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.

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

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.

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

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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