Radiocarbon Chronology at the Narvaez/Anderson Site (8Pi54)

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Introduction

Radiocarbon (or C14) dating is the most widely used chronometric method in archaeology, and is based on the precise measurement of the radioactive isotope ^{14}C in organic materials which contain carbon (see also Aitken 1990; Bowman 1990; Taylor 1997). ^{14}C is produced by the bombardment of nitrogen (N) with neutrons in the upper atmosphere, and is incorporated through photosynthesis of gaseous carbon dioxide (CO_2) into living plants and ultimately into the tissues of herbivores and carnivores. As long as an organism is alive it continually maintains the same proportion of ^{14}C as the atmosphere; after death, however, uptake no longer occurs and the unstable ^{14}C radioactively decays at a constant rate of 50% every 5730 years (half-life). The time which has elapsed since the death of the organism is determined by measuring the remaining ^{14}C content of the sample.

Calibration

Since the amount of ^{14}C in the atmosphere in the past has not been constant, calibration must be done before converting radiocarbon dates to calendar years. Calibration curves have been produced from high-precision radiocarbon dates on tree-ring samples of known age, at intervals of 10 years going back to 6000 BC, and every 20 years back to about 10,000 BC (Stuiver *et al.* 1993). Marine organisms are not typically at equilibrium with atmospheric CO_2, since upwelling currents carry 'old' carbon. Radiocarbon dates on marine organisms (e.g. shells) often appear too old for their archaeological context, since this reservoir effect averages 402 years worldwide (Stuiver & Braziunas 1993). In the Gulf of Mexico, only three marine samples have been analyzed for calibration purposes, with an average marine reservoir effect of 397 ± 20 years, a difference of 5 years from the worldwide mean. Differences of up to several hundred years are known in several regions, however, especially bays or lagoonal areas which experience (or have experienced in the past) incomplete mixing with the bulk of oceanic waters. It must be emphasized, therefore, that no reservoir data specific to Tampa Bay or the Gulf Coast region has been obtained. Practically speaking, even in areas where the reservoir effect has been locally determined, it increases the uncertainty associated with radiocarbon dates on shell, fish or marine mammal bone, and on bones of terrestrial animals (including humans) which consumed marine foods. Calibration calculations are facilitated by programs such as Calib (Stuiver & Reimer 1993; http://weber.u.washington.edu/~qil/calib/index.html) and OxCal (Bronk Ramsey 1995; http://info.ox.ac.uk/departments/rlaha/oxcal/oxcal_h.html).

The Narvaez/Anderson Samples

Eleven samples of charcoal and shell from the Narvaez/Anderson site were radiocarbon dated by Beta Analytic Inc. (Miami, Florida). The charcoal samples, which were not studied or identified as to species, received a full pretreatment sequence to remove solid contaminants as well as carbonates and organic acids; for shell samples, their surfaces were mechanically removed and secondary carbonates were dissolved with an acid etch. Carbon in the samples was converted to benzene and measured with a scintillation spectrometer.

The conventional ages reported in the table below have been normalized against a modern radiocarbon standard through the use of $^{13}C/^{12}C$ ratios, which are directly related to $^{14}C/^{12}C$ ratios. For the Narvaez/Anderson samples, this ratio was not determined: for the two charcoal samples, it was estimated at -25‰ (parts per thousand, relative to the PDB carbonate standard); for the seven shell samples, it was estimated at 0‰. Small differences between these estimates and the actual values would have a negligible effect on calibrated calendar ages.

The radiocarbon determinations were calibrated using the Calib 3.0.3 program (Stuiver & Reimer 1993). For the marine shell samples, the marine calibration curve was employed, using a local delta R value of -5 ± 20 years. For the charcoal samples, the decadal tree-ring calibration curve was used. The calendar ages reported in Table 1 represent the calibrated age range using two standard deviations (the precision of the laboratory measurement), with the intercept shown in parentheses. There is a 95.4% probability that the true age of the analyzed sample falls within these ranges. The probability distribution within these ranges, however, is not symmetrical, and may even fall into discrete segments. In Figure 1, calibrated age ranges are represented by a box plot in which the probability at one standard deviation is shown in black and at two standard deviations in white.

Discussion and Interpretation

Excavations at the Narvaez/Anderson site proceeded in arbitrary 10 cm levels, with the bottom levels of TU-A (26), on the side of a temple mound, and of TU-B (18), in a nearby midden, probably corresponding to the original ground surface and thus presumably contemporary with one another. The area of TU-A, however, is probably at least a partial mixture of redeposited materials from higher up on the mound; intrusions in the form of post holes and pits also have been documented archaeologically. Contact period materials were commonly found only in the uppermost levels of each test unit, but some were recovered from as deep as level 18 in TU-A.

At least one of the six radiocarbon dates from TU-A is out of sequence. The marine shell from level 24 (Beta-106641) is probably up to two centuries younger than the shell sample from level 22 (Beta-109274), and most likely but not unequivocally younger than the charcoal sample from level 19 (Beta-106640). If the level 24 shell is intrusive, then TU-A would appear to document at least 2-3 centuries of sequential activity around 1200-1500 AD. If the level 24 shell is not intrusive, then several problems must be dealt with. First, an 'old' shell must have been deposited in level 22. Second, the likely older calibrated age of the charcoal sample from level 19 would imply the use or intrusive deposition of old wood, or the possibility that the marine reservoir value for the Narvaez/Anderson area is substantially less than the world average. Third, the shell from level 13 might also be 'old' or intrusive. Lastly, since the dates on the shells from levels 3, 11 and 24 are statistically the same, then a fairly rapid construction of the mound would be documented, during the 15th century AD.

In TU-B, the five radiocarbon dates are also not necessarily in sequence. There is some possibility that the charcoal sample from level 11 (Beta-106643) is older than the shell sample from level 15 (Beta-109275). This could be due to its being intrusive; the use of old wood; or local variation in the reservoir effect as suggested above. The shell sample from level 16 (Beta-106644) is clearly much older than any of the other dated samples from TU-B. Excluding this date, and that from TU-A level 22 (which could also be 'old' or intrusive: see above), from a chi-square analysis of the radiocarbon determinations on shell, one finds that the remaining seven shell dates are just barely statistically different at the 95% level ($p < .05 = 12.60$; test statistic = 12.67). If we also exclude the shell from TU-A level 13 (likely to be 'old' or intrusive if shell from level 24 is <u>not</u>

intrusive: see above), the remaining six shell dates are statistically identical ($p < .05 = 11.10$; test statistic = 6.27), implying that activities at the Narvaez/Anderson site were concentrated within a relatively short span of time. The calibrated age range (within two standard deviations) of the weighted average of these dates is AD 1426-1494 with the intercept at AD 1458.

Finally, if the scenario holds that most of the shell dates do pertain to a century or less of activity, then some explanation for the gap of more than a century between the charcoal and shell dates is warranted. This gap must be due either to the use of old wood, or perhaps to the use of incorrect marine reservoir values. If the reservoir effect were indeed lower in the Tampa Bay region, then the calibrated range for these same shell dates could pertain to the 14th rather than the 15th century AD.

Conclusion

The following conclusions are tentative and subject to reevaluation, considering that they are based on a limited number of radiocarbon determinations, some on charcoal and some on shell, and that the reuse of older materials as well as secondary depositional processes may confound the stratigraphic sequence in which they were recovered. The calibration of both shell and charcoal samples as described above indicates that most of the dated materials from the Narvaez/Anderson site may be confidently attributed to a period encompassing the 14th-16th centuries AD, and thus to the later part of the Pinellas phase of the Safety Harbor culture and the early Colonial period (Mitchem 1989; Milanich 1994). Two older shell dates most likely are the result of reuse or redeposition of older materials, perhaps from earlier Safety Harbor culture activity at the site. The two charcoal dates average out to the 14th century, while the seven remaining shell dates are only slightly statistically different and may be assigned almost entirely to the 15th century AD. The discrepancy between the charcoal and shell dates would be narrowed if old wood were used or the specific samples which were dated did not come from the outermost tree rings, or if the reservoir effect in this area is less than the limited data indicate. The reservoir effect in the Tampa Bay area should be investigated further.

The available radiocarbon dates from TU-A and TU-B at the Narvaez/Anderson site suggest that the principal activities at this site pertain to the period immediately prior to the earliest European contacts with Florida. This conclusion is supported by the ceramic finds, which have been attributed to the late Safety Harbor period. The radiocarbon dates do not provide evidence of early 16th century activity at the 'Narvaez' site, and cannot be used to address the question of whether the Narvaez expedition landed there.

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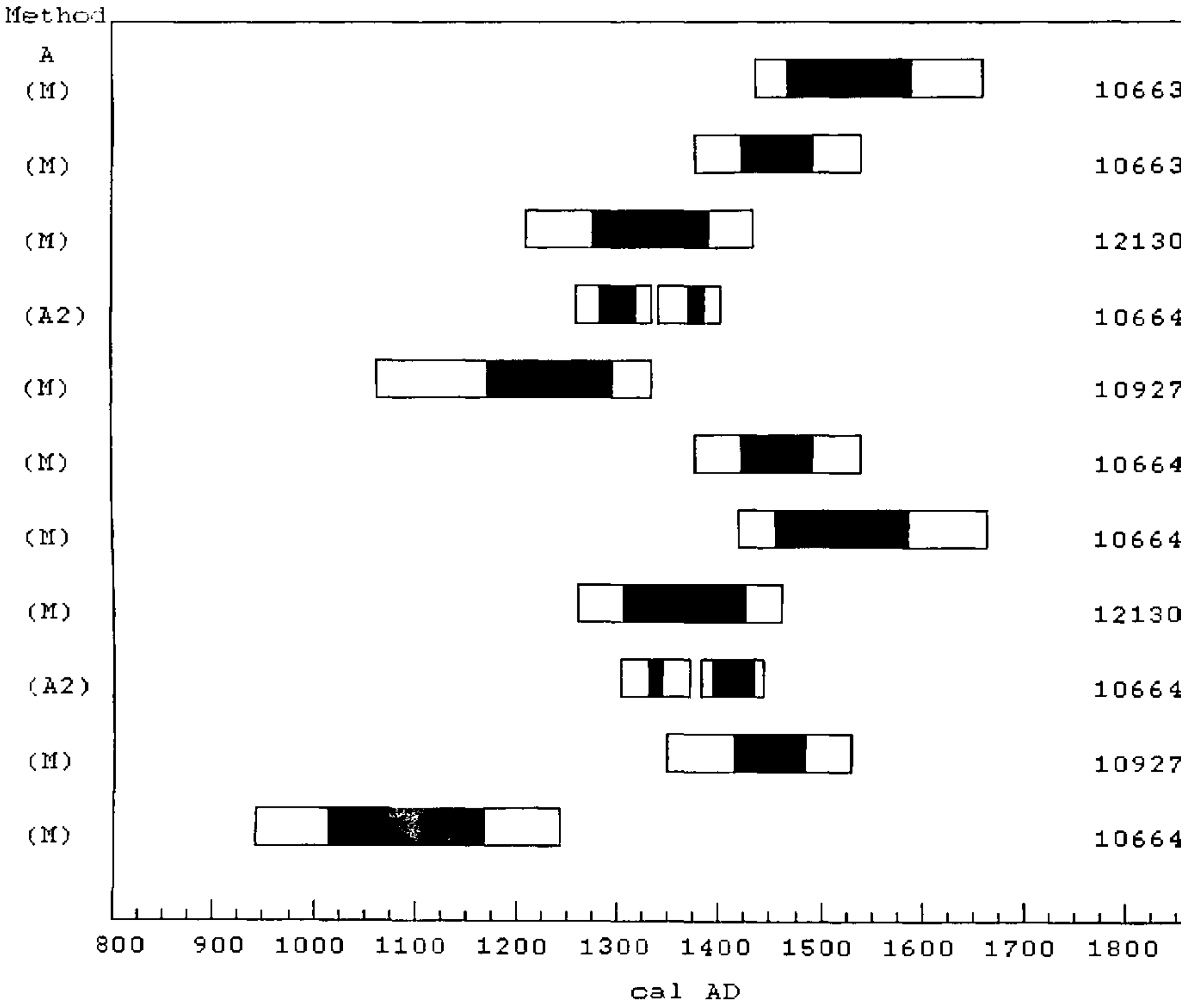
Table 1.

Lab. No.	**Material**	**Context**	**Date**	**Error**	**Calibrated Range (2σ)**
Beta-106638	marine shell	TU-A, level 3 (FS 93)	790	60	1434 (1511) 1660
Beta-106639	marine shell	TU-A, level 11 (FS 728)	880	60	1376 (1453) 1540
Beta-121301	marine shell	TU-A, level 13 (FS 1212)	1070	70	1210 (1313) 1433
Beta-106640	charcoal	TU-A, level 19 (FS 218)	690	50	1259 (1292) 1401
Beta-109274	marine shell	TU-A, level 22 (FS 1026)	1180	70	1062 (1244) 1333
Beta-106641	marine shell	TU-A, level 24 (FS 1036)	880	60	1376 (1453) 1540
Beta-106642	marine shell	TU-B, level 3 (FS 24)	800	70	1419 (1503) 1665
Beta-121300	marine shell	TU-B, level 10 (FS 692)	1010	70	1262 (1373) 1463
Beta-106643	charcoal	TU-B, level 11 (FS 142)	540	50	1304 (1412) 1444
Beta-109275	marine shell	TU-B, level 15 (FS 1057)	890	60	1349 (1448) 1531
Beta-106644	marine shell	TU-B, level 16 (FS 1063)	1330	70	943 (1059) 1243


Method
A
(M)
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12130
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Figure 1.