CHAPTER 19

RADIOCARBON DATING OF THE EARLY OCCUPATIONS

Jonathan B. Mabry
Desert Archaeology, Inc.

The chronology of prehistoric occupations at the Clearwater site, AZ BB:13:6 (ASM), and associated canals, AZ BB:13:481 (ASM), earlier than about A.D. 550, the beginning of the Hohokam ceramic chronology, is based on 34 radiocarbon dates presented in Table 19.1 (this total does not include four dates rejected as unreliable, shown in parentheses). This set of radiocarbon dates includes 18 obtained during previous investigations of this site by Elson and Doelle (1987; dates reported in Mabry 1998) and Diehl (1996, 1997), and 16 new dates obtained during the Rio Nuevo Archaeology project. This combined set of radiocarbon dates also provides a chronological framework for the early portion of the alluvial sequence at the base of A-Mountain (Chapter 20, this report). In this chapter, the age ranges of pre-A.D. 550 occupations in various strata of the floodplain are estimated using the pooled probability method.

THE POOLED PROBABILITY METHOD

The pooled probability method of calculating the age range of an archaeological phase or interval of occupation involves calibrating, pooling, and averaging a set of dates (Eighmy and LaBelle 1996). The first step is to use a calibration algorithm to generate a calibrated age probability distribution for each acceptable radiocarbon date associated with the target time interval. This distribution, whether expressed in terms of a set of paired numerical values or a histogram curve, shows the relative probabilities that the age of the sample falls on each calendar year within the total span of the distribution. Next, the calibrated age probabilities for all the dates for that interval are pooled and averaged. The resulting distribution summarizes the pooled probabilities for the interval. This distribution can divided into 1-sigma and 2-sigma ranges, representing the age ranges containing 68 percent (PR68) and 95 percent (PR95) of the pooled probability distribution, respectively.

THE AGE RANGES OF EARLY OCCUPATIONS

Remains of the earliest occupation at the Clearwater site are contained in the upper portion of Stratum 504 at the Congress Street locus (see Chapter 20). The next oldest occupation is on top of Stratum 503 at the same locus. Stratum 502 at both the Congress Street and Mission loci contains the next oldest remains. Occupations on top of Stratum 502 are dated by associated Hohokam and Protohistoric pottery types instead of by radiocarbon dates (Chapter 7, this report).

There are five radiocarbon dates for Stratum 504 at the Congress Street locus, and two dates for Stratum 503 in the same locus. The dates from Stratum 502 occupations are divided according to the Brickyard and Mission loci (n = 19 and n = 5, respectively). The probability distribution curves and PR95 ranges for the radiocarbon dated features in each stratum are shown in Figure 19.1.

The dates from cultural features in Stratum 504 range between 3800 b.p. and 3620 b.p., uncalibrated, including dates on maize of 3690±40 b.p. and 3650±40 b.p. The PR95 pooled probability range for the calibrations of these dates is approximately 2300-1900 B.C., with a midpoint near 2100 B.C. If only the calibrated dates on maize are included (that is, excluding the dates on wood charcoal), the range is tightly clustered near 2100 B.C. This range indicates the initial occupation occurred during the earliest portion of the unnamed phase of the Early Agricultural period (circa 2100-1200 B.C.). This occupation represents the beginning of a 4,100-year-long sequence of almost continuous occupation at the base of A-Mountain, establishing Tucson's status as one of the longest inhabited places in the United States.

The two dates available from cultural features in Stratum 503 at the Congress Street locus are 3280±40 b.p. and 3220±40 b.p., uncalibrated. The PR95 pooled probability range for the calibrations of these dates is roughly 1650-1425 B.C., with a midpoint near 1540 B.C. If only the date on annual plant tissue is used (that is, excluding the date on wood charcoal), the midpoint is near 1480 B.C. This range indicates the Stratum 503 occupation occurred during the middle part of the unnamed phase of the Early Agricultural period (circa 2100-1200 B.C.).

The dates from cultural features in Stratum 502 range between 2620±40 b.p. and 2140±40 b.p., uncalibrated, at the Congress Street locus, and between 2450±75 b.p. and 2350±60 b.p., uncalibrated, at the Mission locus. The PR95 pooled probability ranges

Table 19.1. Radiocarbon dates from the Clearwater site, AZ BB:13:6 (ASM), by stratum.

Stratum/Context	Material	Uncalibrated Radiocarbon Age b.p.	$^{13}C/^{12}C$ Ratio	Calibrated Age Range (1#sigma)	Sample Number	Reference
Top of Stratum 504, Congress Street Locus						
Pit structure, F. 516	Juniper charcoal	3800±40	-25.0	2290-2150 B.C.	Beta-157018	This report
Intramural pit, F. 580.01	Maize	3690±40	-10.9	2140-2020 B.C.	Beta-175842	This report
Pit structure, F. 581	Charcoal	3680±40	-25.3	2130-2010 B.C.	Beta-175843	This report
Intramural pit, F. 580.01	Maize	3650±40	-10.4	2120-1950 B.C.	Beta-160381	This report
Pit structure, F. 3359	Charcoal	3620±40	-24.8	2030-1920 B.C.	Beta-175844	This report
Top of Stratum 503, Congress Street Locus						
Pit, F. 572	Mesquite charcoal	3280±40	-24.5	1610-1510 B.C.	Beta-190713	This report
Pit, F. 630	Annual plant	3220±40	-8.3	1520-1440 B.C.	Beta-193150	This report
Stratum 502, Brickyard Locus						
"Big house," F. 9357.01	Maize	2620±40	-10.5	820-790 B.C.	Beta-193151	This report
Intramural pit, F. 1040.04	Charcoal	2600±50	-23.2	810-780 B.C.	Beta-90227	Diehl 1997
Intramural pit, F. 1006.02	Maize	2580±60	-8.7	805-770 B.C.	Beta-90225	Diehl 1997
Pit structure, F. 3323	Maize	2530±50	-9.9	790-550 B.C.	Beta-193148	This report
Intramural pit, F. 175.01	Maize	2520±40	-10.5	790-540 B.C.	Beta-85405	Diehl 1996
Pit, F. 1014	Mesquite	2510±50	-26.5	785-525 B.C.	Beta-92620	Diehl 1997
Intramural pit, F. 1006.03	Maize	2500±60	-10.0	785-505 B.C.	Beta-90226	Diehl 1997
Intramural pit, F. 3325.01	Maize	2500±50	-10.6	780-520 B.C.	Beta-193149	This report
Intramural pit, F. 1040.02	Mesquite	2500±50	-23.8	780-515 B.C.	Beta-90231	Diehl 1997
Pit structure, F. 371/370	Mesquite	2480±50	-24.0	775-425 B.C.	Beta-92622	Diehl 1997
Canal, F. 141	Maize	2470±40	-9.2	770-430 B.C.	Beta-160379	This report
Pit, F. 1023	Mesquite	2440±60	-24.9	760-405 B.C.	Beta-92618	Diehl 1997
Pit, F. 1020	Mesquite	2440±60	-23.5	760-405 B.C.	Beta-92621	Diehl 1997
Pit structure, F. 370/371	Maize	2430±60	-9.5	760-400 B.C.	Beta-92619	Diehl 1997
Pit, F. 1029	Maize	2420±50	-10.8	745-400 B.C.	Beta-90229	Diehl 1997
Pit, F. 1016	Maize	2390±50	-11.3	505-395 B.C.	Beta-90228	Diehl 1997
Pit, F. 1009	Mesquite	2390±70	-23.9	525-390 B.C.	Beta-92617	Diehl 1997
Pit, F. 1032	Mesquite	2250±50	-23.3	380-205 B.C.	Beta-90231	Diehl 1997
Canal, F. 139	Charcoal	2140±40	-21.4	200-110 B.C.	Beta-160378	This report
"Big house," F. 9357	Maize	(2010±40)	-11.4	50 B.C.-A.D. 40	Beta-190717	This report
Pit structure, F. 3293	Mesquite	(770±140)	-25.0	A.D. 1160-1310	Beta-193147	This report

for the calibrations of these dates are about 800-175 B.C. and 750-350 B.C., respectively. If the two youngest outlying dates from this stratum at the Congress Street locus are excluded, the PR95 pooled probability range of the remaining dates is approximately 800-400 B.C. These ranges indicate Stratum 502 occupations at both loci correspond with the Early Cienega phase (circa 800-400 B.C.), with at least some continued occupation at the Congress Street locus during the Late Cienega phase (circa 400 B.C.-A.D. 50).

EARLY DATES FOR MAIZE, CERAMICS, AND CANALS

The two direct dates on maize from Stratum 504 at the Congress Street locus, 3690±40 and 3650±40 b.p., uncalibrated (circa 2100 B.C., calibrated), are currently among the oldest radiocarbon dates on maize in the Southwest. They fall within a cluster of unambiguous maize radiocarbon dates between about 3800 b.p. and 3600 b.p., uncalibrated (circa 2200-2000 B.C., calibrated) from multiple sites in several regions of

Table 19.1. Continued.

Stratum/Context	Material	Uncalibrated Radiocarbon Age b.p.	$^{13}C/^{12}C$ Ratio	Calibrated Age Range (1 sigma)	Sample Number	Reference
Stratum 502, San Agustín Mission Locus						
Pit structure	Maize	2450±75	-16.9	765-405 B.C.	AA-6638	Mabry 1998
Intramural pit, F. 65.01	Maize	2430±50	-10.9	760-410 B.C.	Beta-193152	This report
Pit structure	Maize	2395±60	-9.9	755-395 B.C.	AA-6637	Mabry 1998
Pit structure	Maize	2390±65	-10.6	755-395 B.C.	AA-6636	Mabry 1998
Pit structure	Maize (?)	2360±60	-22.5	480-390 B.C.	AA-6639	Mabry 1998
Top of Stratum 502, San Agustín Mission Locus						
Pit structure, F. 15	Maize	1650±40	-10.5	A.D. 380-430	Beta-190710	This report
Pit structure, F. 28	Mesquite	(450±40)	-21.0	A.D. 1430-1460	Beta-190712	This report
Pit, F. 178	Capsicum	(100±40)	-25.7	A.D. 1680-1950	Beta-190711	This report
Top of Stratum 502, Mission Gardens Locus						
Pit structure, F. 3014	Maize	1760±40	-11.7	A.D. 230-450	Beta-193146	This report
Pit structure, F. 3038.02	Columnar-celled seed coat	1600±40	-25.3	A.D. 410-530	Beta-190715	This report

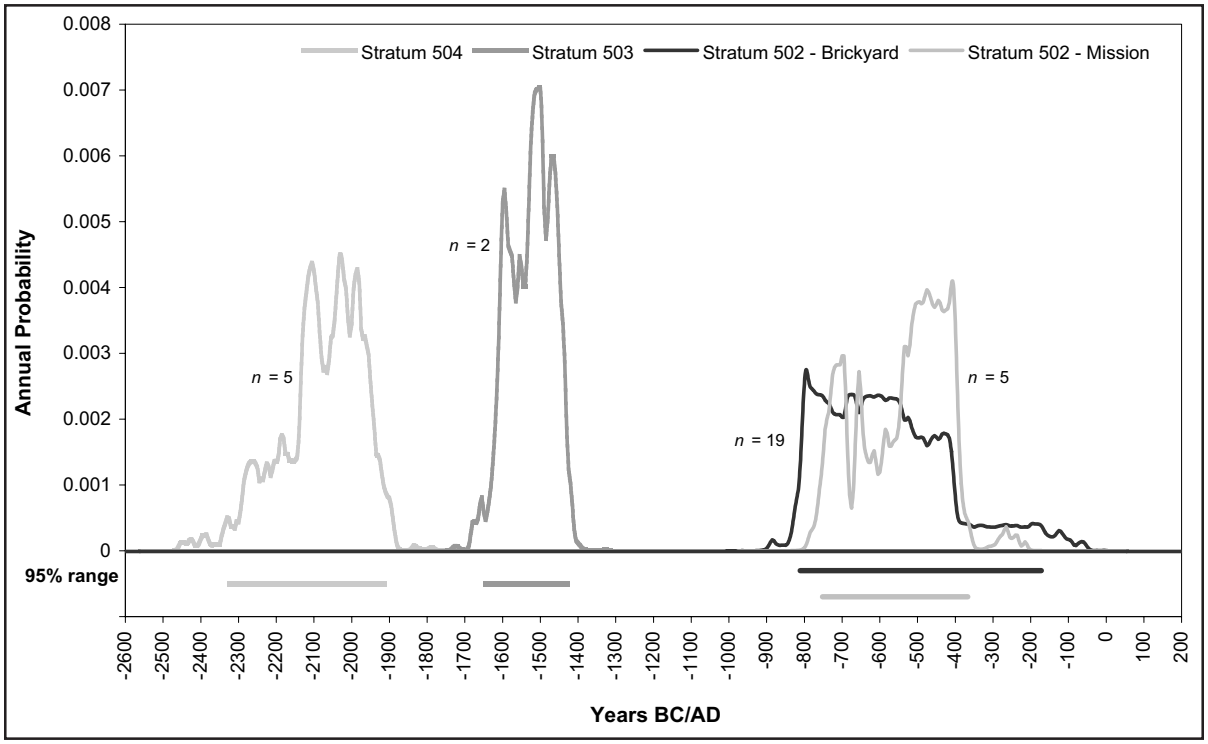

Figure 19.1. Calibrated pooled probability age ranges of major strata of occupation at the Clearwater site, AZ BB:13:6 (ASM).

the Southwest (see a current inventory in Mabry 2005), including a maize date of 3670±40 b.p., uncalibrated (circa 2100 B.C., calibrated) from the Las Capas site, AZ AA:12:111 (ASM), a few miles downstream in the middle Santa Cruz Valley (Hesse and Foster 2005).

The radiocarbon dates from Stratum 504 at the Congress Street locus are also associated with fired ceramic sherds and possible figurine fragments (Chapters 7 and 8, this report). Pit structure Feature 581 contained a sherd and provided a radiocarbon date of 3680±40 b.p., uncalibrated (circa 2100 B.C., calibrated) on wood charcoal. The other ceramics are indirectly associated with the radiocarbon dates from cultural features in this stratum. Currently, these are the oldest known fired ceramics in the Southwest (see Chapter 7). The next oldest known fired ceramics in the region are pottery sherds and figurine fragments in contexts dated circa 1200 B.C., at the nearby Las Capas site (see Heidke 2005, which includes a current inventory of earliest Southwestern ceramics).

Canal Feature 152, BB:13:481, originating in Stratum 503 at the Congress Street locus, is the oldest canal identified during the Rio Nuevo Archaeology project (see also Chapter 20). The canal is indirectly associated with radiocarbon dates near 1500 B.C., calibrated, obtained on samples from two nearby cultural features also originating in this stratum (see above). Canal Feature 141, originating in Stratum 502 and crossing both the Congress Street and Brickyard loci, provided a radiocarbon date on maize of 2470±40 b.p., uncalibrated (circa 600 B.C., calibrated), from a sediment sample collected from canal sediments. Wood charcoal from the fill of Canal Feature 139 in Stratum 502, and also crossing these loci, provided a date of 2140±40 b.p., uncalibrated (circa 150 B.C., calibrated); this canal immediately overlies Canal Feature 140 in the same stratum, providing a minimum age for that canal as well. Canal Feature 152, indirectly dated near 1500 B.C., is currently the oldest known canal north of central Mexico. The next oldest known canal in the Southwest is a canal bracketed prior to roughly 1250 B.C., at the Las Capas site a few miles downstream in the middle Santa Cruz Valley (Mabry 2006).

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