Leonard Rockshelter Revisited: Evaluating a 70-Year-Old Claim of a Late Pleistocene Human Occupation in the Western Great Basin

Geoffrey M. Smith, Sara Sturtz, Anna J. Camp, Kenneth D. Adams, Elizabeth Kallenbach, Richard L. Rosencrance, and Richard E. Hughes

Robert Heizer excavated Leonard Rockshelter (26Pe14) in western Nevada more than 70 years ago. He described stratified cultural deposits spanning the Holocene. He also reported obsidian flakes purportedly associated with late Pleistocene sediments, suggesting that human use extended even farther back in time. Because Heizer never produced a final report, Leonard Rockshelter faded into obscurity despite the possibility that it might contain a Clovis Era or older occupation. That possibility prompted our team of researchers from the University of Nevada, Reno and Desert Research Institute to return to the site in 2018 and 2019. We relocated the excavation block from which Heizer both recovered the flakes and obtained a late Pleistocene date on nearby sediments. We minimally excavated undisturbed deposits to rerecord and redate the strata. As an independent means of evaluating Heizer's findings, we also directly dated 12 organic artifacts housed at the Phoebe A. Hearst Museum of Anthropology. Our work demonstrates that people did not visit Leonard Rockshelter during the late Pleistocene. Rather, they first visited the site immediately following the Younger Dryas (12,900–11,700 cal BP) and sporadically used the shelter, mostly to store gear, throughout the Holocene.

Keywords: Great Basin archaeology, Lake Lahontan, Paleoindian archaeology, cave archaeology, dart and atlatl technology, basketry, geoarchaeology, Humboldt Sink

Robert Heizer excavó Leonard Rockshelter (26Pe14) en el oeste de Nevada hace más de 70 años. Describió depósitos culturales estratificados que abarcan el Holoceno. También reportó sobre lascas de obsidiana supuestamente asociadas con sedimentos del Pleistoceno tardío, lo que sugiere que el uso humano se extendió incluso más atrás en el tiempo. Debido a que Heizer nunca produjo un informe final, Leonard Rockshelter se quedó en la oscuridad a pesar de la posibilidad de que pudiera contener una ocupación de la Era Clovis, o incluso más antigua. Esa posibilidad llevó a nuestro equipo de investigadores de la Universidad de Nevada, Reno y el Desert Research Institute a regresar al sitio en 2018 y 2019. Reubicamos el bloque de excavación del que Heizer recuperó las escamas y obtuvo una fecha del Pleistoceno tardío en los sedimentos cercanos. Excavamos mínimamente depósitos no perturbados para volver a registrar y volver a fechar los estratos. Como un medio independiente para evaluar los hallazgos de Heizer, también fechamos directamente 12 artefactos orgánicos alojados en el Museo de Antropologia Phoebe A. Hearst. Nuestro trabajo demuestra que la gente no visitó Leonard Rockshelter durante el final del Pleistoceno. Más bien, inicialmente visitaron el sitio inmediatamente después del Dryas Reicente (12.900–11.700 cal aP) y usaron esporádicamente el refugio, principalmente para almacenar equipo durante el Holoceno.

Palabras clave: arqueología de la Gran Cuenca, Lago Lahonta, arqueología Paleoindia, arqueología de cuevas, tecnología de dardos y atlatl, cestería, geoarqueología, Cuenca de Humboldt

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With few exceptions, most important cave and rockshelter sites in the Great Basin had been professionally excavated or severely damaged by looters by the end of the twentieth century. As a result, researchers have increasingly turned their attention to previously excavated sites. In some cases, such as the Paisley Caves (Jenkins et al. 2012) and Connley Caves (Jenkins et al. 2017; McDonough et al. 2022), these efforts have changed our understanding of the peopling of the Great Basin. In others, such as Fort Rock Cave (Connolly et al. 2017), renewed work has shown that some sites are irreparably damaged. In both cases—the good and the bad—revisiting old sites has allowed archaeologists to evaluate the remaining potential of important locales.

The archaeological significance of Leonard Rockshelter (26Pe14; herein referred to as LRS) was first recognized in 1936 by guano miner Thomas Derby, who contacted Robert Heizer at the University of California Berkeley (UCB). Derby told Heizer that he had discovered a complete atlatl dart tipped with a sharpened greasewood foreshaft (but lacking a stone point) and a string of approximately 50 *Olivella* shell beads in the guano layer (Heizer 1938)—a claim supported by Heizer's discovery of three greasewood foreshafts and a broken obsidian biface during his first visit the site in 1937 (Heizer 1951). Heizer returned to the site in 1950 to carry out more substantial excavations and obtained some of the first radiocarbon-dated samples from an archaeological site (Arnold and Libby 1950). Among these was a date of 11,120 ± 570 ^{14}C BP (14,940–11,620 cal BP) on bat guano–rich sediment from the site's lowest artifact-bearing stratum.[1] Heizer (1951:94) recovered two obsidian flakes "from the very bottom of this level," which he believed were the oldest artifacts at the site, and a few other artifacts from higher up in the guano layer, including at least two *Olivella* shell beads, a chert biface, and bits of cordage.[2,3] These findings led Heizer (1951:93) to conclude that "there can be no question of the presence of man during the period that bat guano was being laid down." This assertion was supported when he obtained a radiocarbon date of 7040 ± 350 ^{14}C BP (8600–7170 cal BP) on the foreshafts he collected in 1937.

Heizer's (1951) argument for an early occupation at LRS, supported by obsidian flakes purportedly associated with dated late Pleistocene deposits and artifacts directly dated to the initial middle Holocene, piqued our interest. The association of the flakes with guano dated to 14,940–11,620 cal BP was particularly intriguing because that interval encompasses both the earliest evidence of human activity at the Paisley Caves (14,200 cal BP; Shillito et al. 2020) and the Clovis Era (13,050–12,750 cal BP; Waters et al. 2020). If we could replicate Heizer's findings, then LRS might add to our understanding of how people explored and settled the western Great Basin. We returned to LRS in 2018 and 2019 with two goals. First, we sought to relocate an intact profile from Heizer's Area B excavation block, where he recovered the obsidian flakes and other artifacts. Second, we sought to rerecord and redate the strata in that profile. We believed that those efforts would allow us to evaluate Heizer's claim that people first visited LRS during the late Pleistocene.

History of Work at Leonard Rockshelter

Leonard Rockshelter is a north-facing, wave-cut shelter located in the West Humboldt Range of western Nevada on the traditional lands of the Northern Paiute (Figure 1). It sits at the base of a near-vertical rock outcrop at an elevation of 1,285 m (4,216 ft.) above sea level (asl), the lower half of which is coated by a thick mantle of calcareous tufa deposited by Lake Lahontan (Byrne et al. 1979).[4] The shelter overlooks the Humboldt River and the Humboldt Sink, which is typically the terminus of the river.

During wet periods, the Humboldt Sink holds a shallow lake ringed by marshes fed by the Humboldt River. During particularly wet periods in the past, the lake filled and overflowed through a notch (~1,190 m asl) cut in the Humboldt Bar, which is a large beach ridge complex and merged with the lake in the Carson Sink (Adams and Rhodes 2019). Therefore, lake-level rises that have occurred since the Younger Dryas period above 1,190 m asl were shared between the Humboldt and Carson sinks (Adams 2003; Adams and Rhodes 2019; Adams et al. 2008), because they were a single body of water. During

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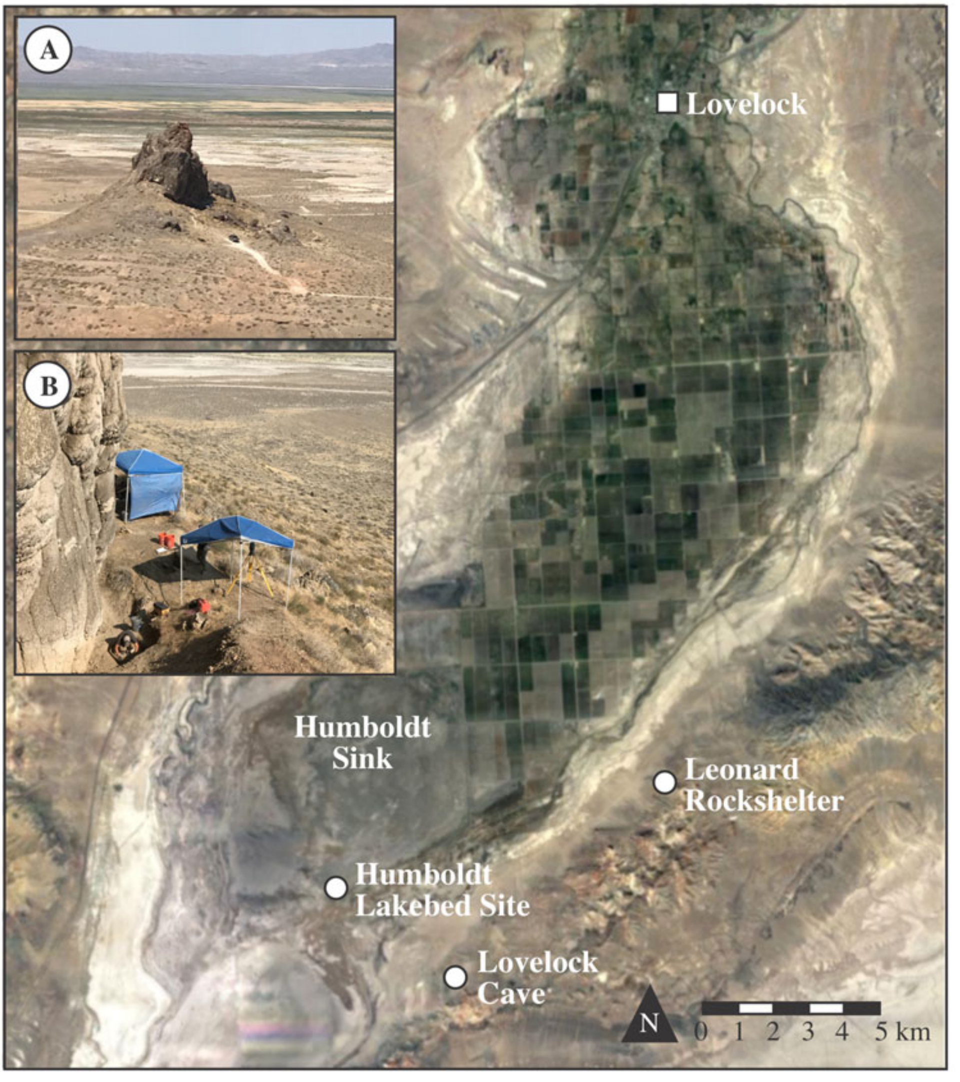

Figure 1. Location of Leonard Rockshelter, Lovelock Cave, and the Humboldt Lakebed Site. Inset A: Steep outcrop beneath which the shelter sites, looking northwest. Inset B: Overview of UNR's 2018 work in Heizer's Excavation Area B, looking northwest. (Color online)

dry periods, the lake and marshes in the Humboldt Sink disappear, leaving a broad playa.

Variations in the amount of water, the size of marshes, and lake levels in the Humboldt Sink through the Holocene are somewhat poorly constrained, but there is evidence in the form of shorelines and other lacustrine deposits that point to relatively large lake-level fluctuations, particularly during the late Holocene (Adams 2003; Adams and Rhodes 2019). Davis (1982) found Mazama tephra (~7680 cal BP) in lake deposits and in alluvial fan deposits, which indicated that the lake level was at approximately 1,200 m asl when the tephra was deposited. Although a lake of this size indicates a strongly positive water balance, there is no evidence of how long those wet conditions lasted. In contrast, the durations of similar-scale lake level rises during the late Holocene were constrained to have lasted from 20 to 50 years, based on the durations

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of anomalously wet periods recorded by tree rings in the headwaters of the Humboldt and Carson Rivers (Adams and Rhodes 2019). Some of these late Holocene lakes reached elevations near 1,200 m asl, which would have at least temporarily inundated archaeological sites within the Humboldt and Carson Sinks (Adams 2003).

In 1936, Thomas Derby began to mine LRS for bat guano to be used as fertilizer. Upon encountering the complete atlatl dart and string of shell beads, Derby contacted Heizer, who visited the site the next year. Heizer (1938:89) carried out "minor excavations" and collected additional artifacts, including three greasewood foreshafts from a bat guano layer near the bottom of Derby's pit (Heizer 1951). He briefly described the atlatl dart and string of *Olivella* shell beads in a short report a year later (Heizer 1938). Heizer returned to the site in 1949 to collect unburned bat guano in the area that produced those items (Heizer 1951) and, working with Willard Libby, he obtained some of the very first radiocarbon dates from an archaeological context: the guano returned dates of 8440 ± 510 ^{14}C BP (11,070–8320 cal BP) and 8820 ± 400 ^{14}C BP (11,140–9000 cal BP), whereas the three greasewood foreshafts produced a combined date of 7040 ± 350 ^{14}C BP (8600–7180 cal BP; Arnold and Libby 1950).

Heizer returned again in the summer of 1950 and, over the course of five weeks, he excavated a substantial portion of the deposits behind the dripline. He focused on four areas (designated A–D; the location of Area D remains unknown) between large blocks of tufa that had fallen from the cliff face (Figure 2). His crew worked quickly, apparently did not screen the excavated deposits, and reached depths exceeding 2 m in some places. We focus mostly on Area B in this article because that is where Heizer reported the earliest evidence of human activity. Area B consisted of five trenches: A, B, C, D, and E. Trenches B and C are relevant here because, as we describe below, we placed our 1 × 1 m test pits near them. Trench B was an irregularly shaped area consisting of a 2.5 × 2.5 m block with a 3.0 × 1.5 m trench extending north from it (see Figure 2). Trench C was a 3.0 × 1.5 m trench that ran perpendicular to Trench B and parallel to the shelter wall. Trenches B and C were separated by a 1 m wide balk that Heizer's crew left in place. The western face of that balk is illustrated in Byrne and colleagues (1979; Figure 3).

Heizer (1951) reported his work a year later. He described three major stratigraphic units. From top to bottom they are (1) windblown dust mixed with woodrat midden debris and rockfall, (2) fine windblown dust mixed with tufa rockfall, and (3) dark brown and sometimes burned bat guano. In their subsequent report, Byrne and colleagues (1979) described two additional strata in Area B: (1) angular gravels underlying the guano layer; and (2) layers of whitish gray sand and silt underlying the upper windblown dust and packrat material layer. These brought the number of reported strata to five (labeled Units A–E from top to bottom; see Figure 3), plus a basal gravel layer to which they did not assign a letter. Stratigraphic Units A–D produced artifacts in varying quantities across the four excavation areas. Unit A produced coiled basketry and arrow fragments in Area D but nothing in Areas B or C. Unit B only produced artifacts in Area C. These included closed-twined basketry fragments, some of which were burned and associated with an infant burial. Unit D produced the tan chert biface, the obsidian biface fragment, the string of 50 shell beads and two other detached shell beads, the complete atlatl dart and greasewood foreshafts, and bits of cordage in Area B; and one obsidian flake in both Area C and Area D. Byrne and colleagues (1979) later analyzed pollen from sediment samples collected during the 1950 excavations, which proved to be challenging because unresolved questions about the contexts of the samples made it difficult to correlate them to Heizer's strata.

Heizer's (1951; Byrne et al. 1979) age estimations for stratigraphic Units A–E were guided by a handful of radiocarbon-dated organic artifacts and sediment samples (Table 1). According to Byrne and colleagues (1979), Lake Lahontan receded below the shelter for a final time prior to approximately 13,900 cal BP, leaving behind well-rounded gravels.[5] Following the lake's recession, angular roof fall (Unit E) and guano-rich sediment (Unit D) accumulated between approximately 13,900 and 8300 cal BP. Heizer

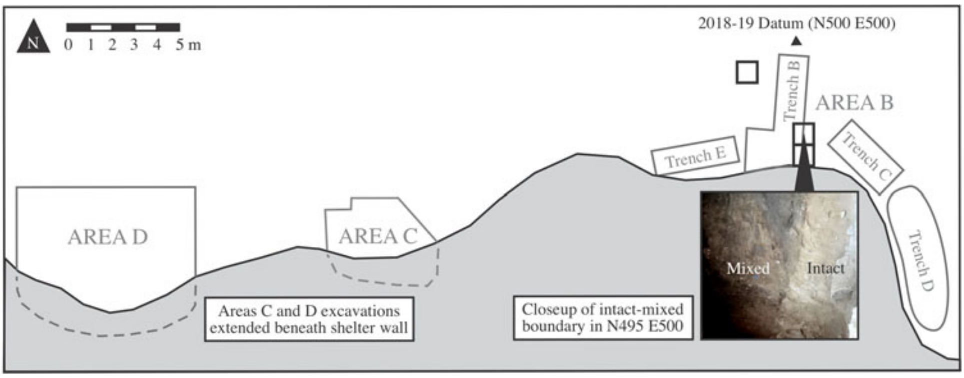

Figure 2. Planview map of Leonard Rockshelter showing Heizer's excavation areas B–D and trenches (gray), and our 2018–2019 1 × 1 m test pits (black). The location of Heizer's Area A is unknown. Inset photograph shows (left) the boundary between mixed deposits; (right) intact deposits in test pit N495 E500. That boundary forms the profile depicted in Byrne and colleagues' (1979:285) Figure 5. Our planview map is adapted from Byrne and colleagues' (1979:285) Figure 4. (Color online)

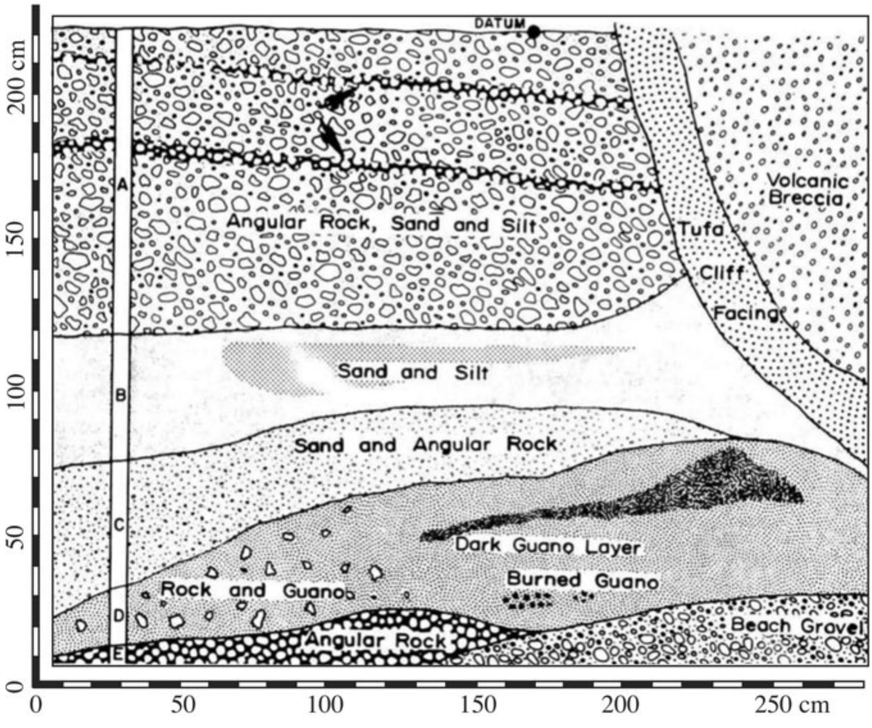

Figure 3. East profile of Trench B as depicted by and adapted from Byrne and colleagues (1979).

did not obtain radiocarbon dates for any materials from the overlying fine sand and rock layer (Unit C). Based on a few radiocarbon-dated artifacts and its lithology, he assigned Unit B an age of roughly 7400–5150 cal BP. Although he did not date anything from Unit A, similarities between the basketry found within both LRS and deposits postdating 5150 cal BP in nearby Lovelock Cave led him to assign Unit A to the same period.

Heizer's (1951) interpretations of site formation and use are historically significant because

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Table 1. Radiocarbon Dates from Leonard Rockshelter.

Object ID[a]	Object Type	Lab Number	^{14}C Date	2σ cal BP Range[b]	Excavation Area	Stratum[c]	Additional Information
FS-33	Fabric	18P/08113	230 ± 30	420–Present	B	1	Commercially produced fabric from mixed deposits; date rejected
1-21549	Winnowing tray	D-AMS 037417	250 ± 25	430–150	n/a	Surface	On surface at base of a cliff ca. 400 ft. above Humboldt Lake
FS-12	Fabric	18P/0918	450 ± 30	535–470	B	Mixed	Commercially produced fabric from mixed deposits; date rejected
FS-33	Fabric	18P/08115	1200 ± 30	1245–1005	B	Mixed	Commercially produced fabric from mixed deposits; date rejected
1-50595	Open-twined basket	D-AMS 037423	1765 ± 40	1730–1550	Unknown	Unknown	Pit 3
2-26704	Coiled basketry	D-AMS 037420	1925 ± 25	1925–1745	D	Unknown	Pit 3A
2-26754	Matting	D-AMS 037413	1950 ± 25	1985–1795	D	Unknown	Pit 2E
2-26695	Cradleboard fragment	D-AMS 037422	2105 ± 25	2145–1995	D	Unknown	Pit 3A
1-50590	Sandal fragment	D-AMS 037415	2825 ± 25	3000–2860	Unknown	Unknown	Pit 1
1-50596	Possible cradleboard fragment	D-AMS 037416	2825 ± 25	3000–2860	Unknown	Unknown	Pit 1
n/a	1 lb. of carbonized basketry	L-554	2740 ± 500	4240–1700	C	B	Base of Stratum B; date rejected by Arnold and Libby (1950)
FS-16	Unburned vegetation	D-AMS 031968	5290 ± 30	6190–5945	B	1	From mixed deposits.
n/a	1 lb. of carbonized basketry	L-554	5690 ± 325	7280–5760	C	B	Base of Stratum B; same material that produced the rejected date of 2740 ± 500
n/a	1 lb. of carbonized basketry	L-554	5780 ± 400	7480–5750	C	B	Base of Stratum B; same material that produced the rejected date of 2740 ± 500
2-26640	Worked wood (possible foreshaft fragment)	D-AMS 037414	7015 ± 35	7935–7750	B	D	Upper guano layer
2-21936	Feather from complete dart reported by Heizer (1938)	D-AMS 037412	7020 ± 25	7935–7790	B	D	Guano layer
n/a	Three greasewood dart foreshafts (combined date)	L-298	7040 ± 350	8600–7180	B	D	Upper guano layer
2-26677	Cordage	D-AMS 037421	7210 ± 35	8165–7940	B	D	Guano layer
2-26678	Cordage	D-AMS 037418	7505 ± 35	8385–8200	B	D	Guano layer
2-26734	Wood (possible manuport)	D-AMS 037419	8350 ± 35	9475–9275	B	D	Guano layer
FS-30	Amaranthaceae wood	D-AMS 031970	8410 ± 45	9530–9300	B	6	Upper limiting date for obsidian biface

(Continued)

Table 1. Continued.

Object ID[a]	Object Type	Lab Number	^{14}C Date	2σ cal BP Range[b]	Excavation Area	Stratum[c]	Additional Information
n/a	Unburned bat guano	L-281	8440 ± 510	11,070–8320	B	D	Unburned guano layer containing wooden artifacts
n/a	Unburned bat guano	L-281b	8820 ± 400	11,140–9000	B	D	Unburned guano layer containing wooden artifacts
FS-8	Charcoal	D-AMS 030013	9835 ± 45	11,390–11,185	B	8	Upper limiting date for lake gravels
FS-4	*Sylvilagus* maxilla	D-AMS 031971	10,000 ± 45	11,700–11,270	B	3/4	Insufficient collagen; date rejected
n/a	Bat guano	None provided	11,200 ± 570	14,940–11,620	B	D/E	

Note: Previously reported dates in shaded rows.
[a] PAHMA (2-x) and UNR (FS-x) ID numbers.
[b] Radiocarbon dates calibrated using OxCal online program (Bronk Ramsey 2009) and IntCal20 curve (Reimer et al. 2020), and rounded following Stuiver and Polach (1977).
[c] UNR strata designated by number, and UCB strata designated by letter. We assigned items in the PAHMA collection to Heizer's (1951; Byrne et al. 1979) stratigraphic units using information contained in the museum's online database.

his work was one of the first times that researchers used radiocarbon dating to answer archaeological questions, but many of the dates on which he based his interpretations were obtained using methods that are now considered unreliable (e.g., combining multiple organic items to obtain a single date, dating bulk guano-rich sediment samples that may be susceptible to contamination from a variety of sources). His work was also important because it demonstrated that LRS contained a stratified cultural record that probably spanned the Holocene. For this reason, LRS was designated a National Historic Landmark in 1961. Though somewhat limited by uncertain provenience data, Byrne and colleagues' (1979) subsequent pollen study was also important because it provided a picture of past environmental conditions in the Humboldt Sink at a time when such information was lacking. Hughes and Bennyhoff (1986; see also Bennyhoff and Hughes 1987) included marine shell beads from LRS in their review of precontact trade networks and, more recently, Adams and colleagues (2008) included Heizer's date on the combined foreshafts in their study of terminal Pleistocene and early Holocene lake levels and site location in the Lahontan Basin. Apart from these studies, most of which took place decades ago, LRS has largely faded into obscurity. Some more senior Great Basin scholars might recall why the site was designated a National Historic Landmark or what Heizer recovered from it, but many junior scholars likely know only the site's name, if that. In the remainder of this article, we outline our return to LRS to reengage readers with the site and address the 70-year-old question of whether it contains evidence of human use dating to Clovis or pre-Clovis times.

UNR's Return to Leonard Rockshelter

Fieldwork: Testing and Stratigraphic Interpretations

To minimize further disturbance to any remaining intact deposits and maximize our chances of replicating Heizer's (1951) results, we sought to relocate the Area B excavation block, expose the eastern wall on which Byrne and colleagues' (1979) stratigraphic profile is based, and excavate a 1 × 1 m test pit into intact deposits. Time is not

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kind to previously excavated sites and if left unprotected, vertical profiles can quickly become slumped messes. Illegal excavations by looters, who sometimes excavate after professionals' work is done, can further confound attempts to relocate a site's datum, excavation sidewalls, or other reference points. Both processes occurred following the end of Heizer's fieldwork, and only a rough outline of the Area B excavation block was discernable.

Prior to excavating in 2018, we established a grid system using a datum set at an arbitrary point (500 m N, 500 m E, and 100 m elevation) near Heizer's Area B excavation block. We used a total station to tie the site datum to a USGS turning point located at 1,201.2 m asl on the gravel road below LRS shown on the 2018 USGS 1:24k *Wildhorse Pass* Quadrangle Map. The ground surface where we placed our site datum sits at 1,285.0 m asl, roughly 84 m above the valley floor. Guided by Byrne and colleagues' (1979) planview map (see Figure 2) and photographs of the Area B excavation block housed at UCB's Bancroft Library—and with a healthy dose of luck—we placed our first 1 × 1 m test pit (N495 E500) so that it almost perfectly crosscut Area B's intact eastern sidewall. In planview, the unit contained clearly distinguishable intact deposits (the balk that the UCB crew left between trenches B and C) and mixed backfill and/or wall collapse (see Figure 2 inset). This distinction between intact and mixed deposits in N495 E500 did not become visible until we had excavated approximately 60 cm below the current ground surface—meaning that the deposits to that depth in N495 E500 were wholly mixed. Subsequent radiocarbon dating of materials from those levels confirmed that fact (see Table 1).

We concurrently excavated a second 1 × 1 m test pit (N498 E497) a few meters northwest of N495 E500 and closer to the shelter's dripline to ensure that we recorded a representative sample of the Area B stratigraphy. The upper deposits proved to be disturbed, and they probably mark where the UCB crew dumped their excavated sediments. The lower deposits were intact and contained a thin band of Mazama tephra, but they were devoid of artifacts and difficult to correlate with the strata in N495 E500. For those reasons, we do not discuss them further here (for additional information about N498 E497 and the small-mammal record from LRS, see Sturtz 2020).

Because we did not encounter artifacts in the lowest strata in N495 E500 (or any artifacts in primary contexts in that test pit, for that matter), and therefore could not replicate Heizer's findings, we returned in 2019 and excavated a third 1 × 1 m test pit (N494 E500) adjacent to N495 E500. Like N495 E500, N494 E500 crosscut Heizer's Area B east sidewall and was therefore a combination of mixed and intact deposits. The east profile of our contiguous N494 E500 and N495 E500 test pits and the south profile of our N495 E500 test pit provide a good representation of the strata that we encountered (Figure 4). Whereas Byrne and colleagues (1979) describe five major stratigraphic units in the vicinity of our test pits, we delineated nine (Table 2). We know that Heizer's Stratum E corresponds to our Strata 8 and 8a. We also know that our Stratum 1, which comprised the upper approximately 60 cm of deposits through which we excavated in N494 E500 and N495 E500, represents mixed fill. Beyond those correspondences, we are less confident in correlating the layers we recorded with those reported by Heizer and colleagues (Byrne et al. 1979; Heizer 1951). Our Strata 2, 3, and 3a *may* represent their Unit B (sand and silt), our Strata 3b and 4 *may* represent their Unit C (sand and angular rock), and our Strata 5–7 *may* represent their Unit D (rock and bat guano). These correlations should be considered tentative at this point, but as we explain below, this uncertainty in tying our fine-grained strata to their coarse-grained strata does not weaken our primary conclusions. Because we excavated just 3 m^2 within a small area, we do not know how representative our stratigraphic interpretations are for the entire site, but based on clear differences between Heizer's interpretations (which he applied to all excavation areas) and our own, LRS's stratigraphy is probably both vertically and laterally more complex than he described.

Our 2018 and 2019 test pits produced a handful of artifacts mostly from the upper levels that we now know were mixed. Precontact artifacts include nine *Olivella biplicata* beads (eight

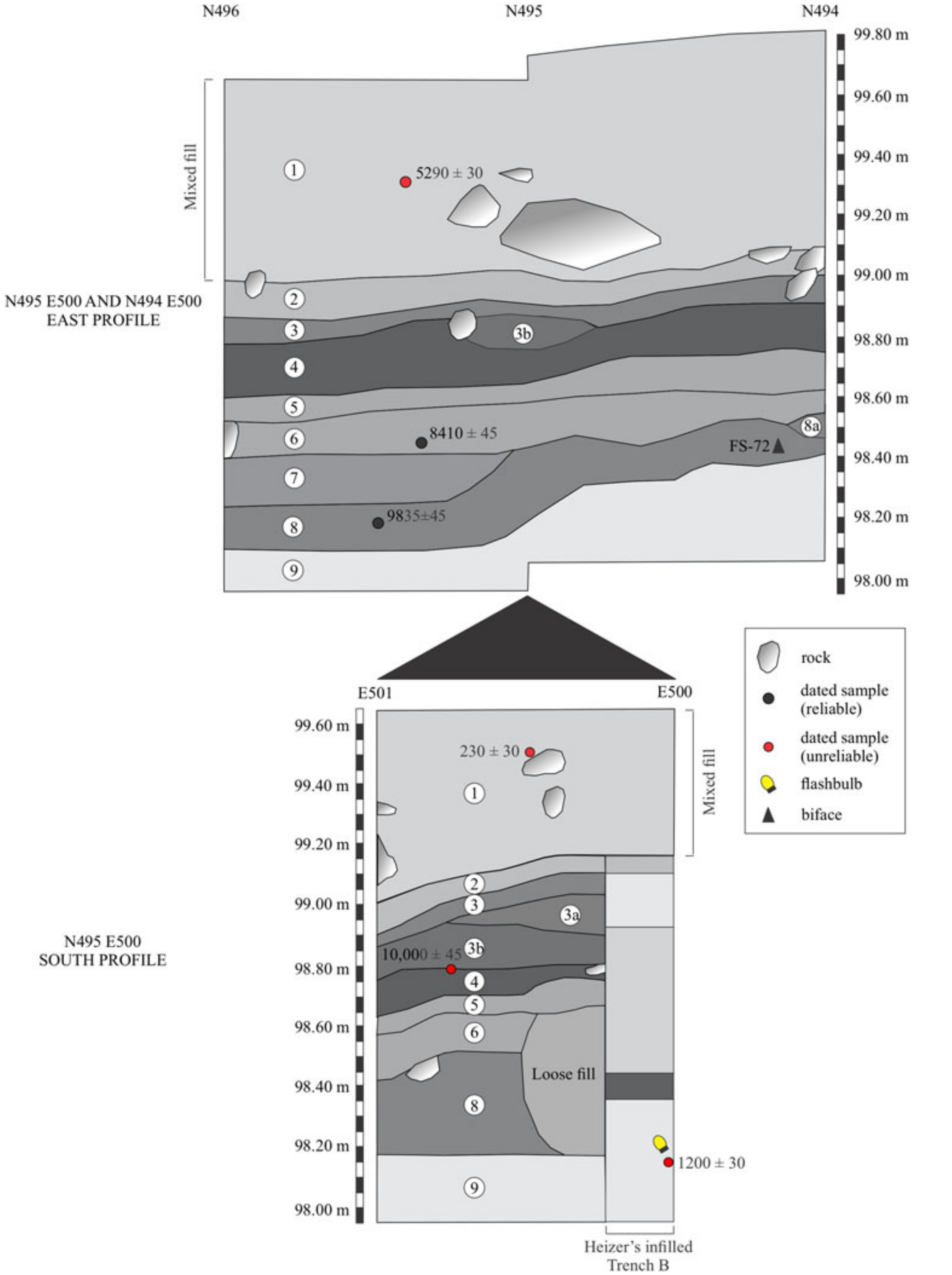

Figure 4. Stratigraphic profiles for N494 E500 and N495 E500 in Heizer's Area B excavation block. (Color online)

A1a small simple spire-lopped and one A1b medium simple spire-lopped [Bennyhoff and Hughes 1987]), a small piece of cordage, and six tiny flakes. Postcontact artifacts include three shell casings, a piece of metal wire, and one piece of degraded fabric. Near the bottom of the infilled Area B excavation block, we found two additional pieces of degraded fabric

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Table 2. Possible Relationships between UCB and UNR Stratigraphic Designations in Heizer's Area B Excavation Block.

UCB Strata[a]		Possible Relationships	UNR Strata	
A	Sand and silt with angular tufa rockfall, guano, packrat nest material; 90–100 cm thick	does not correlate to	1	Poorly sorted gravelly silt with angular to subrounded clasts (<15 cm); 10YR 5/3 (brown); 45–60 cm thick
B	Stratified whitish gray sand and silt (possibly aeolian); 25–40 cm thick	may correlate to	2	Well-sorted sandy silt (<2 mm) with pockets of organic material; 10YR 5/4 (darkish yellowish brown); 5–12 cm thick
			3	Fine sandy silt with several pieces of organic material and angular clasts (<10 cm); 10YR 3/4 (dark yellowish brown); 5–7 cm thick
			3a	Localized lens of well-sorted gravel with sandy silt and angular clasts (<5 cm); 10YR 2/2 (dark yellowish brown); 1–12 cm thick
C	Fine sand and angular gravel (gravel comprises 20%–30% of matrix); 1–50 cm thick	may correlate to	3b	Angular gravels (<2 cm); 10YR 3/2 (grayish brown); 10–15 cm thick
			4	Well-sorted gravels with sandy silt and several angular clasts (<5 cm); 10YR 2/2 (dark yellowish brown); 5–13 cm thick
D	Rock and guano layer, dark guano, and burned guano; 10–50 cm thick	may correlate to	5	Well-sorted fine sandy silt with a few angular clasts (<5 cm); 10YR 4/3 (brown); 5–10 cm thick
			6	Fine sandy silt with some coarse sand; 10YR 4/4 (dark yellowish brown); 15 cm thick
			7	Well-sorted fine sandy silt with several small clasts; 10YR 3/6 (dark yellowish brown); 5–15 cm thick
E	Angular rock (tufa spalls); 1–20+ cm thick	probably correlates to	8	Fine sandy silty subangular to well-rounded gravels (<3 cm); 10YR 3/4 (dark yellowish brown); 20–30 cm thick
			8a	Localized lens of clast-supported well-rounded gravels (<3 cm); 10YR 3/4 (dark yellowish brown)
Beach Gravel	Beach gravel	correlates to	9	Fine sandy well-rounded gravels (<15 cm); 10YR 6/3 (pale brown); 20+ cm thick

[a]As reported by Heizer (1951; Byrne et al. 1979).

and a camera flashbulb. The fabric, which we only identified as being non-Indigenous and commercially produced (probably burlap left behind by the UCB crew) through microscopic analysis[6], and flashbulb are significant because they helped to confirm that portions of the deposits in N494 E500 and N495 E500 were mixed.

We encountered a few tiny flakes in undisturbed deposits along the Strata 2/3 contact ($n = 2$) and Strata 3b/4 contact ($n = 1$) in N494 E500, and within Stratum 7 in N495 E500 ($n = 1$). We also recorded a heavily reworked biface made of obsidian from the Bordwell Spring/Pinto Peak/Fox Mountain source group, located approximately 180 km northwest of LRS, at an elevation of 98.44 m in Stratum 8 in N494 E500 (Figure 5).[7] A piece of charcoal recovered in situ from N495 E500 at an elevation of 98.18 m—135 cm north of the biface and 26 cm below it, but at approximately the same depth within Stratum 8 because the deposits slope downward from south to north—returned a date of 9835 ± 45 ^{14}C BP (11,390–11,185 cal BP). That charcoal date provides an approximate age for the biface. A piece of vegetation found at an elevation of 98.45 m in the overlying Stratum 6 in N495 E500 returned a date of 8410 ± 45 ^{14}C BP (9530–9300 cal BP) and provides an upper limiting age for the biface. The biface and dated samples are significant because they establish

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Figure 5. Bifacial tools from Area B in Leonard Rockshelter. Upper left: 1-50603, a reworked obsidian biface recovered by Heizer in Unit D (guano layer). Lower left: FS-72, a reworked obsidian biface recovered by UNR in Stratum 8, test pit N494 E500. Right: 2-26555, a chert biface recovered by Heizer in Unit D (guano layer). (Color online)

that people visited LRS during the earliest Holocene. As we describe below, the dated charcoal is also important because it provides an upper limiting age for the underlying beach gravels (Stratum 9).

Directly Dating Artifacts to Establish When People Visited the Site

Heizer collected 500+ artifacts during his work at LRS, and these are currently housed in the Phoebe A. Hearst Museum of Anthropology (PAHMA) at UCB. These include basketry and cordage, wooden foreshafts, a few obsidian and chert tools, *Olivella* beads, and worked wood. Less than 20% of the collection might be considered everyday detritus—things such as flakes and animal bones—and we rarely encountered such artifacts during our excavations or noted them in Heizer's backdirt. As an independent means of assessing the possibility that people visited LRS during the late Pleistocene, we sampled 12 organic artifacts in the PAHMA collection for AMS radiocarbon dating. These include basket, cradleboard, mat, sandal, and cordage fragments, as well as the complete atlatl dart and a winnowing tray (see Table 1). We primarily selected items that had some contextual data—for example, an excavation area and/or stratum. We favored items from Unit D (the guano layer) in Area B, where Heizer found the most compelling evidence of early human use and obtained a Pleistocene date on the bat guano. Finally, we sampled a few of the rarer items, including the atlatl dart from the guano layer and a winnowing tray from the surface. Whenever possible, we used detached bits of these artifacts from the containers in which they are stored.

Table 1 lists the radiocarbon dates we obtained on these artifacts. They range in age from 9475–9275 to 430–150 cal BP. Although they constitute a small sample, these radiocarbon dates tell us two things about when people visited the site. First, they do not support the hypothesis that people visited the site during the late Pleistocene. Rather, people probably first visited the site during the earliest Holocene—a scenario supported by the reworked obsidian biface associated with the charcoal dated to 11,390–11,185 cal BP in Stratum 8. Second, the dated artifacts span nine millennia, indicating that people periodically returned to LRS throughout the Holocene, including just before Euro-Americans arrived in western Nevada. It is important to note that although the ages of these dated artifacts reflect times when people visited the site, the gaps between those age ranges do not necessarily reflect periods of disuse, because they may simply be a function of the small number of dated items (Rhode et al. 2014).

Discussion

Heizer's (1951) claim of a late Pleistocene occupation coeval with or earlier than the Clovis Era drew us to LRS. Our goal was to evaluate this claim and better understand the history of human use of the shelter. In many ways, revisiting old sites is more challenging than excavating new ones because there is the added difficulty of deciphering what previous researchers did and where they did it. Our major travails were determining whether the upper levels of our test pits comprised intact or mixed deposits (they were mixed) and finding clear evidence of human

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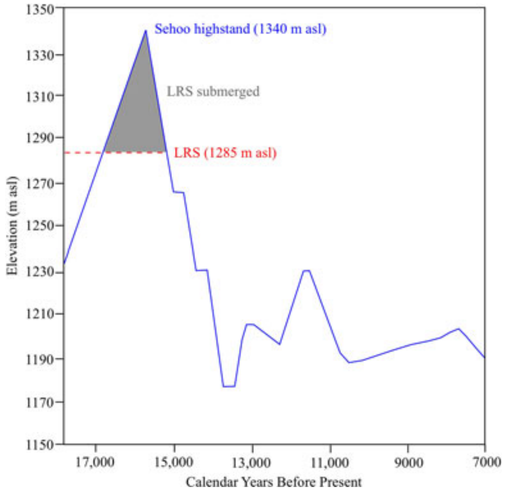

Figure 6. The relationship between the lake-level curve for the Carson-Humboldt sinks of Lake Lahontan (blue line) and the elevation of Leonard Rockshelter (red line). Leonard Rockshelter was inundated by the lake around 17,000–15,000 cal BP during its Sehoo highstand (gray area). As the lake transgressed, the shelter became available for human occupation around 15,000 cal BP. Lake-level curve adapted from Adams and colleagues (2008; Adams and Rhodes 2019). (Color online)

activity in the lower levels (we did). Despite these challenges, we learned three important things about site formation processes and human history at LRS.

First, coupled with a refined understanding of Lake Lahontan's late Pleistocene history (Adams and Wesnousky 1998; Adams et al. 2008), our work provides clarity about both when LRS was first available for occupation and when people likely first occupied it. Regarding when LRS was first available for occupation, the elevation of the ground surface in Area B is 1,285.0 m. The upper boundary of the beach gravel layer, which lies approximately 1.5 m below the ground surface, is 1,283.5 m asl. The last time Lake Lahontan reached that elevation was just before 15,000 cal BP, during its post–Sehoo highstand recession (Figure 6). Consequently, LRS was first available for occupation around 15,000 cal BP.

With respect to when people first occupied the site, drawing on Heizer's (1938, 1951) work and citing his date of 11,120 ± 570 ^{14}C BP (14,940–11,620 cal BP) on guano-rich sediment from near the bottom of stratigraphic Unit D, Byrne and colleagues (1979:284) concluded that "the guano . . . can be taken as marking the beginning of the period during which the shelter was open for human occupation. It was apparently soon occupied because obsidian flakes were recovered from the base of the guano layer in Areas B and C." Heizer's date of 11,120 ± 570 ^{14}C BP (14,940–11,620 cal BP) on guano-rich sediment from the bottom of stratigraphic Unit D is problematic due to its very large error and the fact that is was derived from a bulk sediment sample that could be contaminated by a variety of older (e.g., carbonates) and younger (e.g., humates) sources. It is also discordant with our AMS date of 9835 ± 45 ^{14}C BP (11,390–11,185 cal BP), obtained on a charcoal fragment from Stratum 8 (probably Heizer's stratigraphic Unit E); our AMS date of 7020 ± 25 ^{14}C BP (7935–7790 cal BP), obtained on the complete atlatl dart recovered from stratigraphic Unit D; and Heizer's date of 7040 ± 350 ^{14}C BP (8600–7180 cal BP), obtained on the greasewood foreshafts recovered from the upper part of stratigraphic Unit D.

Together, these facts strongly suggest that the shelter's basal terrestrial deposits—Heizer's stratigraphic Units D and E and our Stratum 8—date not to the latest Pleistocene but rather the initial early Holocene, probably around 11,500 cal BP. If we are correct in this assertion, then LRS experienced a roughly 3,500-year period during which minimal terrestrial sediment accumulated inside the shelter. This is not surprising because the site appears to lack a significant uphill source from which sediment at the site could be derived, and soil development on similar-age beach features in the Lahontan Basin is usually limited to the addition of eolian dust to the coarse gravel (Adams and Wesnousky 1999). Consequently, although we replicated Heizer's discovery of artifacts near the bottom of the terrestrial deposits overlying the lake gravels, we believe that people left them behind during the early Holocene and not the late Pleistocene.

It is important to note that because neither Heizer's nor our own team penetrated the recessional lake gravels, we cannot rule out the possibility that people visited LRS prior to Lake Lahontan's Sehoo highstand. The question of whether humans were present in North America at that time remains debated among Western scientists, although a handful of sites suggests that it may have been the case (Davis et al. 2019; Waters 2019; Williams and Madsen 2020). If people were present in the Lahontan Basin prior to the lake's Sehoo highstand, then LRS would have been available for occupation before approximately 17,000 cal BP but not between roughly 17,000 and 15,000 cal BP, when the shelter was submerged (Reheis et al. 2014). Any traces of pre–Sehoo highstand visits are unlikely to have survived because the shelter was underwater for two millennia or so (see Figure 6) before it filled with gravels transported and deposited in a high-energy wave environment as the lake waters receded below the elevation of the shelter.

Second, although people did not stay in LRS for extended periods, they did leave behind items at various times during the Holocene. The association of the reworked obsidian biface and dated charcoal indicate that these visits began 11,390–11,185 cal BP. Four other radiocarbon-dated sites in the Lahontan Basin—Spirit Cave, the Wallman Bison, Shinners Site A, and Pyramid Lake—confirm a human presence in the area at that time (Adams et al. 2008; Smith and Barker 2017). Other open-air lithic scatters containing Western Stemmed Tradition (WST) and/or concave base points in the Lahontan Basin may also date to around that time, although it is difficult to know because they have not been radiocarbon dated.

People certainly visited the site again during the initial middle Holocene between approximately 8300 and about 7800 cal BP, during which time they left behind bits of cordage, a complete atlatl dart, and three dart foreshafts. The dart, which is tipped with a sharpened greasewood foreshaft that was not designed to accommodate a stone point (Heizer 1938), and the dated greasewood dart foreshafts were both found in Area B. The narrow age range of the dart falls within the broader age range of the foreshafts. These items may represent a hunter's gear stored for later retrieval and, to our knowledge, they represent the oldest directly dated dart / dart components in the Great Basin. Unfortunately, the dart cannot speak directly to questions about the weapon delivery system(s) used by WST hunters because it postdates the end of the WST in the western Great Basin by 1,100–1,200 years (Rosencrance 2019). The dart also cannot speak to questions about the possible co-emergence of atlatls and notched projectile points because it is not tipped with a stone point. A second period of use during the middle Holocene is indicated by burned basketry that Heizer dated to 7400–5750 cal BP. Although there was likely a brief wet period around 7680 cal BP immediately prior to that interval (Davis 1982), much of the middle Holocene was relatively arid. Locally, the Humboldt River ceased flowing at times (Miller et al. 2004), and the Humboldt Sink was generally dry (Byrne et al. 1979).

Four or five late Holocene periods of use are reflected by dates on a sandal fragment, cradleboard fragments, matting, and basketry. People visited at approximately 2900 cal BP, about the same time that people started to occupy the nearby Humboldt Lakebed Site (26Ch15)—a large residential site containing dozens of house features (Livingston 1986)—as well as Lovelock Cave (Heizer and Napton 1970). There is a gap in use of LRS between approximately 2850 and 2000 cal BP that corresponds closely to the Late Holocene Dry Period (LHDP; Mensing et al. 2013), but more direct dating of organic artifacts is needed to demonstrate whether the gap is real and perhaps related to a climatic event or simply a function of our small sample of dated items. Interestingly, there were at least two relatively wet periods within the LHDP, because large lakes appeared in the Humboldt Sink (Adams and Rhodes 2019). Other visits occurred between approximately 2000 and approximately 1500 cal BP, and then they appear to have stopped until 430 cal BP or later, during which time someone left behind a worn winnowing tray. Again, although it may simply be a function of the small sample of dated items, it is worth noting that the gap between 1550 and 430 cal BP corresponds to a time when—based on house form, projectile point frequencies, and radiocarbon dates—the Humboldt Lakebed Site saw heavy use (Livingston 1986). This peak in occupation of the Humboldt Lakebed Site is part of a broader pattern of intensive Late Archaic use of the Humboldt Sink (Sturtz 2020) that did not include either Leonard Rockshelter or Lovelock Cave to the same degree.[8] Within this period of occupation,

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however, the Humboldt Lakebed Site (~1,188 m asl) was inundated by at least three brief lake-level rises, including the Medieval pluvial lake that reached an elevation of approximately 1,202 m asl around 830 cal BP (Adams and Rhodes 2019). In contrast, the Medieval pluvial lake was both preceded and followed by severe, multidecadal droughts (Cook et al. 2010) that likely left the Humboldt Sink dry.

Third, although we excavated only a tiny portion of the site's remaining intact deposits, we found no evidence that people spent significant amounts of time in LRS. Food residues and food processing implements, lithic detritus, and other signs of daily life were generally absent in excavated intact deposits. They were similarly scarce in Heizer's backdirt (either on its surface or in portions that we excavated) and the PAHMA collection. This absence of everyday debris suggests that people mostly used LRS as a place to store gear rather than live. This is not surprising given the site's location. It is north facing and perched on the side of a steep slope, approximately 84 m above the valley floor. There are no freshwater springs nearby. During wet periods when the Humboldt Sink held lakes and/or marshes, people probably gravitated to them rather than the dry rocky slope on which LRS sits. This was certainly the case during the late Holocene, when people established residential sites along the lake's margins (Livingston 1986). Although more dating is certainly needed, there is currently no evidence that the intensity of people's use of LRS rose and fell directly in concert with the intensity of use at those settlements.

Conclusions

Stratified and well-preserved records of human behavior found in dry caves and rockshelters anchor our understanding of chronology, subsistence, and perishable technology in the Great Basin. Professional researchers and pothunters alike have recognized this fact for more than a century, and as a result, most if not all significant cave or shelters have been excavated. Many previously excavated sites retain potential to provide additional information. Unresolved questions about the antiquity of human use led us back to LRS 70 years after Robert Heizer stopped working there. Heizer's limited reporting suggested that LRS might contain a pre-Clovis or Clovis Era occupation, either of which would be significant because evidence for human use during those periods is rare in western Nevada. Our work failed to replicate his findings and suggests that people first visited LRS during the early Holocene. Throughout the Holocene, people periodically visited LRS, but they do not appear to have spent much time there. Instead, they stored a range of personal gear in a manner that is somewhat consistent with other caves and shelters in the Carson and Humboldt Sinks. People's use of the shelter waxed and waned, but not necessarily in tandem with broader land-use patterns in the region.

Acknowledgments. Leonard Rockshelter is located on the traditional lands of the Lovelock Paiute Tribe. It is currently owned by the Archaeological Conservancy. Cory Wilkins (Archaeological Conservancy) facilitated our fieldwork, which was conducted by UNR graduate students Nicole George, Denay Grund, Derek Reaux, Richie Rosencrance, and Sara Sturtz, and supported by Millie and Gavin Smith. Anna Camp, Pat Barker, and Eugene Hattori (Nevada State Museum), Catherine Fowler (UNR Anthropology Department), and Tom Connolly (University of Oregon Museum of Natural and Cultural History) guided the macroscopic analysis of the textiles recovered during our fieldwork, which ultimately led us to collaborate with Elizabeth Kallenbach. Pat Barker and members of the Northwestern Great Basin Textile Dating Project provided several unpublished dates on artifacts from Lovelock Cave (please contact Pat at barker-j@unr.edu for more information). Natasha Johnson (University of California, Berkeley) facilitated our study of the LRS collection housed in the PAHMA. The UCB granted us access to Heizer's photographs and fieldnotes. Comments from David Hurst Thomas and three anonymous reviewers helped us add clarity to the final version of the manuscript. Finally, Hector Urtubia provided the Spanish abstract, for which we are grateful. Unless otherwise noted, all figures are by the authors.

Data Availability Statement. The artifact assemblage, photographs, and fieldnotes related to Robert Heizer's work at LRS are housed at the University of California, Berkeley. The artifact assemblage, photographs, and fieldnotes related to UNR's work at LRS are housed at the University of Nevada, Reno's Department of Anthropology and Anthropology Museum.

Competing Interests. The authors declare none.

Notes

1. We calibrated all radiocarbon dates using the OxCal 4.4 online program (Bronk Ramsey 2009) and IntCal20 curve (Reimer et al. 2020). We followed the procedures

outlined by Stuiver and Polach (1977) for rounding radiocarbon dates and calibrated age ranges.

2. As part of a larger project on the time-space distribution of obsidian use in the Humboldt Sink, Richard Hughes conducted nondestructive energy dispersive X-ray fluorescence (EDXRF) analysis on the four obsidian artifacts—a concave base projectile point (probably a Humboldt dart point), a biface fragment (a possible projectile point fragment), and two flakes—reported by Heizer in 1951 and curated at the PAHMA (see Hughes 2015 for laboratory instrumentation details). The accession cards on file with these artifacts provide some contextual information. Artifact 2-26641 (dart point) came from looters' backdirt near Area D. It is made of obsidian from the Majuba Mountain source (Hughes 1985), located approximately 60 km to the northwest of LRS. Artifact 2-26683 (flake) was recovered from the upper levels of the guano layer (Unit D) in Area D. Artifact 2-26684 (flake) was recovered from deep within Heizer's Area C excavations. Both flakes are made of Majuba Mountain obsidian. It was not immediately clear to us from where artifact 1-50603 (biface fragment) was recovered (its accession card does not specify an excavation area), but we have determined that it is likely the "fragment of a chipped obsidian blade" that Heizer (1951:93) collected during an early visit to LRS (the accession card indicates it was collected in May of 1938). Heizer (1951:92) notes that he collected it from where Thomas Derby had been digging, which was ultimately subsumed by his Area B excavations. If we are correct, then the biface originated in the guano layer (Unit D), as reported by Heizer (1951:92–93). In any case, it is made of obsidian from the Bodie Hills source (Jack 1976), located approximately 200 km south of LRS. It likely represents the earliest occurrence of that obsidian type from an excavated context in this part of the western Great Basin. Further details about these and other obsidian artifacts from the Humboldt Sink will be included in Hughes's forthcoming report.

3. Bennyhoff and Heizer (1958) included the 50 *Olivella* beads on the string and two *Olivella* beads from the guano layer in Area B in a subsequent report. Bennyhoff and Hughes (1987) later classified them all as type A1c (large, simple spire-lopped) beads.

4. Byrne and colleagues (1979) reported the shelter's elevation as 4,175 ft. asl (1,272.5 m asl). In 2018, we used a total station to tie our site datum to a point with a known elevation: a USGS turning point located at 1,201.2 m asl on the gravel road below LRS, shown on the 2018 USGS 1:24k *Wildhorse Pass* Quadrangle Map. At that time, we recorded the site datum's elevation as 1,226.4 m asl. In early 2022, we realized that we had probably made a mistake, and we returned to LRS to check our measurements. We used a total station to measure again from the USGS turning point up to the site datum. We also double-checked the elevation of both the turning point and the site datum using a Trimble Juno GPS unit with 11 cm vertical accuracy. Both methods confirmed that we made an error in 2018. The correct elevation of LRS is 1,285.0 m asl. Unfortunately, the incorrect site elevation of 1,226.4 m asl made it into Sturtz's (2020) master's thesis. That mistake impacts her interpretation of the site's early history (it was not flooded by Lake Lahontan's Younger Dryas transgression to 1,230–1,235 m asl), but it does not affect the validity of her work with the site's small-mammal remains and what they tell us about conditions in the Humboldt Sink during the middle and late Holocene.

5. Byrne and colleagues (1979) and Heizer (1951) reported their work prior to the recognition that radiocarbon dates required calibration to convert them to calendar years. When discussing different points in the past (e.g., 12,000 years ago or 12,000 BP), they are referring to radiocarbon years before present. We converted those references to approximate calendar year equivalents using Grayson's (2011) Appendix 1.

6. We recovered five fragments of coarse plain-woven fabric constructed of *z*-spun, single-ply strands during our excavations. Textile analysts Anna Camp, Pat Barker, and Gene Hattori concluded that they are inconsistent with Great Basin Indigenous fiber technology based on macroscopic attributes (Camp 2018; Connolly and Barker 2004; Connolly et al. 2016; Fowler and Hattori 2011; Fowler et al. 2000). Two of the fragments (FS-27 and FS-12) returned precontact radiocarbon dates (1245–1005 cal BP and 535–470 cal BP), and one fragment (FS-33) returned a date (420 cal BP–present) encompassing the historic period (see Table 1). These dates raised questions about the analysts' preliminary assessment.

To resolve the question of the fabric's origin and cultural affiliation, Elizabeth Kallenbach examined the fabrics microscopically. She extracted fibers from each fragment, mounted them on slides with Entellan new mounting medium, and examined them under a Leica DM EP polarizing microscope. Bast fibers (vascular bundles within the plant stem) such as jute, flax, and dogbane are identified by their birefringence in the cell wall, cross markings, and presence or absence of calcium oxalate crystals. Distinguishing between bast fibers can be difficult; however, a naturally occurring twist (*z* or *s*), or fibrillar orientation, can be observed in the dominant cell wall (Bergfjord and Holst 2010; Haugan and Holst 2014; Suomela et al. 2018).

The largest, most intact fragment (FS-33) is made from a bast fiber, with *z*-twist fibrillars. In contrast, bast fibers commonly used to make Indigenous fine cordage and netting in the Great Basin all have *s*-twist fibrillars, including *Apocynum* (dogbane), *Urtica dioica* (stinging nettle), *Asclepias* (milkweed), and *Linum lewisii* (Rocky Mountain flax). *Apocynum* exhibits distinctive surface ridges or folds (Jakes et al. 1994). FS-33 lacks these consistent surface folds. *Corchorus capsularis* and *C. olitorius* (jute), a commonly used commercial bast fiber for the construction of burlap, has *z*-twist fibrillars. For more conclusive results, a color test for high contents of lignin present in jute could be performed using a solution of phloroglucinol-hydrochloric acid (Schaffer 1981; Speer 1987).

The other four fragments (FS-11, FS-12, FS-27, and an unnumbered specimen) are poorly preserved, making identification difficult. Cross sections of fibers and the presence of crystals could not be observed due to the high level of degradation; however, the four fragments clearly lack birefringence and cross markings indicative of bast fiber, and they do not exhibit characteristics of cotton or hair. Linear striations observable under transmitted white light suggest leaf or bark. Plain weave fabrics made from Indigenous yucca fiber (along with cotton and *Apocynum*) have been documented in the American Southwest (Baldwin 1939; Teague 1992); in the Great Basin, *Juniperus occidentalis* (juniper), *Artemisia* (sagebrush), and *Purshia tridentata* (bitterbush or cliffrose) bark were used in cordage and basketry (Cummings 2004). Given their recovery from mixed deposits from Heizer's excavations and the anomalous coarse plain-weave technology, the fragments we recovered are likely made of a commercial leaf fiber such as *Agave sisalana* (sisal), which is used in mats, bags, and cordage. The wide range of radiocarbon dates obtained on the textiles —some of which predate the Historic period—may reflect chemical treatment of commercial fabrics such as burlap, which can produce erroneous dates.

7. The obsidian biface (FS-72) that UNR recovered is probably a heavily reworked dart point. Its distal end is extensively resharpened into a beveled tip that may have served as a graver or perforator. Its proximal end is broken, and two small flake removals originating from the break end in step terminations. Neither of its lateral margins are edge ground. The stratigraphic position of the point and its association with charcoal dated to 11,390–11,185 cal BP suggest that it is affiliated with the WST, but it is too heavily reworked to confidently assign it as such. In contrast, the chert biface (UCB 2-26555) that Heizer recovered from Unit D in Area B possesses characteristics that permit a more confident typological assignment. Its proximal half exhibits large lobate collateral flake removals with well-shaped margins. Its distal half, beginning at its widest point, is similarly thinned, but the edges are evenly sinuous, reflecting prepared platforms for further shaping and thinning. These technological hallmarks are consistent with WST reduction techniques (Beck and Jones 2015; Davis et al. 2012; Smith et al. 2020), and we interpret it to be an unfinished late-stage WST biface. We hesitate to assign it to a particular stemmed point type (e.g., Haskett or Parman) because it is probably unfinished; however, its large size, paired with lobate flaking and broad shoulders, is consistent with the shift from shoulderless Haskett points to shouldered Parman and Cougar Mountain points that took place across the Pleistocene–Holocene transition (Rosencrance 2019). The obsidian biface (UCB-1-50603) that Heizer recovered is probably a projectile point midsection—perhaps a WST point. It possesses weakly sloping shoulders like those present on Parman and Cougar Mountain points. The blade's margins are reworked, and the biface's proximal and distal ends exhibit rolling hinge fractures suggesting that the point was broken during impact.

8. Livingston (1986) reported 1,456 typed projectile points from the Humboldt Lakebed Site. Of those, 695 (48%) are Rosegate points. Sturtz (2020) reported an additional 142 typed points found within 20 km of LRS. Of those, 59 (42%) are Rosegate points. In the western Great Basin, Rosegate points date to 1300–700 cal BP (Thomas 1981). Of the eight radiocarbon dates from the Humboldt Lakebed Site that are clearly cultural, six fall within the age range of Rosegate points. Of the 44 radiocarbon dates from Lovelock Cave that are clearly cultural, 10 fall within the age range of Rosegate points (Heizer and Napton 1970; Pat Barker, personal communication 2021). None of the directly dated artifacts from LRS fall within the age range of Rosegate points, and neither Heizer nor we recovered any Rosegate points at LRS. In sum, although Late Archaic groups were active in the Humboldt Sink, they seem to have used LRS and, perhaps, Lovelock Cave to a lesser extent or in ways that left few traces (for evidence of a similar Late Archaic gap in the Hidden Cave record, see Kelly 2001; Rhode 2003; and Thomas 1985). Based on both bioarchaeological and archaeological data, wetlands appear to have been a primary focus in the Carson Desert and Humboldt Sink between approximately 1300 and 700 cal BP, although not in a strictly sedentary sense (Kelly 2001; Larsen and Kelly 1995; Zeanah 2004).

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