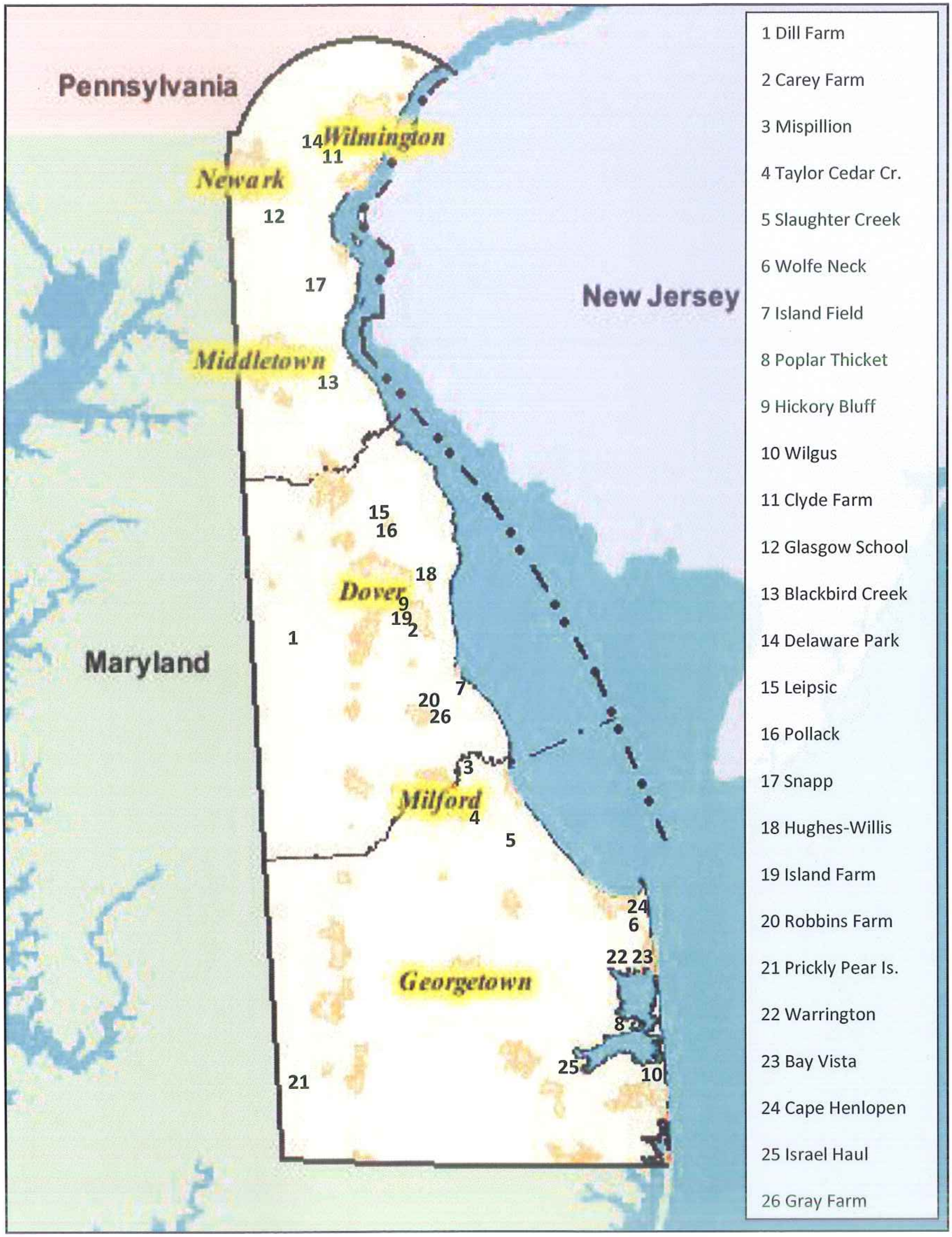

Figure 16 Site locations of radiocarbon dated American Indian ceramics in Delaware.

Table A

:arbon Dates for American Indian Ceramics

esported in the Literature

Lab Code	Excavation Sample	Site Name	Material (species) Dated	Analysis	Conventional Radiocarbon Age	Isotopic Fraction	Calibration Used	Reported Date	2 Sigma Range	Ceramic Associations	References	Notes
Beta - 52096	7K-C-13; Fea. 112	Island Farm	Charcoal	Radiometric	1900±140	NR	NR	**cal AD 107**	cal AD 91: cal AD 317	Accokeek	Custer, Watson and Silber 1995	date too late for Accokeek
Beta - 77643	7S-G-141; Feature 1	Wolfe Neck MAAR	Shell (NR)	Radiometric	2180±60 BP	1.5	Marine 93	**cal AD 190**	cal AD 120: cal AD 260	Coulbourn	Hoffman, Wagner, Rouse, Classen and Moeller 1997	
Beta - 77642	7S-G-141; Feature 1	Wolfe Neck MAAR	Charcoal	Radiometric	1840±70 BP	-25	N.Hemisph. Extended 93	**cal AD 210**	cal AD 100: cal AD 250	Coulbourn	Hoffman, Wagner, Rouse, Classen and Moeller 1997	
Beta - 141000	7K-C-411; N366 E648 Strat B, Lvl. 2	Hickory Bluff	Organic Residue	AMS	1930±40 BP	NR	NR	NR	cal BC 5: cal AD 140	Coulbourn	Petraglia, Bupp, Fitzell and Cunningham 2002	
Beta - 141001	7K-C-411; N314 E673 Fea. 415	Hickory Bluff	Organic Residue	AMS	1980±40 BP	NR	NR	NR	cal BC 55: cal AD 95	Coulbourn	Petraglia, Bupp, Fitzell and Cunningham 2002	
Uga - 1224	7S-D-10	Wolfe Neck SOA	Shell (NR)	Radiometric	2325±65	NR	None	cal BC 375	NR	Coulbourn	Artusy, 1976	
Beta - 76842	7K-D-3; South Central, Fea. 686	Carey Farm UD	Charcoal	Radiometric	1260±70	NR	NR	**cal AD 775**	cal AD 680: cal AD 875	Coulbourn	Custer, Watson and Silber 1995	report notes date is somewhat late for Coulbourn
Beta - 309416	7K-F-11; Feature 3	Gray Farm	Charcoal	AMS	1140±30	-26.3	INTCAL09	NR	cal AD 780: cal AD 980	Coulbourn, Mockley and Townsend	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 3 is non-cultural. Two sigma range includes break between AD 790 and 810
UGa - 1763	7S-K-21; Unit 2, 76/102/16	Wilgus	Shell(mercenaria)	Radiometric	2240±60 BP	NR	NR	cal BC 290	NR	Coulbourn, Wilgus and Wolfe Neck	Artusy 1978	Custer 1983 using Artsuy 1978 defines Wilgus Ware; Coulbourn dominant in context
UGa - 5376	7NC-E-6a	Clyde Farm	Charcoal	Radiometric	2955±90	NR	NR	cal BC 1005	NR	Dames Quarter	Custer, Watson and DeSantis 1986	
Beta - 157390	7NC-D-212; N112/E520 Str. I, Lev.5, Fea. 9	Glasgow School	Charcoal	AMS	2980±40	-26.8	INTCAL98	**cal BC 1210**	cal BC 1360: cal BC 1060	Dames Quarter	Bowen, O'Neill and Crowell 2003	
Beta - 157391	7NC-D-212; N111/E519 Str. I, Lev 5, Fea. 9	Glasgow School	Charcoal	AMS	3030±40	-26.9	INTCAL98	**cal BC 1290**	cal BC 1400: cal BC 1140	Dames Quarter	Bowen, O'Neill and Crowell 2003	
Beta - 149986	7NC-J-195D; Fea. 52	Blackbird Creek	Charcoal (oak)	AMS	3020±40	NR	NR	NR	cal BC 1390: cal BC 1130	Dames Quarter	Versar (2011 Draft)	
Beta - 149988	7NC-J-195D; Fea. 96	Blackbird Creek	Charcoal (hickory)	AMS	3020±60	NR	NR	NR	cal BC 1410: cal BC 1060	Dames Quarter	Versar (2011 Draft)	
Beta - 149990	7NC-J-195D; Fea. 170	Blackbird Creek	Charcoal (white oak)	AMS	2930±40	NR	NR	NR	cal BC 1270: cal BC 1000	Dames Quarter	Versar (2011 Draft)	
Beta - 149987	7NC-J-195D; Fea. 95	Blackbird Creek	Charcoal (hickory)	AMS	2980±40	NR	NR	NR	cal BC 1360: cal BC 1060	Dames Quarter and Marcey Creek	Versar (2011 Draft)	2 sigma has two ranges; range shown is maximum
Beta - 307655	7K-F-11; Feature 12	Gray Farm	Bulk sherd organics	AMS	2930±30	-27.8	INTCAL09	NR	cal BC 1260: cal BC 1020	Dames Quarter Cord-Marked	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 12 is non-cultural; two sigma range includes break between BC 1230 -1220
I-6338	7K-F-17; in situ cremation	Island Field	Cremated Human Bone	Radiometric	1210±90	NR	NR	cal AD 740	NR	Hell Island	Thomas and Warren, 1970	
UGa - 1441	7S-C-17; cat. no. 52	Taylor Cedar Creek	Shell (NR)	Radiometric	1305±55	NR	NR	cal AD 645	NR	Hell Island	Artusy 1976	
UGa - 3439	7NC-E-41	Delaware Park Site	Charcoal	Radiometric	1310±155	NR	NR	cal AD 640	NR	Hell Island	Thomas 1981	
UGa - 3437	7NC-E-41	Delaware Park Site	Charcoal	Radiometric	1345±400	NR	NR	cal AD 605	NR	Hell Island	Thomas 1981	
Beta - 42881	7K-C-194A; Fea. 255/256 Area A	Leipsic	Charcoal	Radiometric	1080±130	NR	NR	NR	cal AD 114: cal AD 778	Hell Island	Custer, Riley and Mellin 1996	
Beta - 42884	7K-C-194A; Fea. 266	Leipsic	Charcoal	Radiometric	1400±80	NR	NR	NR	cal AD 576: cal AD 674	Hell Island	Custer, Riley and Mellin 1996	
Beta - 76843	7K-D-3; South, Fea. 2031	Carey Farm UD	Charcoal	Radiometric	1010±60	NR	NR	**cal AD 1020**	cal AD 990: cal AD 1040	Hell Island	Custer, Watson and Silber 1995	
Beta-128586	7K-C-411; Feature 120	Hickory Bluff	Charcoal	AMS	920±50	NR	NR	NR	NR	Hell Island	Petraglia, Bupp, Fitzell and Cunningham 2002	
Beta - 305001	7K-F-11; Feature 295	Gray Farm	Charcoal	AMS	1170±30	-25.8	INTCAL09	NR	cal AD 780: cal AD 960	Hell Island	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 295 is cultural
Beta - 42882	7K -C-194A; Fea. 255/256 Area D	Leipsic	Charcoal	Radiometric	770±170	NR	NR	NR	cal AD 1040: cal AD 1390	Killens	Custer, Riley and Mellin 1996	
Beta - 69339	7K-C-203; Fea. B218	Pollack	Charcoal	Radiometric	530±70	NR	NR	**cal AD 1409**	cal AD 1280: cal AD 1470	Killens	Custer, Hoseth, Silber, Grettler and Mellin 1994	
Beta - 307304	7K-F-11; Feature 233	Gray Farm	Charcoal	AMS	3270±30	-25.6	INTCAL09	NR	cal BC 1620: cal BC 1460	Killens	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 233 is cultural. Two sigma range includes break between BC 1490 and 1470
Beta - 309420	7K-F-11; Feature 236	Gray Farm	Charcoal	AMS	850±30	-25.7	INTCAL09	NR	cal AD 1160: cal AD 1260	Killens and Townsend	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 236 is non-cultural.
Beta - 56360	7NC-G-101; Fea. 206	Snapp	Charcoal	Radiometric	1640±70	NR	CALIB 1986	**cal AD 411**	cal AD 262: cal AD 531	Marcey Creek	Custer and Silber 1995	noted in report that date is too late for Marcey Creek
Beta- 128589	7K-C-411; Locus A, Block 1 & Fea. 98	Hickory Bluff	Charcoal	AMS	2660±40	NR	NR	NR	NR	Marcey Creek	Petraglia, Bupp, Fitzell and Cunningham 2002	
Beta- 117149	7K-C-411; Feature 2	Hickory Bluff	Charcoal	AMS	2790±40	NR	NR	NR	NR	Marcey Creek	Petraglia, Bupp, Fitzell and Cunningham 2002	
Beta - 304997	7K-F-11; Feature 180	Gray Farm	Charcoal	AMS	3100±30	-27.1	INTCAL09	NR	cal BC 1430: cal BC 1310	Marcey Creek	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 180 is non-cultural
Beta - 307658	7K-F-169; Test Unit 38	Gray Farm	Bulk sherd organics	AMS	3260±30	-25.6	INTCAL09	NR	cal BC 1610: cal BC 1450	Marcey Creek	Diamanti, Hay, Rue, Stiteler and Griffith 2012	T.U.38 is non-cultural; Two sigma range includes break between BC 1490 and 1480
Beta - 56361	7NC-G-101; Fea. 142/193	Snapp	Charcoal	Radiometric	1150±80	NR	CALIB 1986	**cal AD 889**	cal AD 775: cal AD 984	Marcey Creek/Hell Island	Custer and Silber 1995	noted in report that date is too late for Marcey Creek
Beta - 128592	7K-C-411; N389 E624 Strat B, Lvl. 2	Hickory Bluff	Organic Residue	AMS	1850±60 BP	NR	NR	NR	cal AD 45: cal AD 330	Mockley	Petraglia, Bupp, Fitzell and Cunningham 2002	
I- 6060	7K-D-21	Hughes-Willis	Charcoal	Radiometric	1650±110	NR	NR	cal AD 300	NR	Mockley	Artusy 1976	
I - 5817	7K-D-3	Carey Farm SOA	Charcoal	Radiometric	1750±90	NR	NR	cal AD 200	NR	Mockley	Artusy 1976	
UGa - 1273a	7S-D-10	Wolfe Neck SOA	Shell (NR)	Radiometric	1620±65	NR	None	cal AD 330	NR	Mockley	Griffith and Artusy, 1977	
UGa - 1273b	7S-D-10	Wolfe Neck SOA	Shell (NR)	Radiometric	1625±160	NR	None	cal AD 325	NR	Mockley	Griffith and Artusy, 1977	duplicate run of UGa - 1273a
Beta - 157936	7NC-D-212; N201/E413 Str. B, Lev. 1	Glasgow School	Organic Residue	AMS	1630±60	-32.1	INTCAL98	**cal AD 420**	cal AD 260: cal AD 560	Mockley	Bowen, O'Neill and Crowell 2003	
Beta - 42883	7K-C-194A; Fea. 77, Lev. 3	Leipsic	Charcoal	Radiometric	1820±110	NR	NR	NR	cal AD 60: cal AD 340	Mockley	Custer, Riley and Mellin 1996	
Beta - 76645	7K-D-3; South Central, Fea. 623	Carey Farm UD	Charcoal	Radiometric	1640±70	NR	NR	**cal AD 420**	cal AD 370: cal AD 530	Mockley	Custer, Watson and Silber 1995	
Beta - 76837	7K-D-3; South Central, Fea. 371	Carey Farm UD	Charcoal	Radiometric	1240±60	NR	NR	**cal AD 785**	cal AD 695: cal AD 881	Mockley	Custer, Watson and Silber 1995	
Beta - 76839	7K-D-3; South Central, Fea. 440	Carey Farm UD	Charcoal	Radiometric	1720±60	NR	NR	**cal AD 350**	cal AD 245: cal AD 410	Mockley	Custer, Watson and Silber 1995	
Beta - 76840	7K-D-3; South Central, Fea. 465	Carey Farm UD	Charcoal	Radiometric	1300±60	NR	NR	**cal AD 695**	cal AD 665: cal AD785	Mockley	Custer, Watson and Silber 1995	
Beta - 76841	7K-D-3; South Central, Fea. 608	Carey Farm UD	Charcoal	Radiometric	1660±50	NR	NR	**cal AD 410**	cal AD 370: cal AD 435	Mockley	Custer, Watson and Silber 1995	
UGa - 5447	7S-D-9; Fea. 5	Cape Henlopen	Charcoal	Radiometric	1400±50	NR	NR	NR	NR	Mockley	Custer and Mellin 1987	
SI - 4942	7S-C-1b; Feature 6	Slaughter Creek	Charcoal	Radiometric	1175±75	NR	NR	cal AD 775	NR	Mockley and Coulbourn	Custer 1989	may be Coulbourn intrusion into Mockley feature
Beta - 76644	7K-D-3; South Central, Fea. 358	Carey Farm UD	Charcoal	Radiometric	1560±50	NR	NR	**cal AD 535**	cal AD 435: cal AD 575	Mockley and Coulbourn	Custer, Watson and Silber 1995	may be Coulbourn intrusion into Mockley feature
Beta - 76838	7K-D-3; South Central, Fea. 427	Carey Farm UD	Charcoal	Radiometric	1680±60	NR	NR	**cal AD 590**	cal AD 535: cal AD 635	Mockley and Coulbourn	Custer, Watson and Silber 1995	may be Coulbourn intrusion into Mockley feature
UGa - 1762	7S-K-21; Unit 17, Lev. 3, 76/102/2	Wilgus	Shell (mercenaria)	Radiometric	1710±70 BP	NR	NR	cal AD 240	NR	Mockley, Wilgus and Coulbourn	Artusy 1978	Custer 1983 using Artsuy 1978 defines Wilgus Ware; Mockley dominant in context
Beta - 51418	7K-C-13; Fea. 1128	Island Farm	Charcoal	Radiometric	330±110	NR	NR	**cal AD 1590**	cal AD 1440: cal AD 1660	Nassawongo	Custer, Watson and Silber 1995	report notes date is too late for Nassawongo
Beta - 51419	7K-C-13; Fea. 1210	Island Farm	Charcoal	Radiometric	1390±100	NR	NR	**cal AD 664**	cal AD 560: cal AD 759	Nassawongo	Custer, Watson and Silber 1995	report notes date is too late for Nassawongo
UGa - 1761	7K-F-12; Feature 1, Sec. 2, Lev. 2	Robbins Farm	Shell (crassostrea)	Radiometric	750±55	NR	None	cal AD 1200	NR	Potomac Creek and Keyser Farm	Stocum 1977	both ceramic types in same level
Beta - 304998	7K-F-11; Feature 185	Gray Farm	Charcoal	AMS	4120±40	-25.5	INTCAL09	NR	cal BC 2870: cal BC 2570	Selden Island	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 185 is cultural
Beta - 307657	7K-F-11; Feature 195	Gray Farm	Bulk sherd organics	AMS	2890±30	-27.3	INTCAL09	NR	cal BC 1190: cal BC 1140	Selden Island	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 195 is cultural; Two sigma range includes break between BC 1130 and 1000
Beta - 307656	7K-F-11; Feature 185	Gray Farm	Bulk sherd organics	AMS	2710±30	-25.5	INTCAL09	NR	cal BC 910: cal BC 810	Selden Island	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 185 is cultural
Beta - 52097	7K-C-13; Fea. 134	Island Farm	Charcoal	Radiometric	1610±120	NR	NR	**cal AD 426**	cal AD 260: cal AD 570	Selden Island/Wolfe Neck	Custer, Watson and Silber 1995	report notes that date is too late for the types
SI - 4943	7S-C-30a; Feature 2	Slaughter Creek	Charcoal	Radiometric	605±60	NR	NR	cal AD 1345	NR	Townsend	Custer 1989	
UGa - 1760	7S-H-18; Feature 3	Prickly Pear Island	Shell (crassostrea)	Radiometric	935±55	NR	NR	cal AD 1015	NR	Townsend	Custer 1989	
SI - 4946	7S-C-30c; Feature 2	Slaughter Creek	Charcoal	Radiometric	995±60	NR	NR	cal AD 955	NR	Townsend	Custer 1989	
UGa - 924	7S-G-22; Feature 3, Sec. 3, Lev. 1	Poplar Thicket	Charcoal	Radiometric	580±60	NR	None	cal AD 1370	NR	Townsend	Artusy, 1976	
UGa - 925	7S-G-14; Feature 7, Sec. 1, Lev. 1	Warrington	Charcoal	Radiometric	665±85	NR	None	cal AD 1285	NR	Townsend	Griffith 1977	
UGa - 923	7S-A-1; Feature 15, cat. no. 36	Mispillion	Charcoal	Radiometric	865±75	NR	None	cal AD 1085	NR	Townsend	Griffith 1977	zoned incised pipe bowl associated
UGa - 1440	7S-G-26; cat. no. 15	Bay Vista	Shell (crassostrea)	Radiometric	850±55	NR	None	cal AD 1100	NR	Townsend	Griffith 1977	
UGa - 1443	7S-G-22; Feature 4, Sec. 4, Lev. 3	Poplar Thicket	Charcoal	Radiometric	905±55	NR	None	cal AD 1045	NR	Townsend	Griffith 1977	
UGa - 5548	7S-K-35; Fea.1	Israel Haul 1	Charcoal	Radiometric	930±55	NR	NR	**cal AD 1020**	NR	Townsend	Custer and Mellin 1987	Townsend incised motifs are complex
Beta - 29737	7K-F-17; Feature 119	Island Field	Charcoal	Radiometric	710±60 BP	NR	NR	**cal AD 1240**	cal AD 1260: cal 1377	Townsend	Custer, Rosenberg, Mellin and Washburn 1990	
Beta - 29738	7K-F-17; Feature 119	Island Field	Shell (NR)	Radiometric	800±70 BP	0.6	NR	**cal AD 1150**	cal AD 1219: cal 1282	Townsend	Custer, Rosenberg, Mellin and Washburn 1990	
Beta - 307300	7K-F-11; Feature 10	Gray Farm	Charcoal	AMS	330±30	-24.7	INTCAL09	NR	cal AD 1460: cal AD 1650	Townsend and Killens	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 10 is cultural
Beta - 307301	7K-F-11; Feature 10	Gray Farm	Shell (crassostrea)	AMS	790±30	-1.8	Marine09	NR	cal AD 1479: cal AD 1560	Townsend and Killens	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 10 is cultural; calibrated using global marine correction
SI - 4944	7S-C-30b; Feature 1	Slaughter Creek	Shell (NR)	Radiometric	680±50	NR	NR	cal AD 1270	NR	Townsend/Killens	Custer 1989	
Beta - 141542	7K-C-411; N370 E633 Strat A, Lvl. 2	Hickory Bluff	Organic Residue	AMS	2160±50 BP	NR	NR	NR	cal BC 375: cal BC 55	Wolfe Neck	Petraglia, Bupp, Fitzell and Cunningham 2002	
I - 6891	7K-E-12	Dill Farm	Charcoal	Radiometric	2450±85	NR	NR	cal BC 500	NR	Wolfe Neck	Artusy 1976	
UGa - 1223	7S-D-10	Wolfe Neck SOA	Shell (NR)	Radiometric	2455±60	NR	None	cal BC 505	NR	Wolfe Neck	Griffith and Artusy, 1977	
Beta - 42879	7K-C-194A; Fea. 314, Lev. 4	Leipsic	Charcoal	Radiometric	2070±70	NR	NR	NR	cal BC 199: cal AD 1	Wolfe Neck	Custer, Riley and Mellin 1996	noted in report as variant of Wolfe Neck
Beta - 309419	7K-F-11; Feature 197	Gray Farm	Charcoal	AMS	2160±30	-26.6	INTCAL09	NR	cal BC 350: cal BC 110	Wolfe Neck and Selden Island	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 197 is cultural; two sigma range has breaks
Beta - 304999	7K-F-11; Feature 195	Gray Farm	Charcoal	AMS	2790±40	-25.3	INTCAL09	NR	cal BC 1020: cal BC 840	Wolfe Neck, Selden Is. , Coulbourn	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 195 is cultural

NR = not reported

Reported Date is that reported in the publication; bold dates are intercepts reported. A single intercept is no longer reported.

Table B

bon Dates for American Indian Ceramics

Corrected Dates

Lab Code	Excavation Sample	Site Name	Material (species) Dated	Analysis	Conventional Radiocarbon Age	Isotopic Fraction	Calibration Used	Delta R	Delta R Err	2 Sigma Range	Probability (%)	Ceramic Associations	References	Notes
Beta - 52096	7K-C-13; Fea. 112	Island Farm	Charcoal	Radiometric	1900±140	NR	intcal09.14c	NA	NA	cal AD 23: cal AD 223	100.00	Accokeek	Custer, Watson and Silber 1995	report notes date too late for Accokeek
Beta - 77643	7S-G-141; Feature 1	Wolfe Neck MAAR	Shell (NR)	Radiometric	2180±60 BP	1.5	marine09.14c	none	none	cal AD 31: cal AD 339	100.00	Coulbourn	Hoffman, Wagner, Rouse, Classen and Moeller 1997	
Beta - 77642	7S-G-141; Feature 1	Wolfe Neck MAAR	Charcoal	Radiometric	1840±70 BP	-25	intcal09.14c	NA	NA	cal AD 23: cal AD 349	99.43	Coulbourn	Hoffman, Wagner, Rouse, Classen and Moeller 1997	
Beta - 141000	7K-C-411; N366 E648 Strat B, Lvl. 2	Hickory Bluff	Organic Residue	AMS	1930±40 BP	NR	intcal09.14c	NA	NA	cal BC 39: cal AD 139	97.24	Coulbourn	Petraglia, Bupp, Fitzell and Cunningham 2002	
Beta - 141001	7K-C-411; N314 E673 Fea. 415	Hickory Bluff	Organic Residue	AMS	1980±40 BP	NR	intcal09.14c	NA	NA	cal BC 55: cal AD 91	95.53	Coulbourn	Petraglia, Bupp, Fitzell and Cunningham 2002	
UGa - 1224	7S-D-10	Wolfe Neck SOA	Shell (NR)	Radiometric	2325±65	NR	marine09.14c	none	none	cal BC 168: cal AD 161	100.00	Coulbourn	Artusy, 1976	
Beta - 76842	7K-D-3; South Central, Fea. 686	Carey Farm UD	Charcoal	Radiometric	1260±70	NR	intcal09.14c	NA	NA	cal AD 649: cal AD 897	97.70	Coulbourn	Custer, Watson and Silber 1995	report notes date is somewhat late for Coulbourn
UGa - 1763	7S-K-21; Unit 2, 76/102/16	Wilgus	Shell(mercenaria)	Radiometric	2240±60 BP	NR	marine09.14c	none	none	cal BC 41: cal AD 260	100.00	Coulbourn, Wilgus & Wolfe Neck	Artusy 1978	Custer 1983 using Artsuy 1978 defines Wilgus Ware; Coulbourn dominant in context
UGa - 5376	7NC-E-6a	Clyde Farm	Charcoal	Radiometric	2955±90	NR	intcal09.14c	NA	NA	cal BC 1407: cal BC 970	97.38	Dames Quarter	Custer, Watson and DeSantis 1986	
Beta - 157390	7NC-D-212; N112/E520 Str. I, Lev.5, Fea. 9	Glasgow School	Charcoal	AMS	2980±40	-26.8	intcal09.14c	NA	NA	cal BC 1319: cal BC 1110	90.49	Dames Quarter	Bowen, O'Neill and Crowell 2003	
Beta - 157391	7NC-D-212; N111/E519 Str. I, Lev 5, Fea. 9	Glasgow School	Charcoal	AMS	3030±40	-26.9	intcal09.14c	NA	NA	cal BC 1407: cal BC 1191	95.92	Dames Quarter	Bowen, O'Neill and Crowell 2003	
Beta - 149986	7NC-J-195D; Fea. 52	Blackbird Creek	Charcoal (oak)	AMS	3020±40	NR	intcal09.14c	NA	NA	cal BC 1395: cal BC 1187	91.82	Dames Quarter	Versar (2011 Draft)	
Beta - 149988	7NC-J-195D; Fea. 96	Blackbird Creek	Charcoal (hickory)	AMS	3020±60	NR	intcal09.14c	NA	NA	cal BC 1419: cal BC 1111	98.03	Dames Quarter	Versar (2011 Draft)	
Beta - 149990	7NC-J-195D; Fea. 170	Blackbird Creek	Charcoal (white oak)	AMS	2930±40	NR	intcal09.14c	NA	NA	cal BC 1264: cal BC 1010	100	Dames Quarter	Versar (2011 Draft)	
UGa - 5377	7NC-E-6a	Clyde Farm	Charcoal	Radiometric	2955±91	NR	intcal09.14c	NA	NA	cal BC 1407: cal BC 971	98.76	Dames Quarter	Custer, Watson and DeSantis 1987	
Beta - 149987	7NC-J-195D; Fea. 95	Blackbird Creek	Charcoal (hickory)	AMS	2980±40	NR	intcal09.14c	NA	NA	cal BC 1319: cal BC 1110	90.49	Dames Quarter and Marcey Creek	Versar (2011 Draft)	
Beta - 307655	7K-F-11; Feature 12	Gray Farm	Bulk sherd organics	AMS	2930±30	-27.8	intcal09.14c	NA	NA	cal BC 1259: cal BC 1024	100.00	Dames Quarter Cord-Marked	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 12 is non-cultural
I-6338	7K-F-17; in situ cremation	Island Field	Cremated Human Bone	Radiometric	1210±90	NR	intcal09.14c	NA	NA	cal AD 659: cal AD 989	100.00	Hell Island	Thomas and Warren 1970	
UGa - 1441	7S-C-17; cat. no. 52	Taylor Cedar Creek	Shell (NR)	Radiometric	1305±55	NR	marine09.14c	none	none	cal AD 994: cal AD 1230	100.00	Hell Island	Artusy 1976	
UGa - 3439	7NC-E-41	Delaware Park Site	Charcoal	Radiometric	1310±155	NR	intcal09.14c	NA	NA	cal AD 423: cal AD 1022	100.00	Hell Island	Thomas 1981	
UGa - 3437	7NC-E-41	Delaware Park Site	Charcoal	Radiometric	1345±400	NR	intcal09.14c	NA	NA	cal BC 181: cal AD 1408	100.00	Hell Island	Thomas 1981	
Beta - 42881	7K-C-194A; Fea. 255/256 Area A	Leipsic	Charcoal	Radiometric	1080±130	NR	intcal09.14c	NA	NA	cal AD 683: cal AD 1190	99.16	Hell Island	Custer, Riley and Mellin 1996	
Beta - 42884	7K-C-194A; Fea. 266	Leipsic	Charcoal	Radiometric	1400±80	NR	intcal09.14c	NA	NA	cal AD 526: cal AD 779	93.58	Hell Island	Custer, Riley and Mellin 1996	
Beta - 76843	7K-D-3; South, Fea. 2031	Carey Farm UD	Charcoal	Radiometric	1010±60	NR	intcal09.14c	NA	NA	cal AD 932: cal AD 1162	92.67	Hell Island	Custer, Watson and Silber 1995	
Beta-128586	7K-C-411; Feature 120	Hickory Bluff	Charcoal	AMS	920±50	NR	intcal09.14c	none	none	cal AD 1023: cal AD 1213	100.00	Hell Island	Petraglia, Bupp, Fitzell and Cunningham 2002	
Beta - 305001	7K-F-11; Feature 295	Gray Farm	Charcoal	AMS	1170±30	-25.8	intcal09.14c	NA	NA	cal AD 776: cal AD 966	100.00	Hell Island	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 295 is cultural
Beta - 42882	7K -C-194A; Fea. 255/256 Area D	Leipsic	Charcoal	Radiometric	770±170	NR	intcal09.14c	NA	NA	cal AD 891: cal AD 1458	100.00	Killens	Custer, Riley and Mellin 1996	
Beta - 69339	7K-C-203; Fea. B218	Pollack	Charcoal	Radiometric	530±70	NR	intcal09.14c	NA	NA	cal AD 1286: cal AD 1481	100.00	Killens	Custer, Hoseth, Silber, Grettler and Mellin 1994	
Beta - 307304	7K-F-11; Feature 233	Gray Farm	Charcoal	AMS	3270±30	-25.6	intcal09.14c	NA	NA	cal BC 1622: cal BC 1458	100.00	Killens	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 233 is cultural; date too early for type
Beta - 309420	7K-F-11; Feature 236	Gray Farm	Charcoal	AMS	850±30	-25.7	intcal09.14c	NA	NA	cal AD 1052: cal AD 1261	100.00	Killens and Townsend	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 236 is non-cultural
Beta - 56360	7NC-G-101; Fea. 206	Snapp	Charcoal	Radiometric	1640±70	NR	intcal09.14c	NA	NA	cal AD 245: cal AD 564	100.00	Marcey Creek	Custer and Silber 1995	noted in report that date is too late for Marcey Creek
Beta-128589	7K-C-411; Block 1 & Fea. 98	Hickory Bluff	Charcoal	AMS	2660±40	NR	intcal09.14c	none	none	cal BC 900:cal BC 790	100.00	Marcey Creek	Petraglia, Bupp, Fitzell and Cunningham 2002	
Beta-117149	7K-C-411; Feature 2	Hickory Bluff	Charcoal	AMS	2790±40	NR	intcal09.14c	none	none	cal BC 1039: cal BC 835	100.00	Marcey Creek	Petraglia, Bupp, Fitzell and Cunningham 2002	
Beta - 304997	7K-F-11; Feature 180	Gray Farm	Charcoal	AMS	3100±30	-27.1	intcal09.14c	NA	NA	cal BC 1435: cal BC 1298	100.00	Marcey Creek	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 180 is non-cultural
Beta - 307658	7K-F-169; Test Unit 38	Gray Farm	Bulk sherd organics	AMS	3260±30	-25.6	intcal09.14c	NA	NA	cal BC 1615: cal BC 1454	100.00	Marcey Creek	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Test Unit 38 is non-cultural
Beta - 56361	7NC-G-101; Fea. 142/193	Snapp	Charcoal	Radiometric	1150±80	NR	intcal09.14c	NA	NA	cal AD 689: cal AD 1020	100.00	Marcey Creek/ Hell Island	Custer and Silber 1995	report notes that date is too late for Marcey Creek
Beta - 128592	7K-C-411; N389 E624 Strat B, Lvl. 2	Hickory Bluff	Organic Residue	AMS	1850±60 BP	NR	intcal09.14c	NA	NA	cal AD 47: cal AD 263	91.36	Mockley	Petraglia, Bupp, Fitzell and Cunningham 2002	
I- 6060	7K-D-21	Hughes-Willis	Charcoal	Radiometric	1650±110	NR	intcal09.14c	NA	NA	cal AD 134: cal AD 608	100.00	Mockle	Artusy 1976	
I - 5817	7K-D-3	Carey Farm SOA	Charcoal	Radiometric	1750±90	NR	intcal09.14c	NA	NA	cal AD 72: cal AD 441	96.19	Mockle	Artusy 1976	
UGa - 1273a	7S-D-10	Wolfe Neck SOA	Shell (NR)	Radiometric	1620±65	NR	marine09.14c	none	none	cal AD 651: cal AD 923	100.00	Mockley	Griffith and Artusy, 1977	
UGa - 1273b	7S-D-10	Wolfe Neck SOA	Shell (NR)	Radiometric	1625±160	NR	marine09.14c	none	none	cal AD 435: cal AD 1106	100.00	Mockle	Griffith and Artusy, 1977	duplicate run of UGa - 1273a
Beta - 157936	7NC-D-212; N201/E413 Str. B, Lev. 1	Glasgow School	Organic Residue	AMS	1630±60	-32.1	intcal09.14c	NA	NA	cal AD 317: cal AD 560	93.13	Mockley	Bowen, O'Neill and Crowell 2003	
Beta - 42883	7K-C-194A; Fea. 77, Lev. 3	Leipsic	Charcoal	Radiometric	1820±110	NR	intcal09.14c	NA	NA	cal BC 50: cal AD 435	99.09	Mockle	Custer, Riley and Mellin 1996	
Beta - 76645	7K-D-3; South Central, Fea. 623	Carey Farm UD	Charcoal	Radiometric	1640±70	NR	intcal09.14c	NA	NA	cal AD 245: cal AD 564	100.00	Mockle	Custer, Watson and Silber 1995	
Beta - 76837	7K-D-3; South Central, Fea. 371	Carey Farm UD	Charcoal	Radiometric	1240±60	NR	intcal09.14c	NA	NA	cal AD 660: cal AD 896	98.00	Mockley	Custer, Watson and Silber 1995	
Beta - 76839	7K-D-3; South Central, Fea. 440	Carey Farm UD	Charcoal	Radiometric	1720±60	NR	intcal09.14c	NA	NA	cal AD 133: cal AD 433	99.94	Mockley	Custer, Watson and Silber 1995	
Beta - 76840	7K-D-3; South Central, Fea. 465	Carey Farm UD	Charcoal	Radiometric	1300±60	NR	intcal09.14c	NA	NA	cal AD 644: cal AD 876	100.00	Mockle	Custer, Watson and Silber 1995	
Beta - 76841	7K-D-3; South Central, Fea. 608	Carey Farm UD	Charcoal	Radiometric	1660±50	NR	intcal09.14c	NA	NA	cal AD 256: cal AD 534	100.00	Mockle	Custer, Watson and Silber 1995	
UGa - 5447	7S-D-9; Fea. 5	Cape Henlopen	Charcoal	Radiometric	1400±50	NR	intcal09.14c	NA	NA	cal AD 549: cal AD 692	98.40	Mockle	Custer and Mellin 1987	
Beta - 309416	7K-F-11; Feature 3	Gray Farm	Charcoal	AMS	1140±30	-26.3	intcal09.14c	NA	NA	cal AD 809: cal AD 982	98.00	Mockle	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 3 is non-cultural
SI - 4942	7S-C-1b; Feature 6	Slaughter Creek	Charcoal	Radiometric	1175±75	NR	intcal09.14c	NA	NA	cal AD 682: cal AD 993	100.00	Mockley and Coulbourn	Custer 1989	may be Coulbourn intrusion into Mockley feature
Beta - 76644	7K-D-3; South Central, Fea. 358	Carey Farm UD	Charcoal	Radiometric	1560±50	NR	intcal09.14c	NA	NA	cal AD 404: cal AD 604	100.00	Mockley and Coulbourn	Custer, Watson and Silber 1995	may be Coulbourn intrusion into Mockley feature
Beta - 76838	7K-D-3; South Central, Fea. 427	Carey Farm UD	Charcoal	Radiometric	1680±60	NR	intcal09.14c	NA	NA	cal AD 237: cal AD 474	90.44	Mockley and Coulbourn	Custer, Watson and Silber 1995	may be Coulbourn intrusion into Mockley feature
SI - 4942	7S-C-1b; Feature 6	Slaughter Creek	Charcoal	Radiometric	1175±75	NR	intcal09.14c	NA	NA	cal AD 682: cal AD 993	100.00	Mockley and Coulbourn	Custer 1989	may be Coulbourn intrusion into Mockley feature
Beta - 76644	7K-D-3; South Central, Fea. 358	Carey Farm UD	Charcoal	Radiometric	1560±50	NR	intcal09.14c	NA	NA	cal AD 404: cal AD 604	100.00	Mockley and Coulbourn	Custer, Watson and Silber 1995	may be Coulbourn intrusion into Mockley feature
Beta - 76838	7K-D-3; South Central, Fea. 427	Carey Farm UD	Charcoal	Radiometric	1680±60	NR	intcal09.14c	NA	NA	cal AD 237: cal AD 474	90.44	Mockley and Coulbourn	Custer, Watson and Silber 1995	may be Coulbourn intrusion into Mockley feature
UGa - 1762	7S-K-21; Unit 17, Lev. 3, 76/102/2	Wilgus	Shell (mercenaria)	Radiometric	1710±70 BP	NR	marine09.14c	none	none	cal AD 548: cal AD 848	100.00	Mockley, Wilgus and Coulbourn	Artusy 1978	Custer 1983 using Artsuy 1978 defines Wilgus Ware; Mockley dominant in context
Beta - 51418	7K-C-13; Fea. 1128	Island Farm	Charcoal	Radiometric	330±110	NR	intcal09.14c	NA	NA	cal AD 1407: cal AD 1817	93.55	Nassawongo	Custer, Watson and Silber 1995	report notes date is too late for Nassawongo
Beta - 51419	7K-C-13; Fea. 1210	Island Farm	Charcoal	Radiometric	1390±100	NR	intcal09.14c	NA	NA	cal AD 501: cal AD 832	90.23	Nassawongo	Custer, Watson and Silber 1995	report notes date is too late for Nassawongo
UGa - 1761	7K-F-12; Feature 1, Sec. 2, Lev. 2	Robbins Farm	Shell (crassostrea)	Radiometric	750±55	NR	marine09.14c	none	none	cal AD 1466: cal AD 1664	100	Potomac Creek and Keyser Farm	Stocum 1977	both ceramic types in same level
Beta - 304998	7K-F-11; Feature 185	Gray Farm	Charcoal	AMS	4120±40	-25.5	intcal09.14c	NA	NA	cal BC 2872: cal BC 2577	100.00	Selden Island	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 185 is cultural; date too early for ceramics
Beta - 307657	7K-F-11; Feature 195	Gray Farm	Bulk sherd organics	AMS	2890±30	-27.3	intcal09.14c	NA	NA	cal BC 1195: cal BC 977	99.00	Selden Island	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 195 is cultural
Beta - 307656	7K-F-11; Feature 185	Gray Farm	Bulk sherd organics	AMS	2710±30	-25.5	intcal09.14c	NA	NA	cal BC 910: cal BC 808	100.00	Selden Island	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 185 is cultural
Beta - 304999	7K-F-11; Feature 195	Gray Farm	Charcoal	AMS	2790±40	-25.3	intcal09.14c	NA	NA	cal BC 1029: cal BC 835	99.00	Selden Island	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 195 is cultural
Beta - 52097	7K-C-13; Fea. 134	Island Farm	Charcoal	Radiometric	1610±120	NR	intcal09.14c	NA	NA	cal AD 209: cal AD 652	97.39	Selden Island/Wolfe Neck	Custer, Watson and Silber 1995	report notes that date is too late for the types
Beta - 52097	7K-C-13; Fea. 134	Island Farm	Charcoal	Radiometric	1610±120	NR	intcal09.14c	NA	NA	cal AD 209: cal AD 652	97.39	Selden Island/Wolfe Neck	Custer, Watson and Silber 1995	report notes that date is too late for the types
SI - 4943	7S-C-30a; Feature 2	Slaughter Creek	Charcoal	Radiometric	605±60	NR	intcal09.14c	NA	NA	cal AD 1283: cal AD 1422	100.00	Townsend	Custer 1989	
UGa - 1760	7S-H-18; Feature 3	Prickly Pear Island	Shell (crassostrea)	Radiometric	935±55	NR	marine09.14c	none	none	cal AD 1316: cal AD 1485	100.00	Townsend	Custer 1989	
SI - 4946	7S-C-30c; Feature 2	Slaughter Creek	Charcoal	Radiometric	995±60	NR	intcal09.14c	NA	NA	cal AD 941: cal AD 1180	96.02	Townsend	Custer 1989	
UGa - 924	7S-G-22; Feature 3, Sec. 3, Lev. 1	Poplar Thicket	Charcoal	Radiometric	580±60	NR	intcal09.14c	NA	NA	cal AD 1290: cal AD 1432	100.00	Townsend	Artusy, 1976	
UGa - 925	7S-G-14; Feature 7, Sec. 1, Lev. 1	Warrington	Charcoal	Radiometric	665±85	NR	intcal09.14c	NA	NA	cal AD 1215: cal AD 1430	100.00	Townsend	Griffith 1977	
UGa - 923	7S-A-1; Feature 15, cat. no. 36	Mispillion	Charcoal	Radiometric	865±75	NR	intcal09.14c	NA	NA	cal AD 1028: cal AD 1270	100.00	Townsend	Griffith 1977	zoned incised pipe bowl associated
UGa - 1440	7S-G-26; cat. no. 15	Bay Vista	Shell (crassostrea)	Radiometric	850±55	NR	marine09.14c	none	none	cal AD 1393: cal AD 1617	100.00	Townsend	Griffith 1977	
UGa - 1443	7S-G-22; Feature 4, Sec. 4, Lev. 3	Poplar Thicket	Charcoal	Radiometric	905±55	NR	intcal09.14c	NA	NA	cal AD 1021: cal AD 1225	99.55	Townsend	Griffith 1977	
UGa - 5548	7S-K-35; Fea.1	Israel Haul 1	Charcoal	Radiometric	930±55	NR	intcal09.14c	NA	NA	cal AD 1016: cal AD 1218	100.00	Townsend	Custer and Mellin 1987	Townsend incised motifs are complex
Beta - 29737	7K-F-17; Feature 119	Island Field	Charcoal	Radiometric	710±60 BP	NR	intcal09.14c	NA	NA	cal AD 1213: cal AD1398	100.00	Townsend	Custer, Rosenbery, Mellin and Washburn 1990	
Beta - 29738	7K-F-17; Feature 119	Island Field	Shell (NR)	Radiometric	800±70 BP	0.6	marine09.14c	none	none	cal AD 1421: cal AD 1659	100.00	Townsend	Custer, Rosenbery, Mellin and Washburn 1990	
Beta - 307300	7K-F-11; Feature 10	Gray Farm	Charcoal	AMS	330±30	-24.7	intcal09.14c	NA	NA	cal AD 1477: cal AD 1642	100.00	Townsend and Killens	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 10 is cultural
Beta - 307301	7K-F-11; Feature 10	Gray Farm	Shell (crassostrea)	AMS	790±30	-1.8	marine09.14c	none	none	cal AD 1457: cal AD 1617	100.00	Townsend and Killens	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 10 is cultural
SI - 4944	7S-C-30b; Feature 1	Slaughter Creek	Shell (NR)	Radiometric	680±50	NR	marine09.14c	none	none	cal AD 1500: cal AD 1706	100.00	Townsend/Killens	Custer 1989	
Beta - 141542	7K-C-411; N370 E633 Strat A, Lvl. 2	Hickory Bluff	Organic Residue	AMS	2160±50 BP	NR	intcal09.14c	NA	NA	cal BC 366: cal BC 88	96.66	Wolfe Neck	Petraglia, Bupp, Fitzell and Cunningham 2002	
I - 6891	7K-E-12	Dill Farm	Charcoal	Radiometric	2450±85	NR	intcal09.14c	NA	NA	cal BC 782: cal BC 399	100.00	Wolfe Neck	Artusy 1976	
UGa - 1223	7S-D-10	Wolfe Neck SOA	Shell (NR)	Radiometric	2455±60	NR	marine09.14c	none	none	cal BC 337: cal BC 1	100.00	Wolfe Neck	Griffith and Artusy, 1977	
Beta - 42879	7K-C-194A; Fea. 314, Lev. 4	Leipsic	Charcoal	Radiometric	2070±70	NR	intcal09.14c	NA	NA	cal BC 231: cal AD 74	93.11	Wolfe Neck	Custer, Riley and Mellin 1996	noted in report as variant of Wolfe Neck
Beta - 309419	7K-F-11; Feature 197	Gray Farm	Charcoal	AMS	2160±30	-26.6	intcal09.14c	NA	NA	cal BC 358: cal BC 107	100.00	Wolfe Neck	Diamanti, Hay, Rue, Stiteler and Griffith 2012	Feature 197 is cultural

Appendix 1

Calculations of ∆R and ∆R Error

From paired radiocarbon dates

Island Field Site (7K-F-17)

Beta 29737 wood charcoal CRA = 710±60 B.P.

Beta 29738 marine shell CRA = 800±70 B.P.

Measured Reservoir Age (marine shell CRA – wood charcoal CRA)

800-710 = 90±92

1 sigma - $(60^2 + 70^2)$ = 92.19

Calibrated Age Range Wood Charcoal Date

710±60 B.P. = 1 sigma range = cal AD 1252 – cal AD 1387

Mid-point = cal AD 1320 (630 B.P.)

2 sigma range = cal AD 1213 – cal AD 1398

Mid-point = cal AD 1306 (644 B.P.)

Modeled Marine Reservoir Age

Estimated value (cf. Stuiver 1993:154) - 1 sigma 1020 B.P.

2 sigma 1100 B.P.

Value from recalibration iterations 1 sigma = 1081±77 (cal AD 1251-cal AD1387)

2 sigma = 1096±47 (cal AD 1213–cal AD 1397)

∆R (Measured Marine Age CRA – Modeled Marine Age)

1 sigma = 800±70 - 1081±77 = -281±104

Standard deviation = $(70^2 + 77^2)$ = 104.06

2 sigma = 800±70 - 1096±47 = -296±84

Standard deviation = $(70^2 + 47^2)$ = 84.31

Wolfe Neck Site (7S-G-141)

Beta 77642 wood charcoal CRA = 1840±70 B.P.

Beta 77643 marine shell CRA = 2180±60 B.P.

Measured Reservoir Age (marine shell CRA – wood charcoal CRA)

2180-1840 = 340±92

1 sigma = $(60^2 + 70^2) = 92.19$

Calibrated Age Range Wood Charcoal Date

1840±70 = 1 sigma range = cal AD 83 – cal AD 244

Mid-point = cal AD 164 (1786 B.P.)

2 sigma range = cal AD 23 – cal AD 378

Mid-point = cal AD 200 (1750 B.P.)

Modeled Marine Reservoir Age

Estimated value (cf. Stuiver 1993:154) - 1 sigma 2150 B.P.

2 sigma 2140 B.P.

Value from recalibration iterations 1 sigma = 2194±66 (cal AD 83-cal AD 243)

2 sigma = 2168±71 (cal AD 23-cal AD 379)

ΔR (Measure Marine Age CRA – Modeled Marine Age)

1 sigma = 2180±60 - 2194±66 = -14±89

Standard deviation = $(60^2 + 66^2) = 89.19$

2 sigma = 2180±60 - 2168±71 = 12±93

Standard deviation = $(60^2 + 71^2) = 92.95$

Calculations of ∆R and ∆R Error

From paired radiocarbon dates

Gray Farm Site (7K-F-11); Feature 10

Beta 307300 wood charcoal CRA = 330±30 B.P.

Beta 307301 marine shell CRA = 790±30 B.P.

Measured Reservoir Age (marine shell CRA – wood charcoal CRA)

790-330 = 460±42

1 sigma = $(30^2 + 30^2)$ = 42.43

Calibrated Age Range Wood Charcoal Date

330±30 B.P. = 1 sigma range = cal AD 1499 – cal AD 1634

Mid-point = cal AD 1566 (384 B.P.)

2 sigma range = cal AD 1477 – cal AD 1642

Mid-point = cal AD 1559 (391 B.P.)

Modeled Marine Reservoir Age

Estimated value (cf. Stuiver 1993:154) 1 sigma 760 B.P.

2 sigma 790 B.P.

Value from recalibration iterations 1 sigma= 750±72 (cal AD 1498 – cal AD 1634)

2 sigma= 760±33 (cal AD 1477 – cal AD 1641)

∆R (Measured Marine Age CRA – Modeled Marine Age)

1 sigma = 790±30 - 750±72 = 40±78

Standard deviation = $(30^2 + 72^2)$ = 78

2 sigma = 790±30 - 760±33 = 30±45

Standard deviation = (30^2+33^2) = 44.59

In arriving at the $\Delta R = 12 \pm 93$ for the Wolfe Neck pair I calculated the modeled marine reservoir age using iterations in the CALIB 6.0.1 program. At the 2 sigma level, the best marine reservoir age was 2168±71 B.P. Applying this value to the Wolfe Neck marine shell CRA provided a good, if not perfect, match to the re-calibrated Wolfe Neck wood charcoal date (Beta 77642). The re-calibrated 2 sigma wood charcoal date yields a calendar age of cal AD 23 to cal AD 378, while the recalibrated marine shell date (Beta 77643) yields a calendar age of BC 84 to AD 453. In an attempt to further refine the match at the 2 sigma level between the two re-calibrated dates, I attempted to force the ΔR value for 2168±71 to match the recalibrated wood charcoal date through evaluating a series of iterations of ΔR and ΔR Error. The ΔR and ΔR Error that best matches the recalibrated wood charcoal date is $\Delta R = 12 \pm 38$ yielding a 2 sigma date range of call AD 23 – cal AD 379. I think this approach has promise, though for the purposes of this study, I did not apply a ΔR and ΔR Error to the recalibration of the CRA's from marine shell due to the statistical uncertainty of relying on two pairs of dates. It should be noted that in this exercise I did not round the dates and standard deviations as is common convention. Had I done so, the $\Delta R = 12 \pm 38$ would produce a final $\Delta R = 10 \pm 40$; the resulting dates are statistically the same.

Appendix 2

Data for Ceramic Temporal Ranges Figure 15

Re-Calibrated Dates

Ceramic Type	Lab Code	2 Sigma Range	Mid-Point
Accokeek	Beta-52096	AD 23: AD 223	AD 123
Coulbourn	UGa-1224	BC 168: AD 161	BC 4
	Beta-141001	BC 55: AD 91	AD 18
	Beta-141000	BC 39: AD 139	AD 50
	UGa-1763	BC 41: AD 260	AD 109
	Beta-77643	AD 31: AD 339	AD 185
	Beta-77642	AD 23: AD 349	AD 186
Dames Quarter	Beta-157391	BC 1407: BC 1191	BC 1299
	Beta-149986	BC 1395: BC 1187	BC 1291
	Beta-149988	BC 1419: BC 1111	BC 1265
	Beta-157390	BC 1319: BC 1110	BC 1215
	Beta-149987	BC 1319: BC 1110	BC 1215
	UGa-5377	BC 1407: BC 971	BC 1189
	UGa-5376	BC 1407: BC 970	BC 1189
	Beta-307655	BC 1259: BC 1024	BC 1141
	Beta-149990	BC 1264: BC 1010	BC 1137

Ceramic Type	Lab Code	2 Sigma Range	Mid-Point
Hell Island	Beta-42884	AD 526: AD 779	AD 653
	I-6338	AD 659: AD 989	AD 824
	Beta-56361	AD 689: AD 1020	AD 855
	Beta-305001	AD 776: AD 966	AD 871
	Beta-76843	AD 932: AD 1162	AD 1047
	UGa-1441	AD 994: AD 1230	AD 1112
	Beta-128586	AD 1023: AD 1213	AD 1118
Keyser Farm	UGa-1761	AD 1466: AD 1664	AD 1565
Killens	Beta-69339	AD 1286: AD 1481	AD 1384
	Beta-307301	AD 1457: AD 1617	AD 1537
	Beta-307300	AD 1477: AD 1642	AD 1559
	SI-4944	AD 1500: AD 1706	AD 1603
Marcey Creek	Beta-307658	BC 1622: BC 1492	BC 1557
	Beta-304997	BC 1435: BC 1298	BC 1366
	Beta-149987	BC 1319: BC 1110	BC 1215
	Beta- 117149	BC 1039: BC 835	BC 937
	Beta– 128589	BC 900: BC 790	BC 845
Mockley	Beta-128592	AD 47: AD 263	AD 155

Ceramic Type	Lab Code	2 Sigma Range	Mid-Point
Mockley	I-5817	AD 72: AD 441	AD 257
	Beta-76839	AD 133: AD 433	AD 283
	Beta-76838	AD 237: AD 474	AD 356
	I-6060	AD 134: AD 608	AD 371
	Beta-76841	AD 256: AD 534	AD 395
	Beta-76645	AD 245: AD 564	AD 405
	Beta-157936	AD 317: AD 560	AD 439
	Beta-76644	AD 404: AD 604	AD 504
	UGa-5447	AD 549: AD 692	AD 621
	UGa-1762	AD 548: AD 848	AD 698
	Beta-76840	AD 644: AD 876	AD 760
	Beta-76837	AD 660: AD 896	AD 778
	UGa-1273a	AD 651: AD 923	AD 787
	SI-4942	AD 682: AD 993	AD 838
Potomac Creek	UGa-1761	AD 1466: AD 1664	AD 1565
Selden Island	Beta-307657	BC 1195: BC 977	BC 1086
	Beta-304999	BC 1029: BC 835	BC 932
	Beta-307656	BC 918: BC 811	BC 865
Townsend	SI-4946	AD 941: AD 1180	AD 1061
	UGa-5548	AD 1016: AD 1218	AD 1117

Ceramic Type	Lab Code	2 Sigma Range	Mid-Point
Townsend	UGa-1443	AD 1021: AD 1225	AD 1123
	UGa-923	AD 1028: AD 1270	AD 1149
	Beta-309420	AD 1052: AD 1261	AD 1157
	Beta-29737	AD 1213: AD 1398	AD 1306
	UGa-925	AD 1215: AD 1430	AD 1323
	SI-4943	AD 1283: AD 1422	AD 1353
	UGa-924	AD 1290: AD 1432	AD 1361
	UGa-1760	AD 1316: AD 1485	AD 1401
	UGa-1440	AD 1393: AD 1617	AD 1505
	Beta-307301	AD 1457: AD 1617	AD 1537
	Beta-29738	AD 1421: AD 1659	AD 1540
	Beta-307300	AD 1477: AD 1642	AD 1559
	SI-4944	AD 1500: AD 1706	AD 1603
Wolfe Neck	I-6891	BC 782: BC 399	BC 591
	Beta-309419	BC 358: BC 107	BC 232
	Beta-141542	BC 366: BC 88	BC 227
	UGa-1223	BC 337: BC 1	BC 169
	Beta-42879	BC 231: AD 74	BC 79

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