Chapter 28

Geochronology, Archaeological Context, and DNA at the Paisley Caves

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ABSTRACT

The Paisley Caves are the most widely accepted (by professional archaeologists) pre-Clovis site in North America. This is primarily because the directly radiocarbon-dated artifacts found with extinct megafaunal remains (horse, camel, llama, mammoth/mastodon, reindeer, and American lion) are human coprolites from which ancient DNA (Pleistocene haplogroups A2 and B2) has been extracted and verified in blind tests by researchers at independent genetics laboratories. This paper brings together the most current data to address the questions: What are the stratigraphic context and reliability of late-Pleistocene cultural and paleontological remains at the site? What are the cultural and paleontological constituents in the Pleistocene strata? Were they contemporaneous and culturally associated? Is the human DNA evidence reliable?

Geoarchaeological analyses of site sediments indicate the often highly organic deposits are remarkably stable. The site sediments have not been churned up despite the occasional presence of identifiable rodent holes. The only identifiable Pleistocene/early-Holocene lithic technology is the Western Stemmed Tradition extending back to at least the Clovis-era. Chronological control is provided by 203 radiocarbon dates ranging in age from ca. 16,000 cal yr BP to Historic contact. The pre-Clovis DNA evidence is sound. Site occupants were broad-range foragers eating plants, animals, and insects throughout the occupations.

Keywords: Geochronology, Geoarchaeology, DNA, Coprolite, Western Stemmed, Pre-Clovis

Introduction

There remains little debate about the pre-Clovis status of the Monte Verde site in Chile. The site has been accepted outright by roughly 70% of professional archaeologists, with another 20% abstaining from either totally accepting or rejecting its pre-Clovis validity, and only 10% rejecting it outright (Wheat 2012). With a professional acceptance rate of 43%, the Paisley Caves site in Oregon is currently the most widely accepted pre-Clovis site in North America (Wheat 2012). While a substantial number of other pre-Clovis candidates have been

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proposed over the years, very few have been adequately radiocarbon dated (Roosevelt et al. 2002). This problem was resolved at Monte Verde by directly dating in situ perishable artifacts and non-local subsistence remains (Dillehay 1989; Dillehay et al. 2008). At the Paisley Caves it was solved by dating human coprolites (Gilbert et al. 2008a, b; Jenkins et al. 2012a, b).

Roosevelt et al. (2002:164) list seven universal criteria of reliability for validating early Paleoindian dates and sites:

1) a consistent series of accurate dates;
2) statistically precise dates with standard-error bars no greater than about 300 years;
3) dates run on single items;
4) items must be taxonomically identified, carefully cleaned cultural carbon of adequate quantity;
5) items must be derived from recorded stratigraphy;
6) items must be in primary association with artifacts;
7) evidence must be documented in peer-reviewed published accounts.

C. V. Haynes (1964, 1992) concluded that proof of pre-Clovis occupations would require the direct dating of cultural, and preferably human, remains in sound stratigraphic context. He meant, of course, human bones and undeniable artifacts. The aversion of many Native American groups to conducting destructive analysis on human remains means that even if pre-Clovis human skeletal remains have been found, or are found in the future, they might never be dated. Given these constraints, recovering human remains that can be investigated from well-dated contexts constitutes the best form of evidence for proving the pre-Clovis age of an archaeological site in North America. This is the case at the Paisley Caves, where human feces has been directly dated to as much as 14,525 cal yr BP (Table 28.1).

Ecological Setting

The Paisley Caves are located in a west-facing Miocene basalt and rhyolite ridge in the Summer Lake basin of Oregon (Figure 28.1). The Summer Lake basin is the northernmost sub-basin of the Chewaucan hydrologic system. It is separated from the Lower Chewaucan basin by a broad gravel fan formed at the mouth of the Chewaucan River. At the end of the Last Glacial Maximum (ca. 18,000–17,000 cal yr BP), as Lake Chewaucan receded, the river entrenched south of the fan and flowed into Upper Chewaucan Marsh (Friedel 1993, 2001). North of the fan, Pleistocene Winter Lake receded rapidly (Allison 1982). The exposure of the lakebed resulted in a broad, gently sloped plain covered with silty sand overlying sandy basal gravels. Prevalent southwest winds began transporting silt and sand into the caves, gradually forming moderately organic sandy sediments over gravels and wave-rounded boulders by roughly 14,700 cal yr BP. These sediments were trapped behind rock and gravel berms formed at the mouth of each cave by colluvium and cliff weathering debris (Jenkins et al. 2012a, b). About 14,500 cal yr BP an increase in local precipitation and reduction in evaporation caused a rise in lake levels, water overtopped the gravel fan, and a river began

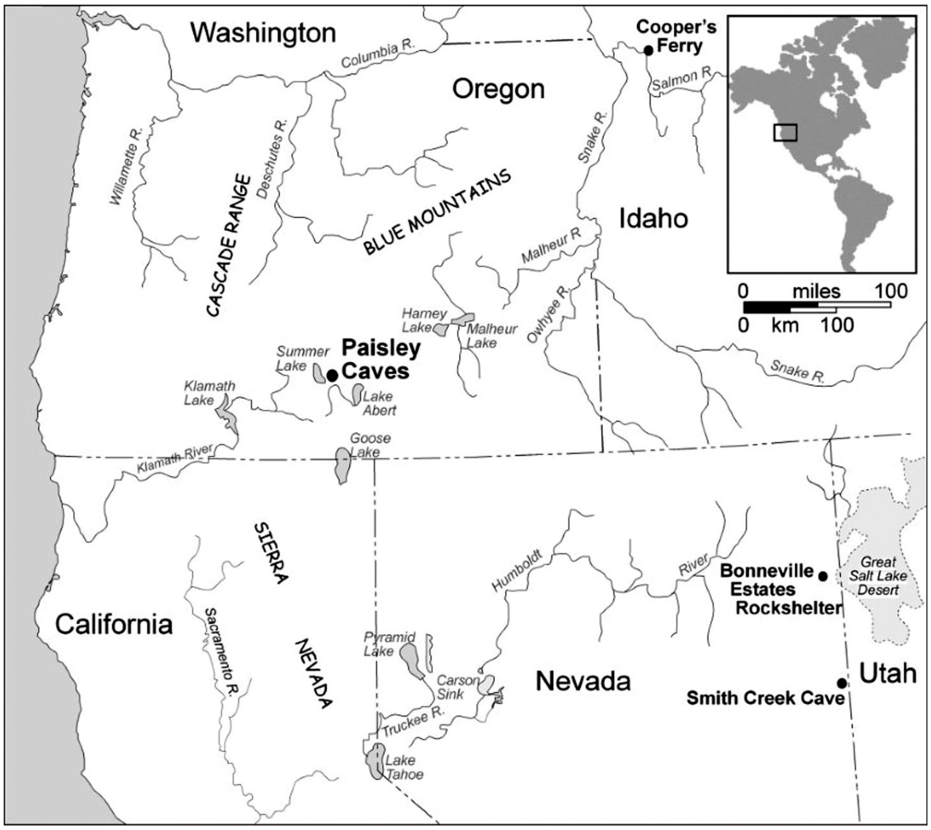

Figure 28.1 Map showing location of the Paisley Caves, Cooper's Ferry, Bonneville Estates Rockshelter, and Smith Creek Cave sites (after Jenkins et al. 2012b).

Table 28.1 Radiocarbon dates from Paisley Caves.

Cave	Excav. unit	Elevation	Lithic unit	Specimen no.	^{14}C Lab. sample no.	Conventional ^{14}C date	Calib. date BP at 1σ (Cal Pal)	Code^{K}	Material
1	NP	NP	NP	100BP-1-5345	AA-19151	145 ± 50	300 (270-0) 0	A	*Scirpus* basketry
1	1/4C	1366.98	4	1294-PC-1/4C-19-1	Beta-195907	1060 ± 40	950 (990) 1040	A	Cotton cloth
1	NP	NP	NP	60-1-9035	Beta-249762	1590 ± 40	1410 (1520) 1530	A	Multiple-warp tule sandal
1	NP	NP	NP	60-1-9017	Beta-249767	1610 ± 40	1400 (1520) 1570	A	Multiple-warp tule sandal
1	1/7A	1366.17	4	2011PC-248	UCIAMS-98926	4290 ± 15	4848 (4852) 4857	A	*Artemesia* charcoal
1	NP	NP	NP	100BP-1-5344	AA-19153	6560 ± 70	7424 (7481) 7538	A	*Scirpus* basketry
1	1/2A	1366.33	Mazama	1374-PC-1/2A-28-2	OxA-16496	6608 ± 35^{1}	7469 (7510) 7551	C	Human coprolite
1	1/2A	1366.33	Mazama	1374-PC-1/2A-28-2	BETA-213428	6640 ± 40^{1}	7492 (7528) 7563	X	Human coprolite
1	1/5A	1365.28	2	1294-PC-1/5A-23-F1	BETA-191540	7600 ± 70	8360 (8422) 8484	A	Charcoal, hearth
1	1/7C	1365.66	2	2011PC-249	UCIAMS-98927	7680 ± 20	8434 (8469) 8504	A	*Artemesia* charcoal
1	1/7C	1365.07	2	2011PC-251	UCIAMS-98928	8575 ± 30	9534 (9542) 9549	G	Carnivore coprolite
1	1/9B	1364.5	1	2011PC-254	UCIAMS-98930	10,010 ± 30	11,371 (11,508) 11,644	G	*Pinus ponderosa* nut shell
1	1/7A	1364.88	1	2011PC-252	UCIAMS-98929	10,095 ± 30	11,502 (11,675) 11,847	G	*Artemesia* charcoal
1	1/9B	1364.5	1	2011PC-254	UCIAMS-98930	10,165 ± 25	11,719 (11,844) 11,968	G	*Pinus ponderosa* nut shell
1	1/6A	1365.06	1	1294-PC-1/6A-7	BETA-239084	10,180 ± 60	11,675 (11,844) 12,013	A	Cut artiodactyl bone
1	1/9B	1364.65	1	1961-1/9B-49-12	AA96488	10,476 ± 56	12,231 (12,408) 12,584	A	2-strand ‘S Twist’ cordage
1	1/7C	1364.72–1364.78	1	1896-PC-1/7C-42-66	UCIAMS-90578	10,540 ± 25	12,393 (12,521) 12,648	G	*Artemisia* charcoal
1	1/4A	1364.68	1	1294-PC-1/4A-32	BETA-226554	11,870 ± 50	13,631 (13,772) 13,912	G	Leporid bone
2	2/3A	1366.1	3	1294-PC-2/3A-25	Beta-228916	340 ± 40	331 (400) 461	A	Leporid bone
2	NP	NP	NP	61-1-10023	Beta-249763	1130 ± 40	950 (1050) 1070	A	Multiple-warp tule/grass sandal
2	2/7D	1365.77	2	1961-PC-2/7D-19-61	UCIAMS-111795	2040 ± 20	1966 (2000) 2034	A	Leather scrap with fringe
2	2/7A	1365.33–1365.39	1	1961-PC-2/7A-31-6	D-AMS1217-407	2107 ± 26^{19}	2041 (2081) 2121	X	*Scirpus* ‘S Twist’ fragment
2	NP	NP	NP	100BP-1-5431	BETA-147424	2270 ± 50	2340 (2330) 2310	A	*Scirpus* sandal
2	2/7A	1365.33–136539	1	1961-PC-2/7A-31-6	AA96489	2285 ± 37^{19}	2206 (2274) 2341	A	*Scirpus* ‘S Twist’ fragment
2	2/6A	1366.5	7	1829-PC-2/6A-16-1	UCIAMS-79714	2295 ± 15	2335 (2340) 2345	C	Human coprolite
2	NP	NP	NP	61-1-10057	Beta-249765	2830 ± 50	2870 (2940) 2990	A	Multiple-warp tule sandal
2	2/4C	1366.48	3	2009PC-162	UCIAMS-68046	6790 ± 15	7621 (7640) 7658	G	Bat guano
2	2/4A	1366.32	3	1830-PC-2/4A-35	UCIAMS-76189	7000 ± 15^{24}	7822 (7866) 7909	C	Human coprolite
2	2/4A	1366.32	3	1830-PC-2/4A-35	UCIAMS-79711	7020 ± 15^{24}	7852 (7886) 7920	X	Human coprolite
2	2/4D	1366.38	3	1830-PC-2/4D-33-2	UCIAMS-79713	7025 ± 15	7856 (7889) 7921	C	Human coprolite
2	2/4C	1366.35	3	1830-PC-2/4C-34-101	UCIAMS-79704	7490 ± 20^{11}	8313 (8338) 8360	C	Human coprolite
2	2/4D	1366.39	3	1830-PC-2/4D-33-1	UCIAMS-76188	7595 ± 15	8395 (8402) 8409	C	Human coprolite
2	2/4C	1366.35	3	1830-PC-2/4C-34-101	UCIAMS-79705	7605 ± 20^{11}	8397 (8406) 8414	X	Human coprolite, soluble urine
2	2/4D	1366.39	3	1830-PC-2/4D-33	UCIAMS-79712	7645 ± 20	8414 (8426) 8438	C	Human coprolite
2	2/3A	1365.8	3	1294-PC-2/3A-31-1	BETA-240513	7680 ± 50	8430 (8480) 8530	A	*Scirpus* basketry
2	2/3C	1366.4	3	1294-PC-2/3C-19-6	BETA-213429	7860 ± 40	8610 (8667) 8723	G	Coprolite

^{K}Code: **A**, artifact, hearth, or food; **B**, paleontological specimen; **C**, human coprolite; **G**, geo/stratigraphic specimen; **X**, duplicate date.
Superscript after conventional ^{14}C date indicates multiple ^{14}C dates on same samples.

Table 28.1 Radiocarbon dates from Paisley Caves (cont'd).

Cave	Excav. unit	Elevation	Lithic unit	Specimen no.	^{14}C Lab. sample no.	Conventional ^{14}C date	Calib. date BP at 1σ (Cal Pal)	Code^{K}	Material
2	2/4C	1366.19	3	2009PC-169	UCIAMS-76192	8180 ± 15	9056 (9094) 9131	G	Coprolite
2	2/7A	1365.77	3	1961-PC-2/7A-18-36	AA9687	9078 ± 52	10,212 (10,246) 10,279	A	3-strand hemp cordage
2	2/4C	1365.85	3	2009PC-166	UCIAMS-68045	9480 ± 20	10,706 (10,725) 10,744	G	Atriplex twig
2	2/4C	1365.85	3	2009PC-165	UCIAMS-68044	9565 ± 20	10,806 (10,922) 11,038	G	Insoluble residue
2	2/6B	1365.4	3	1896-PC-2/6B-59-13	D-AMS1217-410	9774 ± 46^{16}	11,186 (11,209) 11,232	X	Cordage
2	2/6B	1365.4	3	1896-PC-2/6B-59-13	UCIAMS-85337	9995 ± 25^{16}	11,370 (11,473) 11,575	A	Cordage
2	2/6B	1365.48	3	1896-PC-2/6B-57-13	UCIAMS-98931	10,020 ± 30^{15}	11,387 (11,528) 11,669	X	Hearth, *Artemesia* charcoal
2	2/6A	1365.67	3	1896-PC-2/6A-52-101	UCIAMS-80385	10,090 ± 20	11,499 (11,658) 11,816	G	Artemisia twig
2	2/3A	1365.7	3	1294-PC-2/3A-33-7a	BETA-182920	10,160 ± 60	11,633 (11,806) 11,979	A	Processed tissues
2	2/6A	1365.48	3	1896-PC-2/6A-55-101	UCIAMS-80386	10,260 ± 25	11,869 (12,008) 12,147	G	*Artemisia* twig
2	2/3A	1365.95	3	1294-PC-2/3A-28	BETA-239083	10,260 ± 60	11,849 (12,048) 12,247	A	Cut artiodactyl bone
2	2/6B	1365.4	2	1896-PC-2/6B-59-13	UCIAMS-87420	10,290 ± 35^{16}	11,970 (12,141) 12,311	X	Cordage
2	2/6B	1365.35	2	1896-PC-2/6B-60-11	UCIAMS-103089	10,290 ± 30^{18}	11,976 (12,140) 12,304	X	Periosteum tissue on bone
2	2/3C	1365.8	3	1294-PC-2/3C-31	BETA-195908	10,290 ± 40	11,961 (12,140) 12,318	A	Sagebrush rope
2	2/7D	1365.83	2	1961-PC-2/7D-18-28	AA96490	10,319 ± 56	12,016 (12,207) 12,398	A	Braided sagebrush cordage
2	2/7A	1365.73–1365.68	3	2011PC-244b	UCIAMS-98933	10,330 ± 30	12,067 (12,230) 12,392	G	Cervid hair (pronghorn)
2	2/4D	1365.65	3	1829-PC-2/4D-48-1	D-AMS-1217-411	10,356 ± 44^{20}	12,101 (12,284) 12,466	X	Sagebrush cordage
2	2/4D	1365.65	3	1829-PC-2/4D-48-1	UCIAMS-79680	10,365 ± 30^{20}	12,123 (12,297) 12,471	A	Sagebrush cordage
2	2/6B	1365.35	2	1896-PC-2/6B-60-11	UCIAMS-103086	10,365 ± 30^{18}	12,123 (12,297) 12,471	G	Unidentified bone
2	2/7A	1365.75	3	1961-PC-2/7A-18-54	UCIAMS-102112	10,585 ± 35	12,457 (12,569) 12,680	A	Human hair
2	2/4C	1365.6	2	1829-PC-2/4C-49	UCIAMS-76191	10,980 ± 20^{7}	12,803 (12,896) 12,989	C	Human coprolite
2	2/6B	1365.4	2	1896-PC-2/6B-59-29	UCIAMS-90577	11,005 ± 30^{15}	12,816 (12,914) 13,012	A	Hearth *Artemisia* charcoal
2	2/6B	1365.35–1365.30	2	1896-PC-2/6B-60-37	UCIAMS-102110	11,055 ± 35^{15}	12,848 (12,947) 13,046	X	Hearth *Artemisia* charcoal
2	2/4C	1365.6	2	1829-PC-2/4C-49	UCIAMS-77100	11,090 ± 30^{7}	12,880 (12,977) 13,073	X	Human coprolite (water soluble)
2	2/6B	1365.35–1365.30	2	1896-PC-2/6B-60-37	D-AMS-1217-406	11,098 ± 45^{15}	12,882 (12,988) 13,093	X	Hearth *Artemisia* charcoal
2	2/4C	1365.53	2	1830-PC-2/4C-51-101	UCIAMS-77103	11,270 ± 30	13,085 (13,174) 13,262	C	Human coprolite (macro)
2	2/4C	1365.53	2	2009PC-167	UCIAMS-68047	11,560 ± 40	13,339 (13,448) 13,557	X	Insoluble residue
2	2/7D	1365.63–1365.70	2	1961-PC-2/7D-21-4	D-AMS-1217-409	11,623 ± 51^{22}	13,381 (13,510) 13,638	X	*Artemisia* branch
2	2/4C	1365.52	2	1830-PC-2/4C-51-102	UCIAMS-77104	11,625 ± 35	13,386 (13,510) 13,633	C	Human coprolite (macro)
2	2/6B	1365.31	2	1896-PC-2/6B-62-3A	UCIAMS-86251	11,740 ± 25	13,502 (13,624) 13,745	B	Horse maxilla
2	2/4C	1365.5	2	1829-PC-2/4C-51-11	UCIAMS-79658	11,790 ± 35	13,582 (13,689) 13,795	B	Large mammal bone
2	2/7D	1365.63–1365.70	2	1961-PC-2/7D-21-4	UCIAMS-112742	11,810 ± 50^{22}	13,595 (13,720) 13,844	G	*Artemisia* branch
2	2/4C	1365.48	2	2009PC-168	UCIAMS-68018	11,830 ± 25	13,613 (13,735) 13,857	G	Rodent bone
2	2/6B	1365.25	2	1896-PC-2/6B-62-16	UCIAMS-90593	11,930 ± 25	13,688 (13,828) 13,968	A	Butcher-cut bone
2	2/3A	1365.45	1	1294-PC-2/3A-38	BETA-228917	11,980 ± 40	13,752 (13,946) 14,140	G	Sage grouse bone
2	2/6B	1365.34	2	1896-PC-2/6B-61-11	UCIAMS-103085	11,980 ± 35	13,753 (13,945) 14,136	B	Horse bone

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2	2/4C	1365.48	2	1829PC-2/4C-52a	UCIAMS-79659	12,025 ± 30	13,806 (14,003) 14,200	G	Large mammal bone (light)
2	2/4C	1365.48	2	2009PC-168	UCIAMS-68016	12,190 ± 30	14,001 (14,222) 14,442	G	Rodent bone
2	2/4C	1365.48	2	1829PC-2/4C-52b	UCIAMS-79660	12,275 ± 30	14,087 (14,360) 14,633	G	Large mammal bone (dark)
2	2/4C	1365.4	2	1829-PC-2/4C-54-101	UCIAMS-79663	12,320 ± 35	14,136 (14,469) 14,801	G	Rodent ramus
2	2/4A	1365.49	2	1896-PC-2/4A-55-15	UCIAMS-103084	12,340 ± 35	14,180 (14,513) 14,845	B	Horse bone
2	2/6D	1365.3	1	1896-PC-2/6D-61-4	UCIAMS-90594	12,425 ± 30	14,356 (14,671) 14,986	G	Bone
3	NP	NP	NP	NP	Y-109	7610 ± 120	8297 (8416) 8535	G	Rodent droppings
5	5/2B	1366.56	1	1374-PC-5/2B-28-1	Beta-221344	139.1	Modern	A	Cotton string
5	5/5D	1366.56	1b	1374-PC-5/5D-30-1b	UCIAMS-79679	275 ± 25	305 (362) 418	A	Fabric
5	5/7D	1368.16	8	1294-PC-5/7D-4	OxA-16377	1308 ± 28	1202 (1242) 1282	C	Human coprolite
5	NP	NP	NP	NP	GaK-1756	2480 ± 100	2416 (2553) 2690	A	Matting (Bedwell)
5	5/10D	1367.71	6	1294-PC-5/10D-8-5	BETA-213427	4130 ± 40	4591 (4687) 4783	C	Coprolite
5	5/12C	1367.36	5	1704-PC-5/12C-13-6	UCIAMS-79710	4950 ± 15	5655 (5681) 5707	C	Human coprolite
5	5/12C	1367.36	5	1704-PC-5/12C-13-4	UCIAMS-79715	5380 ± 15	6197 (6229) 6261	C	Human coprolite
5	5/12C	1367.36	5	1704-PC-5/12C-13-5	UCIAMS-79708	5545 ± 20	6312 (6349) 6385	C	Human coprolite
5	5/12C	1367.41	5	1704-PC-5/12C-12-6	UCIAMS-79702	5595 ± 15^{10}	6335 (6367) 6399	C	Human coprolite
5	5/12C	1367.41	5	1704-PC-5/12C-12-6	UCIAMS-79703	5655 ± 15^{10}	6421 (6439) 6457	X	Human coprolite, soluble urine
5	5/12C	1367.35	5	1704-PC-5/12C-14-6	UCIAMS-76186	5715 ± 15	6479 (6502) 6525	C	Human coprolite
5	5/5B	1367.21	5	1374-PC-5/5B-23	BETA-226557	5720 ± 40	6460 (6527) 6588	G	Leporid bone
5	5/12C	1367.29	5	1704-PC-5/12C-15-4	UCIAMS-76184	5740 ± 15	6507 (6532) 6557	C	Human coprolite
5	5/12C	1367.26	5	1704-PC-5/12C-15-6	UCIAMS-76182	5750 ± 15	6515 (6557) 6599	C	Human coprolite
5	5/12A	1367.55	5	1704-PC-5/12A-10-11	UCIAMS-76187	5770 ± 15	6546 (6584) 6622	C	Human coprolite
5	5/5D	1367.31	2	1374-PC-5/5D-22	BETA-226559	5810 ± 40	6560 (6612) 6663	G	Leporid bone
5	5/12C	1367.26	5	1704-PC-5/12C-15-5	UCIAMS-76185	6115 ± 15	6966 (6986) 7006	C	Human coprolite
5	5/12A	1367.41	3	1704-PC-5/12A-12-5	UCIAMS-79709	6155 ± 15	7019 (7080) 7141	C	Human coprolite
5	5/5C	1367.26	2	1374-PC-5/5C-23	BETA-226558	6470 ± 40	7340 (7382) 7424	G	Leporid bone
5	5/12C	1367.31	5	1704-PC-5/12C-14-9	UCIAMS-76180	6970 ± 15	7792 (7813) 7833	C	Human coprolite
5	5/12C	1367.11	3	2009PC-128	UCIAMS-75109	6980 ± 15	7803 (7822) 7840	G	Macroflora
5	5/12A	1367.46	3	2009PC-214	UCIAMS-75107	7195 ± 15	7986 (8000) 8014	G	Coprolite
5	5/12A	1367.01	2	1830-PC-5/12A-21	UCIAMS-79673	7260 ± 30	8036 (8090) 8143	C	Human coprolite
5	5/3B	1366.86	2	1374-PC-5/3B-21-F53	BETA-191539	7640 ± 50	8406 (8456) 8505	A	Charcoal, hearth
5	5/11B	1366.49	3	2009PC-151	UCIAMS-79699	7700 ± 20	8450 (8485) 8520	G	Charcoal
5	5/12C	1367.11	3	2009PC-129	UCIAMS-68022	7805 ± 20	8568 (8586) 8603	G	Insoluble residue
5	5/12A	1367.45	3	2009PC-110	UCIAMS-76178	8105 ± 20^{25}	9015 (9040) 9064	X	Uriniferous sand, urine
5	5/12A	1367.45	3	2009PC-110	UCIAMS-76177	8285 ± 15^{25}	9283 (9330) 9377	G	Uriniferous sand, macrofossil
5	5/11B	1366.37	3	2009PC-152	UCIAMS-76179	8355 ± 20	9336 (9385) 9433	G	Uriniferous sand, charcoal
5	5/12C	1367.08	3	2009PC-130	UCIAMS-75108	8510 ± 20	9503 (9517) 9530	G	Uriniferous sand
5	5/12A	1367.41	3	2009PC-112	UCIAMS-79675	8650 ± 30	9561 (9601) 9641	G	Uriniferous sand, macroflora
5	5/11B	1366.29	3	2009PC-154	UCIAMS-79700	8935 ± 20	9973 (10,074) 10,175	G	*Atriplex* twig
5	5/12A	1367.43	3	2009PC-111	UCIAMS-79674	8945 ± 35	9973 (10,077) 10,180	G	Uriniferous sand, macroflora
5	5/12A	1367.24	2	1704-PC-5/12A-16-9	UCIAMS-76183	9170 ± 20	10,269 (10,318) 10,367	C	Human coprolite
5	5/11B	1366.19	2	2009PC-156a	UCIAMS-79698	9410 ± 20	10,606 (10,641) 10,676	G	*Atriplex* twig

^{K}Code: **A**, artifact, hearth, or food; **B**, paleontological specimen; **C**, human coprolite; **G**, geo/stratigraphic specimen; **X**, duplicate date.
Superscript after conventional ^{14}C date indicates multiple ^{14}C dates on same samples.

Table 28.1 Radiocarbon dates from Paisley Caves (cont'd).

Cave	Excav. unit	Elevation	Lithic unit	Specimen no.	^{14}C Lab. sample no.	Conventional ^{14}C date	Calib. date BP at 1σ (Cal Pal)	Code^{K}	Material
5	5/12A	1367.42	3	2009PC-144	UCIAMS-76193	9470 ± 20	10,696 (10,715) 10,734	G	*Atriplex* twig
5	5/11B	1366.19	2	2009PC-156b	UCIAMS-79696	9475 ± 20	10,701 (10,720) 10,739	G	Coprolite
5	5/12A	1367.24	2	1704-PC-5/12A-16-10	UCIAMS-76181	9585 ± 20	10,823 (10,928) 11,032	C	Human coprolite
5	5/11A	1365.57	2	1829-PC-5/11A-37-2	UCIAMS-75104	9625 ± 20	11,120 (11,146) 11,171	A	Cordage
5	5/12A	1367.36	3	2009PC-145	UCIAMS-79697	9700 ± 25	11,141 (11,165) 11,188	G	*Atriplex* twig
5	5/12C	1367.04	3	2009PC-132	UCIAMS-68024	9805 ± 25	11,216 (11,227) 11,237	G	Insoluble residue
5	5/15	1365.86	1	1895-PC-5/15A-29-8a	UCIAMS-90580	9825 ± 25^{26}	11,224 (11,235) 11,245	X	Soluble residue
5	5/12A	1367.36	3	2009PC-145	UCIAMS-79701	9850 ± 25	11,235 (11,246) 11,257	G	*Acanatherum* sp., Indian rice grass
5	5/12C	1367.04	3	2009PC-132	UCIAMS-68048	9860 ± 25	11,240 (11,252) 11,263	G	Urine extract
5	5/15A	1365.86	1	1895-PC-5/15A-29-8a	UCIAMS-90579	9895 ± 25^{26}	11,256 (11,281) 11,306	G	Coprolite macrofossil
5	5/12C	1367.04	3	2009PC-132	UCIAMS-68023	9945 ± 25	11,290 (11,335) 11,379	G	Urine extract
5	5/16A	1365.84	1	2010PC-243	UCIAMS-103090	9965 ± 30^{17}	11,315 (11,399) 11,482	X	Carbonized uriniferous sands
5	5/11B	1366.16	2	2009PC-157	UCIAMS-68041	10,000 ± 25	11,358 (11,487) 11,615	G	Insoluble residue
5	5/11B	1365.79	1	1830-PC-5/11B-30-17	UCIAMS-68020	10,030 ± 25	11,406 (11,544) 11,682	A	Willow dart butt
5	5/6A	1366.26	1a	1294-PC-5/6A-44-1	UCIAMS-79678	10,030 ± 90	11,375 (11,581) 11,787	A	Thread
5	5/6B	1366.36	1a	1294-PC-5/6B-40	BETA-213423	10,050 ± 502	11,419 (11,585) 11,750	X	Human coprolite
5	5/16A	1365.86	2	1896-PC-5/16A-25-5	UCIAMS-87421	10,070 ± 30^{14}	11,455 (11,611) 11,767	X	Cordage
5	5/12C	1367.02	2	2009PC-136	UCIAMS-68035	10,135 ± 25	11,639 (11,787) 11,934	G	Deer coprolite
5	5/12A	1367.31	2	2009PC-115	UCIAMS-75106	10,140 ± 20	11,654 (11,797) 11,939	G	Macroflora
5	5/11B	1366.09	2	2009PC-158b	UCIAMS-79677	10,145 ± 30	11,654 (11,800) 11,946	G	*Artemisia* twig
5	5/12C	1367	2	2009PC-133	UCIAMS-68025	10,195 ± 25	11,781 (11,897) 12,012	G	*Atriplex* twig
5	5/17A	1366.01–1365.96	2	1961-PC-5/17A-8-4	UCIAMS-102111	10,195 ± 30	11,776 (11,895) 12,014	G	*Pinus ponderosa* cone leaf
5	5/11B	1366.09	2	2009PC-158a	UCIAMS-79676	10,200 ± 35	11,778 (11,901) 12,024	G	*Artemisia* twig
5	5/12C	1366.93	2	2009PC-135	UCIAMS-68027	10,215 ± 25	11,811 (11,926) 12,040	G	*Atriplex* twig
5	5/16A	1365.86	2	1896-PC-5/16A-25-5	UCIAMS-85336	10,250 ± 25^{14}	11,856 (11,985) 12,114	A	Cordage
5	5/12C	1366.97	2	2009PC-134	UCIAMS-68026	10,270 ± 25	11,893 (12,048) 12,203	G	*Atriplex* twig
5	5/12C	1366.9	2	2009PC-137	UCIAMS-68028	10,295 ± 25	11,994 (12,154) 12,313	G	Rodent droppings
5	5/12A	1366.98	2	2009PC-102	UCIAMS-75105	10,320 ± 20	12,053 (12,208) 12,362	G	Mummified lizard
5	5/11B	1365.99	2	2009PC-160	UCIAMS-68043	10,360 ± 25	12,118 (12,291) 12,463	G	Charcoal
5	5/5A	1366.51	1b	1374-PC-5/5A-30-1	BETA-171938	10,550 ± 40	12,388 (12,522) 12,655	A	Twisted grass threads
5	5/11B	1365.99	2	2009PC-160	UCIAMS-68042	10,580 ± 25	12,465 (12,572) 12,678	X	Insoluble residue
5	5/5D	1366.71	1b	1374-PC-5/5D-28	BETA-213425	10,690 ± 60	12,620 (12,679) 12,737	G	Coprolite
5	5/18A	1366.06–1366.01	2	2011PC-258	UCIAMS-98932	10,855 ± 30	12,748 (12,821) 12,893	G	Unidentified macroflora in sed.
5	5/6B	1366.36	1a	1294-PC-5/6B-40	OxA-16376	10,965 ± 50^{2}	12,795 (12,891) 12,987	X	Human coprolite
5	5/16A	1365.84	2	2010PC-243	UCIAMS-103091	10,995 ± 30^{17}	12,811 (12,908) 13,005	G	Humic acids
5	5/16A	1365.97	2	2010PC-223	UCIAMS-80378	11,070 ± 25^{13}	12,864 (12,959) 13,054	G	*Artemisia* twig
5	5/5B	1366.81	1b	1374-PC-5/5B-27a	BETA-185942	11,130 ± 40^{8}	12,910 (13,033) 13,156	X	Horse bone
5	5/16A	1365.97	2	2010PC-223	UCIAMS-80380	11,165 ± 25^{13}	12,963 (13,076) 13,188	X	Salts (water soluble)
5	5/12A	1366.89	2	1830-PC-5/12A-23-101	UCIAMS-77102	11,190 ± 30	12,992 (13,098) 13,203	C	Human coprolite (macro)
5	5/16A	1365.91–1365.96	2	1895-PC-5/16A-24-7	UCIAMS-90583	11,205 ± 25	13,010 (13,110) 13,210	C	Human coprolite (macro)
5	5/16A	1365.91–1365.96	2	1895-PC-5/16A-24-7	UCIAMS-90584	11,250 ± 25	13,072 (13,155) 13,237	X	Human coprolite (water soluble)

^{K}Code: **A**, artifact, hearth, or food; **B**, paleontological specimen; **C**, human coprolite; **G**, geo/stratigraphic specimen; **X**, duplicate date.
Superscript after conventional ^{14}C date indicates multiple ^{14}C dates on same samples.

Table 28.1 Radiocarbon dates from Paisley Caves (cont'd).

Cave	Excav. unit	Elevation	Lithic unit	Specimen no.	^{14}C Lab. sample no.	Conventional ^{14}C date	Calib. date BP at 1σ (Cal Pal)	Code^{K}	Material
5	5/16A	1365.97	2	2010PC-223	UCIAMS-80379	11,295 ± 25^{13}	13,100 (13,192) 13,284	X	Water soluble proteins
5	5/16A	1365.85	2	1895-PC-5/16A-25-12	UCIAMS-90586	11,315 ± 25	13,111 (13,206) 13,301	X	Camelid coprolite (water soluble)
5	5/16A	1365.88	2	1895-PC-5/16A-25-16	UCIAMS-90581	11,340 ± 30^{27}	13,124 (13,228) 13,331	C	Human coprolite (macro)
5	5/5B	1366.71	1a	1374-PC-5/5B-27a	UCIAMS-79665	11,365 ± 35	13,141 (13,255) 13,369	B	Horse bone
5	5/12A	1366.89	1b	2009PC-175	UCIAMS-68021	11,370 ± 25	13,145 (13,259) 13,372	G	Bulb or growth
5	5/5B	1366.71	1a	1374-PC-5/5B-27a	UCI-78159	11,420 ± 35^{8}	13,204 (13,326) 13,447	X	Horse bone (ultrafiltration)
5	5/5B	1366.71	1a	1374-PC-5/5B-27a	UCI-78117	11,435 ± 35^{8}	13,233 (13,350) 13,467	X	Horse bone (XAD)
5	5/16A	1365.93	2	2010PC-224	UCIAMS-80381	11,500 ± 30	13,293 (13,406) 13,519	G	Ericacaea twig
5	5/16A	1365.88	2	1895-PC-5/16A-25-16	UCIAMS-90582	11,505 ± 30^{27}	13,298 (13,410) 13,522	X	Human coprolite (water soluble)
5	5/12C	1366.78	1b	2009PC-138	UCIAMS-68029	11,565 ± 25	13,345 (13,451) 13,557	G	Rodent droppings
5	5/12C	1366.8	1b	2009PC-146	UCIAMS-68040	11,770 ± 25	13,559 (13,666) 13,772	G	Midden macrobotanical
5	5/12A	1366.89	1b	1830-PC-5/12A-23-8	UCIAMS-79657	11,795 ± 30	13,588 (13,694) 13,799	B	*Camelops* bone
5	5/16A	1365.92	2	1895-PC-5/16A-24-4	UCIAMS-103088	11,810 ± 40	13,599 (13,717) 13,834	B	Horse bone
5	5/16A	1365.89	2	2010PC-225	UCIAMS-80382	11,815 ± 25	13,604 (13,722) 13,839	G	*Artemisia* twig
5	5/14A	1365.91	2	1896-PC-5/14A-27-2	UCIAMS-103087	11,820 ± 40	13,605 (13,728) 13,851	B	Horse bone
5	5/11B	1365.61	1	1830-PC-5/11B-33-101	UCIAMS-79707	12,050 ± 25^{12}	13,828 (14,033) 14,238	X	Human coprolite, soluble urine
5	5/16A	1365.85	2	1895-PC-5/16A-25-12	UCIAMS-90585	12,125 ± 30	13,918 (14,146) 14,378	B	Camelid coprolite (macro)
5	5/6B	1365.86	1a	1294-PC-5/6B-50	OxA-16495	12,140 ± 70^{3}	13,928 (14,171)14,414	C	Human coprolite
5	5/11B	1365.61	1	1830-PC-5/11B-33-101	UCIAMS-79706	12,165 ± 25^{12}	13,974 (14,196) 14,418	C	Human coprolite, macro
5	5/17B	1365.77	2	1961-PC-5/17B-2-11	D-AMS-1217-408	12,170 ± 44^{21}	13,976 (14,202) 14,428	X	Driftwood (ecofact?)
5	5/12C	1366.84	1b	1830-PC-5/12C-24-1	UCIAMS-68017	12,195 ± 30	14,007 (14,228) 14,448	A	Modified sawtooth bear bone
5	5/6B	1365.86	1b	1294-PC-5/6B-50	BETA-216474	12,260 ± 60^{3}	14,069 (14,346) 14,622	X	Human coprolite
5	5/11B	1365.7	1	1830-PC-5/11B-31-2	UCIAMS-76190	12,265 ± 25^{6}	14,079 (14,337) 14,595	C	Human coprolite
5	5/11B	1365.7	1	1830-PC-5/11B-31-2	UCIAMS-77099	12,260 ± 30^{6}	14,073 (14,329) 14,586	X	Human coprolite (water soluble)
5	5/5D	1366.41	1b	1374-PC-5/5D-31	OxA-16498	12,275 ± 55^{5}	14,084 (14,377) 14,670	C	Human coprolite
5	5/9A	1365.48	1	1294-PC-5/9A-28	BETA-239086	12,290 ± 70^{9}	14,095 (14,424) 14,753	X	Large mammal bone
5	5/9A	1365.48	1	1294-PC-5/9A-28	UCI-78159	12,290 ± 40^{9}	14,100 (14,404) 14,708	G	Large mammal bone
5	5/7C	1366.81	1b	1294-PC-5/7C-31	BETA-213426	12,290 ± 60^{4}	14,097 (14,417) 14,737	X	Human coprolite
5	5/5B	1366.51	1b	1374-PC-5/5B-30-2	BETA-172663	12,300 ± 40	14,110 (14,428) 14,746	B	Camelid bone
5	5/12C	1366.6	1b	2009PC-140	UCIAMS-68031	12,305 ± 30	14,116 (14,435) 14,754	G	*Atriplex* twig
5	5/16A	1365.96–1365.91	2	1896-PC-5/16A-CU-2a	UCIAMS-90591	12,340 ± 25	14,184 (14,513) 14,841	B	Horse bone
5	5/7C	1366.81	1b	1294-PC-5/7C-31	OxA-16497	12,345 ± 55^{4}	14,185 (14,525) 14,865	C	Human coprolite
5	5/12C	1366.7	1b	2009PC-139	UCIAMS-68030	12,350 ± 30	14,208 (14,535) 14862	G	Rodent droppings
5	5/17A	1365.6	2	1961-PC-5/17A-15-5	UCIAMS-103081	12,360 ± 35	14,229 (14,556) 14882	B	Camel bone
5	5/5D	1366.56	1b	1374-PC-5/5D-30	BETA-239087	12,380 ± 70	14,248 (14,591) 14,933	A	Butcher-cut mountain sheep
5	5/12C	1366.46	1b	2009PC-143	UCIAMS-68034	12,380 ± 30	14,261 (14,587) 14,913	G	*Atriplex* twig

^{K}Code: **A**, artifact, hearth, or food; **B**, paleontological specimen; **C**, human coprolite; **G**, geo/stratigraphic specimen; **X**, duplicate date.
Superscript after conventional ^{14}C date indicates multiple ^{14}C dates on same samples.

Table 28.1 Radiocarbon dates from Paisley Caves (cont'd).

Cave	Excav. unit	Elevation	Lithic unit	Specimen no.	^{14}C Lab. sample no.	Conventional ^{14}C date	Calib. date BP at 1σ (Cal Pal)	Code^{K}	Material
5	5/16A	1365.96–1365.91	2	1896-PC-5/16A-CU-2b	UCIAMS-90592	12,385 ± 30	14,268 (14,595) 14,921	B	Horse tooth
5	5/5D	1366.41	1b	1374-PC-5/5D-31	BETA-213424	12,400 ± 60^{5}	14,280 (14,619) 14,958	X	Human coprolite
5	5/17B	1365.77	2	1961-PC-5/17B-2-11	UCIAMS-104663	12,400 ± 35^{21}	14,289 (14,618) 14,947	G	Driftwood (ecofact?)
5	5/16A	1365.76	1	2010PC-227	UCIAMS-80377	12,405 ± 25	14,301 (14,627) 14,952	G	*Artemisia* twig
5	5/16A	1365.83	2	2010PC-226	UCIAMS-80383	12,405 ± 25	14,301 (14,627) 14,952	G	Ericacaea twig
5	5/11B	1365.39	1	1829-PC-5/11B-37-9	UCIAMS-79656	12,410 ± 35	14,308 (14,636) 14,963	B	Horse tooth
5	5/16A	1365.74	1	2010PC-233	UCIAMS-80384	12,410 ± 25	14,312 (14,636) 14,960	G	*Artemisia* twig
5	5/12C	1366.55	1b	2009PC-141	UCIAMS-68032	12,430 ± 30	14,368 (14,681) 14,994	G	*Atriplex* twig
5	5/12C	1366.49	1b	2009PC-142	UCIAMS-68033	12,450 ± 30	14,423 (14,725) 15,027	G	*Atriplex* twig
5	5/7C	1367.41	4	1294-PC-5/7C-19	BETA-239085	12,460 ± 70	14,407 (14,734) 15,060	B	*Camelops*
5	5/5B	1366.81	1b	1374-PC-5/5B-27b	BETA-229783	12,690 ± 90	14,744 (15,070) 15,395	B	Pika bone
5	5/5B	1366.61	1b	1374-PC-5/5B-29	BETA-229782	13,260 ± 60	15,780 (16,190) 16,600	G	Duck bone

^{K}Code: **A**, artifact, hearth, or food; **B**, paleontological specimen; **C**, human coprolite; **G**, geo/stratigraphic specimen; **X**, duplicate date.
Superscript after conventional ^{14}C date indicates multiple ^{14}C dates on same samples.

flowing north into the Summer Lake basin, cutting a channel across the plain approximately 1.5–2 kilometers southwest of the Paisley Caves. The plain and grasslands surrounding the rejuvenated lake provided improved pasturage for mammoth (Elephantidae: *Mammuthus*), mastodon (Mammutidae: *Mammut*), camel (Camelidae: *Camelops*), llama (Camelidae: *Lama*), horse (Equidae: *Equus*), bison (Bovidae: *Bison*), deer/elk (Cervidae), and pronghorn (Antilocapridae). Mountain sheep (Bovidae: *Ovis*), marmots (Sciuridae: *Marmota*), and upland root plants were found in the hills east of the plain. With water more easily available, the Paisley Caves were attractive to late Pleistocene human occupations (Figure 28.2).

University Of Oregon (UO) Investigations 2002–2012

The UO archaeological field school conducted investigations at the Paisley Caves between 2002 and 2012 with the goal of testing Luther Cressman's (1940; Cressman and Williams 1942) hypothesis of Pleistocene human/megafaunal contemporaneity at the site. Here we address the questions: What is the stratigraphic context and reliability of late-Pleistocene cultural and paleontological remains at the site? What are the cultural and paleontological constituents in the Pleistocene strata? Were they contemporaneous? Are the associations merely stratigraphic, or are they behavioral (cultural)? Is the human DNA evidence reliable?

Our 2002–2008 investigations indicated that not only did cultural and megafaunal remains occur in horizontal, vertical, and stratigraphic association in the Paisley Caves, but that human coprolites and extinct megafaunal remains were contemporaneous between 13,255 and 14,500 cal yr BP (Jenkins 2007; Gilbert et al. 2008a, b). However, Poinar et al. (2009) raised questions concerning the context and the reliability of the DNA analysis. Why are there so few artifacts associated with the coprolites? Is the stratigraphic context of these materials reliable? Could the DNA have been leached from younger overlying deposits into older nonhuman coprolites? Most of these questions, and those of Goldberg et al. (2009), have already been satisfactorily addressed (Gilbert et al. 2009; Rasmussen et al. 2009). However, more satisfactory answers to the questions concerning artifacts, stratigraphic integrity, and DNA leaching required new excavations, extensive radiocarbon dating, and more DNA analysis. The new investigations were conducted between 2009 and 2012. The lab analyses have been continuous to the present.

Here, we discuss only the pre-Clovis- to YD-age archaeology of caves 2 and 5, where pre-Clovis human coprolites and artifacts have been recovered. The geoarchaeological methods employed and the lithostratigraphic units (LUs) they described are presented in detail elsewhere and will not generally be presented again here (Jenkins 2007:63–65; Jenkins et al. 2012a, b; Gilbert et al. 2008b:21–25). Only pertinent Pleistocene and early-Holocene strata (LU1, LU2, LU3) will be described relative to the archaeology of the caves.

Cave 2

Cave 2 is 7 m long and 6 m deep (Figure 28.3). Roof fall extends across most of the entrance, blocking direct access to the central and southern portions of the cave. The triangular scar from which the roof fall was dislodged remains easily discernible. Prior to the roof fall, Cave 2 was open to direct entry and had more covered living space, and the interior was less illuminated than it is today. Our excavations in Cave 2 covered 22 m^{2} and removed 30.3 m^{3} of sediments. The northwest end of Cressman's exploratory trench (units 2/7B&D) was found in 2009 near the northeast cave wall. Its straight, vertical walls and flat floor, cut into compact, nearly culturally sterile, bat guano (LU3) as much as 90 cm above bedrock,

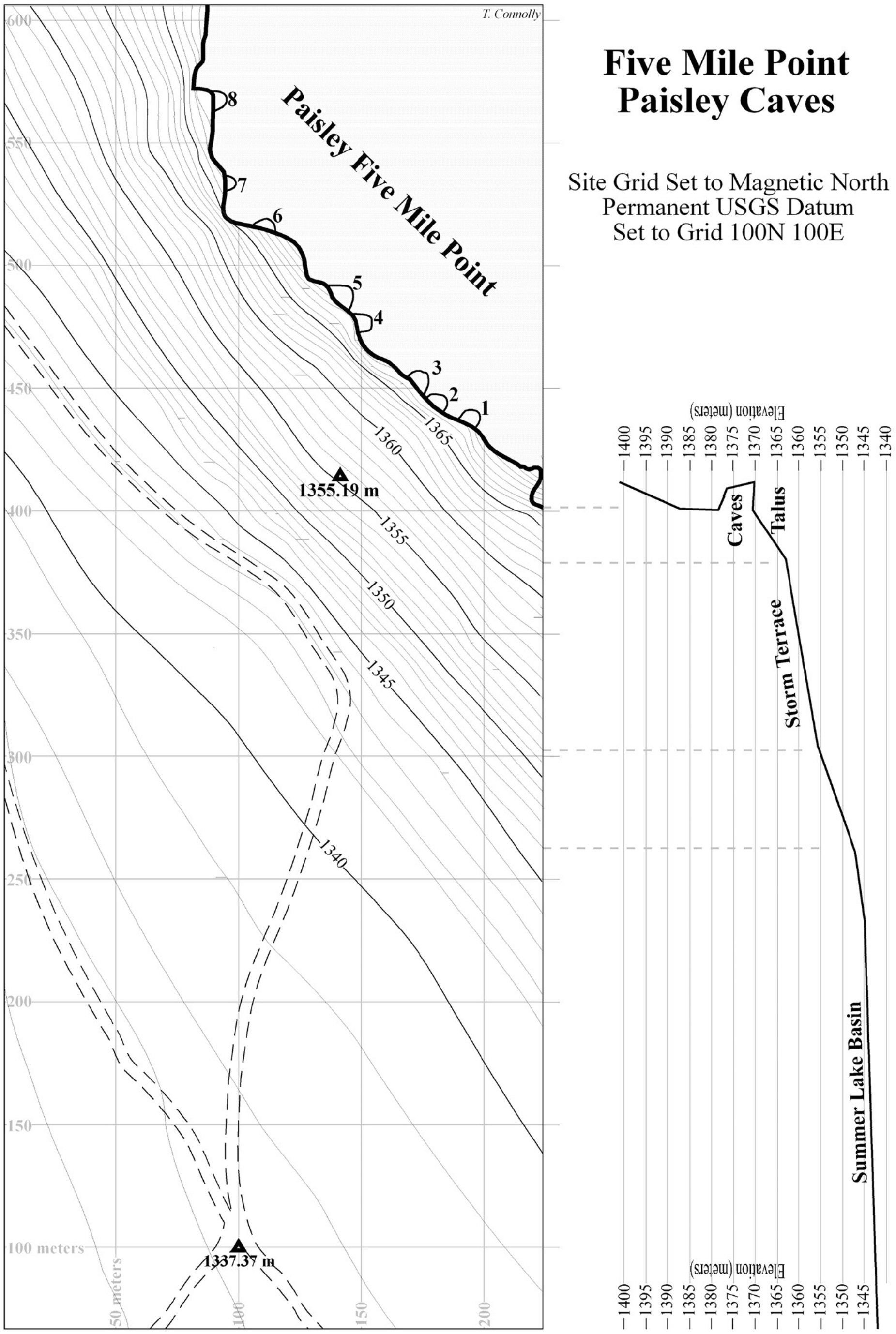


Figure 28.2 Map of the Paisley Five Mile Point Caves (Paisley Caves) site (after Jenkins 2007).

were clearly professional excavations compared with a round vandal hole dug through the floor of the trench. Our excavations reached bedrock at a maximum depth 230 cm below the surface. Late-Pleistocene and early-Holocene deposits, undisturbed by either Cressman or vandals, were found to be present across most of the cave floor. However, the vandal hole, roughly 1 m in diameter and nearly reaching bedrock in late-Pleistocene deposits, cut through the bottom of Cressman's trench at the southeast end nearest the back of the cave. This hole was filled with loose boulders and highly organic spoil dirt. Radiocarbon dating of fragments of *Scirpus* sp. cordage and a leather garment fragment to 2285 ± 37 ^{14}C yr BP (AA-96489; 2206–2341 cal yr BP) and 2040 ± 20 ^{14}C yr BP (UCIAMS-111795; 1966–2034 cal yr BP), respectively, indicate that rodents have subsequently scattered perishable materials from this disturbance outward through their burrows.

The stratigraphy of Cave 2 is significantly different from that of Cave 5 (Figure 28.4). While midden debris of woodrat (Cricetidae: *Neotoma* sp.) is present, it does not form the primary sedimentary component; bat guano does. Moving away from the vandal pit in Cressman's trench, a large boulder leaning against the massive roof fall blocking the

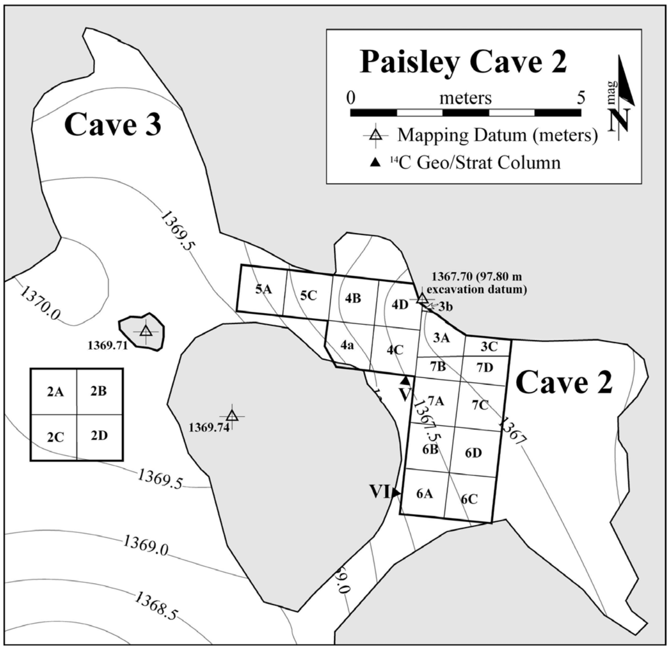


Figure 28.3 Map of Paisley Cave 2 excavations (after Jenkins et al. 2012b).

mouth of the cave was removed by jackhammer to allow excavations through undisturbed deposits below it. A human coprolite recovered below this boulder dated to 2295 ± 15 ^{14}C yr BP (UCIAMS-79714; 2335–2345 cal yr BP), indicating that the roof fell sometime after that. While spoil dirt was thick against the interior of the roof fall, excavations below it encountered 35 cm of nicely laminated (undisturbed) Mt. Mazama tephra overlying compact bat guano. Bat pellets in contact with the base of this tephra dated to 6790 ± 15 ^{14}C yr BP (UCIAMS-68046; 7620–7660 cal yr BP). Human coprolites (n = 5), recovered in chronologically sequential order below the tephra, were dated between 7000 ± 15 ^{14}C yr BP (UCIAMS-76189; 7822–7909 cal BP) and 7645 ± 20 ^{14}C yr BP (UCIAMS-79712; 8414–8438 cal yr BP). These dates fit well with hearth dates in Cave 1 and Cave 5 of 7600 ± 70 ^{14}C yr BP (Beta-191540; 8360–8480 cal yr BP) and 7640 ± 50 ^{14}C yr BP (Beta-191539; 8360–8540 cal yr BP), respectively. While sparse lithic debitage associated with these hearths indicates occupations were very brief, there is consistent evidence of occupations in all the caves investigated. Cultural assemblages exhibit increases in ground stone (metates and manos) during this period, suggesting more regular use of the caves for collecting small seeds following a long period of infrequent occupations between 10,250 and 8540 cal yr BP (Table 28.1).

Stratum LU1 is a gray, culturally sterile, sandy gravel surrounding wave-rounded boulders and cobbles on the cave floor above the basalt bedrock. It represents the floor of the cave at the time Lake Chewaucan subsided (ca. 19,000–18,000 cal yr BP). LU2 is a brown gravelly sand as much as 30 cm thick overlying LU1. A sagebrush (*Artemisia* sp.) twig and mammal bones provide 15 well-ordered dates in this stratum ranging from 12,425 ± 25 ^{14}C yr BP (UCIAMS-90594; 14,356–14,986 cal yr BP) to 11,560 ± 40 ^{14}C yr BP (UCIAMS-68047; 13,339–13,557 cal yr BP). A polished and battered (3 flakes detached at one end) handstone (1896-PC-2/6B-62-22, Figure 28.5B) recovered in situ in LU2 in Unit 2/6B (elevation 1365.28) is bracketed by dates of 11,740 ± 25 ^{14}C yr BP (UCIAMS-86251; 13,502–13,745 cal yr BP) on a horse maxilla found in situ at elevation 1365.31 and 11,930 ± 25 ^{14}C yr BP (UCIAMS-90593; 13,688–13,968 cal yr BP) on a cut artiodactyl bone found in situ at elevation 1365.25. Proboscidean (mammoth/mastodon) protein, Apiaceae-type starch, and grass-seed starch and phytoliths were extracted from the handstone surface (LAS 2011a; Yost and Cummings 2011). This artifact appears to have been used to process proboscidean flesh and grind roots of the umbel family and grass seeds. An edge-modified obsidian flake (1961-PC-2/7C-18s-2) recovered nearby in Stratum LU2 also tested positive for proboscidean protein (LAS 2011b). A rectangular stone block (1961-PC-2/7C-25-2) recovered from LU2 in adjacent Unit 2/7C produced possibly heat-altered and folded starches and microscopic charcoal, suggesting possible parching and grinding of grass seeds. The evidence suggests site occupation during the spring or early summer (Cummings and Yost 2011).

The reliability of Cross-over Immuno-Electrophoresis (CIEP) protein residue analysis has been questioned on the basis of the lack of reliability, subjectivity, and reproducibility (Vance 2011). CIEP laboratory failures to properly identify the animals butchered with experimental stone flake tools in blind tests are troubling, as are false positive results obtained on both archaeological and experimental tools (Fiedel 1996; Vance 2011). However, the positive CIEP proboscidean results obtained in Cave 2 were replicated by two independent laboratories, PaleoResearch Institute (PRI) and the Laboratory of Archaeological Science (LAS), California State University, Bakersfield. They conducted 18 tests (6 at PRI, 12 at LAS) at varying levels of sensitivity. These tests resulted in 15 very strong positive results for proboscidean. A control LU2 soil sample recovered near the handstone tested negative for proboscidean protein, indicating that the positive reactions to tests on the handstone were not caused by background contaminants such as natural accumulations of elephant urine, feces, or rotting flesh (Yost and Cummings 2011). No other proboscidean remains have been identified in the Paisley Caves. The artifacts testing positive for proboscidean proteins were recovered from Pleistocene-age deposits (LU2) and, barring evidence for protein contamination in the sediment, could not derive from overlying YD-age cultural deposits. The chronostratigraphic context of the tools and the multidisciplinary analytical results (CIEP, pollen, starch granule, and phytolith) support the interpretation that these three specimens were used to process food during the late Pleistocene (13,968–13,502 cal yr BP).

Human coprolites and sagebrush charcoal from hearth Feature 2/6-4, in Stratum LU2 provide six dates ranging from 11,625 ± 35 ^{14}C yr BP (UCIAMS-77104; 13,386–13,633 cal yr BP) to 10,980 ± 20 (UCIAMS-76191; 12,803–12,989 cal yr BP). The hearth was surrounded by a dense concentration of burned bone and obsidian debitage. It was dated

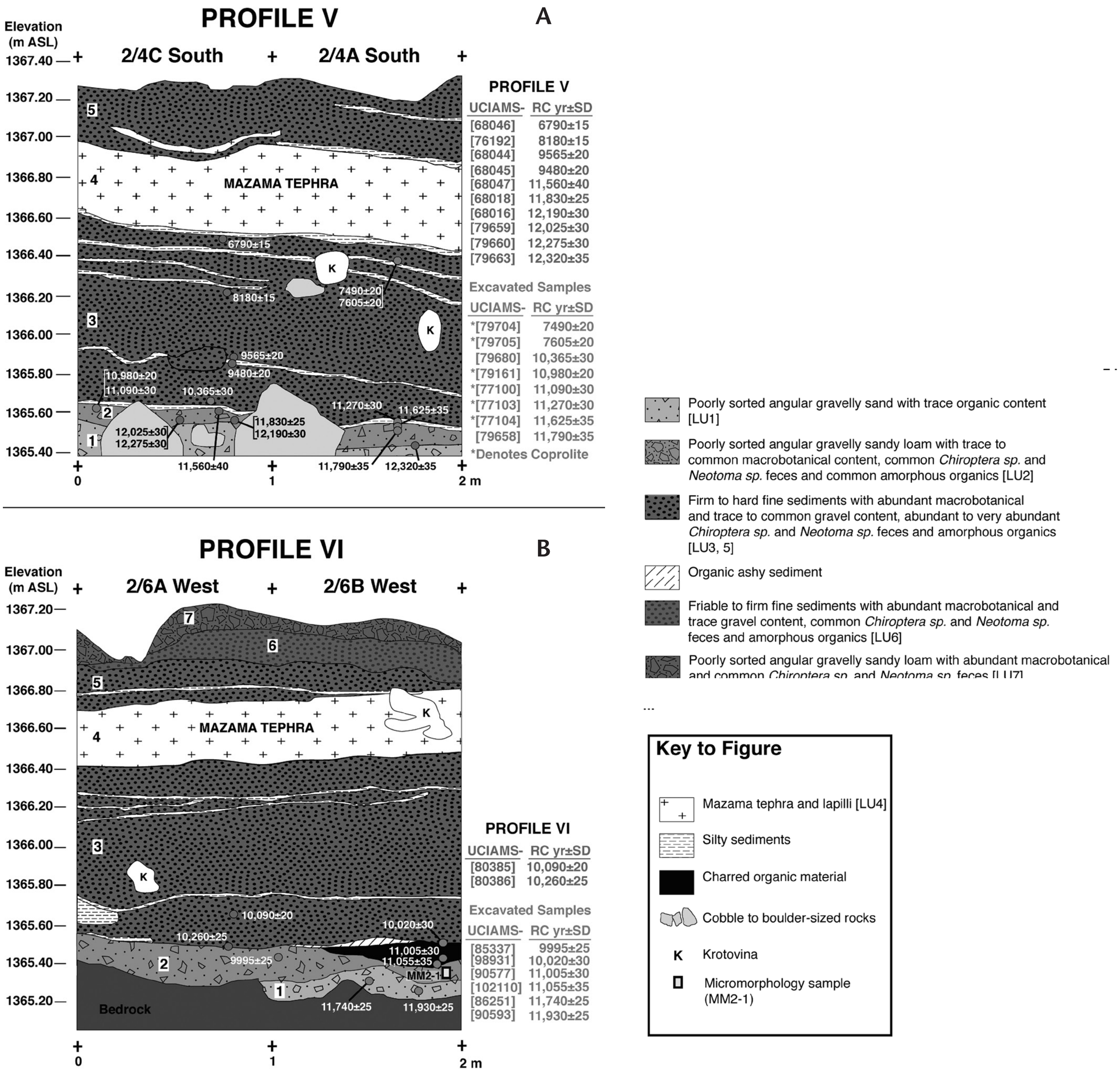


Figure 28.4 Dating column profiles: **A**, profile V (excavation Unit 2/4A&C); **B**, profile VI (excavation Unit 2/6A&B); after Jenkins et al. 2012a).

three times, employing a single piece of sagebrush charcoal each time. The first sample, recovered from sediments taken stratigraphically from the middle of the hearth depression at Level 59, produced a date of 11,005 ± 30 ^{14}C yr BP (UCIAMS-90577; 12,816–13,012 cal yr BP). The second sample, from Level 57 at the top of the hearth depression where LU2 abruptly transitions to LU3, produced an age of 10,020 ± 30 ^{14}C yr BP (UCIAMS-98931; 11,387–11,669 cal yr BP). The final sample, recovered at the bottom of the hearth depression to test whether the fire had burned downward through progressively older sediments, produced an age of 11,055 ± 35 ^{14}C yr BP (UCIAMS-102110; 12,864–13,054 cal yr BP), nearly identical to that of the first sample. LU2 contains little natural organic content compared with overlying LU3, which is highly organic and frequently contains charcoal. It seems unlikely, therefore, that this feature is the product of natural wood accumulation followed by unintentional burning. We conclude that samples 1 and 3 with calibrated ages of 12,816–13,054 cal yr BP represent cultural activity in Cave 2 at about 12,900 cal yr BP.

A unique form of evidence for extinct fauna in LU2 is the identification of American lion or jaguar (*Panthera* sp.), reindeer (Cervidae: *Rangifer tarandus*), and thick hairs with the affinities of sloth (cf. Mylodontidae) hair recovered from

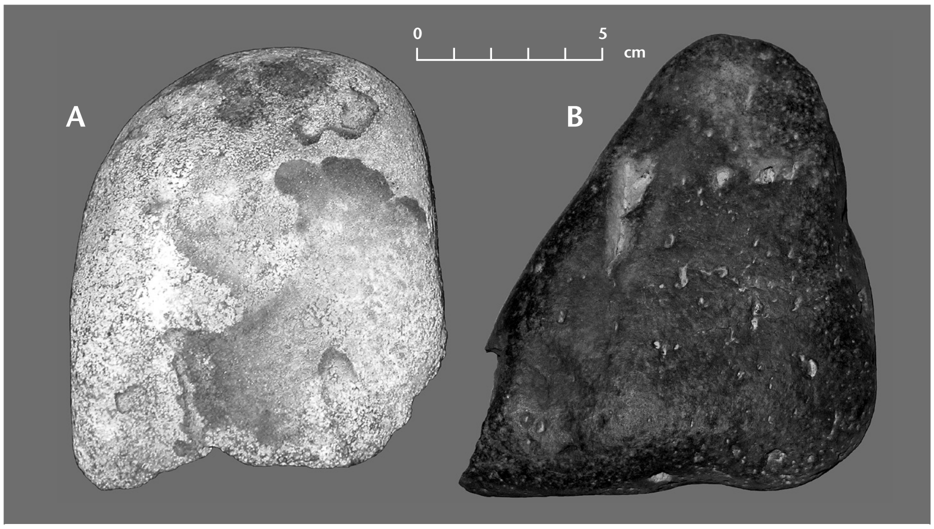


Figure 28.5 Pre-Clovis handstones: **A**, 1294-PC-5/7C-31-2 (horse protein); **B**, 1896-PC-2/6B-62-22 (mammoth/mastodon protein).

Unit 2/4C, Level 50 (B. Yates pers. comm. 2012; Jenkins et al. 2012b). Human coprolites radiocarbon dated to 10,980 ± 20 (UCIAMS-76191; 12,803–12,989 cal yr BP) and 11,625 ± 35 ^{14}C yr BP (UCIAMS-77104; 13,386–13,633 cal yr BP) in levels 49 and 51, respectively, provide the most proximal bounding dates for these specimens.

LU2 is partially capped by a thin (1–3 cm) alluvial silt lens formed about 12,930 cal yr BP. Above this lens is a prominent cultural deposit, a mat of sagebrush twigs and shredded bark 5–8 cm thick, dated by nine AMS dates between 10,160 ±60 ^{14}C yr BP (Beta-182920; 11,630–11,980 cal yr BP) and 10,585 ± 35 ^{14}C yr BP (UCIAMS-102112; 12,460–12,680 cal yr BP). This dense cultural deposit, the Botanical Lens (Figure 28.6), is capped in places by a second silt lens deposited about 10,000 ^{14}C yr BP (11,500 cal yr BP). LU3 is very compact, nearly pure bat guano with occasional silt lenses and pockets of woodrat midden debris.

Two small unlined hearths (Features 2/3A-1, 2/4C-4) roughly 35 cm in diameter and as much as 10 cm thick were encountered in the Botanical Lens. These hearths were surrounded by large quantities of smashed and split artiodactyl bones (pronghorn, deer, mountain sheep) and masses of hair. Bone artifacts include a delicate needle, a scraper, and a polished and striated splinter used as an awl. Other cultural materials include a dense concentration of lithic debitage, pieces of braided and twisted sagebrush rope and cordage, knotted strands of sagebrush bark, a wooden peg, sinew-wrapped twigs, grooved pumice abraders, scrapers, utilized flakes, retouched flake knives, and the base of a Western Stemmed (WS) or Foliate projectile point (Figure 28.7D). Processed edible tissue from hearth 2/3A-1 was dated to 10,160 ± 60 ^{14}C yr BP (Beta-182920; 11,630–11,980 cal yr BP). Fragments of braided sagebrush rope and cordage nearby produced AMS dates of 10,290 ± 40 ^{14}C yr BP (Beta-195908; 11,960–12,320 cal yr BP) and 10,320 ± 60 ^{14}C yr BP (AA-96490; 12,020–12,400 cal yr BP). Pronghorn hair was dated to 10,330 ± 30 ^{14}C yr BP (UCIAMS-98933; 12,070–12,390 cal yr BP), and a lock of human hair with lice egg sacks attached was dated to 10,585 ± 35 ^{14}C yr BP (UCIAMS-102112; 12,460–12,680 cal yr BP).

The Paisley Caves face into the wind (southwest) and generally are not very deep. Consequently, storms involving heavy rains and unusually high winds occasionally blew rainwater to the back of the caves, where it briefly pooled or began flowing toward the mouth of the caves, producing thin silt lenses, which cracked as they dried out. Formation of

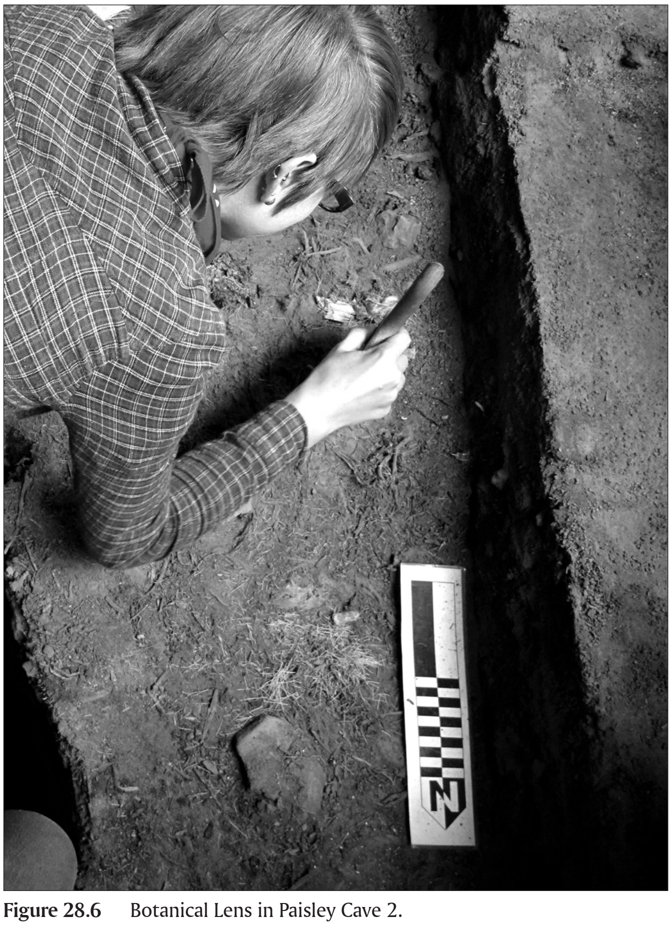


Figure 28.6 Botanical Lens in Paisley Cave 2.

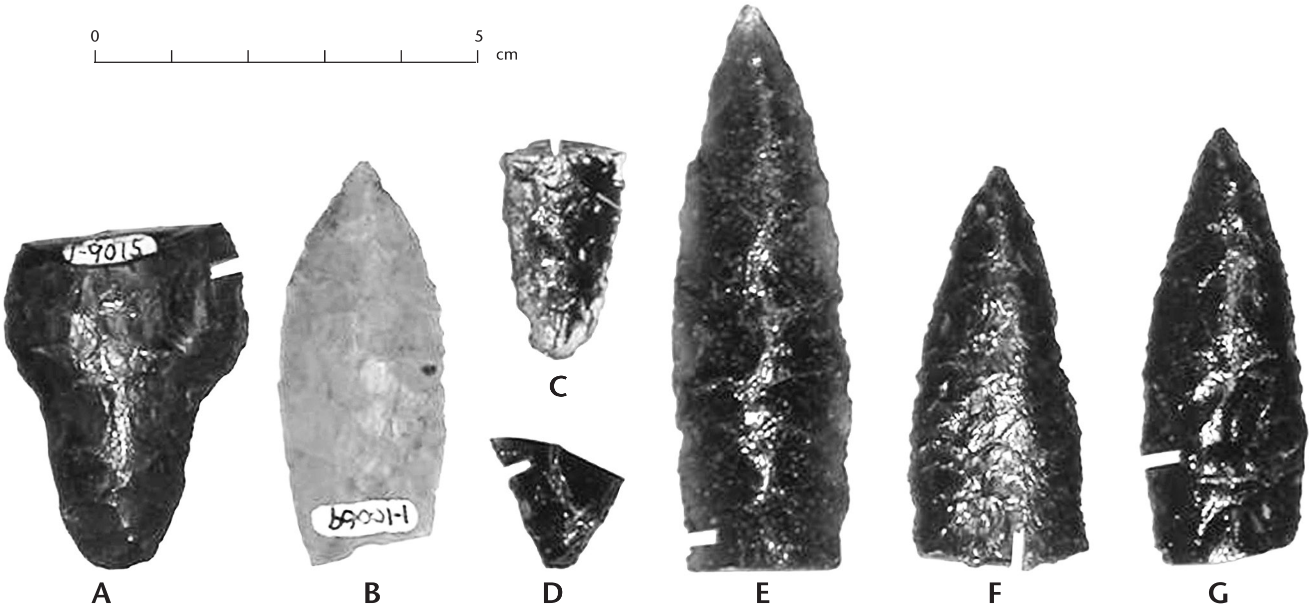


Figure 28.7 Projectile points recovered: **A–B**, Cressman; **C–G**, the UO field school.

the silt lens underlying the Botanical Lens occurred at about the beginning of the YD. It was capped by a second silt lens shortly after the end of the YD. Microscopic examination of the Botanical Lens sagebrush matting reveals a mass of fine to coarse particulates of disaggregated coprolites, crystallized urine, fat, blood, bone, feathers, rat and bat feces, hair, and fragments of marmot, Leporid (Lagomorpha), and vole (*Microtus* sp.) hides. It reeks today and would have been smelly and unhealthy during prolonged YD occupations. Insects and their pupa are common in this mat. Head lice and intestinal parasites (hook worm) were potential health problems for which direct evidence is found on hair and in coprolites (K. Reinhard pers. comm. 2012).

Protein residue analysis (CIEP) of the projectile point base produced a positive result for duck (AINW 2004). Waterfowl and fish remains substantiate the relative proximity of the lake during this period (C. Dove pers. comm. 2009). Still, water for washing soiled bodies was undoubtedly scarce at the site, as all water had to be carried from the lake or marsh a kilometer and more away (Jenkins et al. 2012c). Food preparation on mats or hides on the cave floor made it impossible to keep dirt, hair, feathers, and rodent feces out of the food. Evidence of these unintentional inclusions is found in human coprolites. The mass of processed pronghorn bone and hair in the Botanical Lens, and other YD deposits suggest that the Paisley Caves served as a home base for a good-sized social group during at least one successful pronghorn drive. Hides were shaved of their hair and apparently made into buckskin and leather. Recovered pieces of Leporid hide cut into narrow (2 cm) strips, sagebrush cordage, and knotted sagebrush bark strips suggest that Leporid-skin blankets and perhaps sagebrush clothing may have been produced at the site (Wheat 1967). Leporid-protein residues were extracted from utilized flakes and scrapers in the Botanical Lens and other YD deposits across the site (LAS 2011b; AINW 2010).

Cave 5

Cave 5 is ca. 11 m wide and 6 m deep (Figure 28.8). It was not investigated by Cressman, probably because it had already been vandalized. Our investigations initially avoided the vandalized central and southern interior portions of the cave from which bones of extinct animals and artifacts had

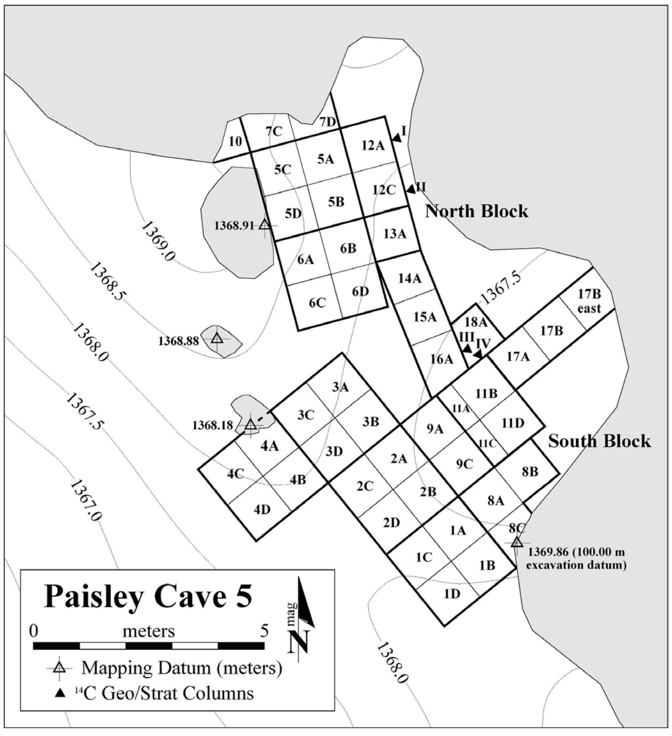


Figure 28.8 Map of Paisley Cave 5 excavations (after Jenkins et al. 2012b).

been mined, and focused instead on peripheral deposits at the dripline in the southeast end of the cave and in a small interior alcove at the northwest end of the cave (Jenkins 2007). Ultimately, excavations explored most of the cave, covering an area of 45 m^2 and removing 75.55 m^3 of sediments (Jenkins et al. 2012b). These excavations were identified as the South and North blocks.

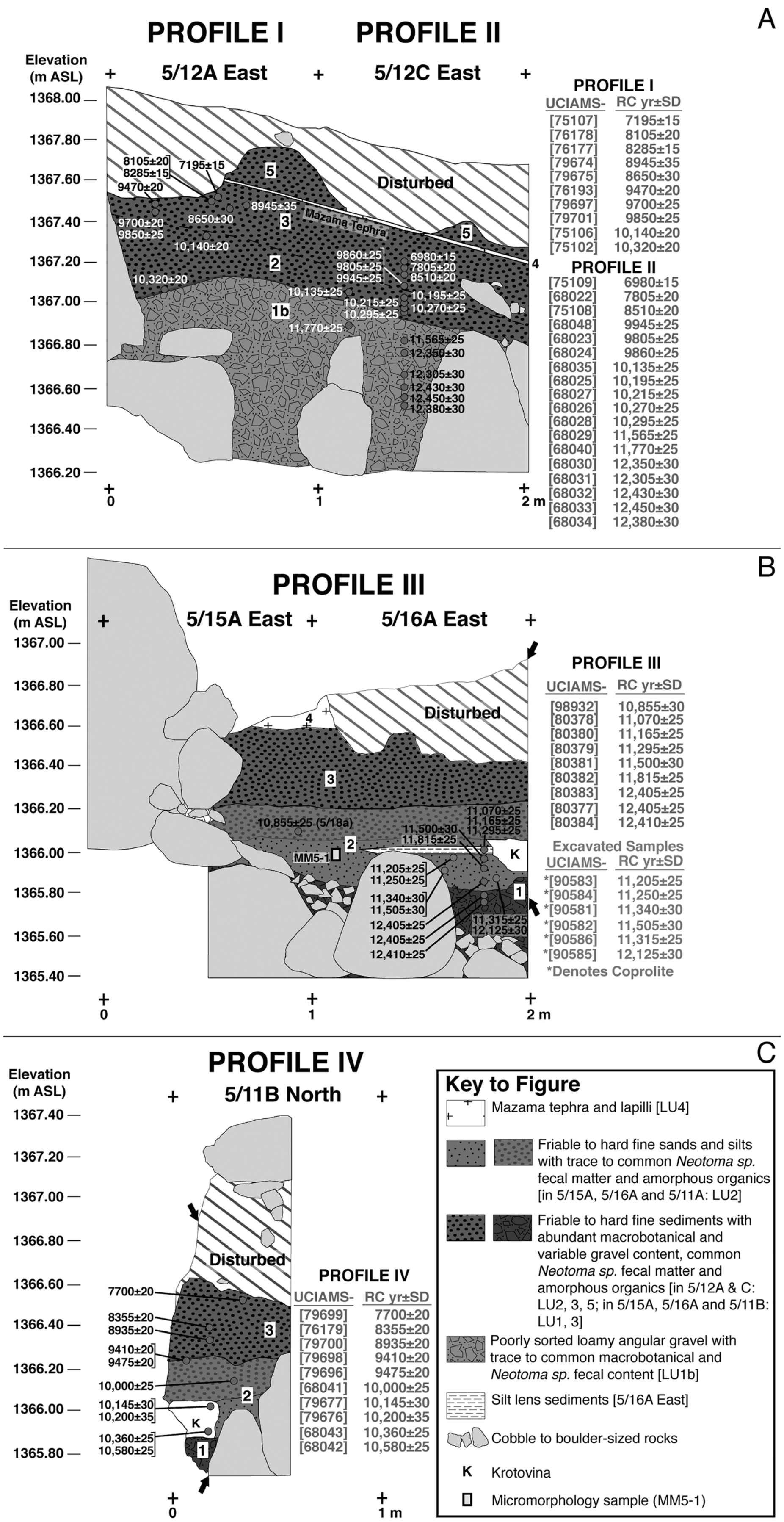
South Block The South Block—Unit 5/15A and all excavations south of it—extends from the interior slope of the vandals' spoil pile near the dripline to the back wall of the cave (Figure 28.8). The upper meter or more of deposits at the mouth of the cave were disturbed organic, gravelly sediments commonly containing sagebrush branches, coarse grass, bulrush, and cordage. This dusty mixture was underlain by 30 cm of pure-white laminated Mt. Mazama tephra. Tephra deposits rapidly thinned to the north and rear of the cave. Manos and metates were most commonly found at and just below this tephra. A small pre-Mazama hearth was dated to 7640 ± 50 BP ^{14}C yr BP (Beta-191539; 8540–8360 cal yr BP) by a single piece of sagebrush charcoal recovered in situ and weighing .5 g.

LU1 is a gray sandy gravel incorporating moderate organic debris surrounding the bottom of water-polished boulders in the floor of the cave. Above this, LU2 deposits of units 5/2, 5/8, and 5/9 near the dripline are dominated by moist alluvial silt and clay lenses interdigitating with tiny thin gravel lenses, causing serious degradation of bone and perishable artifacts. While bone preservation near the mouth of the cave was generally poor, a few large mammal bones were recovered there with a split obsidian cobble, obsidian debitage, and dispersed charcoal to the bottom of excavations, among large wave-rounded boulders, at a depth of 275 cm. The potentially Pleistocene-age charcoal has not been dated because of the lack of clear association with cultural materials and the presence of a large rodent burrow that may have caused translocation of younger charcoals downward into older sediments. However, one nondiagnostic large mammal limb medial segment (1294-PC-5/9A-28) in excellent condition was recovered with obsidian flakes from beneath a boulder in Stratum LU2 and dated to 12,290 ± 40 ^{14}C yr BP (UCIAMS-78122; 14,100–14,708 cal yr BP) and 12,290 ± 70 ^{14}C yr BP (Beta-239086; 14,100–14,750 cal yr BP). While this specimen, dated to the period of earliest human occupations, exhibits conchoidal fractures and other evidence suggesting that it may have been broken open by humans to extract bone marrow, it also exhibits clear evidence of carnivore gnawing.

Deposits farther in the interior of the cave are generally hyper-arid, resulting in the preservation of fragile organic materials including coprolites, cordage, and hair in the late-Pleistocene and early-Holocene deposits of LU2 and LU3. The contact between LU1 and LU2 is uneven owing to the wavy nature of their shared stratigraphic context. In the center of the cave, where a short trench connecting the South Block to the North Block provided a continuous stratigraphic profile across the length of the cave, units 5/11B, 5/11D, 5/15A, 5/16A, 5/17A, and 5/18A contained extremely hard deposits of finely laminated, urine-cemented sand extending vertically through LU2 and LU3 from just above the Mt. Mazama tephra lens to the top of gravels in LU1 (Figure 28.9B; Jenkins et al. 2012a:225, 2012b). These extremely consolidated deposits are predominantly sand with mascerated vegetation, twigs, and occasional rat pellets. To some degree, this cemented deposit protected the late-Pleistocene and early-Holocene cultural deposits below from vandalism.

Camelid and horse bones in this portion of the cave, all recovered in LU2, were dated between 11,810 ± 40 ^{14}C yr BP (UCIAMS-103088; 13,599–13,834 cal yr BP) and 12,410 ± 35 ^{14}C yr BP (UCIAMS-79656; 14,308–14,963 cal yr BP). Macrofossils from a camelidae coprolite, identified by DNA analysis, were dated to 12,125 ± 30 ^{14}C yr BP (UCIAMS-90585; 13,918–14,378 cal yr BP). Solutes extracted from this specimen in distilled water were dated to 11,315 ± 25 ^{14}C yr BP (UCIAMS-90586; 13,111–13,301 cal yr BP). This was the only instance of fractions differing by hundreds of years between macrofossils and their extracted solutes in 12 such proxy tests to investigate whether DNA had likely been leached from younger deposits into older coprolites (Jenkins et al. 2012a:225). This coprolite was located just below the "Indurated Silt Lens" (ISL) formed by water that briefly accumulated on the cave floor during an intense storm. Macrofossils in human coprolites 1830-PC-5/11B-31-2 and 1830-PC-5/11B-33-101, at slightly greater depths in LU2, were dated to 12,165 ± 25 ^{14}C yr BP (UCIAMS-79706; 13,974–14,418 cal yr BP) and 12,265 ± 25 ^{14}C yr BP (UCIAMS-76190; 14,079–14,595 cal yr BP). However, their solutes produced similar ages to the macrofossils of 12,050 ± 25 ^{14}C yr BP (UCIAMS-79707; 13,828–14,238 cal yr BP) and 12,260 ± 30 ^{14}C yr BP (UCIAMS-77099; 14,073–14,586 cal yr BP), respectively. Had these coprolites been exposed to the water that the camelidae coprolite was exposed to, they would also have been contaminated with younger carbon. Instead, their concordant ages indicate that the effects of water were limited spatially, stratigraphically, and in volume.

The oldest well-documented WS projectile point base (1895-PC-5/16A-24; Figure 28.10C) was found in situ, lying horizontal and solidly encased in the ISL. This projectile point was in the cave floor when the ISL formed. Profile III (Figure 28.9B), located in close proximity ~40 cm east of the WS point base, produced dates of 11,070 ± 25 ^{14}C yr BP (UCIAMS-80378; 12,864–13,054 cal yr BP) 4 cm above this point in the ISL, 11,500 ± 30 ^{14}C yr BP (UCIAMS-80381; 13,293–13,519 cal yr BP) at the same elevation but stratigraphically below it, since the lens was moderately sloped down to the west, and 11,815 ± 25 ^{14}C yr BP (UCIAMS-80382; 13,604–13,839 cal yr BP) 4 cm lower yet. Projectile point 1895-PC-5/16A-24 is stratigraphically and chronologically most proximal to the 11,070 ± 30 ^{14}C yr BP (13,293–13,519 cal yr BP) sample. Human coprolite 1895-PC-5/16A-24-7, dated to 11,205 ± 25 ^{14}C yr BP (UCIAMS-90583; 13,010–13,210 cal yr BP) was recovered ex situ in the same excavation unit, 5-cm level, and stratum with the in situ WS point (1895-PC-



PROFILE I

UCIAMS-	RC yr±SD
[75107]	7195±15
[76178]	8105±20
[76177]	8285±15
[79674]	8945±35
[79675]	8650±30
[76193]	9470±20
[79697]	9700±25
[79701]	9850±25
[75106]	10,140±20
[75102]	10,320±20

PROFILE II

UCIAMS-	RC yr±SD
[75109]	6980±15
[68022]	7805±20
[75108]	8510±20
[68048]	9945±25
[68023]	9805±25
[68024]	9860±25
[68035]	10,135±25
[68025]	10,195±25
[68027]	10,215±25
[68026]	10,270±25
[68028]	10,295±25
[68029]	11,565±25
[68040]	11,770±25
[68030]	12,350±30
[68031]	12,305±30
[68032]	12,430±30
[68033]	12,450±30
[68034]	12,380±30

PROFILE III

UCIAMS-	RC yr±SD
[98932]	10,855±30
[80378]	11,070±25
[80380]	11,165±25
[80379]	11,295±25
[80381]	11,500±30
[80382]	11,815±25
[80383]	12,405±25
[80377]	12,405±25
[80384]	12,410±25

Excavated Samples

UCIAMS-	RC yr±SD
*[90583]	11,205±25
*[90584]	11,250±25
*[90581]	11,340±30
*[90582]	11,505±30
*[90586]	11,315±25
*[90585]	12,125±30

*Denotes Coprolite

PROFILE IV

UCIAMS-	RC yr±SD
[79699]	7700±20
[76179]	8355±20
[79700]	8935±20
[79698]	9410±20
[79696]	9475±20
[68041]	10,000±25
[79677]	10,145±30
[79676]	10,200±35
[68043]	10,360±25
[68042]	10,580±25

Figure 28.9 Dating column profiles: **A**, III (excavation Unit 5/16A); **B**, IV (excavation Unit 5/11B) (after Jenkins et al. 2012a).

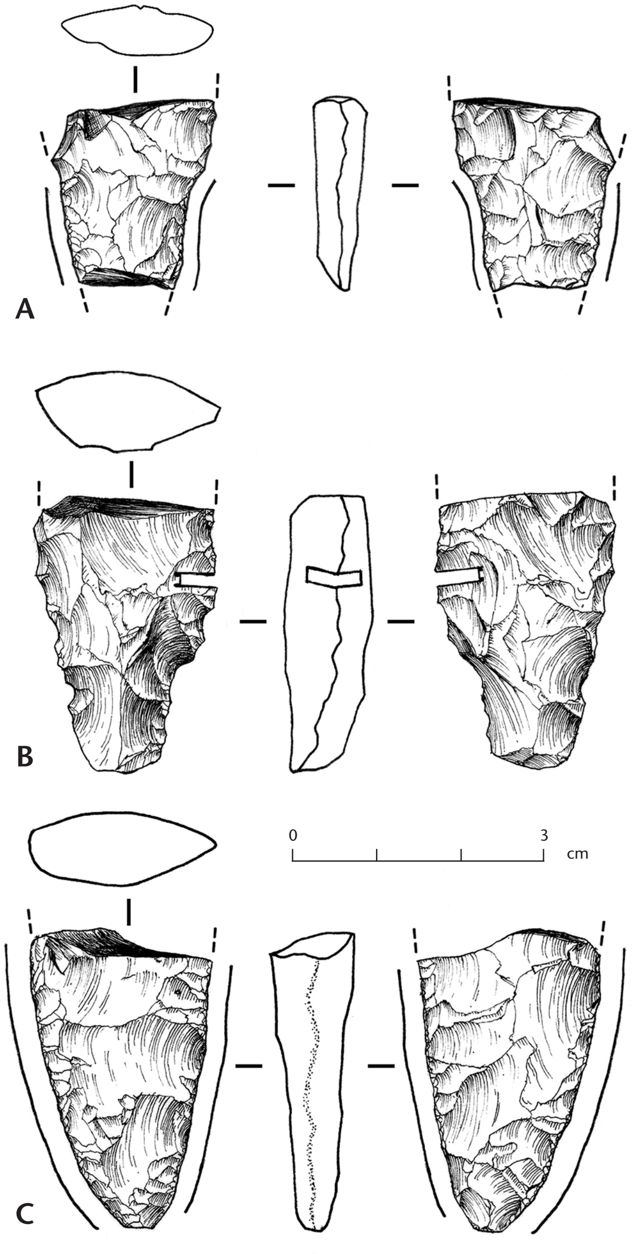


Figure 28.10 Western Stemmed projectile points recovered from Cave 5.

5/16A-24). A second human coprolite (1895-PC-5/16A-25-16) was recovered in situ 9 cm below the projectile point in LU2 and dated 11,340 ± 30 ^{14}C yr BP (UCIAMS-90581; 13,124–13,331 cal yr BP). Human DNA (founding haplogroup A) was extracted in blind tests—initiated at the University of Copenhagen and independently replicated at York University—from specimen 1895-PC-5/16A-24-7, the 11,205 ± 25 ^{14}C yr BP coprolite. Dated twice each, these coprolites produced solute ages of 11,250 ± 25 ^{14}C yr BP (UCIAMS-90584; 13,072–13,237 cal yr BP) and 11,505 ± 30 ^{14}C yr BP (UCIAMS-90582; 13,298–13,522 cal yr BP), respectively. These coprolites are most reasonably associated with the WST (Jenkins et al. 2012a, b).

The ISL is 3–5 cm thick and bears a distinctive grayish color that confirms its correlation between the wall profile and surface appearance on the floor of Unit 5/16A. This grayish color is evident in the photo of profile 5/16A (Figure 28.11A) and is also seen in the plan-view photo of the ISL surface prior to its excavation (Figure 28.11B). The ISL contained the 11,070 ± 25 ^{14}C yr BP dated sagebrush twig. Although silt-size particles are a common sedimentary constituent of nearly all Paisley Caves lithostratigraphic units, silt-dominated units are rare. Apart from the ISL, these other silt-dominated layers are limited to spatially restricted ($\leq$ 30 cm across) brown-colored, extremely thin (< 1 cm) laminae. Thus the ISL can be readily discerned from other silt-dominated laminae on the basis of its color, thickness, and spatial extent (nearly 100 cm across, from east to west). The relative stratigraphic position of the ISL can be accurately reconstructed from these different views (Figure 28.11A–C). Notably, the ISL is contained in the lower half of LU2, which is divided into two internal deposits (Figure 28.11C). The upper half of LU2 retains a reddish brown hue owing to an increase in organic matter. In Figure 28.11B, the intersection of the ISL with the 5/16A East profile is clearly evident a few centimeters below the lower limit of the reddish brown LU2 sediments. This exact stratigraphic arrangement is seen in Figures 28.11A and 28.11C. From these facts we understand the relative stratigraphic position and temporal context of the ISL, the WS points, and coprolites in Unit 5/16A.

Radiocarbon dating of 2 columns (Profiles III and IV) was accomplished by 19 geostratigraphic samples (single *Artemisia* sp., *Atriplex* sp., and *Ericaceae* sp. twigs and charcoal, bones, teeth, and sediments) collected by Stafford with high-precision provenience control (3-dimensional precision of ± 5 mm). These samples provided materials for directly dating strata and assessing time-averaging, the degree of vertical dislocation, and the degree of molecular translocation related to DNA study of coprolites and sediments. The results revealed well-stratified, highly indurated sandy sediments (LU2 and LU3) underlain by gravelly LU1 deposits. Radiocarbon dates from below the Mt. Mazama tephra begin at 7700 ± 20 ^{14}C yr BP (UCIAMS-79699; 8450–8520 cal yr BP) and continue in excellent chronological order to 12,410 ± 25 ^{14}C yr BP (UCIAMS-80384; 14,312–14,960 cal yr BP; Jenkins et al. 2012a:225, b). Although rodent disturbance is documented in late Pleistocene and early Holocene deposits in the South Block, the stratigraphy remains essentially intact.

North Block North Block excavations were conducted in two phases. The 2002/2003 excavations were conducted in predominantly undisturbed sediments located in the small antechamber between a large boulder at the mouth of the cave near the north wall and the rear east wall. The 2007/2009 excavations continued the block excavation, expanding to the north and southeast along the rear wall of the cave (Jenkins 2007; Gilbert et al. 2008b). Indurated rodent feces covering the surface of the antechamber behind the boulder gave clear evidence of the undisturbed nature of the deposits preserved there prior to the first UO excavations. A shallow vandal's trench had been dug along the rear

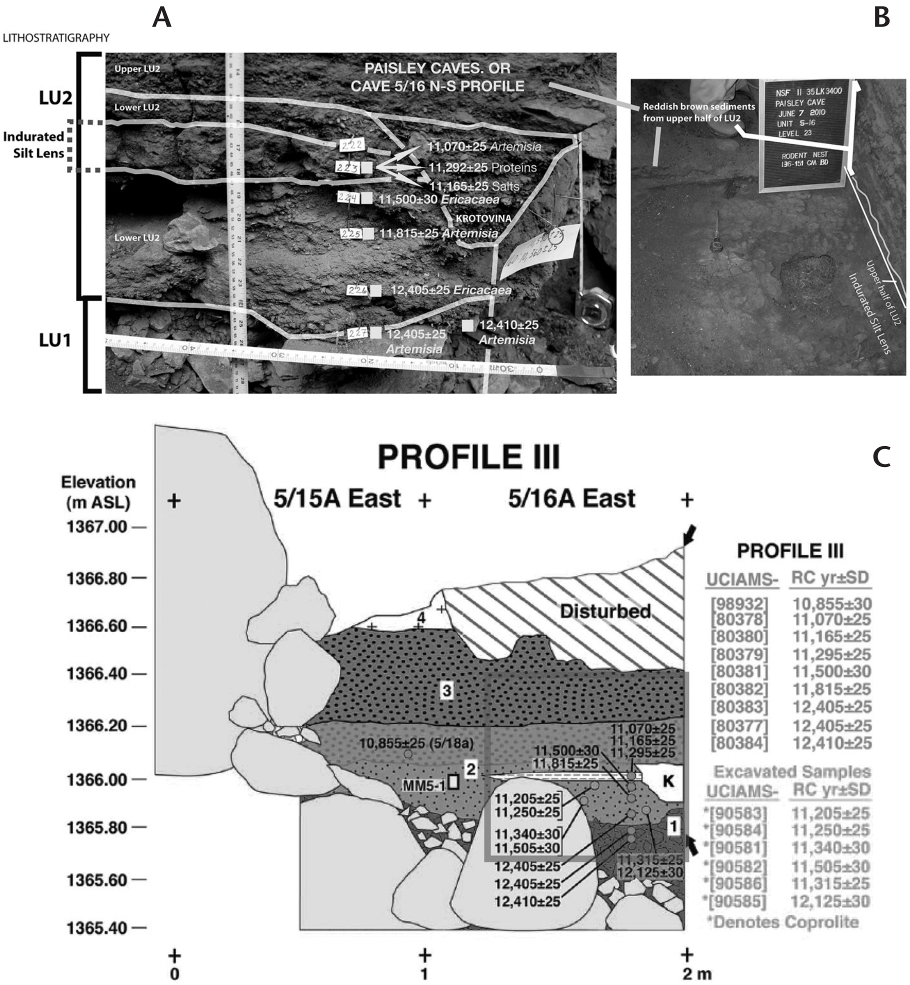


Figure 28.11 Stratigraphic correlation of the Indurated Silt Lens (ISL) with dating column III in excavation Unit 5/16A.

wall of the cave. Excavations were initially established at the base of the boulder to avoid the vandal's trench as much as possible (Figure 28.8). These early excavations revealed a series of very thin (1–3 cm) lamina of alternating fine-silty/coarse-rat-pellet deposits. Excavations reached depths 200–300 cm below the datum set in the large boulder.

The 2007/2009 excavations provided important evidence of site-formation processes involving woodrat midden alterations that influenced the rate of sedimentary accumulation within the North Block. Units 5/5A, 5/5B, 5/7D, 5/12A, and 5/12C exposed amorphous fine powdery ashes representing burning of woodrat nest materials in place—sometimes by humans—and in the floor of the cave due to smoldering fires. Woodrats are not prolific excavators (Verts and Carraway 2002). Their nests are built above ground in protected rocky areas along the walls of caves and in crevices, where tunnels through branches, cactus needles, and other debris collected from within a 50-m radius provide routes of escape from predators. Predators in pursuit of the rats occasionally dug through these nests, scattering the midden debris across the floor of the cave. Survivors of the assaults reassembled their nests from the resulting debris within a few days of the attack. However, detritus too small to be of interest to them often covered larger debris, particularly in spaces between boulders on the floor of the cave. The deposits are stratigraphically and chronologically well ordered (youngest at top, oldest below). Particular sections represent "snap shots in time" that record a particular destruction of the woodrat nest by carnivores (Jenkins et al. 2012a,b). Humans setting fire to woodrat nests drove the rats out so they could be dispatched by hunters. This resulted in mounds of fine powdery ash along the cave walls. These ash mounds then "flowed" downslope across the floor of the cave, moved by gravity, wind, and foot traffic of inhabitants. This process resulted in the gradual admixture to the ash of uncharred items that could not have been in situ when the nest burned.

To investigate whether excavations by rodents destroyed the stratigraphic integrity of the deposits, we dated two columnar profiles (Figure 28.9A). The dates in each column are stratigraphically and chronologically well ordered. Beginning just below the Mt. Mazama tephra, the ages in Profiles I and II range from 6980 ± 15 (UCIAMS-75109; 7803–7840 cal yr BP) to 12,450 ± 30 ^{14}C yr BP (UCIAMS-68033; 14,423–15,027 cal yr BP). A WS projectile point (Figure 28.10B), a biface, a polished handstone from which horse protein was extracted (Figure 28.5A), and 8 pieces of lithic debitage were recovered from LU1 and LU2 deposits. Projectile point 1294-PC-5/6D-47-1 was recovered ex situ from sifted LU2 (LU1a in Jenkins 2007) sediments in excavation Unit 5/6D (Figure 28.10B). Its stratigraphic position relative to calculated rates of sedimentary accumulation suggest that it may date between 12,910–13,600 cal yr BP (Jenkins et al. 2012a:224, b:15). Obsidian and CCS debitage was recovered as much as 15 cm below this projectile point.

Feature 5/3, a possible hearth roughly 60 cm in diameter and 20 cm deep, was located adjacent to the cave wall in units 5/5A and 5/7D (Jenkins 2007). Located at an elevation of 1366.96, it had a deep bowl shape and a lining of charred rocks at the base of the depression. Charred rat pellets and twigs surrounded the sides and base of the feature, but did not cover it, suggesting that the feature burned while the top of the depression was exposed to the atmosphere. Large mammal bones are seldom encountered in noncultural deposits. Those found near this feature included a charred horse phalanx, several non-diagnostic large-mammal bone splinters, and a charred large-bird bone. Cultural remains recovered nearby include an obsidian flake and cordage of hair and fiber. This feature remains undated because the charcoal in it may not reflect cultural activity. The cordage may or may not provide reliable dates associated with the feature. Dating this feature is not a simple matter because the natural production of charcoal in this area complicates interpreting any dating results (Jenkins 2007; Jenkins et al. 2012b).

A cluster of camel and horse bones was encountered in a feature named the Bone Pit. This garbage pit was located in Unit 5/5B beneath a large stone slab with a top elevation at 1366.96. A second slab appeared to have been propped up against a boulder next to the Bone Pit. Inside the Bone Pit were seven faunal elements (camel, horse, and mountain sheep bone, and a horse hoof) identifiable to genus, and in some cases species (Jenkins 2007:69). A horse phalanx recovered next to the capping stone above the pit was dated four times, producing a standard AMS date of 11,130 ± 40 ^{14}C yr BP (Beta-185942; 12,910–13,156 cal yr BP), an AMS date pretreated by Stafford of 11,365 ± 35 ^{14}C yr BP (UCIAMS-79665; 13,141–13,369 cal yr BP), and ultrafiltration and XAD AMS dates of 11,420 ± 35 ^{14}C yr BP (UCI-78159; 13,204–13,447 cal yr BP) and 11,435 ± 35 ^{14}C yr BP (UCI-78117; 13,233–13,467 cal yr BP), respectively, processed by Culleton and Kennett. The three older dates are accepted. This is the youngest dated horse or camelid specimen in the collections.

An astragalus of camel (*Camelops hesternus*) from just below the slab in the pit was dated to 12,300 ± 40 ^{14}C yr BP (Beta-172663; 14,110–14,746 cal yr BP) and a mountain sheep mandible with a cutmark dated to 12,380 ± 70 ^{14}C yr BP (Beta-239087; 14,248–14,933 cal yr BP). A human coprolite from this feature dates to 12,400 ± 60 ^{14}C yr BP (Beta-213424; 14,280–14,958 cal yr BP) and 12,275 ± 55 ^{14}C yr BP (OxA-16498; 14,084–14,670 cal yr BP). Probable human hair (very damaged) was also recovered from the pit (B. Yates pers. comm. 2012). Human coprolite 1294-PC-5/6B-50, identified by human DNA, human hair, and human proteins (Cummings et al. 2007; Gilbert et al. 2008a, b; LAS 2007), was recovered with one CCS and 2 obsidian flakes from adjacent Unit 5/6B in the same stratum and dated to 12,140 ± 70 (OxA-16495; 13,928–14,414 cal yr BP) and 12,260 ± 60 (Beta-216474; 14,069–14,622 cal yr BP).

A cluster of 6 camel and horse bones was encountered in a crevice between a large boulder and the north cliff wall in units 5/7C and 5/10D. The camel bones in particular show excellent preservation, including dried blood and fatty tissues, although one has clearly been chewed on by rodents. These remains could well reflect woodrat accumulations (Jenkins 2007:66).

Finally, 3 camel and 2 horse bones have been identified from units 5/12A and 5/12C. One of these, a camelid calcaneum, was dated to 11,795 ± 30 ^{14}C yr BP (UCIAMS-79657; 13,588–13,799 cal yr BP). Human coprolite 1830-PC-5/12A-23-101, dated to 11,190 ± 30 ^{14}C yr BP (UCIAMS-77102; 12,992–13,203 cal yr BP), and a woody tree growth dated to 11,370 ± 25 ^{14}C yr BP (UCIAMS-68021; 13,145–13,372 cal yr BP) were recovered from the same excavation unit (5/12A), level (23), and stratum (LU2).

1830-PC-5/12C-24-1 is a saw-toothed bear (Ursidae) bone artifact (Figure 28.12A) dated to 12,195 ± 30 ^{14}C yr BP (UCIAMS-68017; 14,007–14,448 cal yr BP). Neither use-wear polish nor striations are visible on the heat-checked surface of this specimen. However, the beveled edges of the triangular "teeth" distinguish it from broken, unmodified saw-toothed specimens (Figure 28.12B). The broken pieces have teeth of varying size and spacing. The breaks follow natural fissures in the bone that extend beyond the teeth (indicated by the arrows) and the edges are very sharp (ca. 90°). The artifact, on the other hand, has teeth that are notably uniform in size and spacing, there is no evidence of fissures extending into the bone beyond the base of the serrations, and the edges of the serrations have all been notably beveled.

Human coprolite 1294-PC-5/7C-31, dated to 12,290 ± 60 ^{14}C yr BP (Beta-213426; 14,097–14,737 cal yr BP) and 12,345 ± 55 ^{14}C yr BP (OxA-16497-239087; 14,185–14,865 cal yr BP), was found with polished handstone 1294-PC-5/7C-31-2 (Figure 28.5A), from which horse protein was extracted by the CIEP method, in LU2. The coprolite contained

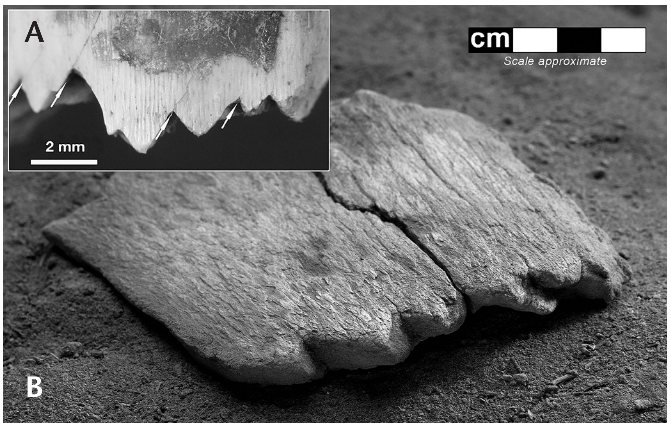


Figure 28.12 Culturally modified bear bone compared with naturally modified artiodactyl bone.

9000 Apiaceae pollen per cc, suggesting possible consumption of a meal of *Lomatium*, and one starch grain most likely representing grass seed. Pollen grains of other edible plants were represented in this coprolite, as well (Cummings et al. 2007).

Discussion

Elements of extinct Rancholabrean megafauna were found scattered in strata LU1 and LU2 across the floors of Caves 2 and 5, and are documented for Cave 3(4) (Cressman 1940). The majority of identifiable elements were foot and toe bones including horse phalanx, maxilla, tooth, calcaneus, carpal, navicular, metapodial, and hoof. Camelid elements include phalanx, astragalus, mandible, pisiform, vertebra, patella, navicular, calcaneus, and carpal. These elements would be common in natural predator accumulations (Hockett and Dilligham 2004; Straus 1982). Long bones, regardless of age (Pleistocene or Holocene) or whether they exhibit evidence for carnivore gnawing or tongue polish, had been broken into small fragments suggesting marrow extraction. Virtually all large carnivores, including humans and domesticated dogs, break long bones to extract marrow. Differing mechanisms by which this process occurs result in distinctive patterns of damage to the bone (Miller 1979; O'Connor 2000). Occasionally megafauna remains exhibit spiral green fractures and conchoidal impact depressions suggestive of humans smashing them with handstones (Barnosky et al. 2004; O'Connor 2000:43). Bone masticated by large carnivores chewing with their molars and canines exhibits distinctive U-shaped grooving on the chewed ends from which the bone is systematically reduced, and surfaces exhibit tongue polish. Smaller mammals chew on bones with chisel-like front teeth, leaving smaller, more symmetrical parallel grooves transverse to edges and ridges of bone. Some of the large-mammal remains in the Pleistocene deposits have been chewed by large carnivores. Most of the bones exhibit some weathering ranging from moderate to extreme degrees of checking, while others were clearly buried while they still had blood, fat, and cartilage attached to them (all stages of weathering as defined by Behrensmeyer 1978). In sum, the taphonomic evidence suggests that Rancholabrean megafaunal accumulations were likely the product of both natural and cultural processes.

Distributional analysis within and across strata shows that when megafaunal remains are present, so are artifacts; when they are absent there are seldom artifacts (Jenkins 2007; Jenkins et al. 2010; McDonough et al. 2012). Megafaunal remains tend to be concentrated along the walls of the caves, where many were incorporated in woodrat nests and some may have been tossed or moved aside by human activity. However, the Bone Pit was likely a cultural feature intentionally filled with megafaunal and cultural remains, then covered with a large stone slab. Human coprolites—identified by DNA, hair, and protein—the same age as the megafaunal remains were found in and around this pit (Jenkins et al. 2012b:Table S1). Their cultural association is supported by directly dated culturally modified bones and by CIEP identification of extinct megafaunal proteins on handstones and edge-modified flakes in Pleistocene strata.

Radiocarbon Dating

Radiocarbon dating of cultural features, identified wood and charcoal, human coprolites, animal feces, artifacts, bones, and sediments provide 203 ^{14}C dates spanning some 16,000 calibrated years (Table 28.1). These dates represent sporadic archaeological investigations at the Paisley Caves spanning some 74 years (1938–2012). Consequently, they provide varying levels of contextual confidence. The most reliable are 157 dates that have been processed by Stafford since 2009. These samples are predominantly in situ macroflora, bones and teeth, and sediments collected with high precision (2 mm) provenience. Many also result from dating different chemical fractions and fossil constituents to assess geochemical mass balances and age heterogeneity within coprolites and strata (Jenkins et al. 2012a, b). The dating results obtained by Stafford on geostratigraphic samples clearly indicate that, other than disturbances noted, the cultural deposits in the Paisley Caves are well stratified, retaining their original structure. Rodent tunnels were detected in the key Pleistocene and early Holocene (LU1 and LU2) sediments. The use of meticulous excavation methods, rigorous geoarchaeological and geochemical techniques, the conformable radiocarbon dates, and the corresponding radiocarbon dates obtained from human coprolites and paleontological specimens in the same excavations give confidence that the deposits are not churned up.

Poinar et al. (2009) questioned whether human DNA leached from younger overlying strata by water could have been carried into older, underlying deposits to contaminate nonhuman coprolites. We initially addressed this question by testing sediment around the coprolites, as well as woodrat pellets, for human ancient DNA. No human DNA was detected. Woodrat DNA was extracted from fecal pellets, and Golden-mantled ground squirrel (*Callospermophilus lateralis*) DNA was obtained from rodent bones near the coprolites, demonstrating that endogenous DNA survives when encapsulated, and the DNA extraction techniques were producing reliable results (Gilbert et al. 2008a, b). Further tests were recently undertaken to investigate for potential leaching of modern or aDNA by attempting to extract human DNA from dry woodrat urine and fecal pellets, and pronghorn and mountain sheep fecal pellets. Again, no human DNA was detected (Jenkins et al. 2012a, b).

Another method of testing for DNA translocation involved 26 ^{14}C measurements on paired macrofossils and water-soluble fractions obtained from 9 coprolites and 3 1-cm-thick sediment samples. Water that could have leached human DNA from younger coprolites or dried urine in overlying strata should also contain younger carbons leached from woodrat urea in those younger sediments. As DNA molecules entered older coprolites in this water, the younger carbon would also enter the coprolites. Solutes younger than macrofossils from the same coprolite would indicate potential DNA contamination from younger overlying strata (Jenkins et al. 2012b: Table 9). However, in 7 of 8 human coprolites, paired fractions had statistically similar ages. Solutes of the 8th coprolite were 165 ^{14}C yr older than macrofossils, a product of deposition in the preexisting environment. Finally, a camelid coprolite recovered immediately below a water-laid silt lens contains solutes that are 810 ^{14}C yr younger than the macrofossils. This specimen clearly indicates the method of testing for translocated carbon in coprolites was valid. The results are entirely comprehensible and provide little (only one specimen equaling 8% of the samples) support for the DNA leaching theory (Jenkins et al. 2012a, b).

Radiocarbon data, stratigraphic thin-section analysis, mummified macrofossils, coprolites, perishable artifacts, and struvite accumulations are all evidence that the Paisley Caves did not generally experience significant wetting events that could transport DNA into older strata. While water did occasionally enter the caves during excessively violent storms and briefly wetted the floors, multiple forms of evidence and tests for DNA contamination indicate leaching is not a good explanation for the presence of human DNA in pre-Clovis coprolites (Jenkins et al. 2012a).

Radiocarbon dating of human coprolites, cultural materials, and paleontological specimens indicates multiple phases of late-Pleistocene human occupations occurred at the site (Figure 28.13). Analyses of human DNA, protein residue, FTIR data, pollen, starch, and phytolith demonstrate the coprolites are human. Five of the coprolites date between 14,865 and 13,930 cal yr BP, overlapping chronologically with camelid and horse remains. A second cluster of human coprolites dates between 13,630 and 12,800 cal yr BP, beginning some 500 years before Clovis and continuing throughout this period. Interestingly, while there are many dated artifacts from the YD, there are few dated human coprolites from this period. This is mostly an artifact of sampling, but may also indicate that with more frequent human occupations latrine behavior may have necessarily been more regimented.

DNA Extraction and PCR Amplification

Full explanations of the ancient DNA investigations are available in Gilbert et al. (2008b) and Jenkins et al. (2012b) and will not be repeated here. Briefly, all initial DNA extraction and PCR set-ups were performed in a dedicated ancient DNA facility in Copenhagen. DNA was extracted from all coprolite and soil samples according to the protocols described by Willerslev et al. (2003). Between 0.1 and 0.5 g of coprolite or soil was used per sample. DNA from coprolites and soil was subsequently amplified using six primer pairs, five of them flanking mitochondrial SNPs characteristic of the five Native American mitochondrial haplogroups A, B, C, D, and X, and one general mammalian primer pair that targets a small fragment of the 16S ribosomal RNA. Selected specimens (human and non-human) were then sent to the Max Planck Institute in Leipzig, Germany; Uppsala University, Sweden; University of York, U. K.; and Washington State University, U.S.A. as blind tests (Table 28.2).

Conclusions

Arguably, the most important archaeological evidence at the Paisley Caves is the direct high-precision radiocarbon dating of single identifiable elements from human coprolites predating the Clovis era (Gilbert et al. 2008a, b) (Table 28.1). The authenticity of the human coprolites is well established by blind-test replication of DNA results at multiple independent laboratories (Gilbert et al. 2008a, b; Gilbert et al. 2009; Jenkins et al. 2012a, b; Rasmussen et al. 2009). Extensive testing has resulted in little support for the DNA leaching hypothesis (Goldberg et al. 2009; Poinar et al. 2009). Stratigraphic thin sections indicate water only wetted cave floors to a limited degree and has seldom percolated downward through hyper-arid deposits. Human DNA is not randomly distributed in the sediments and has not been found in clearly non-human feces. The DNA leaching hypothesis is inadequate to explain the occurrence of human DNA in pre-Clovis and Clovis era coprolites. Rapid accumulation of cave sediments (1 cm per 44–80 years) insures that any direct contamination by later fecal matter or urine would have occurred within ca. 240 years, not thousands of years. The stratigraphic integrity of the deposits, chronostratigraphic associations of late-Pleistocene coprolites, and the contextual reliability of artifacts associated with them has been established by multiple series of internally consistent high-precision AMS dates on single items. Many of these items were recovered with 2-mm accuracy from recorded stratigraphy, taxonomically identified when possible, and the evidence presented in peer-reviewed publications (Jenkins et al. 2012a, b; Gilbert et al. 2008a, b). Multidisciplinary investigations at the Paisley Caves meet all the criteria established by Roosevelt et al. (2002:164) and C. V. Haynes (1964, 1992) for dating and validating Paleoindian human occupations.

The Paisley Caves were occupied multiple times during the late Pleistocene (Figure 28.13). Megafaunal remains (horse bones and protein residues, Camelidae bones and DNA, American lion hair and DNA, proboscidean protein residues) are stratigraphically, chronologically, and behaviorally associated with coprolites and artifacts in well-established stratigraphic contexts. Rancholabrean fauna were common during the first phase of these occupations (ca. 14,500–13,900 cal yr BP) and, while they overlapped the second period of occupation, have not been locally dated as late as the Clovis era (ca. 13,100–12,800 cal yr BP) to this point.

Given the age of human coprolites in the Paisley Caves and the presence of other WST and Clovis sites purportedly dating between 16,000 and 13,000 cal yr BP (13,200 to ca. 11,000 ^{14}C yr BP) in the region nearby (Bedwell 1973; Willig 1988, 1989; Wingard 2001:584; O'Grady et al. 2008; Willig et al. 1988), it is puzzling that evidence of human association with extinct fauna is practically non-existent. Jennings (1986:115) noted a quarter of a century ago that there did not exist anywhere in the Great Basin irrefutable evidence of the exploitation of Pleistocene megafauna by human populations, despite repeated claims to the contrary (Bryan 1979:244; Cressman 1966:41, 1986:122; Orr 1956; Shutler

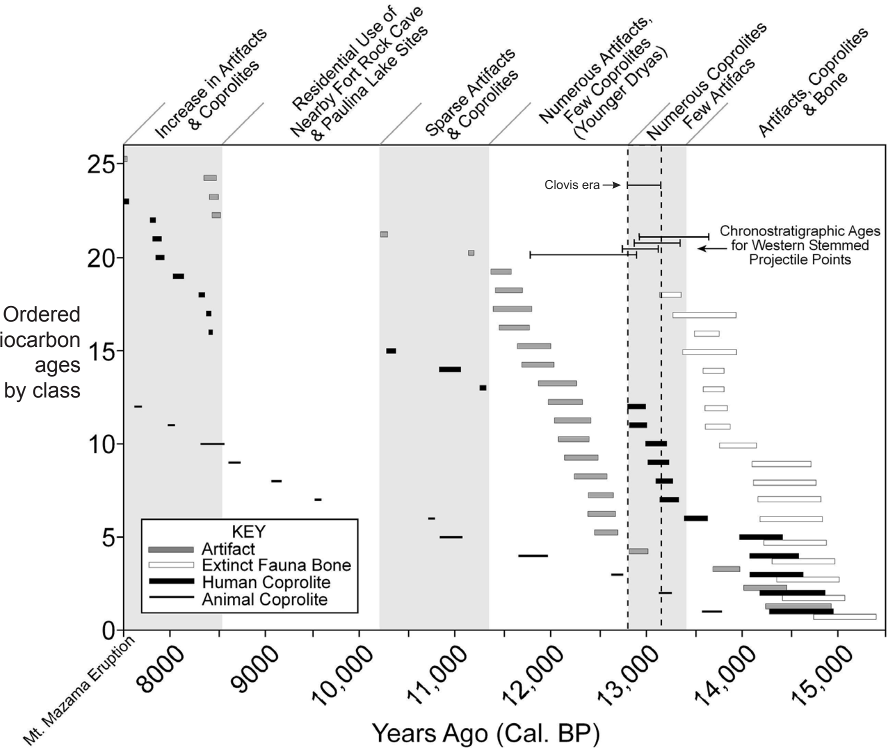


Figure 28.13 Graph showing human and animal coprolite, paleontological, and artifact radiocarbon dates.

1967; Harrington and Simpson 1961). There is no practical reason that late-Pleistocene hunters would have avoided megafauna. Evidence that humans exploited Rancholabrean megafauna in the Great Basin may be rare because the survival of kill sites was extremely rare. G. Haynes (1999, 2002), studying modern elephant hunting-related mortality and the resulting record, notes that though elephant kills are well documented in Africa, very few ancient "kill sites" have been found there. Considering his findings and the dynamic Pleistocene-Holocene landscape of the Great Basin, the paucity of kill sites in this region should not surprise us.

In Oregon, Minor and Spencer (1977) reported excavation of a *Camelops hesternus* skeleton eroding from an "island" of resistant lakebed on the edge of Fossil Lake in the Fort Rock Basin some 60 km north of the Paisley Caves and roughly 40 km west-northwest of the Dietz Clovis/WST site. Three fragments of a WS projectile point—showing fractures typical of impact on bone in flesh—were found among the bones in near-surface deposits with a fragment of another projectile-point base. An obsidian flake was found in the same stratum (Stratum 16) below the bones as the pedestals were removed and the sediments screened. Neither artifacts nor bones were recovered from overlying Stratum 17 or underlying Stratum 15. Other WST points and artifacts were recovered by surface collections in the site nearby. The authors concluded the site likely represented a camelid-kill location, most likely dated between 11,000 and 12,980 ^{14}C yr BP (Minor and Spencer 1977: 32). Attempts to radiocarbon date the camelid bones produced 2 unbelievably young ages near 10,000 ^{14}C yr BP; a third attempt failed to recover datable collagen at the pretreatment stage. The camelid kill site essentially remains undated and has apparently been entirely eroded away in the decades since the investigation. Similarly, a single camelid bone was recovered from the Dietz Clovis/WST site in contextually unreliable near-surface deposits (Aikens et al. 2011:55). The same was true of proboscidean remains found eroding from marsh deposits that contained beveled bone rods, a fluted point, and other cultural and paleontological remains in Lower Klamath Lake (Cressman 1940).

Where are other pre-Clovis Great Basin sites to be found? Small bands of highly mobile hunter-gatherers generally left thin scatters of debitage, a few multifunctional tools such as bifaces and scrapers, and perishables that rapidly deteriorated in open settings. The highly mobile lifestyle that exemplified the earliest colonists served to lessen the quantity and quality of evidence they left behind (Madsen 2004). Cultural assemblages from the earliest components of the few cave sites archaeologically investigated are small, and the lithic assemblages are often composed of non-diagnostic edge-modified flakes, scrapers, and expedient tools (cf. Bedwell 1973:144; Jenkins et al. 2012a, b, for examples). Associated projectile points, when they exist, are narrow, unfluted WST lanceolate and foliate points. The combination of these characteristics assures that the earliest cultural assemblages in the Great Basin look like WST assemblages known to have continued long after the brief Clovis era (Goebel and Keene in press; Willig et al. 1988). WST assemblages like those vandalized from Cougar Mountain Cave could easily contain mixed YD, Clovis-era, and earlier artifacts (Cowles 1960).

The concept that WST could be substantially older than the normative 8000- to 12,700-year time span attributed to it is not new. It was most elegantly made by Bryan (1980; Bryan

Table 28.2 Results of coprolite DNA studies at the Paisley Caves. Locality details, radiocarbon dates and numbers, where available, are listed.

Specimen	Taxon	MtDNA haplogroup	Radiocarbon age	Radiocarbon Lab number
1294-PC-5/7D-4	*Canis latrans*	B2[2]	1308 ± 28	OxA-16377
1374-PC-1/2A-28		B2[2]	6640 ± 40 6608 ± 35	Beta-213428 OxA-16496
1294-PC-5/6B-40	*C. lupus/familiaris*	B2[2]	10,050 ± 50 10,950 ± 50	Beta-213423 OxA-16376
1294-PC-5/6B-50	*Vulpes vulpes*	A2[2]	12,260 ± 60 12,140 ± 70	Beta-216474 OxA-16470
1294-PC-5/7C-31		B[3]	12,290 ± 60 12,345 ± 55	Beta-213426 OxA-16497
1374-PC-5/5D-31		B2[2]	12,400 ± 60 12,275 ± 55	Beta-213424 OxA-16498
1704-PC-5/12A-17-9				
1704-PC-5/12A-17-8				
1704-PC-5/12C-13-5	*Lynx rufus*†		5545 ± 20	UCIAMS-79708
1704-PC-5/12C-14-9	*Homo sapiens*	A	6970 ± 15	UCIAMS-76180
1704-PC-5/12C-14-10				
1704-PC-5/12A-16-8				
1704-PC-5/12C-14-7				
1704-PC-5/12A-16-10	*Homo sapiens*	A	9585 ± 20	UCIAMS-76181
1704-PC-5/12A-12-5	*Homo sapiens*	A[1]	6155 ± 15	UCIAMS-79709
1704-PC-5/12C-15-6	*Homo sapiens*	A[2]	5750 ± 15	UCIAMS-76182
1704-PC-5/12A-14-5				
1704-PC-5/12A-18-4				
1704-PC-5/12A-17-11				
1704-PC-5/12A-18-5				
1704-PC-5/12A-16-9	*Homo sapiens*	A	9170 ± 20	UCIAMS-76183
1704-PC-5/12C-14-WC	*Homo sapiens*	A[1]		
1704-PC-5/12C-13-4	*Lynx rufus*		5380 ± 15	UCIAMS-79715
1704-PC-5/12C-15-4	*Homo sapiens*	B	5740 ± 15	UCIAMS-76184
1704-PC-5/12C-12-6	*Homo sapiens*	A[1]	5595 ± 15	UCIAMS-79702
1704-PC-5/12A-17-7				
1704-PC-5/12C-15-5	*Homo sapiens*	B	6115 ± 15	UCIAMS-76185
1704-PC-5/12C-13-6	*Homo sapiens*	A[1]	4950 ± 15	UCIAMS-79710
1704-PC-5/12C-14-6	*Homo sapiens*	A	5715 ± 15	UCIAMS-76186
1704-PC-5/12A-10-11			5770 ± 15	UCIAMS-76187
PC 2/4 L33 1	*Homo sapiens*	A	7595 ± 15	UCIAMS-76188
PC 5/12-C-19				
PC 5/12-C-20				
PC 5/12-A-21 1				
PC 5/13-A-18				
PC 2/6-C- L33				
PC 2/6-A-21 1				
PC 2/6- A- 15				
PC 2/4-A-35	*Homo sapiens*	A	7020 ± 15	UCIAMS-76189
PC 2/4- C-34	*Homo sapiens*	A	7490 ± 20	UCIAMS-79704
PC 2/4-D-33	*Homo sapiens*	A	7645 ± 20	UCIAMS-79712
PC 2/4-D-33 2	*Homo sapiens*	A	7025 ± 15	UCIAMS-79713
PC 2/6-20-A				
PC 2/6-A-16 1	*Homo sapiens*	A	2295 ± 15	UCIAMS-79714
PC 5/11B-33	*Homo sapiens*	A[1,2]	12,165 ± 25	UCIAMS-79706
PC 5-11B-31	*Homo sapiens*	B	12,265 ± 25	UCIAMS-76190

[1] Haplogroup A specimens that have the 9bp deletion after nucleotide 8281.

[2] Results replicated.

[3] Results replicated in two different labs.

Table 28.2 Cont'd.

Specimen	Taxon	MtDNA haplogroup	Radiocarbon age	Radiocarbon Lab number
PC 5/12A-23	*Homo sapiens*	B	11,190 ± 30	UCIAMS-77102
PC 5/12A-23				
PC 5/12A-21	*Homo sapiens*	A	7260 ± 30	UCIAMS-79673
PC 2/4C-51	*Homo sapiens*	A[1]	11,270 ± 30	UCIAMS-77103
PC 2/4C-51	*Homo sapiens*	A[1]		UCIAMS-77104
PC 2/4C-49	*Homo sapiens*	A[1]		
PC 2/4C-49	*Homo sapiens*	B	10,980 ± 20	UCIAMS-76191
PC 2/4C-49				
1895-PC-5/16A-22-2				
1896-PC-2/6B-62-19				
1895-PC-5/16A-22-3				
1895-PC-5/15A-29-8a	*Homo sapiens*	A	9895 ± 25	UCIAMS-90579
1896-PC-5/16A-25-16	*Homo sapiens*	A	11,340 ± 30	UCIAMS-90581
1896-PC-5/16A-24-7	*Homo sapiens*	A[2]	11,205 ± 25	UCIAMS-90583
1896-PC-5/16A-26-10				
1896-PC-2/6B-62-20				
1896-PC-5/16A-25-12	Camelidae		12,125 ± 30	UCIAMS-90585
1704-PC 5/12A 17-11				
1704 PC 5/12A 17-10				
1829 PC 2/4C 48-28				
1830 PC 5/12C 23-12	*Ovis* sp			
1830 PC 2/4C 29-5				
1830 PC2/4C 34-2B				
1830 PC 2/4D 34-2A				
1830 PC 5/11B-31-12	*Panthera leo*[2]			

[1] Haplogroup A specimens that have the 9bp deletion after nucleotide 8281.

[2] Results replicated.

[3] Results replicated in two different labs.

and Tuohy 2005), and most recently championed by Beck and Jones (2010, 2012), Davis et al. (2012), and Madsen (2012). It is best supported by the evidence for Clovis-age WST points at the Paisley Caves (Jenkins et al. 2012a, b).

The sparse evidence left by the earliest inhabitants of the Great Basin has been subjected to thousands of years of burial, erosion, and displacement. The result is that the oldest archaeological materials are often effectively masked by larger, younger assemblages in sites dug long ago by vandals and professionals. The small size, generic characteristics, and similar constituents of the older and younger materials generally insures that they remain inseparable and unidentified (Madsen 2004). It is only in very rare instances, such as the Paisley Caves, that cultural deposits of Pleistocene age exist and remain stratigraphically separate from overlying YD and Holocene deposits in such a way that the two may be proven to be distinct.

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