Dust Cave (1Lu496) is a habitation site in a karstic vestibule in the middle Tennessee River Valley of Northern Alabama. The cave, periodically occupied over 7,000 years, contains well-preserved bone and botanical materials and exhibits microstratigraphy and intact occupation surfaces. The chronostratigraphic framework for Dust Cave is based on 43 \(^{14}C\) dates, temporally diagnostic artifacts, and detailed geoarchaeological analysis. In a broad sense, five cultural components are defined and designated: Quad/Beaver Lake/Dalton (10,650–9200 cal B.C.), Early Side-Notched (10,000–9000 cal B.C.), Kirk Stemmed (8200–5800 cal B.C.), Eva/Morrow Mountain (6400 to 4000 cal B.C.), and Benton (4500–3600 cal B.C.). Microstratigraphic and artifact analyses indicate that the primary differences in the deposits over time relate to intensity of activity and spatial organization with regard to changing conditions in the cave, not to the types of activities. Geomorphic transformations influenced the timing of occupation at Dust Cave, especially the initial occupation. The chronostratigraphy provides a framework for assessing the stratigraphic separation of Dalton and Early Side-Notched materials, the shift in technology from blades to bifacial tools, and the context of detailed flora and fauna evidence. These remains provide unique insights into forager adaptations in the Mid-south from the end of the Pleistocene through the first half of the Holocene.

Located in the Tennessee River Valley on the southern Interior Low Plateau of northern Alabama, Dust Cave (1Lu496) is a habitation site periodically occupied over 7,000 years (Driskell 1996; Goldman-Finn and Driskell 1994) (Figure 1). The site consists of a karstic cave vestibule with abundant, well-preserved bone and botanical remains and intact occupation surfaces, typically destroyed or eroded in sites in southeastern North America. Positioned along the bluff line at the margins of three rich habitats, the cave provided an excellent base for human exploitation of aquatic, floodplain, and upland resources (Detwiler 2000; Driskell 2000; Walker 1997; Walker et al. 2001). The earliest evidence for human use of the cave begins around 10,900 cal B.C., at which time the entrance was approximately 4.5 m high and as many as 14 m wide, with patches of relic sediments on the bedrock floor of the entrance chamber. Around 4000 cal B.C., after millennia of periodic seasonal human occupation, headroom in the cave was reduced to less than 1 m and the cave was
abandoned. Today the cave vestibule contains over 4 vertical meters of sediment generated through various processes, with human occupation being the primary process accounting for these deep deposits (Collins et al. 1994; Goldberg and Sherwood 1994; Sherwood and Goldberg 2000; Sherwood 2001).

This segment of the Tennessee River contains one of the largest concentrations of diagnostic fluted points in the eastern U.S. (Anderson and Faught 1998; Anderson and Sassaman 1996; Futato 1982, 1996), and the middle Tennessee River has been considered a migration route and staging area for the colonization of eastern North America (Anderson 1996; Mason 1962). In the Southeast, Dust Cave has one of the largest collections of radiocarbon dates in association with archaeological remains from the Pleistocene/Holocene boundary. In addition, the site provides an important dataset for several research topics including site formation, economic and subsistence studies, technological change, and settlement systems. The Dust Cave assemblage of well-preserved bone, charred plant material, and lithic artifacts offers a rare glimpse into foraging behavior in the Midsouth from its Paleoindian beginnings into the Middle Archaic.

In this paper we provide the chronological and geoarchaeological framework for additional studies. We begin by relating the history of the excavations, followed by a discussion of the site in its historical geologic context. We then provide a summary of the cultural chronology at the site in the context of the cave’s depositional history with brief introductory overviews of the regional prehistory. Only the interpretations from the geoarchaeological analysis of the depositional history are incorporated here; the detailed descriptions and results are reported elsewhere (Sherwood 2001). The chronology is supported by 43 radiocarbon age determinations from the cave’s entrance chamber, as well as the diagnostic hafted bifaces. Discrete stratigraphic zones containing diagnostic artifacts are organized into five archaeological units. Four of these units—the Early Side-Notched, Kirk Stemmed, Eva/Morrow Mountain, and Benton—are each dominated by a single projectile point type, or closely related types. Thus, we consider
these units to be true archaeological components, i.e., archaeological units that contain “associated artifacts, debris, and features thought to represent one occupation unit at the site . . .” (Gibbon 1998:174). An occupation unit, we assume, represents serial use of the cave by a single group, or perhaps related groups of people with a similar lifestyle as suggested by related artifacts, particularly these distinctive forms of projectile points. On the other hand, basal stratigraphic units at Dust Cave contain an artifact inventory that includes small numbers of several projectile point styles: Quad, Beaver Lake, Dalton, and Hardaway Side-Notched projectile points. An additional projectile point, a heavily reworked Cumberland, was also recovered from near bedrock. These projectile points, as well as associated radiocarbon dates, suggest the presence of archaeological components representative of both the Middle Paleoindian (Cumberland, Quad, and Beaver Lake) and Late Paleoindian (Dalton and Hardaway Side-Notched). However, limited numbers of projectile points, poor knowledge of date ranges for each of the projectile point types, and a general lack of data concerning type co-occurrence in occupations in the middle Tennessee Valley complicate the issue of further definition of this archaeological unit. Nevertheless, these Paleoindian manifestations are referred to in this paper simply as a Middle/Late Paleoindian component, for want of a better term.

**History and Methods of the Project**

In recent times, the restrictive nature of this small, low-ceiling grotto concealed the fact that it contained a well-preserved and deeply stratified archaeological sequence. As a result, the site was virtually untouched by looters. The cave has a southern exposure, a relatively large entrance chamber (initially about 100 sq m of floor space and a ceiling over 5 m high), and approximately 30 m of additional accessible passageways (Figure 2). Dust Cave was initially investigated, mapped, and named by amateur speleologists (Cobb 1987). Archaeological exploration began at the cave in the summer of 1989 as part of a cultural resource assessment of caves in the Pickwick Basin for the Tennessee Valley Authority (TVA) (Cobb et al. 1994:217-258). This assessment determined that this and other caves low in the valley wall are adversely affected by the inundation of the Tennessee River floodplain. Seasonal raising and lowering of the reservoir levels not only erode open air sites, but also accelerate the chemical weathering
of organic deposits like those preserved in Dust Cave.

As in most multiyear projects, the Dust Cave excavation and recording methods were developed and refined from the project’s initial prospective phase to the final intensive, detailed excavation. Initial investigation (1989) involved a series of five small, hand-excavated test pits that encountered cultural deposits. Three test excavations followed in Basket Cave (1Lu498), located immediately west of Dust Cave, 6 m higher in the bluff face. These units produced limited cultural material (in the case of Test Unit X, no material) but the stratigraphic sequence was to play a key role in the interpretation of the geological history of the project area. During the summers of 1990 and 1991, the team turned its full attention to Dust Cave, excavating 7 test units to bedrock (Test Units A through G, Figure 2). Three summer seasons (1992 through 1994) were devoted to the excavation of a 2-m-wide by 12-m-long trench, from the exterior talus deposits toward the back wall of the entrance chamber (Figure 2). The trench was dug in order to investigate stratigraphic relationships and to provide access beyond the restrictive entrance for additional excavation. The completion of the test trench revealed the extent of the deposits and provided a full vertical exposure that in 1992 was divided into major stratigraphic zones based on general lithostratigraphic similarity, major stratigraphic breaks (unconformable boundaries), and the chronosequence suggested by diagnostic artifacts and preliminary radiocarbon dates (Driskell 1994). Following the initial excavation of the test trench, additional summer seasons (1996 through 2002) were devoted to the excavation of the entrance chamber in order to refine the chronology and analyze the material remains in relation to the complex stratigraphic record in the cave. The cave is currently gated against looters, and a final summer season is planned to conclude the excavation and stabilize the remaining entrance chamber and passageway deposits.

After the testing phase, the excavation strategy involved 1-x-1-m units, excavated in 5-cm levels within stratigraphic units termed “zones.” All the sediments were water screened through 6-mm mesh except those sampled for flotation or designated as specific features for flotation. Unlike open-air sites, soil horizons are rarely developed in a cave (see Farrand 2001; Sherwood and Goldberg 2001), so the absence of pedogenic weathering results in a complex sequence of variable sedimentary lithostratigraphic units. Following the excavation of the Test Trench, zones were organized into a tripartite system. The system designates zone groups A through Y (youngest to oldest) with subzones within groups (e.g., A2, T3) and tertiary lenses within subzones (e.g., A2b, T3f). The subzones and tertiary zones are designated in the order they are identified in the excavation and then correlated within the Dust Cave relational database (Sherwood and Riley 1998). Macroscopic observations were made in the field to distinguish zones and describe the units and their three-dimensional shape. These observations were later supplemented with microscopic observations and interpretations from the micromorphological analysis of sediments in thin section (Goldberg and Sherwood 1994; Sherwood 2001). In this paper, discussion is primarily restricted to the use of the first-order zones representing groups of lithostratigraphic units.

Most of the stratigraphic evidence outside the cave has been removed through erosion by the Tennessee River and through soil formation (with few artifacts recovered). Weathered deposits within the talus change abruptly at the dripline to complex, well-preserved strata in the entrance chamber. Figure 3 presents a section through the talus and entrance chamber, illustrating the complex stratigraphy discernible in the cave. Ephemeral archaeological deposits are present in adjacent areas of two passageways extending farther into the cave, but these are at least partially deflated palimpsests, and not firmly correlated with entrance chamber deposits.

A table containing the chronological data from the $^{14}$C and two summary figures are provided to illustrate the chronological data. Table 1 lists the calibrated intercepts and 2σ calibrated calendar age ranges (Ramsey 2000) for each radiocarbon assay. Driskell (1994, 1996) previously published the majority of these dates in an uncalibrated format. Dates are discussed in the text as cal B.C., and summarized using the younger and older median of the 2σ calibrated age range for that component. Figure 4 illustrates the sum of the probabilities for each of the five components. The frequency distributions of the diagnostic projectile points, bifaces, and unifaces from Dust Cave are illustrated as depth
Figure 3. Stratigraphic profile of the east wall (W62) of the Dust Cave Test Trench.
Table 1. Radiocarbon Dates from the Entrance Chamber at Dust Cave. Many of These Dates Originally Published Uncalibrated in Driskell (1994, 1996).

<table>
<thead>
<tr>
<th>Component *</th>
<th>Lab Number</th>
<th>Material Dated</th>
<th>Uncalibrated (^{14}C) Age</th>
<th>(^{13}C) b</th>
<th>Calendar Age (2σ) c</th>
<th>Dust Cave Provenience d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benton (D4)</td>
<td>Beta-100508</td>
<td>charred material</td>
<td>5000 ± 80 -25.0% e</td>
<td></td>
<td>3960-3650 B.C. (95.4%)</td>
<td>N60 W65, Level 11, 173 cm, Feature 136a</td>
</tr>
<tr>
<td>Benton (D4)</td>
<td>Beta-58895</td>
<td>charred material</td>
<td>5590 ± 50 -25.0% e</td>
<td></td>
<td>4530-4330 B.C. (95.4%)</td>
<td>N62 W64, Level 6, 175-185 cm, Feature 15</td>
</tr>
<tr>
<td>Benton (D4/E1)</td>
<td>Beta-48753</td>
<td>charred material</td>
<td>5380 ± 90 -25.0% e</td>
<td></td>
<td>4360-3980 B.C. (95.4%)</td>
<td>T.U. H, N60.2 W60.1, Level 7, 150-160 cm</td>
</tr>
<tr>
<td>Benton (D4)</td>
<td>Beta-65168</td>
<td>charred material</td>
<td>5280 ± 130 -25.0% e</td>
<td></td>
<td>4400-3750 B.C. (95.4%)</td>
<td>N60 W64, Level 6, 160-178 cm, Feature 47/136</td>
</tr>
<tr>
<td>Eva/Morrow Mt (E1)</td>
<td>Beta-100509</td>
<td>charred material</td>
<td>5400 ± 80 -25.0% e</td>
<td></td>
<td>370-4030 B.C. (93.8%)</td>
<td>N59.2 W64.6, Level 15, 196 cm, Feature 150b</td>
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<tr>
<td>Eva/Morrow Mt (E1)</td>
<td>Beta-48752</td>
<td>charred material</td>
<td>6700 ± 100 -25.0% e</td>
<td></td>
<td>5790-5470 B.C. (95.4%)</td>
<td>T.U. H, N60.00 W59.60, Level 12, 200-210 cm</td>
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<tr>
<td>Eva/Morrow Mt (E4)</td>
<td>Beta-65169</td>
<td>charred material</td>
<td>5910 ± 70 -25.0% e</td>
<td></td>
<td>4950-4590 B.C. (95.4%)</td>
<td>N62.6 W62.9, Level 11, 215-220 cm, Feature 69</td>
</tr>
<tr>
<td>Eva/Morrow Mt (intrusive P1)</td>
<td>Beta-48755</td>
<td>charred material</td>
<td>6050 ± 100 -25.0% e</td>
<td></td>
<td>5300-4700 B.C. (95.4%)</td>
<td>N61 W63, Level 13, 280-286 cm, Feature 34</td>
</tr>
<tr>
<td>Eva/Morrow Mt (J1a)</td>
<td>Beta-100510</td>
<td>charred material</td>
<td>6480 ± 90 -25.0% e</td>
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<td>5620-5290 B.C. (95.4%)</td>
<td>N62 W64.50, Level 23, 245 cm, Feature 177</td>
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<td>Eva/Morrow Mt (J1a)</td>
<td>Beta-58897</td>
<td>charred material</td>
<td>6790 ± 120 -25.0% e</td>
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<td>5900-5480 B.C. (95.4%)</td>
<td>T.U. H, N60 W59.6, Level 16, 240-250 cm, Feature 38</td>
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<tr>
<td>Eva/Morrow Mt (J3)</td>
<td>Beta-65171</td>
<td>charred material</td>
<td>6350 ± 90 -25.0% e</td>
<td></td>
<td>5480-5060 B.C. (95.4%)</td>
<td>N62.7 W62.8, Level 16, 245-251 cm, Feature 88</td>
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<tr>
<td>Eva/Morrow Mt (K3)</td>
<td>Beta-65173</td>
<td>charred material</td>
<td>6280 ± 90 -25.0% e</td>
<td></td>
<td>5470-4990 B.C. (95.4%)</td>
<td>N63.5 W63.5, Level 11, 222-225 cm</td>
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<tr>
<td>Eva/Morrow Mt (K3)</td>
<td>Beta-65170</td>
<td>charred material</td>
<td>7480 ± 120 -25.0% e</td>
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<td>6600-6000 B.C. (95.4%)</td>
<td>N60 W64, Level 18, 159 cm</td>
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<td>Eva/Morrow Mt (K3)</td>
<td>Beta-65182</td>
<td>charred material</td>
<td>6840 ± 90 -25.0% e</td>
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<td>5970-5950 B.C. (1.1%)</td>
<td>N58 W64, Level 18, 270-275 cm, Feature 71</td>
</tr>
<tr>
<td>Eva/Morrow Mt (K3)</td>
<td>Beta-65175</td>
<td>charred material</td>
<td>6570 ± 120 -25.0% e</td>
<td></td>
<td>5590-5550 B.C. (2.8%)</td>
<td>N63.5 W63.2 Level 22, 275-280 cm</td>
</tr>
<tr>
<td>Eva/Morrow Mt (E1)</td>
<td>Beta-58898</td>
<td>charred material</td>
<td>5670 ± 120 -25.0% e</td>
<td></td>
<td>4800-4250 B.C. (95.4%)</td>
<td>N58 W64, Level 11, 200-208 cm, Feature 56</td>
</tr>
<tr>
<td>Eva/Morrow Mt (J/K)</td>
<td>Beta-58893</td>
<td>charred material</td>
<td>6660 ± 100 -25.0% e</td>
<td></td>
<td>5740-5460 B.C. (92.5%)</td>
<td>N58 W64, Level 14, 240 cm</td>
</tr>
<tr>
<td>Eva/Morrow Mt (K5/N2)</td>
<td>Beta-65175</td>
<td>charred material</td>
<td>6570 ± 190 -25.0% e</td>
<td></td>
<td>5850-5050 B.C. (95.4%)</td>
<td>N60 W64, Level 21, 270-275 cm</td>
</tr>
<tr>
<td>Kirk Stemmed (P3/P14)</td>
<td>Beta-65184</td>
<td>charred material</td>
<td>8330 ± 170 -25.0% e</td>
<td></td>
<td>7750-6800 B.C. (95.4%)</td>
<td>N60 W64, Level 36, 345 cm</td>
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<tr>
<td>Kirk Stemmed (L1)</td>
<td>Beta-65178</td>
<td>charred material</td>
<td>7040 ± 110 -25.0% e</td>
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<td>6160-6130 B.C. (1.5%)</td>
<td>N59.1 W62.5, Level 24, 283-293 cm, Feature 98</td>
</tr>
<tr>
<td>Kirk Stemmed (P1)</td>
<td>Beta-48756</td>
<td>charred material</td>
<td>7680 ± 170 -25.0% e</td>
<td></td>
<td>7050-6200 B.C. (95.4%)</td>
<td>N60.2 W62.2, Level 17, 285-295 cm (burial fill from top depth 246 cm)</td>
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<tr>
<td>Kirk Stemmed (P18)</td>
<td>Beta-147136</td>
<td>charred material</td>
<td>8830 ± 50 -25.8% e</td>
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<td>8210-7740 B.C. (95.4%)</td>
<td>N61.52 W61.28, Level 50, 320-325 cm</td>
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<tr>
<td>Kirk Stemmed (P2)</td>
<td>Beta-65180</td>
<td>charred material</td>
<td>7010 ± 90 -25.0% e</td>
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<td>6030-5710 B.C. (95.4%)</td>
<td>N60 W64, Level 25, 290 cm (intrusive pit)</td>
</tr>
<tr>
<td>Mixed (Q1)</td>
<td>Beta-81608</td>
<td>charred material</td>
<td>8470 ± 50 -25.0% e</td>
<td></td>
<td>7600-7470 B.C. (91.8%)</td>
<td>N64 W64, Level 38, 359 cm</td>
</tr>
<tr>
<td>Component</td>
<td>Beta-Number</td>
<td>Charred Material</td>
<td>Dates (1σ)</td>
<td>Radiocarbon Age (B.C.)</td>
<td></td>
<td></td>
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<td>------------------------------------------------</td>
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<tr>
<td>Early Side-Notched (R9)</td>
<td>Beta-81602</td>
<td>charred material</td>
<td>10070 ±   60</td>
<td>10,150–9300 B.C. (95.4%)</td>
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<tr>
<td>Early Side-Notched (R1?)</td>
<td>Beta-81606</td>
<td>charred material</td>
<td>9720 ±    70</td>
<td>9290–9090 B.C. (63.2%)</td>
<td></td>
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<tr>
<td>Quad/Beaver Lake/Dalton (T)</td>
<td>Beta-81610</td>
<td>charred material</td>
<td>10070 ±  70</td>
<td>10,200–9300 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (T1-T2?)</td>
<td>Beta-65177</td>
<td>charred material</td>
<td>9990 ± 140</td>
<td>10,400–9200 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (T2)</td>
<td>Beta-147135</td>
<td>charred material</td>
<td>10140 ±  40</td>
<td>10,350–10,250 B.C. (1.9%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (T2)</td>
<td>Beta-41063</td>
<td>charred material</td>
<td>10330 ± 120</td>
<td>10,900–9600 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (T2)</td>
<td>Beta-133788</td>
<td>charred material</td>
<td>9950 ±    50</td>
<td>9620–9250 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (T2c)</td>
<td>Beta-147132</td>
<td>charred material</td>
<td>10010 ±  40</td>
<td>10,000–9900 B.C. (2.8%)</td>
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<td>Quad/Beaver Lake/Dalton (T2-T3?)</td>
<td>Beta-40681</td>
<td>charred material</td>
<td>10490 ± 360</td>
<td>11,200–9200 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (T8-T2?)</td>
<td>Beta-81611</td>
<td>charred material</td>
<td>9890 ±    70</td>
<td>9620–9210 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (T8-T3)</td>
<td>Beta-133791</td>
<td>charred material</td>
<td>10100 ±  50</td>
<td>10,200–9300 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (U1)</td>
<td>Beta-81609</td>
<td>charred material</td>
<td>10340 ± 130</td>
<td>10,900–9600 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (U1a)</td>
<td>Beta-65181</td>
<td>charred material</td>
<td>10310 ± 230</td>
<td>10,900–9300 B.C. (95.4%)</td>
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<td></td>
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<tr>
<td>Quad/Beaver Lake/Dalton (U1a)</td>
<td>Beta-65179</td>
<td>charred material</td>
<td>10390 ±  80</td>
<td>10,900–9,800 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (U2)</td>
<td>Beta-13599</td>
<td>charred material</td>
<td>10500 ±    60</td>
<td>10,950–10,100 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (U3)</td>
<td>Beta-133790</td>
<td>charred material</td>
<td>10310 ±  60</td>
<td>10,900–9,800 B.C. (95.4%)</td>
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<td></td>
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<tr>
<td>Quad/Beaver Lake/Dalton (U3)</td>
<td>Beta-40680</td>
<td>charred material</td>
<td>10345 ±  80</td>
<td>10,900–9800 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (U3)</td>
<td>Beta-81613</td>
<td>charred material</td>
<td>10490 ±  60</td>
<td>10,950–10,000 B.C. (95.4%)</td>
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<tr>
<td>Quad/Beaver Lake/Dalton (U3?)</td>
<td>Beta-100506</td>
<td>charred material</td>
<td>10370 ± 180</td>
<td>11,000–9400 B.C. (95.4%)</td>
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<td></td>
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<tr>
<td>Non-Cultural (Y1)</td>
<td>Beta-81603</td>
<td>charred material</td>
<td>10590 ±  60</td>
<td>11,000–10,350 B.C. (92.6%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a Component based on distinct group of lithostratigraphic units containing regionally diagnostic projectile points.

b All dates are corrected for isotopic fractionation.

c All dates are calibrated using Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron].

d Each Excavation unit has its own level sequence.
below datum (Figure 5). Given the slight slope of the deposits at the site and the complexity of intersecting pits, there is no perfect correlation between depth and zones. However, the frequency of the projectile points by depth does conform to the regional projectile point typology. Additionally, the predominance of unifaces in the deepest deposits provides support for the antiquity of the lower cultural deposits at Dust Cave.

### Geomorphic History

To understand the depositional history of Dust Cave, we must first review the geomorphic context. Cave entrances represent unique depositional environments with input from processes outside the cave (exogenous) and from within the cave system (endogenous) (Sherwood and Goldberg 2001). Dust Cave contains a complex series of anthropogenic, biogenic, and geogenic sediments, all part of or impacted by the geomorphic processes within this section of the middle Tennessee River Valley.

Dust Cave is located at 130.5 m amsl, in the western portion of the middle Tennessee River Valley where the river cuts down through horizontal Mississippian age rocks. The result is an elevated, rolling karstic plateau on either side of the river and its floodplain (Figure 1). This relatively narrow section of the river (1–3 km wide) is located immediately downriver from Muscle Shoals, the largest shoals in the Tennessee River system. This bedrock shoal marks the steepest descent in the extensively dammed 1,040 km system, with a drop of about 40 m over 55 km. Relative to other sections of Pickwick Lake, the eastern section immediately below Wilson Dam and adjacent to Dust Cave, experienced minimal rise in the river levels. Coffee Slough is located in front of the cave, at the base of the talus slope (ca. 10 m from the entrance, and 2 m lower in elevation). The slough is a drowned spring-fed creek bed (once part of Cypress Creek) that trends west, paralleling the Tennessee River until it intersects the main channel 7 km below the cave (Figure 1).

During the late Pleistocene the Tennessee River base level and the floor through this narrow section of the valley were at least 6 m higher than they are today. During this time, Dust Cave would have been completely full of sediment (Figure 6). This supposition is based on evidence from Basket Cave, located in the valley wall approximately 6 m above Dust Cave (Collins et al. 1994, 1995; Sherwood 2001) (Figure 6). In Basket Cave, Tennessee River alluvium (Figure 7; Strata I, II) is buried below 2 m of red clay and rock (Figure 7: Strata III, IV) derived from within the cave system. The Tennessee River alluvium has a unique regional signature derived from the Southern Appalachians and...
is composed of conspicuous amounts of mica (Collins et al. 1994) and minor amounts of pyroxene (Sherwood 2001). The top of Stratum II produced a date of 15,630 ± 544 BP (Collins et al. 1994:40), 16,700 cal B.C. (18,200–15,300 cal B.C., 95.4%, Ramsey 2000), suggesting that some time after 16,700 cal B.C., the Tennessee River and local groundwater base level began to lower. Collins et al. (1994, 1995) refer to this process as the “dewatering” of the Cumberland Plateau. In addition, the narrow valley and steep descent associated with Muscle Shoals most likely accelerated the major Terminal Pleistocene erosional phase that is suggested by the shift in source material in the Basket Cave sequence (Figure 7).

With the lowering of the water table, the caves in the valley wall, including Dust Cave, became major spring conduits, flushing sediments from their entrances (Collins et al. 1994:37). Following the overall lowering of the water table and spring activity, erosion at Dust Cave was concentrated in the entrance of the cave, leaving remnant alluvial deposits in the back passage and eroding the sediments in the entrance chamber, nearly to bedrock (Figure 6). The upper reaches of the fluvial sequence in Basket Cave (Figure 7; Stratum IIa) were inundated with slack water, followed by extensive endogenous sedimentation (Sherwood 2001). In Dust Cave, at least one spring channel remained active as the water table continued to drop in the valley. A seasonally active localized spring conduit is still present in the cave floor today. The lowering base level, as well as the increased precipitation at the end of the Pleistocene (Del-
The earliest $^{14}$C date in Dust Cave, 11,000–10,350 cal. B.C., comes from Zone Y sediments that accumulated in the entrance chamber as a result of a dwindling phreatic drainage (Table 1; Figure 3). This phreatic drainage activity would have moved relic Tennessee River alluvium mixed with endogenous sediments from the back of the cave to the entrance chamber, where they were reworked. These processes also resulted in a mixing of extinct Pleistocene fauna—Giant Beaver (*Castoroides*) and Dire Wolf (*Canis dirus*) (Paul Parmalee, personal communication 1999)—with Holocene species, such as white-tail deer, raccoon, turtle, and various birds and reptiles (Walker 1998).

**Stratigraphy, Chronology, and Archaeological Components**

Initial human occupation of the middle Tennessee Valley in northern Alabama occurred during the late Pleistocene. Although large numbers of Paleoindian points have been found in the middle Tennessee Valley (Futato 1982, 1996), the majority have been recovered from eroded deposits, resulting in a lack of stratigraphic context and radiometric dates. As a consequence, dating of the sequence of Paleoindian projectile point types in the region is primarily inferential. Building on a temporal sequence for the Paleoindian period in the southeastern U.S. that is divided into Early, Mid-
Figure 7. Basket Cave plan view with test units and the southeastern profile of Test Unit X. (cave plan based on a map provided by the Alabama Cave Survey)
dle and Late subperiods (e.g., Anderson et al. 1990; Anderson and Sassaman 1996; Sassaman and Anderson 1990), the chronological ordering of Paleoindian point forms in the middle Tennessee Valley is as follows: Early Paleoindian (11,500–10,900 cal. B.C.) represented by Clovis, Middle Paleoindian (10,900–10,000 cal. B.C.) characterized by Cumberland, Beaver Lake, and Quad point types, and Late Paleoindian (10,000–9200 cal. B.C.) characterized by Dalton and Hardaway Side-Notched types.¹

Quad/Beaver Lake/Dalton Component. The earliest radiocarbon date associated with human habitation in the cave is derived from Zone U and suggests initial occupation around 10,650 cal B.C. To date, 17 samples from Zones U and T have produced dates to confirm a range of 10,650 to 9200 cal B.C. (Table 1). Viewed in combination with the diagnostic artifacts, these zones are described as Middle to Late Paleoindian. For the purposes of this discussion and based on the diagnostic artifacts, Zones U and T are treated as one component (see above). In Table 1 and Figure 4 we divide the radiocarbon dates as Quad/Beaver Lake (Zone U) and Quad/Beaver Lake/Dalton (Zone T) based on stratigraphic variation and radiocarbon dates. Zone T may be a Dalton component, but the limited number of diagnostic hafted bifaces makes this an uncertain designation (Figure 5). This division of Zones U and T may, as the artifactual analysis progresses, prove to have the resolution needed to discriminate a cultural/behavioral basis that reveals time-transgressive technological shifts.

Several formal lithic artifact classes, including hafted bifaces, blades, and other formal uniface types, characterize the Quad/Beaver Lake/Dalton component at Dust Cave. The numerically small projectile point assemblage contains several types known to occur in early contexts elsewhere. These include Quad, Beaver Lake, a reworked Cumberland, Dalton, and Hardaway Side-Notched (as defined in DeJarnette et al. 1962) (Figure 8). These types are not thought to co-occur, as single-component assemblages of each type have been recovered elsewhere. Based on depth, the Quad and Beaver Lake types appear earlier in the sequence relative to other diagnostic Paleoindian hafted bifaces (Figure 5).

The inclusion of Dalton as a Late Paleoindian cultural manifestation at Dust Cave requires some qualification. First, it is important to contextualize the cultural-historical framework employed in this paper with respect to changing climate regimes occurring during the Pleistocene/Holocene transition. Although the term “Paleoindian” is often considered synonymous with late Pleistocene cultural manifestations in North America, such an association is not completely applicable in the case of Dalton. Based on the extant radiocarbon record Dalton dates from approximately 10,000–9200 cal. B.C., Dalton occurs both within and immediately post-dating the Younger Dryas (ca. 10,900–9650 cal B.C. [Alley et al. 1993; Dansgaard et al. 1989]). Representing one of the largest abrupt climate changes to occur within the past 100,000 years, the terminus of the Younger Dryas cooling event marks the onset of the Holocene. In this context, Dalton is both a Pleistocene and Holocene manifestation.

It is also important to note similarities in both chipped tool technologies and land-use patterns between Dalton and preceding Middle Paleoindian manifestations in northern Alabama. From a technological standpoint, Dalton tool-kits share several similarities with earlier Paleoindian technologies, namely the continued use of a distinct unifacial technology (discussed below). In terms of land-use patterns, the use of both caves and rockshelters, considered a Dalton adaptation to increasing population densities and reorganization of hunter-gatherer seasonal rounds (Walthall 1998), occurs during the Middle Paleoindian times in northern Alabama as evidenced by the presence of Cumberland, Quad and Beaver Lake points in such contexts (e.g., Clayton 1965; DeJarnette et al. 1962; Goldmann-Finn and Driskell 1994). While Dalton peoples were undoubtedly adjusting to changes in both fauna and flora associated with shifting climate regimes occurring during the Pleistocene/Holocene transition, both their technological organization and land-use patterns are reminiscent of preceding Middle Paleoindian cultures in northern Alabama.

One of the most significant aspects of this chipped stone tool assemblage is the large number of temporally diagnostic unifaces, including blades, thumbnail scrapers, and gravers, which are also documented at other Paleoindian sites in the Southeast (Coe 1964; Daniel and Wisenbaker 1989; DeJarnette et al. 1962; Soday 1954). One other intriguing artifact class almost solely associated
Figure 8. Hafted bifaces recovered at Dust Cave: (a) Cumberland, (b) Quad, (c) Beaver Lake, (d) Dalton, (e) Hardaway Side-Notched, (f) Early Side-Notched, (g) Kirk Corner-Notched, (h) Plevna (Kirk Corner-Notched Variant), (i), Kirk Stemmed, (j) Kirk Stemmed, (k) Kirk Serrated, (l) Kanawha, (m) Eva, (n) Morrow Mountain Stemmed, (o) Morrow Mountain Straight Base, (p) Crawford Creek, (q) White Springs, (r) Buzzard Roost Creek, (s) Benton.
with this component is a set of unifacial blades that appear to have been removed from specialized blade cores (Meeks 1994). Although no blade cores have been uncovered at Dust Cave, a number have been recovered from surface collections nearby (Collins 1999). A small number of other bifaces, mostly broken during the later stages of production, occur in this component as well (Figure 5). Organic tools have also been recovered, including antler tines, bone awls, and a bone eye needle (Goldman-Finn and Walker 1994).

The entrance chamber was at its largest during this early set of occupations, with both endogenous and exogenous sediments accumulating. Formation processes included slope wash from the talus in front of the cave, plant growth during periods of human abandonment, influx of eolian sediments from the floodplain, and occasional overbank deposition during flooding along Cypress Creek and the Tennessee River (Sherwood 2001). Areas along the back and margins of the entrance chamber were often damp, so activities were focused in the central front area of this space and, presumably, on the adjacent talus in front of the entrance. The floor of the cave slopes gently from the rear of the entrance chamber to the drip line. This also directly affects the vertical artifact distribution, with the earliest deposits concentrated in the front portion of the chamber. This is evident in the earliest artifact distributions, where diagnostics in the rear of the cave appear compressed relative to the front of the cave (Figure 3). Shortly before 10,000 cal B.C., there was a resurgence of the phreatic aquifer in the cave, and the joint-controlled drainage channels became active again, resulting in the erosion of fine-grained sediment and the accumulation of a lag of weathered limestone gravel adjacent to these channels in the rear of the entrance chamber. Post-depositional water movement resulted in partial decalcification of the sediments, producing subsidence of these deposits. This was quickly followed by the influx of well-sorted silt related to periodic slope wash, and possible eolian and slack water sediment accumulations in the cave (Sherwood 2001).

Zone T deposits, overlying the basal zones discussed above, probably developed over a period of ~700 calendar years from 10,000 to 9300 cal B.C. The deposits are directly related to periodic flood activity of the Tennessee River, which resulted in both the influx of alluvial sediments and some localized erosion; burrowing is also evident. However, both the fluvial influx of sediments and the bioturbation must have been highly localized, because the first discrete intact cultural deposits (represented by clay prepared surfaces2, small pits, and burned surfaces) are within Zone T. As diagnostic Early Archaic artifacts begin to dominate the artifact assemblage with the transition to Zone R, the activity in the cave increases with the expansion of anthropogenic deposits throughout the entrance chamber.

**Early Archaic ca. 9500-6900 cal. B.C.**

(11,500–8900 cal. BP)

The beginning of the Early Archaic period coincides with the onset of the Holocene. This post-glacial period in the southeastern U.S. is marked by warmer climatic conditions, resulting in changes in vegetation, fauna, seasonal temperatures, and fluctuations in sea level (Delcourt et al. 1983; Delcourt and Delcourt 1985). Corresponding with the post-Pleistocene environment is the development of a regionalized sequence of projectile point types in the Southeast including side-notched, corner-notched, and bifurcated points (Anderson et al. 1996; Broyles 1966; Chapman 1985; Sassaman and Anderson 1990). In the middle Tennessee Valley, the Early Archaic projectile point sequence is as follows: Early Side-Notched (9200–8500 cal B.C.), Kirk Corner-Notched (8500–7800 cal. B.C.), and various bifurcate forms including LeCroy and Kanawha (7800–6600 cal. B.C.) (Futato 1980; Goldman-Finn 1995; Meeks 2001).

**Early Side-Notched Component.** One Early Archaic component, primarily represented in Zone R, is defined by the Early Side-Notched projectile points. Anthropogenic deposits in Zone R are very similar to those in the Late Paleoindian Period; they take the form of prepared surfaces and small pits, but are more concentrated and extend across the entire entrance chamber. Rock-lined hearths also begin to appear.

Based on the artifact density of this component, this may represent one of the most intense periods of use in the cave’s history. Two radiocarbon samples from these deposits indicate dates ranging from ca. 10,000 to 9000 cal B.C. There is significant overlap in the probabilities for the dates from Quad/Beaver Lake/Dalton (Zone T) and the Early
Side-Notched (Zone R) (Figure 4). Some of this is probably attributed to the small sample representing the later component, but it is important to note that the greatest probability associated with the Early Side-Notched component falls immediately after the Late Paleoindian with a date of 9300 cal. B.C.

During the preliminary phases of the Dust Cave excavation, Driskell (1994, 1996) noted the presence of Early Side-Notched bifaces associated with pre-10,000 B.P. dates. This association was observed during the initial testing of the cave in the lower levels of Test Unit A and the northernmost portion of the Test Trench (Figure 2). Subsequent detailed geoarchaeological analyses have provided a more comprehensive understanding of the depositional environment of the cave and how these unexpected early dates were associated with Early Archaic material. Assessment of stratigraphic profiles indicates that these 14C samples were collected from an isolated area of Zone T (14C dates were initially published by level or by depth in Driskell 1994:Table 1; 1996:Table 16.1). As noted in the discussion of the Paleoindian component, the periodic resurgence in the karstic aquifer directly affected zones immediately overlying the joint patterns in the floor that channel this water. The resurgence winnowed the fine sediments along localized areas at the top of Zone U into Zone T4, and consequently would have easily mixed charcoal from Zone U with coarse clasts (in this case projectile points) from the overlying Zone T.

The Early Side-Notched period in the Midsouth has remained enigmatic. Side-Notched projectile points occur in early contexts throughout the Southeast, yet the chronology, technological assemblages, and subsistence practices have remained relatively unknown. As a “pure” Early Side-Notched assemblage, Dust Cave represents an important dataset (Randall 2002). Recent analyses of the lithic technology indicate similarities with and differences from the preceding periods; the differences include the significant decrease in the importance of core-derived blade technology and an increased focus on bifacial technology (Randall 2001) (Figure 5). The faunal subsistence data also indicate a shift in strategies from a riverine/floodplain emphasis to a more terrestrial focus (Walker 1997, 1998; Walker et al. 2001). The preliminary floral data, however, do not reflect this shift. Instead, the macrobotanical data indicate no significant change in plant exploitation from the Paleoindian to the Early Side-Notched (Detwiler 2000).

The Early Side-Notched diagnostic projectile point assemblage is composed almost entirely of a distinctive side-notched style referred to locally as Big Sandy (Cambron and Hulse 1975), but also known throughout the southeastern U.S. as Taylor (Michie 1966) or Bolen Plain (Bullen 1975) (Figure 8). One heavily resharpened Dalton was recovered from these deposits as well. Except for this specimen, it is interesting to note that other types typically associated with Big Sandy, such as Greenbrier (Lewis and Lewis 1960) and Dalton, are wholly absent from the deposit. This is unlike the situation at the Stanfield-Worley Bluff Shelter (DeJarnette et al. 1962) and other nearby rockshelters, where Dalton and Big Sandy projectile points were found together. This lends further credence to the possibility that Dalton and Big Sandy types are temporally distinct forms (Brookes 1979; Goodyear 1982; Morse 1994). Another temporally diagnostic artifact may be the expanded base drill, which has been locally referred to as Lerma Rounded Base (DeJarnette et al. 1962). Two have been recovered so far and are solely associated with the Early Side-Notched component. Other chipped stone tools include stage bifaces and unhafted and hafted bifaces, similar to those found elsewhere throughout the Southeast at this time period. Bone tools include antler tines, a grooved antler handle, and a number of bone awls and needles (Goldman-Finn and Walker 1994).

Although Zone R contains a rich assemblage associated with the Early Side-Notched component, its upper boundary is truncated. A stratigraphic disconformity is interpreted between Zone R and the overlying Kirk Stemmed component and appears to have erased a time range of at least 8800 to 8000 cal B.C. (Figure 4). This disconformity continues from the entrance chamber into the stratigraphy of the talus (Figure 3) (Sherwood 2001). Erosion rather than non-deposition is supported by the sudden change in the character of the sediments, the sharp boundary, and the near absence of the Early Archaic Kirk Corner-Notched point type, which is otherwise common in the region (Futato 1996; Meeks 2001). The sedimentation rate could have dropped significantly during this time, with human abandonment of the cave, but the features related to such a hiatus (burrow-
ing, soil formation near the drip line, and sedimentation lacking anthropogenic sediments) are not present (Sherwood 2001).

What produced this disconformity is not certain. Most of the evidence points toward a major fluvial event, occurring sometime between 8800 and 8200 cal B.C., which originated within the karst system and flushed sediments out of the cave (Figure 3). This time estimate is based on the sum of the age probabilities for the Kirk Stemmed component separated from the date for the overlying Zone Q of ~7600–7470 cal B.C. Zone Q is a mixed, poorly sorted deposit resting on the Zone R disconformity (Figure 3). The shape and distribution of Zone Q (thickest at the front and thinning toward the back) might suggest the opposite direction for the source area (from the floodplain). However, the absence of Tennessee River alluvium does not support this source direction.

Zone Q is an extensive tabular red zone that is easily distinguished throughout the entrance chamber. Artifacts in Zone Q include a mixture of Early Side-Notched and Kirk Stemmed materials, along with a few of the otherwise-absent Kirk Corner-Notched projectile points. This mixture of components further supports the presence of an erosional event(s) that reworked material from the upper reaches of Zone R and a probable Kirk Corner-Notched component. Zone Q may be primarily the result of one major depositional event, with a number of slope wash events, as evidenced by remnant fluvial microstructures and comparatively brief human deposition (based on the presence of fewer features) (Sherwood 2001). Interestingly, the surface of Zone Q is marked with a dense charcoal deposit (wood and nut) suggesting one large-scale burning event. Wood charcoal from the top of Zone Q (Beta 81608) produced a date of 7570 cal B.C. (Table 1).

**Middle Archaic 6900–3700 cal. B.C. (ca. 8900–5700 cal. BP)**

The beginning of the Middle Archaic period coincides with changing environmental conditions associated with the onset of the Middle Holocene Hypsithermal warming period. During this time, the climate became warmer and drier, resulting in decreased rainfall and vegetation changes. Evidence obtained from pollen samples in the Southeast suggests that the cool, temperate mixed hardwood forests of the initial Holocene were replaced by oak-hickory, mixed hardwood, and southern pine forests (Delcourt et al. 1983; Delcourt and Delcourt 1985). Corresponding with these changing environmental conditions during the Middle Holocene, the Middle Archaic period in the Southeast is marked by the regional replacement of the Early Archaic notched points with a series of stemmed point types (Coe 1964; Chapman 1985; Sassaman and Anderson 1990). For the middle Tennessee Valley, the Middle Archaic is defined by the presence of Kirk Stemmed/Serrated points (6900–6300 cal. B.C.), Eva/Morrow Mountain points (6300–5400 cal. B.C.), Sykes/White Springs points (5400–4300 cal. B.C.), and Benton points (4800–3700 cal. BP) (Futato 1980; Goldman-Finn 1995; Meeks 2001).

**Kirk Stemmed Component.** The first Middle Archaic component, characterized by straight stemmed projectile points associated with Justice's (1987:82–4) Kirk Stemmed Cluster and called the Kirk Stemmed horizon by Driskell (1994), is associated almost exclusively with Zone P (Figure 3). The majority of projectile points conform to the serrated variety of the Kirk Stemmed type, although the serrated and unserrated varieties appear to be coeval in the Dust Cave sequence. Two Kanawha bifurcated-base projectile points (Broyles 1966) were also recovered, placing Dust Cave at the southern extent of this bifurcate distribution (Figure 8). Stone artifacts also include stage bifaces, expedient tools, and pitted cobbles called “nutting stones” (assumed to function in the processing of mast). The number of unifaces declines from this point forward. Bone tools include awls of various types, bone needles, antler tines, and fishhooks (Goldman-Finn and Walker 1994).

Five radiocarbon dates derived from Zone P indicate a time range of over 2,000 calendar years, from 8200 to 5800 cal B.C., with the greatest overlap among intercepts at ~5800 cal B.C. This broad range of dates is probably a product of the disconformity at the Early Side-Notched/Kirk Stemmed boundary. In addition, this is regionally a late date for Kirk Stemmed. The lack of Tennessee River alluvium among the Zone P sediments suggests that the floodplain had stabilized by this time. The deposits associated with the early Middle Archaic Kirk Stemmed component are concentrated from the center of the entrance chamber to the back wall. Human activity
is represented in complex localized intercalated deposits, including stacked prepared surfaces, small pits, and large-scale sediment accumulations generated from burning (charcoal, ash, burned aggregates and burned microartifacts) (Figure 3). The periphery of the entrance chamber (at least that portion that has been investigated along the western margin) was used as a dumping area for a prodigious amount of fireplace rake-out (Sherwood 2001).

_Eva/Morrow Mountain Component_. Immediately following this period of intensive burning in the entrance chamber, the sedimentation rate decreased and the function of the cave appears to have shifted for a time from habitation to a place for human burial. While burials are found in other components in Dust Cave, the majority appears to intrude into Zone P (originating at the Zone N/P contact) with a tentative Eva/Morrow Mountain association. Following this period of human burial in the cave, the deposition of Zone N suggests a time of restricted human activity, concentrated in the front of the cave, at around 5720 cal B.C. (Figure 3). With limited human habitation, the majority of the Zone N sediment appears to be the result of slope wash events combined with colluvium and autochthonous sediments (Sherwood 2001).

The upper boundary of Zone N is abrupt and may be an erosional contact associated with intentional lowering of the cave floor (Sherwood 2001) (Figure 3). Physical alteration of cave and rock-shelter living surfaces is recorded ethnographically among hunters and gatherers, and includes the creation of hollow areas for hearths and domestic space or separate sleeping depressions (Galanidou 2000). We cannot speculate at this point on the purpose of such alterations in Dust Cave. However, based on the limited ceiling height with the potential need to increase the vertical height, localized excavation by the inhabitants is a plausible explanation.

Immediately above Zone N, Zones K, J, and E represent the return of intensive occupation concentrated in the front of the entrance chamber (Figure 3). Based on 13 radiocarbon dates (Table 1), spanning ca. 6400 to 4000 cal B.C., with the greatest overlap among probabilities at ~5400 cal B.C., this component immediately followed the Kirk Stemmed component in time (Figure 4). Anthropogenic sedimentation increases along with the presence of Middle Archaic Eva/Morrow Mountain projectile points. This component is comprised of hafted bifaces from Justice's (1987:100–107) Eva Cluster and Morrow Mountain Cluster. These include the Eva II type (Lewis and Lewis 1961) and Morrow Mountain rounded base and stemmed varieties (Cambron and Hulse 1975:89–91) (Figure 8). Although the Eva examples are found in association with both varieties of Morrow Mountain, Eva points tend to occur somewhat earlier in the sequence. Long and Josselyn (1965) argued that these forms represent a continuum in morphology, which would appear to be the case at Dust Cave. Other stone artifacts include stage bifaces and expedient unifaces. Bone tools include awls, needles, pins, fishhooks, and antler tines (Goldman-Finn and Walker 1994).

One portion of Zone K consists of coalescing prepared clay surfaces, and features associated with burning (including several rock-lined hearths) (Sherwood 2001) (Figure 3). The surfaces, as well as small pits, human burials, and dog burials, further complicate the stratigraphy (Homsey 2003a; Morey 1994; Walker and Morey 2002). The sediments indicate relatively stable, dry conditions in the cave punctuated by occasional, short wet periods, particularly during the deposition of Zone J sediments (Sherwood 2001). In Zone J numerous small pits are recorded with activity shifting away from the back half of the cave toward the entrance. Correlating artifact density, phosphorus, and magnetic susceptibility data, Homsey (2003b) has suggested that this period of human activity in the cave may be one of the most intense.

Zone E represents the last of the Eva/Morrow Mountain component. Human activity was intense, with numerous prepared surfaces and intersecting small pits concentrated farther toward the entrance of the cave. This kind of repeated use of the same location within the cave for the same function, across components, suggests a high level of spatial organization that persisted through time. Some of that overall organization may have been limited by the decrease in vertical ceiling height by this time (ca. 2 m).

_Benton Component_. The final occupation of Dust Cave is associated with Zone D. Four radiocarbon dates suggest a ca. 1000 yr period from 4500 to 3600 cal B.C. (Figure 4). The diagnostic biface assemblage from this component is dominated by large stemmed projectile points associated with Justice's (1987:111–114) Benton cluster. A small number of Sykes/White Springs, Crawford
Creek, and Morrow Mountain projectile points have also been recovered from this component (Figure 8). Typically, these types are associated with earlier dates in the region, although locally there is some evidence for their co-occurrence (Meeks 1998). Other stone implements include a variety of stage reduction bifaces and groundstone pestles. Bone tools include awls, antler tines, needles, fishhooks, and bone projectile points (Goldman-Finn and Walker 1994).

During the formation of Zone D the cave living space was significantly reduced vertically and horizontally by sediment infilling. The primary geogenic sediment source was colluvium, contributing to both the interior sediments and the talus deposits. Limited human activity continued to be concentrated even closer to the mouth of the cave, shifting to the east. It is not clear why this lateral shift occurred. Perhaps there is a change in the floor or ceiling elevation to the east of the current excavation.4

The upper zones, beginning with Zone D, become increasingly decalcified. Decreasing human activity resulted in the reduced production of calcareous ash to buffer the sediments. Buffering conditions were also produced through periodic carbonate-enriched water moving through the cave sediments, either through vadose activity (fluctuations in groundwater) or as drip when the interior microenvironment was more moist. Whatever the processes, as the cave filled with sediment and became increasingly drier, the sediments became decalcified, resulting in decreasing preservation of bone artifacts.

The subzones composing Zone A were deposited after people abandoned Dust Cave ca. 3600 cal B.C. (Figure 3). This zone contains a few random artifacts and represents a dry, relatively static phase in the cave’s depositional history. Colluvium makes up the majority of Zone A, with some degree of bioturbation responsible for reworking of sediments in some areas of the cave. The northeastern portion of the entrance chamber is now completely infilled. Together, these processes protected the archaeological deposits until recent investigations.

Discussion and Conclusions

This paper presents a summary of the chronosтратigraphy at Dust Cave using the comprehensive radiocarbon sequence from the entrance chamber, the diagnostic hafted bifaces, and the results from the geoarchaeological analysis. In a broad sense, five cultural components are defined based on stratigraphy and diagnostic artifacts, and designated as Quad/Beaver Lake/Dalton (10,650 to 9200 cal B.C.), Early Side-Notched (10,000 to 9000 cal B.C.), Kirk Stemmed (8200 to 5800 cal B.C.), Eva/Morrow Mountain (6400 to 4000 cal B.C.), and Benton (4500 to 3600 cal B.C.). Based on the analyses performed thus far, patterns are emerging relating to regional and local site formation processes, and economic, technological and settlement shifts.

The timing of cave and rockshelter use in the southeastern U.S. has previously been related to an increase in population density and a reorganization of hunter-gatherer seasonal rounds, while underemphasizing or discounting the potential of the active geologic environment to destroy or affect occupation (Walthall 1998). Although social and economic factors certainly may have played a role in the timing of the occupation of Dust Cave, the geoarchaeological research at the cave confirms that the geomorphic history in the middle Tennessee River Valley directly affected both the organization of people on the landscape and the potential for geologic processes to erase traces of early human occupation. Geomorphic transformations directly influenced the timing of the occupation of Dust Cave and played a significant role in the cave’s depositional history. These considerations are directly relevant to the development of settlement models in the Midsouth.

Although geogenic, biogenic, and some pedogenic processes contributed to the Dust Cave deposits, anthropogenic processes generated or modified the majority of the sediments (Goldberg and Sherwood 1994; Sherwood 2001). Similarities in the types of these anthropogenic sediments throughout the sequence, which are ultimately a reflection of the activities that generated them (Courty et al. 1989), indicate the overall similarity in the types of activities occurring in the cave over time. For example, the coterminous construction and organization of the prepared surfaces suggest that the features share a similar function, and consequently indicate similar types of activities in the cave for nearly 7,000 years (Sherwood 2001; Sherwood and Chapman 2003). The primary differ-
ences in the deposits are related to the intensity of human activity, and the spatial organization within the cave, not to the kinds of activities taking place. Geoarchaeological analyses thus far indicate that spatial organization within the cave appears to be directly linked to the microtopography within the cave and the condition of the substrate (e.g., wet or dry). The only deviation from this pattern occurs for a brief time soon after 5900 cal B.C., when the cave may have functioned chiefly as a burial place and not a habitation or specialized activity site.

The designation of Paleoindian components at Dust Cave remains a complex issue. Much of our typology for diagnostic hafted bifaces representing distinct Southeastern Paleoindian subperiods is based on presumed temporally meaningful morphological changes in Paleoindian point forms, and relies largely on a combination of stratigraphic evidence and assumed contemporaneity with similar point forms from dated contexts in other regions of the U.S. However, a review of the sum of probabilities for the \(^{14}\text{C}\) sequence for Zone U and Zone T, combined with a lithostratigraphic difference, suggests the possibility of two distinct components: Middle Paleoindian (Quad/Beaver Lake) and Late Paleoindian (Dalton). Despite the low frequency of diagnostic hafted bifaces attributed to these subperiods, the point remains that the frequency distribution of these tools related to depth does indicate chronostratigraphic ordering. In addition, the stratigraphic separation of Dalton and Early Side-Notched materials makes Dust Cave a particularly significant dataset.

Several important contributions toward our understanding of the Early Archaic can be derived from the data. The Early Side-Notched component, though truncated, provides insights into this otherwise enigmatic technology with the significant decrease in the importance of core-derived blade technology and the growing focus on bifacial technology (Figure 5). This technological shift corresponds to the end of the Younger Dryas (ca. 9650 cal B.C.) and may reflect less need for a highly maintained, curated technology in response to the increasing stability of the early Holocene landscape (Anderson 2001).

The disconformity between Zones R and Q during the Early Archaic, occurring just before ca. 7500 cal B.C., suggests a large-scale erosional event. This event may be documented elsewhere on the landscape. Preliminary attempts to match the region’s diachronic settlement patterns with climatic data (e.g., ice-core data) indicate a possible oscillation during the Early Archaic that could have influenced landscape use and resource distribution (Anderson 2001; Meeks 2001). This oscillation could tie into other human/landscape shifts within the southeastern U.S. The dataset at Dust Cave may offer the resolution necessary to begin to refine our understanding of such shifts and the speed at which they occurred.

The nature of the transition from the Paleoindian to the Archaic in the Eastern Woodlands is key to discussions concerning economic, technological, and social shifts during the Pleistocene/Holocene transition (Anderson and Gillam 2000; Anderson and Sassaman 1996; Driskell 2000; Meltzer 1988). Dust Cave joins a growing number of sites that document Paleoindian and Early Archaic cultures engaged in regionally diverse generalized strategies (e.g., Bousman et al. 2002; Daniel 1998; Lopinot et al. 2000; Walker et al. 2001). The Middle Archaic assemblage is also significant as it offers well-preserved flora and fauna beyond shell mound contexts, providing researchers the opportunity to reevaluate settlement and subsistence issues from this period. In general, Dust Cave provides a full-scale record of forager adaptations in the Midsouth from the end of the Pleistocene to the first half of the Holocene. The chronostratigraphic sequence offers a rigorous framework for continued analyses of faunal, floral, and lithic artifacts from this site, as well as the consideration of new and old data from other sites throughout the region.

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Notes

1. The validity of this tripartite sequence, as it is applied to the archaeological record of the Southeast, is open to speculation given the few dates in direct association with Paleoindian point forms in the region. With the exception of absolute dates associated with Dalton points (e.g., Goodyear 1982), dating of many Paleoindian point forms is tentative, relying on a combination of stratigraphic evidence and assumed contemporaneity with firmly dated, morphologically similar point forms in the Southwest, Plains, and Northeast (see Anderson et al. 1996:7–13 for a full discussion of the assumptions underlying this tripartite sequence). However, as will be discussed in the paper, dates obtained from Dust Cave in association with both Quad and Beaver Lake points provides confirmation of these forms dating between 10,900–10,000 cal B.C., as well as provides further support for the temporal span of Dalton (10,000–9200 cal B.C.).

2. “Prepared Clay Surfaces” is used to refer to discrete ≤1 m², 1–3 cm thick, clay layers that are found throughout the Dust Cave sequence (Sherwood 2001). These surfaces are composed of red residual clay and typically burned, often with thin ash deposits covering their surface.

3. Futato (1983:417) used the term “Seven Mile Island Phase” to refer to Benton manifestations in the western portion of the middle Tennessee River Valley dating to 3600–3000 B.C. This terminology was used in preliminary publications on Dust Cave (Driskell 1996; Goldmann-Finn and Driskell 1994).

4. Deposits in the eastern portion of the entrance chamber continue to the ceiling. It is difficult to judge the nature of the ceiling in this area since it is not exposed.

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