Radiocarbon Based Occupation Patterns of the San Antonio River Basin

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Summary

We explore the utility of summed probabilities on calibrated radiocarbon dates as a gross measure of regional occupational intensity. Our data consists of 321 dated contexts, most of which are features, from over 40 sites within the San Antonio River Basin (SARB). Interpreting the summed date patterns is complex, given shifting research interests, deterioration of bone and charcoal over time, differential taphonomic processes, sampling issues, and the non-linear nature of the calibration curve. We investigate these complications and explore ways to lessen their impacts. This allows us to highlight several periods where occupation in the basin may be more (e.g., ca. 5000-4200) or less (e.g., ca. 1800-1000 BP) intensive that require additional investigation.

The Summed Probability Patterns

The peaks, shifts, and troughs in Figure 2 are the result of numerous processes beyond changes in the number of people and/or the number and variety of activities (occupational intensity). To use the patterns as a proxy for occupational intensity, we need to understand other processes. We discuss two of these other processes in the following sections.

Location, Sample Selection, and Initial Treatment

The SARB covers an area of ca. 50,000 km² (Fig. 1). Our dates come from 6 counties, though most are concentrated in a roughly 3,025 km² area in and around Bexar County. Most of the dates are from sites along major rivers or springs. Locations away from water are underrepresented. The dates used here, then, likely contain a variety of spatial and temporal biases.

Figure 1- Archaeological Sites (blue dots) in the SARB. Sites with dates used here are shown with a red buffer.

The raw SARB data will be available on the Digital Archaeological Record (t-DAR) and on the CAR-UTSA website shortly in an open-access format. We will make all data available for researchers to share. Comments on this research are encouraged and should be sent to the authors.

From the literature and our current project (Mission Reach), we amassed an initial set of 450 radiocarbon dates from over 40 archaeological sites within the SARB. We called these dates as they ran on charcoal or bone and those not directly associated with archaeological contexts. We eliminated those with standard errors above +/-100. The remaining dates come from 6 labs and were all run within the last 30 years.

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Increased human activity on a landscape should, in most cases, produce a stronger occupational signal, including a higher overall frequency of datable material. However, using dates as a proxy for occupational intensity is complicated by many factors, only two of which we have considered. Taphonomic loss and calibration procedures can produce signals, and calibrations are often dependent on distributions that significantly distort the underlying pattern. In the case of the SARB, when we access and try to control for these factors, the underlying pattern still suggest several periods (e.g., ca. 5000-4200, 1000-250 BP) that could reflect intensive use, as well as several suggestive of lower use intensity (e.g., ca. 6250- 5000, 1800-1000 BP). We are conducting additional investigations, including analysis of other types of dates, such as those from rivers and springs, soil types, and landforms.

An example of another type of comparison that we have undertaken is shown in Figure 6 where we contrast 56 dates from the roughly 8 km long Mission Reach segment of the San Antonio River with the remaining SARB dates. Differences at this scale are less a function of calibration or temporal bias and, therefore, may highlight other processes that need investigation.

The calibrated data set for that period assumes equally spaced dates (e.g., 1 date per 22.2 years) and the average standard error (e.g., +/- 41) at the number of dates (e.g., 90) and the average standard error (e.g., +/- 41) in a given 2000 year period. We created an artificial data set for that period assuming equally spaced dates (e.g., 1 date per 22.2 years) and constant standard error (e.g., +/-41). We did this for each 2000 year period and then summed the calibrated probabilities to produce Figure 4. Comparisons with Figure 2 (left) suggest similarities.

The non-linear relationship clusters calendar dates at some time periods and there is not a 1:1 relationship between the radiocarbon and calendar scales. A second source of the variability in Figure 2 is the calibration procedure as well as other processes beyond changes in the number of people and/or the number and variety of activities (occupational intensity). To use the patterns as a proxy for occupational intensity, we need to understand other processes. We discuss two of these other processes in the following sections.

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In an attempt to lessen the calibration bias evident in Figure 4, we standardized and subtracted the Figure 4 simulation from the Figure 2 SARB data to produce an index (Figures 5–6). Positive (white) spikes have more than expected dates and negative (red) spikes have less than expected.

Figure 5 -  Relative Date Index.

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Ongoing Research

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