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Radiocarbon Dating: Analysis of the Burns Site

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Abstract

This paper aims to outline the period of use of the Burns site by the Ais Native Americans and other earlier groups of Paleoindians. After the evaluation and recalibration of samples submitted for radiocarbon testing, the strata of the Burns site could then be associated with their correlated radiometric dates. These dates tell us when the site was occupied, as well as the extent of its use through time and the activities associated with each stratum. Creating a comprehensive timeline aids in understanding how the site was utilized by the Ais and other Paleoindians. Results of this analysis yielded dates that place the site's occupation between AD 255 and 1921.

Introduction

The Ais people inhabited the Indian River region on the east coast of central Florida as mobile hunter-gatherers. The environment in this region is characterized by its proximity and association with the Indian River Lagoon and the Atlantic Ocean, with their diet consisting of primarily bony fish and species such as catfish, black drum fish, redfish, seatrout, and mullet. Bony fish made up more than 80 percent of the vertebrates consumed, and shellfish such as moon snails, whelk, crown conch, and coquina also made up a large percentage of the Ais' subsistence (Demming and Horvath 1999; Penders 2012:86). The Indian River region has been defined as a distinct cultural group or transitional area between the St. Johns culture to the north and the Glades culture to the south.

The Burns site (8BR58) is located on the Cape Canaveral Air Force Station (CCAFS) and includes the Burnham cemetery, the Wilson Brother's cemetery, and a Native American burial mound (**Figure 1**). Pottery styles in this region have been previously used to date the sites they

are found at, with cultural styles such as Malabar II and St. Johns II associated with the period A.D. 750-1565 (Milanich 1994:250). Radiocarbon dating, as to be detailed in this paper, gives a more accurate and specific occupation time frame for the sites in question.

Figure 1: Burns site Native American burial mound, Source: Penders, Thomas, "Burns Action Shot" (2018). *All Burns Site Photographs*. 217. https://stars.library.ucf.edu/burns-photos/217

Methodology

Radiocarbon samples previously submitted for testing under the IntCal 13 ratio required recalibration due to fluctuations in the ratio of carbon-12 to carbon-14 in the atmosphere. The online program OxCal was used for this purpose. The consistent radioactive decay of ^{14}C into nitrogen-14 makes it a reliable source of dating, as every 5,730 years, half of the ^{14}C in a sample will have decayed into nitrogen-14. The length of this cycle is significant: radiocarbon's long lifespan gives sufficient opportunity for the carbon to be recycled many times and to be reborn through photosynthesis. As a result, the ratio of carbon-12 to carbon-14 is consistent in all living things (Libby 1970:3). Yet just as the ratio of ^{12}C: ^{14}C has changed since the interment of the sample, the ratio continues to oscillate today. The newest calibration curve, IntCal 20, provides a

more accurate analysis of the samples previously submitted for testing, as with every new curve, the resulting dates become more precise.

After the recalibration of these samples, the newer radiocarbon samples that were tested under the IntCal 20 calibration curve were examined alongside them. Compiling these dates allowed for the association of the samples with the strata they were extracted from. The samples discussed in this paper were collected from Test Units G, E, and I (**Figure 2**).

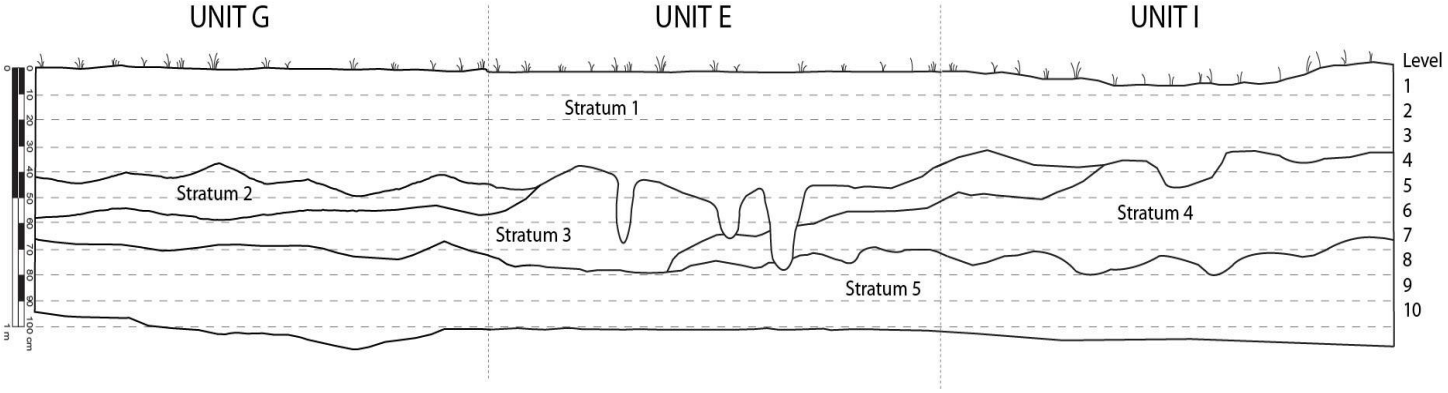

Figure 2: Strata map of Test Units G, E, and I of the Burns Site. Source: S. Barber

Results

A total of 14 bone (both heated and non-heated), charcoal, and bulk sherd organics samples were considered in this paper, as well as 15 shell samples. A sample from Test Unit B (8BR85-SS21-1) was excluded from this analysis as the focus remains on Test Units G, E, and I, and two samples from Test Unit F (8BR85-SS69-2 and 8BR85-SS70-3) were excluded for the same reason. The recalibration of the previously submitted samples yielded slight alterations in the resulting dates. For instance, the sample 524136 from Test Unit E was dated to AD 1033-1191 (94.1% probability) and AD 1198-1204 (1.4% probability) under the IntCal 13 calibration curve, and was dated to AD 1040-1214 (95.4% probability) under the IntCal 20 calibration curve (**Figure 3** and **Figure 4**).

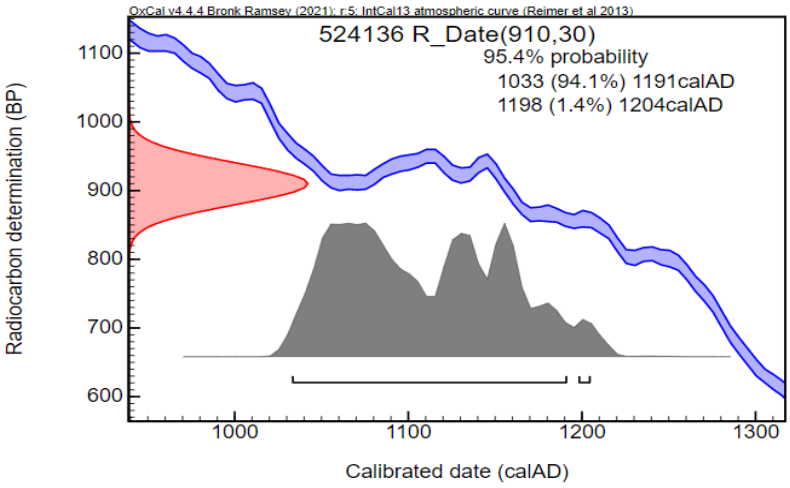

Figure 3: IntCal 20 calibration curve of sample 524136 (TU E), Source: OxCal

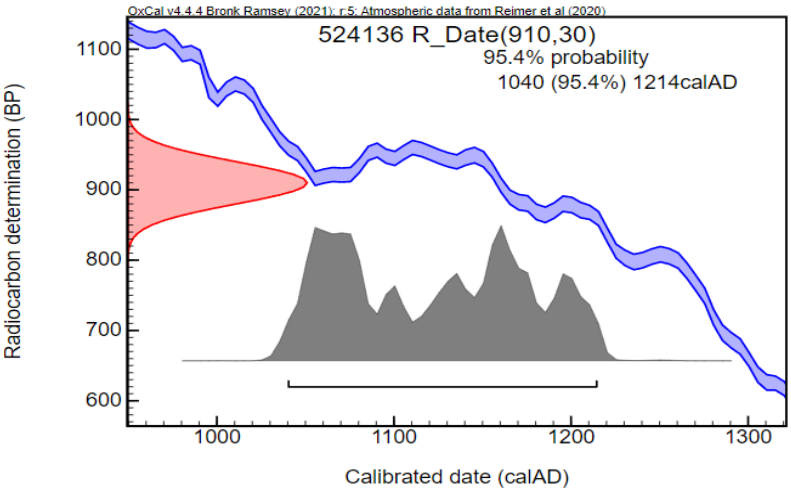

Figure 4: IntCal 13 calibration curve of sample 524136 (TU E), Source: OxCal

Radiocarbon Dating of Shell

Shell as a medium for radiocarbon dating is unfavorable, due to several factors that alter the dates to be much older or younger than would be expected. For instance, the hard-water effect, in which shelled animals synthesize their skeletons underwater from older carbon sources, skews radiocarbon dates to be significantly older. Isotope fractionation is another uncertainty when it comes to dating marine shells and occurs when the carbon isotope ratios are altered due to different reaction times of ^{14}C from the atmosphere as it is transferred into oceanic HCO3- (Douka et al. 2010:21). The carbon isotope ratios are thus inaccurate, and the resulting dates are

skewed as a result. For this reason, the 15 shell samples considered were separated out from the charcoal, bone, and bulk sherd organics samples, and were not examined in the association of radiocarbon dates to the strata of Test Units G, E, and I.

Stratum 1

Stratum 1 was dated using four samples, two from Test Unit E and two from Test Unit G. Sample 524135 (TU E) of heated bone has the 95% calibrated dates of AD 1808-1921 (69.3% probability) and AD 1691-1729 (26.2% probability). The charcoal sample 524136 (TU E) has a 95% calibrated date of AD 1040-1214. The charcoal sample 8BR85-SS100-6 of Test Unit G has a 95% calibrated date of AD 1174-1267. Sample 8BR85-SS101-7 (charcoal) from Test Unit G was dated to AD 724-775 (51.3%) and AD 662-709 (44.1%). The radiocarbon date range of Stratum 1 is thus AD 662-1921.

Stratum 2

Stratum 2 was dated using three samples, all from Test Unit G. The charcoal sample 8BR85-SS98-4 was dated to AD 1209-1275 (93.3%) and AD 1180-1189 (2.2%). The charcoal sample 8BR85-SS99-5 has a 95% calibrated date of AD 1216-1271. The non-heated bone sample 8 (FS90) was dated to AD 990-1050 (70.0%) and AD 1080-1154 (25.4%). The estimated age of Stratum 2 is therefore AD 990-1275.

Stratum 3

Stratum 3 was dated through the evaluation of one sample from Test Unit E. Sample 8BR85-SS102-8 is a charcoal sample dated to AD 1176-1267 (95.4% probability). As this sample is the only representative of Stratum 3, the stratum thus has an estimated age of AD 1176-1267.

Stratum 4

Stratum 4 has five associated samples, all from Test Unit I. Sample 8BR85-SS103-9, a charcoal sample, is dated to AD 1227-1283 (95.4%). Another charcoal sample, 8BR85-FS178-10, has the 95% calibrated dates of AD 1118-1212 (48.8%) and AD 1043-1106 (46.6%). The non-heated bone sample of 3 (FS95) was dated to AD 1215-1280 (95.4%). Sample 13 (FS97) of bulk sherd organics was dated with a 95.4% probability to AD 326-423 (78.8%) and AD 255-285 (16.6%). Another bulk sherd organics sample, sample 14 (FS94), was dated to AD 1419-1495 (94.2%) and AD 1602-1610 (1.3%). The range of the possible age of Stratum 4 is thereby AD 255-1610.

Stratum 5

Stratum 5 was dated using one sample from Test Unit G. The charcoal sample 1 (none given), otherwise identifiable by its lab sample number 548731, was dated with 95.4% probability to AD 944-1026 (71.8%) and AD 893-929 (23.6%). Thus, the estimated age of Stratum 5 falls within AD 893-1026.

Inconsistencies with Data

The strata of Test Units G, E, and I have an overall radiocarbon date range of AD 255-1921. While a vast range is to be expected from an evaluation of several strata, the notable inconsistencies in a few of the layers with the Law of Superposition are significant. Stratum 4, for instance, is superimposed atop Stratum 5, and yet Stratum 4 has a bottom age bracket of AD 255, compared to Stratum 5's AD 893. The high-end bracket of Stratum 4, AD 1610, is younger than the range of the stratum above it, Stratum 3, with a date range of AD 1176-1267. These unexpected results may be due to a number of factors. Contamination or improper handling of

samples could contribute to an unreliable radiocarbon date. The two most varied samples in Stratum 4 (13 (FS97) and 14 (FS94)) were both bulk sherd organic samples and notably the only ones of this kind used in the analysis. The discrepancy in these dates could therefore be the result of improper handling of this specific type of sample, or perhaps unreliability in the radiocarbon dating of this type. Stratum 4 may also have been poorly defined during the mapping of the strata, leading to inconsistencies in the division between layers. Future research into how this layer formed will provide better insight into the extent of the Burns site's use through time and the reasons for the discrepancies.

Comparison with Surrounding Sites

The Burns site exists in proximity to several other Native American sites, and its radiocarbon dates are thus significant in determining its relationship among them. The DeSoto Grove Site A, also located on the Cape Canaveral Air Force Station, has radiocarbon dates of 413-354 BC (78.7%) and 285-229 BC (16.7%) (as evaluated from one bone sample, CCAFS SS60, collected in 1994 and recalibrated under IntCal 20. The associated shell samples were excluded for the purposes of this paper). This sample, collected from level 2 of Test Unit B (10-20 cmbd), is therefore significantly older than any of the samples referred to in this paper at the Burns site. Thus, occupation of the DeSoto Grove Site shifted over time to sites such as the Burns site, with activity occurring much later.

The Holmes Mound is another archaeological site located on the CCAFS, and two samples of bone provide the radiocarbon dates for it. Both were collected in 1994 and were recalibrated under IntCal 20. CCAFS SS56, from level 2 (10-20 cmbd) of Test Unit B, has 95% calibrated dates of AD 1016-1158 (92.7%) and AD 995-1005 (2.8%). CCAFS SS57, from level 6 (50-60 cmbd) of Test Unit D, is dated to AD 645-707 (64.6%) and AD 736-775 (30.9%). The

dates for this site range between AD 645-1158 and are thus comparable to the dates of Stratum 5 at the Burns site.

The Sams site, located on Merritt Island, was dated through the analysis of seven charcoal samples (shell sample SS-18 was excluded for the purposes of this paper). Sample SS-6 was taken from Test Unit C (from 70-87 cmbd) and has 95% calibrated dates of AD 666-778 (66.5%), AD 785-838 (21.0%), and AD 845-877 (7.9%). Sample SS-7 has the same radiocarbon dates as SS-6 and was taken from TU C, 34-50 cmbd. Sample SS-8, collected from Test Unit C (34-50 cmbd), has the radiocarbon dates of AD 671-880 (95.4%). Sample SS-12 was dated to AD 1036-1226 (95.4%) and was collected from Test Unit C (38-49 cmbd). Sample SS-14 was taken from Test Unit D (83-100 cmbd) has the radiocarbon dates of AD 881-1027 (95.2%) and AD 779-781 (0.3%). Sample SS-20 was dated to AD 822-995 (90.0%), AD 773-790 (4.7%), and AD 1008-1014 (0.7%), and was collected from TU D, between 58-63 cmbd. Sample SS-23 has dates of AD 534-650 (91.1%), AD 478-496 (2.6%), and AD 440-455 (1.7%), and was collected from TU D (50-78 cmbd). The dates for this site range between AD 440 and 1226 and therefore fit within the dates assigned to the Burns site (AD 255-1921).

Whilst there are other archaeological sites located near the Burns site such as Hammock Mound A and the NOTU site, only shell radiocarbon samples have been thus far recorded for these, and for purposes of consistency and accuracy, they have therefore been excluded from this analysis.

Conclusion

The Burns site functions as an essential component in the understanding of the culture and activities of the Ais people and their predecessors. Through analyzing the radiocarbon dates

produced from the site, the period of occupation was determined to be from AD 255 to 1921. The site is therefore comparable to the nearby Holmes Mound and Sams site, and was occupied several centuries later than DeSoto Grove site A.

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