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WYOMING ARCHAEOLOGICAL SOCIETY

THE WYOMING **Archaeologist**

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On the Cover:

The Debarard Earth Oven (48AB3354): See Koenig et al., this issue.

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WYOMING CULTURAL TRUST FUND

BECAUSE OUR CULTURE MATTERS

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Any funding for the George C. Frison Institute please contact Dr. Jason Toohey at University of Wyoming Anthropology, Dept. 3431, 1000 E. University Avenue, Laramie, WY 82071; or email jtoohey2@uwyo.edu.

IN MEMORIUM

EUGENE (GENE) GLEN THOMPSON
1935-2022

Eugene (Gene) Glen Thompson, of Lander, WY, peacefully passed away on December 18, 2022. Gene was born October 28, 1935 in Gurley, NE. He was raised on a small wheat farm in rural, western Nebraska, near Lodgepole. He and his late brother, Dennis, were instrumental in maintaining the farm as teenagers. After graduating from Lodgepole High School, he joined the Army. Once he completed his commitment, he married his high school sweetheart, Audrey Quinn. The newlyweds then moved to Chadron, NE, where Gene enrolled at Chadron State College. During four years of support with the GI Bill, he completed his Bachelor's and Master's degree, while also working to support his new marriage. After completing his studies, he impacted the lives of countless children, parents, and teachers in communities in South Dakota, California, Nebraska, and Wyoming, through teaching, coaching, and school administration leadership. He served as an elementary principal, middle school principal, and superintendent. His leadership skills also extended to community boards, councils and organizations, and state and national education committee work.

Important in Gene's life were his faith, family, and passion for the outdoors. Faith in Christ and a commitment to his church were a priority in his life, starting in childhood. Over the last 25 years, the faith and commitment were centered through Faith Lutheran Church in Lander, where he attended with Audrey, participated in services and volunteer activities, and served on the council. His family love started with that for his "beloved" Audrey and extended to his children, grandchildren, great granddaughter, brothers and sisters, nephews and nieces, cousins, and more. He was also able to extend that love to friends, who he made feel like family. His outdoor passions included fishing for walleye and trout from his boat; chasing elk, deer, and antelope across the mountains and high plains of Wyoming; and walking countless miles seeking upland birds. We anticipate that the fish and wildlife of Wyoming will offer a respectful moment of silence, and then let out a significant sigh of relief!

Gene is survived by his children, Dr. Greg (Linda) Thompson and Shelley Pine; grandchildren Dr. Kyle Thompson (Dr. Maxine Warren), Dr. Mitchell Thompson (Dr. Jenna Sarantakos), Cole Pine, and Cassandra Pine; and great granddaughter Lila (Kyle and Maxine). In addition, he is survived by his sisters Ann Whitefoot and Elaine Beveridge; his brother, Gary (Paulette) Thompson; brothers and sisters in law Reuben and Connee Quinn, Kelley and Elaine Quinn, and Joyce Thompson; and numerous nieces and nephews. He was preceded in death by his "beloved" wife Audrey; his brother Dennis Thompson; brothers in law Harold Whitefoot and Harold Beveridge; and nephew, Mark Thompson.

A Celebration of Life Memorial Service will be held at Faith Lutheran Church, 1600 Sinks Canyon Road, Lander at a date to be determined. A graveside service will be held at Pleasantview Cemetery in Lodgepole, NE in the spring.

In lieu of flowers, memorials may be mailed directly to: Faith Lutheran Church, 1600 Sinks Canyon Road, Lander, WY 82520 or Rocky Mountain Elk Foundation, 5705 Grant Creek, Missoula, MT 59808.

EDITOR NOTE: Gene was a long time member and former president of the Fremont County Chapter, WAS.

IN MEMORIUM

Mary Lou Larson
1954-2022

Mary Lou Larson, professor emerita at the University of Wyoming and longtime member and friend of the Wyoming Archaeological Society (WAS), passed away unexpectedly on April 1, 2022 at the Society for American Archaeology Annual Meeting in Chicago, Illinois. Mary Lou's lifelong interest and passion for understanding the past was perhaps destined from birth. Born in Laramie on August 18,1954 to Mary H. and noted UW history professor T.A. Larson, Mary Lou had an early exposure to the world of academic research, writing, and teaching. But, unlike her father's focus on Wyoming's recent history, it was the ancient past through archaeology and anthropology that captured her imagination. As an undergraduate at the University of Wyoming, she took ethnographic survey classes from William Mulloy, Plains and North American archaeology survey courses from George Frison, and other cultural anthropology and linguistics classes, graduating with honors in 1976. During her undergraduate years, Mary Lou worked on many sites in the Big Horn area, including Medicine Lodge Creek and Laddie Creek. This fieldwork would prove pivotal in her later research. She then traveled to the University of California at Santa Barbara for graduate work and immersed herself in various approaches to archaeological method and theory, hunter-gatherer studies and California archaeology, earning her M.A. (1982) and PhD (1990) in anthropology.

Mary Lou's heart was always in Wyoming, and while finishing her PhD, she spent most of her time there, completing laboratory analysis of the Laddie Creek materials for her dissertation, conducting fieldwork at other, mostly Archaic age, sites and beginning her teaching career. Starting in 1982, Mary Lou served as a visiting assistant/adjunct professor in the UW Anthropology Department. In 1996, she was hired into a tenure track assistant professor position and was promoted to associate professor with tenure in 2000. Mary Lou was named Full Professor in 2007 and served as department chair from 2011 to 2014. She retired in 2020. During her career, Mary Lou published five books, dozens of articles and book chapters, innumerable technical reports, presented or co-authored over 100 papers at regional, national and international conferences, all the while teaching up to three classes a semester, supervising field schools, and shepherding over 30 students through their graduate studies.

Mary Lou's primary research interests focused on hunter-gatherers in the Plains and Rocky Mountains, and George Frison was a huge influence on her research. While other Frison students concentrated on Paleoindian bison kills and faunal studies, she and the senior author of this obituary (Francis) once quipped we both wanted to research other aspects of Wyoming's ancient hunter-gatherers. Thus, Mary Lou focused on chipped stone and other technologies, site structure, spatial organization, and geographic information systems (GIS), often as those topics pertained to the "less glamorous" Archaic period, and the transition between Paleoindian to Archaic adaptations. Beginning with her undergraduate field experience, Mary Lou went on to investigate the Helen Lookingbill, Mill Iron, Henn, Beehive, Bugas-Holding, Nelson, Two Moon, and Last Canyon sites and rockshelters. She also participated in several major regional archaeological surveys, the most notable (and perhaps the most arduous) of which was the Western Powder River Basin survey project. Her work, along with other Wyoming archaeologists, culminated in the 1997 publication of *Changing Perspectives of the Archaic of the High Plains* (University of South Dakota Press), co-edited with this obituary senior author. Mary Lou's desire to broaden the perceptions of Wyoming prehistory beyond big-game hunting resulted in the 2010 revision and renaming (with Marcel Kornfeld and George Frison) of the third edition of *Prehistoric Hunter-**Gatherers** of the High Plains and Rockies* (Left Coast Press).

After purchase of the Hell Gap site by the Wyoming Archaeological Foundation, Mary Lou (along with George Frison and her partner and spouse of 43 years Marcel Kornfeld) began long term fieldwork and research at the site in the late 1990s and continuing for the next 27 years. This started with analysis of the 1960s excavation records and collections of Cynthia Irwin-Williams and Henry Irwin from Hell Gap and continued with further, highly targeted excavation. As a result of this lifetime endeavor, *Hell Gap: A Stratified Paleoindian Campsite at the Edge of the Rockies* (University of Utah Press) was published in 2009. The work undertaken by Mary Lou was central to the designation of Hell Gap as a National Historic Landmark in 2017 and to the current Save America's Treasures Project, which will digitize the Hell Gap collections from the 1960s to the present.

Information sharing and collaboration between the public, avocational societies and professional communities served as the foundation for Mary Lou's practice of archaeology. To this end, she and Marcel hosted WAS summer meetings at their field projects for the past 30 years. She also organized and facilitated student presentations at WAS spring meetings for many years. Mary Lou was working on a popular version of *Prehistoric Hunter-Gatherers of the High Plains and Rocky Mountains* at the time of her passing, and she served on the Wyoming National Register Review Board since 2001. In response to the flood of data generated by energy development and Section 106 in the late 1980s and 1990s, she worked with the Wyoming State Historic Preservation Office and Bureau of Land Management to help develop computer systems, GIS datasets for the Cultural Records Office, and contexts to be used in the evaluation of site significance. Mary Lou was also an organizer of two Plains and two Rocky Mountain Anthropological conferences.

Meticulous is the first word to come to mind when describing Mary Lou's approach to archaeological fieldwork, analysis, research, and writing. She had extremely high expectations for herself and approached all aspects of the practice of archaeology with care, caution, and attention to detail. These traits enabled her to tease out extremely detailed observations of the nuances of stratigraphy, separate ephemeral cultural levels, and identify post-depositional impacts to buried deposits. Mary Lou's attention to detail also characterized her approach to the analysis of chipped stone debitage using "minimum analytical nodules" to identify individual episodes of reduction or tool manufacture. Mary Lou's analytical techniques will have an important influence on chipped stone analysis for years to come.

Mary Lou taught archaeology to countless undergraduate and graduate students during her years at UW and reached many students beyond UW through Hell Gap field schools. She taught courses ranging from European prehistory to the Archaic Plains and Rocky Mountains. Mary Lou was among the vanguard of scholars specializing in GIS and brought this important method into her UW classroom. Mary Lou was an exacting teacher and mentor who held her students to the same high standards she expected for herself. She accepted no excuses, which allowed those who met her challenges to find and reach their potential.

Mary Lou endured major health issues throughout her entire professional career. She faced these head-on with an iron will and infinite determination. She never let her health stop her from doing what she wanted, such as attend the 2022 SAA meeting. Mary Lou leaves a lasting legacy – through the students she trained, the greater understanding of Archaic and Wyoming archaeology as a whole, and through her bravery and grit. Mary Lou was quite simply a *grande dame* of Wyoming archaeology. She will be sorely missed by all.

Julie Francis
Department of Anthropology
University of Wyoming

Judson Finley
Department of Sociology and Anthropology
Utah State University

THE HARTZOG CACHE IN NORTHEASTERN WYOMING

by
John Greer and Mavis Greer

ABSTRACT

A prepared pit containing a cache of 112 fairly large chert flakes was found in open country of the Powder River Basin (48CA2300). Flakes were analyzed by physical characteristics relative to size, flake type, platform, edge modification, counts, and percentages. Source of the material is likely the southern part of the Hartville Uplift of southeastern Wyoming. The cache appears to represent a personal bag of expedient tools and unaltered flakes to be shaped and used in the future by the owner. It was most likely not intended for trade or exchange. The flakes were packed and padded in a bag probably transported by dog during pre-horse days. The bag was buried in a simple pit, and perhaps marked but never retrieved.

INTRODUCTION

A small concentration of fairly large flakes was noted during a cultural survey for planned oil and gas development by Cities Service Oil Company (subsequently CSO Production) in northeastern Wyoming (Greer and Greer 1986). The location is on private land in the Hartzog Draw Oilfield of southern Campbell County, 38 miles southwest of Gillette (Figure 1). The exposed surface remains suggested the location of a cache, and excavation revealed a pit with additional artifacts, with 112 flakes in total (all counts and descriptions here supersede the 1986 site form). This paper presents analysis of the artifacts relative to what they tell us about where the materials likely came from, when they were left at this location, and who may have cached them at this open grassy prairie location within the Powder River Basin.

The site is on an elevated broad flat upper bench beside steep slopes bordering the deeply entrenched grassy Hartzog Draw, the main seasonal drainage through this area (Figures 2-4). The surrounding undulating, essentially featureless, area supports low ridges and benches separated by drainages flowing into the north-flowing Hartzog Draw. The cache was placed in an area of sandy loam sparsely covered with short grasses, scattered sage, and minimal prickly pear. Vantage is open with a good view of Pumpkin Buttes in the distance to the south.

DESCRIPTION

At the time of initial discovery (Greer and Greer 1986), fourteen flakes were exposed on the surface in an area with no surrounding indications of occupation. The exposed portion of the cache was clustered in a surface area about 46 cm in diameter, about 6 meters (20 feet) from the edge of a steep slope overlooking the drainage (Figures 2-5). Another 98 flakes were found undisturbed in a small pit immediately below the surface flakes, for a final count of 112 artifacts. The cache is an isolated feature with no indication of related cultural activity.

Excavation found flakes closely packed into a small excavated pit 30 cm across and 8 cm deep (Figure 6). The bottom of the pit was fairly flat although somewhat uneven, and edges mostly were almost vertical. The original pit, before surface erosion, probably was a little deeper, judging from the few flakes exposed on the present surface. The pit was probably about 35-37 cm in diameter by about 15 cm deep when originally dug. A dark reddish clay-like soil (containing red ochre) was in the upper part of the pit surrounding the uppermost flakes. This red soil was integral to the contents and was obviously used as packing to pad the flakes from banging against each other while being transported (a tradition we have observed with pottery in Spain and Guatemala). The red material is not native to this particular location, but its red ochre content was not

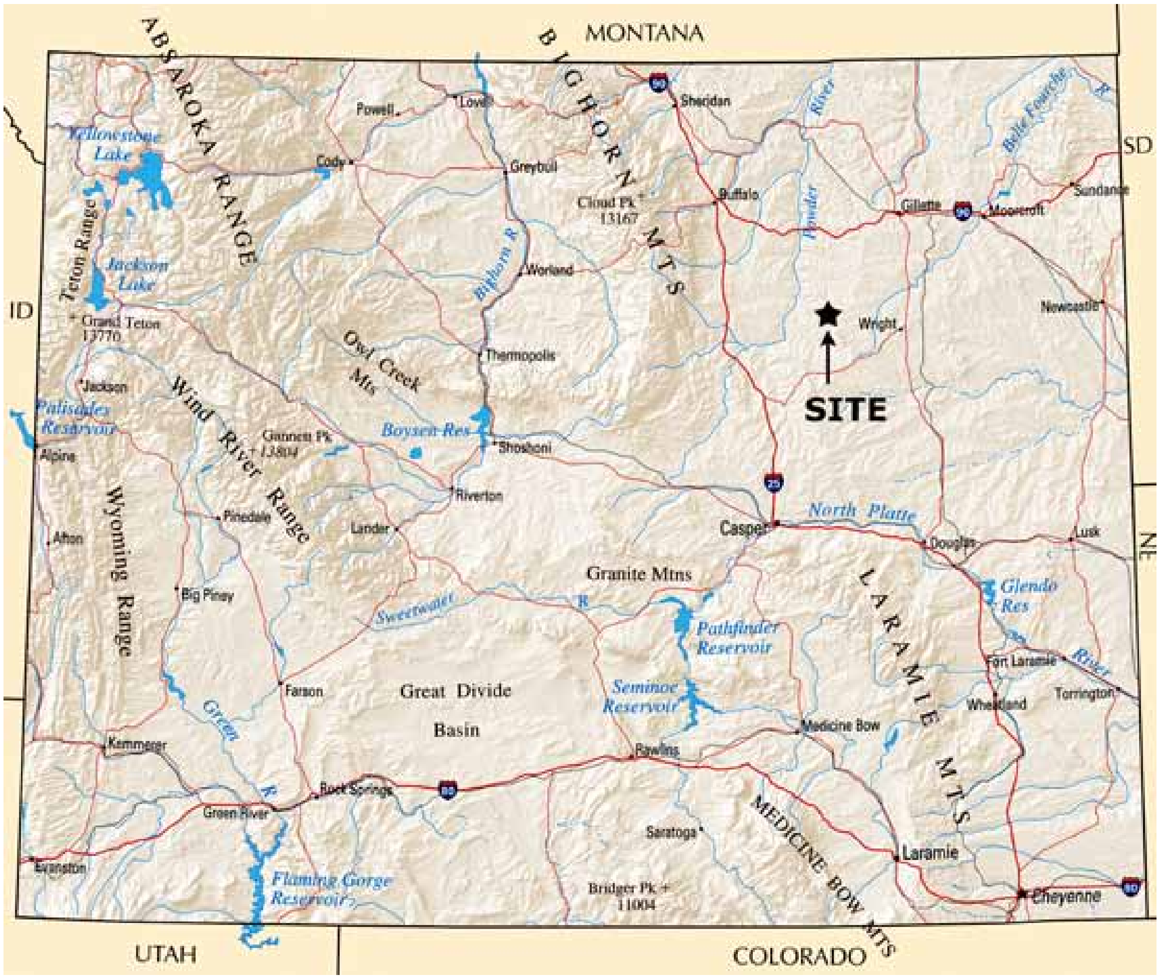

Figure 1: 48CA2300 location map, Wyoming.

used to paint or intentionally coat the artifacts, as has been noted at other sites; it is for packing only. The flakes were probably in a carrying bag that was placed in the pit intact, and the flakes eventually settled to mostly horizontal, with some flakes almost vertical around the edge of the pit. It is possible, though much less likely, that the flakes were dumped out of the bag and into the pit, which allowed the red clay to end up on top. After the bag was placed in the pit, the pit and contents were covered with local soil. Soil then seeped down, filling whatever small spaces existed between the flakes. One hundred and twelve mostly large, flakes were originally placed in the pit (Figures 7-11, Tables 1-2), for a total weight of 5.05 kg (11.125 pounds). Estimated weight for the bag plus red soil padding plus flake contents is 6-7 kg (13-15 lbs.). There is no indication of other items in the bag, such as bone, wood, or fiber.

ARTIFACTS

The following material and artifact descriptions concentrate on physical properties. Interpretation and implications are presented both here and in the Discussion.

RAW MATERIAL

All cached flakes are chert, from translucent to opaque in a range of colors. This high-quality material is mostly translucent light gray with a honey interior and mottled to variegated colors. Normal inclusions consist of very fine to small dark red to dark gray dots, dendritic and moss-like designs, and reddish clouds. Most flakes are primary and secondary decortication flakes (n=67; 60% of all flakes), and a few more have cortex on the platform only (n=12), with varying amounts of cortex occurring on 72% of all flakes. Some flakes (n=9; 8% of all flakes) have a waxy surface that presently

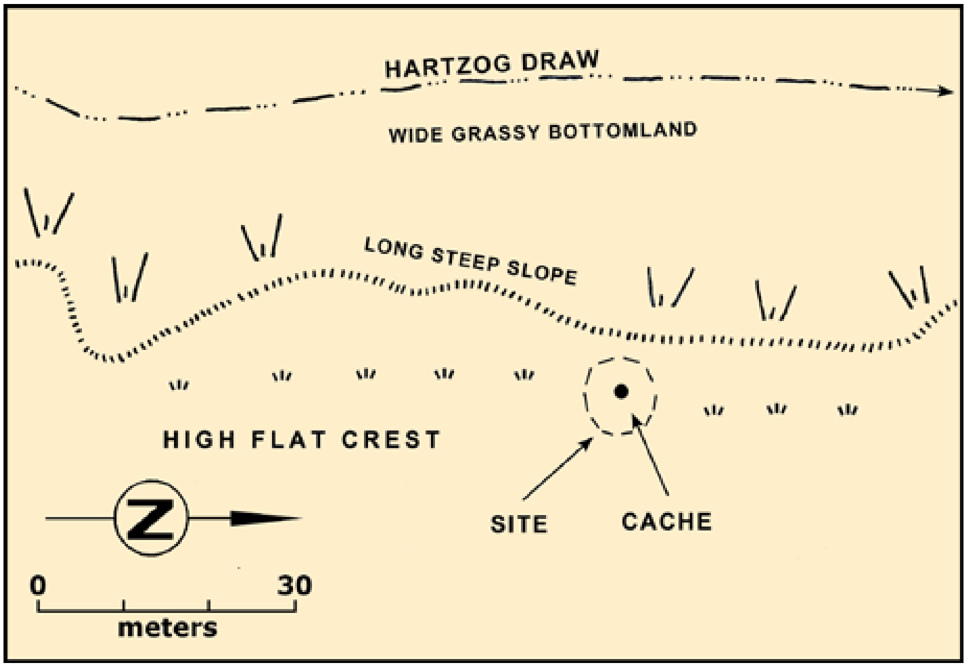

Figure 2: 48CA2300 site sketch (M Greer 1986).

Figure 3: 48CA2300, Brian Greer at cache upon discovery, looking southwest (J Greer 1986).

cannot be explained. The smoothness seems to be integral to the material and does not seem to be the result of heat-treatment, grass polish, or sand-wind polish. Dark red flakes, especially, have this waxy surface. The source location is not confirmed, but as discussed below, the artifacts are likely from the Hartville Uplift in southeastern Wyoming. There is no quartzite, porcellanite, petrified or silicified wood, basalt, or obsidian in the collection.

Most of the chert is considerably dry and somewhat friable and appears to have come from an exposed layer, not from excavated and cool deposits that still retained moisture (like in the main Hartville excavated quarry pits). Multiple flakes are obviously

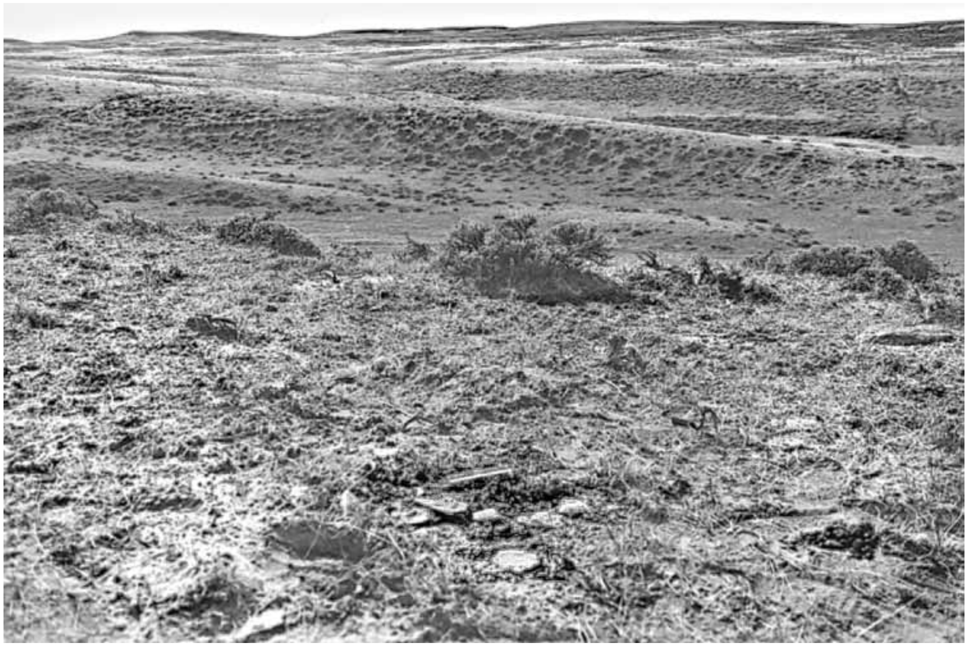

Figure 4: 48CA2300, general view of undisturbed cache exposed on the surface, looking west (J Greer 1986).

Figure 5: 48CA2300, undisturbed cache exposed on the surface, looking southwest. Brian Greer pointing at flakes. (J Greer 1986).

of the same material, but there is enough variation that not all flakes may be from the same immediate location.

FLAKE SHAPE

Elongated Flakes. Blades, blade-like flakes, and elongated flakes in general make up about half the sample (n=58; 52% of all flakes; e.g., A1, A21) and indicate a preference for elongated flakes, several of which are relatively narrow. Shapes appear to be intentional (though sometimes irregular) but mostly not from formal blade cores. Platforms are usually tiny to small and fairly thin, and resulting flakes are often narrow with parallel sides. Flaking results

Figure 6: 48CA2300, cache pit (with 30 cm scale) after excavation of flakes (left), looking south (J Greer 1986).

were variable, with some dorsal ridges low to nearly flat and others highly crested. Some low ridges are doubled, parallel ridges. On thick elongated flakes with high ridges, an attempt was sometimes made (n=4) to thin the ridge by removal of flakes from one (n=2) or both (n=2) sides of the ridge, running from the crest down toward the adjacent lateral edge. Two flakes were worked on only one side of the ridge, and two had flakes removed on both sides of the crest, in both directions (e.g., A61).

Constricting Flakes. A few flakes begin at a wide platform, then constrict all the way to the distal end (n=4; 4% of all flakes; e.g., A68, A97). Few of these are present relative to flake assemblages we have observed at other sites.

Expanding Flakes. These are essentially the opposite of blade production. They begin usually at a platform of restricted width and then expand barely or to an extreme to the wider distal end (n=15; 13% of all flakes; e.g., A107, A108). Some are diamond-shaped and initially expand from a tiny to relatively narrow platform to wide shoulders in the middle, and then contract to a narrow distal end or tip (n=8; 7% of all flakes; e.g., A6, A20).

Sequent Flakes. The core is set up and treated in a specialized way to produce a kind of expanding flake (Dibble and Prewitt 1967:53; Greer 1968:70-71). The usually flat, single-faceted (or cortical), wide, thin platform is continually struck at essentially the same place to produce what are sometimes called "series flakes." These are most often relatively wide and short and are characterized by a prominent positive bulb extruded on the ventral face (next to the core) and a deep negative bulb depression on the dorsal face (from removal of the previous flake). The resulting platform is usually a distinctive wavy shape and often appears battered. In some assemblages, such as southwest Texas (Dibble and Prewitt 1967), sequent flakes were specifically produced and selected for specialized end scrapers with wide transverse or diagonal distal edges. The prominent positive bulb on the ventral face is often separately thinned, and it is likely that the tools were hafted, as were most small end scrapers on the Plains (Newberry 1982:9; Wedel 1970). Flakes similar to sequent flakes have been treated much the same, struck from the same unaltered platform as the previous flake and with the same resulting bulb characteristics (n=6; 6% of 103 flakes with proximal ends; e.g., A30, A102). Many of the platforms, however, were set up to produce elongated blade-like flakes.

Core Platform Rejuvenation Flake. A small blocky interior chunk (Figure 7, A4) — 31 mm long x 25 mm wide x 20 mm thick — is relatively thick and has no cortex. This core platform rejuvenation

Table 1: Artifact attributes: dimensions, type, shape, platform; with artifact number along left side. See photos, Figures 7-11.

NO.	L	W	TH	TYPE	SHAPE	PLATFORM	ANGLE
1	86	40	17	secondary	elongated blade; narrow; dorsal ridge	tiny; thick; single-faceted	68°
2	78	49	12	secondary	elongated; wide	thin; single-faceted	63°
3	71	43	10	primary	elongated; wide; crude	cortical (black)	70°
4	31*	25*	20	interior; core edge rejuvenation	blocky; relatively thick	single-faceted from new flake along top of core; original platform edge	89°
5	80	51	10	secondary	irregular; short; wide; thin	cortical; platform edge battered	72°
6	65	66	19	interior	diamond -shaped; pointed ends; wide in middle; curved	tiny; multi-faceted	67°
7	50	30	6	interior	elongated; wide; thin	thin; multi-faceted	86°
8	64	46	12	interior	elongated; crude; thin	small; thick; single-faceted	77°
9	79	48	10	interior	elongated	thin; wide; multi-faceted; platform surface battered; platform edge battered	87°
10	78	65	19	secondary	somewhat diamond-shaped to elongated; no dorsal ridge; most of dorsal face covered with cortex	small; thick; single-faceted	72°
11	63	38	10	secondary	elongated; no dorsal ridge	thick; small; single-faceted	68°
12	73	56	17	secondary	elongated (wide); dorsal ridge	single-faceted	80°
13	65	44	14	secondary	elongated; no dorsal ridge; medial flake surrounded by cortex around the edges	wide; thick; single-faceted	70°
14	48	43	5	interior	rounded; pointed both ends; thin	snapped (missing)	NA
15	40	26	7	interior	elongated	snapped (missing)	NA
16	61	44	5	interior	wide; rounded; thin	snapped (missing)	NA
17	44	44	13	secondary	rounded	thin; sharp edge; multi-faceted	45°
18	52	40	8	secondary (mostly interior)	somewhat elongated sequent flake; trapezoidal; distal end hinge	platform surface battered	72°
19	66	37	14	secondary	elongated; wide; dorsal ridge	multi-faceted; platform surface battered	90°
20	53*	48	10	interior	diamond shaped; pointed ends; wide in middle	tiny; platform surface battered	80°
21	76	287	9	interior	elongated blade; low dorsal ridge	very thin; edge only; platform surface battered	60°
22	49*	49	10	interior	expanding; broad	thick; narrow; single-faceted	64°
23	49*	40	12	secondary	irregular; slightly expanding; distal edge snapped	snapped (missing)	NA

NO.	L	W	TH	TYPE	SHAPE	PLATFORM	ANGLE
24	56	47	13	secondary	broad; barely expanding; distal end hinged up	thin; single-faceted	88°
25	94	55	14	secondary	irregular; somewhat elongated; wide; pointed distal end	mostly single-faceted; platform edge somewhat battered	69°
26	95	58	14	interior	expanding; diamond shaped; wide middle	reduced/missing (tiny, thin, edge only)	NA
27	90	46	15	secondary	elongated; fairly wide; dorsal ridge	reduced (tiny, thin); small point; edge only	61°
28	75	47	15	secondary	barely expanding	wide; thin; multi-faceted; platform surface battered	90°
29	60*	42	12	secondary	slightly expanding; broad; parallel sides	thin; single-faceted	60°
30	89	70	16	secondary	large circular sequent flake	wide; single-faceted; platform edge battered	72°
31	79	61	18	secondary	broadly rectangular; fairly thin	thick; wide; multi-faceted; platform edge battered	90°
32	65	83	22	secondary	widely expanding; wide; convex distal edge	single-faceted; platform edge battered	79°
33	53	60	23	interior	rectangular outline; high dorsal peak	removed (missing) by dorsal retouch	NA
34	56	44	22	secondary	rectangular; thick	narrow; thick; single-faceted. A thick lateral edge was previously the primary platform from which other flakes were removed in attempts to thin the piece.	79°
35	70	94	26	secondary	expanding; very wide; nearly straight distal edge	wide; multi-faceted; entire platform surface battered	66°
36	87	61	13	secondary	irregular; expanding; straight distal edge	wide; thick; multi-faceted	68°
37	73	70	17	secondary	sequent flake	large; single-faceted	65°
38	62	66	15	interior	nearly circular; broad proximal end	wide; single-faceted	75°
39	64	45	13	secondary	expanding; diamond shaped, narrow ends, wider middle	tiny; platform surface battered; platform edge battered	74°
40	55	55	10	interior	diamond; expanding; wide wings; rounded bottom	long; single-faceted	71°
41	61*	60	15	interior	elongated; snapped in half (distal portion snapped)	wide; moderately thick; multi-faceted; platform edge battered	69°
42	75	53	20	interior	triangular; contracting; pointed distal end	single-faceted; lateral flake from edge removed the previous platform and formed a new single facet from which this flake was removed; platform edge somewhat battered (previous flakes removed from this edge)	54°
43	60	43	8	interior	slightly expanding; oval	cortical; thin; fairly small	90°
44	62	40	6	secondary	expanding from narrow platform; widest in middle; wide basal edge	tiny; multi-faceted	90°

NO.	L	W	TH	TYPE	SHAPE	PLATFORM	ANGLE
45	77	54	11	interior	expanding; broad; straight distal edge; curved	small; multi-faceted; platform surface somewhat battered	97°
46	56*	63	16	secondary	square; wide platform; snapped distal end	single-faceted; platform edge battered	85°
47	72	43	11	secondary	square; fairly thin	cortical	42°
48	63	56	7	interior	rectangular; wide straight platform, straight edges, straight distal end; previous lateral platform (wide, single-faceted, battered edge)	snapped (missing). Two other edges previously used as platforms; one snapped (missing). cortical edge apparently not used as a platform.	NA
49	58	48	12	primary	round to oval; expanding from small platform; rounded distal edge	tiny; single-faceted; platform edge battered	62°
50	78	43	17	interior	elongated; dorsal; curved; distal end rounded and battered. Surface smooth; completely patinated white.	multi-faceted; not formally prepared; platform edge battered and rounded	78°
51	61*	49	11	interior	elongated; expanding from platform; nearly parallel lateral edges; distal portion snapped	single-faceted; platform edge battered and rounded	70°
52	82	28	17	secondary	elongated; dorsal ridge	single-faceted; partially cortex; platform edge battered	48°
53	63	50	10	interior	triangular; expanding from tiny platform to nearly straight distal edge	tiny; multi-faceted; platform edge battered and rounded	65°
54	46	50	9	secondary	somewhat rectangular; slightly expanding; angular distal edge	snapped (missing)	NA
55	49	38	9	interior	rectangular; slight expanding; one lateral edge snapped during flake removal	cortical; wide; barely thick; single-faceted	70°
56	75	47	15	interior	somewhat elongated; dorsal ridge; expanding to wide shoulders, short distal tip	edge only (missing); snapped during flaking	NA
57	66	47	18	interior	elongated; wide; broad in middle, narrow both ends; primary dorsal ridge	thick; single-faceted;	63°
58	53*	30	13	secondary	elongated; thick; dorsal ridge; both ends snapped; parallel sides	snapped (missing)	NA
59	54	39	9	interior	elongated; slightly expanding; low dorsal ridge; thin	multi-faceted; platform edge battered and rounded	47°
60	113	130	35	secondary (mostly interior)	very large; expanding from wide platform to broad wide middle; convex distal margin	wide; single-faceted;	64°

NO.	L	W	TH	TYPE	SHAPE	PLATFORM	ANGLE
61	102	50	26	interior	elongated; very thick; high dorsal ridge battered (flaked) in both directions; somewhat curved	multi-faceted; platform surface somewhat battered; platform edge battered; small remnant of original platform still remains	81°
62	108	48	17	secondary	irregular sides; elongated; high dorsal ridge; curved	thin; narrow; single-faceted, platform edge battered and rounded	74°
63	107	48	15	interior	elongated; expanding from tiny platform to wide rounded distal end	tiny; removed/reduced at tiny end	NA
64	121	59	26	interior	elongated (curves somewhat to side); thick; high dorsal ridge; expands from tiny platform; pointed distal end	small; wide; thick; single-faceted	83°
65	108	70	21	secondary	somewhat diamond shape; expands rapidly from narrow platform to wide shoulders, than taps to narrow distal tip	small; wide; thick; single-faceted	72°
66	121	78	26	primary	elongated oval; expands from narrow platform, low shoulders, to dully pointed distal tip	fairly wide; moderately thick; single-faceted	49°
67	65	43	9	secondary	elongated; wide; somewhat diamond shape from narrow platform to wide shoulders to narrow distal tip	narrow; single-faceted;	63°
68	119	67	20	interior	elongated; wide; mostly narrows from wide platform to pointed distal tip	wide; thick; bi-faceted; platform edge battered	69°
69	100	47	18	interior	elongated; irregular dorsal ridge; thick; diamond shape, expands from narrow platform to rounded shoulders to long descending distal tip (very thin)	wide; fairly thin; single-faceted	63°
70	80	49	18	secondary	elongated; wide; diamond shape, expands from narrow platform to rounded shoulders to constricted distal end	wide; thin; single-faceted; platform edge battered and rounded	38°
71	64	62	18	interior	from wide platform (edge only) the edges drop nearly parallel, then expand to wide shoulders and a rounded distal edge; prominent dorsal ridge flaked/battered along one side; somewhat curved	wide; thin; reduced to edge only	NA
72	46	36	9	secondary	elongated; rectangular; narrow; thin; parallel sides; dual dorsal ridges; curved (undercut distal end)	wide; fairly thin; single-faceted; complete width of flake	41°

NO.	L	W	TH	TYPE	SHAPE	PLATFORM	ANGLE
73	65	47	10	interior	elongated; irregular; expanding; somewhat elongated rectangle	tiny; very thin; narrow; covered with calcium carbonate; platform edge battered and rounded	67°
74	57	59	11	interior	triangular; expanding from tiny platform to convex distal edge	narrow; very thin; multi-faceted; platform edge battered and rounded	88°
75	64	50	16	secondary	elongated rectangle	wide; thick; single-faceted	67°
76	86	54	17	secondary	elongated; wide; expands slightly to somewhat rounded should and to a long thin distal tip	wide; thick; single-faceted; natural exterior stone surface	101°
77	96	64	18	interior	elongated; wide oval; relatively thin for size; even thickness	large; wide; thick; mostly single-faceted	72°
78	66	54	5	interior	expanding; thin	snapped during production (missing)	NA
79	60	43	27	interior	elongated triangle; thick convex distal end	tiny; fairly narrow; thin; single-faceted	96°
80	69	32	9	secondary	elongated blade; parallel sides	cortical; very small; narrow; thin	64°
81	42*	45	10	interior	square fragment from elongated flake; low dorsal ridge; proximal end snapped	snapped proximal end (old break), no platform	NA
82	84	43	13	secondary	elongated; irregular	moderately wide; very thin; single-faceted (almost removed to an edge only); platform edge intensively battered	69°
83	75	50	15	secondary	elongated rectangle; broad; sequent flake	wide; thick; single-faceted; wavy; battered platform edge	76°
84	66	56	20	secondary	diamond-shaped; expands from prominent platform to pointed shoulders and down to thin pointed distal end	wide; thick; single-faceted; on edge of cortex	51°
85	60	69	1	interior	triangular; expanding	moderately wide; thick; single-faceted	64°
86	55	70	17	secondary	elongated wide oval	Present platform: half cortical; rest bi-faceted and partially retouched. Previous platform (to one side; previous thinning): wide; thin; single-faceted; 81%	40°
87	71	40	10	interior	elongated; wide; perpendicular to previous sequent flake surface	wide; thin; single-faceted; platform edge battered and rounded	43°
88	63*	40	10	secondary	elongated rectangle	wide; bi-faceted	76°
89	25	48	5	interior	short; wide; sequent flake	thin; wide; single-faceted; curved; platform surface heavily battered; recessed edge	67°

NO.	L	W	TH	TYPE	SHAPE	PLATFORM	ANGLE
90	58	50	10	interior	elongated wide oval; relatively thin	mostly reduced to only an edge; small remnant is thin, single-faceted	78°
91	34	48	7	secondary	wide short rectangle; sequent flake	very wide; thin; single-faceted; curved	76°
92	56	22	12	secondary	elongated blade; narrow; dorsal ridge	round; thick; cortex	103°
93	47	53	15	interior	oval	wide; thick; large; single-faceted	94°
94	49*	40	11	interior	elongated; wide; dorsal ridge; both ends snapped	snapped (missing)	NA
95	61	23*	8	interior	elongated blade; narrow; thin; low dorsal ridge	wide; very narrow; platform edge battered; reduced to essentially edge only (platform missing)	NA
96	74	52	5	primary	elongated oval; wide; very thin	snapped (essentially missing); original remnant wide, thin	88°
97	56	46	12	secondary	triangular; constricts to distal point	wide; thick; cortical	64°
98	74	51	13	interior	elongated blade; wide; dorsal ridge	medium width; thick; single-faceted	70°
99	71	57	21	interior	elongated wide rectangle; parallel sides from wide platform to expanding wings at distal end; dorsal ridge;	wide; very thick multi-faceted; platform surface battered; platform edge not battered	60°
100	71	55	10	secondary	broad; irregular	appears mostly to be cortical (natural smooth exterior of original piece); wide; fairly thick; single-faceted; some nibbling across platform surface; platform edge somewhat battered	90°
101	61	51	13	secondary	triangular; expands from moderately wide platform out to wide wings and then constricts to pointed distal tip; dorsal ridge	fairly wide; thick; single-faceted; platform edge slightly battered	68°
102	56	35	6	interior	elongated rectangle; thin; large broad flute down the middle; low lateral parallel dual dorsal ridges; like a sequent flake	fairly narrow; very thin; nearly an edge; platform surface battered; platform edges battered (both dorsal and ventral); platform too altered to measure	NA
103	55	36	8	interior	elongated blade; parallel sides; dorsal ridge; hinged proximal end	snapped hinge (missing)	NA
104	66	59	20	secondary	crude elongated irregular rectangle; dorsal crest; distal end terminates in upward hinge	small; thick; single-faceted; platform edge battered	83°
105	76	51	21	secondary	elongated; expands slightly from platform, then constricts to distal end; thick; three parallel dorsal ridges; curved	somewhat wide; rounded; platform completely worked (missing); platform edge worked and rounded	NA

NO.	L	W	TH	TYPE	SHAPE	PLATFORM	ANGLE
106	56	39	8	secondary (essentially interior)	elongated oval; expanding; thin	wide; thin; cortical	90°
107	46*	59	8	secondary (essentially interior)	broad sequent flake; distal portion snapped during flake removal from core	wide; thin; curved (typical of sequent flakes); mostly just edge remnant of single-faced platform	70°
108	62	40	8	secondary (essentially interior)	elongated; expanding; dorsal ridge on proximal half	narrow; fairly thick; cortical to single-faceted; platform edge battered and smoothed	59°
109	73	29	7	interior	elongated narrow blade; nearly flat; curving dorsal low ridge; curved	tiny; single-faceted	64°
110	80	36	18	secondary	elongated thickly crested blade; high dorsal crest with flake removal onto both sides in attempt to remove the high dorsal ridge; curved outline; curved cross section	wide; somewhat thick; single-faceted	110°
111	67	45	16	secondary (mostly interior)	elongated; wide; parallel sides; pointed distal tip	cortical; originally flat exterior cortical (88°). Then angular flake removed half of this platform and became the final sloping platform for the flake.	42°
112	64	44	15	interior	elongated wide oval; dorsal ridge	medium width; medium thickness; single-faceted; platform edge battered; edges alongside platform also battered in attempt to remove platform	102°

Table 2: Artifact attributes: red clay, CaCO3, cortex, material; with artifact number along left side. See photos, Figures 7-11.

NO.	RED CLAY	CaCO3	CORTEX	CORTEX	MATERIAL
1	yes	no	15%	part of dorsal ridge	mottled dark to medium gray; red clouds; translucent; fine-grained
2	yes	no	40%	dorsal	light gray; translucent; fine-grained; fine brown and dark red dendritic dots
3	no	no	75%	dorsal; platform black cortex	dense; brown to medium gray; fine-grained; somewhat translucent
4	no	no	none	none	mostly medium gray to yellowish gray; honey interior; fine-grained; profuse spaced dendritic inclusions mostly dark gray, some dark red and dark red lines connecting the dendrites; unique material (other material similar but not quite the same).
5	yes	yes	10%	dorsal	light gray; some darker clouds; fine-grained; translucent
6	yes	yes	none	none	somewhat mottled light gray; fine-grained; translucent
7	yes	yes	none	none	somewhat mottled dark gray to reddish brown; opaque

NO.	RED CLAY	CaCO3	CORTEX	CORTEX	MATERIAL
8	no	no	none	none	variegated light gray to yellowish brown; dark brownish red and dark red profuse inclu-sions; opaque mottled brownish gray
9	yes	yes	5%	minor on edge of platform, distal end, dorsal face	variegated medium gray to medium yellow-ish brown; linear (plant?) inclusions; dense; mostly opaque; portions somewhat translu-cent
10	yes	yes	70%	most of dorsal face covered	mottled light to medium gray; somewhat translucent
11	yes	yes	60%	most of dorsal face covered	light gray to brownish gray; dark gray large dendritic inclusions; light gray and yellowish cloud inclusions; translucent
12	yes	no	15%	distal and proximal	mottled light to medium gray with honey dis-coloration; dark gray inclusions; fine-grained; translucent
13	yes	no	20%	band around distal and lateral edge	mottled dark reddish brown to brownish gray; dark gray and cream/red inclusions
14	yes	yes	none	none	mottled light gray; dark reddish-brown dot/ dendritic inclusions; fine-grained; translucent
15	yes	yes	none	none	mottled light to medium gray; fine-grained; translucent; fine dark reddish brown dot inclusions
16	no	no	none	none	mottled light to medium gray; some reddish-brown clouds; translucent
17	no	no	5%	dorsal; white cortical clouds (residual discoloration) on dorsal face	light gray; some banding; translucent; dark gray and dark red dendritic inclusions
18	no	no	2%	along one edge	mottled medium gray to brownish gray; translucent
19	yes	yes	5%	mostly proximal	light to medium gray; honey clouding; trans-lucent
20	no	no	none	none	mottled light gray; honey to medium gray cloud inclusions translucent
21	yes	yes	none	none	light to medium gray; translucent; dark gray dot inclusions
22	no	no	none	none	variegated medium to dark gray; interior red portion; opaque
23	yes	yes	10%	some black on proxi-mal portion	variegated light to medium gray; dark gray dot and red linear inclusions; very smooth surfaces
24	yes	yes	5%	proximal (beside platform)	variegated medium to dark gray to yellowish brown; dark gray dot and red linear inclu-sions
25	no	no	3%	small portion on one lateral edge	light to medium gray; fine-grained; translu-cent; dark red dot and dendritic inclusions
26	yes	yes	none	none	variegated dark gray; edges somewhat translucent; some dark gray clouds and broad linear inclusions
27	yes	yes	25%	all along one side, part of another edge, and distal end	variegated medium to dark gray; translucent edges; reddish brown cloud inclusions
28	yes	yes	60%	most of dorsal face covered with cortex	variegated dark gray; fine-grained; translu-cent edges; dark gray fine dot inclusions

NO.	RED CLAY	CaCO3	CORTEX	CORTEX	MATERIAL
29	yes	yes	55%	dorsal	light to medium gray; fine-grained; translucent; dark gray dot and semi-linear inclusions
30	yes	yes	10%	distal edge	medium gay; fine-grained; edges somewhat translucent; some dark gray dot inclusions; red splotched inclusions
31	yes	yes	5%	along distal edge	variegated dark gray; honey cloud interior; translucent edges; dark gray dot inclusions
32	yes	yes	2%	on one rounded corner	medium gray; fine-grained; translucent edges; dark gray dot and cloud inclusions
33	yes	yes	none	none	dark brownish red; opaque; fine-grained; waxy surface; dark reddish brown and dark gray dot and fine linear inclusions
34	yes	no	10%	along distal end	dark gray with reddish brown areas; opaque
35	yes	no	2%	distal portion	variegated medium gray and tan; translucent; some light gray; dark gray dot and dendritic inclusions
36	no	yes	5%	dorsal	variegated light gray to reddish brown; fine-grained; translucent; interior cloud inclusions
37	yes	no	65%	distal portion	variegated light to dark gray; translucent; small light gray dot inclusions
38	yes	no	none	none	light gray; fine-grained; smooth; opaque; fine-grained
39	yes	no	30%	distal portion	light to medium gray; fine-grained, translucent; some dark gray cloud inclusions
40	no	no	none	none	medium gray; fine-grained; translucent; interior honey clouds; dark gray large dot inclusions
41	yes	yes	none	none	light gray; moderately fine-grained; translucent (especially around edges; some honey clouding
42	yes	no	none	none	variegated light to dark gray; moderately fine-grained, translucent; honey interior
43	yes	no	1%	platform only	light to medium gray; fine-grained; translucent; some honey interior; reddish brown to dark gray dot and dendritic inclusions
44	yes	yes	2%	along distal edge	brownish light gray; translucent; red and light cream large dot/cloud inclusions
45	yes	yes	none	none	variegated light to medium gray; fine-grained; translucent; honey interior; fine red linear inclusion; broad-line dark gray band inclusions
46	yes	no	2%	part of one edge corner	mostly light gray; fine-grained; translucent; honey interior; dark red and dark gray dot inclusions
47	yes	yes	2%	platform; small area of proximal surface	variegated medium to dark gray; some lightener tan areas; fine-grained; mostly opaque, edges barely translucent; dark gray dot inclusions
48	yes	yes	2%	thin band along lateral edge	variegated medium gray; fine-grained; translucent; dark gray and brownish red dot inclusions (profuse)
49	yes	no	90%	dorsal	medium brownish gray; some honey and beige areas; fine-grained; edges translucent (except for cortex); some tiny dark gray dot inclusions

NO.	RED CLAY	CaCO3	CORTEX	CORTEX	MATERIAL
50	yes	no	5%	a little on platform; on rounded distal end and adjacent area of lateral edge	medium gray interior; translucent on thin edge
51	yes	yes	none	none	variegated light to medium gray; edges translucent (honey interior); dark and medium gray large dot inclusions
52	yes	yes	35%	along dorsal ridge and platform	honey-gray; fine-grained; translucent (honey interior); reddish cloud and dot inclusions
53	yes	yes	none	none	variegated light to medium gray; fine-grained; translucent; honey interior; profuse fine red linear inclusions; dark red clouds
54	yes	yes	2%	along part of lateral edge; one distal corner; most of distal edge; mostly an interior flake	light gray; some honey interior; fine-grained; dark red fine line inclusion
55	yes	yes	1%	platform only	light honey gray; some honey discoloration; fine-grained; translucent; some dark gray fine line and dot inclusions
56	no	no	none	none	medium gray; light gray and dark red inclusions Very smooth exterior surface.
57	yes	yes	none	none	honey light gray; fine-grained; translucent edges; dark gray prominent dot inclusions
58	yes	yes	15%	along side of platform break; part of lateral portion; large area of distal end	medium gray; fine-grained; translucent; red dendritic inclusions; some dart gray dots
59	no	yes	none	none	light gray; fine-grained; translucent; honey interior; brownish red and dark gray dot inclusions
60	yes	no	18%	part of one edge and part of other edge; mostly black, with holes, rust colored inclusions, tiny quartz crystals; shite limestone-like cherty inclusion beside platform	variegated light to medium gray; light rust colored banding; some micro quartz crystals; cortex integrated into the interior
61	yes	no	none	none	grayish brown to brownish gray; black dot inclusions; opaque (thick); interior/ventral surface yellowish cream
62	yes	no	6%	some along one edge	honey medium gray; fine-grained; translucent sides (thick center); mostly dark red irregular linear and cloud inclusions; some dark gray
63	yes	no	none	none	variegated light gray to brownish gray; portions of interior reddish brown; some red areas; dense, mostly opaque; high quality; translucent only around edges
64	yes	yes	none	none	variegated tan to grayish brown to medium gray; dense; opaque; high quality; dark gray, brownish red, and red fine line and dot inclusions
65	yes	yes	25%	dorsal face; both edges	variable light to medium gray; high quality; translucent; dark red dot inclusions

NO.	RED CLAY	CaCO3	CORTEX	CORTEX	MATERIAL
66	yes	yes	95%	most of dorsal face	medium gray; some light gray covering (cloud) on ventral face; some crystalline inclusions on edge (from cortex); fine-grained; translucent around edge (rest thick), honey interior; profuse dark gray dot inclusions
67	yes	yes	6%	two areas of one lateral edge	variegated light to medium gray; light brown cloud/splotch; some banding and large dark gray dots; fine-grained; mostly opaque; some translucent around edges; profuse dark gray linear and dot inclusions
68	yes	yes	none	none	variable light to medium gray; dense; mostly opaque; translucent; honey interior; dark brownish red to dark gray dendritic inclusions
69	yes	yes	none	none	variable light to medium gray; fine-grained; translucent; honey interior; mostly dark brownish red dot inclusions and some wider linear clouds
70	yes	yes	20%	dorsal and along one thick edge	medium gray; fine-grained; translucent; honey interior; brownish red dot inclusions
71	yes	yes	none	none	variegated medium gray matrix with dominance of dark brownish red or dark rust inclusions of separate dots and dense dot clusters (covers about 60-80% of surface); also round light gray splotches
72	yes	no	8%	distal corner	medium gray; fine-grained; translucent; light gray to honey interior; dark red and dark gray fine and wide dot inclusions; some gray clouds
73	yes	yes	none	none	honey-medium gray; fine-grained; translucent; honey interior; dark red and dark gray mostly fine dot inclusions
74	yes	yes	none	none	variegated light gray, medium gray, grayish brown, honey brown; mostly opaque; translucent around edges; prolific inclusions of dark gray dots and dendrites, cream small splotches, dark gray dendritic banding, dark red small splotch
75	yes	yes	18%	around squared edge	variable white, light gray, medium gray; honey and dark red internal clouds; fine-grained; translucent; honey interior; dark gray clouds and large dot inclusions
76	yes	no	35%	platform; dorsal	variable light to medium gray; fine-grained; translucent; honey interior; dark gray dot inclusion
77	no	yes	none	proximal end is near outer rim of source piece (variegated and banded light gray matrix with dark gray to black and dark yellowish brown areas with open tiny geode holes and a broad coarse grained band; like A60).	variable to variegated light gray to honey to reddish honey in main matrix, and then proximal 20% (as above under cortex); numerous weak bands/seams throughout; very high quality; translucent; some dark gray dot inclusions but mainly honey interior with gray banding
78	yes	no	1%	small irregularity at proximal end	light gray; translucent; honey interior; no inclusions/dots

NO.	RED CLAY	CaCO3	CORTEX	CORTEX	MATERIAL
79	yes	yes	none	none	dense medium gray to beige; very fine-grained; opaque; waxy surface; yellowish brown interior; dark gray very fine dots and dot-line inclusions
80	yes	yes	2%	small area on edge beside platform; tiny portion on distal corner	light to medium gray; fine-grained; translucent; dark gray medium dot and dendritic inclusions
81	yes	yes	none	none	light gray; very fine-grained; translucent; mostly dark red dot and dendrite inclusions
82	yes (+ red ochre)	no	20%	along entire angle distal edge	light gray; black edge next to distal cortex; translucent; honey interior; dark red and dark gray tiny dot inclusions; some internal lines
83	yes	yes	25%	distal and lateral edge	variegated tan to yellowish brown; fine-grained; half of ventral face is yellowish beige; opaque; waxy surface; dark gray fine dot and linear inclusions
84	yes	no	40%	most of proximal portion	variable medium gray; light gray and brownish gray portions; fine-grained; translucent (distal portion); honey clouds interior; some medium gray dot inclusions
85	yes	no	none	none	mostly light gray; areas of medium gray; fine-grained; translucent; dark honey interior; brownish red and dark gray dendrite inclusions and groups
86	no	yes	20%	dorsal; half of platform	variable light gray and brownish light gray; some light patina discoloration; translucent; honey interior; dark gray and dark red fine dot inclusions
87	yes	no	1%	two very small pieces on one edge	light gray; translucent; dark red dot inclusions
88	yes	no	60%	much of dorsal surface	light gray; light patina on ventral face; translucent; no obvious intrusions
89	yes	no	none	none	variable brownish to reddish brown to medium gray; dark yellow areas; translucent; honey interior; dark gray to brown irregular small splotches
90	yes	yes	none	none	variegated dark gray; inclusions of cream, brown, brownish red, medium gray; yellowish and dark red clouds; translucent; honey interior; profuse dark gray to brown clouds, large cream dots, linear patterns
91	yes	no	2%	narrow portion along one edge	light gray; small area of white patina on ventral face; light yellowish red area; translucent; light gray interior with area of darker orange; a few dark gray dot inclusions
92	yes	no	2%	on platform only	variegated dark reddish gray and orangish beige; dense; opaque; fine-grained; tiny black dendritic inclusions
93	yes	no	none	none	dense variegated brownish gray to dark gray; waxy surface; dense; opaque; profuse dark reddish brown dot inclusions
94	yes	yes	none	none; small limestone-like inclusion on end of proximal break	light gray to honey; fine-grained; translucent; honey interior; large opaque white inclusions; some dark gray and reddish dot and linear inclusions

NO.	RED CLAY	CaCO3	CORTEX	CORTEX	MATERIAL
95	yes	yes	none	none	medium gray; some thin minor patina on dorsal surface; translucent; honey interior; dark red fine dot inclusions
96	yes	no	65%	mostly dorsal face	variable light to medium gray; linear and large light gray to brownish light gray clouds; translucent; mostly cloud inclusions, one dark red dendritic; intrusive hole like A60, A77.
97	yes	no	8%	platform only; crude (like A60, A77, A90); black rim under cortex	light gray; fine-grained; translucent; honey interior; no interior inclusions. Distinctive cortex.
98	yes	no	none	none	dark gray; fine grained; waxy surface; mostly opaque; some translucence on edges; dense dark gray dot and linear inclusions
99	no	yes	none	none	light gray with some honey discoloration; translucent; honey interior; a few dark gray dot and banding inclusions
100	yes	yes	16%	probably platform and edge beside platform; probably smooth exterior surface of natural original rock	dark reddish brown dorsal; light brownish yellow ventral; opaque; high quality; waxy surface; internal light tan clouds; across entire ventral surface are profuse internal light grayish brown medium dot inclusions
101	yes	yes	40%	about half of dorsal face; from dorsal ridge to edge of flake	light gray; translucent; honey interior; some darker gray interior banding; a few dark gray tiny dot inclusions
102	no	yes	none	none	light gray; some thin white patina discoloration on dorsal face; translucent; light gray to honey interior; dark gray dot and dendritic inclusions
103	yes	no	none	none	dark brownish red; very fine-grained; waxy surface; opaque; dark gray dot and dot cluster inclusions. Different material from anything else.
104	no	no	55%	beside platform; much of dorsal face	variable medium gray; translucent; honey interior; dark gray and dark red dot and dendritic inclusions (somewhat profuse)
105	yes	no	5%	some on thick dorsal crest; attempted removal	Essentially same as A71 and A56. Highly variegated; finely banded; medium gray matrix with intensive dark red fine parallel bands; some dark gray dense dot cluster bands; some cream areas full of banding; dense; opaque; high quality; surface very smooth
106	yes	no	2%	on platform only; none on rest of flake	light gray; fine-grained; translucent; light gray interior; lots of dark red dot inclusions
107	no	yes	2%	small piece of distal corner	light gray; minimal ventral thin patination discoloration; fine-grained; translucent; honey and light gray interior; mostly dark red dot and dendritic inclusions; some dark gray dots
108	yes	no	1%	platform only; none on surface	medium gray; some minor black and cream areas; translucent; dark honey interior; linear gray interior clouds

NO.	RED CLAY	CaCO3	CORTEX	CORTEX	MATERIAL
109	no	no	none	none	dark brownish rust; dorsal face with lots of lighter grayish grown mottling; dense; opaque; surface very smooth to almost waxy; ventral black and cream dot inclusions; dorsal more mottled from cream dot/ area inclusions. Unique material, but similar to A103.
110	yes	no	7%	some at distal end	dark brownish gray to dark gray; fine-grained; opaque; fine-grained dark gray net-like and dense linear inclusions; some dark gray fine-line inclusions
111	yes	no	2%	some original natural surface of the parent stone next to platform	light gray dorsal surface; mottled medium grayish brown ventral surface with dark gray fine dot linear inclusions; larger cream clustered dot inclusions; dense material; opaque; surface very smooth to waxy
112	yes	no	none	none	honey medium gray; fine-grained

flake removed the original platform surface and formed a new single-faceted platform, but subsequent use is not known. A flake was struck from the side of the top of the core and removed the previous platform up to the platform edge, which is now somewhat battered from removal of previous flakes. The material is very fine-grained, mostly medium gray to yellowish gray with honey interior (visible with strong back-light along one thin edge). There are profuse spaced dendritic inclusions, mostly dark gray and some dark red, plus an area of dark red lines connecting the dendrites. The material is unique in this assemblage, although some other flakes are similar. There also are no other cores or core parts. The resulting small, thick, blocky chunk is nonfunctional, and there is no obvious or potential use. It is impossible to imagine why a debitage piece like this would be in one's personal toolkit or bag of tools and flakes.

Curved Cross Section. Longitudinally curved flakes (e.g., A105. A110) were intentionally produced for production of certain tools. The initial curved cross section would be easiest to produce from a large cobble core with a natural curved surface, but it is also possible to prepare the surface of a block or bedrock piece to produce the same desired curve. Across the Plains flakes with curved cross sections were most often produced for end scrapers, such that the distal end of the scraper was undercut and provided a stronger, more preferred scraping bit. As the scraper became dull and was resharpened, the undercut bit end was reduced, and the ventral face became flatter. The ventral face is also often polished from use. In this sample, 10 flakes (9% of all flakes) are curved, although there is rarely any edge retouch or evidence of use, and none have been formally retouched into tools with functioning distal edges.

FLAKE CHARACTERISTICS

Nearly all pieces are proximal, and most have platforms (n=103; 92% of all flakes). Some accidentally terminate in overshot ends (turn or curve downward around the core) or hinge fractures (turn up; e.g., A18, A104). That is, a few do not terminate in evenly feathered edges from finely controlled flake removal.

Flake Analysis Methods. Cache contents consisted of 112 flakes subsequently numbered for analysis (Tables 1-2). Measurements were made with digital calipers relative to the flake axis when removed from the core and not relative to flake shape. Thickness is maximum thickness. An asterisk beside a measurement indicates a fragmentary piece. All photos were likewise taken with the proximal (platform) end up and the distal end or edge downward. Platforms are described as thick or thin (thickness from dorsal to ventral face) and wide or narrow (width along the platform edge). Thickness and width designations refer only to this cache. Platform angle was measured from the dorsal face with a digital protractor. Translucency, internal hue, and inclusions were checked by holding the flake in front of a bright light. Thickness (range 5-35 mm; average 14 mm) variably restricted light passage, but in most cases thin edges transmitted light well

Figure 7: 48CA2300, Artifacts 1-25; proximal end up; about half natural size (note scale).

Figure 8: 48CA2300, Artifacts 26-44; proximal end up; about half natural size (note scale).

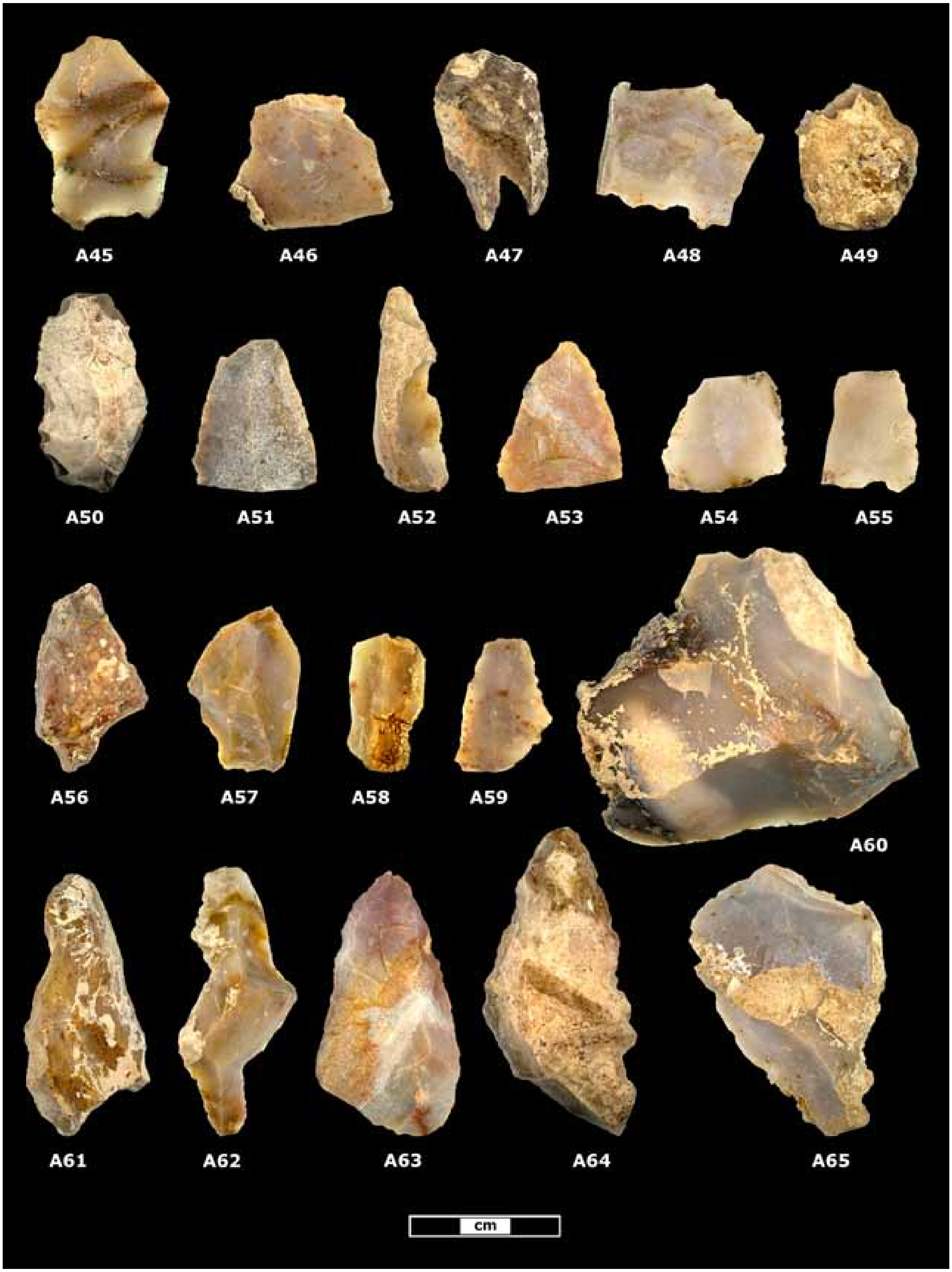

Figure 9: 48CA2300, Artifacts 45-65; proximal end up; about half natural size (note scale).

Figure 10: 48CA2300, Artifacts 66-87; proximal end up; about half natural size (note scale).

Figure 11: 48CA2300, Artifacts 88-112; proximal end up; about half natural size (note scale).

(except for opaque pieces), because of the usual high quality of the material.

Sizes. Most flakes would be considered medium size to large, with at least one flake very large (287 mm wide) compared with others in this sample. Length ranges 25-121 mm (average 70 mm); twelve flakes have fragmentary length. Width ranges 22-287 mm (average 52 mm). Thickness ranges 11-35 mm (average 14 mm). These averages are greater than most flakes on lithic scatter sites in eastern Wyoming based on our measurements at hundreds of sites (site forms on file with the Wyoming Cultural Records Office). The upper end of the length and width ranges is also greater than most in eastern Wyoming apart from quarry sites.

Fragments. Only 12 flakes (11% of all flakes) have fragmentary lengths to some degree, with either the proximal or distal portions missing. This means that 89% are longitudinally complete and indicates intentional selection of flakes. Those deemed usable by the owner of the cache were retained even if they were broken during initial or secondary flake removal. Only five (4% of all flakes) have snapped approximately in half. These are the proximal half of large flakes and indicate a choice to retain proximal portions broken during removal from the source or core.

Sharp Edges. Flake edges are mostly sharp, which indicates that reduction in size, shape, or edge modification were not important for transport of the flakes.

Limited Reduction. Flakes were not systematically reduced into retouched bifacial blanks or preforms at the quarry location or afterward. They were transported to the cache as mostly unaltered flakes.

Short Transport Distance. Edges are in good condition with little battering or "bag" retouch. This suggests they may have been transported for a relatively short time, possibly a relatively short distance, or they were well padded for transport. If transport had been further and longer, or the flakes not well padded, the edges should have received more edge wear.

Padded for Transport. The small amount of transport edge wear also suggests the pieces were adequately padded in grass or packed in soil, such as the reddish sandy clay observed in the pit. Padding also indicates they were carefully packed in a bag specifically for transport. Because of the known use of hide bags and smaller pouches on the Northern Plains, we suggest materials were placed in a hide container that disintegrated while in the pit rather than in a woven basket or ceramic container.

PLATFORMS

Platform Overview. Platform attributes were considered for their presence, completeness, shape, and possible alteration (Table 3). Categories are discussed individually below, with frequency counts and percentages.

Flakes were produced by an expert familiar with flaking setup and technology to create flakes in several expected shapes. This was done by striking platform control as part of planning, and resulting flake shapes are not haphazard or accidental.

All flake removal appears to have been done by hard-hammer percussion, sometimes with a large hammerstone and considerable force. There is no indication of the use of a bone or hard-wood billet or the upper sides of a small cylindrical stone in a billet-like fashion.

Platform size and shape are often prepared for removal of a certain kind and shape of flake. For most, platform angles (Table 4) suggest use of bedrock chunks or blocky cores, not bifacial cores in the form of a large biface. Several elongated flakes and blades have curved cross sections (e.g., A105. A110) indicative of removal from a curved core surface, perhaps a large rounded cobble (n=10, 9% of all flakes). Flake removal by multiple or repetitive blows from the core or platform edge produced different kinds and shapes of flakes, including expanding sequent flakes and parallel-sided blades, some with previously removed flute-like flakes along the center (e.g., A91, A102).

Measurable Platforms. The platform is variably present on most of the 112 total flakes and the platform angle measurable (n=93; 83% of all flakes; Table 4).

Platform Missing. The platform is missing and platform angle not measurable on only a small percentage of the flakes (n=19; 17% of all flakes). Of these, some proximal ends are snapped and missing (n=11; 58% of missing platforms; 10% of all flakes; e.g., A14-16, A48). On many, the platform is just a remaining edge from a battered platform surface or battered edge from reducing that edge (n=5; 26%

Table 3: Platforms.

platform present, measurable,	(n=93; 83% of all flakes)	
platform missing, total,	(n=19; 17% of all flakes)	
platform snapped,	(n=11; 10% of all flakes)	(58% of platforms missing)
platform reduced to edge only,	(n=5; 4% of all flakes)	(26% of platforms missing)
platform reshaped by retouch,	(n=3; 3% of all flakes)	(4% of all platforms) (16% of platforms missing)
tiny-small-narrow (not just thin),	(n=27; 29% of all platforms)	
platform surface battered,	(n=14; 15% of all platforms)	
platform edge battered,	(n=34; 37% of all platforms)	
single-faceted,	(n=56; 60% of all platforms)	
multi-faceted,2+ facets,	(n=21; 23% of all platforms)	
cortical platform, all,	(n=13; 14% of all platforms)	
cortical platform only,	(n=6; 6% of all platforms)	
platform + other cortex,	(n=7; 8% of all platforms)	(6% of all flakes)
cortical platform with battered edge,	(n=4; 4% of all platforms)	
combined single-faceted/cortical,	(n=1; 1% of all platforms)	
platform covered with CaCO3,	(n=1; 1% of all platforms)	

of platforms missing; 4% of all flakes; e.g., A33, A105). On three flakes, the platform is completely removed by intentional reshaping to a rounded end or dull point (4% of all platforms; 16% of platforms missing; 3% of all flakes; e.g., A26).

Table 4: Platform edge angles.

ANGLE, DEGREES	N=	% OF ALL PLATFORMS (N=93)
0-9	0	0
10-19	0	0
20-29	0	0
30-39	1	1%
40-49	9	10%
50-59	3	3%
60-69	30	32%
70-79	24	26%
80-89	12	13%
90-99	10	11%
100-109	3	3%
110	1	1%
30-49	10	11%
60-99	76	82%

Tiny Platforms. Most platforms are wide and many thick, but also common are small, tiny, or narrow (not wide) platforms (n=27; 29% of all platforms; e.g., A107-109). Of all flakes with platforms, only two have a ground platform edge, one on a small, narrow platform (A108).

Faceted Platforms. Flakes were removed from single- or multi-faceted prepared platforms or from cortical platforms. All platforms were specifically selected or prepared for flake removal. Most are single-faceted (n=56; 60% of all platforms), and about half that many are multi-faceted with two or more facets (n=21; 23% of all platforms).

Cortical Platforms. The natural surface of the parent cobble or block was used as the striking surface for a few flakes (n=13; 14% of all platforms). Some cortical platforms have a battered platform edge (n=4; 31% of cortical platforms), and on one the platform edge is ground. For cortex flakes, the cortex may be only on the platform of an otherwise interior flake (n=6; 46% of cortical platforms). Others are secondary flakes with additional cortex on other parts of the flake (n=7; 54% of cortical platforms; 8% of all platforms).

Platform Surfaces. The platform surface itself is occasionally battered, and sometimes worked or retouched (n=14; 15% of all platforms). A few platform surfaces were removed by reworking (n=3; 4% of all platforms).

Platform Edges. On flakes with a platform, about a third have a battered (and usually rounded) platform edge from previous removal of multiple flakes, suggesting multiple blows against that platform edge and some degree of preparation (n=34; 37% of all platforms). Two platform edges are additionally ground or rounded for controlled flake removal (n=2; 2% of all platforms). Sequent flakes also often fit into this category.

Platform Edge Angles. Biface thinning flakes or flakes removed from bifacial cores would be expected to have platform angles of about 30-49 degrees, but few in this sample fall within that range (n=10; 11% of all platforms) (Table 4). No flakes have characteristics of obvious biface thinning although many platforms are small, multi-faceted, reduced, shaped, or have ground edges for strengthening the platform. Most common are flakes with angles of 60-99 degrees (n=76; 82% of all platforms), which would be expected from blocky cores, exposed bedrock layers, or even initial reduction of thick cobbles.

MULTI-SIDED CORES

Some flakes have flake scars indicating multi-directional flake removal from various edges or platforms of the parent block, whether a detached chunk used as a core or as part of exposed edges of in-place bedrock layers. One example is A57 (Figure 9), with two primary, contiguous, single-faceted prominent platforms. The last use, which removed the final elongated flake, was from a platform at a laterally sloping angle to the axis of the blade. Adjacent to this is a contiguous, almost identical platform with a heavily battered edge, and from which at least one large flake was removed at nearly 90 degrees to the flake axis. Before that, a large expanding flake was removed contiguous to the last one. Finally, however, it appears a flake was removed proximally from the distal end, removing a flute running about a third of the way up the middle of the blade and bordered by low dorsal crests. That last platform is missing and now is just the remaining edge. All this seems to indicate that flake removal revolved around the perimeter of what must have been a circular cobble core, but not a biface to be thinned or used as a blade core. Primary platforms are wide and thick, at nearly 90 degrees, and were intentionally prepared – not the normal thinner edge of a bifacial core. Other flakes in the sample similarly exhibit multi-directional flake removal across the surface of the resulting flake, so this kind of core with revolving or multiple platforms must have been fairly common.

REDUCTION STAGE AND CORTEX

An attempt was made by the knapper to produce flakes that in the future could be reduced into tools. Only one-third of all pieces are interior flakes with no remaining cortex (n=44; 39% of all flakes). Most, however, are primary and secondary decortication flakes (n=67; 60% of all flakes). A few more have cortex on the platform only (n=12), for a total of 71% of all flakes with some degree of cortex (n=79), usually a thick, white exterior surface (Table 5).

A few (n=9; 13% of all primary and secondary decortication flakes) are initial decortication flakes with greater than 60% cortex that were intended to remove the cortical surface of the core or block. Most cortex flakes (n=58; 87% of all primary and secondary flakes) are secondary flakes with 55% or less cortex remaining on the dorsal surface. These all were removed from the core with some remnant cortex, and there is little indication of subsequent attempts at cortex removal. This indicates that the flakes were assembled during initial removal from a cortical core in an effort to select interior material free of useless cortex. On a few additional flakes, the exterior or cortical surface was used only as the striking platform (n=6; 6% of all platforms), and seven flakes with cortical platforms also contain additional cortex (8% of all platforms; 11% of all flakes).

CaCO3 and RED CLAY

A thin deposit of calcium carbonate (CaCO3) residue occurs on half the flakes (n=57; 51% of all flakes; Table 2), especially on the dorsal surface and around mostly the edges of the ventral face. The deposit presumably is from contact with fine white ash or limestone burned at a high temperature. This usually accumulates from limestone or ash powder under wet conditions, as well as during cooking in a fire pit. This would suggest pit-associated heating, but on these pieces, there is no other evidence of intentional heat treatment to affect flaking charac-

Table 5: Flake attributes, counts, and percentages.

Primary flakes		
60-95% cortex, n=9	8% of all flakes	
90-95% cortex, n=2	2% of all flakes	22% of primary flakes
60-75% cortex, n=7	6% of all flakes)	78% of primary flakes
Secondary flakes		
1-55% cortex, n=58	52% of all flakes	
20-55% cortex, n=15	13% of all flakes	26% of secondary flakes
40-55% cortex, n=5	4% of all flakes	9% of secondary flakes
20-35% cortex, n=10	9% of all flakes	17% of secondary flakes
1-18% cortex, n=43	38% of all flakes	74% of secondary flakes
Interior flakes		
no cortex, n=44	39% of all flakes	
cortical platform, n=13	14% of all platforms	
platform only, n=6	6% of all platforms	
platform plus additional		
on surface, n=7	8% of all platforms	11% of all flakes

teristics of the chert.

Red clay and CaCO3 occur together on nearly half the sample (n=50; 45% of all flakes). This indicates a high relationship between the two. Red clay occurs without CaCO3 on about a third of the flakes (n=42; 38% of all flakes), and CaCO3 occurs on a few with no red clay (n=7; 6% of all flakes). This low correspondence may be from lack of ability to discern the red clay in the lab during analysis rather than actual absence. Otherwise, CaCO3 rarely occurs without the related presence of clay. Only 13 flakes (12% of all flakes) have neither red clay nor CaCO3. If this is real, it may indicate that some flakes were not in contact with the red clay and received no accumulation of CaCO3 from ash or from burning. Or, they were packed in a different way, perhaps at a different time, and possibly from a different location within the general Hartville region.

TOOLS, RETOUCH, AND EDGE USE

Nearly one-fourth of all flakes show some kind of edge modification, whether the result of non-use shaping or from use (n=24, 21%) (Table 6). Some have battered portions in attempted reduction of flake thickness and perhaps shape, probably for intended hafting. An example of this is attempted reduction of prominent dorsal crests on some flakes, with battering either from the edge up to the ridge crest or from the crest down along one or both sides (n=6; 25% of retouched flakes; e.g., A61, A110). On some retouched pieces, the platform edge is worked or battered, sometimes reduced to an edge, sometimes as part of sequent flake platform edge preparation (n=10, 42% of retouched flakes). Such retouched platforms are not considered edge preparation for tools.

Only one flake (A63) is formally reshaped by beveling around the entire edge for eventual prescribed use and could be a finished tool in the form of an elongated, teardrop-shaped uniface (Figure 9; Table 6). In this case the striking platform has been removed by flaking, and the proximal end is now pointed. Other flakes had been removed from the dorsal face before this flake was removed from the core and before final edge beveling and shaping. Other pieces with retouched or beveled edges also could have functioned as tools.

On most, however, there is minor to intensive edge nibbling from use and occasionally minor to minimal flaking or beveling along the immediate edge as part of edge use (n=19; 79% of retouched flakes). On some the edge is additionally rounded from use (n=9, 38% of retouched flakes). This kind of edge nibbling or micro use retouch is likely from cutting or scraping against a relatively hard material, while edge rounding could be more from repeated rubbing against a softer material, such as wood or hides. Additional use as scraping or planing tools

Table 6. Retouch, edge modification, and evidence of use. *Right* and *Left* are relative to photo view; proxi mal/platform end up. See photos, Figures 7-11.

NO.	RETOUCH AND USE
6	proximal end somewhat battered. dorsal battering along upper-left edge; minor nibbling along other three edges; rounding of left and right corners.
21	proximal end battered to an edge; distal end snapped; fine dorsal retouch along right edge; minor nibbling along left edge from use.
33	major dorsal flaking along proximal edge, removed the platform; battered distal edge in unsuccessful attempt to thin that hinged end up to the dorsal crest; limited battering to minor dorsal retouch along right edge; dorsal and ventral nibbling all along the left edge and lower rounded corner down onto the left part of the distal edge at both rounded corners.
34	platform edge battered; lower-right squared edge battered in attempt to thin the edge; dorsal battering on upper-left edge.
40	dorsal flaking along right edge up to the ridgecrest; rounded lower-right corner; edge retouch and edge smoothing continues from lower-right corner around onto the adjacent part of the hinged distal edge; left edge and distal edge bifacially nibbled from use.
41	platform edge and platform face battered; distal portion snapped; fine dorsal nibbling from use along left edge.
50	dorsal flaking along the right edge up to the ridgecrest; edge rounded from use; left edge crude irregular dorsal flaking or battering; along left edge bifacially nibbled and dulled from use.
53	right edge intensive bifacial edge nibbling and some rounding from use; left edge bifacially very finely minimally nibbled from use; distal edge also rounded from nibbling along the hinge fracture edge.
56	dorsal beveling/flaking along the right edge and rounded lower-right corner; left edge dorsally flaked and battered up to the ridgecrest and then rounded from flaking; dorsal battering on the distal tip.
61	dorsal flaking along lower part of right edge and rounded corner, and lower part of left edge to the rounded corner; battering along both sides of ridgecrest, attempted thinning of the ridge; some larger battering along left edge up to the ridgecrest; distal edge battered; flake curved with undercut distal end.
63	completely dorsally beveled around perimeter as for a large scraper; beveling removed platform at pointed proximal end; some rounding of beveled edges; lower-right corner rounded from dorsal flaking.
64	irregular battering along right edge; main upper part of left edge battered up to the highly crested dorsal ridgecrest, and edge more finely retouched along that margin; distal edge and lower part of left edge at curve dulled from minor nibbling and use.
68	platform edge battered from sequent platform preparation for wide blades; entire right edge dorsally flaked to sharp low-angle edge (or partial bevel) all the way to the distal tip; lower portion of left edge finely bifacially nibbled from use.
71	platform edge flaked to a fine bevel; right edge mostly irregular fine battering with some irregular minor bifacial nibbling along the edge; distal edge and left concave edge bifacially nibbled from use; lower-left rounded corner with minor nibbling but dulled; ventral face looks to be polished from use.
77	platform edge battered; distal edge snapped; some dorsal use-flaking all along extreme left edge.
78	narrow use wear along slightly curved right edge, dulled from use, mostly dorsal; some minor dorsal edge use wear along left curved edge; some minor dorsal edge wear-flaking along fragmented distal edge;
79	right edge flaked, and then bifacial intensive nibbling from edge use down around distal tip and all of left edge.
83	platform edge and platform surface somewhat battered from sequent type removal of elongated blade-like flake; deep negative bulb at proximal end; left curved edge has controlled battering and deep nibbling all the way from the platform edge down around the lower-left curved corner; both dorsal and ventral surfaces possibly smoothed from use.
90	upper-right edge fine dorsal flaking and rounded edge; edge nibbling and use continue on dorsal face down around the right curved corner, around distal end, and all along left edge.
93	platform edge lightly battered; right flake edge heavily nibbled from use; all of left edge bifacially nibbled from use and somewhat dulled and rounded.
100	right edge some minor dorsal nibbling; lower-right corner snapped when proximal-to-distal flake removed that corner and produced a large flake scar; some bifacial fine edge nibbling on a remnant portion of distal edge; entire left edge heavily bifacially nibbled from use.
105	fine bifacial nibbling along right edge; dorsal face of that same right edge almost a fine bevel; distal end reshaped and rounded from unifacial dorsal bevel, which continues all along the left edge, along with some fine bifacial nibbling from use.

NO.	RETOUCH AND USE
108	lower-right and extreme lower-left corners snapped; small remnant portion of distal edge between those snaps intensive very narrow bifacial nibbling to a rounded edge; left edge narrow dorsal bevel, and fine irregular use nibbling, and edge rounded from use; left edge more obvious intentional intensive bevel and then minor bifacial edge nibbling and rounding.
112	prominent dorsal crest, but no attempt to thin from the crest; distal end intensive dorsal flaking to form an even curve and reduce dorsal crest thickness at the end; dorsal flaking continues along left edge to even and strengthen the edge, with some minor bifacial nibbling and smoothing of the edge; right edge minor bifacial nibbling from use, and edge somewhat rounded; ventral face at least partially polished from use.

is evidenced by polish on the ventral surface (n=2; 8% of retouched flakes), like on many Plains end scrapers. From this sample, it is obvious that some of the flakes were utilized or modified to varying degrees for use as tools and were probably kept in the bag by the owner for his personal use.

AGE AND FUNCTION

Determining when the flakes and tools were assembled by the person who eventually buried them is difficult because there are no diagnostic artifacts or datable organics. This recurring problem has been previously discussed at length (Clark and Fraley 1985; Kay 1985; LaBelle 2015). Clark and Fraley studied material types of more than 800 artifacts of varying ages from excavated bison kills in the northeastern Powder River Basin of Montana and Wyoming and found that Hartville Uplift materials were used primarily during the latter part of the Late Prehistoric Period (1985:16-17). Details of their method have been criticized (Kay 1985), but it helps recognize an established pattern.

Ages for Paleoindian caches have been based on the kinds of blades and bifaces and often the presence of red ochre (LaBelle and Johnston 2015; White 2019), but the Hartzog cache is not considered that age. Caches on the Northwestern Plains dating after the arrival of the horse, during the Protohistoric and early historic era, are not only rare for quarried lithic material but are expected to contain metal or indications of historic use. Large bifaces or quarried material prepared for travel and trade were rare in early historic times, when most formal quarries were no longer used, and transport by horse could have been affected by battles with guns as well as bows and arrows. This cache was more likely assembled when people were on foot, with dogs doing much of the hauling, probably during the Terminal Archaic or Late Prehistoric period. This age is consistent with the physical condition of the cache and location of the pit.

The predominance of worked and utilized pieces in the bag suggest they were for personal ongoing use by the owner, not for trade or exchange. The items were personally important but were not something needed in the immediate future and were recoverable at the owner's leisure. They were placed at this nondescript location, possibly quickly and without obvious planning to select a more recognizable, unique location.

DISCUSSION

Caches have been discussed extensively in varying degrees of generalization for locations across North America (e.g., Archaeology in Montana, Volume 26, No. 2, 1985 devoted to cache articles; LaBelle 2015). Tunnell described a cache as "an accumulation of useful material that is hidden away for future recovery and utilization" (1978:1). Binford (1980:22) likewise felt that a cache represents temporary field storage of a high bulk (or presumably high weight) resource, by logistically organized collectors. LaBelle (2015:9) discusses the reporting history and various functions of caches across the Plains and concentrates on 37 lithic caches from Colorado arranged into four main categories. Passive caches (for storing seasonal gear), insurance caches (for stashing lithic material of low availability or quality as a backup plan for anticipated future use), and afterlife caches (for burial goods or provisions) do not pertain to the Hartzog Cache, but the Load-Exchange category seems closest to the Hartzog cache as being placed here to avoid additional transport of a heavy bag of rocks.

Laurent and Eckerle (1983), in discussing the partially excavated Timber Creek cache in northeastern Wyoming, point out that Binford's definition of intentional storage is not obvious in their case. Rather, the materials may be accidental abandonment of accumulated items from simple loss, death of the owner, or just the fact that the cache was never revisited. Often it is not possible to distinguish hoarded and transported resources from truly stored ones, or purposeful storage from accidental loss. In the Hartzog case, however, the cache appears to have been purposefully stored based on the preparedness of the pit and placement of items in it even though they were not retrieved. LaBelle (2015:9) points out, cache items found by archeologists are those that were lost, forgotten, or not needed again. Apparently, the Hartzog cache was one of those that was no longer available to the original owner. Once buried and covered with native vegetation, relocation of the Hartzog pit would have been difficult if not impossible. A large sandstone rock presently 2.4 m (8 ft) north of the cache may have been placed there to help relocate the materials, but it was not successful. The owner could have died or just never returned to this location.

The contents of the Hartzog cache are distinct from other caches, particularly ones with thinned bifaces, dart point and arrowpoint preforms, and large biface blanks, such as the Tillard Cache (Greer and Greer 2016) 96 km (60 miles) southeast of Hartzog Draw, the Timber Creek Cache 66 km (41 miles) northeast of Hartzog Draw (Laurent and Eckerle 1983), the Rattlesnake Ridge Cache 148 km (92 miles) east-southeast of Hartzog Draw (Lippincott 1985), the Inyan Kara Cache in the Black Hills (Barlow 1968), and ones in southeastern Montana (Clark and Fraley 1985; Greer and Greer 2022). The difference may be because there was a different function for this cache, such as stashing a personal toolkit for future use of the contents.

There are various ways of interpreting frequencies of flake attributes and their implications. We considered flake characteristics, raw material, flake shape, flake orientation, platform, presence and interaction of CaCO3 and red clay, and edge modification relative to possible tool use. These data not only describe and explain the contents of the cache, but provide comparative data for other lithic assemblages, especially for eastern Wyoming. Most of the raw material is high quality, mostly translucent, dendritic chert, with some opaque pieces. All materials probably originated from exposed layers and cobbles in the southern part of the Hartville Uplift, about 196 km (222 miles) away in southeastern Wyoming (Craig 1982). The dendritic dark red pieces with a waxy surface and the high-quality opaque pieces are typical of those found in the southern part of the Uplift. Sources of similar cherts also occur in the Black Hills, about 160 km (100 miles) east (Clark and Fraley 1985:12; Sundstrom et al. 2008:118), but chert in this cache appears most likely from southeastern Wyoming, a source intensively used during this estimated time. Pieces were produced by percussion from larger cores, almost certainly mostly from in-place layers of raw material. Flakes with curved cross sections suggest that some are from rounded cobbles, not just blocks from chert layers.

Most flakes are larger than is common on lithic scatter sites across eastern Wyoming. Although some are fragmentary, 89% are longitudinally complete, so an original attempt was made to retain complete flakes and, if broken, at least the proximal portion. Edges are generally sharp although some have nibbled edges, limited edge retouch, and some intensive edge beveling. There is little or no indication of production of bifacial blanks for transport. Edge characteristics indicate that materials were in a bag and padded for transport, presumably planned for a relative short distance.

F lakes conform fairly well to several generalized shapes. Some are constricting, others expanding, especially sequent flakes from repeated use of prepared platforms. Most are elongated, some to the point of being long, narrow blades. Curved flakes have the same overhung form common for end scrapers. Sizes of the cache flakes relative to more usual flake sizes across eastern Wyoming suggest these flakes were produced for further reduction and shaping and were not intended for final use in their present form.

A few flakes are from multi-sided cores as evidenced by previous flake scars across the dorsal face from several directions, indicating that the core was struck from various edges. This kind of core rotation appears to have been fairly common. One small chunky piece (A4) is a core platform rejuvenation flake that removed the original platform with a lateral flake that produced a new single-faceted platform. The material is unique, unlike any other flake in the cache, and no other core pieces are present. The reason for the occurrence of this unusable debitage piece in a bag of personal items is not obvious.

An attempt was made to remove cortex, but 71% of all flakes still retain varying amounts of cortex on both primary and secondary flakes and flakes with a cortical platform. Most common are flakes with only 1-18% remnant cortex on the dorsal face (38% of all flakes). Of all flakes 39% are interior flakes with no cortex.

The flakes were packed in a bag with red clay to keep the pieces from rubbing against each other. There is no indication that grass or other material was used in addition to or instead of the clay. Clay residue still adheres to 82% of all flakes, and clay on others now may not be discernible. Of all flakes, 51% have spotty remnants of thin calcium carbonate ($CaCO_3$) deposit on one or both surfaces, possibly from contact with fine ash or heavily burned limestone. Both red clay and $CaCO_3$ residue are present together on at least 50% of all flakes. There is no other indication flakes were heat-treated or subjected to high temperature.

Nearly one-fourth of all items (n=24, 21%) show evidence of flaking, shaping, post-removal modification of the platform, attempted thinning of the dorsal ridge, edge retouch, or use. Some have varying intensity of modification by edge battering, and others have initial retouch, possibly just from strengthening the edge or minimal edge modification. Others are clearly shaped, with formally beveled edges. Minor nibbling and smoothing of edges and polishing of flake surfaces (mostly ventral) indicate use of the flakes in various activities, such as cutting and scraping. Observed kinds of flake or edge modification are summarized (Table 6).

SUMMARY

This was an intentional cache of flakes that were individually selected and not just random core reduction debitage. All materials are most likely from the southern end of the Hartville Uplift in southeastern Wyoming. Flakes were carefully selected for inclusion according to size and attributes, and this sample consists of a wide variety of sizes, shapes, and materials. Most flakes were saved with no appreciable edge strengthening or shaping into oval bifaces for transport and future reduction, as is common at quarries and with other caches. However, nearly a fourth (21%) of the flakes were shaped, prepared, and used as tools before being placed in the bag for transport. Of course, retouch and use may have occurred anywhere between the source and the final cache location, and at any time. This supports the interpretation that the assemblage was the personal collection of generalized tools and flakes and provides suggestions about the owner's organization. The materials were likely placed in a bag for personal travel and his personal future use, and not for trade or exchange.

The flakes were brought to this location, almost certainly in a bag at least partially lined with red clay, possibly to keep the sharp flakes from cutting through the pouch. Once at this location, the filled bag was deliberately placed for storage (or the contents separately dumped) into a shallow excavated pit and covered over. The location is rather nondescript in terms of returning for any buried or hidden material. A large sandstone rock is eye-catching on the broad flat upper bench and may have been moved to this location (now just north of the cache) to help relocate the materials. Such relocation and retrieval by the user, however, never occurred.

In summary, probably sometime during the Terminal Archaic or Late Prehistoric period, around 500 BC to 1500 AD, this bag of useable artifacts, many of which would need additional work before functioning beyond expedient cutting or scraping, were produced and collected, probably from various locations within the Hartville Uplift source area, and then packed carefully for transport and future use by the owner. Travel was interrupted, and the bag was buried in a shallow pit, possibly marked, away from any established campsite, lithic source area, or recognizable ritual location. Although planned retrieval is assumed, it never happened.

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THE DEBARARD EARTH OVEN (48AB3354): HOT ROCK COOKING IN THE LARAMIE BASIN

by

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ABSTRACT

In April 2021, an earth oven feature was identified eroding from a Laramie River terrace (48AB3354). The oven consists of a thick zone of charcoal and carbon-stained sediment overlain by a layer of fire-cracked sandstone, all within a shallow depression and capped by alluvium. Below the feature were several unburned fragments of large mammal bone, but no other artifacts were observed. Although no formal testing was conducted, the feature was profiled and samples were collected for radiocarbon dating and Zooarchaeology by Mass Spectrometry (ZooMS). Results demonstrate the feature was used during the Late Prehistoric period (633-532 cal BP), and the fragmentary faunal remains were bison (*Bison bison*). The estimated size of the earth oven heating element at AB3354 is similar to other earth ovens from Albany County (<100 kg of rock), which are all substantially smaller than the larger earth ovens likely associated with bulk geophyte processing in western Wyoming. This relatively small size, combined with the presence of large mammal bones, suggests the oven at AB3354 may have been used as a meat oven for cooking large ungulates—akin to other earth ovens in Albany County. Additional research of earth oven features in southeast Wyoming can evaluate whether meat ovens are more common in the Laramie Basin than ovens for cooking geophytes and other plant resources.

INTRODUCTION

In April 2021, a hearth feature eroding out of the eastern bank of the Laramie River was reported to Todd Surovell. Upon visiting the site, the presence of burned sandstone overlaying a thick zone of charcoal and carbon-rich sediment indicated the feature was not a hearth but rather an earth oven used for pit-cooking foods (Black and Thoms 2014). The DeBarard earth oven (48AB3554), named after the landowner, is approximately one-meter in diameter and contains 50-100 kg of Frontier Sandstone. These dimensions are fairly large for features in the Laramie Basin, but substantially smaller than the large geophyte ovens of Western Wyoming and the Pacific Northwest (Francis 1995; Thoms 1989). The AB3554 feature is also more informal compared to the slab-lined, cylindrical ovens found across much of the state (Smith et al. 2001; Smith and McNees 1999; Thompson and Pastor 1995). We profiled the earth oven at AB3554 and documented the stratigraphic context, noting several large mammal bones within the feature and stratigraphically below the pit fill. No chipped-stone artifacts were observed, and no artifacts or ecofacts which may have been associated with the cooked foods were observed above the heating element. Importantly, we also recognized the nearest source of the Frontier Sandstone used as the heating element as approximately 800 meters from the site.

Because a relatively small sample of earth ovens from the Laramie Basin have been analyzed, charcoal was collected for radiocarbon dating and a sample of bone was collected for Zooarchaeology by Mass Spectrometry (ZooMS) analysis (Buckley et al. 2009). The radiocarbon date of (633-532 cal BP) places the use of the feature in the latter part of the Late Prehistoric Period (Kornfeld et al. 2010). The large bone fragment collected from beneath the feature can be classified as bison (*Bison bison*) based on ZooMS spectra peak alignment, and given the stratigraphic positioning, we suspect these faunal remains were associated with a previous oven firing rather than random alluvial ecofacts. Based on the overall size of the oven and the association with bison remains, we suspect the DeBarard earth oven was a re-used meat oven rather than a feature for cooking tubers or geophytes. Although additional formal testing would be necessary to fully evaluate this hypothesis, there is clear evidence at the Joe Miller site (AB18; Burnett et al. 2008) that earth ovens were used to bulk process large game associated with mass kills in the Laramie Basin. If the DeBarard oven is indeed a meat oven, then it is also plausible an extensive Late Prehistoric site may be present within the alluvial terrace.

EARTH OVEN FEATURES IN WYOMING

Earth oven cooking features—frequently referred to as roasting pits—are common occurrences in the archaeological record of Wyoming and are perhaps best-recognized from the concentrations of fire-cracked rock (FCR) or fire-altered rock (FAR) which are the remnants of earth oven heating elements (Black and Thoms 2014). Earth ovens are layered arrangements of heated rocks, packing material, food, and an earthen cap which cook food underground in a moist environment through a process called hydrolysis: the breakdown of complex molecules via the uptake of a water molecule (Wandsnider 1997:4). In most instances, rocks are heated in a fire to serve as a heating element, green packing material and food are placed above the rocks once the wood has burned away, and the feature is sealed with a thick layer of earth (Black and Thoms 2014:208-209). The cooking temperature within an earth oven is generally maintained near 100°C, which allows foods with complex carbohydrate chains the required cooking time to successfully convert indigestible carbohydrates into digestible components (Thoms et al. 2018; Wandsnider 1997).

Each time an earth oven is built and fired, it is disassembled to remove the cooked food and ready the pit for reuse (Black and Thoms 2014:209). This process of oven reuse can generate substantial debris rings around a single oven pit, primarily in the form of spent cooking stone (FCR too small to retain heat), but also ash, charcoal, and the charred and uncharred remains of foodstuffs. Larger accumulations associated with earth ovens are termed burned rock middens, roasting pits, or earth oven facilities (Koenig and Miller 2023).

Based on archaeological, ethnographic, and contemporary records of Indigenous foodways, earth ovens in Wyoming were used to cook a variety of plant and animal resources, including sego lily (*Calochortus nuttallii*), biscuitroot (*Lomatium* sp.), camas (*Camassia* sp.), onion (*Allium* sp.), bison (*Bison bison*), elk (*Cervus canadensis*), bear (*Ursus* sp.), pronghorn (*Antilocapra americana*), and rabbits (Eckles and Wedel 1999; Francis 1995; Millington and Burnett 2008; Smith et al. 2001; Smith and McNees 1999; see also Rood [2018] for possible rock-less rabbit ovens). The variation of Wyoming oven features, from the smaller, cylindrical features to larger, informal ovens, likely corresponds to the different foods cooked. For instance, the cylindrical ovens (slab lined and not) were likely associated with small-scale geophyte or meat cooking (Joyce et al. 2022; Smith et al. 2001; Smith and McNees 1999; Wandsnider 1997) whereas the larger features are for bulk processing geophytes or large faunal resources (Francis 1995; Millington and Burnett 2008; Page 2017). Regardless of the variation in size, earth ovens are an important technology because they convert the fatty, starchy, or inulin-rich resources into digestible fats and carbohydrates (Thoms et al. 2018; Wandsnider 1997). This technology opened new subsistence resources to Indigenous peoples across North America (Thoms 2009), and earth ovens became increasingly important within domestic and non-domestic settings throughout the Holocene (Koenig and Miller 2023).

ALBANY COUNTY EARTH OVENS

Within Albany County, two sites provide the best sample of excavated earth oven features (Table 1): China Wall (AB1) and Joe Miller (AB18). The earth ovens from both sites, identified here as informal, shallow pits containing FCR, are fairly small (<1 m diameter) with total FCR masses ranging from 0.75-89 kg (Figure 1). Most features (23 of 27) date from ca. 1000-2000 cal BP, and none of the features at AB1 or AB18 are of the cylindrical variety. The earth ovens at the Joe Miller site are associated with the fragmentary remains of at least 11 elk and four pronghorn (Kennedy and Burnett 2008), suggesting the features were used to cook meat. Ethnographically, the use of earth ovens for cooking different meats is common (Wandsnider 1997:Table 5), and

Table 1: Summary of Earth Ovens Excavated from the China Wall (AB1) and Joe Miller (AB18) Sites.[a]

Site	Feature	Age (RCYBP)	cal BP (95.4%)[b]	cal BP Median	Dimensions (cm)	Estimated Volume (m^3)	FCR mass (kg)	FCR Density (kg/m^3)	FCR Count	Lithic Count	Bone Count
AB1	1	3760±70	4403-3924	4129	46x42x8	0.02	39	2523.29	47	9	5
AB1	2	1380±40	1355-1177	1299	70x70x25	0.12	39	318.37	90	8	21
AB1	14	1160±70	1267-930	1077	65x65x23	0.10	14	144.07	n/a	3	15
AB1	15	1660±60	1700-1404	1545	56x36x14 (truncated)	0.03	14	496.03	71	1	14
AB1	16	1330±60	1349-1078	1243	43x14x7	0.00	0.75	177.98	26	1	0
AB1	18	1220±60	1284-978	1141	73x45x11 (truncated)	0.04	13.5	373.60	62	1	0
AB1	21	2560±70	2779-2369	2619	65x44x10	0.03	21.5	751.75	85	0	0
AB1	22	1780±80	1886-1518	1670	37x40x? (truncated)	0.00	2	1351.35	32	0	0
AB1	25	1640±40	1688-1408	1515	57x80x5	0.02	n/a	n/a	5	1	5
AB1	26	620±40	660-545	602	64x30x15	0.03	n/a	n/a	4	2	4
AB1	29	1840±80	1930-1548	1749	51x?x23 (truncated)	0.06	19.5	325.96	25	0	4
AB1	30	2000±60	2111-1749	1934	70x60x9	0.04	28	740.74	19	0	4
AB1	32	1190±70	1273-959	1110	40x25x5	0.01	1.75	350.00	n/a	0	0
AB1	33	1720±70	1745-1412	1612	58x40x7	0.02	2	123.15	n/a	0	0
AB1	34	1580±70	1687-1313	1462	50x42x7	0.01	1.5	102.04	n/a	7	1
AB1	35	640±70	685-525	607	46x42x8	0.02	1	64.70	n/a	0	0
AB1	36	1390±60	1392-1176	1304	72x60x10	0.04	6	138.89	n/a	2	4
AB1	37	1940±70	2048-1705	1862	50x50x7	0.02	3.5	200.00	n/a	2	0
AB1	38	1010±70	1062-744	909	41x38x5	0.01	n/a	n/a	2	0	0
AB1	40	1770±60	1820-1537	1655	50x45x7	0.02	1.75	111.11	n/a	1	1
AB1	41	1350±60	1362-1127	1265	50x50x11	0.03	4.5	163.64	n/a	0	0
AB1	42	1450±60	1515-1276	1344	50x50x15	0.04	13	346.67	n/a	7	1
AB1	43	1270±60	1296-1065	1200	60x65x11	0.04	9.25	215.62	n/a	1	0
AB18	1	1510±40	1515-1307	1383	96x86x21	0.17	89	513.34	258	n/a	n/a
AB18	2	1735±35, 1780±40, 1560±70	1705-1545 1775-1546 1574-1305	1623 1657 1448	53x39x31	0.06	22.75	355.04	104	n/a	n/a
AB18	3	1680±35	1698-1420	1572	82x75x23	0.14	40	282.79	141	n/a	n/a
AB18	4	--	--	--	63x53x11	0.04	9.3	253.21	31	n/a	n/a
AB18	5	1605±35	1542-1401	1473	59x52x20	0.06	26.75	435.95	218	n/a	n/a
AB18	6	--	--	--	69x54x28	0.10	15.25	146.17	69	n/a	n/a
AB18	7	1610±40	1567-1389	1476	73x61x14	0.06	18.6	298.35	141	n/a	n/a

[a] Data compiled from Burnett and colleagues (2008) and Waitkus (2013).

[b] 95.4% confidence intervals from OxCal 4.4 (Bronk Ramsey 2009) and the IntCal20 calibration curve (Reimer et al. 2020).

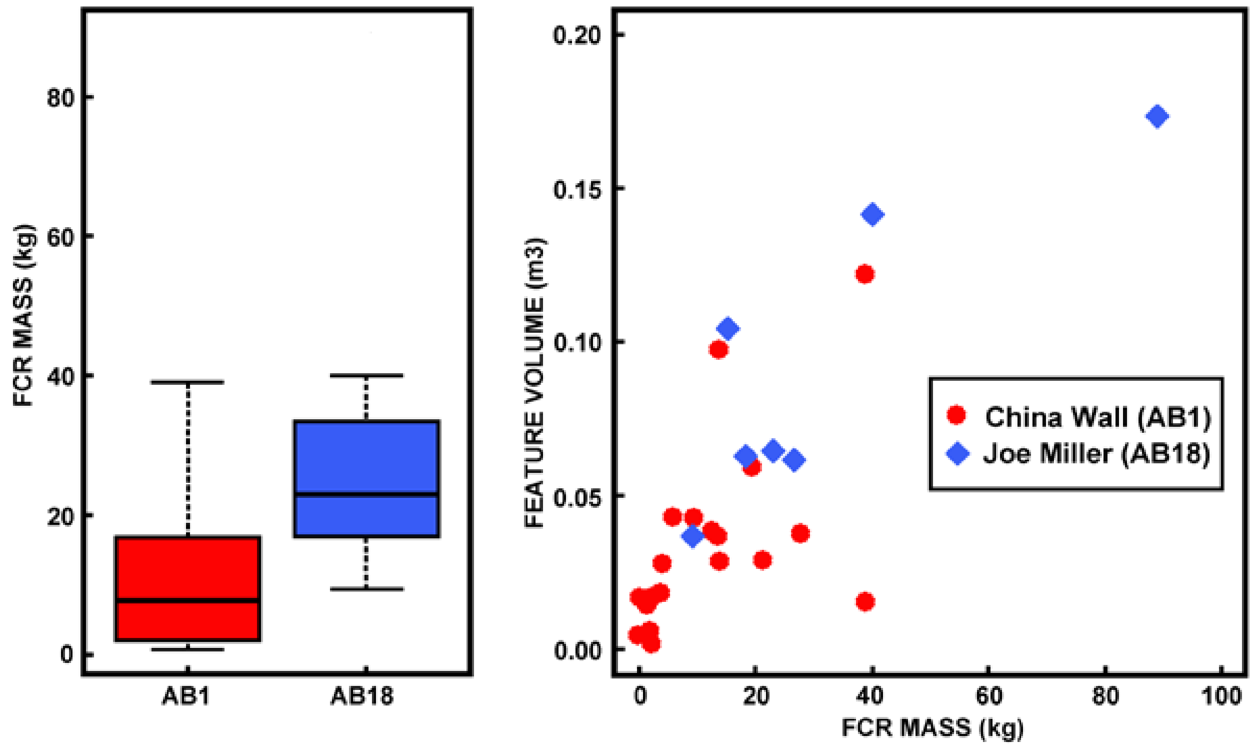

Figure 1: Sizes of excavated earth oven heating elements at China Wall (AB1) and Joe Miller (AB18). These features are substantially smaller than the large geophyte ovens in western and northwestern Wyoming, some of which contain nearly 300 kg of rock (Francis 1995).

feature size should likely correspond with either the total volume of meat (more meat, bigger oven) or the fat content (higher fat, bigger heating element; Wandsnider 1997). Since the faunal assemblage at Joe Miller suggests primarily the same type of resource (elk), it is likely the variable sizes of the heating elements (~15-89 kg of FCR) either corresponds with varying quantities or specific elements.

Most features at China Wall are smaller than those at the Joe Miller site (<15 kg FCR) suggesting they were likely used to cook small quantities of meat or starchy geophytes which require short cooking times rather than longer cooking times associated with large quantities of food or inulin-rich geophytes (Smith et al. 2001; Thoms et al. 2018; Wandsnider 1997). However, there are five features at China Wall (Features 1, 2, 21, 29, and 30) which have the same size heating elements as Joe Miller. The size of the heating elements combined with the presence of high densities of burned and calcined medium to large mammal bones (deer, antelope, bison, sheep, and possibly elk; Wassil et al. 2013) indicated at least some of the China Wall features were used to cook larger quantities or specific cuts of meat. The association between earth ovens and faunal remains in Albany County is markedly different than the cylindrical features in other areas of Wyoming where a lack of faunal remains can be used to infer plant processing (Smith et al. 2001:171).

AB3354: THE DEBARARD EARTH OVEN

The DeBarard Earth Oven was identified eroding out of the right bank of the Laramie River in southern Albany County (Figures 2 and 3). The T1 terrace is roughly two meters in height, with terrace sediments composed primarily of bedload alluvium (coarse sands and fine gravels), with a moderately well-developed soil on the modern ground surface. The earth oven is located about 75 cm beneath the current surface.

The feature itself measures approximately 120 cm wide by 30 cm in depth (Figure 4), although its upper contact appears to be erosional so it could have been deeper during use. The bottom of the feature/oven pit boundary is identifiable based on the sediment change from course-grained Laramie River alluvium to carbon-stained, fine-grained organic material. This zone of charcoal and carbon

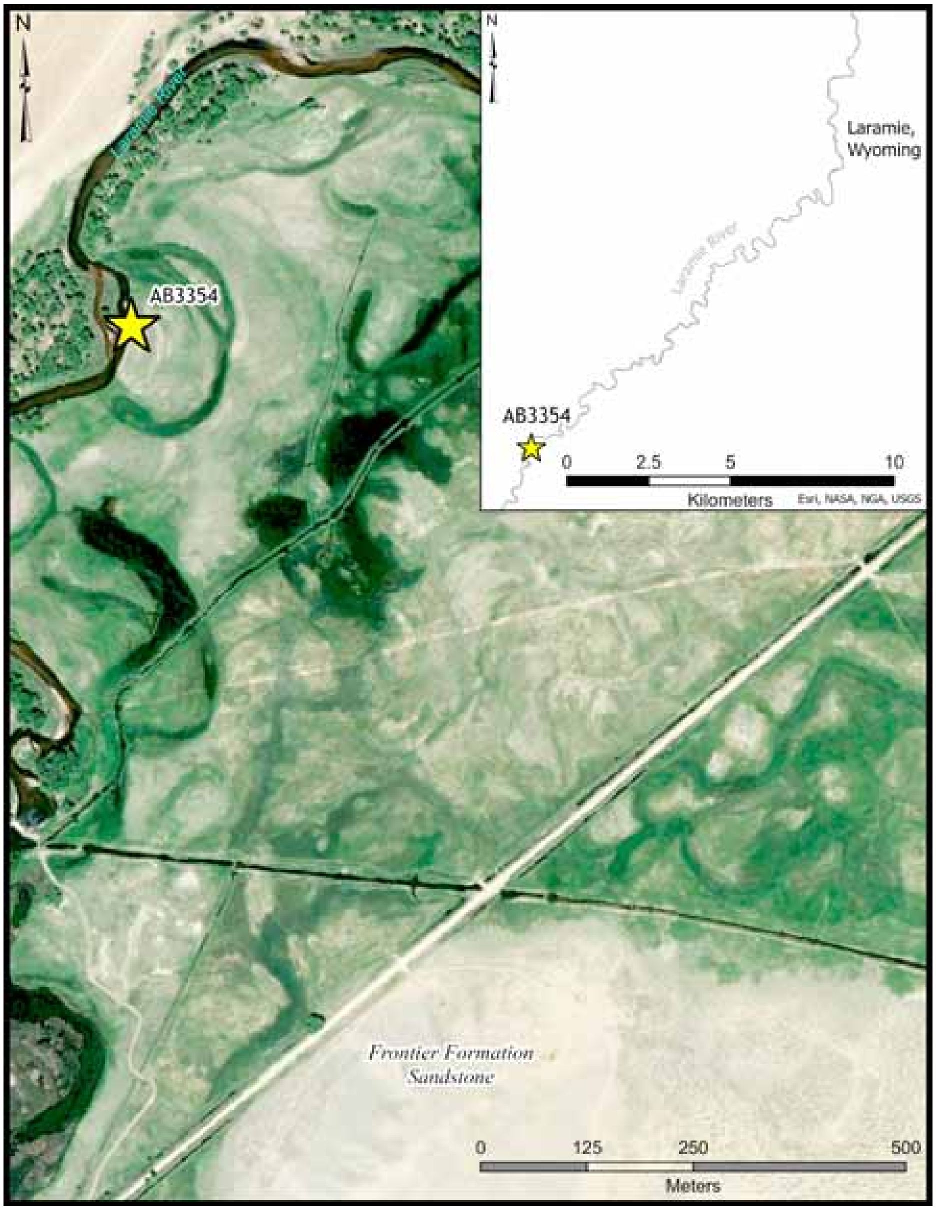

Figure 2: Location of AB3354 relative to Laramie, Wyoming (inset) and the relationship between AB3354 and likely source of the sandstone rock used as the heating element.

staining averages five cm thick, and is overlain by at least 15 large, burned, angular, carbon-stained sandstone clasts. An additional 18 sandstone rocks were found in sloughed material on the face of the terrace. Based on the amount of FCR observed, we estimate the total rock mass within the feature is between 50-100 kg. Importantly, the sandstone is not available in the immediate site area but likely originated from an outcrop of Frontier Sandstone located about 800 m southeast (Figure 2).

The only other artifacts/ecofacts identified were three pieces of large mammal bone (identified in the field as large ungulate) observed in the fill beneath the large sandstone clasts. We did not observe bone at any other location in the terrace, and based on the close spatial association with the feature, we are interpreting these bones as evidence of what was cooked in a previous oven. In other words, the bones are likely from a previous oven built in the same pit, and the bones were left in the bottom of the pit before the documented oven was constructed. This also demonstrates the repeated use of the DeBarard feature, which is common with earth oven technology (Black and Thoms 2014). The low temperatures

Figure 3: View of AB3354 facing east. Feature is visible in cutbank center near the tape.

beneath oven fires may not burn or carbonize bones from previous events (Hladek 2022), explaining the unburned nature of the recovered bone fragments. This lack of carbonization at the bottom of a thermal feature contrasts sharply with temperatures and carbonization of organic material within the fire's combustion zone (Bach 1997).

ZOOARCHAEOLOGY BY MASS SPECTROMETRY

ZooMS, first developed just over a decade ago, is a peptide mass fingerprinting method which extracts Type I collagen (COL1) from bone and provides the ability to perform taxonomic identification of trypsin-digested collagen using a matrix assisted laser desorption/ionization time-of-flight mass spectrometer (MALDI-TOF-MS; Buckley et al. 2009; Ritcher et al. 2022). This zooarchaeological method is a particularly useful approach to analyzing faunal assemblages where diagnostic osteological features are not present, as in the case with the bone fragment recovered from AB3354.

Traditional zooarchaeological analysis identified the bone fragment from AB3354 as "unidentified large ungulate." Therefore, the goal was to use this technique to provide a lower-level taxonomic identification of the faunal specimen and gain better insight into the subsistence economy of the individuals who built and used the DeBarard Earth Oven. The young age of the site combined with fairly rapid burial via alluvial deposition contributed to a well-preserved bone fragment with high molecular collagen which lent itself well to ZooMS analysis.

Following the minimally destructive protocols (Buckley 2009; van der Sluis et al. 2014; Welker et al. 2015), a small hole was drilled into the DeBarard bone fragment to obtain between 10-15 milligrams of bone needed for two ZooMS samples. Laboratory procedures involved demineralization; wash and humic acid removal; denaturing the collagen structure; digestion in protease (trypsin); and acidifying/purifying the sample. Both acid soluble and acid insoluble fractions of each sample were then spotted in triplicate onto a MALDI plate and run through the MALDI-TOF mass spectrometer. The location of peaks on the x-axis (mass to charge ratios) and the number of peaks associated with the produced archaeological spectra were directly compared to

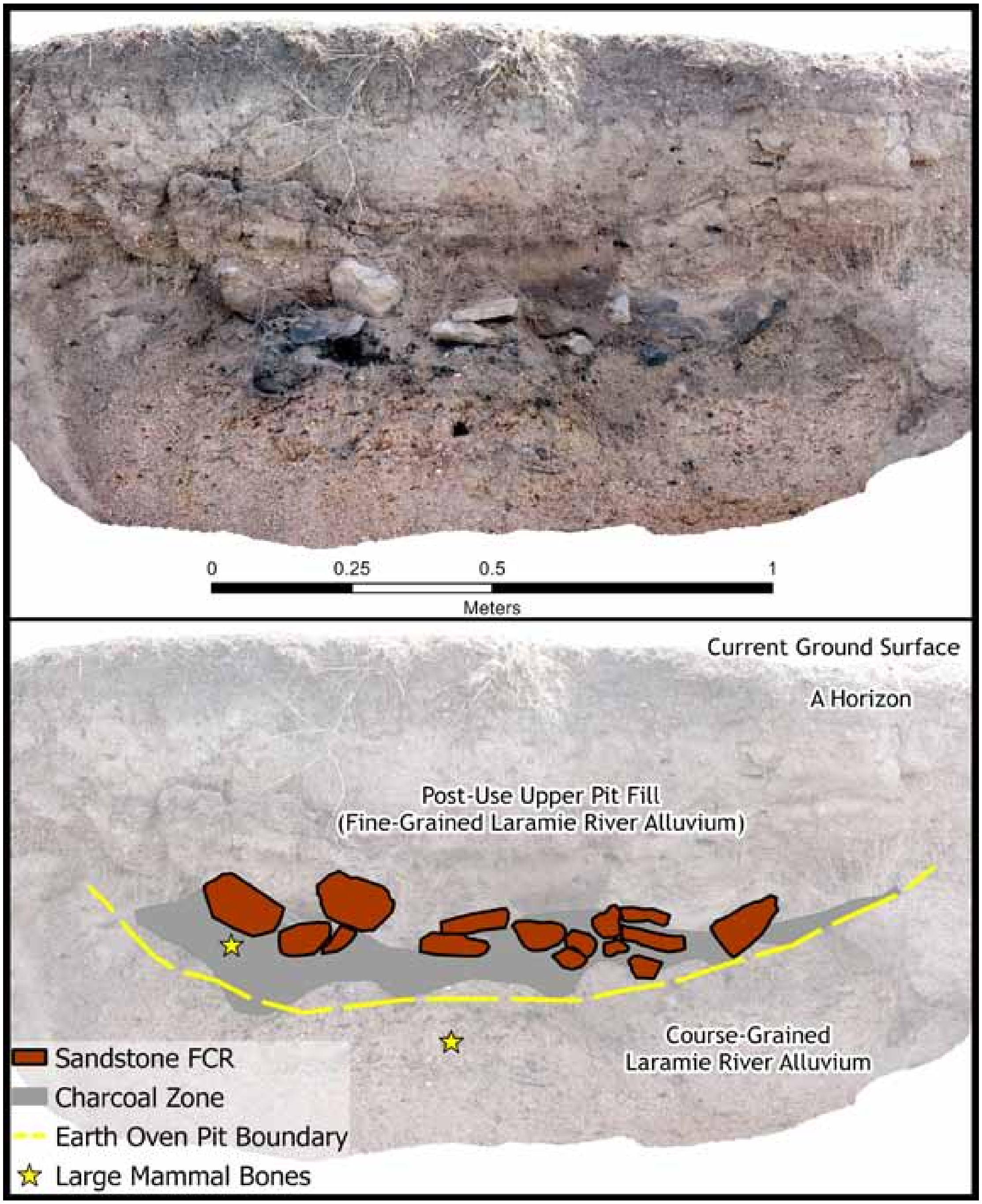

Figure 4: Top: Cross-section of feature eroding from Laramie River cut bank. Bottom: Feature profile showing relationship between sandstone FCR, charcoal, pit boundary, and large mammal bones.

spectra developed from known animal specimens compiled into a developing UW ZooMS reference database. Large ungulate spectra currently available for comparison within the UW ZooMS reference database include bison (*Bison bison*), pronghorn (*Antilocapra americana*), elk (*Cervus canadensis*), horse (*Equus ferus caballus*), caribou (*Rangifer tarandus*), mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*), moose (*Alces alces*), camel (*Camelus bactrianus*), and cow (*Bos taurus*).

Twelve ZooMS spectra were produced from the AB3354 bone fragment. Nine of the twelve spectra are excellent in regard to their quality. One of the spectra produced by the acid soluble fraction

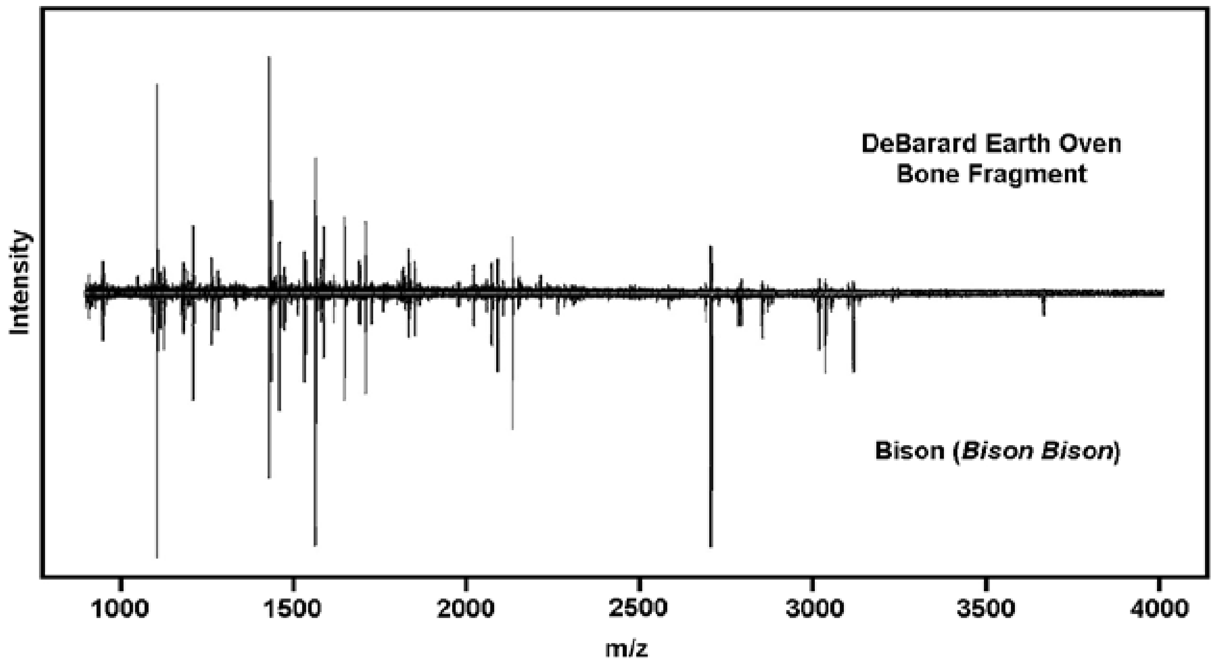

Figure 5: Butterfly graph displaying spectra for the DeBarard Earth Oven bone fragment and modern bison (Bison bison). Peak positions produced from AB3354 bone fragment strongly correspond with known collagen peptides associated with modern bison.

of the second sample contains the least amount of background noise. When a signal to noise ratio is set to 4, most peaks (97.22%) match with the location of known *Bison bison* spectral peaks within the UW ZooMS reference database (Figure 5). Higher signal to noise ratios (5-8) targeting the most intense spectra peaks produce results strongly suggesting peak alignment (100%) with bison. Furthermore, all spectra show peaks 1208, 1283 and 2854, peaks present in bison but absent from cervids. They also lack 1525 and 2901, peaks present in bighorn sheep but absent from bison. In summary, all nine spectra demonstrate with certainty this bone is bison (*Bison bison*).

DISCUSSION

Although no formal testing was conducted at AB3354, the feature is clearly an earth oven and not a hearth or stone boiling pit, based on presence of a thick layer of charcoal underlying a layer of sandstone FCR. A single sample of charcoal was AMS radiocarbon dated to 633-532 cal BP (D-AMS 2406-42007; 572±21 BP; carbonized cf. *Dasiphora fruiticosa*; Puseman 2021). The presence of a small, brushy shrubs in the oven corresponds with the frequent occurrence of quick burning fuel (such as sagebrush) within oven features (Thoms 2008:445). The age of the feature is roughly 1,000 years later than the features at the Joe Miller site but contemporaneous with earth ovens at the China Wall site (Table 1).

The AB3354 oven shares similar morphologies (~1 m diameter; 50-100 kg heating element) with probable meat ovens excavated at the Joe Miller and China Wall sites (Burnett et al. 2008; Eckles and Waitkus 2013), and the identification of bison via ZooMS suggests bison as the cooked food. In this scenario, we must consider the likelihood the DeBarard earth oven is either part of a larger camp or processing site, such as China Wall or the Herald Bergman site (AB3122; Allaun and Surovell 2019), or potentially associated with a primary kill site like Joe Miller or the Willow Springs Bison Pound (AB130; Bupp 1981). In either case, it is probable the bison was killed relatively close to the oven pit and explains why the Indigenous cooks traveled nearly a kilometer to acquire suitable rocks to serve as the oven heating element. This substantial investment in oven construction suggests the DeBarard oven—and those at Joe Miller—are likely associated with group aggregations and feeding larger numbers of people (Wandsnider 1997:14) rather than the smaller, familial ovens found at many Wyoming sites (see Smith and McNees 1999).

CONCLUSION AND FUTURE RESEARCH

Earth ovens are an understudied, and under recognized, aspect of the Wyoming archaeological record which can provide important insight into past behaviors. The DeBarard Earth Oven (AB3354) is one of just a handful of described earth ovens from Albany County, and it is possible future research using remote sensing or shovel testing could identify a substantial buried archaeological component associated with the oven. Based on the morphology of the feature (~1 m diameter; 50-100 kg sandstone FCR) and the presence of bison bones, we suggest this feature was used for cooking meat. Meat ovens are known from the Northern Plains both ethnographically (Linderman 2002:139; Murdock 1934:268; Wandsnider 1997) and archaeologically (e.g., Brink and Dawe 2003), so it is not altogether unexpected the feature at AB3354 may have been used to cook meat. However, much of the archaeological literature on earth ovens is focused on use of these features for cooking plants (e.g., Black and Thoms 2014; Koenig and Miller 2023; Smith et al. 2001) which may bias our interpretations of feature use and ignores the fact earth ovens were used to cook a variety of foods.

The DeBarard Earth Oven also demonstrates more directed earth oven research must be conducted in Wyoming. There is ample literature examining how cook stones fracture given different types of cooking (e.g., earth ovens vs. stone boiling; Brink and Dawe 2003; Neubauer 2018), but we know little about the morphological variation of oven features in Wyoming. Documenting the variation of oven morphology across the state and through time can provide insight into the types and quantities of foods cooked (see Thompson and Pastor 1995:86-92). These types of analyses should be combined with laboratory (e.g., Joyce et al., 2022), experimental (e.g., Smith et al. 2001), ethnoarchaeological (e.g., Stark 2023), and oral traditions to provide a holistic understanding of earth oven cooking in Wyoming.

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