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Stratigraphy and Chronology of the Pleistocene to Holocene Transition at Bonneville Estates Rockshelter, Eastern Great Basin

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THIS CHAPTER PRESENTS INITIAL RESULTS OF GEOARCHAEOLOGICAL research at Bonneville Estates Rockshelter (BER), a multicomponent site in the eastern Great Basin. Details on site geomorphology, stratigraphy, and radiocarbon chronology and age of cultural components of the late Pleistocene through the middle Holocene are included. This chapter facilitates further discussion of lithic, faunal, and floral assemblages from BER (see Goebel, this volume; Hockett, this volume; Rhode and Louderback, this volume) to address human adaptations and paleoecology of the east-central Great Basin during the Pleistocene to Holocene transition.

To tackle the question of whether early inhabitants were more "Paleoindian" or more "Archaic" in their adaptations, comparisons of the remains left by early people in a given region or at a given site should be systematically compared with those of later Archaic peoples. For much of the Great Basin this type of comparison is difficult at best. Most sites containing early archaeological remains are surface sites; therefore, their association with later archaeological remains at the site or in the region cannot be known for sure. At BER, however, we have a very detailed record for these periods, so this chapter includes a description of deposits from both the late Pleistocene to early Holocene and the middle Holocene.

SITE LOCATION AND HISTORY OF EXCAVATIONS

BER is located near the Nevada/Utah border in the eastern Great Basin, approximately 50 km south of West Wendover, Nevada, and the famed Danger Cave (Figure 5.1). BER is a rather large shelter, measuring about 25 m wide by 10 m high by 15 m deep near its center. The immensity of the shelter is realized when considering the surface area of deposits measures more than 250 m^2. The shelter's entrance faces to the southeast and overlooks an unnamed wash that

FIGURE 5.1.
Map of the Great Basin showing the locations of Bonneville Estates Rockshelter and Danger Cave.

drains northeast to the Bonneville salt flats. Natural vegetation in close proximity to the site consists of an *Atriplex* and *Purshia* community with several grasses such as *Achnatherum hymenoides* and *Achnatherum speciosum* (Rhode 2002).

BER was discovered and recorded by Steve Dondero and Tim Murphy of the Elko District of the U.S. Department of the Interior Bureau of Land Management (BLM) in 1986. Unfortunately, the rockshelter was actively being looted at this time. In 1988 P-III Associates Inc., directed by Alan Schroedl, conducted test excavations for the BLM in order to establish whether intact cultural deposits still existed at the site. They found a well-preserved sequence of cultural strata spanning the last 6,000 ^{14}C years of prehistory (Schroedl and Coulam 1989), but due to budgetary constraints they were unable to excavate into deeper deposits.

During the summer of 2000, a joint BLM and University of Nevada field crew—led by Bryan Hockett, Ted Goebel, and Kelly Graf—began excavating at BER to determine whether deposits predating 6000 ^{14}C BP existed, and if such deposits possessed the potential for investigating changes in the paleoecology and adaptive strategies of humans in the eastern Great Basin during the late Pleistocene and early Holocene. By the end of the 2001 field season, we had exposed the profile in Figure 5.2, establishing that humans had occupied BER

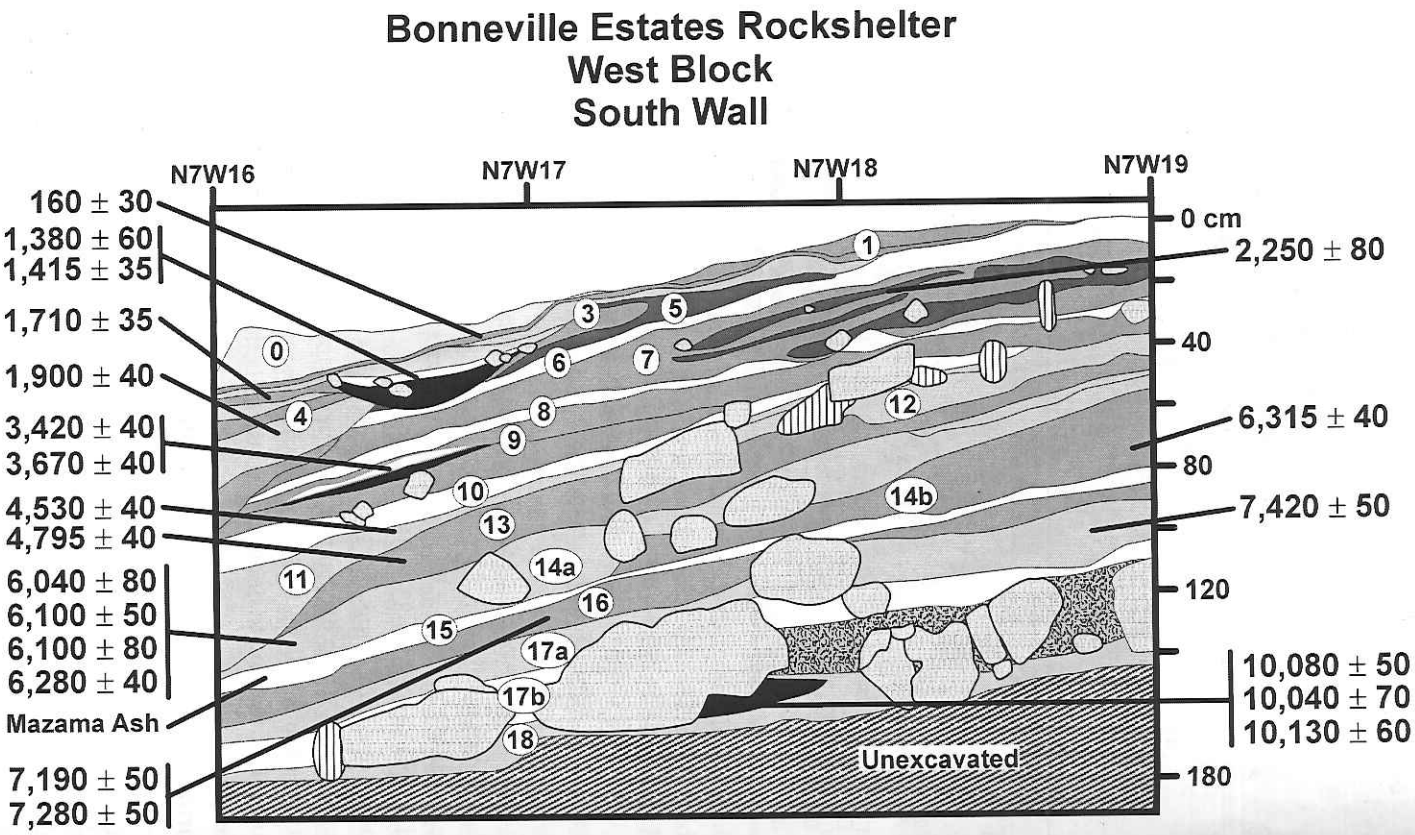

FIGURE 5.2. Stratigraphic profile of the West Block of Bonneville Estates Rockshelter showing the deposits exposed during our 2001 excavations.

from the late Pleistocene throughout the Holocene (Goebel et al. 2003; Graf et al. 2002a, 2002b, 2004). As of 2006, our excavations covered an area of 67 m^2, with 55 m^2 penetrating into or through late Pleistocene to early-middle Holocene deposits (the other 12 m^2 had not been excavated to early-middle Holocene or late Pleistocene depths) (Figure 5.3), exposing several late Pleistocene and early Holocene living floors and activity areas.

Two separate block excavations (West Block and East Block [Figure 5.3]) were initially opened between 2000 and 2002. After three seasons of excavations, it became apparent that the stratigraphy could be generally correlated based mainly on radiocarbon dates and diagnostic artifact types, but the nature of deposition rates and preservation of sediments in these two areas was different. For these reasons, in 2003 we began to excavate a trench connecting the two blocks to expose a profile allowing precise correlations between their stratigraphic profiles. Through 2006, the trench had been excavated into middle Holocene deposits.

All artifacts and ecofacts encountered were three-point provenienced, and all sediments from excavated deposits were screened through ⅛" mesh (screened materials were provenienced to 50 cm^2 horizontal quadrants and 5 cm vertical intervals or the stratigraphic unit, depending on which came first). Four column samples measuring approximately 50 cm^2 were collected, for which all sediment was run through sieves to a size of 1.6 mm; laser ablation analysis was conducted on the fraction smaller than 1.6 mm. Detailed feature and artifact distributions were carefully mapped and photographed.

SITE GEOMORPHOLOGY AND PALEOECOLOGICAL CONTEXT

BER is located in the Lead Mine Hills of the western Bonneville Basin (Figure 5.4). The rockshelter is situated at the late Pleistocene highstand of pluvial Lake Bonneville at approximately 1,580 m in elevation. Before the construction of the Bonneville highstand beach, the lake's waters had eroded the Upper Pennsylvanian limestone and dolomite precipices of the Lead Mine Hills, carving the large opening of BER. This occurred before about 15,000 ^{14}C BP (18,800 cal BP). Also during the lake's last highstand, beach gravels were deposited within and in front of the rockshelter. Soon after 15,000 ^{14}C BP (18,800 cal BP), the lake breached Red Rock Pass near the town of Zenda, Idaho, and the lake's level fell to the Provo shoreline, 1,470 m. The rockshelter, therefore, would have been open for occupation after about 14,500 ^{14}C BP (17,500 cal BP) (Benson et al. 1990, 1997; Currey and Oviatt 1985; Rhode et al. 2005).

During Provo times, as the lake level stabilized, the shoreline would have been within 2.5 km of the rockshelter, and the nearby vegetation community would have been dominated by limber pine and sagebrush (Rhode 2000). Sometime after 14,000 ^{14}C BP (17,000 cal BP), but before about 10,800 ^{14}C BP (12,800 cal BP), the region experienced a long drought in which the lake became severely desiccated to levels lower than the modern-day Great Salt Lake (Currey

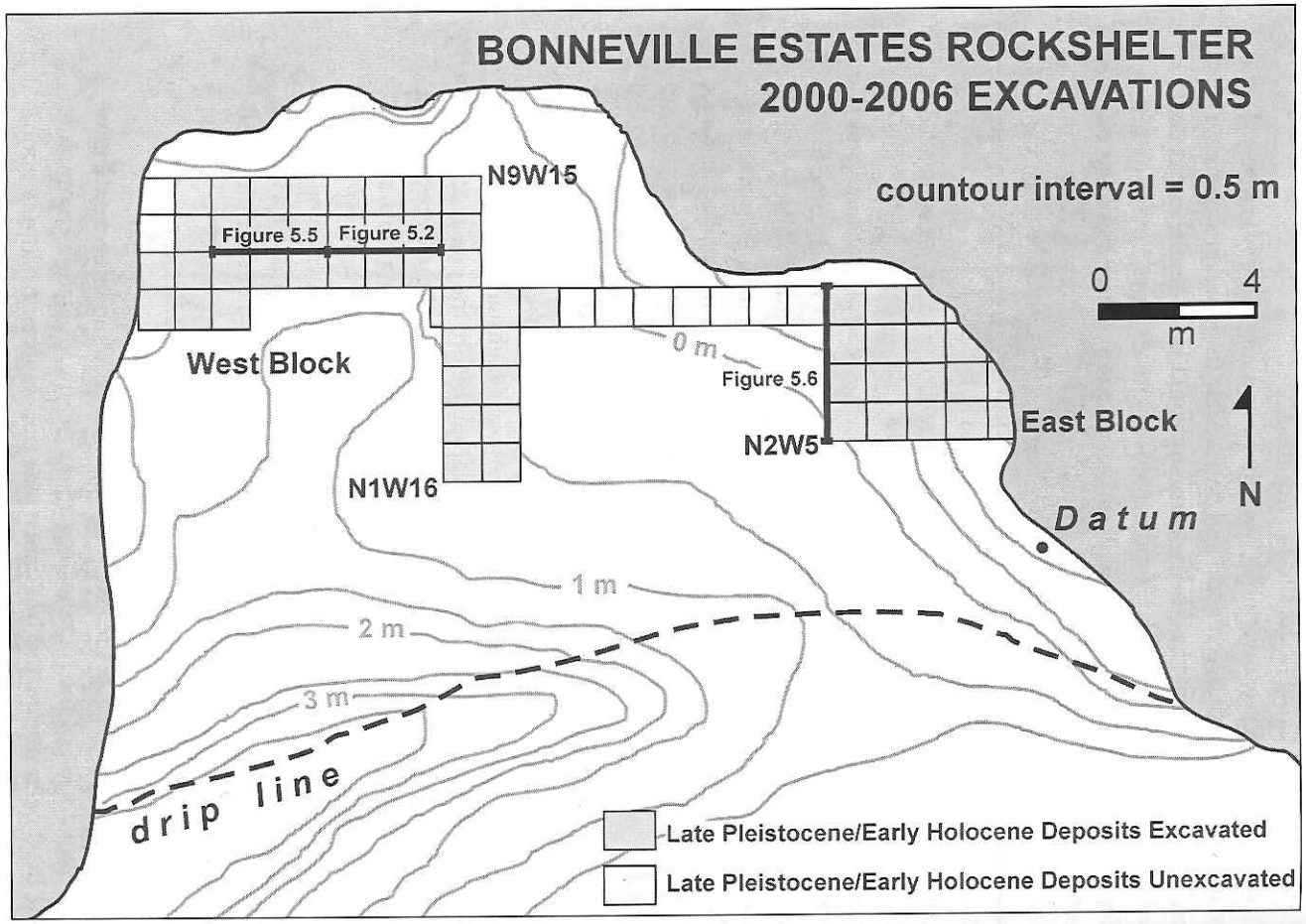

FIGURE 5.3. Excavation map of Bonneville Estates Rockshelter for the field seasons of 2000–2006.

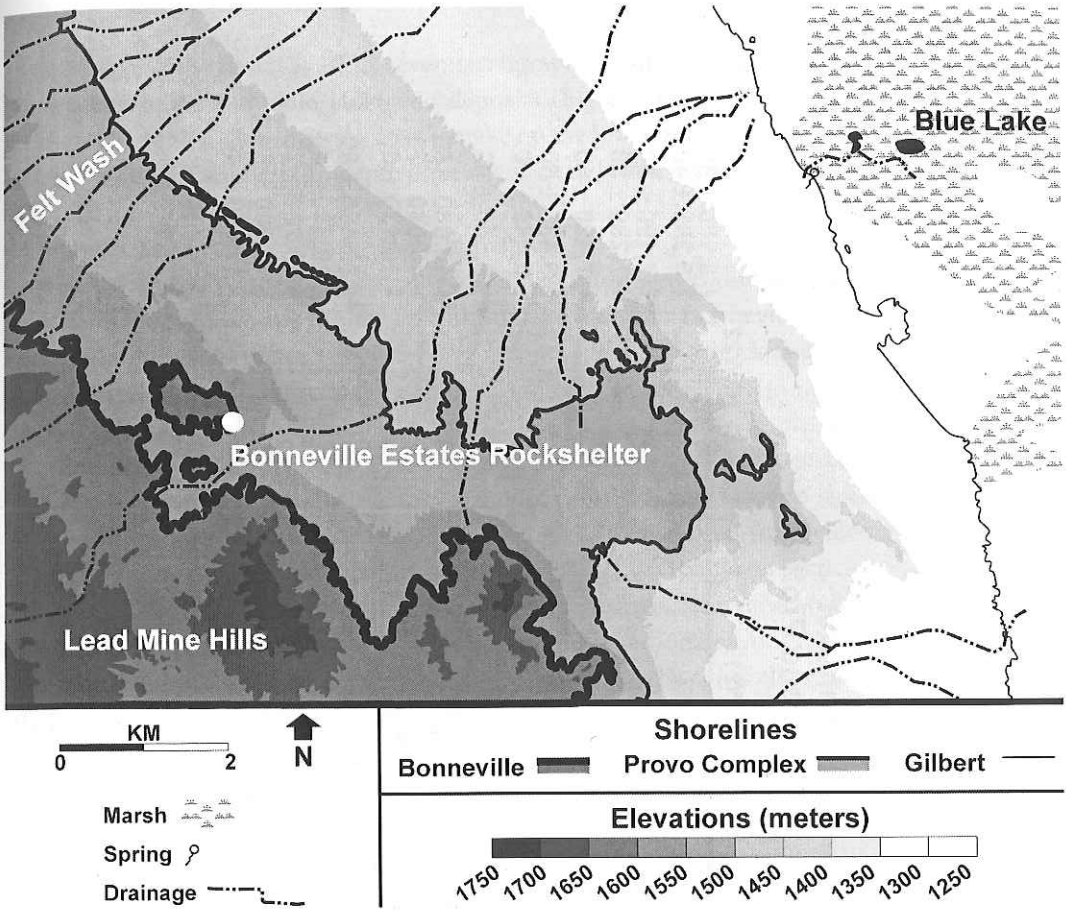

FIGURE 5.4. Map showing the relation of Bonneville Estates Rockshelter to major pluvial shorelines and other geomorphic features.

and Oviatt 1985; Oviatt 1997; Rhode et al. 2005). By 10,800 ^{14}C BP (12,800 cal BP), the lake rose again, forming the Gilbert shoreline at an elevation of about 1,314 m. At this time the lake would have been located nearly 6 km from the rockshelter, and the local vegetation community would have still been dominated by limber pine and sagebrush (Rhode 2000). After about 10,000 ^{14}C BP (11,400 cal BP) the lake receded from the Gilbert shoreline, and the modern-day springs feeding Blue Lake, about 8 km east-northeast of BER, became active. Since these springs are still active, we can assume that during much of the Holocene water would have been locally available to BER occupants.

STRATIGRAPHIC CONTEXT

As mentioned above, excavations of BER have mainly focused on the West and East blocks. Because the stratigraphic profiles of the two blocks cannot yet be directly correlated with confidence, I present each separately. Stratigraphic descriptions are based mainly on field observations and the results of particle size analysis (Farrand 2001).

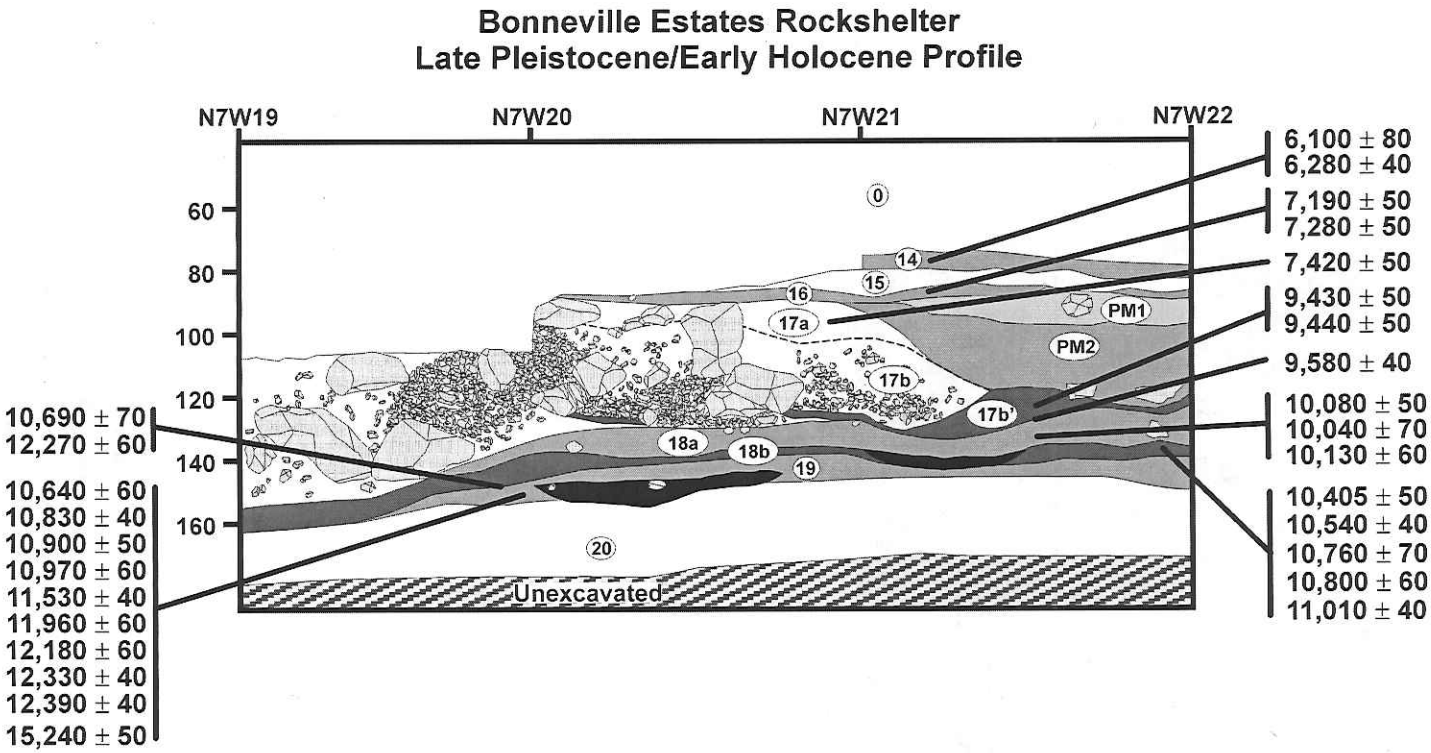

FIGURE 5.5. Lower profile from the West Block showing Stratigraphic Units 20 through 16.

West Block

In the 34 m² West Block at BER, seven stratigraphic units represent the late Pleistocene to early-middle Holocene deposits (Figures 5.2 and 5.5). These stratigraphic units, labeled Strata 20–14, make up the lower 200 cm of the West Block deposits, extending to a depth of nearly 300 cm below the surface. Below is a description of each of these stratigraphic units, beginning with the lowest (Stratum 20) and ending with the highest (Stratum 14).

Bedrock in the West Block is mantled by a deposit of well-rounded gravels interpreted as representing the late Pleistocene beach of Lake Bonneville; however, these gravels have been exposed only in 1 m² of the West Block and have not undergone detailed description and analysis.

Overlying the gravel is Stratum 20, which has been completely excavated in 1 m² and partially exposed in 30 m² of the West Block. It is a yellowish-brown, loose sandy loam that contains occasional angular gravel-sized to cobble-sized eboulis clasts and rare boulder-sized clasts. Stratum 20 has been subdivided into two sub-strata, 20a and 20b. The upper of the two (20a) contains particles strongly coated with calcium carbonate; this may represent chemical weathering of the sediment in place or leaching of calcium carbonate from overlying strata. Where excavated, Stratum 20 has been found to be culturally sterile, affected only by geogenic and biogenic processes. Few faunal and floral materials have been found, and when present are poorly preserved.

To date, Stratum 19 has been excavated across an area of about 20 m² and is visible in the profiles of the southwestern corner of the West Block. This stratum ranges from 2 to 10 cm thick, and its lower contact with Stratum 20 is diffuse. Stratum 19 is a dark yellowish-brown loam that grades from a loose matrix of loam and eboulis at its base to a compact loam near its upper contact with Stratum 18. The stratum contains many angular gravel-sized to cobble-sized eboulis clasts. It also contains numerous plant macrofossils and animal bones, but these are typically somewhat deteriorated. Formation of Stratum 19 can be attributed mainly to biogenic and geogenic processes; however, as discussed below, anthropogenic processes may have affected the upper portion of Stratum 19.

Stratum 18 extends across the West Block and has been excavated in portions of 31 m². This stratum overlies Stratum 19; the contact between the two is gradual in places. Stratum 18 was further subdivided into Sub-strata 18b and 18a in the western half of the West Block excavation. As the stratigraphic profile dipped to the east, 18b and 18a became indistinguishable. During excavation both elevation and slight sediment color changes were used to distinguish between the two units. Sub-stratum 18b was excavated across much of the West Block (portions of 30 m²). It ranges from 5 to 10 cm thick and consists of a grayish-brown, very compact sandy loam with few angular gravel-sized to cobble-sized eboulis clasts. Sub-stratum 18b's lower contact with Stratum 19 was typically quite clear. Sub-stratum 18a was present in portions of 20 excavation squares of the West

Block. This sub-stratum ranges from 4 to 10 cm in thickness and, where present, has an abrupt contact with the underlying sub-stratum, 18b. Sub-stratum 18a consists of a brown loose-to-compact sandy loam that contains occasional gravel-sized to cobble-sized eboulis clasts. Both 18b and 18a contain numerous well-preserved plant macrofossils, faunal remains, and lithic and perishable artifacts (i.e., cordage, and bone and antler tools). Formation of Stratum 18 appears to have been predominantly anthropogenic, but evidence of biogenic and geogenic processes is also present (see Rhode and Louderback, this volume).

Stratum 17 is prevalent across the West Block of the shelter. It has been excavated in 40 m^2 and is present in all profiles of the West Block. It overlies and has a clear lower contact with Stratum 18. Stratum 17 has been divided into three sub-strata: 17b, 17b', and 17a. Lower-lying Sub-stratum 17b has been excavated across most of the West Block (portions of 40 m^2) and is a 20 to 25 cm thick rubble zone composed predominantly of angular gravel-sized to boulder-sized eboulis clasts, but yellowish-brown silt fills the few voids in this sub-stratum. The formation of 17b can be attributed exclusively to geogenic processes, especially the spalling of large eboulis clasts from the shelter's ceiling, probably during several roof collapse episodes. Sub-stratum 17b' is an organic-rich lens (with numerous very well preserved plant macrofossils and animal bones) near the base (within 10 cm) of Sub-stratum 17b in the western portion of the West Block (10 m^2). Sub-stratum 17b' is generally 2–6 cm thick and consists of a yellowish-brown, compact loam. Few gravel-sized to cobble-sized eboulis clasts are present. Its upper and lower contacts with Sub-stratum 17b are typically very distinct. Sub-stratum 17a has been excavated across much of the West Block (24 m^2) and forms a wavy but clear lower contact with Sub-stratum 17b. It is a yellowish-brown sandy loam containing many angular gravel-sized to cobble-sized eboulis clasts. The formation of Sub-stratum 17a can be attributed mainly to geogenic processes; however, a single hearth feature and a small assemblage of lithic artifacts provide evidence of human activity as well. Vegetal remains are rare.

Stratum 16 directly overlies Stratum 17 and has been found only in portions of 18 m^2 of the West Block. It ranges in thickness from 2 to 10 cm and consists of a brown, loose sandy loam with many angular gravel-sized to cobble-sized eboulis clasts. It is rich in organic remains (plant macrofossils and animal bones), and the formation processes of this stratum appear to have been anthropogenic as well as biogenic and geogenic in nature.

Stratum 15 is a very thin (1–3 cm thick), predominantly silt band. Stratum 15 forms an abrupt boundary with Stratum 16 below and Stratum 14 above and contains few angular gravel-sized eboulis clasts. It also contains several isolated pockets of Mazama ash. This stratum contains no organics and few lithic artifacts and was formed exclusively by geogenic processes.

Stratum 14 has been excavated in 21 excavation squares in the West Block. Unfortunately, two large looters' pits in the northern portion of the West Block

erased Stratum 14 from the rockshelter deposits; however, we know that its extent is larger than the excavated area because it is present in the southern and eastern profile walls of the West Block excavation. Stratum 14 has been subdivided into three sub-strata, 14c, 14b, and 14a. While Sub-stratum 14c appeared in only four excavation squares, Sub-strata 14b and 14a are the best known from our excavations (exposed in 21 excavation squares). Sub-stratum 14c is very thick, ranging from about 10 to 30 cm in thickness where excavated. It is a yellowish-brown sandy loam containing rare angular gravel-sized to cobble-sized eboulis clasts. Sub-stratum 14b, ranging from 2 to 20 cm in thickness, consists of a brown sandy loam with abundant to rare angular gravel-sized to cobble-sized eboulis clasts. Sub-stratum 14a has a wavy lower contact with Sub-stratum 14b. It also ranges from 2 to 20 cm in thickness and consists of a yellowish-brown sandy loam with few to many angular gravel-sized to cobble-sized eboulis clasts. All sub-strata of Stratum 14 contain numerous very well preserved vegetal and faunal remains, as well as human coprolites and human-produced textiles (basket and cordage fragments). Stratum 14 was formed through anthropogenic as well as biogenic and, to a lesser extent, geogenic processes.

In the far western portion of the West Block, a prehistoric wood rat midden was found interdigitated with Strata 17 and 16. Present in portions of 6 m^2, the midden appeared to be stratified with several horizontal layers of predominantly unconsolidated vegetal materials and wood rat dung. Two column samples were collected from this area of the shelter. Future paleoecological analyses of these columns will provide important information about the local environment of the shelter during this time.

In sum, seven stratigraphic units have been described from the late Pleistocene to early-middle Holocene deposits in the West Block of BER. These units are well stratified and in some cases can be further divided into sub-strata based on slight textural and/or color changes. The basal unconsolidated deposit is lacustrine in origin and probably represents a relatively stable lake level of Pleistocene Lake Bonneville. Strata 20–14 consist of terrestrial sediments formed from roof fall activities, in-washing of colluvial materials from outside the rockshelter's drip line, deposition of aeolian materials, and possibly in-place weathering of the sediment. In these strata rodent activity is present —sometimes minor, other times predominant (Strata 19, PM2, PM1). Strata 18b–17b' were primarily deposited through human activities, providing a well-preserved record of late Pleistocene occupation of BER, especially in the western half of the West Block. Sub-stratum 17b was formed primarily by geogenic activities related to a major roof collapse episode or series of episodes. Strata 17a, 16, 15, and 14 represent the early to early-middle Holocene. Although 17a contains a few cultural remains, it is primarily geogenically derived silt and rubble. Stratum 15 contains no artifacts and is geogenic. Strata 16 and 14 contain well-preserved cultural remains and represent the major Early Archaic occupations of the West Block.

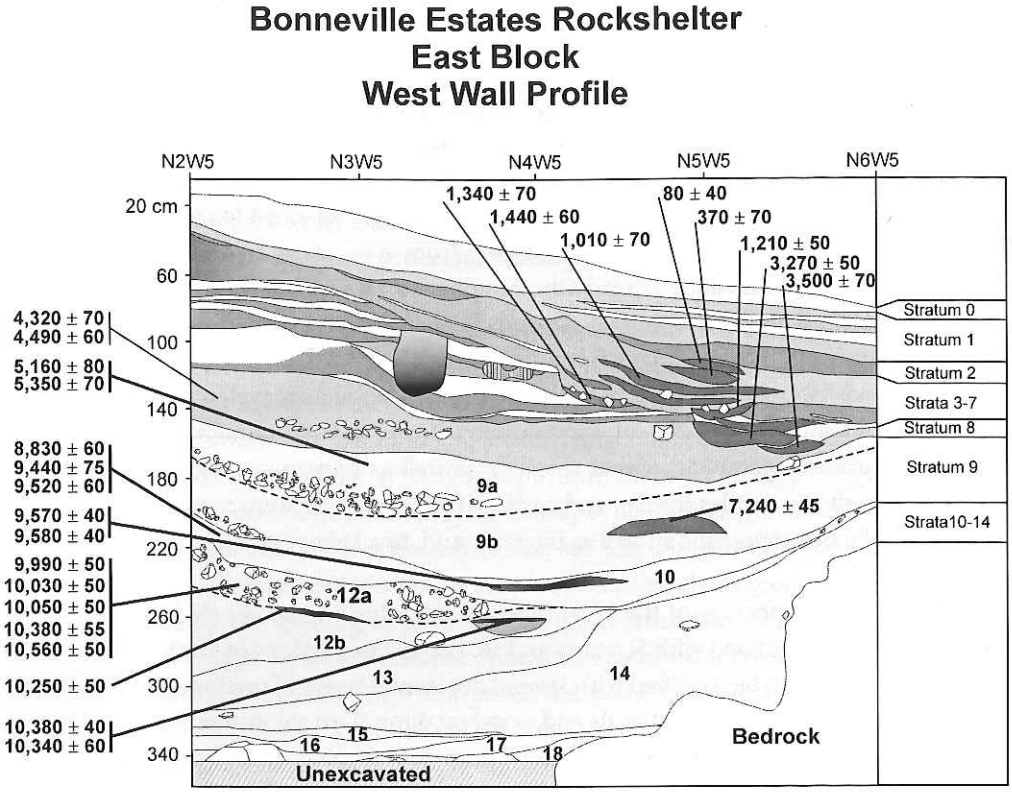

FIGURE 5.6. Stratigraphic profile of the East Block of Bonneville Estates Rockshelter. Substratum 12a was originally designated Stratum 11 but has recently been incorporated into Stratum 12.

East Block

In the East Block excavation at BER, the late Pleistocene to middle Holocene deposits consist of 10 distinguishable stratigraphic units (Figure 5.6). These are represented by Strata 18–9, which extend to a depth of nearly 340 cm below the modern surface of the East Block and have been excavated across an area of 14 m². Strata 18–13 are culturally sterile units of late Pleistocene lacustrine gravels and sands, colluvium, and roof fall materials, while Strata 9–12 are culture-bearing stratigraphic units. Because no column samples of sediment from the East Block have been collected yet, descriptions of this set of deposits are less detailed than those for the West Block.

Strata 18–13 are culturally sterile deposits that have been exposed across an area of 6 m² in the western portion of the East Block. Stratum 18 ranges from 2 to 10 cm in thickness and contains predominantly sub-rounded to rounded gravel-sized clasts interpreted as Lake Bonneville beach gravels. Along the back wall of the rockshelter, Stratum 18 directly overlies bedrock. Stratum 18 contains a few sub-angular to sub-rounded boulders. Their relatively rounded nature suggests that their presence is probably the result of roof spalling activity prior to the deposition of Stratum 18 gravels. Stratum 17 overlies Stratum 18,

forming a gradual contact. This stratum ranges from 2 to 10 cm in thickness and consists of gravel-sized rounded clasts and coarse sands mixed with occasional sub-angular to sub-rounded boulders of roof fall. Strata 18 and 17 were formed through geogenic processes.

Stratum 16 forms a clear boundary with Stratum 17 below it, ranges from 1 to 10 cm in thickness, and consists of a yellowish-brown, loose silt-rubble matrix with many sub-angular to angular gravel-sized eboulis clasts. Stratum 15 has a clear basal contact with Stratum 16, ranges from 1 to 8 cm in thickness, and consists of a yellowish-brown silt-rubble matrix with many sub-angular to angular gravel-sized eboulis clasts with isolated cobble-sized clasts. Stratum 14 overlies Stratum 15; they are separated by a clear contact. Stratum 14 ranges from 10 to 80 cm in thickness and is a yellowish-brown, loose silt-rubble matrix containing predominantly sub-angular to angular gravel-sized eboulis clasts less than 2 cm in diameter. In the southern half of the excavation Stratum 14 contains isolated cobble-sized eboulis clasts. Stratum 13 shares a clear contact with lower-lying Stratum 14, ranges from 1 to 35 cm in thickness, and contains a yellowish-brown silt-rubble matrix with predominantly sub-angular to angular gravel-sized eboulis clasts. Strata 16–13 were mainly formed by geogenic processes.

Stratum 12 is the lowest stratum of the East Block with cultural remains. Its lower contact with Stratum 13 is distinct. Stratum 12 ranges from about 2 to 80 cm in thickness and can be subdivided into two sub-strata based primarily on textural differences observed in the field. Sub-stratum 12b consists mainly of a yellowish-brown, loose silt-rubble matrix with sub-angular to angular gravel-sized clasts. Above this is Sub-stratum 12a, consisting of yellowish-brown, loose rubble, angular cobble-sized eboulis clasts, and isolated gravel-sized eboulis clasts.[1] The few cultural remains from Stratum 12 were located in the lower-lying Sub-stratum 12b. Stratum 10 overlies Stratum 12; they are distinguished by a gradual contact. Stratum 10 ranges from about 2 to 20 cm in thickness and consists of a light yellowish-brown, unconsolidated silt-rubble matrix with many sub-angular to angular gravel-sized eboulis clasts. Stratum 9 overlies Stratum 10, forming a gradual boundary. Stratum 9 ranges from 10 to 60 cm in thickness and can be divided into two sub-strata based primarily on textural differences. Sub-stratum 9b consists of a yellowish-brown silt-rubble matrix containing primarily sub-angular to angular gravel-sized clasts of eboulis with isolated cobble-sized clasts. Sub-stratum 9a also consists of a light yellowish-brown, massive silt-rubble matrix with many sub-angular to angular gravel-sized eboulis clasts and a zone of cobble-sized clasts near its contact with Sub-stratum 9b.

In sum, the lower 100–150 cm of the East Block profile contain culturally sterile deposits that were formed largely through geogenic processes. Strata 18 and 17 are lacustrine beach gravels and sands deposited by Lake Bonneville, presumably as the lake receded from its highstand. Strata 16–9 are terrestrial

deposits formed predominantly through two geologic processes: (1) in-washing of colluvial materials from outside the drip line of the rockshelter, and (2) roof spalling and collapse. There is also evidence of aeolian processes and in-place weathering. Rodent activity is present in these strata but does not appear to have significantly impacted the deposits. Even though Strata 12–9 contain evidence of the earliest human occupations in the East Block, human presence and activities were fairly minimal in this area of the rockshelter, leaving behind few lithic artifacts. Faunal remains and features, although present, have been severely affected by in situ weathering of the deposits and thus are not as well preserved as in the West Block.

RADIOCARBON CHRONOLOGY AND AGE AND CONTEXT OF CULTURAL COMPONENTS

Samples of charcoal, bone, and textile fragments from both the West and East Block stratigraphic profiles of BER were dated through accelerator mass spectrometry (AMS) and conventional radiocarbon (^{14}C) procedures. Charcoal was prevalent in the profile and in cultural features encountered during excavations. Because site preservation at BER is very good, and nearly all of the late Pleistocene to early-middle Holocene stratigraphic units were at least partially formed through anthropogenic means, typically only materials clearly associated with human activities were used for radiocarbon dating (e.g., wood charcoal from hearth features and textile fragments). Pretreatment and radiocarbon analysis of samples conducted at the NSF-Arizona AMS Facility (AA) and Beta Analytic Inc. (Beta) followed standard methods described by Jull et al. (1983) and Long et al. (1989) for the AMS radiocarbon dating of charcoal and bone. Samples obtained from the Lawrence Livermore National Laboratories Center for Accelerator Mass Spectrometry (CAMS) and the University of California, Irvine, Accelerator Mass Spectrometry Laboratory (UCIAMS) were first sent to Stafford Research Laboratories Inc. for pretreatment. The radiocarbon chronology for the late Pleistocene to early-middle Holocene of BER is presented below, coupled with a discussion of the cultural components of both the West and East Block excavations.

West Block

As of 2006, we had obtained 31 radiocarbon determinations spanning the late Pleistocene to early-middle Holocene in the West Block (Table 5.1). These determinations have been corrected for ^{13}C fractionation. No radiocarbon estimates have been obtained for Strata 20, 17b, or 15 because these strata contain little to no organic materials for dating.

STRATUM 19

We have radiocarbon dated 10 samples from within Stratum 19 and two from the contact of Stratum 19 with above-lying Sub-stratum 18b. Initially, during

Table 5.1. Bonneville Estates Rockshelter AMS Radiocarbon Age Estimates from the West Block

Stratum	Component	Square	Feature	Lab Number	Material	Age Estimate[a]	Age Calibrated[b]
19	n/a	N8W22	n/a	UCIAMS-22180	Bone	15,240 ± 50	18,950–18,020
19	6	N7W20	04.13b	Beta-195045	Hearth charcoal	12,390 ± 40	15,180–13,960
19	6	N7W20	04.13b	Beta-195046	Hearth charcoal	12,330 ± 40	15,060–13,840
19	6	N7W19	03.17	AA-58587	Hearth charcoal	12,180 ± 60	14,700–13,760
19	6	N8W22	n/a	Beta-209265	Bone	11,960 ± 60	14,320–13,520
19	6	N6W20	04.13b	Beta-210523	Bone	11,530 ± 40	13,650–13,210
19	6	N7W20	04.13b	Beta-200874	Hearth charcoal	10,970 ± 60	13,100–12,700
19	6	N7W19	03.17	UCIAMS-22176	Bone	10,900 ± 50	13,010–12,690
19	6	N7W19	03.17	Beta-210524	Bone	10,830 ± 40	12,940–12,660
19	6	N7W19	03.17	Beta-200875	Hearth charcoal	10,640 ± 60	12,790–12,490
19/18b contact	6	N8W20	03.16/04.13	AA-58595	Hearth charcoal	12,270 ± 60	14,860–13,820
19/18b contact	6	N8W19/20	03.16/04.13	AA-58590	Hearth charcoal	10,690 ± 70	12,810–12,550
18b	6	N6W16	05.06	Beta-207009	Hearth charcoal	11,010 ± 40	13,120–12,720
18b	6	N8W20	03.15a	AA-58594	Hearth charcoal	10,800 ± 60	12,920–12,640
18b	6	N8W20	03.15a	AA-58592	Hearth charcoal	10,760 ± 70	12,880–12,600
18b	6	N7W21	04.14	Beta-195047	Hearth charcoal	10,540 ± 40	12,800–12,220
18b	6	N8W20	03.14	AA-58593	Hearth charcoal	10,405 ± 50	12,685–11,985
18a	6	N7W17	01.01	Beta-170444	Hearth charcoal	10,130 ± 60	12,140–11,340
18a	6	N7W17	01.01	Beta-164229	Hearth charcoal	10,080 ± 50	12,020–11,280
18a	6	N7W17	01.01	Beta-170443	Hearth charcoal	10,040 ± 70	11,950–11,210
18a/17b' contact	6	N6W22	05.02	Beta-207010	Hearth charcoal	9580 ± 40	11,190–10,690
17b'	6	N8W19	03.13	AA-58589	Hearth charcoal	9440 ± 50	10,810–10,550
17b'	6	N8W19	03.13	AA-58588	Hearth charcoal	9430 ± 50	10,780–10,540
17a	5	N8W17	00.01	CAMS-72351	Hearth charcoal	7420 ± 50	8380–8140
16	5	N7W17	n/a	CAMS-72352	Dispersed charcoal	7280 ± 50	8110–7990
16	5	N7W17	n/a	Beta-164230	Textile fragment	7190 ± 50	8120–7920
14	5	N8W20	03.11	AA-58591	Garbage pit charcoal	6315 ± 40	7340–7140
14	5	N7W15	01.04	Beta-164227	Hearth charcoal	6280 ± 40	7290–7150
14	5	N7W15	01.05	Beta-164226	Hearth charcoal	6100 ± 80	7250–6750
14	5	N4W15	n/a	Beta-164224	Cordage fragment	6100 ± 50	7210–6810
14	5	n/a	n/a	Beta-29542	Bulk charcoal	6040 ± 80[c]	7130–6690

[a] Age in ^{14}C BP, reported with 1 σ (standard deviation).

[b] The CalPal online radiocarbon calibration program (CalPal 2006) was used to calibrate radiocarbon age estimates; presented with 2 σ range.

[c] This date was obtained by Schroedl and Coulam (1989) and is a conventional date on bulk charcoal presumably from Stratum 14.

the 2003 and 2004 field seasons, four age estimates were obtained from wood charcoal excavated from a stacked feature, 03.16/04.13/04.13b. These yielded the following ages: 12,390 ± 40 (Beta-195045), 12,330 ± 40 (Beta-195046), 12,270 ± 60 (AA-58595), and 10,690 ± 70 (AA-58590) ^{14}C BP. In 2003 we exposed only a small corner of this feature (then designated 03.16); this produced the age estimates of 12,270 ± 60 and 10,690 ± 70. In 2004 we continued excavating the feature and were able to delineate two stacked features, an upper hearth (03.16/04.13) and a lower burn feature (04.13b). The ages of 12,390 ± 40 and 12,330 ± 40 were obtained on unidentified wood charcoal from the lower part of this feature (04.13b). In fall 2004 we also dated a piece of *Artemisia* wood charcoal from the lower feature, 04.13b, which returned an age estimate of 10,970 ± 60 (Beta-200874).

Another hearth feature, 03.17, was excavated from Stratum 19 during the 2003 season. This feature produced an age estimate of 12,180 ± 60 (AA-58587) on unidentified wood charcoal and a subsequent age of 10,640 ± 60 (Beta-200875) on *Artemisia* wood charcoal.

The results of our 2004 excavations and radiocarbon testing led to some concern and questions regarding the nature of the pre-12,000 ^{14}C BP age estimates and raised the possibility that the unidentified samples were old pine wood. Therefore, five bone samples were submitted (three to Beta Analytic and two to Stafford Research Laboratories) to further explore the discrepancy in ages. Two samples were taken from a portion of Stratum 19 that did not contain cultural materials either horizontally or vertically, while three were taken from either within or adjacent to the hearth features described above. These samples include long bone shaft fragments of medium-bodied to small-bodied ungulates. The first two samples came from excavation square N8W22, which contained no Stratum 19 artifacts or cultural features. N8W22 is two excavation squares west of the nearest hearth feature (04.13b), and vertically the dated bone samples came from just above the contact of Strata 19 and 20. Resulting age estimates are 15,240 ± 50 (UCIAMS-22180) and 11,960 ± 60 (Beta-209265) ^{14}C BP. Of the three bone samples from near the previously dated hearth features, the first came from within hearth feature 04.13b and yielded an estimate of 11,530 ± 40 ^{14}C BP (Beta-210523). The other two bone samples were split from a single bone specimen that was found adjacent to hearth feature 03.17. This bone produced age estimates of 10,900 ± 50 (UCIAMS-22176) and 10,830 ± 40 ^{14}C BP (Beta-210524).

Thus, we have three sets of dates for Stratum 19: (1) 15,240 ^{14}C BP, (2) ~12,300–11,500 ^{14}C BP, and (3) 10,900–10,600 ^{14}C BP. These dates, along with the nature of the deposits, suggest that Stratum 19 is the result of slow, gradual accumulation of natural materials (perhaps through packrat activity). The bone dating to 15,240 ± 50 ^{14}C BP (~18,500 cal BP) predates the last highstand of Lake Bonneville and is clearly discordant. It is either an old bone that was brought into the shelter and incorporated into a nest by a packrat after about 12,300 ^{14}C BP, or it is an aberrant radiocarbon assay. The charcoal and bone producing dates

ranging from 12,300 to 11,500 ^{14}C BP are probably the result of natural processes. Most likely, they represent the in situ burning of natural midden organics (both wood and bones) of Stratum 19 by humans making fires on the surface of Stratum 19. If this were the case, then the 10,900–10,600 ^{14}C BP dates more likely reflect initial human activities in this part of the shelter.

As described above, Stratum 19 is relatively thin and forms gradual to diffuse boundaries with the natural strata below and cultural strata above. The stratum's cultural materials include the two ephemeral hearth features discussed above and 34 pieces of nondiagnostic debitage found primarily in the upper 5 cm. Macrobotanical and faunal remains are present throughout Stratum 19; however, many of these are likely the result of natural accumulation processes. These data support the interpretation that this stratum is the result of gradual accumulation of mainly natural deposits between 15,200 and 12,500 cal BP. Based on these interpretations, cultural remains from Stratum 19 are assigned to Cultural Component 6, the Pre-Archaic.

Sub-stratum 18b

Six radiocarbon age estimates have been obtained from Sub-stratum 18b. Sample Beta-207009, a piece of wood charcoal from hearth feature 05.06, yielded an estimate of 11,010 ± 40 ^{14}C BP. Sample AA-58594, a piece of wood charcoal from hearth feature 03.15a, yielded an age of 10,800 ± 60 ^{14}C BP. Sample AA-58592, also wood charcoal from feature 03.15a, yielded an age of 10,760 ± 70 ^{14}C BP. These two dates from the same hearth feature (03.15a) overlap at one standard deviation (or sigma). A wood charcoal sample (Beta-195047) from hearth feature 04.14 provided an age estimate of 10,540 ± 40 ^{14}C BP, and a wood charcoal sample (AA-58593) from hearth feature 03.14 yielded an estimate of 10,405 ± 50 ^{14}C BP. These last two dates overlap at two sigma.

Considering these radiocarbon estimates, three distinct human occupations may be represented, possibly one at about 11,000 ^{14}C BP, a second at about 10,800–10,700 ^{14}C BP, and a third at about 10,500–10,400 ^{14}C BP. After calibration, however, these distinctions are blurred, with each age range overlapping with the next-youngest range. Therefore, these ages cannot be unequivocally separated. The data suggest that Sub-stratum 18b accumulated within an 1,100-year span between 13,100 and 12,000 cal BP. It likely represents a series of short-term human occupations during that time.

No diagnostic artifacts have been found in association with feature 05.06 in the vicinity of square N6W16. However, a single Haskett Stemmed point base was found during the 2006 field season in the western portion of the West Block excavation (N5W21), not far from the radiocarbon-dated hearth features (03.14, 03.15a, and 04.14). On this basis, Sub-stratum 18b is assigned to Cultural Component 6, the Pre-Archaic component of the rockshelter. Both horizontal and vertical placement of the Haskett point, coupled with radiocarbon assays, suggest that it dates to between 10,800 and 10,400 ^{14}C BP (12,900 and 12,000 cal BP). The earliest hearth feature (05.06, dating to about 11,010 ^{14}C BP [~13,000

cal BP]) cannot be attributed to a specific Pre-Archaic complex since no diagnostic points have been found in association with it.

SUB-STRATUM 18A

Three radiocarbon age estimates have been obtained from Sub-stratum 18a. These three estimates are from a single hearth feature that was excavated during the 2001 and 2002 field seasons. All three samples consisted of wood charcoal from feature 01.01 and resulted in age estimates of 10,130 ± 60 (Beta-170444), 10,080 ± 50 (Beta-164229), and 10,040 ± 70 (Beta-170443) ^{14}C BP. All three of these age estimates overlap at one sigma.

Calibration of these radiocarbon age estimates places the occupation between about 12,000 and 11,200 cal BP, suggesting that Sub-stratum 18a may have accumulated during a 700- to 800-year span of time. Based on radiocarbon determinations and the presence of Parman Stemmed points, Sub-stratum 18a is assigned to the Pre-Archaic, the sixth cultural component.

SUB-STRATA 18A AND 17B' CONTACT

Sub-strata 18a and 17b' are typically separated by a silt band that forms the base of 17b. In the far western section of our 2005 and 2006 excavations, however, 18a and 17b' were not clearly separated by silt. During excavation of these strata in square N6W22, we encountered hearth feature 05.02. A piece of wood charcoal from this ephemeral hearth feature yielded one radiocarbon assay of 9580 ± 40 (Beta-207010) ^{14}C BP.

SUB-STRATUM 17B'

Two radiocarbon age determinations have been obtained for Sub-stratum 17b'. Sample AA-58589, wood charcoal from hearth feature 03.13, yielded an age estimate of 9440 ± 50 ^{14}C BP. Sample AA-58588, also wood charcoal from hearth feature 03.13, provided an estimate of 9430 ± 50 ^{14}C BP. The two age estimates overlap at one sigma.

These data, coupled with the age range given for Feature 05.02 from the contact of Sub-strata 18a and 17b', suggest that Sub-stratum 17b' ranges in age from about 11,150 to 10,500 cal BP. Diagnostic cultural materials include stemmed points, which, coupled with the radiocarbon determinations, suggest that Sub-stratum 17b' represents a late Pre-Archaic occupation. It has been assigned to Cultural Component 6.

SUB-STRATUM 17A

One radiocarbon determination was obtained from Sub-stratum 17a. Sample CAMS-72351, wood charcoal from hearth feature 00.01, provided an age estimate of 7420 ± 50 ^{14}C BP. Calibration of this age estimate shows that Sub-stratum 17a was deposited around 8380–8140 cal BP. These data also suggest that the upper portion of Stratum 17 represents an ephemeral occupation of humans in the West Block area of the shelter after a 2,200-year hiatus following

about 10,500 cal BP. The artifact assemblage from Sub-stratum 17a is small and contains no diagnostic artifacts, but based on the radiocarbon determinations, Sub-stratum 17a probably represents the first Early Archaic occupation in BER and is therefore assigned to Cultural Component 5.

Stratum 16

Two radiocarbon age estimates have been obtained from Stratum 16. Sample CAMS-72352, a piece of dispersed wood charcoal found next to a piece of a coiled basket, yielded an age estimate of 7280 ± 50 ^{14}C BP. The other sample, Beta-164230, a fragment of the coiled basket piece, provided an age estimate of 7190 ± 50 ^{14}C BP. Calibration of these age estimates suggests that Stratum 16 accumulated over a 200-year period (8110–7920 cal BP). As discussed above, although well-preserved, this stratum is restricted to a small area of the rockshelter. No cultural features such as hearths have been found, and cultural materials consist of a small assemblage of nondiagnostic lithic artifacts. Based mainly on the radiocarbon age estimates, we conclude that Stratum 16 represents an Early Archaic occupation of the shelter and assign it to Cultural Component 5.

Stratum 14

Five radiocarbon determinations have been obtained for Stratum 14. Sample AA-58591, wood charcoal from pit feature 03.11, is most likely associated with Stratum 14 and yielded an age of 6315 ± 40 ^{14}C BP. We encountered feature 03.11 just below a large looters' pit. The looters had stopped digging when they hit rocky and sterile Stratum 17, leaving a large portion of Feature 03.11 undisturbed. The top of it was truncated, so we cannot unequivocally say that it represents the Stratum 14 occupation; however, given its radiocarbon age, it likely does. The next sample, Beta-164227, wood charcoal from hearth feature 01.04, yielded an age estimate of 6280 ± 40 ^{14}C BP. These first two estimates overlap at one sigma. A sample of wood charcoal from an adjacent hearth feature, 01.05, provided an estimate of 6100 ± 80 (Beta-164226) ^{14}C BP. Sample Beta-164224, a cordage fragment, yielded an age estimate of 6100 ± 50 ^{14}C BP. Finally, in the late 1980s Schroedl and Coulam (1989) obtained an age estimate of 6040 ± 80 (Beta-29542) ^{14}C BP on bulk charcoal collected from their excavations at the BER. From their descriptions, we conclude this bulk charcoal sample came from Stratum 14. The last three dates overlap at one sigma.

Calibration of the radiocarbon data suggests that Stratum 14 accumulated during a 600-year span of time (7340–6690 cal BP); however, only one sample of the five from Stratum 14 can be clearly assigned to a sub-stratum. This was the cordage sample (Beta-164224) from Sub-stratum 14a. As discussed above, the 6300 ^{14}C BP (7340–7140 cal BP) and 6040 ^{14}C BP (7130–6690 cal BP) estimates cannot be directly tied to a sub-stratum of 14 since they were impacted by looting or were from an earlier phase of excavation, respectively. The two samples (Beta-164227 and 164226) from adjacent hearth features 01.04 and 01.05

TABLE 5.2. Bonneville Estates Rockshelter AMS Radiocarbon Age Estimates from the East Block

STRATUM	COMPONENT	SQUARE	FEATURE	LAB NUMBER	MATERIAL	AGE ESTIMATE[a]	AGE CALIBRATED[b]
12	6	N3W3	D4-10-C8/ C7b	Beta-182931	Hearth charcoal	10,560 ± 50	12,800–12,260
12	6	N4W3	D5-10-C8a/C8d	AA-58600	Hearth charcoal	10,380 ± 60	12,670–11,950
12	6	N3W4 N2W3	E4-12-C5/ D3-10-C10	Beta-195013	Hearth charcoal	10,380 ± 40	12,670–11,970
12	6	N3W4 N2W3	E4-12-C5/ D3-10-C10	Beta-203504	Hearth charcoal	10,340 ± 60	12,680–11,940
12	6	N2W4	E3-13-C4	Beta-206278	Hearth charcoal	10,250 ± 50	12,340–11,680
12	6	N4W3	D5-10-C8a/C8d	Beta-182935	Hearth charcoal	10,050 ± 50	11,920–11,260
12	6	N3W3	D4-12-C9b	Beta-182934	Hearth charcoal	10,030 ± 50	11,870–11,230
12	6	N3W3	D4-10-C8/ C7b	AA-58598	Hearth charcoal	9990 ± 50	11,710–11,230
10	6	N3W4 N4W4	E4-10-C3/ E5-10-C7	Beta-195042	Hearth charcoal	9580 ± 40	11,190–10,690
10	6	N3W4 N4W4	E4-10-C3/ E5-9-C5b	Beta-195044	Hearth charcoal	9570 ± 40	11,170–10,690
10	6	N5W4	E6-10-C10	Beta-161891	Hearth charcoal	9520 ± 60	11,200–10,580
10	6	N5W4	E6-10-C10	AA-58599	Hearth charcoal	9440 ± 80	11,070–10,450
10	6	N3W0	A4-9-C1	Beta-203507	Hearth charcoal	8830 ± 60	10,250–9610
9b	5	N4W4	E5-9-C5a	AA-58596	Hearth charcoal	7240 ± 50	8210–7950
9a	5	N3W2	C4-10-C8g	Beta-182933	Hearth charcoal	5350 ± 70	6330–5950
9a	5	N3W2	C4-10-C8c	Beta-182928	Hearth charcoal	5160 ± 80	6140–5680

[a] Age in ^{14}C BP, reported with 1 σ (standard deviation).
[b] The CalPal online radiocarbon calibration program (CalPal 2006) was used to calibrate radiocarbon age estimates presented with 2 σ range.

were impossible to assign to a specific substratum of 14 because ash smears and burnt materials lying in and around the hearths blurred their precise stratigraphic context. Cultural materials are quite numerous from Stratum 14, and the presence of diagnostic large side-notched points suggests an Early Archaic affiliation. Stratum 14, therefore, is assigned to Cultural Component 5.

East Block

We currently have 16 radiocarbon determinations to help date the late Pleistocene/early-middle Holocene deposits in the East Block. These are presented in Table 5.2. These determinations have been corrected for ^{13}C fractionation. No radiocarbon estimates have been obtained for Strata 18–13 because these strata are noncultural and have yielded no well-preserved organic materials for dating. Presented below are chronology and cultural affiliations of Strata 12, 10, and 9.

Stratum 12

Eight radiocarbon estimates have been obtained for Stratum 12. Sample Beta-195013, wood charcoal from hearth feature E4-12-C5/D3-10-C10, yielded an age of 10,380 ± 40 ^{14}C BP. Sample Beta-203504, a second piece of wood charcoal from hearth E4-12-C5/D3-10-C10, provided an age estimate of 10,340 ± 60 ^{14}C BP. Both ages from this hearth overlap at one sigma. A second hearth feature, E3-13-C4, produced wood charcoal dated to 10,250 ± 50 (Beta-206278) ^{14}C BP. All three dates from these two hearths overlap at two sigma. An age estimate of 10,560 ± 50 (Beta-182931) ^{14}C BP was obtained from wood charcoal excavated from an ephemeral, unprepared hearth feature, D4-10-C8/C7b. A second sample of wood charcoal from this hearth feature produced an age estimate of 9990 ± 50 (AA-58598) ^{14}C BP. Two wood charcoal samples from another ephemeral hearth feature, D5-10-C8a/C8d, produced two age estimates of 10,380 ± 60 (AA-58600) and 10,050 ± 50 (Beta-182935) ^{14}C BP. Just below these hearths, sample Beta-182934, wood charcoal from hearth feature D4-12-C9b, yielded an age estimate of 10,030 ± 50 ^{14}C BP. Most likely, the two older estimates from Features D4-10-C8/C7b (10,560 ± 50) and D5-10-8a/8d (10,380 ± 60) are aberrant ages, given their vertical positions above hearths E4-12-C5/D3-10-C10 and E3-13-C4.

These results suggest the possibility of two human occupations represented in Stratum 12. The first may have occurred sometime between about 10,380 and 10,250 ^{14}C BP, and the second may have occurred at about 10,000 ^{14}C BP. After calibration, however, these distinctions are blurred, with the age ranges overlapping with the next-youngest range. These data suggest that Stratum 12 accumulated over a 1,600-year period from 12,800 to 11,200 cal BP and likely represent a series of short-term human occupations during this time frame. Stratum 12 contains a very small lithic assemblage, including one Parman Stemmed point fragment. The artifact assemblage and the radiocarbon ages presented above suggest a Pre-Archaic cultural affiliation. Therefore, Stratum 12 is assigned to Cultural Component 6.

Stratum 10

Five radiocarbon age estimates have been obtained for Stratum 10. Sample Beta-195042, wood charcoal from hearth feature E4-10-C3/E5-9-C5b, yielded an age estimate of 9580 ± 40 ^{14}C BP. Another wood charcoal sample (Beta-195044) from hearth feature E4-10-C3/E5-9-C5b produced an age of 9570 ± 40 ^{14}C BP. These two estimates overlap at one sigma. Wood charcoal from hearth feature E6-10-C10 yielded two age estimates of 9520 ± 60 ^{14}C BP (Beta-161891) and 9440 ± 80 ^{14}C BP (AA-58599). Both estimates overlap at one sigma, and all four ages presented above overlap at two sigma. A final radiocarbon age estimate for Stratum 10 was obtained on wood charcoal from hearth feature A4-9-C1, 8830 ± 60 (Beta-203507) ^{14}C BP. This estimate does not overlap with the other dates from Stratum 10.

These results suggest that Stratum 10 may contain two separate human

occupations. The earlier occupation may have taken place between about 9580 and 9440 ^{14}C BP (11,190–10,450 cal BP), and the later occupation may date to approximately 8800 ^{14}C BP (10,250–9610 cal BP). The small lithic assemblage from this stratum includes a Parman-like stemmed point. The artifact assemblage and radiocarbon ages suggest a late Pre-Archaic cultural affiliation, and therefore Stratum 10 has been assigned to Cultural Component 6.

STRATUM 9

A single radiocarbon age estimate was obtained from Sub-stratum 9b. The sample consisted of wood charcoal from hearth feature E5-9-C5a and yielded an age of 7240 ± 50 (AA-58596) ^{14}C BP. Two radiocarbon ages were obtained from a stacked set of hearth features in Sub-stratum 9a. Sample Beta-182933, wood charcoal from lower hearth feature C4-10-C8g, provided an age of 5350 ± 70 ^{14}C BP. The second sample, wood charcoal from upper hearth feature C4-10-C8c, yielded an age estimate of 5160 ± 80 (Beta-182928) ^{14}C BP. These two ages overlap at two sigma.

Calibration of these radiocarbon estimates suggests that Stratum 9 accumulated over a 2,300-year period, with Sub-stratum 9b dating to 8210–7950 cal BP and Sub-stratum 9a dating to 6330–5680 cal BP. Unfortunately, the artifact assemblage from Sub-stratum 9b contains no diagnostic lithic artifacts; however, based solely on the radiocarbon date presented above, an Early Archaic cultural affiliation is suggested. Sub-stratum 9b contains a rich lithic assemblage, including large side-notched projectile points clearly representing an Early Archaic cultural occupation. Therefore, Stratum 9 is assigned to Cultural Component 5.

DISCUSSION AND CONCLUSIONS

BER became available for human occupation shortly after about 15,000 ^{14}C BP (18,800 cal BP) as Lake Bonneville receded from its high shoreline. The wash located directly in front of the rockshelter may have provided an intermittent source of water during relatively cool, wet episodes in the past, and the springs at Blue Lake would have provided a relatively close source of permanent water. Due to its large size, south-facing entrance, and close proximity to water throughout much of the late Pleistocene and Holocene, BER would have made an excellent occupation site for humans (as well as other animals).

Both the West and East Block excavations at BER contain a series of late Pleistocene to middle Holocene deposits in sealed primary contexts. In the West Block these deposits include 11 stratigraphic units. Because preservation is very good in the West Block, seven of these stratigraphic units contain cultural materials—not just lithic artifacts but also perishable artifacts, well-preserved faunal remains, floral remains, and features. In the East Block, the late Pleistocene to middle Holocene deposits include 10 stratigraphic units. Of these, three contain cultural materials. Although lithic artifacts and features

occur, faunal and floral remains are not well preserved. Clearly, geogenic processes have greatly affected the preservation level in the East Block; consequently, separation of cultural occupations is largely based on concentrations of lithic and faunal materials, and associated radiocarbon dates from ephemeral hearth features.

Evidence for the earliest unequivocal human occupations of the rockshelter comes from Stratum 18b in the West Block excavation and dates to between about 13,100 and 12,000 cal BP. The earliest of these dates, about 13,120–12,720 cal BP (11,010 ^{14}C BP), falls into the established time of Clovis (Fiedel 1999; Haynes 2002); however, to date no diagnostic projectile points have been found associated with the feature that produced this date. Interestingly, a Clovis point base was found during the summer 2004 field season in Stratum 1, associated with the historic occupation of the site. This point was obviously removed from its original context, which was either in the rockshelter or somewhere nearby. It must be stated that the equivocal nature of the dating of Stratum 19 does not exclude the possibility of an earlier occupation at BER. Further excavations should help to clarify this issue.

Pre-Archaic hunter-gatherers wielding Great Basin stemmed points and an associated toolkit appear to have repeatedly used the rockshelter on a frequent basis, utilizing both the West and East Block areas from about 12,900–12,000 cal BP (10,800–10,300 ^{14}C BP), 12,000–11,200 cal BP (10,200–9990 ^{14}C BP), and again 11,000–10,500 cal BP (9580–9430 ^{14}C BP).

After about 10,600 cal BP, there was a hiatus in human occupation of the West Block until after 8400 cal BP; however, a single hearth in the East Block (but with no associated artifacts) may suggest that Pre-Archaic people used the rockshelter again about 9700 cal BP. This is not surprising because soon after 9500 cal BP a shift to drier and possibly warmer climatic conditions in the Bonneville Basin had begun (Rhode et al. 2005; Schmitt and Madsen 2005).

Immediately following a 1,400-year hiatus of human activity, Archaic people began to make use of the rockshelter, discarding their artifacts in both the West and East blocks. Two very small lithic assemblages, each associated with a single hearth, mark human occupations between about 8300 and 8000 cal BP. Paleoecological records for the region suggest that between about 8100 and 6800 cal BP the climatic transition to modern conditions had occurred, with pinyon pine and Utah juniper migrating into the Bonneville Basin (Rhode et al. 2005). After a period of relatively dry conditions, during which Great Salt Lake desiccated, the climate became slightly moister about 6800 cal BP (Schmitt and Madsen 2005). These changes in vegetation and climate likely correlated with the rich Early Archaic occupations of Strata 16 and 14 in the West Block of the site.

BER contains a wealth of evidence of human occupations during the transition from the terminal Pleistocene to early Holocene. It presents some of the first detailed evidence of Pre-Archaic hunter-gatherer adaptations in the Great Basin and offers a precise record of human technological and subsistence

activities as climate and environment changed during the early Holocene. Chapters in this volume by Goebel, Hockett, and Rhode and Louderback provide further details of some of this record.

NOTE

1. During excavation, Sub-stratum 12a was originally designated Stratum 11; however, due to its ephemeral nature, it has been incorporated into Stratum 12 as Sub-stratum 12a.

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