

**United States Department of the Interior
National Park Service****National Register of Historic Places Multiple Property Documentation
Form**

This form is used for documenting property groups relating to one or several historic contexts. See instructions in National Register Bulletin *How to Complete the Multiple Property Documentation Form* (formerly 16B). Complete each item by entering the requested information.

☒ New Submission☐ Amended Submission**A. Name of Multiple Property Listing**

Paleoindian Archaeology in Wyoming

B. Associated Historic Contexts

(Name each associated historic context, identifying theme, geographical area, and chronological period for each.)

Paleoindian Archaeology in Wyoming

C. Form Prepared by:

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D. Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this documentation form meets the National Register documentation standards and sets forth requirements for the listing of related properties consistent with the National Register criteria. This submission meets the procedural and professional requirements set forth in 36 CFR 60 and the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation.

Signature of certifying official_____
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Signature of the Keeper_____
Date of Action

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State

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Section E: Historiography of “Early Man” Studies: The Plains, Rockies, and Beyond

Historiography is most basically defined as the history of history. This section summarizes the history of Paleoindian prehistory in North America, focused on Wyoming and the High Plains. This section’s subsections are divided chronologically. Important archaeological events, site investigations, and theoretical developments are described in the order that they historically occurred as much as possible, and through the historical lens in which they were interpreted. This section concludes with a summary of how “Big Questions” in Paleoindian archaeology developed, and how Paleoindian archaeology was and is related to the evolution of archaeological laws and ethics.

19th Century: Archaeological Beginnings and Unilineal Cultural Evolution

During the second half of the 19th century, archaeology began to move past its antiquarian roots and develop as an academic discipline (Trigger 2009). The “antiquity of man” was an important topic of interest in both the Old and New Worlds (see Lyell 1863), and comprised the single dominant research question addressed by North American archaeologists until the rise of Franz Boas’ historical particularism near the end of the 1800s.

Before archaeologists could begin answering when humans first appeared in the Americas, several scientific preconditions needed to be met. First, biblical scholar James Ussher had previously estimated the age of the Earth as only six thousand years (Ussher 1658). Six thousand years did not leave enough time to explore the antiquity of humankind anywhere in the world, let alone North America. In the early 1830s, Charles Lyell (1830-1833) released a pivotal work: *The Principles of Geology*. In this series, Lyell published painstakingly collected data that support the concept of *uniformitarianism* (Hutton 1795), which suggests that natural processes operating to shape past environments are the same as contemporary processes. Lyell’s assertion that the earth changes gradually indicated that our planet was of much greater age than previously thought. This realization allowed the scientific community to consider and accept the second precondition necessary for studying the antiquity of humankind, the theory of evolution by natural selection (Darwin 1859; Matthew 1831; Wallace 1855), since the amount of time required for evolution to occur was now feasible. Together, the great antiquity of the earth and the theory of evolution by natural selection provided the epistemological breakthroughs necessary for exploring the biological and cultural antiquity of humankind, in both the Old World and the New.

However, until radiocarbon dating was accepted as an established method of absolute chronological measurement in 1949 (Libby et al. 1949), answering the question of “Early Man’s” antiquity in North America was an imprecise endeavor:

In the great geological past outside history, we have no such evidence of the flow of the years, and we can only arrange our events in due relation to each other, without knowledge either of the length of time necessary for each, or of the length of any of the intervals. Consequently we cannot [...] measure the antiquity of man in terms of years (Dawkins 1883:338).

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Until 1949, archaeologists relied almost exclusively on relative dating methods, primarily borrowed from the geological sciences and based on stratigraphic context. These include the law of superposition, establishing direct associations between material culture and items of known antiquity (such as extinct species of animals), typology, and seriation.

In 1847, Jacques Boucher de Crévecoeur de Perthes published a detailed stratigraphic study of deeply buried river gravel terrace deposits in northwestern France. At this site, chipped stone and antler tools were discovered in context with extinct fauna, including mammoth and woolly rhinoceros (Trigger 2009:143-4). Over the next decade, several other sites containing cultural material in direct association with extinct fauna were discovered in Europe, thus establishing humankind's relative antiquity on that continent (Lyell 1863). Throughout the latter quarter of the 19th century, early North American archaeologists scrambled to discover sites with similar associations showing that artifacts were at least as old as extinct fauna on this continent. However, no archaeological site unequivocally established the great antiquity of humankind in North America until 1927, when a Paleoindian point was found embedded in the ribcage of an extinct species of bison¹ near Folsom, New Mexico. The point and the extinct animal were declared indisputably associated by national experts visiting the Folsom site later that year (Figins 1927; Meltzer 2006b).

Before the discovery of the Folsom site, several North American archaeologists furnished evidence that purportedly established humankind's antiquity in North America, but most of these finds were later refuted. Perhaps most famously, geologist James D. Whitney (1880) recorded the presence of artifacts and human remains in context with Tertiary² gravel deposits and extinct species of flora and fauna in California. If these human remains were truly the same age as the Tertiary gravels, they would represent the oldest known people anywhere in the world. These cultural materials were identified and recovered by miners in the gold belt; some artifacts were allegedly extracted from extremely deep mine shafts, ostensibly supporting their great antiquity (Whitney 1880). Subsequent investigators dismissed claims for a Tertiary human occupation of the Americas by showing that the cultural materials and human remains were either redeposited and in secondary context or planted by the miners themselves (Dawkins 1883; Holmes 1899a, 1899b). Furthermore, in 1903, Ales Hrdlička traveled to the United States to study all the supposed skeletal evidence of "Early Man" and determined that no clear evidence dated any known North American human remains prior to the post-glacial period. He also called for improved data collection methods and recordation of contextual information (Hrdlička 1937; Meltzer 1983, 2006b:24-27).

In addition to debating the antiquity of "Early Man" in North America, scientists during this era also began preliminary attempts to correlate paleoclimate with human behavior, though at the time, these ideas were cast with egregiously racist overtones. Dawkins, for example, suggested that "river-drift hunters," in "a primeval condition of savagery," may have dispersed globally "before the glacial submergence and the lowering of the temperature in northern

¹Bison sp. (McDonald 1981:133). See Lyman (2015) for a contemporary reanalysis of association between the Folsom point and the bison remains.

² Now known as the Paleogene, Neogene, or Quaternary.

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Europe, Asia, and America.” (Dawkins 1883:343). Dawkins also noted that “It is *not* reasonable to suppose that the Straits of Behring [sic] could have offered a free passage [...] while there was a great barrier or ice, or of sea, or of both, in the high northern latitudes” (Dawkins 1883:343, italics added). Though the attitude with which these ideas are presented in no way reflects the views of contemporary Paleoindian archaeologists, the ideas themselves reveal an early recognition that paleoclimate influenced human patterns of dispersal across the globe.

Throughout the latter half of the 19th century, archaeological method and theory was heavily influenced by the concept of unilineal cultural evolution, borrowed from cultural anthropology (e.g., Grote 1877). The unilineal cultural evolution approach is now obsolete, but was an early attempt to explain variation and change in material culture. In unilineal cultural evolutionists’ view, technological innovation caused directed social progress from savagery to barbarism to civilization as human societies universally advanced through “various grades [or] stages of development or evolution” (Tylor 2008[1873]:29, 39). Cultural anthropologist Lewis Henry Morgan (2008[1877]:45-47) demarcated the divisions between progressive “Ethnical Periods” through the appearance of supposedly universal technological innovations. He argued that the invention of new technologies and technologically-related behaviors, including using fire, the bow and arrow, ceramics, iron tools, writing, irrigation systems, and domesticated plants and animals, led all cultures on a directed path of social evolution towards civilization. In 1816, Danish scholar Christian Thomsen created the first seriated cultural chronology, represented by artifacts manufactured successively out of stone, bronze, and iron, each age followed in succession by the next (Thomsen 1848). This early chronological scheme effectively characterized the European archaeological record in a broad sense, but circularly supported unilineal cultural evolutionary frameworks when cultures worldwide were categorically forced into Stone, Bronze, and Iron Age stages of development.

In the United States, unilineal cultural evolution contributed to the ideological justification of Divine Right and Westward Expansion, since white colonists were seen as representing a more “advanced” stage of civilization than Native American “savages.” This theoretical perspective permeated the ethnocentric archaeological investigations of Early Man that were produced during the late 1800s. For example, Grote (1877:587) wrote that “All mankind have not progressed equally. Some are in the Stone age now [...] the Indian was in the Stone age at the advent of Europeans” (see also Abbott 1899; Dawkins 1883). Modern Native Americans were viewed as relics of the past because they had failed to progress beyond the Stone Age. This view was rampant in Western academic and popular writings throughout this era. For example, one British periodical noted that the “Pueblo people with their lank hair and primitive ways [...] seem almost to give one a living picture of much of the life of early man” (PH 1903:136).

Early 20th Century: Culture History

The rise of cultural relativism and historical particularism in the early 1900s influenced many scholars to dismiss unilineal cultural evolution as ethnocentric and politically motivated, as it stemmed from 18th century Enlightenment ideals of progress and justified 19th century colonialist and racist thinking (Haller 1971). Anthropologists such as Franz Boas began to overturn these ideals beginning around 1900. Boas wrote, for example, that “[t]here is no reason

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to believe that one race is by nature so much more intelligent, endowed with great will power, or emotionally more stable than another that the difference would materially influence its culture” (Boas 1931:6). Rather, differences between societies are a result of each culture’s unique history (Boas 2008[1920]). Highly influenced by Boasian principles, this culture-historical approach characterized much of the early professionalization of archaeology in the United States (Trigger 2006:278-80; see Boas 1899, 2008[1920]). This era in North American archaeology focused on defining geographic and historically particular culture areas and temporal relationships describing how each culture developed uniquely rather than superimposing a timeless, directed, universal, and unilineal template of cultural progression onto all human societies(e.g., Kidder 1927; Willey and Phillips 1958; Wormington 1957[1939]).

Culture-historical studies largely focused on defining the spatiotemporal boundaries between archaeological material culture traditions:

We find certain types of remains – pots, implements, ornaments, burial rites and house forms – constantly recurring together. Such a complex of associated traits we shall call a “cultural group” or just a “culture.” We assume that such a complex is the material expression of what today we would call “a people” (Childe 1929:v-vi).

Archaeological culture traditions do not necessarily correspond to contemporary conceptions of ethnic groups or “a people,” since they are based strictly on material residues and do not account for immaterial aspects of cultures, such as language and belief systems. Archaeological culture traditions as described above are now usually referred to as cultural complexes. Cultural complexes were (and are) defined by archaeologically visible differences in *material* culture.

Under culture-historical frameworks, changes in material culture were thought to occur mainly by the migration of peoples and the associated inter-cultural diffusion of inventions. During the culture-historical era, it was generally believed that inventions were conceived only once in a single core region prior to spreading geographically outward towards peripheries (Trigger 2009:221-222, 228). The purpose of archaeology shifted away from classifying cultures into universal stages of unilineal evolution to tracing humans’ culturally relative material residues across time and space.

Around the 1920s, Alfred Kidder produced a relative chronology for the Southwest culture region (Kidder 1916, 1924, 1927). Kidder’s “Pecos Classification” was the first comprehensive culture-historical synthesis attempted anywhere in the United States. Nels Nelson (1913, 1916) and Kidder (1916) also conducted complex, diachronic seriations of ceramic styles in the Southwest, marking the beginning of the “chronological revolution in American Archaeology” (O’Brien et al. 2005:12-13). Kidder’s chronology exemplifies the implementation of increasingly rigorous scientific archaeological methodology and tight chronological control in terms of stratigraphy, seriation, and classification in the early 1900s (Trigger 2009:290).

Along with these advances in archaeological theory and method came the advent and codification of archaeological ethics and the first nationwide movement towards cultural resources management. This had little to do with Early Man studies in North America, but nevertheless affected the subsequent treatment of Paleoindian sites over the next century and into the present. During the early decades of the 1900s, most scientific archaeological pursuits

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focused on post-Paleoindian archaeological cultures that were characterized by greater sociopolitical complexity and located outside the Great Plains and Rockies. These investigations focused on regions such as the Southwest (e.g., Ancestral Puebloan sites) and the Midwest (e.g., Cahokia). In 1888, Richard Wetherill's discovery of Mesa Verde ushered in an antiquarian era of unregulated looting in that region (Lynott 2003:18). This escalated into a "nationalistic uproar" (Lynott 2003:18) when Gustaf von Nordenskiöld teamed up with the Wetherill brothers to excavate Cliff Palace and other Mesa Verdean sites, subsequently exporting the artifacts to Finland (von Nordenskiöld 1973[1893]). This perceived loss of national history combined with the archaeological community's push to protect sites from looting and vandalism and to excavate them scientifically led the government to pass the Antiquities Act in 1906 (Lynott 2003:19).

During the first decades of the 20th century, archaeological interest in establishing the antiquity of humans in North America persisted. Some archaeologists argued that Native American ancestors had been present on this continent since the last glacial period, estimated by European varve analysis to have ended approximately 10,000 BP, while others rejected all evidence supporting this hypothesis (O'Brien et al. 2005:11). Though several sites had produced apparent associations between artifacts and extinct Pleistocene fauna (e.g., Gidley and Loomis 1926; Loomis 1924; Williston 1902; see also Meltzer 2006a:40-45), unequivocally accepted evidence was not forthcoming until 1927. This pivotal date should probably be considered the advent of professional Paleoindian archaeology in North America.

Establishing the Antiquity of Man in North America: The Folsom Type Site

The Folsom site (29CX1, LA8121) was exposed and subsequently discovered after a late summer rain storm in 1908, in Colfax County, New Mexico, on the western fringe of the Great Plains (Meltzer 2006b:1-3). George McJunkin, an African American worker on a nearby ranch, discovered bison remains eroding out of an arroyo wall and reported them to an amateur naturalist who eventually helped organize a visit to the site in 1922 (Meltzer 2006b:4). Archaeologist Jesse Figgins and paleontologist Harold Cook identified the Folsom bison as an extinct species, and commenced excavations in 1926 on the basis of the Folsom site's potential paleontological interest. Cook (1927) and Figgins (1927) actually published on the Folsom site before any anthropogenic artifacts were identified. The archaeological importance of Folsom was established later in 1927, when a Folsom point was discovered in situ with extinct bison remains (Meltzer 2006b:5), currently accepted as representing an extinct taxon of *Bison* sp. (McDonald 1981:133; Meltzer et al. 2006:209).

To preclude any potential controversy in regards to the context of the Folsom point, investigators left it in place until expert paleontologists and archaeologists (including Alfred Kidder) could travel to the site and verify the authenticity of the association (Meltzer 2006b:6). The evidence from Folsom was indeed accepted as resolving the debate over whether humans had been present in North America at least as far back as the latest Pleistocene (Meltzer 1983:34-38), and within a decade of this discovery, at least seven major professional archaeological

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symposia were dedicated to expounding on the chronology associated with the human colonization of North America (Meltzer 2006a:23).³

The discovery of the Folsom site had a number of lasting impacts (e.g., Meltzer 2006a). Increasing the time scale of human habitation in the Americas allowed for the subsequent development of large-scale space-time chronologies, and provided the time depth necessary to explain variation and complexity of contemporary Native American cultural groups. After the Folsom discovery, the scientific community accepted that enough time had passed since Native Americans initially occupied this continent to allow for a diversity of lifeways to develop aboriginally rather than somehow diffusing to North America from the Old World. This also meant that ethnographic analogies could not necessarily be drawn between living Native American cultures and Paleoindians, as the chronological separation between them was too great. Also relevant to the ensuing development of Paleoindian archaeology was the idea that “Early Man” sites could be discovered by seeking out paleontological sites and subsequently searching for chipped stone tools among the bones. This informal survey bias might have contributed to early notions of Paleoindians as focusing almost exclusively on large game for subsistence (Meltzer 2006a:45-6).

Considering the Folsom site as the “type site” for Folsom projectile points also had lasting implications for the way that Paleoindian points types are defined, as it set a typological precedent in North American archaeology. *Type sites* are locations where distinct projectile point forms are first identified in situ and formally described by archaeologists. Usually, projectile point types are named after locations near their respective type sites. Folsom points are named “Folsom” because they were first identified in context near the town of Folsom, New Mexico. For better or for worse, Paleoindian points today are commonly labeled based on their resemblance to the “ideal” projectile point specimens excavated from each of these type sites. The state of Wyoming has given rise to a number of Paleoindian point types, including Goshen, Eden, Cody, Hell Gap, Agate Basin, and James Allen/Frederick.

*1930-1950: The Professionalization of Early Man Studies*Paleoindians as Mammoth Hunters: The Clovis Type Site

From 1932-1937, Edgar B. Howard and John L. Cotter began investigating archaeological sites on the New Mexico side of the Texas-New Mexico border, on a large, elevated plateau called the Llano Estacado (Wormington 1957[1939]:47-8). In 1934, 1936, and 1937, Howard and Cotter recovered artifacts, including two fluted Clovis points, which were unequivocally associated with the remains of a mammoth at Blackwater Draw No. 1 (making it the Clovis type site, 29RV2). One of the Clovis points lay below a mammoth vertebra and

³ As an interesting aside, the first Plainview points were found in association with extinct bison near Colorado City, Texas, at the Lone Wolf Creek site (41MH23) in 1925, pre-dating the discovery at Folsom by two years. However, the circumstances of the excavation at Lone Wolf Creek combined with the failure of its excavators to recognize the significance of the find meant that the Folsom site, rather than Lone Wolf Creek, was given credit for originally establishing the antiquity of humans in North America (Wormington 1948:10-11, 1956[1939]:110).

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another was wedged between two mammoth leg bones. Other chipped stone tools and flakes, as well as polished bone tools, were also recovered (Cotter 1937; Howard 1935, 1936, 1937; Stock and Bode 1937). Furthermore, Clovis points were recognized as occurring stratigraphically below Folsom points (Cotter 1938:117; Wormington 1957[1939]:48).

Later, stratigraphy and site formation processes at Blackwater Draw No. 1 were studied in greater detail. The Clovis-aged mammoth stratum was disconformably overlain by a stratum of sterile sand. Disconformably above the sterile sand was a stratum containing cultural materials and a species of extinct bison (Antevs 1935, 1949; Cotter 1937; Evans 1951; Sellards 1952:29-31). Circumstantial evidence led investigators to conclude that the upper, extinct bison stratum was Folsom-aged. Folsom points were discovered in the area, but not in situ, with the exception of one Folsom point which was purportedly removed from a bison vertebra by a local collector (Wormington 1957[1939]:49). Despite this discrepancy, Howard's work is credited as being able to place Clovis prior to Folsom for the first time (Boldurian and Cotter 1999:12), as the two cultural complexes' relational context was previously unclear due to a lack of stratified sites (see Renaud 1931, 1932). The stratigraphic superposition of Folsom over Clovis was finally confirmed at Lubbock Lake, Texas, nearly two decades later (41LU1; Holliday 1997:32; Sellards 1952).

Archaeological work at Blackwater Draw was also significant because it was one of the first projects in American archaeology to call on multidisciplinary scientists (vertebrate and invertebrate paleontologists and paleobotanists) to complete geoarchaeological and paleoenvironmental reconstructions. These multidisciplinary scientists accurately interpreted the Pleistocene-aged site as a lacustrine environment utilized by nomadic Paleoindian groups (Boldurian and Cotter 1999:13; Holliday 1997:25).

Before archaeological excavations were carried out at Blackwater Draw No. 1, in 1932 two Clovis points were discovered in context with the remains of twelve mammoths at the Dent site in Colorado (5WL269; Figgins 1933, Haynes et al. 1998; Wormington 1957[1939]:43-44). However, at Dent, "the actual nature of the human-mammoth relationship [was and still is] not at all clear" (Kornfeld et al. 2010:73; see Brunswig 2007a:112-117). Shortly after the Blackwater Draw No. 1 discoveries, Clovis points were also found in context with mammoth at the Miami site in Texas in 1937 (41RB1; Holliday 1997:27; Sellards 1938), and subsequently at the Naco (AZ FF:9:1 ASM; Haury 1953) and Lehner (AZ EE:12:1 ASM; Haury 1956; Haury et al. 1959; Mehringer and Haynes 1965) sites in Arizona.

Finding and Dating a Folsom Campsite: Lindenmeier

After the initial discovery of Folsom cultural material at the type site (a bison kill), archaeologists began seeking an occupational camp of similar antiquity to illuminate a fuller picture of Folsom-aged peoples' lifeways. Another goal was to identify a site with stratigraphy that was conducive to geologic dating. At the time, the age of the Folsom type site could only be poorly estimated from the presence of extinct fauna (Wormington 1957[1939]:31). These lacunae were filled in 1934 and 1938 when Frank H.H. Roberts, Jr., conducted excavations at Lindenmeier (5LR13), a multi-occupation Folsom campsite and bison kill in northeastern

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Colorado. Lindenmeier provided geologic context that was used to estimate an age for the site that was more precise than was possible at Folsom.

At Lindenmeier, chipped stone artifacts, sandstone abraders, awls, incised bone discs, bone and lignite beads, hammerstones, charcoal, rubbed pieces of red ochre, and extinct camel and bison remains were recovered in context with Folsom points underlying as yet undefined, unfluted point layer (Gunnerson 1987:133; Haynes 2003; Haynes and Agogino 1960; Lassen 2013:15; Roberts 1935, 1936, 1937, 1939; Wilmsen 1974; Wilmsen and Roberts 1978; Wormington 1957[1939]:33-37). These unfluted points were later named Midland, and hypothesized to be a transitional type between fluted and unfluted lanceolate projectile point styles by some (Hofman et al. 1990), while others consider them unfluted Folsoms (Taylor 2006:163).

Geoarchaeologists dated Lindenmeier by correlating its location on a river terrace to an estimate of when that river terrace formed. This placed the site's chronological formation between substages of the Wisconsin glaciation, somewhere between 25,000 and 10,000 BP (Bryan 1937; Bryan and Ray 1940; see also Haynes 2003). Lindenmeier was one of very few large, professionally excavated Folsom habitation sites on the Plains for decades (Gunnerson 1987:133), and remains the most extensive Folsom occupation known (Lassen 2013:55). As an occupational site, Lindenmeier has provided a more nuanced understanding of Folsom lifeways than a kill site would alone, and investigation into Lindenmeier's archaeological material continues into the present day (e.g., see Chambers 2015).

Early Chronological Syntheses: The Contributions of Hannah Marie Wormington

In 1936, shortly after obtaining her BA in anthropology, Hannah Marie Wormington began her career curating artifacts from Lindenmeier and other Paleoindian sites at what is now known as the Denver Museum of Nature and Science (Stanford 1996b). In 1939, Wormington published the first synthesis of Early Man studies in North America: *Ancient Man in North America*. This first edition summarized Paleoindian archaeology in only eighty pages. Wormington subsequently published 2nd (Wormington 1944), 3rd (Wormington 1949), and 4th (Wormington 1957) editions, updating each version of the book with new discoveries and technological and methodological advancements. In the mere eighteen years between the publication of the first and fourth editions of *Ancient Man in North America*, the book quadrupled in length. This was partially due to the development of radiocarbon dating (Libby et al. 1949), and to the exposure and deflation of many Plains Paleoindian sites during the Dust Bowl (e.g., Frison and Todd 1987:4; Seebach 2006:72), but also bears testament to the rapidly growing field of Early Man archaeology during the 1940s.⁴ Wormington's books were especially important because they summarized archaeological scientific developments in a format that was easily accessible to professionals, avocationals, and the interested public (Krieger 1958).

⁴ Around this time, another archaeologist also contributed to summarizing and clarifying the state of Paleoindian research, in an abbreviated form accessible to professionals. E.H. Sellards' annotated bibliographies of sites and references relevant to Paleoindian archaeology cover time periods up to 1940 (Sellards 1940) and from 1940-1945 (Sellards 1947).

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The Sandia Controversy

Geoarchaeological studies and an increased understanding of the antiquity of Paleoindian occupations in North America only contributed to archaeologists' long-standing desire to find evidence of the earliest people on this continent. By the 1930s, nearly a century had passed since the first alleged associations between artifacts and extinct fauna were reported in Tertiary-aged gravels at various locations throughout the country (see Whitney 1880 and Peopling of the Americas section). Consensus was developing that the first North American immigrants likely came across the Bering Strait from Asia (Howard 1936:400), yet the question of human antiquity on this continent was not (and still has not) been satisfactorily answered (see Antevs 1935). Finds at Folsom, Blackwater Draw No. 1, Lindenmeier, and elsewhere meant that by the late 1930s, pushing back the earliest date for occupation of the Americas would require the discovery of sites that pre-dated known Clovis and Folsom sites.

Beginning in 1937, Frank C. Hibben started publishing research concerning a site that he claimed significantly pre-dated Folsom (Hibben 1937, 1940, 1941a, 1941b, 1946, 1955, 1957). Sandia Cave (LA39937), New Mexico, contained archaeological material and Pleistocene megafauna, including ground sloth, camel, mastodon, mammoth, and horse, deposited within a deep natural rock fissure at the base of a cliff face (Thompson and Haynes 2012; Hibben 1943:253). Hibben initially released a report on Sandia Cave that introduced a new, single-shouldered Paleoindian point type with two varieties, which Hibben named Sandia points (Hibben 1941a, 1941b; Wormington 1957[1939]:85-89).

Aided by geoarchaeological interpretation (Bryan 1941), Hibben (1941a, 1943, 1946) reported that Pleistocene archaeological deposits at Sandia Cave underlaid a partially solidified, stalagmitic crust, and contained Folsom points and other artifacts. Below the Folsom level was a sterile stratigraphic unit of yellow ochre, approximately 15-20 cm deep (Hibben 1943). Sandia points and two fire hearths were purportedly found below the sterile layer, which led Hibben to interpret Sandia points as older than Folsom by "a considerable, but as yet unascertainable, period of time" (Hibben 1943:253). Hibben (1957) later claimed that the Sandia level dated to 17,000 BC or earlier (Hibben 1957; Johnson 1957), but the circumstances and origin of this early date are unclear. As a response to the dating and other discrepancies, debate broke out concerning whether components at Sandia Cave could actually be interpreted as pre-Folsom (Bliss 1940a, 1940b; Brand 1940; Byers 1942; Ceram 1971:243-251; Gross 1951, 1957; Hibben 1941a, 1957; Howard 1988; Johnson 1957; summarized by Krieger 1957; Preston 1995; Stevens and Agogino 1975; Thompson et al. 2008, Thompson and Haynes 2012). Hibben also suggested that Sandia points were "very similar to flint points of the Paleolithic or Old Stone Age of Europe (Hibben 1940:15). The tenuous and contentious suggestion that there may have been some connection between Paleoindian and European Paleolithic cultures continues in various forms to the present day (see The Development of Big Questions in Paleoindian Archaeology section).

The controversy surrounding Sandia Cave is still not indisputably resolved. In 1986, Haynes and Agogino (1986) confirmed the presence of a Folsom component at Sandia Cave, but supported an earlier argument by Bliss (1940) that extensive bioturbation had destroyed the site's

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integrity. Further studies confirmed that most of the extinct Pleistocene fauna present had been deposited in Sandia Cave as part of a carnivore den (Thompson et al. 2008), which did not provide support for Hibben's (1941b) assertion that Sandia Cave should be interpreted as a hunting station; rather, it may have been sporadically used as an ochre mine in prehistory (Haynes and Agogino 1986).

The chronological understanding of Sandia points (and whether or not they are even valid artifacts) is likewise still debated. According to some, Sandia points are "very rare, and their cultural and technological basis has never been reliably established" (Thompson and Haynes 2012:312). Recent investigations at Sandia Cave suggest that although it is a genuine paleontological and archaeological site, "there is no evidence that there was ever a human occupation at Sandia Cave that predated the Folsom" (Thompson and Haynes 2012:313). Other reputable archaeologists have gone so far as to suggest that the Sandia points may have been tampered with and/or planted, but whether or not scientific fraud was actually committed at Sandia Cave remains an open question. The Sandia Cave controversy has simmered under the radar for decades. Many archaeologists have responded to this debate by refraining from addressing it outright, perhaps in part because Hibben threatened legal retaliation against anyone that would formalize allegations against him (see Preston 1995).

"Yuma," Eden, and Scottsbluff Points, the Cody Complex, and the Finley Site

Following the designation of Folsom projectile points, major confusion ensued regarding whether Folsom was contemporaneous with several unfluted point styles that, lacking individual type sites, were all named Yuma points after several publications by Renaud (1931, 1932). Many of these diverse point styles were found on the surface of bowl-shaped "blow-outs" in Yuma County, Colorado, and sometimes the unfluted points were discovered in proximity to Folsom points. The poor context of these discoveries meant that the chronological relationship between Yuma and Folsom was unclear at best, but some archaeologists suggested these point types were at least partially contemporaneous. However, artifacts found on deflated surfaces are not necessarily associated (Wormington 1948, 1957[1939]:103-107). There were no similarities in shape and flaking technique that indicated Folsoms and Yumas should be lumped into the same cultural complex (Figgins 1934, 1935), and only extremely limited evidence suggested that Yuma-style points might have coexisted with Folsom for a short interval, after which Folsom points disappeared from the record and Yumas persisted (Roberts 1940:64).

Furthermore, the Yuma category contained a number of technologically differentiable types: stemmed and unstemmed points, convex and concave bases, and parallel-oblique and horizontal-parallel flaking patterns. Wormington remarked that the breadth of the projectile point morphologies represented in the Yuma group rendered its "definition [...] virtually meaningless" (Wormington 1957[1939]:105). In response to these issues, the catch-all Yuma category was discussed at a conference on terminology and typology of early point types in 1941, during which it was decided that categories such as Generalized Yuma and Unfluted Folsom would be discarded until type sites with in situ representatives of these styles could be found so they could subsequently be named (Wormington 1948, 1957[1939]:106).

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At the 1941 Yuma conference, two of the point types previously known as Yumas were properly named and defined owing to recent discoveries at the Finley site (48SW5) in southwestern Wyoming during the 1940 field season. At Finley, Eden and Scottsbluff point types were excavated in context from a bison kill on the margin of a dune field (Barbour and Schultz 1936; Bell and Van Royen 1933; Hack 1943; Howard 1943; Howard et al. 1941; Satterthwaite 1957; Schultz and Frankforter 1951). Both of the point types identified at Finley were stemmed. The thinner points with less pronounced shoulders, previously referred to as “Collateral Yuma,” had not yet been identified in situ and were thus named Eden points after the Finley site’s close proximity to Eden, Wyoming. The broader, more strongly stemmed point type identified in the same level as Eden was previously found in context at the Scottsbluff Bison Quarry (25SF2) in Nebraska (Barbour and Schultz 1932; Schultz and Eiseley 1935, 1936). Following Howard’s suggestion, this second point type was therefore named Scottsbluff in retrospect (Wormington 1948, 1957[1939]:106-107, 124-7).

Finley was the first site where the Eden point type was discovered directly associated with Scottsbluff, and thus played an important role in defining the Cody complex. However, Eden and Scottsbluff’s relationship was not formalized until a decade later when they were also found to be coeval at the Horner site (48PA29; Jepsen 1951:24). Subsequent geological studies at Finley placed Eden and Scottsbluff as younger than Lindenmeier (that is, younger than Folsom; Hack 1943), and early geological interpretation estimated their age as between 7,000 and 9,000 BP (Moss 1951, 1952).

In the Canadian province of Alberta, Eden and Scottsbluff points were found throughout the 1930s to 1950s and beyond (Wormington 1957[1939]). Many of these points were discovered on deflated surfaces in context with what are now known as Alberta points. Alberta points are in some ways similar to Scottsbluff points but are larger, longer-stemmed, thicker, and have slightly convex bases and blunted distal tips (Wormington 1957[1939]:133-5). Subsequent archaeological studies have confirmed that Alberta points are occasionally found in context with Cody complex materials. Stratigraphic levels where these point types co-occur are now termed Alberta/Cody complex. However, Alberta’s chronological place was not well understood until the 1960s.

Fleshing Out Chronology: The Plainview, Agate Basin, and Angostura Type Sites

In 1945, the discovery of a bison kill near Plainview in northwestern Texas (41HA1) slightly elucidated the chronological relationship between some of the points that had previously been referred to as unfluted, Folsom-like “Yuma” points and Folsoms (Sellards et al. 1947; Speer 1990; Wormington 1948:10-11, 1957[1939]:107-110). At the Plainview site, Plainview points were recognized as a distinct typological category, and were “the first unfluted Paleoindian projectile point type to be formally described and proposed based on a sizable collection” (Holliday et al. 1999:445-6; Holliday et al. 2017).

Despite the large sample size of Plainview points from the type site, confusion regarding typological distinctions within this group of unfluted Folsoms over space and time developed and persisted for nearly half a century. Echoing the typological problems archaeologists had previously experienced with “Yuma” terminology, the “Plainview” category eventually became

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a catch-all for unfluted, lanceolate projectile points with concave bases (Holliday 1997; Holliday et al. 1999:446; Knudson 1983; Wheat et al. 1972). At the turn of the 21st century, Holliday and colleagues (1999:451) summarized and clarified the spatiotemporal relationships between what are now commonly thought to represent two distinct, unfluted, lanceolate point styles. The Northern Plains variety first appeared as Goshen⁵ during the Clovis-Folsom transition.⁶ On the Southern Plains, a similar point type manifested as Plainview, contemporaneous with late Folsom and beyond.

The Agate Basin type site (48NO201) also came to the attention of professional archaeologists in the mid-1940s. Agate Basin, a bison kill located in eastern Wyoming, was discovered by sheep rancher William Spencer around 1916. Spencer informed Robert E. Frison, George C. Frison's uncle and Deputy Game Warden of Newcastle, Wyoming, of the site's existence. Robert Frison was unfamiliar with the type of points eroding from an arroyo bank at Agate Basin and, thereby recognizing the site's potential importance, he brought it to the attention of archaeologist Frank H.H. Roberts. Robert Frison assisted with the first formal excavation of Agate Basin in 1942 (Frison 1982a:11, 2014:71), and the site was first published in 1943 (Roberts 1943). However, a full summary of the investigation was delayed due to the advent of World War II (Sellards 1947:968), and the excavation was not reported in detail until 1961 (Frison 1978:160-168; Frison and Stanford 1982; Roberts 1951, 1961). Long, slender, lanceolate points with parallel or slightly convex sides, basal grinding, horizontal flaking, and straight or convex bases had previously been described as "collateral Yuma" (Sellards 1947:968). After the Agate Basin site investigations, such points were properly named "Agate Basin" (Wormington 1957[1939]:141).

In the late 1940s, excavations at the Ray Long site (39FA65) near Hot Springs, South Dakota, produced points somewhat similar to Agate Basin in outline but morphologically differentiable due to their straight or concave bases and predominantly parallel-oblique flaking (Hughes 1949; Wheeler 1954; Wormington 1957[1939]:138-141). These were named Angostura points after the soon-to-be-built Angostura Dam and Reservoir (completed in 1949). During the 1950s, Wormington (1957[1939]:140) warned that the term "Angostura" was "rapidly, and most unfortunately, replacing Yuma as a name to be applied indiscriminately to all lanceolate points." However, it was later recognized that Angostura points significantly post-date Agate Basin, and that they may represent a "local or regional [variant] of the terminal Paleo-Indian manifestation for the Northwestern Plains" (Frison 1978:37,83, 1991:74), along with James Allen/Frederick

⁵ The Goshen type was not defined as such until the 1970s at Hell Gap (Irwin-Williams et al. 1973). The first Goshen point was scientifically discovered and identified by Wesley Bliss during a Missouri River Basin survey project and named Boxelder, after Boxelder Creek in Platte County, Wyoming (Bliss 1950; Jennings 1948). However, Bliss' point was not found in a datable context (Kornfeld et al. 2010:65). Because of this, Goshen points should not be referred to as Boxelder, but perhaps Bliss should be credited as the first professional archaeologist to describe this point type (Taylor 2006:152).

⁶ Some archaeologists still believe that Goshen and Plainview points should be considered a single morphological type. Others disagree but acknowledge that there might be a spatiotemporal continuum between the types. Regardless of whether they are considered the same morphological type, Goshen and Plainview complexes may date to different time periods (Frison 1996:207; Taylor 2006:153).

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and Lusk points, neither of which were well defined until after World War II. Lusk is now subsumed into the same typological category as Angostura (Pitblado 2007).

Cultural Resources Management and World War II

Throughout the first half of the 20th century, archaeologists increasingly recognized that systematic salvage work was needed to recover and preserve information about archaeological sites, which faced rapid destruction in the face of modern development and looting (Davis 1972). Predominantly after World War II, the government implemented large development projects in an attempt to prevent a reoccurrence of pre-war, depression-era social and economic conditions (Banks and Czaplicki 2014:11). As a result of archaeologists' concerns surrounding the advent of these government-organized development ventures, salvage archaeology became a full-fledged reality. An Interagency Archaeological Salvage Program was developed to locate, document, test, and/or excavate archaeological sites, and was formalized by 1944 (Banks and Czaplicki 2014).

Perhaps most notably during this era, the government instituted the River Basin Survey program to salvage archaeological information and/or materials from areas that would be affected by the Federal construction of dams and reservoirs meant to regulate drinking water and provide hydroelectric power to American residents (Banks and Czaplicki 2014:12). These salvage projects set a precedent for dealing with archaeological materials that influenced the later development of cultural resources management in the United States and had an enormous impact on archaeological data collection pertaining to the Paleoindian period and beyond, for better or for worse (Frison 1973b:157-160; Mitchell 2006). The Angostura type site (Ray Long), for example, was excavated as part of the Missouri Basin Project before it was partially destroyed by the construction of the Angostura Dam and Reservoir circa 1949 (Pitblado 2007:315-318; Wormington 1957[1939]:138; see also Hannus et al. 2012:Appendix A).

The River Basin Surveys program also homogenized methods and conventions for site recordation by, for example, creating standard forms and instituting a trinomial site numbering system (Butler 2009). "Smithsonian" site numbers consist of three alphanumeric parts in the form 00AB9999. The "00" portion is a number designating the state in which the site was recorded, numbered from 1-50. State numbers are mostly in alphabetical order. The number for Wyoming is "48," because it is alphabetically the last state. Alaska and Hawaii are out of order, with state numbers "49" and "50," because they became states after the original Smithsonian trinomial system was implemented. The middle letters of the trinomial represent a two-letter abbreviation for the county in which the site occurs, and the numbers at the end of the trinomial represent the number of the site, mostly in the order in which they were recorded within that county.

The Radiocarbon Revolution

In 1949, Willard F. Libby, Ernest C. Anderson, and James R. Arnold published an article in *Science* introducing the radiocarbon dating method, which they had tested on carbon samples from two Egyptian tombs of known calendric ages (Libby et al. 1949; see also Libby 1946,

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1948). The radiocarbon dates they obtained using this new method were concordant with the known ages of the corresponding Egyptian tombs, within an error margin. Over the next several decades, Libby and colleagues continued to refine the radiocarbon dating method and the radiocarbon calibration curve (Arnold and Libby 1949, 1951; Clark 1975; Libby 1961, 1963, 1972, 1980). These refinements continue into the present day (e.g., Povinec et al. 2009; Reimer et al. 2013), but the basic dating technique was established in 1949. The first Folsom site to be dated was Lubbock, Texas (Sellards 1952), producing a date of 9883 ± 350 ^{14}C BP (Libby 1952; Wormington 1957[1939]:40).⁷

The development of radiocarbon dating was a scientific breakthrough that would revolutionize archaeological chronology building (Marlowe 1980). Within a decade, the widespread dissemination of a dating technique that allowed archaeologists to estimate sites' calendar ages ushered in the culmination of the culture-historical era and paved the way for new theoretical paradigms to emerge. Prior to 1949, archaeologists struggled to place sites in chronological context with each other by utilizing only the limited relative dating and geological methods available. The advent of an absolute dating technique that could be applied to almost any site (with substantial enough organic materials) allowed successive generations of archaeologists to shift their focus from descriptive chronology building to testing hypotheses about other aspects of human behavior.

*1950-1970: The Culmination of the culture-historical Era*More Pieces to the Chronological Puzzle: The Cody Complex and the James Allen and Midland Type Sites

The Horner site, a bison kill near Cody, Wyoming, was discovered by a local collector named James Allen in 1939 (Wedel 1987:19), but was not excavated until the late 1940s or reported until the 1950s (Jepsen 1951, 1953a, 1953b). Though Eden and Scottsbluff points had previously been found in context with each other at the Finley site, Horner became the type site for the Cody complex, which was recognized and named by Wormington shortly after the original Horner site excavations (Wormington 1957[1939]:127-8,136-7).

A full monograph detailing the findings at Horner was not published until more than three decades later (Frison and Todd 1987; see also Wilmsen 1970). This reanalysis of Cody complex cultural materials and stratigraphic relationships indicated that the site likely represented a short-term occupation or series of occupations and a mass, late-fall to winter bison kill, or an area immediately adjacent to such a kill (Frison et al. 1987:364). Reanalysis of the Horner projectile points showed spatial segregation in point types. Points with a mixture of Alberta/Cody characteristics tended to be found in the same area as Scottsbluff points and Eden points tended to be found in a separate but contemporaneous area. This finding served to “both

⁷ Around this time, Libby and colleagues also dated several other Paleoindian sites (Arnold and Libby 1950; Holliday 2000a:238), including two of the Lime/Medicine Creek sites in Nebraska (Arnold and Libby 1951; Libby 1955), the Horner Site in Wyoming (Arnold and Libby 1951; Libby 1955), and the Ray Long site in South Dakota (Arnold and Libby 1951; Libby 1952).

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clarify and confuse the issue of Alberta/Cody and the Cody complex” (Bradley and Frison 1987:230). Additional work at the Claypool site in Colorado also contributed to these early definitions of the Cody complex (5WN18; Bradley and Stanford 1987; Dick and Mountain 1960; Stanford and Albanese 1975; Wheat et al. 1972; Wormington 1957[1939]:128-132). Today, most archaeologists agree that Cody diagnostics include Cody knives and/or several point types occurring alone or in combination: Alberta, Alberta/Cody, Kersey, Firstview, Eden, and Scottsbluff (Kneel and Muñiz 2013).

James Allen also discovered another bison kill approximately fourteen miles south of Laramie, Wyoming, which was later named the James (Jimmy) Allen site (48AB4) in his honor. In 1949, James Allen reported the site to William Mulloy, founder of the University of Wyoming Anthropology Department, who later excavated and published the James Allen site investigations. The James Allen site produced an early radiocarbon date of 7900 ± 200 ^{14}C BP (Mulloy 1959; Wormington 1957[1939]:1414-146), and became the type site for James Allen points, which had previously been known as Oblique Yuma (Mulloy 1959). More recently, archaeologists have suggested that James Allen points are part of diverse Late Paleoindian point styles which reflect regional differences and/or variability in subsistence strategies (Frison 1978:37, 83, 1991:74; Pitblado 1999, 2003, 2007).

Farther south, at the Scharbauer site (41MD1) near Midland, Texas, an artifact collector named Keith Glasscock discovered human remains in a blown-out sand dune. These remains seemed to be in context with extinct fauna, a hearth, seven fluted Folsom points, and twenty-one points that appeared similar to Folsom but were unfluted (Wendorf et al. 1955; Wendorf and Krieger 1959; Wormington 1957[1939]:41-2, 241-248; see also Sellards 1955). The unfluted points were later named Midland, after the nearby city (Holliday 1997:40). Though originally thought to be Paleoindian-aged human remains (the first known to science), the site produced conflicting dates. Radiocarbon ages ranged from 4000 to over 20,000 ^{14}C BP (Wendorf and Krieger 1959; Wormington 1957[1939]:245). A new, as-yet experimental method of absolute dating using uranium isotopes was also attempted at Scharbauer, but produced pre-Folsom dates, suggesting that the site was perhaps as old as 19,000-15,000 BP (Holliday 1997:41; Rosholt 1958; Wendorf and Krieger 1959; Wormington 1957[1939]:246). The actual age of the Midland woman is still in doubt, although it seems that she was coeval with or post-dates Folsom (Holliday and Meltzer 1996).

Partially in response to the complex stratigraphy and dating issues at the Scharbauer site, the original Scharbauer investigators launched an interdisciplinary High Plains Paleoecology Project to study end-Pleistocene environmental change in the region by incorporating archaeology, stratigraphy, geochronology, paleobotany, and paleontology. These interdisciplinary studies compared multiple Southern Plains Paleoindian sites. The High Plains Paleoecology Project eventually concluded that the Southern High Plains (and therefore more northerly locations as well) were at least partially forested during portions of the Paleoindian period (Holliday 1997:42-3; MacGinitie 1962; Wendorf 1961, 1970; Wendorf and Hester 1962, 1975), contra the previously held notion that the late Pleistocene and Holocene Southern Plains had always been grassland (Clements 1920; Elias 1942). After investigations at Blackwater

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Draw No. 1,⁸ this was one of the first interdisciplinary Paleoindian studies on the Plains (Holliday 1997:38-45), and set an early precedent for future archaeological projects that increasingly emphasized the impact of paleoenvironment on human behavior.

Early Comprehensive Chronologies of the Northwest Plains

More than a quarter century of Paleoindian finds combined with the advent of radiocarbon dating meant that by the mid-1950s, the time was ripe for a compilation of the first culture-historical synthesis of the Northwestern Plains. This preliminary attempt was accomplished by Mulloy in 1953, originally appearing as his doctoral dissertation (Mulloy 1953) and formally published in 1958. In this preliminary chronological outline, Mulloy warned that “[t]he complex prehistory of the northwestern Plains and adjacent Mountains is only beginning to be understood” (Mulloy 1958:4), because in this region, “archaeological investigation is in early infancy” (Mulloy 1958:7).

By the late 1950s, Paleoindian-aged sites such as James Allen, Horner, Ray Long, Agate Basin, Finley, and Lindenmeier were known on the Northwest Plains. However, Mulloy (1958) refrained from fully addressing the Paleoindian period in his chronological synthesis because none of the Paleoindian sites contained “appreciabl[e...] stratigraphic sequences” (Mulloy 1958:7). At this time, the earliest known cultural complex on the Northwestern Plains was Folsom, from surface finds and the previous excavations at Lindenmeier (Mulloy 1958:204-5). Thanks to the Lindenmeier, Horner, Finley, James Allen, and Ray Long sites, Mulloy (1958:205-8, 219-20) tentatively suggested that the Cody complex, James Allen, and Angostura point types post-dated Folsom. However, stratigraphic, temporal, and potential evolutionary relationships between these Paleoindian complexes and the Folsom complex remained unclear.

Mulloy (1958:208) impressionistically suggested that “Early Period” (Paleoindian) social organization seemed to be characterized by small, nomadic groups, practicing a hunting economy supplemented by some gathering. In contrast, “Early Middle Prehistoric Period” (Early Archaic) peoples appeared to focus more heavily on vegetable gathering nearly devoid of large game procurement in the west (especially in the Wyoming Basin) while more easterly Early Archaic groups continued to hunt bison (Mulloy 1958:210). Though Mulloy was working with extremely limited data, many of his carefully phrased impressions and suggestions were confirmed by later archaeologists.

Several subsequent discoveries significantly contributed to the next attempt to comprehensively describe Plains Paleoindian culture history (Wedel 1961, 1964). Post-Clovis Paleoindian bison hunting was further explained by the discovery and analysis of the Lime/Medicine Creek sites in southwestern Nebraska (25FT41, 25FT42, and 25FT50; Bamforth 2007; Schultz et al. 1948; Wedel 1961:72). At the MacHaffie site near Helena, Montana (24JF0004), fluted Folsom points were found stratigraphically below Scottsbluff points, confirming the Folsom complex’s greater antiquity (Forbis and Sperry 1952). In 1960, the remains of a mammoth that was possibly associated with artifacts was discovered outside

⁸ And also at the Finley site (see Schultz and Frankforter 1951; White 1953).

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Rawlins, Wyoming, and named the U.P. Mammoth site (48CR182; Haynes et al. 2013; Irwin et al. 1962; McGrew 1961; Prasciunas 2012).

Building on these and previous finds, Waldo Wedel (1961, 1964) synthesized culture history for the entire Great Plains region. Of the Northwest Plains specifically, he noted that “[m]uch of the information bearing on these early hunter-folk comes, in fact, from sites in adjacent regions, where the associations have been more clearly determined” (Wedel 1961:247). Nevertheless, Wedel constructed a much more detailed chronological chart than attempted by Mulloy (1953, 1958) several years prior.

Wedel (1961: 280, 1964:196) described the earliest inhabitants of the Northwest Plains as “Early Big Game Hunters.” This may have been one of the earliest explicit, academic labelings of Northwest Plains Paleoindians implying that they were exclusively large-game specialists. There is no doubt that this view of Paleoindian subsistence was influenced by several factors. Preferential preservation of stone tools and fauna over floral remains meant that evidence for plant exploitation was relatively difficult to find in the Paleoindian-aged archaeological record. The preponderance of single-event kill sites over campsites meant that most of what was known about Paleoindians came from large animal kills. The high proportion of non-local toolstone in projectile point assemblages made Paleoindians seem exceedingly nomadic (Goodyear 1979). Additionally, contemporary ethnographic studies of foragers focused great attention on the “Man the Hunter” stereotype (e.g., Lee and DeVore 1966). The categorization of Paleoindians as almost exclusively “Big Game Hunters” persisted for decades, until archaeologists began to recognize that some Paleoindian diets were more diverse (Kornfeld 2007a).

Based largely on finds at Dent and U.P. Mammoth (sites where mammoth-human relationships are still largely unclear; Haynes et al. 2013; Kornfeld et al. 2010:73), Wedel noted that mammoth hunters appeared earlier than bison hunters (Wedel 1961:75). Wedel (1961:280, 1964:196) also correctly agreed with previous assertions that Folsom preceded other Northwest Plains Paleoindian point types, including Eden, Plainview, Scottsbluff, and Angostura. Furthermore, he explicitly placed the Altithermal, a warm and dry climatic event (Antevs 1955; Deevey and Flint 1957; Flint 1947), as occurring between what would later be named the Paleoindian and Early Archaic periods (Wedel 1961:18-19, 280), providing yet another example of the increased archaeological interest in determining the effects of the paleoenvironment on prehistoric human lifeways during this era.

Thanks to the work of Mulloy (1953, 1958), Wedel (1961, 1964), and others, a picture of Paleoindian chronology and economy on the Northwest Plains was beginning to emerge by the early 1960s. However, archaeologists still considered it necessary to find a stratified, multi-component site containing the full sequence of Northwest Plains Paleoindian complexes to clarify chronological relationships and broaden understandings of settlement and subsistence strategies.

Chronology Building: The Hell Gap Site

In 1959, a series of stratified, multi-component sites dotting the banks of a stream in the Hell Gap valley of eastern Wyoming (48GO305) were discovered by James Duguid and Malcolm McKnight, University of Wyoming students and amateur archaeologists (Agogino and

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Irwin-Williams 1965; Knudson 2009). They immediately recognized Hell Gap's importance, in part because they identified a previously unknown and undefined point type, later named Hell Gap, on the surface (Agogino 1961). Hell Gap also became the purported type site for Frederick⁹ and Goshen points (Irwin-Williams et al. 1973; Kornfeld and Larson 2009). Culture-historical archaeologists were seeking a keystone chronological site for the High Plains. Hell Gap represented the manifestation of this dream.

Generously funded by grants from the National Geographic Society (Agogino and Irwin-Williams 1971; Irwin 1973, 1971, 1970, 1969; Irwin and Brew 1968), Harvard University, and the American Philosophical Society, excavations at Hell Gap were conducted by protégés of H. Marie Wormington. Cynthia Irwin (later Irwin-Williams) and Henry Irwin (siblings), in conjunction with George Agogino of the University of Wyoming, excavated at Hell Gap from 1959-1966 (Irwin-Williams et al. 1973). They identified four Paleoindian localities. Early and subsequent excavations at Hell Gap have primarily focused on Localities I and II (Irwin-Williams et al. 1973; Haynes 1965; Irwin 1973, 1970, 1969, 1968; Irwin and Brew 1968; Larson et al. 2009). Early chronology building was primarily based on information obtained from Locality I, because it yielded "an excellent stratigraphic sequence including remains of most of the Paleo-Indian complexes present in Hell Gap valley" (Irwin-Williams et al. 1973:44; see also Irwin et al. 1966, 1965). The sequence established at Hell Gap was important to the entire Great Plains culture region and beyond, since it allowed for "the construction of the most complete sequence of Paleo-Indian cultures available to date and its placement in a dated geological context" (Irwin-Williams et al. 1973:52; see also Agogino et al. 1964; Irwin 1967; Irwin et al. 1965; Irwin and Wormington 1970). Hell Gap is still one of very few known sites in North America that contains over 4,500 years of stratified Paleoindian complexes (Freeland et al. 2014:14).

Hell Gap was one of few long-term, reoccupied Paleoindian campsites known in the 1960s, although other Paleoindian campsites had previously been located at Lindenmeier (Colorado), Lime Creek (Nebraska), MacHaffie (Montana), Agate Basin (Wyoming), and a newly analyzed Lusk component at the Betty Green site (48NO203; Greene 1967) in eastern Wyoming. With these few exceptions, most previous knowledge about Northwest Plains Paleoindians had been garnered from kill sites. Thus, Hell Gap's original investigators recognized that the site had great potential to elucidate "Paleo-Indian structures, community organization, and activities related to the more complex and stable camp situation [...] and the changing resource base which supported them" (Irwin-Williams et al. 1973:52).

Indeed, as a long-term campsite with evidence of diverse subsistence practices and domestic structures in multiple components, Hell Gap inherently showed that Paleoindians were not exclusively large game specialists, and that they were not constantly nomadic. However, early investigators focused mainly on chronology building and only attempted to answer temporal questions. Though excellent notes and records of the initial excavations at Hell Gap were and are available, after the 1970s, Hell Gap "languished" (Kornfeld and Larson 2009:7) until archaeologists began reanalysis of materials and initiated new excavations in the 1990s.

⁹ James Allen and Frederick points are very similar (Frison 1991b:66) and many typologists now consider them to represent the same type (Pitblado 2007:318)

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This work continues into the present day (e.g., Head et al. 2012; Larson et al. 2009; Larson et al. 2000; Kornfeld et al. 2002; Pelton et al. 2017; Schmitz et al. 2015, etc.). Hell Gap was designated a National Historic Landmark on December 23, 2016.

The Rise of Cultural Resources Management (CRM)

The US government demonstrated concern over the preservation of historic and prehistoric resources in the form of the Antiquities Act of 1906 and through salvage archaeology conducted through the 1940s, but the laws and institutions that form the core tenets of today's cultural resources management were not implemented until the latter half of the 1960s. During the early 1960s, President Kennedy's administration executed urban renewal projects that demolished many historic neighborhoods to make space for modern neighborhoods (King 2013:19-20). Residents of these areas and other stakeholders began to take issue with this policy, since it destroyed the historic sense of community and place.

In response to public outcry and in conjunction with recently codified archaeological ethics (Champe et al. 1961), the Johnson administration enacted the National Historic Preservation Act (NHPA) in 1966, thus establishing the National Register of Historic Places (NRHP) and State Historic Preservation Offices (SHPOs). The NHPA also included Section 106, which eventually required that federal agencies, prior to the approval of any development projects on federal land, that use federal funding, or require federal permits, must consider the impacts on historic properties and afford SHPOs and/or the Advisory Council on Historic Preservation a reasonable opportunity to comment on such actions (King 2013:19, 21). Originally, Section 106 only required assessment of impacts on properties that were already listed in the National Register; after 1972,¹⁰ all eligible properties were (and are) required to be treated as if they are listed.

In 1969, the National Environmental Policy Act (NEPA) was implemented in response to increasing awareness of anthropogenic behaviors that negatively damaged the environment (e.g., the publication of *Silent Spring*; Carson 1962). Under NEPA, government agencies were required to assess the impacts of their actions on the quality of human environments, which eventually included archaeological and historic sites as well as traditional cultural properties (King 2013:5, 20-21).

Thanks to the NHPA and NEPA, Paleoindian and other prehistoric archaeological sites enjoyed increased protection from looting, vandalism, and destruction in the face of development projects. By the early 1970s, archaeologists that worked specifically to ensure compliance with environmental and preservation laws began calling their profession Cultural Resources Management (CRM; King 2013:23).

Archaeological Theory: The Rise of the Processual Paradigm

During the culture-historical era, archaeological research primarily focused on identifying sites and building chronologies. Questions generally did not progress beyond asking what

¹⁰ Under Executive Order 11593.

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archaeological materials were present where, and when in prehistory they were deposited. Larger hypotheses pertaining to the colonization of the Americas, including when it happened and where people came from, had been proposed but not sufficiently tested. By the 1960s, the most widely accepted hypothesis suggested that Paleoindians populated the Americas by traversing the Bering Strait from East Asia or Siberia, either by land or by sea (e.g., Haynes 1969; Solecki 1951; Willey 1966b:141; Wilmsen 1964, 1965:185-6; Wormington 1957[1939]:249-260). But even including the early colonization of the Americas literature, Paleoindian research prior to the 1960s was almost exclusively descriptive. Archaeologists strove only to answer the what, where, and when of material culture.

After the advent of radiocarbon dating but before the Hell Gap chronology was released, Wormington (1957[1939]:259) acknowledged that “[t]o the casual observer the growing list of unanswered questions regarding the ancient inhabitants of North America may seem appalling.” Yet, Wormington argued that this increasing list of unknowns was portentous, because it indicated that archaeologists were finally gaining a complex enough understanding of the Paleoindian period that important questions could be asked. To summarize this insight, Wormington (1957[1939]:260) concluded that “[t]o find an answer, one must first have sufficient knowledge to formulate the question.”

Wormington was not alone in forecasting this change in archaeological research trajectories. Wedel (1963:214-15), for example, also acknowledged that pure description should no longer constitute the main goal of archaeological work. One beneficent consequence of the early studies at Hell Gap was that the pursuit of these previously idealistic notions became a feasible reality on the Northwest Plains. Hell Gap’s stratified components, in context with datable organic materials, freed Paleoindian archaeologists to shift their focus from purely chronological questions to formulating and testing hypotheses designed to elucidate more interesting aspects of human behavior.¹¹

This shift in archaeological focus was not isolated to Paleoindian studies on the Northwest Plains. It was part of a broader theoretical movement in professional archaeology that was reverberating throughout the United States. This movement was precipitated by a series of academic events. Disagreements regarding the meaning of typology came to a head during a particularly salient debate between James Ford and Albert Spaulding which occurred in the mid-1950s. Spaulding (1953) argued that valid archaeological “types,” styles, or constellations of artifact traits, represent real and culturally recognized phenomena. According to Spaulding (1953), material culture types could be discerned statistically and were not arbitrarily defined by archaeologists. Ford (1954), on the other hand, agreed that valid archaeological types could be statistically assigned by typologists, but argued that those types did not represent natural templates envisioned by prehistoric artifact manufacturers (see also Krieger 1944). This debate marks an introspective, critical turning point in the application of the culture-historical approach, though the question of typological meaning in and of itself was not getting archaeologists any closer to understanding prehistoric lifeways.

¹¹ For summaries of the development of Early Man studies up to this point, see Holliday (2000a), Wilmsen (1965) and Wormington (1966).

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In 1958, Willey and Phillips (1958) synthesized culture-historical theory into a single methodological volume, which defined geographic space by localities, regions, and areas, and temporality by phases. Willey and Phillips' (1958:2) oft-quoted statement that "American archaeology is anthropology or it is nothing" appears in this book. This confrontational call to action referenced the growing concern that archaeological culture history had reached its maximum theoretical potential. Throughout the culture-historical era, archaeologists had become preoccupied with producing descriptions and typologies of material culture, tracing material culture traits across space and time, explaining their distribution through diffusion and migration, and generally neglecting to acknowledge that people created these material residues in the first place (e.g., Haury 1950:521; Trigger 2009:289,312-313).

Complementing Willey and Phillips' earlier work, Willey (1966, 1971) published two large volumes synthesizing known culture-historical sequences for recognized culture areas in North and South America. In this two-volume set, Willey (1971:476) defined "culture stages" as having "general similarity of culture content—i.e., 'hunting-gathering cultures,' 'agricultural cultures,' or 'urban cultures.' Such cultures so grouped in a stage may or may not be generically related to one another." Thus, cultures were grouped into typological categories rather than the unilineal cultural evolutionary sequence suggested by Tylor (2008[1873]) and Morgan (2008[1877]) in the 1800s.

Willey (1971:478-9) also divided North American cultures into twelve culture areas, one of which was "the Plains." Willey (1966:37) referred to early Plains Paleoindians as "The Big-Game Hunting Tradition," presumably after Wedel (1961, 1964). Willey (1971) defined the earliest Paleoindians in North America as the Clovis complex, based on analogous information excavated from sites in the Southwestern United States. Willey built the remaining bulk of the Plains Paleoindian sequence based on personal communication with Henry Irwin on the Hell Gap chronology and information summarized in Wormington's (1957) synthesis. The publication of Willey's (1966a, 1971) comprehensive two-volume culture-historical summary effectively provided archaeologists with the freedom to move beyond simple prehistoric questions of what happened, when, and where, to pursue "other equally important and more humanly appealing strands of man's endeavor from the distant past" (Willey 1966a:478). Thus, prehistoric archaeologists finally had sufficient knowledge and chronological background necessary to formulate questions that asked *why* prehistoric peoples behaved in certain ways.

Developments in American cultural anthropology also influenced the direction that American archaeology was turning. In the United States, much of late 19th and early 20th century cultural anthropology, like archaeology, consisted of description and documentation. "Salvage ethnography" operated under the assumption that Native American cultures were disappearing and would soon go extinct in the face of modernization (see Boas 2008[1920]). Under early culture-historical and salvage frameworks, culture was circularly defined as culturally relative: "Culture embraces all the manifestations of social habits of a community, the reactions of the individuals as affected by the habits of the group in which he lives, and the products of human activities as determined by those habits" Boas (1930:79).

In the 1950s-1970s, some cultural anthropologists began to articulate problems with the "fruitless assumption that culture comes from culture" (Steward 1955:36), as well as the failure of this early view to sufficiently account for the physical environment's influence on cultural

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development and change. Some cultural anthropologists overcompensated for this lack of environmental consideration by suggesting theories of culture change that, in retrospect, smacked heavily of environmental and/or cultural determinism (see Sahlins and Service 1960). Leslie White, for example, argued that the amount of energy available in any given environment dictated the level of cultural complexity possibly attainable. In White's theoretical framework, which he termed *culturology*, "no amount of, addition to, or improvement of, [technology] can advance culture beyond a certain point so long as the energy factor remains unchanged" (White 1959:56). White clearly stated that his theory of culture change did "not differ one whit in principle from that expressed in Tylor's *Anthropology* in 1881" (White 1959:ix). This was clearly problematic, for many of the same reasons as the unilineal cultural evolution of the 1800s was problematic. However, White made important and lasting contributions to archaeology by emphasizing environment as an explanatory variable in human behavior, and in redefining the concept of culture: "man, and man alone, possesses an elaborate extrasomatic mechanism which he employs in the process of living. This extrasomatic mechanism, this traditional organization of tools, customs, language, beliefs, etc., we have called a culture" (White 1959:38).

Around this time, cultural anthropologist Julian Steward proposed an alternative view of cultural evolution. Steward's (1955) cultural ecology represented somewhat of a middle ground between culturology and the Boasian approach. Steward argued that certain types of behaviors, such as subsistence practices, are directly related to environment and ecology, while non-functional cultural features may be determined "by purely cultural-historical factors—by random innovations or by diffusion," (Steward 1955:37). Steward emphasized the multilineal effects of ecology, environment, technology, and social organization on each other, which became an important archaeological theme, but his approach was later deemed rather ad-hoc and anecdotal (Kelly 2007[1995]:43, 47).

On the heels of these exciting new ideas, Lewis Binford published a pivotal paper in 1962 called "Archaeology as Anthropology," a title that explicitly referenced a defining quote recently published by Willey and Phillips' (1958:2): "American archaeology is anthropology or it is nothing." Calling for an archaeological movement away from description and towards explanation, Binford clearly laid out the framework and goals of a new paradigm in archaeology, which was later dubbed *processualism*. Drawing on White, Binford (1962:218) defined culture as the "extra-somatic means of adaptation for the human organism." In Binford's view, adaptation referred to both physical and social environments. Possibly drawing on Steward, Binford (1962) argued that different types of material culture change in different ways, but that these changes occur in direct response to social and environmental conditions and in context with the entire cultural system. Change in one variable within a cultural system concomitantly causes predictable and quantifiable adjustments to other variables within that cultural system. These continuous, autocorrelated adjustments, taken together, are what Binford referred to as "process" (Binford 1965; Lyman 2007).

Over the next thirty years, Binford published articles in top journals at a "prodigious pace," and was probably "the most read and cited American archaeologist of the last forty years" (O'Brien et al. 2005:39-40). His early articles and books laid out the processual framework (e.g., Binford 1963, 1964, 1965, 1967, 1968a, 1968b, 1968c). One explicit goal of the processual "New Archaeology" was to turn the discipline into a science, seeking overarching, nomothetic

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laws and patterns in human behavior (Spaulding 1968) by proposing and testing hypotheses grounded in uniformitarianism (Binford 1968a; Sullivan 1978; Watson et al. 1971; Watson 1976). Binford and his processualist colleagues refined the field of ethnoarchaeology as a tool to help archaeologists interpret the past, while simultaneously cautioning that the range of contemporary human behavioral variation does not reflect the full range of past human behaviors (e.g., Binford 1967, 1968b, 1976, 1978a, 1978b, 1979, 1980, 1981b, 1983, 1984, 1986; Binford and O'Connell 1984).

One of Binford's many important contributions to archaeological theory was the realization that in archaeology, on-the-ground discoveries and the development of research methods and theories must come hand in hand:

We would not know anything at all about the past, of course, if our energies were entirely devoted to developing a perfect research methodology and we failed to collect any archaeological facts about the past. Yet, on the other hand, if we had a complete archaeological record and no way to give meaning to it, we still would be no nearer to knowing the past. Obviously, the two sides of archaeological research must necessarily develop together, but that is easier said than done (Binford 1983:22).

Through the 1970s and 1980s, some processual archaeologists explicitly recognized that meaningfully interpreting material residues in terms of cultural processes required the development of bridging arguments that connected static archaeological context to dynamic, or systemic, prehistoric behavioral context (Binford and Binford 1968; Fritz 1972; Reid et al. 1975; Schiffer 1972). By the 1980s, this practice was termed "middle range theory" (e.g., Binford 1977:1-10, 1981a, 1981b) or, similarly, the study of "formation processes" (e.g., Schiffer 1976, 1981, 1983, 1985, 1996).¹² Connecting observable archaeological statics to unobservable, prehistoric behavioral dynamics required that archaeological site patterning was interpreted by using bridging arguments constructed through ethnographic analogy and experimental archaeology, and by accounting for natural site formation and taphonomic processes (Schiffer 1983).

Much of Binford's ethnoarchaeological research was published as a direct result of his fieldwork with the Nunamiut Inuit in north-central Alaska between 1969 and 1973. All Paleoindians were foragers. Therefore, many of Binford's studies were (and are) particularly relevant to Paleoindian archaeology because of his studies' foci on hunter-gatherer subsistence, mobility, and technology. One of his important ethnoarchaeological contributions was defining the difference between "expedient" and "curated" technologies, and positing that the organization of these technologies "may be situationally responsive to external conditions resulting in within-system differences in the archaeological remains at different locations" (Binford 1976:262-8, 1978:343), depending on the availability of raw materials and/or the ability to replace discarded artifacts.

¹² For critical summaries of these theoretical developments see Broughton and O'Connell (1999), Flannery (1967), Kelly (2011), O'Brien et al. (2005), Plog (2011), Raab and Goodyear (1984), and Schiffer (2011).

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Binford (1978a) also explicitly addressed the organization of space. He introduced the concept of drop and toss zones by recognizing that small, unobtrusive items may be discarded in close proximity to hearths whereas larger, more “unsightly” items will be tossed farther out-of-the-way (Binford 1978a:349-50). Binford and other contemporary ethnoarchaeologists recognized that the organization of space is structured by activity areas (Binford 1978a:350-4; Yellen 1977), but that archaeological material residues do not necessarily reflect the direct byproducts of human behavior. Some activities may not produce material residues, or artifacts may be discarded far from where they were originally used. In many cases, artifacts are intentionally discarded in out-of-the-way, low-intensity use areas. Sometimes, “disposal patterns result in a distribution that is essentially inversely related to the patterns of use intensity” (Binford 1978a:356).

Throughout the early decades of processual theory building, Binford and other ethnoarchaeologists (e.g., Yellen 1977) observed many empirical patterns and correlations between material residues and human behavior by observing living peoples. However, overarching explanations as to *why* these patterns existed had thus far only been inductively proposed rather than deductively tested as hypotheses. In the late 1970s, Binford argued that the next goal of processualism should be to use these variables “to explore causal relationships between activities and their organization in space” (Binford 1978a:360; see also Binford 1976:268).

Several years later, Binford accomplished this task. The most-cited archaeological article of all time is Binford’s (1980) paper, “Willow Smoke and Dog’s Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation” (Smith 2008, 2009). In this article, Binford compares his ethnoarchaeological experiences with the Nunamiut (Binford 1978a, 1978b) to data collected among the Ju/’hoansi in southern Africa (e.g., Silberbauer 1972) and other recently developed cross-cultural ethnographic databases (Murdock 1967) to outline differences in the dynamics of hunter-gatherer cultural adaptations. These cultural adaptations were framed in terms of the organization of mobility strategies. Binford explicitly linked differences in mobility strategies (dynamics) to expected inter-site variability and patterning in the archaeological record (statics).

According to Binford (1980), the Nunamiut exemplify one end of the hunter-gatherer mobility spectrum, referred to as “collectors,” while the Ju/’hoansi represent the other end, referred to as “foragers.” Collectors organize themselves around long-term residential base camps and send small parties to specialized short-term camps in order to exploit resources. Collectors move residential bases infrequently, but travel relatively long distances when they do so. This strategy is termed logistical mobility. In contrast, foragers “map on” to resources by frequently moving their entire residential camp to those resources, foraging within a limited radius, and subsequently moving the entire camp a short distance to the next resource patch. Binford argued that the organization of mobility around a collector strategy is an adaptive response to environments with widely distributed resources that are clumped or specifically localized, whereas foraging strategies are better suited to environments with resources that may be scattered but are distributed ubiquitously.

Using a database of global, cross-cultural information (Murdock 1967), Binford tested if these mobility strategies correlate to environmental conditions. In general, he found that hunter-

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gatherers in Arctic (food-poor) and equatorial (food-rich) environments are characterized by higher mobility than in temperate environments, though the organization of mobility changes between the Arctic (collectors) and equatorial areas (foragers). He concluded that hunter-gatherer mobility strategies therefore reflect and are affected by patterns of food distribution, which are in turn dictated by environmental conditions. Binford (1980) hypothesized that differences in mobility patterns should manifest archaeologically, as foragers will produce different types of archaeological sites than collectors, and these sites will inherently be characterized by different types of artifact assemblages (Binford 1976). In addition to providing theoretical background to aid in interpretation of hunter-gatherer archaeological sites, this paper also offered an example of how processual studies were supposed to work. Binford observed that there were differences in mobility patterns among living hunter-gatherer cultures, inductively presented a hypothesis to explain that variation, and then deductively tested that hypothesis with cross-cultural and environmental data. Binford's hypothesis was supported, so he concluded that an overarching pattern in human behavior exists. He then linked that pattern to the archaeological record by explaining how material residues reflect that behavior.

To illustrate the value of the processual approach, Binford also became embroiled in a debate with French archaeologist Francois Bordes over the meaning of Mousterian (Neanderthal) tool types in Europe (Trigger 2009:402-403; Wargo 2009). Bordes created a taxonomy of 63 types of Mousterian tools. Using statistical analysis combined with qualitative impressions, Bordes quantified the frequencies of these tool types at different sites and used this information to divide them into three (and eventually four) distinct groups (Bordes 1953; Bordes and Sonnevile-Bordes 1970). By 1961, Bordes concluded that these different tool frequency distributions represented different ethnic groups of Neandertals with unique cultural identities, suggesting that "the existence of different cultures within the Mousterian complex appears to be an established fact" (Bordes 1961:807). Binford disagreed, arguing that if culture was an "extrasomatic means of adaptation" (1962:218), these different tool frequencies were more appropriately explained as patterns produced by a single ethnic group reacting to different environmental conditions.

Binford argued that taxonomic categories of tools were created by contemporary archaeologists and did not necessarily reflect the same meanings attributed to them by prehistoric peoples (Binford 1972; Binford and Binford 1966; Wargo 2009:81-2). In this vein, the Bordes-Binford debate topically hearkened back to the Ford-Spaulling debate of the 1950s. However, Binford explicitly framed his arguments as a refutation of the culture-historical notion that variations in material residues directly reflect differences in ethnic groups (a viewpoint that Binford critically called the "aquatic view" of culture [Binford 1965:204]). Binford also contested the idea that spatiotemporal differences in material cultural traits only result from diffusion and migration of peoples from one area to another; rather, different material residues may reflect diverse environmental conditions (Wargo 2009:85, 87). According to Melissa Wargo's dissertation on this topic, the Bordes-Binford debate had no clear winner in terms of superiority of one archaeologist's arguments over the other. However, it did mark the commencement of a rift between Old World archaeology, which relied on a historical approach, and the processual "New Archaeology" of the New World, which emphasized scientific and environmental explanations for cultural variability (Wargo 2009).

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Back on the Northwest Plains, a Rancher Turns Archaeologist

In 1965, Edwin Wilmsen (1965:186) wrote that “[t]he intensive study of complete artifact assemblages [similar to Binford’s functional analysis of Mousterian tools] promises to become one of the more interesting aspects of Paleo-Indian studies.” In context with this theoretical climate and inspired by the Bordes-Binford debate, native Wyomingite George C. Frison, an avocational archaeologist and rancher-turned-graduate student at the University of Michigan (Frison 2014), published an important article addressing form, function, and typology of chipped stone tools (1968b). Using artifacts from the Piney Creek site, a Late Prehistoric bison kill and associated butchering area in northern Wyoming, Frison suggested that chipped stone tools are resharpened throughout their use lives; therefore, “[t]ool typology must consider [...] whether two or more different-appearing tools are not the same tool, functionally, at different stages of use” (Frison 1968b:154). This important realization was later termed “the Frison Effect” (Jelinek 1976), and had lasting and widespread repercussions for lithic and typological analysis of chipped stone assemblages across time and space.

Many professional North American archaeologists prior to Frison wrongly believed that the Plains had not been intensively occupied by Native Americans until after the introduction of horses during the Protohistoric period (Frison 2014:46, 1973b:151, 153; Kroeber 1939:76-79; Wissler 1907). The Northwest Plains was not a region garnering mainstream archaeological interest back in the 1960s (Frison 2014:60). Despite this previous lack of professional archaeological attention, Frison completed his PhD dissertation on Late Prehistoric archaeology in Wyoming in 1967 (Frison 1967) with the support of Mulloy (Frison 2014:58-9). Frison subsequently returned to the Plains, where he was hired as the second archaeologist at the University of Wyoming (after Mulloy), and was appointed head of the Anthropology Department, also in 1967 (Frison 2014:66). Frison’s academic archaeological career began in the 1960s, and throughout that decade he published numerous articles on Northwest Plains archaeology (e.g., Frison 1962, 1965, 1968a, 1968c, 1970a, 1970b, etc.). However, Frison’s studies of Paleoindian-aged sites did not academically crystallize until the 1970s.

*1970-1990: The Age of Frison*Emergence of the Foothill/Mountain Complexes

Frison returned to the Plains just as a slew of new Paleoindian sites were being discovered and/or investigated, many of them by Frison himself. By the 1970s, it was generally accepted that fluctuating environmental conditions affected Plains occupations as early as 10,000 BP (e.g., Irwin-Williams and Haynes 1970). A longer period of warming and drought, called the Altithermal, occurred at the end of the Paleoindian period, beginning around 7,000 BP (Antevs 1955; Frison 1975; Irwin-Williams and Haynes 1970; Reeves 1973; see also Sheehan 1995). One area of utmost research importance on the Northwest Plains was filling a chronological gap in culture history between the Late Paleoindian period and post-Altithermal, Middle Archaic McKean occupations (Frison 1973a:310-11). Frison (1973a:311) urgently remarked that “no

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High Plains archaeologist can rest easily until these unknowns [regarding the Altithermal gap] are solved.” In the Bighorn Mountains and Bighorn Basin of northern Wyoming, data recovered from several sites began to fill this gap and provide a picture of projectile point diversification and subsistence intensification during Late Paleoindian times.

Pryor Stemmed and Lovell Constricted projectile point types were added to known Late Paleoindian point styles based on their presence in context with radiocarbon dates from several rockshelters throughout the Bighorn Mountains and Bighorn Basin. Pryor Stemmed points were first discovered at the Grey-Taylor site (48JO303) and dated to 7800 ± 110 ^{14}C BP (Frison 1991b:27) but were originally misidentified as Meserve points¹³ (Anonymous 1959a, 1959b, 1960, 1963; Frison and Grey 1980; Grey 2004). A few years later, Husted (1969) found them in context at several rockshelters in the Big Horn Canyon and Big Horn Mountains, including Schiffer Cave (48JO319), Bottleneck Cave (48BH206), and Sorenson (24CB202). Combining this with data recovered from other sites such as Medicine Lodge Creek (48BH499) and Paint Rock V (48BH349),¹⁴ Husted properly named this point type Pryor Stemmed.¹⁵

Lovell Constricted points were discovered and named based on their stratigraphic context below Pryor Stemmed at several Big Horn Canyon rockshelters, including Bottleneck Cave (8270 ± 180 ^{14}C BP; Frison 1991b:31; Husted 1969:12-13) and Sorenson (7800 ± 250 ^{14}C BP; Frison 1991b:31; Husted 1969), as well as at Mummy Cave (North Fork Cave #1) in the Absaroka Mountains (48PA201; Husted and Edgar 2002; McCracken et al. 1978; Wedel et al. 1968). Medicine Lodge Creek also produced points similar to Lovell Constricted in context with a similar radiocarbon date (8320 ± 220 ^{14}C BP; Frison 1991b:28, 1973a, 1976b).

A variety of other Late Paleoindian points were also described around this time, but not all styles were incorporated into named typological categories. The Helen Lookingbill site (48FR308; Frison 1976b, 1983; Kornfeld et al. 2001; Wasilik 2006) yielded points reminiscent of Hell Gap but probably more closely related to Haskett points, which had been described in Idaho at the Haskett site (10PR37; Butler 1968, 1978; Frison 1983a:15). Southsider Shelter (48BH364; Frison 1978:37, 38) and Little Canyon Creek Cave (48WA323; Frison 1978:40, 1983:9; Miller 1988) also produced several typologically elusive Late Paleoindian points.

Around the 1960s and 1970s, several sites in north-central and northwest Wyoming were investigated that included deeply stratified cultural deposits, allowing archaeologists to

¹³For a discussion of the Meserve point type see Myers and Lambert (1983).

¹⁴Frison (1976b:168-9) is referenced in all three *Prehistoric Hunters* books as the original source for Paint Rock V (Frison 1978:29, 1991:41; Kornfeld et al. 2010:74). However, Frison (1976b) refers only to a site called Paint Rock IV in-text, though the photograph on page 169 depicts Paint Rock V. Since there may be some confusion regarding which Paint Rock shelter is which in Frison (1976), subsequent publications (e.g. Cannon 2016; Frison and Grey 1980) should probably be used as references instead (Laura Cannon, personal communication 2016).

¹⁵Pryor Stemmed points were eventually identified in situ at Schiffer Cave (8500 ± 160 ^{14}C BP, 8360 ± 160 ^{14}C BP; Frison 1991b:27, 1973a), Bottleneck Cave (8160 ± 180 ^{14}C BP, 8040 ± 200 ^{14}C BP; Frison 1991b:31; Husted 1969), Sorenson (7650 ± 250 ^{14}C BP; Frison 1991b:31; Husted 1969), Medicine Lodge Creek (8340 ± 220 ^{14}C BP, 8160 ± 220 ^{14}C BP; Frison 1991b:28, 1976b), and Paint Rock V (8340 ± 160 ^{14}C BP, 8140 ± 150 ^{14}C BP; Cannon 2016; Frison 1976b:168-9, 1991b:27, 2014:157-8; Frison and Grey 1980:36-38).

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understand the typological and subsistence-based transition from the Late Paleoindian to Early Archaic periods in greater detail for this region. These sites include some that were previously mentioned, such as Mummy Cave (North Fork Cave #1),¹⁶ Medicine Lodge Creek,¹⁷ Helen Lookingbill,¹⁸ and Southsider Shelter,¹⁹ as well as the Early Archaic-aged Laddie Creek site (48BH345).²⁰ In Colorado, Wilbur-Thomas (5WL45) shelter yielded stratified deposits including Cody complex materials through Early Archaic and later components (Breternitz 1971). In Montana, Late Paleoindian-age, stratified deposits with points of similar style and technology to the Bighorn Canyon and Medicine Lodge Creek sites were identified at Myers-Hindman (24PA504; Frison 1978:38; Lahren 1976).

Evidence for subsistence practices at some of the sites listed above suggested that many Middle and Late Paleoindian peoples primarily practiced a carefully scheduled hunting and gathering seasonal round targeting a broad variety of plant and animal foods, with few exceptions. One of these is the Horner site. Designated a National Historic Landmark in 1961, it is the only known Paleoindian communal bison kill/butchering area in the Bighorn Basin. The specialized subsistence strategy at Horner appeared very different from Paleoindian sites with evidence for broad subsistence practices. The site contained classic Cody complex points and seemed to exhibit a communal bison hunting subsistence adaptation, making it more similar to the post-Clovis Paleoindian sites on the open plains to the east than to Late Paleoindian-aged sites located in the nearby foothills and mountain areas (Frison 1976:172-3, 1987).

Based on data recovered from Horner and from other communal bison procurement sites on the more easterly open plains (discussed below), Frison (1975:292-3, 1976, 1978:33, 1983) suggested that two post-Folsom, Paleoindian economic adaptations existed on the Northwest Plains. The first adaptation occurred primarily in the “open country,” and was characterized by the “more familiar Plano [unfluted] cultural complexes” found in the Hell Gap chronology (Frison 1975:292) which were used as part of a subsistence economy predominantly based on communal large game hunting.²¹ The second adaptation occurred in foothills and mountainous areas characterized by “greater topographic relief where a great variety of plants and animal life could be found” (Frison 1975:292), and included a diverse array of diagnostic projectile point styles such as James Allen/Frederick, Angostura/Lusk, Pryor Stemmed, and Lovell Constricted (Frison 1975, 1978:37; Pitblado 2007:328). Frison postulated that Late Paleoindian, “foothill-mountain” peoples exploited a larger range of resources, including smaller animals and flora, than peoples on the open plains (Frison 1976b).

¹⁶Occupied from approximately 9300 ¹⁴C BP through the Late Prehistoric (Frison 1991b:29; McCracken et al. 1978; Husted and Edgar 2002).

¹⁷Occupied from approximately 9800 ¹⁴C BP to the Late Prehistoric at 230 ¹⁴C BP, minus the Cody complex (Frison 1991b:28).

¹⁸Occupied from approximately 10,000 BP to the Late Prehistoric, possibly later than 1530 ¹⁴C BP (Frison 1983a:8, 14).

¹⁹Southsider produced two probable Late Paleoindian/Early Archaic food storage pits (Frison 1991b:30, 83, 343-344).

²⁰Occupied from approximately 7600-5400 ¹⁴C BP (Frison 1978:44).

²¹For the origins of the term “Plano,” see Jennings (1955:20).

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In tandem with this emerging understanding of prehistoric regional diversity, information gathered from fields such as ethnoarchaeology, and high resolution paleoclimatological studies (using pollen, phytoliths, and gastropods), Frison argued that:

Man's interaction with Holocene environments through time reflects rational responses and was therefore systematic in nature. These conditions should provide the basis for construction of predictive explanatory models. The validity of the models will rest on data gathered from diverse areas of study so that strong interdisciplinary efforts will be needed in order to formulate valid models (Frison 1975:299).

This statement clearly shows Frison's processual perspective, as he sought not only to describe prehistoric cultural variability, but also to explain dynamic changes in human behavior by using explanatory models couched in environmental studies (see also Albanese 1977). Frison (1992:338) explicitly summarized his explanatory model for the contrast between foothill-mountain and open plains lifeways by the early 1990s, concluding that "[t]he underlying reason for the dichotomy was ecological and resulted from a different resource base in each area," (see also Frison 1988). The resource base on the open plains consisted predominantly of bison taken with communal hunting strategies. In the foothills and mountains, Late Paleoindian peoples focused on smaller animals like bighorn sheep and mule deer. Bighorn sheep may have been hunted with nets (Frison et al. 1986) and clubs, potentially explaining the comparative paucity of Paleoindian projectile points in foothill-mountain areas.

Paleoindian Habitation Sites: Insights into Chronology, Settlement, Subsistence, and Technology

Archaeological investigations at several other Paleoindian habitation sites in the 1960s and 1970s helped refine the Northwest Plains Paleoindian chronology and provided a more complex picture of Paleoindian technology, settlement, and subsistence patterns elsewhere in Wyoming. Sister's Hill (48JO314; Agogino and Galloway 1965; Frison 1978:32; Haynes and Grey 1965) was originally described as a single-component, Hell Gap campsite on the northeastern Wyoming plains. A radiocarbon date at Sister's Hill placed it around 9650 cal BP (Agogino and Galloway 1965), which was chronologically important since the Hell Gap component at the Hell Gap type site had not yet been directly radiocarbon dated (Frison 1978:32). Technological analysis combined with this new radiocarbon date led the Sister's Hill investigators to suggest that Hell Gap points developed from Agate Basin points, and that Cody complex points subsequently developed from Hell Gap (Agogino and Galloway 1965).

Sister's Hill was also important because it upset the entrenched supposition that Paleoindians were always large game hunters. By the 1970s, Clovis peoples were seen as "specialists in taking mammoths" (Haynes 1970:81), and most post-Clovis Paleoindians were painted as bison hunting specialists (e.g., Bonnicksen et al. 1987), though there was some debate about this topic (e.g., see Johnson 1977). For example:

Reacting against an earlier tendency to oversimplify [...] and to over-emphasize the hunting aspects of Paleo-Indian economy, some scholars have underlined the probable

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role of small game and plant foods in Paleo-Indian subsistence and have minimized that of the larger species. While foraging activities doubtless did play an important part, it is felt that reaction against oversimplification may be carried too far and that excessive preoccupation with these aspects may result in losing sight of the *essential orientation* of many (not all) Paleo-Indian cultures. The available evidence [...] strongly suggests that the late Pleistocene and early post-Pleistocene population of the American High Plains-Southwest were strongly oriented toward hunting large game (Irwin-Williams and Haynes 1970:61, emphasis in original).

The Hell Gap people occupying Sister's Hill, however, did not seem to have targeted any large game. Bison were completely absent from the faunal record, which only contained smaller animals such as antelope, mule deer, porcupine, ground squirrel and other rodents. The investigators suggested that bison may be absent from the Sister's Hill assemblage because they were not present during the site's season of occupation (Agogino and Galloway 1965:192). Perhaps this is true, or perhaps the Hell Gap-aged occupants of Sister's Hill intentionally targeted other resources. Whatever the reason, Sister's Hill provided evidence that not all Plano Paleoindian groups were constantly on the move, chasing exclusively after bison herds (Forbis 1968:8-9).²²

Pine Spring (48SW101; Frison 1978:32; Sharrock 1966) was initially investigated during this era, and represents another important Paleoindian campsite. Pine Spring is located in the Upper Green River Basin in Wyoming. In this area, stratified sites are relatively rare. Investigations at Pine Spring identified two occupational components, one with Agate Basin-like projectile points, and the other with a mixed Late Paleoindian and Archaic assemblage. The faunal remains from both occupations contained predominantly bison and bighorn sheep. The older level contained approximately three times more bighorn sheep than bison, and the younger level thirty times more bighorn sheep than bison (Kornfeld and Larson 2008:26; but see Kelly et al. 2006). Based on these numbers, the people at Pine Spring appeared to have primarily targeted fauna smaller than bison. Like at Sister's Hill and Frison's Foothill/Mountain complex sites in northwestern Wyoming, the Pine Spring assemblage did not support the assumption that all post-Folsom Paleoindian groups were predominantly bison specialists. Based on this and other evidence, Marcel Kornfeld and Mary Lou Larson eventually suggested outright that it was time "to admit that our perception of Paleoindians as exclusively big-game hunters is simply wrong" (Kornfeld and Larson 2008:21; see also Kornfeld 2013).

Investigations at the Hanson site (48BH329) during the 1970s and 1980s provided other insights into Folsom lithic technology. Hanson is a Folsom habitation site located at an ecotone between the northeastern Bighorn Basin and the foothills of the Bighorn Mountains, and was discovered by two amateur archaeologists from Cody, Wyoming in 1973 (Milford and Imogene Hanson; Frison and Bradley 1980:1, 8). The site contained three well-defined, circular, hard-

²² During reinvestigative excavations at Sister's Hill in 2017, Spencer Pelton and colleagues identified and dated a previously unknown Cody component at the site, including at least one in situ diagnostic projectile point. These exciting results have not been formally reported yet (Spencer Pelton, personal communication 2018).

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packed (presumably lodge) floors (Albanese 1978:385-6; Frison 1978:114-146; Frison and Bradley 1980:9). The Folsom cultural level(s) at Hanson were “heavily impregnated with red ochre” (Frison and Bradley 1980:9) but contained very few organic materials, probably due to their near-complete combustion in what may have been a natural fire. No anthropogenic thermal features were identified (Frison and Bradley 1980:10), but Hanson yielded an extensive lithic assemblage, including twenty-five fluted (Folsom) and unfluted (Midland) points²³ (Frison and Bradley 1980:15, 80). Folsom tools had previously been studied as part of the full range of Paleoindian tool types (Irwin and Wormington 1970), in analyses of the Lindenmeier lithic assemblage (Wilmsen 1968, 1974; Wilmsen and Roberts 1978), and in northeastern Colorado (Agogino and Parrish 1971), but not at the scale of a technological system in its entirety.

In light of this lacuna, Frison and Bradley (1980) saw Hanson as an opportunity to conduct a complete morphological and technological analysis of Folsom lithic technology. They observed different types of flake production (Frison and Bradley 1980:18), platform preparation (27-30), and biface production (31-42) techniques. Frison and Bradley postulated a production sequence for Folsom projectile point manufacture (45-57). Interestingly, they also divided the Hanson tools into the typology previously published by Bordes (1961, 1972) for Mousterian assemblages in France (Frison and Bradley 1980:63). One outcome of this exercise was the realization that many tools at Hanson could have functioned as multi-purpose implements and/or been modified throughout the sequence of performing a specific task (109). As was previously mentioned, the modification of tools throughout their use-lives is now known as the Frison Effect. For a more recent study of the lithic assemblage at Hanson, see Crume (2017).

During the 1970s-1990s, work at Hanson and several other Paleoindian site investigations demonstrated increased archaeological recognition that stone tools were often used to perform multiple functions. For example, projectile points were also used as knives at Jurgens, Olsen-Chubbuck, and Claypool (see below; Wheat and Scott 1979:148). The theoretical importance of bifacial technology and/or multi-purpose tools to hunter-gatherers and the relationship of lithic reduction strategies to mobility were also explicitly stated during this era, in 1988 (Kelly 1988).

Frison and Bradley’s (1980) Hanson study additionally brought greater attention to the question of why fluted points were fluted. Attempted fluting of projectile points results in a high incidence of failure, leading Frison (1978:55-6,146) to suggest that it seemed implausible that Folsom points were fluted for functional purposes only, and that fluting may have had some sort of ritual or symbolic purpose (see also Frison and Bradley 1980:111-112, 1981, 1982:209-212; Judge 1973:100-101). This debate continues into the present day. The lithic analysis conducted at Hanson illustrates some of the increasingly complex questions and methods for investigating chipped stone technology that developed during the 1970s-1980s. The Hanson site was listed in the National Register of Historic Places on December 15, 1978.

More Paleoindian Kill Sites: Bison and Mammoth

Though a handful of additional Paleoindian habitation sites were investigated on the Northwest Plains in the 1970s and 1980s as described above, especially in the Bighorn Basin and surrounding foothill-mountain areas, the number of known kill sites continued to overshadow

²³ For a timely comparison of Folsom and Midland see Judge (1970).

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campsites (see Todd 1986). Bison kills are so common on the Northwest Plains that Frison once “postulated, without fear of contradiction, that a person can stand on the Wyoming-Colorado border and look from one buffalo jump, trap, or pound to another continuously to the forests of Canada” (Frison 1973b:172). Paleoindian kill sites investigated around the 1970s also contributed to a more precise regional and diachronic understanding of Paleoindian lifeways and helped fill the “Altithermal gap” in knowledge that plagued archaeologists’ understanding of the transition from Paleoindian to Archaic periods.

Throughout the American West, archaeological investigations suggested that after Folsom times, Paleoindian subsistence generally diversified and mobility practices shifted towards more restricted, time-scheduled seasonal rounds prior to the onset of full-blown Archaic lifeways thought to correspond with the onset of the warm, dry Altithermal. In recognition of this trend, some archaeologists began to argue that Paleoindian complexes post-dating Pleistocene megafaunal extinctions ought to be termed “Protoarchaic” (Krieger 1964:38). This proposition was met with heated debate. A number of Plano kill and butchering sites on the more easterly, open plains suggested that a “Protoarchaic” trend did not necessarily apply to the Late Paleoindian period in that ecozone. For a related discussion of the “Desert Culture” and regional subsistence adaptations, see Wheat (1971:26-7).²⁴

At the Fletcher site in Alberta (DjOw-1), for example, Cody complex points were found in context with a mass bison kill and geologically dated to 7,000-11,000 BP (Forbis 1968). Based on his investigations at Fletcher, Forbis (1968:9) argued that “on the Great Plains, the Paleo-Indian tradition of bison hunting persisted with no substantial change, at least until the onset of the Altithermal, approximately 7,000 years ago. Fletcher is one site in this continuum” (Forbis 1968:9). Of course, 7,000 BP significantly post-dates the end of the Paleoindian Period. Archaeologists’ understanding of when and where the Altithermal occurred have shifted over the years, perhaps in part because of regional variation in how this climatic event manifested (see Meltzer 1999).

Other kill and butchering sites also supported the notion that at some sites, post-Clovis Paleoindians continued focusing almost exclusively on bison for subsistence. Carter/Kerr-McGee (48CA12; Frison 1978:188-9, 1984) is a stratified site in the Powder River Basin which included four different cultural levels: Clovis, Folsom, Agate Basin-Hell Gap, and Alberta/Cody. All occupations were associated with bison bone except the Clovis level (which included extinct camel [*Camelops* sp.] and pronghorn-sized fauna; Frison 1984:305; Frison et al. 1978; see also Grunwald 2016). The Alberta/Cody level was associated with a bison bonebed and was thought to represent a butchering area in proximity to the initial kill location (Frison 1984:291, 294). Carter/Kerr-McGee produced evidence of relatively static communal, large ungulate procurement using a nearby arroyo trap (or traps) that spanned multiple Paleoindian cultural complexes (Frison 1984:305). To Frison (1984:306), this meant that Carter/Kerr-McGee

²⁴ “Protoarchaic” may be a useful regional term to describe portions of the Late Paleoindian period in Wyoming, especially in the foothill-mountain areas and southwestern portions of the state (which appeared to have ties with the Great Basin “Desert Culture;” see Haynes 2007), but not on the open plains (Hofman 2007).

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demonstrated that Paleoindians “develop[ed] and continu[ed] a lifestyle that was successful and changed little for nearly two millennia” on the open plains.

Indeed, by the 1970s other archaeologists agreed that “[e]vidence from almost every site on the Plains demonstrates that buffalo constituted the single most important food resource” (Reher 1974:113). This was likewise supported by the results of investigations at the Casper site (48NA304; Frison 1974), another bison trap in central Wyoming. At least one herd of an extinct species of bison was driven into the unmodified trough of an active, parabolic sand dune. These bison were subsequently killed and butchered with Hell Gap cultural complex materials at approximately 10,000 BP (Frison 1974:71; Frison et al. 1978).

In addition to an extensive lithic assemblage, the Casper site also yielded many bone artifacts that were interpreted as expediently manufactured tools made out of bones recovered from the freshly killed bison. Green bone is “extremely tough and superior in strength to bone that has been allowed to dry” (Frison 1974:31). Experimental studies showed that green bone tools can be especially effective as choppers for removing muscle attachments and for chopping thinner bone elements (Frison 1974:31). However, such breaks can also be produced by natural, non-anthropogenic agents, such as carnivore and rodent gnawing, or geologic processes (Kornfeld et al. 2010:185-186). At Casper, some of the bison bones were stacked by element, perhaps because they were organized into frozen meat caches. Whether these stacks were produced for ritualistic or utilitarian purposes is unknown, but stack-building behavior probably occurred after bison butchering was completed (Frison 1974:49). The site also contained a butchered camel and a Clovis point. Subsequent investigations revealed that the camel is likely not associated with the bison remains, and may not be associated with the Clovis point. However, the camel remains were (and are) of interest because camel is relatively rare in Paleoindian sites (Frison et al. 1978).²⁵

Frison’s work at the Casper site included groundbreaking, archaeologically relevant observations about bison behavior and human interactions with bison that were heavily informed by his previous firsthand experience as a cattle rancher (see Frison 2014). The Casper monograph is one of the earliest detailed publications framing the interpretation of archaeological remains with insightful contexts of bison driving and handling behaviors (Frison 1974:14-18), age, sex, and seasonality determinations (Frison 1974:18-21; Reher 1974; Wilson 1974a), and butchering practices (Frison 1974:26-51). The Casper site was listed in the National Register of Historic Places on June 25, 1974.

During the 1970s, Frison also returned to the Agate Basin and nearby Sheaman (48NO211) sites, identifying Clovis,²⁶ Folsom, Agate Basin, and Hell Gap components and correlating them with bison remains, methods of bison procurement, taphonomic processes, and paleoenvironment (Frison 1978:164-170; Frison and Stanford 1982).²⁷ Indeed, throughout the

²⁵ Camels may have traveled in smaller herds and been less tethered to water sources than other end-Pleistocene megafauna, perhaps making them less susceptible to Paleoindian hunting strategies (Frison et al. 1978:399).

²⁶ A Clovis occupation was identified at Sheaman, but is now thought to be possibly Goshen (Frison 1988:87-88; Frison et al. 1996; Waters and Stafford 2014:545-6).

²⁷ These reinvestigations also identified bone points used in tandem with the traditional lithic Folsom points from the Folsom level at the Agate Basin site (Frison and Zeimens 1980). The implications of

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1970s-1980s, Frison almost single-handedly developed the middle range theories necessary to connect evidence of bison procurement at archaeological sites with human behavior. He concluded the Casper monograph with the processual observation that bison studies should be used to “provide meaningful interpretations of past human cultural systems. The next problem will be to find the archeologist talented enough to synthesize the findings of [paleontology, biology, and animal ecology] experts into a meaningful whole” (Frison 1974:243).

Several archaeologists, including Frison himself, moved rapidly towards this goal. Focusing on bison procurement and bonebeds on the open plains, Joe Ben Wheat and colleagues (Wheat 1978; Wheat and Scott 1979) provided a more complex understanding of the organization of Plano Paleoindian economy by dividing its material residues into four aspects: mass kill sites, butchering stations, long-term camp sites with various activity areas, and short-term camp sites with limited activities. These four aspects of bison economy were exemplified by two sites in Colorado, the Jurgens site (5WL53; Wheat 1977, 1978; Wheat and Scott 1979) and the Olsen-Chubbuck site (5CH1; Wheat 1966, 1978; Wheat et al. 1972).

Olsen-Chubbuck (Wheat 1966, 1978; Wheat et al. 1972) was interpreted as a Cody complex bison trap and primary kill location where at least two hundred animals were driven into a deep, narrow arroyo, pinned by a steep wall, and subsequently slaughtered. According to some archaeologists, Olsen-Chubbuck is one of few Paleoindian bison kills where the geomorphic feature used to trap the bison is unequivocally known, along with the Casper site (Frison 1978:177-9). According to Wheat (1978), Olsen-Chubbuck represents the first of his four aspects of Paleoindian economic organization: the mass kill (Wheat 1978).²⁸

Wheat (1978) suggested that the Jurgens site included three activity areas that respectively represented each of the other three aspects of Paleoindian bison economy: butchering stations, long-term camps, and short-term camps (see also Muñiz 2005). All of the Jurgens localities are associated with a local manifestation of the Cody complex, termed “Kersey” (Wheat and Scott 1979:146, 152).

Jurgens Area 1 was classified as a long-term campsite because almost all of the bison remains were completely disarticulated, and only small, high-utility elements remained. Area 1

osseous and lithic points occurring together have barely been explored. An incised bone disk, similar to the one identified at Lindenmeier, was also found in the Agate Basin level at Agate Basin, along with other “problematic” polished, incised, and ground bone and ivory at Agate Basin and Sheaman, respectively (Frison and Stanford 1982:172).

²⁸ As an aside, Wheat conducted an innovative demographic analysis at Olsen-Chubbuck. Based on the number of bison excavated at the site, and by estimating the amount of meat, butchering time, and daily caloric intake of humans, Wheat (1966) concluded that the bison kill could have been operated by 100 people, and fed 150 people for 23 days. Therefore, Wheat (1968:52) argued that “[i]t seems reasonable to assume that the Paleo-Indian band was about this size.” It has recently been recognized that Cody complex kills such as Olsen-Chubbuck were originally perceived as ‘typical’ Paleoindian kills, even though most bison kills were actually small, less than seven animals. Cody complex sites appear to include generally larger kills than other Paleoindian complexes (Hill 2013:109; see also McCartney 1990). Whether or not Wheat’s (1968:52) band-size estimate is correct and/or applicable to the entire Paleoindian period is certainly debatable, but this early study still represents one of very few attempts at reconstructing Paleoindian demography. Frison attempted a similar analysis at Carter/Kerr-McGee (Frison 1984:309).

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also included a diversity of animal species (approximately twenty), indicating day-to-day hunting rather than a single kill event (Wheat 1978:88). Wheat also recognized that long-term occupations produce a greater diversity of tool types than short-term occupations, a phenomenon which had recently been termed the “Clarke effect” (Schiffer 1975:54-55). Campsites should also include a preponderance of projectile point bases over tips, since hafted tools are discarded during refurbishment of hunting technologies, which generally occurs at habitation sites (Wheat 1978:88), though tips may occasionally return to camp embedded in animal carcasses (Flenniken 1985:273-4, 1991:185). These notions were explicitly published as general archaeological theory in Cahen and colleagues (1979) and Keeley (1982). According to Wheat (1978), patterns consistent with long-term camp occupations described above were present at Jurgens Area 1.

Jurgens Area 2 included disarticulated portions of two bison and three pronghorn, suggesting isolated, single-kill procurement events. High utility faunal elements were preferentially transported back to camp where they were immediately consumed and intensively processed (Wheat 1978:89). Based on the paucity of artifacts, the presence of projectile point bases, and condition of the faunal remains, Wheat interpreted Area 2 as a short-term campsite.

Area 3 at Jurgens produced a bison bonebed containing the remains of at least thirty-three bison. The bonebed predominantly included high utility vertebral units and low utility leg portions. Complete crania were absent from this locality, and much of the faunal material remained in partially articulated units that would have been small enough to carry. The percentage of articulated units was greater in Area 3 than at the campsites but much less than at the Olsen-Chubbuck primary kill site, indicating that the bison had been chopped up into portable units and transported a short distance from the primary kill location (Wheat 1978:87-8). Based on these patterns and the preponderance of butchery tools, including projectile points reused as butchering implements, Jurgens Area 3 was interpreted as a butchering station.

The high incidence of low utility leg units at the Jurgens Area 3 butchering station might seem “puzzling,” but Wheat (1978:88; Wheat and Scott 1979:147) suggested that, “with a bison hind- or fore-quarter thrown over the shoulder for carriage, the foot makes an excellent carrying pole or handle.” This phenomenon had been termed the “schlepp effect” a decade earlier. The phrase was coined by Perkins and Daly (1968) to describe the faunal assemblage at a site in Neolithic Turkey. Though many of these patterns of faunal interpretation had been previously suggested, Wheat seems to have been the first to synthesize them completely in a Plains Paleoindian context.

Wheat’s (1978) paper on Paleoindian bison economy was released as part of a large symposium on bison procurement and use published by *Plains Anthropologist*, which took place in 1974 at Frison’s request (Davis and Wilson 1978).²⁹ Though the symposium was broad in chronological scope, many of the papers and much of the discussion focused specifically on the Paleoindian period, and participants included almost all of the contemporary big names in Northwest Plains bison-oriented archaeology. The symposium culminated in a fascinating panel discussion among several professional archaeologists and bison experts, including Frison, Wheat, Charles A. Reher, Dennis Stanford, John P. Albanese, Richard G. Forbis, Larry

²⁹ An earlier symposium on buffalo jumps, organized through the Montana Archaeological Society, took place in 1961 (Malouf and Conner 1962).

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Agenbroad, Eileen Johnson, Thomas F. Kehoe, “Bison Pete” Gardner, and others. A manuscript of this session was published (Davis and Wilson 1978), and highlights many of the main concerns faced by Northwest Plains archaeologists during the 1970s.

Of particular relevance to Paleoindian studies was discussion over when the Paleoindian period ended, how it is differentiable from the Archaic, and what archaeologists actually meant by the term “Archaic.” Did “Archaic” refer to a chronological time period, a regional cultural manifestation, or “a period of time between Early and Late Prehistoric periods during which most cultures adopted diversified economic bases, in contrast to the earlier (and perhaps later) singular emphasis on big-game hunting” (Frison qtd. Wilson and Davis 1978:327)? As mentioned earlier, this debate had previously manifested in disagreements over the possible use of the term “Protoarchaic” (Krieger 1964), and in discussions of regional variability characterizing post-Folsom Paleoindian lifeways.

Symposium participants also discussed the meaning of typology. Many participants’ comments reflected increasing antipathy or caution towards using points as singular cultural indicators and/or diagnostics on the Northwest Plains (Wilson and Davis 1978:332-3). In lieu of other diagnostic artifact types, this reliance on points was (and still is) especially pronounced in Paleoindian archaeology (Frison 1978:77-8, 84).

Another concern addressed how general theoretical perspectives should shape the future of Northwest Plains archaeology. Wheat (qtd. Davis 1978:307) suggested that “[w]e have reached a point in time where we do not need more sites. We need better excavation of fewer sites... recording of everything that we can find, utilizing every analytical technique available.” Consensus suggested that data collection was beginning to outpace analysis, and many archaeological sites were being excavated only to deteriorate in repository boxes without any comprehensive analysis ever being completed.³⁰ Frison (qtd. Davis 1978:308) agreed with Wheat on these opinions, but took them a step farther by adding the processual suggestion that archaeologists must “remember that we claim to be scientists” and that “[w]e need to present hypotheses. We need to test these hypotheses [... and we] need to reach conclusions on the basis of interpretation of the data we gather.”

In addition to Olsen-Chubbuck and Jurgens, several other Northwest Plains Paleoindian bison procurement sites were also reported at this symposium. In Colorado, Jones-Miller was interpreted as a Hell Gap bison kill where animals were butchered in place (SYM8; Albanese 1978:382-3, 385-6; Frison 1978:168; Stanford 1974, 1975, 1978). In Nebraska, Hudson-Meng (25SX115; Agenbroad 1973, 1974a, 1974b, 1977, 1978a, 1978b; Frison 1978:177) was described as a bison bonebed. The site was originally interpreted as a possible bison jump or arroyo trap associated with the Cody complex.³¹

Models of regional variability in Late Paleoindian and Early Archaic lifeways during the Altithermal gap were beginning to take shape thanks to these and other archaeological

³⁰ Though this was a widespread issue in Plains archaeology by the 1970s, this problem might not have become pervasive in Wyoming proper until the 1980s or even later (Danny N. Walker, personal communication 2018).

³¹ In the 1990s, subsequent work at Hudson-Meng sparked debate over whether the bonebed actually represents an anthropogenic bison kill or some kind of natural kill event that was possibly scavenged by Cody peoples (Largent 2007; Todd and Rapson 1997, 1999, 2016). This debate remains unresolved.

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investigations throughout the 1970s-1980s, but the degree and extent of continuity in bison procurement throughout these time periods was still unsatisfactorily answered. In some areas of the open plains, communal bison hunting likely continued to occur even after the Late Paleoindian period, throughout the Altithermal drought, and beyond. The Hawken bison trap in northeastern Wyoming provided evidence of this continuity (Frison et al. 1976; Kornfeld et al. 2010:251-2). Elsewhere across the open plains, Early Archaic peoples' dependence on bison seemed to have decreased during the Altithermal, perhaps because of decreased bison population sizes. Continued dependence on bison at Hawken during the Altithermal may have occurred because of the location's relatively mesic microclimate. Moist conditions at Hawken may have turned the area into an oasis for supporting large bison herds amidst surrounding Altithermal aridity (Frison 1992:399). But answering these questions with temporal precision required the enhancement of regional paleoclimatic reconstruction techniques that were tailored towards individual archaeological projects (e.g., Frison 1986b:22-25).

In the early 1980s, Frison (1982b) synthesized seasonality reconstructions at several High Plains Paleoindian sites (Agate Basin, Horner, Carter/Kerr-McGee, Hawken, and Colby) and recognized that Paleoindian bison hunting strategies seemed to differ from those practiced during later periods. Paleoindians appeared to have targeted large game predominantly in the late fall/winter and possibly produced frozen meat caches to be used throughout the colder months (Frison 1982b). In contrast, during Late Prehistoric and ethnographic times, there seemed to be a predominance of late summer/early fall kills and meat was preserved by drying or turned into pemmican (Frison 1982b).

In summary, by the 1980s archaeologists recognized that a wide variety of natural and human-constructed bison traps were used or probably used at communal bison kills (e.g., Agate Basin, James Allen, Fletcher, Casper, Olsen-Chubbuck, Hudson-Meng) or at butchering areas adjacent to kills (e.g., Horner, Carter/Kerr-McGee, Jurgens, Finley) throughout the Paleoindian period (see Frison 1998:14580). However, the geomorphic and/or anthropogenic features used to trap the bison were (and are) ambiguous at Agate Basin, James Allen, Horner, Carter/Kerr-McGee, Fletcher, Jones-Miller, Jurgens, and Hudson-Meng. The exact method of bison procurement is only known at very few Paleoindian sites on the Northwest Plains. Evidence from the Casper site indicates that animals were trapped within a parabolic sand dune,³² and at Olsen-Chubbuck, they were stampeded into an arroyo. Arroyo trap sites like Olsen-Chubbuck seemed less common in the archaeological record than they should be (Frison 1978:181), perhaps because "[a] deep, narrow arroyo filled to the brim with dead bison cannot be regarded as a happy task to face in terms of salvaging the products of the kill for future consumption" (Frison 1978:178). Many questions regarding methods and strategies for communal bison procurement continue to intrigue archaeologists today, but sophisticated developments in lithic, faunal, and geomorphic analyses throughout the 1970s and 1980s, coupled with a processual scientific perspective, led to the development of more complex regional, diachronic, and seasonal accounts of Paleoindian subsistence strategies at these sites.

³² It was once thought that a possible kill area at the Finley site also represented a parabolic sand dune trap (Frison 1974:12), but subsequent investigations revealed that the "bonebed" in this area had been previously disturbed by collectors (Kornfeld et al. 2010:244).

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Plains archaeologists of the 1970s to 1990s were awash in bison procurement sites and the boxes upon boxes of faunal remains recovered from them. But bison were not the only fauna targeted by Paleoindians. Another mammoth kill in association with Clovis artifacts was recognized as such in 1973 (Frison 1986b:6), though the site's first fluted point was discovered a decade earlier by Donald Colby, a heavy equipment operator from whom the site takes its namesake (Frison 1986a:91). The Colby site (48WA322) is located in the Bighorn Basin of northern Wyoming. It was excavated from 1973-1978, and included at least seven mammoths and small numbers of other extinct Pleistocene fauna, including horse and camel (Albanese 1978; Frison 1976a, 1978:86-110; Frison and Todd 1986; Frison 1986b:1; Madden 1978; Walker and Frison 1980). Stone and bone tools, and four Clovis points, were recovered from Colby. Three of the points were excavated in context with piles of mammoth bone, and some of the faunal material appeared intentionally stacked (Frison 1976a; 1986a:91-6). The presence of tools in context with the mammoth and detailed taphonomic studies (Todd and Frison 1986) strongly suggested human involvement over multiple mammoth procurement events (Frison 1986a:104). For some archaeologists, these results confirmed previously existing evidence for "extensive Clovis mammoth hunting" (Frison 1986a:114), but also left investigators with more questions than answers.

Archaeologists did not (and still do not) know exactly what hunting strategies Clovis peoples used to take down mammoths or whether hunts were planned or opportunistic (Fox et al. 1992; Frison 1986b:104-111). While some archaeologists have turned to studying modern elephant behavior to speculate on these topics (Frison 1978:110-112), whether and to what extent modern elephants can be used as an analogy for extinct proboscideans remains debatable.

By the 1970s, a pressing question was whether Clovis points were delivered by atlatl or handheld spear, and if either technology could adequately penetrate mammoth hide (Frison 1986a:109). To answer this, in 1984 and 1985, Frison traveled to Hwange National Park, Zimbabwe, to test Clovis replica thrusting spears and atlatl darts on dead and dying elephants during a scheduled culling meant to bring the elephant population within the carrying capacity of the park (Frison 1986c, 1989). Though the ethical status of this study might be disputable under today's animal welfare standards, it nevertheless comprises an excellent example of using experimental archaeology to gain a practical understanding of the capabilities and limitations of Clovis weaponry. Frison (1989:783) found that Clovis points used in conjunction with either thrusting spears or atlatls will penetrate elephant hide and inflict lethal wounds on adult, juvenile, male, and female African elephants (see also Huckell 1982). This affirmatively answered the question of whether Clovis weaponry was functionally capable of performing as an effective tool for killing mammoths.

Updated Syntheses of Northwest Plains Prehistory: Frison's Legacy

As should be evident from the summaries of new site investigations reported above, by the 1970s, "functional typologies of Paleo-Indian assemblages using varied and sophisticated methods of analysis [were] beginning to provide more anthropologically oriented interpretations" of archaeological data (Frison 1973b:156-7). By 1978, no synthesis of prehistory specifically focusing on the Northwestern Plains had been produced in the two decades following the publication of Mulloy's (1958) speculative but impressively accurate outline of culture history in

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this region. The time was ripe for a new and updated synthesis of Northwest Plains culture history and research. Incorporating new data from the sites summarized above, in the late 1970s Frison (1978) published the first edition of *Prehistoric Hunters of the High Plains* (hereafter referred to as *Prehistoric Hunters*) in order to fill this lacuna. Subsequently revised and updated editions of this book were published in 1991 (Frison 1991b) and 2010 (Kornfeld et al. 2010), incorporating new research topics and sites investigated throughout the decades between each edition. The third edition's title was revised to *Prehistoric Hunter-Gatherers of the High Plains and Rockies* in recognition of the realization that prehistoric Northwest Plains peoples did not focus exclusively on large game for subsistence, and that the "Northwest Plains" culture area also included foothills and mountains.

The original edition of *Prehistoric Hunters* (Frison 1978) was the first comprehensive synthesis of Northwest Plains prehistory to include detailed, locally-focused information on the Paleoindian period. This work summarized all known, unequivocal occupations in the area from the Clovis phase through the Protohistoric period on the Northwest Plains. Other excellent summaries of Northwest Plains culture history have subsequently been published (e.g., Gunnerson 1987; Haynes 2000a; Taylor 2006), but none is as extensive in scope or as explicitly geared towards placing culture-historical information in context with contemporary research trends as *Prehistoric Hunters*. The old and new versions of Frison's book are veritable tomes of pertinent information, summarizing significant archaeological data, analyses, and interpretations. *Prehistoric Hunters* is accessible to a wide range of audiences, including professional and avocational archaeologists and the educated general public. Indeed, Wormington (1979:178) pronounced the first edition of the book a "landmark in archaeological research and interpretation." Many of the groundbreaking questions neatly presented by Frison in 1978 have still not been satisfactorily answered, and remain salient to contemporary archaeologists. The quality and magnitude of Frison's work, particularly in terms of the lasting value of the *Prehistoric Hunters* books, cannot be understated. His immense contributions to Northwest Plains archaeology deservedly led to his election into the National Academy of Sciences in 1997 (Frison 2014:260-261).

Site Investigations through the 1980s

Many new Paleoindian campsite investigations throughout the 1980s were incorporated into the second and/or third editions of *Prehistoric Hunters* (Frison 1991; Kornfeld et al. 2010). These sites enhanced archaeological knowledge of Paleoindian subsistence, chronology, technological organization, mobility, seasonality, and/or ideology.

Deadman Wash (48SW1455) is a deeply stratified site that includes two Paleoindian components and produced diagnostic Scottsbluff points, as well as Archaic and Late Prehistoric occupations. This site was investigated in the early 1980s, and made important contributions to the development of a relative projectile point chronology for southwestern Wyoming. The chronology in southwest Wyoming differs from the rest of the state (Armitage, Creasman, and Mackey 1982; Armitage, Newberry-Creasman, et al. 1982; Mackey et al. 1982), possibly due to its proximity to Great Basin cultural influences (Metcalf 1987; Zier et al. 1983). Deadman Wash is also important because of the explicit correlation investigators made between paleoclimatic change, availability of resources, and ensuing changes in human subsistence behavior at the end

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of the Paleoindian period. According to Armitage, Creasman, and Mackey (1982:3) and Mackey and colleagues (1982), a xeric climatic regime during the Early Altithermal (circa 7,000-7,500 BP) caused a reduction in surrounding vegetation which precipitated a local erosional event. They suggested that this change in climate correlated temporally with the extinction of large early Holocene bison species, a reduction in the size of ensuing bison populations, and a shift in human subsistence emphasis from hunting to gathering (Armitage, Creasman, and Mackey 1982:3). This paleoclimatic change, then, hypothetically marked the end of the Paleoindian period and ushered in Archaic-style subsistence strategies at the site.

Another deeply stratified camp investigated during the mid-1980s in Montana, Indian Creek (24BW626; Davis 1984), contained Folsom and later components and also provided evidence for a shift in subsistence strategies at the end of the Paleoindian period. The faunal record from Indian Creek implied that Early and Middle Paleoindian groups utilized bison and marmots, with a shift in hunting towards bighorn sheep during Late Paleoindian/Early Archaic times (Davis 1984).

Also in Montana, and with a depth and span of occupation similar to that found at Indian Creek, a retooling campsite at Barton Gulch (24MA171; Davis et al. 1988; Frison 1991b:67, 77-9) provided insights into the production of formal Paleoindian stone tools. The lanceolate projectile points discovered at Barton Gulch provided an example of a Foothill/Mountain-like Paleoindian occupation north of the Bighorn Canyon rockshelters.³³ The points are characterized by parallel-oblique flaking, and depending on which associated radiocarbon dates are considered, are temporally the same age or slightly older than Cody or Angostura/Lusk complex points on the open plains. The Indian Creek point assemblage showed that parallel-oblique flaking and lanceolate shapes are not exclusively found in post-Cody Paleoindian assemblages; points with these characteristics may be found throughout certain regions on the Northwest Plains in pre-, peri-, and post-Cody times (Frison 1991b:67, 77-9). Other sites, including Little Canyon Creek Cave (Miller 1988) and Bush Shelter (48WA324; K. Miller 1987, 1988) in the southern Bighorn Mountains of northern Wyoming, also bolstered evidence for Foothill/Mountain Paleoindian occupations in that region thanks to investigations conducted during the 1980s.

Montana's Mill Iron site (24CT30; Frison 1991b; Bradley 1991:379-80; Frison and Bradley 1988; Frison 1988, 1996) yielded cultural materials that allowed investigators to clarify subsistence behavior practiced by Goshen complex peoples. The Goshen complex was first tentatively defined as an unfluted variant of the Clovis complex during investigations at the Hell Gap site in the mid-1960s (Irwin 1967:223, 1970:135) based on the original discoveries of one complete and two incomplete projectile points.³⁴ Goshen was eventually separated into its own cultural complex by the Irwins (Irwin-Williams et al. 1973; Frison et al. 1996:205), though it also exhibited noticeable similarity to Plainview and Midland points (Frison 1991a; Frison et al.

³³ Projectile points found as part of this complex may be referred to generically as Foothill/Mountain complex. They were briefly referred to as Barton Gulch. Alternatively, the complex is now often called Hardinger or Alder, and sometimes includes the Metzal point type label (Davis 1989; Davis et al. 1988; Taylor 2006:288).

³⁴ Additional points recovered from the Hell Gap site have subsequently been identified as Goshen (Marcel Kornfeld, personal communication 2018).

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1996:206, 207; Thomas 2006:163). The 1980s investigations at Mill Iron recovered much more extensive evidence of Goshen style projectile points than had previously been found at Hell Gap.

The Mill Iron cultural materials supported and justified the Irwins' decision to separate Goshen into its own cultural complex. However, dating and stratigraphic context at Mill Iron was not sufficiently precise to answer whether Goshen was coeval with portions of the Clovis complex, fell temporally between Clovis and Folsom, or was contemporaneous with Folsom (Frison 1988). Lithic analyses performed in the 1980s and 1990s suggested that Goshen points are technologically more closely related to Folsom than they are to Clovis, but, contrary to expectations, Goshen points do not exhibit technological characteristics that are transitional between Clovis and Folsom (Frison et al. 1996:206). These chrono-typological relationships have still not been satisfactorily clarified, though our understanding of the Plano chronology and extent of occupations has been supplemented by information gathered at other sites throughout the 1980s and beyond.³⁵

One intriguing technological question resulting from studies at Mill Iron asks why Goshen points were not fluted while Clovis and Folsom points were (Bradley and Frison 1996:68; Frison et al. 1996:208). The more complete definition of the Goshen complex obtained from Mill Iron investigations has also cast doubt on whether components from other sites, previously identified as Clovis, would more aptly be characterized as Goshen. In 1988, Frison suggested the so-called Clovis components from the Sheaman site (48NO211), the Anzick Cache (24PA506; see next section), and Carter/Kerr-McGee might be more closely affiliated with Goshen complex materials than they are with Clovis (Frison 1988:87-88; Frison et al. 1996; Waters and Stafford 2014:545-6). These research questions have not been fully resolved in the literature.

A Clovis-aged mammoth site in South Dakota was also investigated during the latter half of the 1980s, yielding evidence of butchery and exploitation strategies used during end-Pleistocene megafauna procurement. At Lange-Ferguson (39SH33; Hannus 1989, 1990, 2018), several diagnostic Clovis points were discovered in situ with mammoth bones, though the mammoths may have been opportunistically scavenged rather than hunted (Frison 1991b:150; Hannus 1990). Butchering the mammoth would have required the efforts of at least a band-sized group of individuals, providing some basis for speculation about Clovis social organization (Hannus 1990). Perhaps one of the most interesting discoveries at Lange-Ferguson was the identification of an expedient, osseous tool industry. As the mammoths were butchered, their green bones may have been worked into bone cleavers/choppers and flaked, and presumably used during subsequent mammoth butchering at the site. Lange-Ferguson was one of the first mammoth sites in North America to yield evidence of this behavior (Hannus 1990:52), though expedient osseous tool industries had previously been suggested at several bison procurement

³⁵ In the Pine Bluffs area of southeastern Wyoming, for example, Goshen points and other types characterizing the remainder of the Plano Paleoindian sequence have been identified through professional excavations, surveys, and examinations of private collections (Reher 2004). Other investigators found that Plano Paleoindian occupations were present in North Dakota at the Moe site, thus expanding their previously known geographic range eastward (32MN101; Schneider 1982a, 1982b). Plano material culture may have spread even farther eastward from southern Manitoba and eastern North Dakota into western and northern Minnesota following the recession of glacial Lake Agassiz (Schneider 1982b).

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sites. Jurgens (Wheat and Scott 1979:148) and Casper (Frison 1974:29-31), for example, were argued to include expediently manufactured and discarded green bone tools made from slaughtered bison. Later, interpretations of the expedient bison bone industries were revised, and they are now thought to reflect mostly taphonomic processes rather than human behavior (Kornfeld et al. 2010:185-6).

In Colorado, a short-term, Folsom-aged bison kill and campsite investigated through the 1980s and 1990s also provided insights into Paleoindian social interaction and residential mobility related to cooperative large game hunting. At Stewart's Cattle Guard (5AL101; Jodry 1987, 1988, 1999a, 1999b; Jodry and Stanford 1992), investigators employed ethnographic analogy, taphonomic, and spatial analyses to conduct detailed site patterning studies. Eight bison were killed by Folsom hunters in one event or over a short period of time near the campsite. High utility elements were transported back to camp, where they were further disarticulated, meat was stripped, and marrow was recovered for consumption. At least three functionally distinct activity areas were identified, and further divided into activity clusters by plotting artifact densities across space. The low diversity in tool types at Stewart's Cattle Guard as compared to Lindenmeier suggested that it was a short-term occupation (Jodry and Stanford 1992), yet it provided "one of the most complete pictures of the processing activities that took place in [Folsom] fall bison hunting camps" (Jodry 1999b:80).

The investigators argued that Stewart's Cattle Guard was one of many sites providing evidence of a shift towards specialized bison exploitation during post-Clovis times. This may have occurred because a paleoclimatic cooling event termed the Younger Dryas (11,000-10,000 ¹⁴C BP)³⁶ allowed for increased bison populations immediately following the Clovis phase. Specialized, seasonal bison kills such as Stewart's Cattle Guard suggested that Folsom peoples extensively planned and geared up for these operations, which would have involved the aggregation of multiple family groups practicing highly mobile lifeways into larger bands. This, in turn, implied that Folsom peoples drew on extensive social networks when organizing and implementing some subsistence-related tasks (Jodry 1999a:327-30).

Certain facets supporting this hypothesis, including evidence for high residential mobility and close monitoring of bison movements across the landscape, were bolstered by the existence of Folsom-aged hunting stands and overlooks such as found at the Adobe site in eastern Wyoming (48CA2162; Hofman and Ingbar 1988). Small lithic scatters are often dismissed as unimportant, even though they may have been relatively common during Paleoindian times. Investigations at sites like Adobe increased understanding of the diversity of Paleoindian site types. By 1990, archaeologists recognized that sparser, less noticeable sites characterized by low artifact density are just as important for elucidating Paleoindian lifeways as the more obvious kill, butchery, and campsites are (Hofman and Ingbar 1988).

In the 1980s, investigations at a unique site named Powars II at Sunrise Mine in eastern Wyoming suggested there was more to understand about Paleoindian lifeways than was evident from kill, camp, and ephemeral sites (48PL330; Stafford 1990; Stafford et al. 2003). Powars II was discovered by a collector named Wayne Powars in the late 1930s after it was exposed by historic iron ore mining, but was not known to professional archaeologists until half a century

³⁶ See "Paleoclimatic Effects on Paleoindian Behavior," below; Jodry (1999a:325).

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later (Frison 1991b:368). This prehistoric ochre mine is one of only two known ochre mines in North America, and is the only Paleoindian-aged ochre mine known on this continent (with the possible exception of Sandia Cave; see “The Sandia Controversy” discussion and Haynes and Agogino 1986).

Powars II contains prehistoric quarrying and other tools as well as point types dating throughout the Paleoindian period. The site lacks archaeological materials affiliated with later chronological periods. “The presence of materials spanning virtually the entire Plains Paleoindian cultural sequence demonstrates that ochre was an important entity in Paleoindian cultural systems” (Stafford 1990:73). Indeed, in 2014, investigators at the nearby Hell Gap site recovered several ochre spheres, a possible mortar and pestle for processing ochre, and a mammoth tusk tool coated in red ochre. The ochre at Hell Gap was likely procured from Powars II (Marcel Kornfeld, personal communication 2016; Kornfeld et al. 2015). Additionally, in 2016, investigators at La Prele (48CO1401; Byers 2002a), a Clovis-aged mammoth site in east-central Wyoming, excavated a large ochre stain associated with formal stone tools, debitage, faunal remains, and several bone needles. This ochre was also likely obtained from Powars II (Mackie et al. 2016; Zarzycka et al. 2019).

Evidence from Powars II has led some archaeologists to speculate that red ochre was imbued with symbolic significance and power by Paleoindian peoples on the Northwest Plains (Stafford et al. 2003). However, many Powars II projectile points are broken or reworked and appear to have been functionally utilized (Stafford 1990:28), implying that they may not have been manufactured explicitly for ritual purposes. Due to the efforts of professional archaeologists and thanks to a sympathetic and interested landowner, investigations at Powars II were recently re-initiated and will hopefully elucidate Paleoindian ochre mining and its meaning (Frison et al. 2018; George Zeimens and George C. Frison, personal communication 2016).

1960s-1990s: The Development of Big Questions in Paleoindian Archaeology

Even after the rise of the processual paradigm in American archaeology, Northwest Plains Paleoindian studies in the latter half of the 20th century were largely dominated by efforts to find new archaeological sites and refine chronological and geographical understandings of archaeological cultures.³⁷ But “[m]erely finding something does little good unless [archaeologists] can give meaning to it” (Binford 1983:25). Along with fleshing out and solidifying culture-historical sequences during the 1960s-1990s, most of the big questions facing Paleoindian archaeologists today also began to emerge (see Grayson 1988; Wormington 1983). Theoretical developments in other realms allowed archaeologists to test new and more nuanced hypotheses that influenced archaeological site interpretation. These scientific developments spanned many fields, including zooarchaeology (e.g., Binford 1981), taphonomy (e.g., Aslan and Behrensmeyer 1996; Behrensmeyer 1978; Efremov 1940, 1958; McGrew 1975; Voorhies 1969), and geomorphology (e.g., Leopold and Miller 1954; Leopold et al. 1964).

³⁷ For an abridged culture history of the western Plains and Rocky Mountain region as of 1983, including some excellent photographs, see Frison (1983b).

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Peopling of the Americas

At least since Columbus arrived in the New World, scholars have debated when the first people(s) migrated into the Americas and which migration route(s) they traversed (Meltzer 2015a:25). After repeated discoveries of Clovis complex materials in situ with mammoth remains beginning in the 1930s, Clovis material culture became the earliest unequivocally accepted evidence of humans in the Americas, and remains so to this day. However, Paleoindian archaeologists continued (and continue) to seek evidence for pre-Clovis sites. The Sandia complex was the first well-developed professional claim for the existence of a pre-Clovis cultural complex, but the circumstances surrounding the context and discovery of Sandia materials meant that this “evidence” fell into disrepute by the 1960s (Bryan 1991:16). By the 1970s, other sites of greater antiquity than Clovis had been put forward by the archaeological community, but all were shown to be of younger age than originally thought, such as Tule Springs, Nevada (26CK4; Haynes 1967), or were shown to contain natural geofacts that were not anthropogenically produced, such as at Calico, California (Haynes 1973).

During the late 1970s, several archaeologists suggested that Little Canyon Creek Cave in northern Wyoming provided potential evidence of a pre-Clovis occupation based on the existence of a cultural level that appeared to be associated with extinct musk ox and collared lemming, located stratigraphically below an unconformity. Above the unconformity, a date of $10,170 \pm 250$ ^{14}C BP was obtained on a fire hearth (Shaw and Frison 1979; Stanford 1982:210).³⁸ This assertion was not always repeated in subsequent research papers or publications about the site (e.g., Miller 1988), but in 1996, Frison and Robson Bonnichsen (1996:311) noted that the situation was not “satisfactorily explained [...] since] the occurrence of unquestionable human artifacts and extinct fauna (*Symbos* and *Ovis*) [exist] below an unconformity” at Little Canyon Creek Cave. This intriguing site may require further investigation. However, it was almost completely excavated (Robert L. Kelly, personal communication 2018).

Since at least the 1980s, some archaeologists have considered flaked megafaunal bone as evidence of a pre-Clovis, osseous tool industry, even when stone tools are absent (e.g., Bonnichsen et al. 1987; Bonnichsen 1979; Holen 2006), at paleontological and/or archaeological sites including Lamb Spring in central Colorado (5DA83),³⁹ Old Crow in the Canadian Yukon,⁴⁰ Bluefish Caves in the Canadian Yukon (MgVo-1, MgVo-2, and MgVo-3),⁴¹ Rye Patch in Nevada (26PPe23),⁴² Dutton and Selby in northwestern Colorado (5YM37 and 5YM36, respectively)⁴³ and La Sena in Nebraska and Lovewell in Kansas (25FT177 and 14JW306, respectively).⁴⁴ In contrast, other archaeologists argue that these osseous “tools” are actually

³⁸ Even higher in the profile, a date of 8800 ^{14}C BP was associated with Late Paleoindian artifacts (Frison and Bonnichsen 1996:311).

³⁹ See Fisher (1992), Rancier et al. (1982), Stanford (1982), Stanford et al. (1981a, 1981b).

⁴⁰ Numerous localities; see Cinq-Mars and Morlan (1999), Irving and Harington (1973), Zazula and Froese (2013).

⁴¹ See Cinq-Mars (1979), Cinq-Mars and Morlan (1999), Harington and Cinq-Mars (2008), Morlan and Cinq-Mars (1982).

⁴² Firby et al. (1982, 1987:23-25).

⁴³ See Stanford (1979, 1983, 1999) and Stanford and Graham (1985).

⁴⁴ Holen (1995, 1996, 2005; 2006, 2007), Holen and Holen (2006), Holen and May (2002).

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geofacts produced through natural processes, such as carnivore gnawing, and are not anthropogenic (e.g., Karr 2015).

Other sites of purported pre-Clovis antiquity indisputably contain stone tools, but produced unreliable dates,⁴⁵ were questionably interpreted,⁴⁶ or are characterized by poor or complex stratigraphic context.⁴⁷

Several claims for extremely early occupations in South America were put forward to the scholarly community in the late 1980s, including dates up to 32,000 BP at Boqueirão da Pedra Furada in eastern Brazil (Bednarik 1989; Guidon and Delibrias 1986) and 13,000 BP or earlier at Monte Verde in south-central Chile (Dillehay 1984, 1986, 1988, 1989, 1997; Dillehay and Collins 1988, 1991; see also Fiedel 2000; Meltzer 1997; Meltzer et al. 1997), though the validity of these dates and the anthropogenic reality of the artifacts at these sites were (and still are) contested (Adovasio and Pedler 1997; Boëda et al. 2014; Lahaye et al. 2015; Lynch 1990; Meltzer et al. 1994). Partially due to repeated false alarms and/or ambiguities in the interpretation and dating of potential pre-Clovis sites, by the 1960s-1970s “the possibility that Clovis was first became a generally unstated premise in the minds of most North American archaeologists” (Bryan 1991:16).

The discovery and interpretation of purported pre-Clovis sites has been a contentious topic for decades. Because of an explosion in Paleoindian archaeology after the 1950s, the shift in power relationships that occurred due to the introduction of “fresh young blood” into the field, and because of some of the “dubious” pre-Clovis claims put forward by a few of these new Paleoindian scholars, rifts and professional tension between Clovis-first and pre-Clovis proponents have developed in some cases (Agogino 2006:771).

Rather than embroiling themselves in academic politics, a handful of dedicated scholars have steadfastly focused their efforts on meticulously collecting the data required to scientifically test Clovis first versus pre-Clovis hypotheses. By the 1960s-1970s, the widespread view that Clovis was first was bolstered by excellent geochronological work conducted by geoarchaeologist C. Vance Haynes, Jr. (Holliday 2000c). Haynes was one of the first (if not the first) geoarchaeologist to carefully take note of the geologic applications of radiocarbon dating and the stratigraphic provenience of radiocarbon samples, rather than simply using the method to directly date singular artifacts (Haynes 1968:596; Holliday 2000c:514). He was the first to lay out an accurate Paleoindian chronology based on radiocarbon dates rather than relying exclusively on relative stratigraphic relationships (Haynes 1964). The Great Plains, referred to as the “Paleoindian ‘heartland’” on at least one occasion (Holliday 2000c:517), was an appropriate culture area for Haynes to carry out this type of work, because this area was where most known, long-term stratified Paleoindian sites were known to occur (Holliday 2000c:512). Indeed, Haynes has prolifically provided invaluable geoarchaeological interpretation at almost every important Paleoindian site on the Great Plains (e.g., Anderson and Haynes 1979; Haynes 1966,

⁴⁵ E.g., Meadowcroft Rock Shelter in Pennsylvania; 36WH297 (Adovasio et al. 1975, 1977, 1980, 1983; Adovasio et al. 1988; Kelly 1987); see also the Lewisville site.

⁴⁶ E.g., the Lewisville site in Texas; 41DN72 (Crook and Harris 1957, 1962; Heizer and Brooks 1965; Stanford 1982; Shiley 1985).

⁴⁷ E.g., Levi Rock Shelter in Texas; 41TV49 (Alexander 1963; Stanford 1982); see also Meadowcroft Rock Shelter

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1967, 1968, 1970, 1971, 1973, 1974, 1975, 1980, 1981, 1982, 1991, 1992, 1993, 1995; Haynes and Agogino 1960, 1966; Haynes et al. 1992, 1998, 1999).

Among many instrumental insights, Haynes' early work with radiocarbon dates suggested that no reliable dates for human occupation of the Americas existed prior to 12,000 ¹⁴C BP (Haynes 1967, 1992), meaning that unequivocal evidence for a pre-Clovis culture, in the early 1990s, was lacking. Haynes' careful collection and interpretation of radiocarbon dates eventually tightened the age range of Clovis to only three hundred years, between 11,200 and 10,900 ¹⁴C BP (Haynes 1964, 1980, 1982, 1992, 1993). Haynes' students have subsequently suggested that Clovis originated and spread throughout North America in as little as two hundred years, between 11,050 and 10,800 ¹⁴C BP (Stafford et al. 1991; Waters and Stafford 2007).

Tight chronological information characterizing the Clovis complex and the colonization of North and South America opened the door to many pertinent questions about America's first peoples (Dillehay and Meltzer 1991:287; Lynch 1991:267). *Who* were they? Was Clovis truly first, or did Clovis develop indigenously (Haynes 1987; Stanford 1979)? *Where* did they come from? By the 1980s, consensus existed that the earliest Amerindians migrated from East Asia (Bonnichsen 1991:323; Fladmark 1979, 1983; Rouse 1976). *How* did they come? By the 1980s, most scholars agreed that the first American colonists traversed the Bering Land Bridge and eventually made their way through the ice-free corridor between the Laurentide and Cordilleran ice sheets, though the exact timing of this event (or events) was (and is) disputed (Bandi 1969; Bonnichsen et al. 1987; Bryan 1965, 1969; Fladmark 1979; Haynes 1966, 1969, 1971; Morlan 1991; Reeves 1971, 1973; Shutler 1971; Soffer and Praslov 1993; Wendorf 1966; see also Dawe and Kornfeld 2017). Others favored a Pacific coastal migration route, but this was a minority position through the 1990s (Bryan 1991:18; Heusser 1960; Kreiger 1961; Fladmark 1979; Macgowan and Hester 1962). *Why* did they come? This era's favored hypothesis suggested that climate change in northeastern Asia pushed human populations into new habitats, eventually leading them into the Americas (Bonnichsen 1991:323; Greenberg et al. 1986). Finally, *what* happened after they arrived?⁴⁸

The Overkill Hypothesis

Few questioned the Clovis-first model until Paul Martin turned some facets of it into testable hypotheses with expected outcomes, beginning in the late 1960s (Bryan 1991:21; see also Bamforth 1999:221-222). Martin and colleagues⁴⁹ suggested that the first colonists of the Americas entered from Siberia by land through an ice-free corridor between the Laurentide and Cordilleran ice sheets at the end of the late-glacial (around 12,000 BP). They hypothesized that these big game hunters rapidly tracked large animals across the land bridge and southward onto the Great Plains. Martin argued that the naiveté of Pleistocene megafauna and Paleolithic hunters' expertise allowed them to hunt numerous species of large mammals to extinction by the end of the Pleistocene, including mammoths, mastodons, gomphotheres, and giant ground

⁴⁸ For a fuller understanding of scholarly works and perspectives on the peopling of the Americas, see Meltzer (2009), Anderson and Gillam (2000), Dincauze (1984), Fiedel (2000), Pitblado (2011), et cetera.

⁴⁹ Martin (1958, 1967, 1973, 1984, 1986, 1987, 1990, 2005), Martin and Klein (1984), Martin and Wright (1967), Mosimann and Martin (1975), Martin and Steadman (1999).

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sloths.⁵⁰ This hypothetical *blitzkrieg*, or “lightning war” against the megafauna was termed *overkill* (see also Agenbroad 1988; Mead and Meltzer 1984).

Some argued against the plausibility of *blitzkrieg* and the overkill hypothesis,⁵¹ stating that humans carrying Clovis culture could not possibly have entered and spread throughout the Americas in a mere two-to-three hundred years, though several computer generated models supported the notion that this would have been possible under certain conditions (Alroy 1999, 2001; Mithen 1993; Mossiman and Martin 1975; Surovell 2000; Whittington and Dyke 1984; see also Paul Martin et al. 1985). The overkill debate is intimately tied to the presence or absence of pre-Clovis sites in the Americas, because scholars that accept evidence for the existence of pre-Clovis cultures⁵² argue that humans lived alongside mammalian megafauna for thousands of years without causing their extinction (Irving 1985; Krieger 1964; Leakey et al. 1968; MacNeish 1976, 1982).

One testable hypothesis suggested by Martin’s overkill model involves mapping the chronological and spatial distribution of Early Paleoindian sites across the Americas. If humans rapidly entered the Americas through an ice-free corridor from the north, then the oldest sites in the Americas should lie within the ice-free corridor or in the northernmost unglaciated regions of North America. The oldest sites in South America should be younger than the oldest sites in North America (Carlson 1991; Clark 1991; Wright 1991). However, by the 1990s radiocarbon dates at stratified sites appeared to show that fluted points occurred at approximately the same time in South America as they did in North America (Bonnichsen 1991:321; see also Bryan 1978; 1986, 1987; Gruhn and Bryan 1991; Lynch 1990), and fluted point cultures did not seem homogeneously distributed across the Americas. Rather, regional diversity in point types existed from the earliest times (e.g., Bryan 1991:20; Rouse 1976).

In light of these spatial, chronological, and typological findings, and contra Martin’s rapid wave-of-advance model of colonization that occurred in tandem with the overkill hypothesis (Martin 1973, 1984; Mossiman and Martin 1975), beginning in the 1960s some archaeologists argued that fluted point cultures originated indigenously from a pre-Clovis culture in the southeastern United States (Mason 1962). The development of databases of Paleoindian projectile point finds in the 1990s (Anderson et al. 2010) eventually allowed researchers to quantify the preponderance and diversity of fluted-points across space to test this supposition further. They found that recorded Clovis projectile points were indeed most prevalent in the southeast as compared to the rest of the country. Some interpreted this as evidence supporting the proposition that Clovis culture originated in the United States, east of the Mississippi (Anderson and Faught 1998, 2000; but see Haynes 1983; Kelly and Todd 1988:236; Steele et al. 1998).

Others expounded on the implications of this pattern, using it as evidence to advance the hypothesis that the Americas were colonized from the east. This small minority of archaeologists suggested that Paleoamericans colonized North America by traveling across the Atlantic Ocean

⁵⁰ For a list of mammalian taxa that went extinct during this time, see Koch and Barnosky (2006:Supplemental Table S1).

⁵¹ For additional perspectives, see, for example, Frison (1987), Meltzer and Mead (1983), and Wroe et al. (2004).

⁵² See Dincauze (1984), Guthrie (1984), Marshall (1990), Meltzer (1991), Morlan (1988), Owen (1984), Toth (1991), West (1983).

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from southwestern Europe. This hypothesis was (and is) in direct opposition to the traditionally accepted notion that this continent's earliest colonizers entered from the northwest, by land or by sea (Boldurian and Cotter 1999; Stanford and Bradley 2000), but in some ways harkens back to Hibben's claims that Sandia points were similar to European Paleolithic technology (Hibben 1940:15). Termed the Solutrean hypothesis after the Solutrean culture in Europe to which Clovis lithic technology bears some resemblance (Bradley and Stanford 2004; Stanford and Bradley 2000, 2012; see also Bradley 1993), this potential route of entry into the Americas remains extremely contentious (Eren and Patten et al. 2013; O'Brien et al. 2014; Oppenheimer et al. 2014; Straus 2000; Straus et al. 2005). One of the main bodies of evidence used to support the Solutrean hypothesis is the observation that Clovis points are more prevalent in the southeastern United States than they are in the west. However, doubt was recently cast on the relevance and meaning of fluted point density data when Mary Prasciunas suggested that the preponderance of Clovis points in the southeastern United States may reflect survey bias related to modern population density, cultivation practices, intensity of archaeological research, and environmental productivity rather than serving as a proxy for actual Paleoindian population density (Prasciunas 2008, 2011).

A warming (Baker 1983; Dohrenwend 1984; Ruhe 1970; Whitehead 1973) and swiftly changing climate (Bryson et al. 1970; Davis and Jacobson 1985; Haynes 1980; Jacobson et al. 1987; Dort 1970), including an increase in seasonal extremes (Guthrie 1984; Harris 1985:120), at the Pleistocene/Holocene transition melted ice sheets that may have opened pathways allowing humans to colonize the Americas, but also affected Pleistocene megafauna, other floral and faunal species, and altered biotic communities throughout the Americas (Guthrie 1984; Harris 1985:210). In response to Martin's overkill hypothesis and in light of these climatic changes, by the 1970s some researchers began to point to climate change, rather than human hunting, as the primary causal factor of the end-Pleistocene extinctions in the Americas (Bryson et al. 1970:72; Guthrie 1984; Graham 2001, 2003, 2006a, 2006b; Graham et al. 2002; Graham and Lundelius 1984; Grayson 2007; Guthrie 2003, 2006; Kiltie 1984; Solé et al. 2002; Lundelius 1988). Others argued in support of multicausal hypotheses suggesting that a combination of climate change and human hunting increased extinction risk for large fauna during the Pleistocene to Holocene transition (Barnosky et al. 2004; Koch and Barnosky 2006). The overkill versus climate change debate to explain end-Pleistocene megafauna extinctions remains unresolved.⁵³

Paleoindian Lifeways and Human Behavioral Ecology

By the 1970s, some anthropologists began poking holes in Steward's cultural ecology as a general framework for addressing environmental effects on human behavior and vice versa. In order to propose and test hypotheses explaining how Paleoindian (and other forager) behavioral patterns affect and are affected by the environment, including questions surrounding the human colonization of the Americas, it was necessary to move towards a theoretical perspective that was not couched in ad-hoc explanations that drew on group selectionism (Kelly 2007[1995]:49). For some, this was accomplished by supplementing cultural ecological theory with biologically

⁵³ For a review of these, other, and more nuanced hypotheses explaining the end-Pleistocene extinction event, see Haynes (2009).

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and environmentally based models of microeconomic choice. In anthropology, this theoretical framework is generally referred to as human behavioral ecology (e.g., Kelly 2007[1995]; Smith 1992a, 1992b; Smith and Winterhalder 1992, 2006; Winterhalder 1983; Winterhalder and Smith 2000), but borrows heavily from several related fields including ethology (Tinbergen 2005[1963]), sociobiology (Wilson 1975, 1978⁵⁴), and behavioral ecology (Maynard Smith 1978, 1982; Roff 1992).

In human behavioral ecology, human adaptation is explained in ecological context by using simple, mathematical models of individual choice. Synchronic choices are evaluated using a Darwinian, selectionist framework. Individuals practicing behaviors that maximize their fitness are positively selected for. While cultural ecology assumed a presupposed set of goals resulting in methodological collectivism, human behavioral ecologists name the process of natural selection as responsible for fixing, maintaining, and altering behavioral phenotypes. The difference is that in human behavioral ecology, it is assumed that selection operates on the individual level, towards optimizing currencies that maximize reproductive fitness (Kelly 2007[1995]:48, 50, 53). This quantitative approach requires that models are framed in terms of measurable currencies (often caloric intake, time, number of surviving offspring, or some combination of the above; e.g., Bird and O'Connell 2006; Cronk et al. 2000; Kelly 2007[1995]:50-62; Smith 1992a, 1992b; Smith and Winterhalder 1992, 2006; Surovell 2009:4-13; Winterhalder 1983).

Themes commonly addressed by human behavioral ecologists include resource acquisition and processing, hunting strategies, prestige and costly signaling, mobility, mating and parenting, exchange, sharing, coercion (Bird and O'Connell 2006; Smith and Winterhalder 2006; Winterhalder and Smith 2000), and technology (Bettinger et al. 2006; Surovell 2009), especially in relationship to foraging behavior. It is assumed that human behavior that deviates from patterns predicted by ecological models does so because unidentified currencies that are difficult to quantify, such as symbolic capital, might be prioritized over caloric gain or reproductive potential under culturally relative circumstances. Human behavioral ecology frameworks are most often applied to hunter-gatherer economic systems rather than complex societies.

Unlike the direct symbolic ties that sometimes exist between the ethnographic record and recent historic cultures, drawing direct ethnographic analogies between contemporary cultures and Paleoindians is difficult if not impossible. Paleoindians existed in the deep past and are therefore not clearly analogous to specific descendent cultures in the present. Human behavioral ecology allows archaeologists to use cross-cultural patterns observed in a wide range of modern hunter-gatherer cultures to form hypotheses that might help explain overarching patterns in Paleoindian hunter-gatherer behavior. Because of human behavioral ecology's emphasis on biological, economic, and environmental variables, it is particularly useful for providing overarching insights into Paleoindian behaviors.

Some criticisms of human behavioral ecology include its assumption that foraging efficiency, rather than culture, is the strongest force in shaping human behavior.⁵⁵ Human behavioral ecology models also assume that human behaviors exist in states of homeostasis at

⁵⁴ Wilson's 1978 book, *On Human Nature*, won the Pulitzer Prize in 1979.

⁵⁵ This might nullify the importance of anthropology as a separate field from biology; see Sahlin's (1976).

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adaptive optima (Bettinger 1987:134-138, 1991:163-5, 211), neglecting to consider dynamic models that explain cultural and behavioral change over time. However, human behavioral ecology does provide reasonable expectations for predicting which behaviors should maximize specific currencies in particular environments (see Nettle et al. 2013; West and Burton-Chellew 2013).

The salience of human behavioral ecology for aiding in the interpretation of Paleoindian lifeways was apparent to archaeologists by at least the 1980s (see Bamforth 1988; Kelly and Todd 1988). In a “much-cited paper” (Haynes 2009:9) entitled “Coming into the Country: Early Paleoindian Hunting and Mobility,” Robert L. Kelly and Lawrence C. Todd (1988) utilized optimal foraging theory and cross-cultural ethnographic analogy (Kelly 1983, 1985) to provide a new model of Early Paleoindian lifeways. In this paper, Kelly and Todd (1988) implicitly drew on the marginal value theorem, diet breadth, and patch choice models and from behavioral ecology to explain Paleoindian behavior.⁵⁶ They explicitly presented their findings as “an alternative to the overkill model” (Kelly and Todd 1988:240) and contested the overkill hypothesis, suggesting instead that the end-Pleistocene “extinction process probably would not have been much different if humans had not entered the New World at the end of the Pleistocene” (Kelly and Todd 1988:240).

Drawing heavily on Guthrie’s (1984) paleoclimatic reconstruction, Kelly and Todd (1988) suggested that climatic changes at the end of the Pleistocene caused a shift in biotic communities from high species diversity, patchy environments, to lower diversity patches that followed latitudinal and elevational gradients. As Paleoindian colonists entered and spread throughout the Americas, they encountered this rapidly changing environment. Early Paleoindians probably targeted large game because it is more calorically efficient than plant collection and because it is “easier to locate, procure, and process the faunal as opposed to floral resources of an unknown region” (Kelly and Todd 1988:233, 234). Paleoindians undoubtedly exploited plant resources opportunistically, but did not process them intensively (Kelly and Todd 1988:234). As faunal densities decreased locally due to climate change, Paleoindians had two options. They could respond by switching to different resources in the same territory (broadening diet breadth), or by switching territories (Kelly and Todd 1988:233). Contemporary hunter-gatherers generally react to resource stress by broadening diet breadth; that is, by incorporating a wider variety of lower-ranked resources into their diet. During recent ethnographic times, moving to a new territory would incur costs associated with displacing the people(s) already established in those areas (Kelly and Todd 1988:234). However, Paleoindians colonizing an empty continent would not have needed to displace neighboring populations to move across the landscape.

According to Kelly and Todd (1988), rather than switching to different resources within the same territory, Early Paleoindians likely responded to climate-driven changes in resource availability by switching ranges. This behavior rapidly brought Paleoindian peoples into contact with new and unknown regions. Kelly and Todd (1988:235) argued that swift movement across

⁵⁶ For descriptions and examples of these models see Bettinger (2009:1-20), Bettinger and Baumhoff (1982), Charnov (1976a, 1976b), Hawkes et al. (1982), MacArthur and Pianka (1966), Perlman (1980), Smith (1979), Wilmsen (1973), Winterhalder (1977), Winterhalder and Smith (1981).

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the landscape explained the widespread similarities in Paleoindian artifact types and styles across large geographic regions, including pervasive evidence for fluting behavior and a preponderance of steep-edged end scrapers, spurred scrapers, beaked graters, burins, and bifaces. According to Kelly and Todd (1988:237-8), large game generalization explained Paleoindians' investment in portable and curated technologies, their high residential and logistical mobility, lack of storage facilities, and the preponderance of low-intensity kill sites containing relatively few animals. This combination of behaviors also indicated that Early Paleoindians had no modern hunter-gatherer analogs, as they practiced a lifeway characterized by facets of both forager *and* collector strategies (sensu Binford 1980; Kelly and Todd 1988:239). Over time, as Paleoindian populations became more packed, territorial boundaries would have developed, thus increasing regional diversification in point types (Kelly and Todd 1988:240). These ideas continue to provide insights into humans' role in and/or response to the end-Pleistocene megafaunal extinction event.

Kelly published a volume summarizing general behavioral ecological theory and explaining how to apply this framework to archaeological and anthropological questions in 1995. Kelly's (1995) book was originally entitled *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways*. A reprint was published in 2007, and a completely revised second edition in 2013. Though human behavioral ecology might contribute to archaeological studies of all prehistoric foraging cultures, it continues to prove especially useful when attempting to understand peoples that lived during Paleoindian times. Paleoindian cultures operated under different environmental constraints than modern hunter-gatherers, practiced unique foraging behaviors and mobility strategies, and are separated from modern cultures by thousands of years of chronological time. It therefore cannot be assumed that Paleoindian behavioral patterns are directly analogous to that of any one contemporary descendent community.

Climatic Effects on Paleoindian Behavior

Early researchers in paleoclimatic reconstruction recognized that Pleistocene ecosystems have no modern analogues, referring to Pleistocene biotic provinces as "disharmonious species mixtures" (Graham 1976; Graham and Lundelius 1984), "defunct species associations" (Slaughter 1967), lacking "modern or extant counterparts" (Matthews 1979), or non-analog communities (FAUNMAP Working Group 1996), meaning that paleoclimate could not be easily reconstructed by identifying Pleistocene plant and animal communities and matching them up with similar modern communities (Guthrie 1984). The absence of modern climatic analogs also contributes to difficulties associated with using single modern foraging cultures as referents for Paleoindian cultures. Paleoindians operated in environments that lack modern equivalents.

To reconstruct paleoenvironments, archaeologists and interdisciplinary researchers turned to a variety of different techniques. Palynology, phytolith analysis, soils analysis, dendrochronology, stable isotopes, macrofossils, packrat (*Neotoma* sp.) middens, and paleontological fauna were widely employed by the late 1970s-1980s.⁵⁷ Prior to this era, the post-glacial climatic sequence was generally understood as a retreat of ice sheets accompanied

⁵⁷ See Barry (1983b) and Sachs et al. (1977) for reviews of available techniques and Frison (1986b:22-5) for a summary of how they were implemented archaeologically.

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by gradual temperature warming and increased aridity leading into the Altithermal. This general model was proposed by Antevs (1948, 1952, 1955) in the 1940s and 1950s. By the 1960s, paleoclimatologists explicitly stated that Antevs' model had "served its purpose but [was] no longer sufficiently sophisticated" (Bryson et al. 1970:56; see also Haynes 1990), since climate does not change in the same way everywhere (Bryson et al. 1970; Sawyer 1966).

In light of this realization, paleoclimatologists began spatially analyzing radiocarbon dates and using other methods to map isochrones of the Cordilleran and Laurentide ice sheets to map the end-Pleistocene glacial retreat at higher resolution (Bryson 1974; Bryson et al. 1970; Bryson and Wendland 1967a, 1967b; CLIMAP Project Members 1976; Denton and Hughes 1981; Peltier 1994; Porter 1988; Ruddiman and Wright 1987). In some regions (i.e., North Dakota), glacial ice may have retreated an average of perhaps one kilometer every twenty to twenty-five years (Bonnichsen et al. 1987:419), but this rate probably varied across space and time. Deglaciation in mountainous regions occurred differently than continental glaciation. In the 1980s, it was understood that deglaciation was complete in the Rocky Mountains by 11,000-10,000 BP (Porter et al. 1983:99).

By the 1960s, the chronological precision at which paleoclimatic change was modeled at a continental scale was beginning to improve. In addition to the previously recognized Altithermal event, European paleoclimatologists identified two other, earlier post-glacial events that also became important for interpreting Paleoindian lifeways: the Allerød⁵⁸ interstadial and the Younger Dryas stadial. These climatic episodes were recognized in Europe based on analyses of varve deposits and plant pollen (Iverson 1953; Nilsson 1968). In Europe, the post-glacial Allerød warming event (interstadial) was estimated to have occurred between 12,100 and 10,900 ¹⁴C BP. The Younger Dryas cooling event (stadial) was thought to have occurred between 10,900 and 10,100 ¹⁴C BP (Antevs 1962:199; see also Mangerud et al. 1974).⁵⁹ Based on geologic evidence, Antevs (1962) argued that the Allerød and Younger Dryas were not isolated to Europe; he suggested that these climatic events occurred simultaneously in North America. Antevs (1962) impressively came to this conclusion even despite apparent discrepancies between uncalibrated European and American radiocarbon dates at that time.

Geologically, the Younger Dryas eventually became "by far the best studied of the millennial-scale cold snaps of glacial time" (Broecker et al. 2010:1078). The identification and widespread acceptance of the Younger Dryas in North America (Engstrom et al. 1990; Mathewes 1993; Mayle et al. 1993; Mayle and Cwynar 1995a, 1995b; Mott et al. 1986; Peteet 1987; Walker et al. 1990; Wright 1989) overturned the previous notion that uninterrupted warming occurred after the Last Glacial Maximum (also known as the LGM, which ended 19,000-20,000 BP; Clark et al. 2009). Abrupt cooling during the Younger Dryas followed by rapid warming might have affected Paleoindian peoples (Meltzer and Holliday 2010). By the end of the 1990s, some paleoclimatologists documented that the magnitude and rate of the Younger Dryas event probably varied regionally (Alley and Clark 1999:174). Recognition of the Younger Dryas

⁵⁸ This stadial is now combined with the previously separated Bølling stadial and summarily referred to as the Bølling-Allerød (Meltzer and Holliday 2010).

⁵⁹ In retrospect, these early dates lie remarkably close to the 12,900-11,700 cal BP currently estimated as the chronological range of the Younger Dryas (Broecker et al. 2010).

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eventually inspired a slew of questions relating to Paleoindian behavioral responses to climate change.

Despite that a more precise understanding of paleoclimate at the continental scale had developed by the mid-1980s (e.g., Hopkins et al. 1982; Porter 1983; Ruddiman and Wright 1987; Wright 1984), localized deglaciation and climate changes were still poorly understood in the Rocky Mountains and Great Plains because few stratified sites containing both preserved paleoclimatic indicators and high chronological control were known (such sites include, for example, lakes and bogs; Barry 1983a, 1983b:398-9; Markgraf and Lennon 1986:1-2; but see Dort and Knox 1970; Forbis et al. 1969; Graham et al. 1987). Based on the limited paleoclimatic evidence available at the time, some suggested that the northern and eastern Great Plains had been characterized by grassland vegetation for only around 8,000 years or so. This group contended that, based on palynological indicators, the northern Plains was comprised predominantly of spruce boreal forest between approximately 14,000 and 10,000 BP, then replaced by a deciduous forest that lasted for the next 1,000-2,000 years (Barry 1983b:399; Birks 1976; Bryant 1977; Gröger 1973; King 1981; McAndrews et al. 1967; Radle 1981; Szabo 1980; Van Devender et al. 1979; Van Zant 1979; Watts and Bright 1968; Wells 1970a, 1970b; Watts and Wright 1966; Wright 1976; Wright and Reeve 1981). Woodland environments may have persisted regionally in some areas much more recently than 8,000 BP, possibly up to two hundred years ago in some regions that are now arid (e.g., the Laramie Basin; Wells 1970a, 1970b). In certain portions of Wyoming, the post-glacial period seemed more mesic than present conditions (see Markgraf and Lennon 1986).

On the other hand, in the westerly Great Basin-like portions of Wyoming, other paleoclimatologists suggested that the late Pleistocene treeline was lower than at present, while elevations below 1,500 meters were not forested, and had been comprised of sagebrush shrub-grassland since the last glacial period. It was thought that ice caps in the Rocky Mountains began breaking up 14,500-13,000 BP, and a transition to modern vegetation may have begun as early as 13,000 BP at some lower elevations and concluded as late as 8,000 BP in others (Baker 1976, 1983; Bright 1966; Bright and Davis 1982; Thompson and Mead 1982; Spaulding et al. 1983; Van Devender and Spaulding 1979; Waddington and Wright 1974). Agreeing with earlier researchers, this camp of paleoclimatologists suggested that Altithermal conditions were warmer and drier than modern conditions (Burkart 1976; Reider 1980, 1982a, 1982b, 1983; Scott 1980).

These two possible paleoclimatic scenarios were summarized in a paper by Markgraf and Lennon (1986). They tested which paleoclimatic scenario was supported by new, stratified pollen samples spanning 13,000 years collected from a dry playa in the Powder River Basin. Based on these new data, Markgraf and Lennon (1986) concluded that the shortgrass prairie of eastern Wyoming has remained relatively unchanged for the past 13,000 years, except for a shift from mesic to arid conditions which occurred in post-Paleoindian times, around 5,000 BP (Markgraf and Lennon 1986). They suggested that no floral species have gone extinct on the High Plains since Clovis times, though vegetation communities and zones have shifted their ranges (Cummings 1996; Frison and Bonnicksen 1996:306; Markgraf and Lennon 1986).

Contrary to previous notions, Markgraf and Lennon's (1986) results did not support the hypothesis that an Altithermal drought contributed to a shift in subsistence strategies from Late Paleoindian to Early Archaic phases, nor did a drought explain the "Altithermal gap" (Benedict

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and Olson 1978) in archaeological records. Instead, expanding on a hypothesis previously presented by Frison (1984), Markgraf and Lennon (1986) suggested that the relative paucity of Early Archaic sites in the eastern Wyoming lowlands was probably attributable to differences in geomorphic preservation, rather than a product of climatically-induced human behavioral changes.

During the 1990s, C. Vance Haynes, Jr., proposed what some scholars later termed the “Clovis drought hypothesis,” though it remains unclear whether the paleoclimatic trends he observed primarily in the southwestern United States and southern High Plains also apply everywhere on the Northwest Plains. Haynes (1991, 1993, 1995; Haynes et al. 1999) suggested that during the Clovis phase, two periods of drought preceded the Younger Dryas. Evidence for these droughts included the presence of hand-dug, prehistoric wells at the Clovis type site in New Mexico (Haynes et al. 1999; see also Evans 1951; Green 1962; Hester et al. 1972) and at the Aubrey site in Texas (41DN479; Ferring 1995); a mammoth-dug well at Murray Springs in Arizona (AZ EE:8:25 ASM; Haynes 1991; Haynes and Huckell 2007); and an eolian sand lens at the Miami site in Texas (Holliday et al. 1994). At the onset of cooler and wetter Younger Dryas conditions, Haynes argued, a temporally diagnostic, algal “black mat” formed stratigraphically above Clovis artifacts (Haynes 1991; Haynes et al. 1999), and was still visible at many sites in the Northwest Plains (Haynes 2008). Thus, Haynes suggested that a combination of rapidly changing environmental conditions from drought to glacial cold along with human predation were probably both significant factors in the megafaunal extinction (Haynes 1998; Haynes et al. 1999:468). Other geoarchaeologists agreed that rapid fluctuations in temperature and moisture occurred throughout the Early Paleoindian period on the Southern Plains, but rejected Haynes’ evidence for a Clovis-aged drought and proposed alternative paleoclimatic scenarios (e.g., Holliday 2000b). For example, Vance T. Holliday, who participated in field studies of the prehistoric “well” at the Clovis type site, suggested that it could be any type of pit and was not necessarily a well (Holliday 2000b:5).

Around the turn of the century, Frison teamed up with a zoologist and climatologist to create novel, high chronological resolution paleoclimatic reconstructions at three sites in northeastern Wyoming: Carter/Kerr-McGee, Agate Basin, and Hawken (Lovvorn et al. 2001). Isotopic analysis of bison bone from these three sites allowed investigators to estimate the relative abundance of C₃ (cool/moist) and C₄ (warm/dry) plants consumed by bison during Folsom, Agate Basin, Hell Gap, and Early Archaic times. They found that during the Younger Dryas (represented by Folsom and Agate Basin phases), conditions were cooler and more mesic than at present. At the end of the Younger Dryas (represented by the Hell Gap phase), conditions were warmer than during the preceding Agate Basin phase, but were still cooler and wetter than present conditions. During the Early Archaic, conditions were wetter and slightly warmer than at present (Lovvorn et al. 2001; this broadly corroborates data obtained from packrat nests in the Bighorn Basin by Lyford et al. [2002]). The authors concluded that rapid warming at the end of the Younger Dryas may have caused the split between open plains versus foothill-mountain lifeways during the Late Paleoindian period.

However, Lovvorn and colleagues’ (2001) unexpected finding that mesic conditions characterized the Altithermal environment at Hawken required further explanation. Based on data from other studies, Lovvorn and colleagues (2001) suggested that an abbreviated

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Altithermal at the end of the Paleoindian period, characterized by hot, arid conditions, may have lasted for just two hundred years between 8,000 and 7,800 BP. During this time, herbivores may have migrated into refugia in the western mountains or lower altitudes of the more easterly plains. Though grasslands rebounded abruptly after the Altithermal (prior to 7,300 BP at Hawken), herbivores lagged behind. The absence of large game animals in these regions throughout the Early Archaic might therefore explain the Altithermal gap in archaeological records (Lovvorn et al. 2001).⁶⁰

Some of the discrepancies between paleoclimatic scenarios produced by different researchers were (and are) caused by varying scales of study, regional variation in climatic change, and differential preservation of the ecofacts used to conduct paleoclimatic reconstruction. In light of this, by the 1980s archaeologists realized that regional data can “offer clues to late Pleistocene conditions... but these interpretations must be used cautiously” (Frison 1986b:23). Archaeologists now widely recognize that regional data cannot substitute for site-specific paleoclimatic reconstructions (Bryson and Bryson 2009). Despite some inconsistency between Paleoindian paleoclimatic scenarios across Wyoming and North America, several general conclusions can be drawn. Paleoindian peoples were affected by warming trends after the LGM, the megafaunal extinctions at the end of the Clovis phase, the beginning and end of the Younger Dryas cooling event (Eren 2012), and the onset of the Altithermal (Bonnichsen et al. 1987; Martin et al. 1985). The degree, kind, and regional variability of these climatic fluctuations remain equivocal (e.g., Eren 2012; Meltzer and Holliday 2010; Smallwood et al. 2015).

Processual versus Postprocessual Paleoindian Archaeology

At a basic level, archaeology will always be intimately tied to artifact and site discovery, identification, culture history, dating, and chronology building (e.g., Bamforth 1999; Flannery 1982). To aid in these basic interpretive goals, a host of interdisciplinary scientific techniques were developed and in full-blown use by archaeologists by the turn of the 21st century. These include remote sensing, geophysical prospecting, archaeobotany, palynology, faunal analysis, dendrochronology, Accelerator Mass Spectrometry (AMS) radiocarbon dating and calibration, lithic analysis and sourcing, and bioarchaeological methods (McGovern et al. 1995). Until the rise of “The New Archaeology” in the 1960s, archaeological theory was chiefly concerned with questions of culture history. Aided by these new analysis techniques, archaeologists’ understanding of northern Plains prehistory grew considerably throughout the latter half of the 20th century. The introduction of processualism to archaeological epistemology expanded archaeologists’ goals beyond culture history. Processual archaeologists explicitly frame(d) middle range theories as steps toward constructing bridging arguments that answer “how” and “why” questions about prehistoric peoples and to identify and explain nomothetic laws and overarching patterns in human behavior.

The processual paradigm was (and is) an inherently scientific framework that emphasizes a positivist perspective. By its very nature, this approach intrinsically lends itself towards

⁶⁰ These paleoclimatic results broadly corroborated paleoclimatic regimes for Wyoming that were previously constructed by Danny N. Walker a decade prior, which examined diachronic, mammalian species distributions (Walker 1987; see also Chomko and Gilbert 1987; Wendland et al. 1987).

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quantitative analyses of human behavioral responses. The causality of human behavior is generally explained with explicit reference to measurable, environmental variables. Hence, processual archaeologists tend to emphasize studies that address topics such as settlement, mobility, subsistence practices, resource acquisition, technological production, seasonality, and population size. Processual archaeology does not lend itself towards answering questions that reach beyond functional, environmentally adaptive, biologically directed behavioral patterns. In the 1980s, a postprocessual critique to the processual paradigm arose in response to this and other related concerns.

Postprocessual archaeologists suggested that the processual paradigm placed too much emphasis on positivism and its proponents failed to recognize the subjectivity inherent to their own historical reconstructions. According to the postprocessual critique, processual archaeologists failed to acknowledge the historically particular circumstances that influenced social change. Furthermore, archaeologists working under a processual framework did not address many of the very aspects of human behavior that define us as humans, including ideology, symbolism, gender, cultural meaning, and individual agency (e.g., Earle and Preucel 1987; Hodder 1985, 1986, 1987, 1991; Miller and Tilley 1984; Patterson 1990a, 1990b; Preucel 1991; Shanks and Tilley 1987; Shennan 1986; Watson and Fotiadis 1990). In the 1980s, one postprocessual thinker suggested that “archaeology has become so rational it is dehumanized. Much of the best of archaeology has become not only mechanical but almost devoid of cultural context” (Leone 1986:432).

In a scathing reply to this critique, Binford argued that “[w]e cannot see the past from the ancients’ cultural perspective because they cannot tell us what might have been” (Binford 1987:398). According to Binford (1987:398), postprocessual archaeologists that attempt to do so are “self-appointed authorities” (Binford 1987:403) that are “[e]xploiting the past for contemporary purposes” (Binford 1987:402) by using their “alleged knowledge to create pasts consistent with their beliefs” (Binford 1987:403). Though these debates dominated archaeological discussions nationwide in the late 1980s and early 1990s, until the turn of the 21st century, Great Plains archaeologists rarely entered into dialogues concerning archaeological theory, nor did archaeological data from the Great Plains play into epistemological discussions published elsewhere (Bamforth 1999:209; Mitchell 2006; but see Kornfeld and Francis 1991; Spector 1993).

By the late 1990s, at least one provocative book entitled *Engendering Northern Plains Paleoindian Archaeology* was explicitly framed as a postprocessual critique of the “de-cultured and hunting-dominated, functionalist models of Paleoindian lifeways, [in order] to make more apparent Paleoindian individuals, men, women, and children as prehistoric actors, and to identify some of the possible dynamics surrounding gender relations” (Hudecek-Cuffe 1998:94). This book is not widely read or cited by Northwest Plains archaeologists.

By 2000, some “processual-plus” theorists on the Great Plains, combining various aspects of processualism and postprocessualism as appropriate, began to argue that:

It may be that subsistence and settlement patterns are more readily studied using the kinds of technically rigorous, often quantitative, approaches often thought of as scientific, and that ideology [and social matters] are better studied through other epistemological

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lines of thinking...] [T]he problems of arraying evidence and constructing arguments differ when we consider different kinds of research questions (Bamforth 1999:212).

These theoretical debates have not, and will likely never, reach any kind of unanimous conclusion in archaeology. However, since Paleoindians were living in non-analog environments and lack traceable cultural continuity with contemporary indigenous groups, the written records and ethnographic analogies often employed in postprocessual analyses of later prehistoric, protohistoric (e.g., Spector 1993), and historic sites (e.g., Shackel and Little 1992) simply do not exist and therefore may not be useful or applicable to the interpretation of Paleoindian-aged archaeological sites.⁶¹ There is still a paucity of justifiable and realistic methods for imbuing Paleoindian archaeological research with prehistoric social and cultural meaning.

*1970s-Present: The Fluorescence of Archaeological Law and Ethics*The Archaeological Resources Protection Act (ARPA)

In 1974, William D. Lipe wrote a “landmark paper” (Lynott 2003:20) promoting a new paradigm for cultural resources management encouraging the development of a new conservation ethic. Lipe (1974) framed his ideas in direct opposition to contemporary salvage archaeological practice, which advocated that “if a site is threatened... dig it up” (Lipe 1974:214). Lipe viewed archaeological resources as “non-renewable,” and therefore suggested that cultural resources management projects should avoid sites rather than salvage them, and that when excavation was deemed absolutely necessary, any data collected should be couched in problem-oriented research questions. He also argued that academic archaeologists must provide “full and explicit theoretical justification for the[ir] proposed work” when excavating sites that are not immediately threatened (Lipe 1974:242).

By the late 1970s, the attitude of archaeological professionals was generally turning towards Lipe’s conservation ethic. This atmosphere arose in tandem with the increasingly widespread sentiment that existing archaeological laws were inadequate to protect archaeological resources. By the 1970s, “looting had reached notorious proportions, especially in the Southwest” (McManamon 2001:265). The Antiquities Act was difficult to enforce, and the penalties for convicted criminals were minimal (a maximum fine of \$500 and/or 90 days of imprisonment; 34 Stat. 225, 16 U.S.C. 433). Thus, to rectify these problems, the Archaeological Resources Protection Act (ARPA) was passed into federal law in 1979. ARPA defined what was meant by “archaeological resources” and applied to both “public” and “Indian” lands. ARPA specifically lists prohibited activities, which include looting, vandalism, and trafficking of

⁶¹ For example, in a volume focused on how to employ the postprocessual critique in Plains archaeology (Duke and Wilson 1995), one scholar suggested that “[...] changes in gender systems should be expected in all Native American cultures during the past twelve thousand or more years [...] Thus, although ethnographic and ethnohistoric data are useful in expanding our knowledge of possible gender systems, independent investigation is needed before conclusions can be drawn concerning prehistoric gender systems” (Whelan 1995:54). This quote illustrates the difficulties in applying postprocessual analysis techniques (such as direct ethnographic analogy) to Paleoindian archaeological interpretation, and is one of extremely limited instances where Paleoindian-aged archaeology is even mentioned throughout the volume.

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illegally obtained artifacts.⁶² It increased the monetary penalties for people convicted of archaeological violations, and introduced felony and misdemeanor sanctions.⁶³ ARPA also promoted cooperation and communication between various stakeholders, including governmental authorities, professional archaeologists, private individuals, and Native Americans. Amendments to ARPA in 1988 required that federal land managers actively establish programs to increase public awareness of the significance of archaeological resources and conduct archaeological surveys to identify them. Additional regulations were issued in 1990, requiring that any materials removed during professional projects must be managed, curated, and preserved following strict professional guidelines (36CFR79; Fetterman 2012; Hutt et al. 1992; Iraola 2004; Keller 1996; King 2013:275-278; McManamon 2001; Seidemann 2007).

ARPA was not specifically designed to protect Paleoindian resources. However, Paleoindian-aged archaeological sites, as some of the rarest and oldest in the Americas, may be preferentially protected for several reasons. Cultural resource managers and their law enforcement colleagues may implicitly place higher scientific value on older sites,⁶⁴ Paleoindian sites may be considered more newsworthy than younger archaeological resources in some cases, and/or they may include artifacts worth higher monetary values on the illegal antiquities market. In one of the most widely used “price guides” published by and for artifact collectors, for example, Clovis points from the northern high plains may be valued in excess of \$15,000 (Overstreet 2013:1090) with a low-end value of \$125 (Overstreet 2013:1088), whereas most Late Prehistoric points are valued well under \$100 (Overstreet 2013:1077-1138) with a high-end value of \$900 (Overstreet 2013:1087). Any ethical, professional archaeologist would refuse to

⁶² Incidentally, surface collection of arrowheads is not protected under ARPA, which reads that “[n]o penalty shall be assessed under this section for the removal of arrowheads located on the surface of the ground” (16 U.S.C. 470ff(a)3). However, *arrowhead* is a very specific term that should not apply to other types of points, such as those that tipped spears or darts (Fetterman 2012:20). Hypothetically, artifacts from Paleoindian sites should not fall under the “arrowhead exception.” However, arrowheads and all other prehistoric and historic artifacts are protected by other laws. A person that appropriates or destroys arrowheads, features, or “any other object of antiquity that is situated on land owned or controlled by the Federal Government [...] shall be imprisoned not more than 90 days, fined under this title, or both” (18 U.S.C. § 1866).

⁶³ Financial penalties may include commercial or market value of artifacts and restoration costs. Prison sentences may be up to two years for first-time offenders or five years for repeat offenders. The maximum fines for Class A misdemeanors and felonies were increased to \$100,000 and \$250,000 in 1987; these are now the maximum fines for ARPA violations. Originally, the maximum penalties for violating ARPA were lower but far exceeded those emplaced by the American Antiquities Act (Fetterman 2012).

⁶⁴ For example, in 2012 the Bureau of Land Management (BLM) offered a \$2,500 reward for information leading to the arrest and conviction of the individual(s) responsible for looting an archaeological site in Shoshone Canyon, west of Cody, Wyoming. A BLM Special Agent involved in the investigation publicly stated that, “It wasn’t a recent Native American site within the last 100 years. We’re looking at the possibility of something quite older that might have been recovered. It’s kind of a guess what was in there, but all indications are that it was older than 4,000 years” (Ramirez, qtd. Kidston 2012). The agent also stated that “the damage of that is quite big, scientifically. The whole loss of a timeline, on the scientific side, is tremendous. You can’t fix that” (Ramirez, qtd. Kidston 2012). This quote is meant to illustrate the implicitly higher value that may be placed on older archaeological resources. There is no evidence that the particular site referenced here dates older than Early Archaic times (Kiersen Crume, personal communication 2018).

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place a monetary value on historic resources;⁶⁵ their cultural heritage value is monetarily priceless. However, in practice, archaeologists must be aware of the unfortunate fact that many people consider artifact collecting a lucrative endeavor (LaBelle 2003:116).⁶⁶

In 1984, five years after ARPA was passed into law, Frison used the Carter/Kerr-McGee Paleoindian site in the Powder River Basin of Wyoming as a case study to specifically address the changing attitudes put forward by Lipe (1974). In the 1970s, the Powder River Basin experienced rapid development in the name of energy extraction and was surveyed in concordance with archaeological law. Carter/Kerr-McGee was not identified during initial surveys, and was subsequently exposed by strip mining. Most of the site was destroyed and subsequently looted (Frison 1984). In 1984, no other Paleoindian sites had been identified in the Powder River Basin,⁶⁷ and Carter/Kerr-McGee provided 2,000 years of stratified cultural sequences from Clovis through Alberta/Cody. The site also yielded data that shifts in Paleoindian settlement and subsistence strategies over time (Frison 1984). The relative lack of Paleoindian sites in this area was attributed to erosive processes, which were thought to have destroyed most of the Paleoindian-aged sediments in the basin (Frison 1984). As part of the Carter/Kerr-McGee project, Frison also conducted his own surveys of the region and identified an abundance of previously unrecognized, post-Paleoindian archaeological sites. Earlier CRM surveys failed to identify these sites, perhaps because their only goal was avoidance; research was discouraged (Frison 1984:310). In this vein, Frison (1984:311) scathingly remarked that “[c]ultural resource management that fails to recognize the need for continuing research is as sterile as teaching without research.” On this, Frison broadly agreed with Lipe (1974).

On other matters, Frison (1984) diverged from Lipe’s (1974) point of view. Frison (1984:311) suggested that CRM archaeologists recruited by private industry failed to identify archaeological sites in the Powder River Basin because they lacked the interdisciplinary background necessary to understand paleotopography and geomorphic processes affecting site preservation, making many CRM archaeologists poorly suited candidates for identifying where archaeological resources are (and are not) likely to be found. Inadequate training among CRM archaeologists was (and is) problematic for many reasons. Recall Lipe’s (1974) proposition that archaeological sites should be avoided unless it is absolutely necessary to excavate them. An avoidance policy sounds reasonable in theory, but High Plains landscapes are generally characterized by sparse vegetative cover and high rates of erosion, meaning that exposed cultural resources face imminent destruction because they are inherently threatened by natural processes (Frison 1984:311). On the High Plains, then, a policy of avoidance often meant that energy development infrastructure was “moved to an alternate location which destroy[ed] other cultural resources that were not yet exposed by natural processes” (Frison 1984:311) and therefore also not identified by ill-trained CRM archaeologists. Thus, a counterargument to Lipe’s (1974)

⁶⁵ Unless required as part of an Archaeological Resource Damage Assessment (see McAllister 2007).

⁶⁶ Only 34 cases in federal district courts nationwide have resulted in ARPA violations since ARPA’s enactment in 1979. No ARPA violations have been issued in the Federal District Court for the District of Wyoming as of October, 2016 (Marcia Peterson, personal communication 2016).

⁶⁷ In 2016, the Wyoming Cultural Records Office (WYCRO) database contained records for approximately one hundred Paleoindian-aged sites in the Powder River Basin (Ross Hilman, personal communication 2016).

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avoidance policy was that in practice, it resulted in the destruction of more sites overall and the loss of more data than a salvage program would.

In Frison's most poignant critique of CRM archaeology, he suggested that:

Archaeology has progressed in the directions indicated more than two decades ago (Binford 1962) but it has also split into factions, some of which contend that archaeology is as much a public service as a science. This is a distorted view and should be corrected to remind everyone that the public service aspects of archaeology were conceived and developed to protect the resource and ensure its proper use (Frison 1984:211-212).

On the flip side of this coin, the role of research in public archaeology remains the subject of ongoing discussion into the present (Richardson and Almansa-Sanchez 2015:195). Some scholars have recently argued that every archaeologist is ethically bound to pursue public archaeology (Little 2002; McGimsey 1972; White et al. 2004), at least to some extent:

The very notion that public archaeology is the concern of a subgroup within the archaeologists' professional community runs the risk of immediately absolving the rest of that community of some key responsibilities. The moment it becomes the specific responsibility of the 'public archaeologist' to grapple with the complex of challenges and issues that characterize public engagement with archaeology, other archaeologists are freed to scuttle back to their ivory tower to continue their research, or at most to hand down suitably condensed narratives for the consumption of the uninitiated masses (Grima 2016:5).

At one extreme end of the public archaeology proponents' spectrum, some advocate that "public inspiration [is the] ultimate goal of archaeological inquiry" (Jameson 2003:160). Many research-focused academics disagree with this mission statement.

Public archaeology developed out of a desire to educate the public and engender widespread appreciation for cultural heritage in order to reduce looting of archaeological sites (Frison 1984), but these origins do not necessarily dictate whether public education should or should not constitute one of the primary priorities of archaeological research projects today. There is no correct answer to this question. Indeed, the ethics and obligations associated with archaeological practice "must always be in flux" (Smith and Burke 2003:191), and are debatable. However, all contemporary archaeologists should be aware of these discussions and make intentional decisions about how to frame their work in terms of explicit goals, outcomes, and agendas, whether they label themselves as academics, research scientists, cultural resource managers, CRM archaeologists, or in developing public outreach programs.

The Native American Graves Protection and Repatriation Act (NAGPRA)

Today, the most obvious public stakeholders in archaeological resources are probably Native Americans. Historic and prehistoric resources on Native American lands were protected under the Antiquities Act. However, this early legislation failed to consider or protect Native American cultural rights. Along with its many other flaws and weaknesses, the Antiquities Act

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did not recognize tribal laws or tribal jurisdiction over Indian lands (Wright 2004:133). As an attempt to move towards rectifying hundreds of years of governmental policies that destroyed Native American religious traditions and cultures, Congress enacted the American Indian Religious Freedom Act (AIRFA) in 1978, which established federal policy that was meant to protect and preserve traditional Native American religious traditions and land-use practices, including granting indigenous peoples access to traditional sites (Trope 2013).⁶⁸ In 1979, with increased awareness for Native American civil rights under AIRFA, ARPA legislation significantly improved the position of Native American tribes as stakeholders/collaborative partners in archaeological resources. ARPA initiated a precedent for archaeologists to consider not only any potential ethical responsibilities they had towards Native American communities, but legal responsibilities as well.

ARPA required that Native American tribes be notified 30 days prior to the issuance of excavation permits when excavation might result in harm to tribal, religious, or cultural sites. Tribes were not required to obtain ARPA permits to excavate resources present on Indian lands, and could issue permits to their own members. Furthermore, ARPA explicitly stated that archaeological resources on Indian lands belong to the tribes (Wright 2004:133-134). Unfortunately, no Native Americans were involved in ARPA's drafting (Wright 2004:134), and "[s]ince the mid-1970s, when Indian concerns began to be formally incorporated into cultural studies, there has been a major gap between what Indian people want to protect and how much protection managers of non-reserved land are willing and able to provide" (Stoffle et al. 1997).

In response to continued conflicts over Native American religious freedoms and cultural interests, including the lack of protection for sacred and burial sites, the need to obtain ceremonial objects such as eagle feathers, the desire for the repatriation of human remains, and in response to the fact that AIRFA was not enforceable in court, several organizations joined forces to form the American Indian Religious Freedom Coalition in 1988 (Trope 2013:19). Though the coalition was formed to address a wide range of civil rights issues, the enactment of laws mandating repatriation became its primary focus (Trope 2013:20). Due largely to the efforts of this coalition, the Native American Graves Protection and Repatriation Act (NAGPRA) was successfully passed into federal law in 1990.

In essence, the NAGPRA of 1990 mandated that federal agencies and museums receiving federal funds must inventory their human remains, funerary items, sacred objects, and objects of cultural patrimony and actively consult with affiliated tribes to determine whether they desired repatriation of ancestral human remains or cultural items (Nash and Colwell-Chanthaphonh 2010). Originally, "affiliation" was established by lineal descent to an individual or cultural affiliation with a tribe.⁶⁹ Repatriation to federally recognized, affiliated tribes was (and is) legally

⁶⁸ Properties of traditional religious and cultural importance to Indian Tribes (Traditional Cultural Properties, or TCPs) were officially introduced to the CRM community in National Register Bulletin 38 in 1990 (King 2003) and became legally recognized as eligible for inclusion in the NRHP due to revisions of the NHPA in 1992 (Ferguson 2003:139).

⁶⁹ In 2010, an addition to NAGPRA, referred to as "the final rule" or Rule 10.11, dictated that if federal agencies and museums could not establish affiliation through descent or culture, they must contact federally recognized tribes currently located in the same *geographic region* as unaffiliated remains were recovered. This addition to NAGPRA remains emotionally charged and somewhat contentious (Dumont 2011).

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mandatory while repatriation to non-federally recognized tribes is voluntary (Trope 2013:30). NAGPRA also protected burial sites and cultural items located on federal and tribal lands, and prevented the trafficking of illegally obtained Native American human remains and cultural items (Trope 2013:29). Under NAGPRA, archaeologists may only excavate funerary sites on federal or Indian land after consultation with the appropriate tribe(s). When buried human remains or funerary items are inadvertently discovered as part of any archaeological or development project where ARPA also applies, disturbance activities must cease until the appropriate tribe(s) are consulted (Trope 2013:38-9).

Archaeological opinions regarding NAGPRA vary tremendously. Some archaeologists believed (or still believe) that “NAGPRA spelled the death knell of museums and science” (see Nash and Colwell-Chanthaphonh 2010:100). Others suggest that NAGPRA “has served as an example to the world and as a catalyst for other countries to address... fundamental issues of human dignity” (Trope 2013:45). NAGPRA implementation has certainly forged new relationships among archaeologists, museum officials, and Native American groups. In most cases, these interactions are largely positive (e.g., Ambler and Goff 2013; Lawler 2010b; Rose et al. 1996). In a few high-profile cases involving Paleoindian human remains, disagreement over how to appropriately determine “affiliation” under NAGPRA has erupted into legal and ethical battles among scientists, the United States Government, and Native American communities (Watkins 2004).

The most well-known and contentious case involving the repatriation of human remains under NAGPRA surrounded a Paleoindian-aged human skeleton that was originally dated to 8410 ± 60 ^{14}C BP (Taylor et al. 1998) and nicknamed Kennewick Man. Kennewick Man was inadvertently found eroding out of the bank of the Columbia River in Washington state, on federal land, in 1996 (Burke 2008; Chatters 2001; Downey 2000; Owsley and Jantz 2001, 2014; Thomas 2000; see also Powell 2005). Five local tribes claimed him as ancestral. The US Army Corps of Engineers, responsible for managing the federal land on which Kennewick Man was found, decided to repatriate his remains to the Umatilla. Before the remains were repatriated, however, eight archaeologists and physical anthropologists filed a court suit against the government which was intended to block repatriation so that Kennewick Man could be scientifically studied (Watkins 2004:71). This case is known as *Bonnichsen et al. v. United States et al.* The anthropologists argued that 1) Paleoindians are too far removed, temporally, from modern Native Americans to adequately establish cultural affiliation (Horn 1997), 2) Kennewick Man’s antiquity and morphology indicated that he was Paleoamerican but not necessarily Native American and therefore NAGPRA did not apply (Meltzer 2015b; Owsley and Jantz 2001:566-567) and 3) that Kennewick Man was characterized by exceptional antiquity and so well preserved that scientific studies would certainly provide knowledge important for elucidating the colonization of the Americas and therefore be of major benefit to the United States (Bruning 2006).⁷⁰

⁷⁰ Once cultural affiliation has been established under NAGPRA, cultural items must be immediately repatriated to the appropriate federally recognized tribe. The only exception to this rule is when the cultural item is considered “indispensable for completion of a specific scientific study, the outcome of which would be of major benefit to the United States” (25 U.S.C. 3005(b)). Under these circumstances, the item must be returned within 90 days of the study’s completion (Trope 2013:35).

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In 2004, the court determined that Kennewick Man was not Native American within the meaning of NAGPRA, and anthropologists won the right to study his remains (Meltzer 2015:1486). The results of their work were published in 2014 by Douglas Owsley⁷¹ and colleagues (Owsley and Jantz 2014). During these studies, Kennewick Man was re-dated to a slightly younger age (approximately 8500 cal BP; Stafford 2014). Based on scientific evidence such as isotopic analysis, Owsley and Jantz (2014) repeatedly suggested that Kennewick Man was a migrant from elsewhere along the Pacific Coast.

Genetic evidence, however, provided a different perspective (Rasmussen et al. 2015). After Owsley and colleagues published on Kennewick Man, an unaffiliated group of scientists showed genetically that “the Colville [one of the five tribes requesting repatriation of the remains] are either direct descendants of the population to which Kennewick belonged or one to which he was very closely related” (Meltzer 2015b:1489; Rasmussen et al. 2015). In light of this discrepancy, one archaeologist involved in the genetic sequencing of Kennewick Man, David J. Meltzer, indirectly accused Owsley and colleagues of intentionally politicizing the outcomes of their work. In an academic publication, Meltzer (2015b:1487) wrote that “it is hard to shake the suspicion that calling [Kennewick Man] a traveler was done to create doubt that he was a resident of the area in which he was found and therefore had any descendants in the region.” Whether Owsley and colleagues intentionally politicized their findings to set a precedent for future NAGPRA cases involving Paleoindian remains will probably never be known, partially because their results can never be verified. As a result of the genetic evidence released in 2015 (Rasmussen et al. 2015), in 2016 a group of bipartisan legislators voted that Kennewick Man’s remains be repatriated (Francis 2016). Further scientific study of his remains will not be possible, since he was reburied in 2017 at the behest of the five tribes claiming affiliation with him (Francis 2016).

Contemporary Paleoindian archaeology can be political and ethically charged, especially when it involves human remains. Several hypotheses relevant to the colonization of the Americas contributed to the epic, two-decade storm of controversy that surrounded the repatriation of Kennewick Man. The initial morphological identification of the Kennewick Man as “Caucasoid,” the public’s misunderstanding of the word “Caucasoid” (Meltzer 2015b:1485), and perhaps increased press coverage of the Solutrean hypothesis, were seen by some as dangerous pieces of a puzzle that would come together to erode Native American land claims. If European ancestors were shown to have been the first peoples in the Americas, this could overturn decades of post-colonial thinking and quash the rising notion that the US Government has a continuing responsibility to rectify the “cultural genocide” (Tinker 1993) that was historically committed against Native American cultures in the name of Euroamerican expansion (e.g. Zimmerman 2005). The contentious scientific and ethical debates that came to a head during the Kennewick Man case addressed issues that have also affected the treatment of other Paleoindian remains, and will undoubtedly continue to alter the way bioarchaeological studies of prehistoric Native Americans are conducted in the future.

⁷¹ Douglas Owsley is an undergraduate alumnus of the University of Wyoming and is currently a prominent physical anthropologist at the Smithsonian Institution.

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Paleoindian Human Remains on the Northwest Plains

All of the known Paleoindian human remains from the Northwest Plains were discovered in the late 1960s through 1980s, although none of them were adequately studied until decades after they were initially found. Paleoindian-aged remains are rare throughout the Americas (Steele and Powell 1993). Due in part to tribal desires and the implementation of NAGPRA, few Paleoindian individuals are currently available for scientific study (Lawler 2010a, 2010b). As yet, no Paleoindian burials are scientifically known in Wyoming, but this does not preclude the possibility that Paleoindian human remains might be identified in the future.

In Wyoming, the oldest dated human remains are affiliated with the Early Archaic period and were found at the J. David Love site (48SU4479) in the Green River Basin. The site was identified in 2002 when an archaeologist monitoring construction of an oil/gas well pad recognized several charcoal stains. The development project was halted to allow for extensive archaeological testing and excavation. The ensuing investigations revealed six housepits, one burial structure, and three surface structures with dates spanning the Early Archaic through Late Archaic phases (McKern 2007). An elderly woman was interred in one of these structures. The burial structure was associated with a bulk soil sample dated at 7290 ± 50 ^{14}C BP (McKern 2003; McKern and Current 2004). Her age was estimated at over 60 years, her teeth exhibited an unusually high degree of dental attrition, and her left twelfth rib was broken, probably due to interpersonal violence (Gill 2004). Though the woman was missing long bone and craniofacial portions, her pelvic morphology was determined to be “Caucasoid-like.” The scientist who performed the forensic analysis on her remains, George Gill,⁷² stated that:

One should be cautioned about placing too much emphasis upon this ‘Caucasoid-like’ pelvic morphology. With so many North American skeletons from the Paleoindian period showing non-Mongoloid, Caucasoid-like traits (e.g. Kennewick Man, Spirit Cave Man, Minnesota Woman, etc.) it is tempting to think that this 7,200 year old female might belong to such a population. Yet without a femur, facial skeleton, palate, preserved teeth or a cranial vault to examine, such a suggestion simply cannot be verified (Gill 2004:n.p.).

The chronological age of the J. David Love woman close to the Late Paleoindian/Early Archaic transition and her “unique features” as described by Gill (2004:n.p.) might make her relevant to future Paleoindian research in Wyoming and beyond. If additional research were to be conducted on the J. David Love woman’s remains, most bioarchaeologists today would probably emphasize genetic research over analysis of her morphological traits.

Only four Paleoindian-aged skeletons from three sites are scientifically known on the Northwest Plains. In Colorado, a 25-30 year old woman was found at Gordon Creek (5LR99; Anderson 1966, 1967; Breternitz et al. 1971; Owsley and Jantz 2001; Swedlund and Anderson 2003). She was ritually interred in a pit coated with red ochre. Her body itself was also coated in red ochre, and she was placed on her left side, with her head facing north and limbs tightly

⁷² George Gill is professor emeritus of biological anthropology at the University of Wyoming. During the study of human remains from the J. David Love site, he filled the role of forensic anthropologist.

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flexed. Gordon Creek Woman was buried with a variety of non-diagnostic grave goods, including lithics, worked bone, and elk teeth (Breternitz et al. 1971:179). Recent lithic analysis and a new radiocarbon date suggest that she may have been associated with the Hell Gap cultural complex (Muñiz 2004). Gordon Creek Woman has not yet been repatriated or reburied, and her status remains unclear (Lawler 2010b).

Discovered in 1968 by two workmen, the Anzick burial in Montana (24PA506; Canby 1979; Jones 1996; Jones and Bonnicksen 1994; Lahren and Bonnicksen 1974; Morrow 2006; Owsley and Hunt 2001; White 2015; Wilke et al. 1991) has recently become one of the most important Paleoindian burials (along with Kennewick Man) in terms of the insights that subsequent genetic studies have provided into our understanding of the peopling of the Americas (Rasmussen et al. 2014). At the Anzick site, two subadult skeletons were recovered; one skeleton (Anzick-1) was stained with red ochre with an approximate age of 1.5 years old and the other (Anzick-2) appeared bleached with an estimated age of 7 years old (Owsley and Hunt 1999). Radiocarbon dates of the Clovis-aged infant place him at about 12,600 cal BP (Rasmussen et al. 2014). The 7-year old juvenile was eventually determined to be unassociated with the Clovis-aged burial, but still dates to the Paleoindian period at around 9600 cal BP (Owsley and Hunt 2001). Despite initial confusion regarding the context of both of the skeletons, it was eventually established that the ochre-stained individual was interred immediately below a cache of approximately one hundred ochre-covered Clovis artifacts (Owsley and Hunt 2001:117-118), although some archaeologists still dispute the purported association between the cache and the infant (Stanford and Bradley 2012:180). The cache included antler foreshafts (Morrow 2006:31) which immediately provided important insights into the previously hypothetical organic components of Clovis weapons systems (Lahren and Bonnicksen 1974).

Recent genetic studies on Anzick-1 showed that he “is more closely related to all indigenous American populations than to any other group” (Rasmussen et al. 2014:225), but is more closely related to central and southern Native Americans than to northern Native American individuals. The researchers concluded that “[a]s such, contemporary Native Americans are effectively direct descendants of the people who made and used Clovis tools and buried this child” (Rasmussen et al. 2014:228), which has important implications for the future application of NAGPRA to Paleoindian-aged remains.⁷³ In addition to genetic studies, Morrow (2006:32) pointed out that, “[a]s the only known Clovis burial, the Anzick site assemblage affords archaeologists access to an unexplored realm of the Clovis complex, the realm of belief.” Northwest Plains Paleoindian archaeologists have not yet fully answered Morrow’s challenge to explore Clovis belief systems (but see Morrow 2016). The male infant was reburied in 2014 at the behest of Native American tribes in Montana (Callaway 2014; White 2015). As of 2016, artifacts from the cache remained on display at the Montana Historical Society in Helena, Montana. The whereabouts of Anzick-2 are currently undisclosed.

⁷³ One critique of this work is that Anzick-1’s genome was not compared to any other Native Americans located in the contemporary United States, and only four genomes from Canadian First Nations peoples were included for comparison (these individuals were all more distantly related to the Anzick-1 genome than individuals from the much larger Meso- and South American sample). This finding potentially has implications for NAGPRA application, and could be used to support or block repatriation of Paleoindian remains to contemporary tribes in the United States, depending on which direction one wishes to spin it.

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Another Paleoindian skeleton named Hourglass Cave Man was discovered by three spelunkers at a high altitude cave in Colorado in 1988. Morphological analysis suggested that he was between 35 and 45 years old, and did not exhibit any skeletal markers of poor health or nutrition. He appeared to have died within Hourglass Cave (5EA1009), rather than intentionally emplaced post-mortem (Mosch and Watson 1997). Before he was reburied (Lawler 1010b), researchers conducted genetic analysis on his remains and produced a somewhat obscure publication. The results of this analysis purportedly supported the Beringian migration hypothesis for the colonization of the Americas, rather than coastal migration from Polynesia (Stone and Stoneking 1996). However, Hourglass Cave Man was never fully studied. An AMS date suggested that he was approximately 8170 ¹⁴C BP, potentially affiliating him with terminal Paleoindian times (Mosch and Watson 1993; Reed and Metcalf 1999:58).

Summary

Since the European colonization of North America, scientists and the public have exhibited great interest in understanding the origins and lifeways of the first known peoples on this continent. Archaeological theory and methods have progressed far from their antiquarian beginnings. Under the 1800s theoretical framework of unilineal cultural evolution, early North American anthropologists viewed contemporary Native Americans as relics of the past, still living in the “Stone Age” (Grote 1877:587). The rise of Franz Boas’ concepts of cultural relativism and historical particularism in the early 1900s led most archaeologists to discard this ethnocentric notion and begin quests to develop regionally specific cultural chronologies. Though scientists tirelessly searched for the oldest people(s) in the Americas for over a century, evidence for the great antiquity of humans on this continent was not forthcoming until Folsom points were discovered lodged within the ribs of an extinct species of bison in 1927 (but see Lyman 2015). This year marks the advent of professional Paleoindian archaeology.

Over the next several decades, other important Paleoindian discoveries and investigations occurred across the Great Plains. In many cases, professional archaeologists were amicably aided by avocationalists or collectors that knew enough, and cared enough, to direct academic attention towards significant archaeological finds. By the early 1960s, Clovis, Folsom, Plainview, Midland, Agate Basin, Alberta, Eden, Scottsbluff, Angostura, and James Allen point types were defined on the Northwest Plains, but their exact chronological position in relation to each other was poorly understood.

Despite this lack of concrete, chronological knowledge, Paleoindian culture history across North America was impressively summarized throughout the 1930s-1950s by Wormington (1939, 1944, 1949, 1957). Several culture-historical syntheses were compiled for the Northwest Plains in the 1950s (Mulloy 1953, 1958) and the early 1960s (Wedel 1961). Though these early chronological syntheses incorporated a great deal of educated guesswork, many of the observations and inferences published within them were confirmed during investigations at Hell Gap in the mid- to late 1960s (Irwin-Williams et al. 1973; Larson et al. 2009), when Agogino and the Irwins identified a stratified cultural sequence spanning almost the entire Paleoindian period. Hell Gap became the type site for three new Paleoindian phases: Goshen, Hell Gap, and Frederick. It also contained stratified cultural horizons for seven Paleoindian cultural components, confirming some of Wormington, Mulloy, and Wedel’s earlier

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impressions and suggesting that the relative chronological order of Paleoindian phases was Goshen to Folsom to Agate Basin to Hell Gap to Cody to Frederick to Lusk.

Besides these few pioneering scholars, the Northwest Plains was largely neglected by archaeologists during the first half of the 20th century, but was eventually recognized as an important region of study. One of the next people to systematically investigate archaeology across all time periods on the Northwest Plains was “Doc” George C. Frison. His archaeological career began in the 1960s, and he started publishing on the Paleoindian period in the 1970s. Frison and contemporaries’ comprehensive culture-historical investigations were combined with absolute dating by radiocarbon, which had been invented in 1949, and couched within the scientific theory and methods put forward during the rise of the processual paradigm in the 1960s. These developments ushered in the New Archaeology on the Northwest Plains, an effort which took regional shape largely under the leadership of Frison. The results of these efforts are summarized in Frison and colleagues’ comprehensive and accessible *Prehistoric Hunters* books (Frison 1978, 1991b; Kornfeld et al. 2010).

A relatively solidified Paleoindian cultural chronology arose from a combination of site investigations at Hell Gap and elsewhere, the invention of radiocarbon dating, interdisciplinary collaboration, and the recognition that diachronic regional differences in material cultural traditions existed among southwestern Wyoming, the foothill-mountain areas, and the eastern Wyoming grasslands. The development of this chronology allowed archaeologists to begin addressing more interesting topics in Paleoindian prehistory. From the 1980s through the 1990s, archaeologists on the Northwest Plains were actively asking and answering more complex questions about Paleoindian material culture and behavior. General topics of interest included technology, settlement patterns, mobility, subsistence behaviors, the impact of paleoclimatic change on Paleoindian peoples, how and why the initial peopling of the Americas occurred, the plausibility of the overkill hypothesis, and examining regional diversity in any of the above subjects. By the end of the 1980s, Robert L. Kelly and colleagues explicitly outlined how methods from human behavioral ecology might be used to explain Paleoindian behavioral patterns (Kelly and Todd 1988). This provided one theoretical framework for conducting processual inquiries into the Paleoindian period.

Throughout the 1980s and 1990s, the postprocessual critique inspired spirited debates across the nation and the world. However, Northwest Plains Paleoindian archaeologists largely ignored these theoretical discussions and rarely attempted to address postprocessual topics or use postprocessual methods (and still do not, but see Hudecek-Cuffe 1998). With some exceptions, Plains archaeology has continued to emphasize culture-historical description and remained comparatively atheoretical, or perhaps more properly, implicitly rather than explicitly theoretical (Bamforth 1999). Some archaeologists have hypothesized that an emphasis on purely culture-historical research on the Plains persists into the present day because of the historical legacy of the way that archaeology developed in this culture area. Plains archaeology has commonly been done to serve large-scale, public, salvage agendas. This, in turn, may have predisposed research goals towards culture-historical ends, rather than using culture history to facilitate the asking and answering of processual questions (Mitchell 2006; see also Binford 1983:22). Frison was probably the first to call attention to this phenomenon, which he recognized over thirty years ago (Frison 1984).

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Just as “salvage” and “conservationist” CRM archaeology influenced the direction and conduct of academic archaeological research on the Northwest Plains, so too did academic archaeology, the development of archaeological ethics, and changing political opinions influence the enactment of archaeologically relevant laws and cultural resources management practices. In 1906, the Antiquities Act was enacted to help preserve archaeological resources as national heritage for the American public and as data for scientific research. In the 1960s, the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA) extended greater protections to archaeological resources. The Archaeological Resources Protection Act (ARPA) of 1979 enhanced the penalties associated with illegal looting and vandalism of archaeological sites on federal and Indian lands. With ARPA and the American Indian Religious Freedom Act (AIRFA) of 1978, the federal government began to acknowledge Native Americans as collaborative partners in the management of archaeological resources and traditional cultural properties. In 1990, the Native American Graves Protection Act (NAGPRA) became the first archaeologically relevant legislation to actively include Native American interest groups in the lawmaking process.

Though none of these laws are specifically directed towards Paleoindian resources, Paleoindian-aged artifacts may be preferentially affected by them because they tend to be highly valued by for-profit collectors (e.g., Overstreet 2013) and/or implicitly considered to be of greater scientific value than younger resources. Paleoindian-aged human remains have also been subjected to a disproportionately large amount of legal attention. On some occasions, disagreements over whether Paleoindian remains can or should be considered “affiliated” with contemporary Native American tribes under NAGPRA have erupted into bitter battles, within and among groups of archaeologists, biological anthropologists, federal and local government agencies, and Native American groups (e.g., Meltzer 2015b, Thomas 2000). More often, discussions involving discoveries of prehistoric human remains are amicable and respectful (e.g., Ambler and Goff 2013; Lawler 2010b; Rose et al. 1996). Though no Paleoindian skeletal materials are scientifically known from Wyoming as yet, they have been identified in neighboring states, including Montana, Colorado, and Idaho. Therefore, the future discovery of Paleoindian human remains in Wyoming is certainly a possibility. If this ever occurs, the treatment of the remains will no doubt require careful consideration and collaboration between archaeologists, Native Americans, and other interested parties.

Paleoindian resources in Wyoming are valued by a variety of interest groups. Some of these groups include Native Americans, avocationals, academics, cultural resource managers, the public, the government, private collectors (e.g., Taylor 2006; Westfall 2002), and, unfortunately, for-profit looters. Since its beginnings, Wyoming archaeology has been characterized by an unusually large amount of cooperative collaboration between various members of some of these groups (see Pitblado 2014). In many cases, the lines between them are blurred. For example, Frison’s interest in archaeology began when he started collecting artifacts off of his grandparents’ ranch near Ten Sleep, Wyoming, at the age of nine (Frison 2014:6).

These relationships of collaboration are also created and bolstered by archaeologists that repeatedly organize activities at Paleoindian sites in Wyoming. For example, at least every other year, academic archaeologists Marcel Kornfeld and Mary Lou Larson welcome throngs of local, national, and international public to visit the open excavation at Hell Gap. The Wyoming

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Archaeological Society, which is primarily comprised of avocational archaeologists, graduate students, CRM archaeologists, and a few academics, often holds a summer gathering at Hell Gap as well. These anecdotes illustrate how America's first peoples continue to captivate generations of Wyomingites, professional archaeologists or otherwise. Indeed, in a culture-historical sense, Wyoming, and Hell Gap in particular, is the chronological and geographic "heart" of the "Paleoindian 'heartland'" (Holliday 2000b:517).

Future Wyoming Paleoindian archaeologists should continue to build on robust culture-historical roots. Equally important will be forging interdisciplinary research programs that are theoretically and scientifically directed in order to "give meaning to [the past]" (Binford 1983:22). Frison and others have already provided some excellent examples of how this is possible in studies of Northwest Plains Paleoindian archaeology, but this has only recently become a widespread practice. If we pursue these goals into the future, Paleoindian studies will continue to provide value to a variety of Wyomingites that have scientific, educational, and/or heritage interests in America's prehistory, and will inherently contribute to promoting ethics of conservation, knowledge acquisition, and cultural sensitivity among the public.

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Wyoming Paleoindian Chronology

In 2000, Vance T. Holliday summarized the history of Paleoindian typology and chronology on the Great Plains up to the turn of the 21st century. He stated that:

The broad outline of the Paleoindian chronology for the Great Plains that emerged in the 1960s basically has not changed. It was refined and in some regions added to, but with the exception of a few local records, it has not undergone a significant revision. Perhaps the most significant change is the realization that there probably was significant temporal overlap of some point types, and that the old unilinear sequence does not account for all the known typological variation (Holliday 2000a:264; see also Frison 1993; Hofman 1996:76; Sellet 1999; Sellet et al. 2009).

Eighteen years later, Holliday's (2000) observations still apply. The chronology for the Wyoming plains is still largely based on the original stratified sequence of cultural complexes identified during the 1960s investigations at Hell Gap, Wyoming (Larson et al. 2009). This stratigraphic sequence was first correlated with radiocarbon dates by C. Vance Haynes, Jr. (1964). Since that time, the chronology has been refined with new radiocarbon dates and other evidence from successive site investigations. By the 1970s, George C. Frison and others documented and described post-Folsom variation in Paleoindian complexes for the foothill-mountain areas of Wyoming that differed from the material culture and lifeways encompassed by the Plano complexes on the more open, easterly plains as described at Hell Gap. In the 1980s, largely due to efforts led by Michael D. Metcalf (Metcalf 2011, 1987; Metcalf et al. 2005; Reed and Metcalf 2009, 1999; Thompson and Pastor 1995), archaeologists recognized that southwestern Wyoming had ties to the Great Basin and that the chronology and prehistory of this subregion of Wyoming "did not conform completely with chronologies used for surrounding areas" (Kornfeld et al. 2010:66).

In the past few decades, Plains archaeologists have also recognized that not all variation in Paleoindian projectile point morphology and technology can be organized into categorical types. In some cases, much variation within and overlap between typological categories exists (Bamforth 1991:320). However, established point types are still useful descriptive labels and chronological indicators for the Paleoindian period when they are viewed with an understanding of this fluidity. We must also remember that point types were created by and for archaeologists, and we do not fully understand whether the differences among these types had functional, symbolic, or other meaning to Paleoindian peoples. If the established chronology and typology presented here is not helpful for answering a specific research question, then different types of typologies or other research methods should be used to address that question.

Since several excellent and comprehensive chronologies have already been published for the High Plains (Frison 1978, 1983b, 1991b; Frison and Mainfort 1996; Gunnerson 1987; Haynes 2000a; Kornfeld et al. 2010; Pitblado 2003:79-144; Taylor 2006), this section focuses specifically on chronology and typology within and directly adjacent to Wyoming. It also describes spatiotemporal variation within Wyoming, among the Plano complexes on the eastern grasslands (see also Eighmy 1984:7-11, 29-48), the foothill-mountain areas (see also Guthrie et

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al. 1984:12-21), and southwestern Wyoming with its apparent ties to the Great Basin (see also Grady 1984:20-24). The divisions between these culture areas have “some merit,” but “with the accumulation of new data,” they also seem to be an “oversimplification of the Paleoindian archaeological record” (Frison and Walker 2007:230). Although the way these geographic divisions correlate with archaeological cultures is unsolidified and regionally patchy, they are still useful for understanding diversity in Paleoindian material culture and lifeways.

General Paleoindian Diagnostics and Brief Comparisons to the Archaic

The Paleoindian chronologies for all subregions of Wyoming are almost exclusively based on projectile point typologies. Due in part to Paleoindian sites’ antiquity and overall lack of preserved organics, in lieu of other temporal diagnostics, Paleoindian archaeologists still rely heavily on projectile point morphology and technology (in tandem with radiocarbon dating) to place sites and isolates in chronological context (Kornfeld et al. 2010:48-56). Relying on point types as markers of entire Paleoindian cultural systems is problematic for a variety of reasons (Bamforth 2009), but necessary in the absence of other reliable, temporally diagnostic indicators. Point types will be considered in more detail, but it is worth noting here that Paleoindian points tend to be lanceolate or stemmed in outline whereas corner-, side-, and basally-notched points generally do not appear in the archaeological record until the Early Archaic. Additionally, the presence of ground edges near the bases of projectile points commonly indicates that they are Paleoindian-aged (Frison et al. 2015:183). The diversity of point types present over a given area is much lower during Paleoindian than Archaic times (Reed and Metcalf 1999:83). However, this could reflect historical scientific bias influenced by the way archaeologists divided Paleoindian versus Archaic points into types that has been perpetuated into modern times (Marcel Kornfeld, personal communication 2018).

Other tools and specific types of debitage, such as Cody knives and Folsom channel flakes, are occasionally diagnostic of the Paleoindian period; these are described in tandem with their associated cultural complexes throughout this section. Functional and/or morphological tool types including graters, borers, and spurred end scrapers, are often found in Paleoindian assemblages but rarely found in post-Paleoindian components (e.g., Kornfeld et al. 2010:52, 55). Therefore, these tool types may suggest the presence of Paleoindian complexes but cannot be considered absolutely diagnostic (Eren, Jennings, and Smallwood 2013; Kornfeld et al. 2010:52-56; Rogers 1986).

The presence of extinct megafauna in association with artifacts can be used to indicate that sites are Early Paleoindian in age. At U.P. Mammoth⁷⁴ and La Prele, for example, extinct megafauna was identified near artifacts but investigators have either not identified any diagnostics (Haynes et al. 2013), or have not yet situated diagnostics in full context with megafaunal remains (Mackie et al. 2016).⁷⁵ Based on depictions of extinct animal species such as mammoths, Late Pleistocene rock art has been identified on the Colorado Plateau, but is of

⁷⁴ At U.P. Mammoth, none of the artifacts are clearly associated with the mammoth remains.

⁷⁵ A Clovis point was recovered from a shovel test at La Prele in 2017 (Todd Surovell, Matt O’Brien, Robert L. Kelly, Madeline Mackie, and Spencer Pelton, personal communication 2017). At the time of writing, this artifact was not yet published or fully situated in stratigraphic context.

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unknown cultural affiliation (Agenbroad and Hesse 2004). In general, if a site contains non-diagnostic artifacts in association with proboscidean or other extinct Pleistocene faunal remains, it was probably contemporary with Clovis, Goshen, or Folsom; however, this does not necessarily mean that people at the site were affiliated with the Clovis, Goshen, or Folsom cultural complexes. Additionally, it is not outside the realm of possibility that some sites exhibiting a co-occurrence of extinct fauna with anthropogenic artifacts might turn out to be pre-Clovis in age.

Though ground stone used for plant processing⁷⁶ occasionally appears in Early and Middle Paleoindian assemblages⁷⁷ [Frison 1986a:100-101]) and more often in Late Paleoindian assemblages⁷⁸, it is present in much higher frequencies throughout the Archaic. The increased quantity and size of ground stone artifacts and features during Archaic times is generally thought to reflect increased dietary reliance on and intensive processing of flora, such as roots, tubers, and seeds, subsequent to Paleoindian times (Greubel et al. 2009; Kornfeld and Larson 2008:21). Though Archaic occupations overall exhibit broader diet breadth than Paleoindian occupations (Hill 2007), it is worth noting that “the term ‘Archaic’ no longer carries the connotation of a time of hardship; rather, the term is used to denote the time beginning approximately 8000 [radiocarbon] years ago when a shift from lanceolate to side-notched projectile points occurred and new features and artifacts appeared” (Larson and Francis 1997:1-13). In some areas, the onset of the Archaic appears to have been associated with a reduction in the importance of communal bison hunting and a reduction in the overall range size of prehistoric groups (Bamforth 1997), but the shape and magnitude of these effects are regional and debatable (e.g., Lovvorn et al. 2001; Meltzer 1999).

Paleoindian fire hearths were almost always formed on the surface of the ground or in shallow depressions, while stone-filled fire pits generally appear only in Archaic and later occupations (Kornfeld et al. 2010:61). However, the form of thermal features is not necessarily temporally diagnostic, and should only be employed as one of multiple lines of evidence to date a site. Other features such as deer and pronghorn bonebeds⁷⁹ (Kornfeld et al. 2001; Pastor and Lubinski 2000), housepits (Harrell et al. 1997; Larson 1997; Larson and Francis, ed. 1997; Shields 1998; Waitkus and Eckles 1997), storage pits,⁸⁰ pit houses and milling bins (in southwest

⁷⁶ Ground stone that is not used for plant processing *is* commonly found in Paleoindian assemblages. These types of artifacts include ground hematite nodules and stone abraders, such as were found at Lindenmeier (Wilmsen and Roberts 1978:121-125; see also Stanford 1999:301-302) and Hell Gap (Marcel Kornfeld, personal communication 2018).

⁷⁷ For example, at Jurgens (Wheat and Scott 1973:129-130), Allen (Bamforth 2007:184-187), and possibly at Colby. The Colby ground stone artifact might be an abrader for manufacturing wood or osseous tools (Frison 1986a:100-101).

⁷⁸ For example, at Medicine Lodge Creek (Frison 2007b:57-60; see also Walker and Frison 2018), China Wall (Waitkus 2013:9-46 – 9-47), and Game Creek (Page 2017:323).

⁷⁹ However, Trapper’s Point (48SU1006) is a large pronghorn procurement site in Wyoming’s Green River Basin, dates to over 8000 BP (Miller et al. 1999), and has “a strong possibility of extending back into Late Paleoindian times” (Frison 2007a:1; Julie Francis, Mark Miller, and Paul Sanders, personal communication 2016).

⁸⁰ However, there are possible cache pits in Late Paleoindian levels at Medicine Lodge Creek (Frison 2007b:61-62). Southsider produced two probable Late Paleoindian/Early Archaic food storage pits (Frison

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Wyoming; McGuire et al. 1984; Miller and McGuire 1997; see also Metcalf and Black 1991) did not appear until the Archaic (Kornfeld and Larson 2008:21).

Portable art objects are consistently found in large Paleoindian campsites, but in terms of absolute numbers they are some of the rarest artifacts present at these sites (Lemke et al. 2015; Walker et al. 2012:701). Organic tools of bone or ivory, including points, rods, needles, and awls, are occasionally found in Paleoindian-aged sites as well (e.g., Lahren and Bonnicksen 1974). Portable art and organic tools have the potential to function as temporal diagnostics (as implied by Walker et al. 2012:707⁸¹), but their diachronic attributes are currently too poorly understood to suggest precise temporal affiliations.

In sum, the range of temporal diagnostics that can be used to consistently, positively, and definitively indicate that a site is affiliated with the Paleoindian period are few. Point morphology is the main diagnostic indicator used to identify Paleoindian complexes at sites on the Northwest Plains. A few specific types of stone tools and debitage function as temporal diagnostics in some cases. The presence of extinct megafauna in association with artifacts may be used to assign the affiliation of certain site components to the Early Paleoindian period, but not to specific cultural complexes.

Projectile Point Typology, Cultural Complex Descriptions, and Radiocarbon Dates

On the eastern Wyoming plains and in Rocky Mountain regions, Paleoindian cultural chronology is traditionally separated into three subdivisions: Early, Middle, and Late Paleoindian periods. Though pre-Clovis sites may eventually be identified in Wyoming, the Early Paleoindian period is generally conceptualized as including fluted point styles and their contemporaries: Clovis, Goshen, and Folsom/Midland. The Middle Paleoindian period generally encompasses the Plano complexes as identified at Hell Gap: Agate Basin, Hell Gap, and Cody complex varieties. The Late Paleoindian period is characterized by relatively more diversity in point styles and greater variation in point morphologies across space. On the open Wyoming plains, the Late Paleoindian period may include James Allen/Frederick and some other unnamed lanceolate varieties. Late Paleoindian foothill-mountain assemblages may include Late Paleoindian complexes found on the open plains, as well as Angostura/Lusk, Pryor Stemmed, Lovell Constricted, and/or several point forms found at sites such as Medicine Lodge Creek and Mummy Cave (North Fork Cave #1) that are not well defined as individual types. The Early, Middle, and Late Paleoindian periods on the open plains and foothill-mountain areas are traditionally categorized into the phases listed above, but are also conceptualized as temporally overlapping. That is, Early, Middle, and Late Paleoindian are shown as fuzzy temporal boundaries with each sub-period partially blending into the next (Kornfeld et al. 2010:49). The resolution with which we are able to geographically and chronologically understand shifts in Paleoindian lifeways and technologies is not currently clear enough to reveal how most of the transitions between Paleoindian phases occurred on fine spatiotemporal scales.

1991b:30, 83, 343-344). Schiffer Cave also produced storage pits (Frison 1973a:305, 1991:Table 2.3; Frison and Grey 1980:34; LaBelle 2005:205).

⁸¹ The Barnes "mammoth tusk" described in Walker and colleagues (2012) is now known to be a piece of incised travertine that dates to the Late Archaic (Todd Surovell, personal communication 2016).

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In southwestern Wyoming, the “Late Paleoindian”-era cultural chronology diverges slightly from that described above. A transition to Archaic-style lifeways may have begun slightly earlier in the Wyoming Basin than in other parts of the state. Additionally, some “Late Paleoindian”-era projectile point varieties in southwest Wyoming appear to link that region to the Great Basin culture area. See the “Southwest Wyoming (Wyoming Basin)” section, below.

All Areas of Wyoming

Early Paleoindian: Clovis (circa 13,100-12,650 cal BP)

Clovis cultural complex description. The Clovis cultural complex is predominantly viewed as an open plains manifestation. However, this stereotypical understanding probably needs revision since Clovis technology has also been identified in many foothill-mountain contexts and in southwestern Wyoming (Pitblado 2016; Kornfeld 2002:54).

Clovis material culture was traditionally defined almost entirely by stone Clovis points. This practice is now viewed as “an unfortunate failing among archaeologists and has led to confusion and uncertainty in our efforts to understand the Clovis manifestation” (Bradley et al. 2010:2). Over the past few decades, numerous publications detailing Clovis technology have remedied this problem, especially in reference to Clovis lithic assemblages.⁸² However, the term *Clovis* still means different things to different archaeologists. It may refer to a diagnostic projectile point form, a sophisticated stone tool production industry, a category of fluted points and unifacial tools made on blades and biface-reduction flakes, and/or the earliest widespread archaeological culture in North America (Goebel 2014). No matter how it is defined, the recognition of *Clovis* is heavily dependent upon “complex, sophisticated, and distinctive” (Bradley et al. 2010:178) chipped stone artifacts and associated lithic reduction strategies.

Clovis peoples on the Northwest Plains appear to have depended heavily on large game animals for subsistence, including mammoth (Frison 1986a; Hannus 1989, 1990; Haynes et al. 1998; Jennings 2014; Surovell and Waguespack 2008), extinct species of bison (Bement and Carter 2014; Frison and Stanford 1982), and possibly camel (Frison 2000:29, 1984:305; Frison et al. 1978; Haynes and Stanford 1984), with some evidence for small game exploitation as well (Stanford 1999:292; Waguespack and Surovell 2003). Clovis peoples probably consumed plant foods, but evidence for the consumption of perishable floral remains is absent from Clovis assemblages. This paucity of floral remains may be influenced by preservation bias.⁸³ The lack

⁸² See Boldurian and Cotter (1999); Bonnicksen and Turnmire (1991); Bradley et al. (2010); Bradley (1982:203-208); Collins (1999a); Frison and Bradley (1999); Haynes (2002); Haynes and Huckell (2007); Huckell and Kilby (2014); Kilby (2008); Kohntopp (2010); Prasciunas (2008); Smallwood and Jennings (2014); Smallwood (2015); Waters et al. (2011). For a review of other Clovis lithic studies, see Ellis (2013).

⁸³ This is a classic “absence of evidence is not evidence of absence” type of statement. Clovis kill and campsites tend to be found in open-air locations. In caves and rockshelters, evidence for plant and/or small animal use would have been subject to greater degrees of preservation, if it indeed existed in the first place (Frison 2007a:9; but see also Kelly 2015).

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of ground stone in Clovis assemblages suggests that heavy processing of plants did not occur (often or ever) during this phase.

Clovis stone tools are often manufactured out of exotic raw materials obtained from distant sources,⁸⁴ which supports the hypothesis that Clovis peoples were highly mobile (Asher 2016; Goodyear 1979; Stanford 1999:289-290). Clovis peoples' high mobility might be related to their reliance on large game and because they were colonizing an empty continent devoid of other human groups that would have restricted their ability to establish or maintain large range sizes⁸⁵ (Kelly and Todd 1988; Prasciunas 2014). On the other hand, these interpretations may not be accurate because the preponderance of exotic stone in Clovis sites might suggest the movement of lithics rather than people as is traditionally assumed (Bamforth 2009; Ellis 2013:148). Regardless, a "general consensus" (Kilby 2008:2, 10) exists that Clovis and Folsom peoples' mobility far exceeded that of any known, modern hunter-gatherer groups (Amick 1996).⁸⁶ Surovell's (2000) computer models showed that extremely high mobility would have been feasible for Early Paleoindian peoples to maintain. Clovis peoples also manufactured high-tech tools (Spiess 1984; Todd 1983) that were efficient to transport and curated for relatively long periods of time rather than expediently manufactured and discarded (Kelly and Todd 1988; but see Bamforth 2002a; Jennings et al. 2010; Prasciunas 2007).

Since at least the 1960s, archaeologists have drawn parallels between Old World, Upper Paleolithic sites and Clovis sites in North America, implying that Clovis peoples may represent a colonizing population that was not far removed from originating groups in eastern Eurasia (Ellis 2013:129). Like Old World Upper Paleolithic peoples, Clovis groups hunted mammoth, produced lithic blades (e.g., Boldurian and Hoffman 2009; Collins 1999a; Green 1963) and burins (Hemmings 1970:122), and Clovis assemblages occasionally include organic tools (Lahren and Bonnicksen 1976; Frison and Stanford 1982:156-7), such as presumed shaft wrenches (Haynes and Hemmings 1968), that resemble Upper Paleolithic varieties. Red ochre also appears to have been important to Clovis (and later Paleoindian) groups, as well as Upper

⁸⁴ "Lithic raw materials were routinely transported hundreds of kilometers from their source areas" (Kilby 2008:10-11).

⁸⁵ Or a continent of relatively low population density, if pre-Clovis cultures indeed existed.

⁸⁶ One view entrenched in the archaeological literature suggests that *all* Paleoindians may have been highly-mobile, high-tech foragers that ranged over extremely large areas. In contrast, Archaic peoples were characterized by relatively reduced mobility and consequently, their stone tools were not as highly invested in or "beautifully made" as Paleoindian tools (Hofman 1997:xii). This was supported by the repeated observation that Paleoindians tended to produce relatively high quality, curated stone tools out of exotic raw materials, which in turn suggested that they may not have known when or where they would next be able to refurbish their tools with new, local raw material (Amick 1996; Kelly and Todd 1988; Prasciunas 2014; but see Bamforth 2002a; Jennings et al. 2010; Prasciunas 2007). However, such conceptions of Paleoindian range size and mobility largely originated from analyses of projectile points and a few other limited classes of lithic artifacts, which do not necessarily represent overall Paleoindian technology and raw material use. In light of this potential bias, Douglas Bamforth (2009:142,154; see also 1991) recently stated that "the inference of large Paleoindian ranges is more a matter of faith than of evidence [because of...] the degree to which Paleoindian archaeology has probably overinterpreted a limited database." Whether post-Folsom Paleoindian groups were actually characterized by relatively extreme degrees of residential and/or logistical mobility remains debatable, and should be viewed as a hypothesis to be tested rather than a known facet of Paleoindian behavior.

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Paleolithic peoples (Frison 1982c; Frison and Bradley 1980:9; Frison and Stanford 1982:143-144; LaBelle and Newton 2010; Morrow 2016; Roper 1991; Stafford 1990; Stafford et al. 2003; Tankersley et al. 1995; Walker et al. 2012). Perhaps the most contentious hypothetical tie between Clovis and Upper Paleolithic peoples is the assertion that certain aspects of Clovis technological production resemble Upper Paleolithic Solutrean technology, which preceded the Clovis complex by approximately 5,000 years in Europe (Eren and Patten et al. 2013; Stanford and Bradley 2012). The meaning, if any, of the parallels drawn between Clovis and Upper Paleolithic cultures is equivocal.

Several types of Clovis sites are known on the Northwest Plains, including caches, kills, and open-air camps. One unique aspect of Clovis material culture was the creation of stone tool caches that included large numbers of high quality bifaces and/or Clovis points (Frison and Bradley 1999; Huckell and Kilby 2014; Stanford and Jodry 1988; Tankersley 1998). Though later Paleoindian groups occasionally produced stone tool caches, “Clovis appears to be the only Paleoindian group to have *regularly* deposited caches of artifacts” (Kilby 2008:3; emphasis added). Many Clovis archaeological assemblages include disproportionately high percentages of exotic toolstone, and this is especially true of caches. According to Bradley and colleagues (2010:106), “Clovis knappers went well out of their way to obtain colorful high quality stones, especially for making items to be deposited in caches.” Some suggest that Clovis caches were imbued with symbolic significance (e.g., Gillespie 2007), although this is debatable. This suggestion is bolstered by the presence of an ochre-covered cache of stone and antler tools associated with the only known Clovis burial, that of a male infant at the Anzick site in Montana (Canby 1979; Jones 1996; Jones and Bonnicksen 1994; Lahren and Bonnicksen 1974; Morrow 2006; Owsley and Hunt 2001; Rasmussen et al. 2014; White 2015; Wilke et al. 1991). It may be worthwhile to speculate that perhaps some other Clovis caches, which are predominantly known from private collections, were once associated with burials as well.

Another distinctive type of Clovis site is the proboscidean kill and/or scavenging location. Based on the frequency of Clovis proboscidean kills compared to other known Clovis sites, “Clovis peoples seem to have exploited elephants with much greater frequency than in any other time and place [worldwide]” (Surovell and Waguespack 2008). However, like almost everything in Early Paleoindian archaeology, this finding is debatable. Others have argued this apparently high proportion of elephant kills is a result of the way Paleoindian archaeologists have traditionally looked for Clovis sites—by seeking out paleontological remains and then searching for archaeological residues among the large bones (Meltzer 2006a:45-6). Regardless of the degree that Clovis peoples exploited proboscideans, they certainly hunted, killed, and/or scavenged mammoth, mastodon, and gomphothere remains at numerous sites across the Americas before these species went extinct at the end of the Pleistocene. In Wyoming, the Colby site (Frison and Todd 1986) appears to represent a planned mammoth kill event (or events), while the Lange-Ferguson site in South Dakota (Hannus 1989, 1990, 2018) might exemplify more of an opportunistic kill. At other sites, such as Dent (Brunswick 2007a; Figgins 1933), U.P. Mammoth (Haynes et al. 2013), and La Prele (Byers 2002a; Mackie et al. 2016), the exploitation strategies employed (or lack thereof in the case of U.P. mammoth) are not yet clear.

Several open-air Clovis camps are also known from the Wyoming vicinity. Indian Creek in Montana is a multi-occupation campsite with a Clovis component. It might have been visited

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by foragers in the spring seeking to replenish winter-depleted lithic raw material while hunting bison and marmot (Davis 1984; Davis and Baumler 2000). The Sheaman site is another Clovis camp (Frison and Stanford 1982:143-157), though some have argued this site is actually affiliated with the Goshen complex (Waters and Stafford 2014), or even Agate Basin (Sellet 2015). All known Clovis occupation and kill sites on the Northwest Plains are open-air.

Stone Clovis points were “exquisitely made” (Ellis 2013:129) weapon tips. Whether they always or ever tipped handheld spears or atlatl darts is still an open question, since no unequivocal evidence of atlatl use (or handheld spears for that matter) exists from the Clovis era. Three possible atlatl hooks that are potentially Clovis-aged were identified in Florida, manufactured out of a llama phalanx, a mastodon vestigial tusk, and a proboscidean ivory shaft, but none have been dated (Bradley et al. 2010:129-131). The oldest unequivocally known and dated evidence of atlatl on the Northwest Plains consists of an atlatl dart recovered from an ice patch in the Rocky Mountains near Yellowstone National Park. It dates to 9230 ± 25 ^{14}C BP (10,496-10,283 cal BP, 2σ range), making it coeval with the Cody complex (Lee 2010). Even if future archaeologists establish that atlatls were indisputably in use during Clovis times, this would not necessarily mean that Clovis points always tipped atlatl darts. For example, many modern foraging cultures use handheld spears in tandem with other projectile technologies (e.g., Churchill 1993). Additionally, diagnostic, stone Clovis points were not the only weapon tips utilized by Clovis peoples; Clovis-associated bone, antler, and ivory points and rods have been identified throughout North America (Bradley 2005; Bradley et al. 2010:135-136; Dunbar and Webb 1996; Hester et al. 1972:117; Lyman et al. 1998; O’Brien et al. 2016; Pearson 1999; Redmond and Tankersley 2005), including at the Sheaman site (Frison and Stanford 1982:156-7) and in the Anzick burial cache (Lahren and Bonnicksen 1976; Stanford 1996a). The function and meaning of these osseous artifacts require further investigation.

Clovis lithic technology description. Clovis lithic assemblages sometimes include macroblades, produced from either conical or wedge-shaped cores. As far as blades go, Clovis varieties tend to be large, long, narrow, and thick. They are often curved, with smooth interiors lacking obtrusive bulbs of percussion or large ripple marks, perhaps indicating they were produced by direct soft hammer percussion or indirect percussion (Bradley et al. 2010). Some Clovis blades were serrated into denticulates. Others were turned into side scrapers, end scrapers, and graters, or were used in an unmodified form for a variety of tasks. Other Clovis blades do not exhibit use wear, so were either discarded without ever functioning as tools or were only ephemerally utilized (Bradley et al. 2010:10-55; Collins and Lohse 2004; Kilby 2008:13-14, 2014). Clovis blades and blade cores are commonly identified in the southern Plains and eastern North American culture areas (Boldurian and Cotter 1999; Collins 1999a, 1999b; Collins and Young 1989; Green 1963; Huckell 2007; Kilby 2008:13; Parry 1994; Sanders 1990), but overall, the geographic range of Clovis blade production is poorly understood (Bradley et al. 2010:55). Macroblades were identified in the Clovis component of the Sheaman site (Kornfeld et al. 2010:75), so could potentially exist in other Wyoming Clovis sites.

The most discussed aspect of Clovis lithic technology is the characteristic bifacial reduction strategy employed by Clovis peoples (Boldurian and Cotter 1999; Bradley 1982:203-208, 1993; Bradley et al. 2010:56-96; Huckell 2007; Kilby 2008:13; Stanford 1991). Clovis lithic

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assemblages often include large and relatively thin discoidal⁸⁷ or leaf-shaped bifacial cores and the flakes removed from them. These bifaces were shaped by systematically removing thin, wide flakes using careful platform preparation and guide ridge selection (Bradley et al. 2010). Flakes were removed in a highly controlled manner using several different reduction strategies, including the production of overlapping/transmedial/transverse flakes (which slightly overshoot the guide ridge in the center of the bifacial core), full-face flakes (which extend the width of the core but do not overshoot the opposite margin), overshoot/*oultrepassé* flakes (which overshoot the opposite margin of the core), end thinning flakes (which are taken from either end of the biface but are not meant to be left as flutes on the finished piece), and diving, comedial, invasive, and marginal flakes, which are taken from the lateral margins and do not extend past the medial center of the biface (Bradley et al. 2010:65). Generalized, amorphous core reduction also occurs in Clovis lithic assemblages, but is not diagnostic of the complex and seems relatively less common (Kilby 2008:14). For a visual example of a Clovis biface reduction sequence, see Kornfeld et al. (2010:468).

Historic and modern consensus suggests that overshoot flaking frequently characterizes Clovis production strategies more often than other Paleoindian phases (Huckell 2014; Kornfeld et al. 2010:60), but this has recently been questioned (e.g., Sellet 2015:86). Originally thought to result from flaking mistakes (Callahan 1979), some lithic analysts now consider Clovis overshoot flaking an intentional strategy that was employed to create large flakes useful for a variety of tasks, to thin bifaces or bifacial cores, and/or for removing square edges (Bradley et al. 2010:68-77; Eren and Desjardine 2014; Frison and Bradley 1999). Other recent research supports Callahan's (1979) original hypothesis that overshoot flaking is highly inefficient for manufacturing bifacial tools and therefore was likely accidental (Eren and Patten et al. 2013; Eren et al. 2014). The jury is still out on whether or not Clovis overshoot flakes were produced intentionally or inadvertently. Regardless, overshoot and other types of flakes were repeatedly produced from Clovis bifacial cores in a patterned and recognizable manner. Some scholars have hypothesized that flake removal continued until cores were too small to serve this purpose, at which point they may have been converted into bifacial cutting tools. Over the course of their use lives, these bifacial tools were often reduced further into Clovis points, knives, or other tool forms (Frison 1989; Huckell 1982, 2007; Kay 1996; Kilby 2008:13; Stanford 1991).

Stone Clovis points are an iconic aspect of the complex's material culture. Clovis points are characteristically lanceolate in shape, with margins that usually contract slightly towards the base but may be parallel or slightly excurvate, the bases are usually shallowly concave (Morrow 2014a:91-2), and the cross-sections are generally lenticular (see Boldurian and Cotter 1999:56-73 for descriptions and images of the type site specimens).

Clovis points commonly exhibit large basal thinning flake scars, called flutes, that usually extend to the maximum width of the biface, terminating at or past the area of the hafting element (Bradley 2010:469). Clovis points tend to be fluted on both sides, with channel flakes removed from the proximal end of the biface, producing shorter flute scars relative to the overall point length than are generally seen on Folsom points (see Bradley et al. 2010:100 for an illustration). That is, Clovis flutes generally do not run more than one half the length of the point (Morrow

⁸⁷ This type of core is sometimes called "Levallois-like" (Bradley et al. 2010:59).

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2014a:92). Clovis points were the first (but not the last) type of weapon tips to be fluted. Indeed, fluting technology was invented in the New World and appears earliest on Clovis points (Morrow 2014a:83). Later fluted-point cultures may have been derived from Clovis (Morrow 2014a:83), but Clovis fluting is distinct and other point types were fluted using different lithic reduction strategies (Bradley et al. 2010:100-101). According to some scholars, not all Clovis points were fluted, and in other cases, more than one flute was removed per side (Morrow 1995, 1996, 2014a). Finally, the Clovis point reduction sequence did not always end with fluting. Sometimes, post-fluting, “it is clear that care was taken not to have retouch invade the sides of the channel flake scars, while in other cases, retouch all but obliterated the fluting (especially on some cache points)” (Bradley et al. 2010:101). Whether Clovis points were fluted for functional (i.e., hafting, bloodletting, or costly signaling) or stylistic reasons remains debatable. For additional examples of Clovis point images, see Frison and Bradley 1982:153, Kornfeld et al. (2010:75), Taylor (2006:125, 131, 133-137), Jones (1996:187, 197), and Morrow (2016:25).

Clovis radiocarbon dates. The presence of a radiocarbon calibration plateau affecting Clovis-aged dates decreases the resolution at which the Clovis phase can be temporally understood (Fiedel 2014a; Haynes et al. 2007; Prasciunas and Surovell 2014). There are six sites in and immediately adjacent to Wyoming that include diagnostic Clovis technology in reasonably secure association with radiocarbon dates: Anzick, Colby, Sheaman,⁸⁸ Lange-Ferguson, Dent, and Indian Creek. The estimated age range for Clovis in and adjacent to Wyoming based on these sites is calculated as approximately 13,100-12,650 cal BP.⁸⁹

⁸⁸ Sheaman is traditionally interpreted as part of the Clovis cultural complex but might actually fit better within the Goshen complex, or be transitional between them (Frison 1988:87-88; Frison et al. 1996:208; Waters and Stafford 2014). Sellet (2015) argues that the Sheaman site might be Agate Basin.

⁸⁹ The estimated age range for the Clovis complex in and adjacent to Wyoming was calculated by first creating a pooled mean or “average” of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for Clovis complex ages. The summed 1 σ probability range (13,122-12,640 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age range for Clovis in and adjacent to Wyoming (circa 13,100-12,650 cal BP). This date range should be viewed as a hypothesized approximation. The addition of more dates might broaden the temporal span of the Clovis complex, and re-dating the sites already included with more precision might shrink its temporal range.

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Table-1. Key Clovis (or Possible Clovis) Sites in and Adjacent to Wyoming and Radiocarbon Dates.

Site Name	Site Number	Radiocarbon Dates (^{14}C BP)	Calibrated (2σ , Intcal13; cal BP)	Lab	Material	Citation(s) and Notes
Anzick-1 (Wilsall) ^{†G}	24PA506	10,705 \pm 35	12,722-12,590	CAMS-80538	Human bone collagen	Rasmussen et al. (2014)
Colby [†]	48WA322	11,200 \pm 220	13,448-12,707	RL-392	Mammoth bone collagen	Frison (1986b:22) H Holliday 2000a:245)
		10,864 \pm 141	13,060-12,559	SMU-254	Mammoth apatite	Frison (1986b:22) H
		(Average: 10,962 \pm 119)	(13,065-12,697)			
Sheaman ^{†pG}	48NO211	(Average: 11,224 \pm 50)	(13,193-12,999)	Published average of AA-40988 AA-40991 AA-40989	Bulk paleosol charcoal and insoluble organics	Haynes et al. (2004:32) Surovell (2014:32)
		10,305 \pm 15 (not used to calculate Clovis time span)			Bone/antler point	Waters and Stafford reject Haynes et al. (2004:32). According to Waters (2004:32) the osseous point the associated with Goshute radiocarbon age fits previously conceived ages than it does for because the projectile Sheaman might fit better than Clovis point variant (1996). They suggest a mixed assemblage or entirely Goshute. Therefore, the reported here for calculate the estimated Clovis. Sellet (2015) younger date, combination of the projectile point occupation of the Sheaman Agate Basin.
Lange-Ferguson [†]	39SH33	11,140 \pm 140	13,248-12,731	AA-905	Charcoal	Haynes (1992:360);
		10,800 \pm 530	13,758-11,139	I-13104		

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		<i>(Average: 11,118 ± 135)</i>	<i>(13,213-12,723)</i>		Mammoth bone collagen	Hannus (1990:52, 1991:51); publication uncorrected Haynes (1992:360);
Dent [†]	5WL269	11,200 ± 500	14,279-11,605; 11,524-11,502	I-473	Mammoth bone organics	Brunswick (2007a:91-92); 1992:360); Holliday (1991:51)
		10,980 ± 90	13,039-12,714	AA-2941	Mammoth bone DAX hydrolysate	Brunswick (2007a:91-92); Holliday (2000a:245-246) (1991:51)
		10,660 ± 170	12,896-12,041	AA-2942	Mammoth bone aspartic acid	Brunswick (2007a:91-92); Holliday (2000a:245-246) (1991:51).
		10,800 ± 110	12,976-12,543	AA-2943	Mammoth bone glutamic acid	Brunswick (2007a:91-92); Holliday (2000a:245-246) (1991:51)
		10,600 ± 90	12,725-12,377; 12,340-12,301; 12,284-12,236	AA-2945	Mammoth bone hydroxyproline	Brunswick (2007a:91-92); Holliday (2000a:245-246) (1991:51)
		10,710 ± 90	12,755-12,521; 12,477-12,428	AA-2946	Mammoth bone glycine	Brunswick (2007a:91-92); Holliday (2000a:245-246) (1991:51)
		10,670 ± 120	12,788-12,375; 12,347-12,235; 12,201-12,173	AA-2947	Mammoth bone alanine	Brunswick (2007a:91-92); Holliday (2000a:245-246) (1991:51)
		<i>(Average: 10,754 ± 42)</i>	<i>(12,740-12,636)</i>			Brunswick (2007a:91-92); Holliday (2000a:245-246) (1991:51)
Casper ^p (not used)	48NA304	11,190 ± 50	13,157-12,934	CAMS- 61899	Camel bone	Frison (2000:29); Haynes (2007); Prasciunas and Frison (2007). The date and diagnosis cannot not be associated (George). personal communication. deference to George's suggestion, this date is Clovis age range cal.

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						evidence that the date of the Clovis diagnostic.
Indian Creek ^{tp}	24BW626	10,980 ± 110	13,059-12,708	Beta-4619	Charcoal	Davis (1984); Davis (2000:17); Davis and (1992); Prasciunas and Haynes et al. (1992:5) (1999:297)
U.P. Mammoth ^{*†} (not used)	48CR182	11,289 ± 350 11,562 ± 88 11,596 ± 88 11,507 ± 116 11,547 ± 117	13,594-12,528; 12,459-12,439 13,568-13,226 13,589-13,253 13,557-13,121 13,586-13,128	I-449 AA-84864 AA-84865 AA-100399 AA-100400	Mammoth tusk organic matter Mammoth tusk collagen Mammoth tusk collagen Mammoth tusk collagen Mammoth tusk collagen	Haynes et al. (2013:) Haynes et al. (2013:) Haynes et al. (2013:) Haynes et al. (2013:) Haynes et al. (2013:)
La Prele ^{pf} (not used)	48CO1401	9060 ± 50 8890 ± 60 9600 ± 160 9631 ± 52 9871 ± 48 9924 ± 75 10,154 ± 47 10,323 ± 39 10,382 ± 40 10,650 ± 100		CAMS-72350 CAMS-74661 AA104893 AA105803 AA105497 AA105646 D-AMS 004329 D-AMS 004329 AA105496 AA104892	Mammoth KOH-collagen Mammoth untreated collagen Humates Humates Humates Humins Humates Humin Humins Humins	Byers (2002a:421) Byers (2002a:421) Mackie et al. (2016:) Mackie et al. (2016:) Mackie et al. (2016:) Mackie et al. (2016:) Mackie et al. (2016:) Mackie et al. (2016:) Mackie et al. (2016:) Mackie et al. (2016:)

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		10,654 ± 58		AA108894	Ultrafiltered collagen	Mackie et al. (2016:
		10,760 ± 30		UCIAMS-40174	Gelatin	Mackie et al. (2016:
		10,776 ± 59		AA108895	Ultrafiltered collagen	Mackie et al. (2016:
		10,844 ± 73		AA105499	Humates	Mackie et al. (2016:
		10,873 ± 35		AA107604	Humins	Mackie et al. (2016:
		10,963 ± 50		AA104814	Humins	Mackie et al. (2016:
		10,969 ± 52		AA105498	Humins	Mackie et al. (2016:
		(not used)				
Carter/Kerr-McGee		No dates	---	---	---	Frison (1984)
<i>Caches:</i>						
Crook County	Wyoming	No dates	---	---	---	Tankersley (1998)
Fenn	Utah/ Wyoming/ Idaho/ border	No dates	---	---	---	Frison and Bradley (provenience unknown)
Franey*	Nebraska	No dates	---	---	---	Grange (1964); Kilb
Mahaffy*	Colorado	No dates	---	---	---	Bamforth (2014); Yocum (2013b)
CW*	Colorado	No dates	---	---	---	Muñiz (2014); Holen
Drake	Colorado	No dates	---	---	---	Stanford and Jodry (2011:24-38).
Watts*	Colorado	No dates	---	---	---	Kilby (2008)
Sites in Alberta	Alberta, Canada	Various	---	---	---	Synthesis of academic research on Clovis sites in Alberta (2011:24-38).

* Indicates the site appears contemporary with Clovis but lacks diagnostics to establish cultural affiliation.

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[†] Indicates that other relevant radiocarbon dates exist but were excluded in favor of the most reliable/applicable dates.

^p Indicates probable (not definite) association between diagnostic artifacts and the radiocarbon date(s) listed.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with caution or not at all.

^G Indicates that some suggest that the site is possibly affiliated with the Goshen cultural complex, rather than Clovis.

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Goshen cultural complex description. “No one knows exactly when [the Goshen point type] starts, when it ends, and what its true geographic range is” (Sellet et al. 2009:750). Goshen has been recognized at numerous sites on the open plains as well as in foothill-mountain areas, but when the complex started and ended might vary regionally. Frison hypothesized that Goshen might have occurred later and/or lasted longer in foothill-mountain areas than it did on the open plains (Frison 2007b:33, 36).

Goshen points were first recognized as a distinct type in the 1970s, after they were excavated by Cynthia Irwin-Williams and Henry Irwin at Hell Gap, where they were thought to occur stratigraphically below Folsom at Locality I (Irwin-Williams et al. 1973). Discovered at the end of the Irwins’ last field season, a single complete and two incomplete Goshen specimens were initially and hastily lumped into what was thought to be the Clovis cultural complex because they occurred below Folsom. These points were later re-classified as Plainview,⁹⁰ and eventually named Goshen. Two “Midland” points were also identified during the 1960s Hell Gap excavations at Locality II (Irwin 1967), but are now thought by some scholars to be “indistinguishable from the Goshen points from Locality I” (Sellet et al. 2009:752; see also Frison 1992). Others disagree with the reclassification of these Midland points (Marcel Kornfeld, personal communication 2018).

Since the 1960s, other sites with Goshen components have been described throughout the Northwestern Plains (Frison 1992). Most notably, evidence from the Mill Iron site confirmed that Goshen ought to be considered its own cultural complex (Frison 1996). However, the Goshen cultural complex is still poorly defined both typologically and chronologically. This confusion may originate from the long time span and great morphological variability that appear to characterize Goshen points on the Northwest Plains. Goshen points “do not fit a strict template” (Sellet et al. 2009:750). That is, Goshen point bases might be straight or concave, with or without ears; their sides may be parallel, constricted, or expanding; their tips might be triangular or curvilinear; and their flaking patterns vary (Sellet et al. 2009:750). Like its southern counterpart, the Plainview point type (Holliday 1997; Holliday et al. 1999:446; Knudson 1983; Wheat et al. 1972), the Goshen type might currently function as a catch-all category. Future studies of Goshen point variability might lead to the refinement and/or revision of what the term “Goshen” means (e.g., see Sellet et al. 2009).

Recent intra-site analyses of the Hell Gap site archaeological materials have shown that Goshen points at Locality I exist in the same stratigraphic unit as Folsom, occurring both above and below Folsom and Agate Basin diagnostics (Sellet 1999, 2001; Sellet et al. 2009:752). However, as mentioned above, this study also relabeled several Midland points as Goshen. At the Jim Pitts site in South Dakota, investigators suggested that Goshen points mostly occur

⁹⁰ The labels “Plainview” and “Goshen” apply to points that appear typologically very similar—Goshen on the Northwest Plains and Plainview on the Southern Plains. However, Plainview may have occurred at a slightly different time than Goshen and their chronological relationship remains poorly understood (Frison et al. 1996:206; Holliday et al. 1999; Waters and Stafford 2014:547). To further highlight the morphological difficulties associated with these typological divisions, Buchanan and Collard (2010) found that the shape of the blade portions of Folsom and Plainview projectile points are indistinguishable.

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stratigraphically below Folsom, Agate Basin, Cody, and fishtail-shaped points, but a few were found in younger levels, in the same stratigraphic unit as the Folsom, Agate Basin, and fishtail points (Sellet et al. 2009:752). Some archaeologists contend that this point type mixing may be a result of bioturbation, rather than chronological reality (Marcel Kornfeld, personal communication 2018). Currently, based on radiocarbon dates and stratigraphy at all known sites in the region with Goshen components, it seems that the Goshen complex is as old or older than Folsom and probably coincided with several Paleoindian complexes younger than Folsom as well. Whether Goshen temporally overlapped with Clovis remains unclear, but available radiocarbon dates suggest that this is a distinct possibility (Frison 1996:8; Sellet et al. 2009; Waters and Stafford 2014).

Goshen points occur at a wide variety of site types, including open-air camps, kill/butchery locations, and rockshelters. Hell Gap localities I and II (Larson et al. 2009), the Jim Pitts site (Sellet et al. 2009), and Carter/Kerr-McGee (Frison 1984)⁹¹ are open-air, multi-component campsites. Mill Iron (Frison 1996) and Carter/Kerr-McGee (Frison 1984) are butchery areas and camps located near bison kills. Upper Twin Mountain in Colorado is a high elevation bison kill (Kornfeld and Frison 2000), and the Dilts site produced a single Goshen point associated with a bison kill (LaBelle 2007). Medicine Lodge Creek (Frison 2007) is an open-air habitation site sheltered at the base of a cliff, while Bush Shelter (K. Miller 1987, 1988), and Bentzen-Kaufmann Cave (Grey 1962, 1963) are closed rockshelter sites.

At most known Goshen sites, the predominant subsistence focus appears to have been bison. No clear evidence suggests that Goshen complex peoples hunted proboscideans or any other large end-Pleistocene megafauna besides bison. However, at Mill Iron, a modified fragment of mammoth rib was recovered in the camp processing area. This artifact may have functioned as some kind of mid- or foreshaft for a weapon, possibly an atlatl dart (Bradley and Frison 1996:66-67; Frison 2004:109).⁹² Other sparse evidence for osseous Goshen technologies also exists. Some have suggested that the osseous points from the “Clovis” occupation at Sheaman should actually be considered Goshen (Waters and Stafford 2014), opening the question of whether osseous points and rods similar to those identified at some Clovis sites also exist as part of the Goshen complex. Additionally, an incised bone disc, which may have been a pendant, was recovered in association with Goshen cultural complex materials at Mill Iron. It closely resembles a similar artifact recovered from the Folsom level at the Agate Basin site (Bradley and Frison 1996:68; Frison and Craig 1982:Figure 2.109k).

Goshen lithic technology description. Like the Clovis complex but unlike other Paleoindian complexes, Goshen seems to include a blade production industry (Bradley and Frison 1996:65; Irwin-Williams et al. 1973). Also like Clovis, Goshen lithic technology relies predominantly on a bifacial reduction strategy. Based on limited information from Mill Iron, it does not seem that Goshen points were often produced from flake blanks (Bradley and Frison 1996:65). Unlike Clovis, Goshen lithic reduction strategies do not, at present, seem to indicate any preference for

⁹¹ Carter/Kerr-McGee’s “Goshen” level might actually be Clovis, and the site type associated with this component is not yet clear (Marcel Kornfeld, personal communication 2018).

⁹² Also, a fossilized mammoth radius was discovered in Bentzen-Kaufmann Cave (Grey 1962, 1963). The association, if any, between the mammoth radius and the Goshen point is dubious.

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overshot flaking. Like Folsom peoples, Goshen toolkits sometimes include ultrathin bifaces (e.g., see Kornfeld et al. 2010:472). These impressions can and should be revised as more information regarding Goshen lithic materials becomes available.

When describing the Goshen points from Hell Gap, Cynthia Irwin-Williams (1973:46) suggested that “[t]ypical projectile points of the Goshen complex are lanceolate with parallel to slightly convex or concave sides and concave bases,” and that “in overall outline they resemble the Clovis form.” Considering the larger sample recovered from the Mill Iron site, Bruce Bradley and George Frison noted that “there is a wide range of forms present [...] To us, there is a greater resemblance in form to Folsom points than there is to Clovis points.” They further suggested that the defining characteristic of Goshen points is often the presence of “well controlled and evenly spaced pressure flake scars that include comedial and transmedial terminations. Flake scar orientations are mainly perpendicular to the point axis, except for the basal thinning flakes, which are parallel with it” (Bradley and Frison 1996:43). Michael Waters and Thomas Stafford (2014:541) likewise describe Goshen points as lanceolate in form, with transverse or collateral pressure flaking, basal thinning, slightly concave bases, and ground basal margins. Goshen points are generally lenticular in cross-section (Kornfeld et al. 2010:79, 473; Sellet et al. 2009:737).

Goshen radiocarbon dates. There are seven sites in the Wyoming area that contain diagnostic Goshen projectile points in reasonable association with radiocarbon dates: Hell Gap, Medicine Lodge Creek, Dilts, Mill Iron, Bush Shelter, Jim Pitts, and Upper Twin Mountain. The Hell Gap site contains dated Goshen complex materials at two different localities, which were treated as separate sites in this radiocarbon analysis. This gives a combined total of eight Goshen sites used to calculate the approximate span of Goshen for the Northwest Plains.⁹³ The estimated age range for Goshen based on these dates is 13,000-11,250 cal BP.

Key Goshen Sites in and Adjacent to Wyoming and Radiocarbon Dates.

⁹³ The estimated age range for the Goshen complex in and adjacent to Wyoming was calculated by first creating a pooled mean or “average” of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for Goshen complex ages. The summed 1 σ probability range (12,991-11,240 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age range for Goshen in and adjacent to Wyoming (circa 13,000-11,250 cal BP). This date range should be viewed as a hypothesized approximation. The addition of more dates might broaden the temporal span of the Goshen complex, and re-dating the sites already included with more precision might shrink its temporal range.

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Site Name	Site Number	Radiocarbon Dates (^{14}C BP)	Calibrated (2σ , Intcal13; cal BP)	Lab	Material	Citation(s) and Notes
Hell Gap: Locality I ^P	48GO305	10,955 \pm 135	13,087-12,673	AA-14434	Charcoal	Frison et al. (1996:214); Haynes et al. (2009:752); Stanford (1999) and Stafford (2014) for a cri
Hell Gap: Locality II ^P (Goshen-Folsom-Midland level)	48GO305	10,930 \pm 200	13,219-12,517; 12,492-12,424	A-503	Humates	Haynes et al. (1992:94, 96; 2009:752); these dates were produced by excavators on the "Midland" level which is now considered post-Midland (Irwin-Williams et al. (1973))
		10,690 \pm 500	13,561-11,101	A-504	Humates	Haynes et al. (1992:94, 96; 2009:752)
		10,290 \pm 500	13,089-10,568	A-502	Humates	Haynes et al. (1992:94, 96; 2009:752)
		(Average: 10,823 \pm 174)	(13,094-12,384; 12,266-12,244)			
Medicine Lodge Creek	48BH499	9700 \pm 620	12,706-9548	RL-154	Unpublished	Frison (2007b:33, Figure 3.2) (2009:752)
		9920 \pm 80	11,704-11,666; 11,646-11,201	Beta 183839	Unpublished	Frison (2007b:33, 36)
		(Average: 9916 \pm 79)	(11,701-11,670; 11,642-11,200)			
Dilts [†]	48CA4718	10,170 \pm 50	12,057-11,686; 11,682-11,620	CAMS-105766	Bison bone	LaBelle (2007:114); Sellet et al.
Mill Iron [†]	24CT30	10,450 \pm 25	12,529-12,451; 12,444-12,374; 12,351-12,231; 12,204-12,127	UCIAMS-61659	XAD collagen (bison)	Waters and Stafford (2014) states that the dates they produced are used in the literature (2015:137-139), Frison (1999), Haynes (1992), and Stanford (1999)
		10,465 \pm 20	12,538-12,382; 12,321-12,308; 12,274-12,239; 12,153-12,148	UCIAMS-98370	XAD collagen (bison)	Waters and Stafford (2014)
		10,435 \pm 25	12,522-12,467; 12,431-12,365; 12,358-12,221; 12,215-12,120	UCIAMS-98371	XAD collagen (bison)	Waters and Stafford (2014)

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		<i>(Average: 10,450 ± 15)</i>	<i>(12,525-12,457; 12,438-12,379; 12,329-12,302; 12,282-12,235; 12,174-12,120)</i>			
Bush Shelter	48WA324	9590 ± 180	11,388-11,377; 11,357-10,380; 10,317-10,301	UCR-2048		Frison (2007b:33; 1991b:27)
Jim Pitts	39CU114 2	<i>(Average: 10,185 ± 25)</i>	<i>(12,024-11,762)</i>	Published average of seven dates: AA-23767 AA-20294 AA-23782 Beta- 65398 SR-6155 AA-23777 AA-20291	Charcoal Charcoal Charcoal Charcoal Bison tooth Charcoal Charcoal	Sellet et al. (2009:752); Waters and see also Donohue and Sellet (1999:307).
Upper Twin Mountain	5GA1513	10,240 ± 70 10,450 ± 50 <i>(Average: 10,379 ± 41)³</i>	12,379-12,328; 12,308-12,273; 12,240-11,705; 11,662-11,651 12,546-12,122 <i>(12,411-12,057) ³</i>	CAMS- 16081 CAMs- 26782	Bison bone Bison bone	Kornfeld and Frison (2000:1 (2009:752); Stanford (1999: Stafford (2014) Kornfeld and Frison (2000:1 (2009:752); Waters and Sta
Carter/Kerr -McGee	48CA12	No dates (it is older than the Folsom level above it which dates 10400 ± 600 ¹⁴ C BP; RL- 917; charcoal)	---	---	---	Frison (1984); Haynes and S and Meltzer (2002:329). Ori Clovis but after Mill Iron wa technology at this site seems range of Goshen (Frison 198
Bentzen- Kaufmann Cave	48SH301	No dates	---	---	---	Grey (1962:240, 242). At th (Grey's [1962:243] point nu from "Level 3" without exac produced one post-Paleoind may or may not have been i Goshen point. Level 3 also i flaked, side-notched point (C number 9), three human teet

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						fossilized mammoth radius (Frison (1996:207; 1988:88).
Second Look	48SU1565	No dates	---	---	---	This site is a short-term hunt. Lithics include 13 designated and one possible Midland (H

[†] Indicates that other relevant radiocarbon dates exist but were excluded in favor of the most reliable/applicable dates.

^p Indicates probable (not definite) association between diagnostic artifacts and the radiocarbon date(s) listed.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with caution or not at all.

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StateEarly Paleoindian: Folsom/Midland (circa 12,700-12,000 cal BP)

Folsom/Midland cultural complex description. The Folsom complex is perhaps best known for its role in establishing the antiquity of humans in the Americas. Folsom complex materials have been identified on open plains, in foothill-mountain areas, and in southwest Wyoming. Folsom is probably the most-studied Paleoindian cultural complex (e.g., Amick 1999; Bradley 1982, 1991; Clark and Collins 2002; Frison and Bradley 1980; Hofman 1992; Hofman et al. 1990; Meltzer et al. 2002; Williams 2015). In that vein, Jack Hofman (2002:411) once noted that “[p]erhaps the most important aspect of Folsom archaeology is the fact that, at least for the Plains region, Folsom represents the earliest part of the archaeological record for which there is widespread, varied, and substantial evidence and documentation of human activity.” This may reflect prehistoric land use patterns, or could be because Folsom material culture is clearly defined and encompasses multiple diagnostic artifacts that are easily recognizable (Marcel Kornfeld, personal communication 2018). Known Folsom site types in and around Wyoming include a variety of single and multi-component camps, kills, butchery locations, hunting overlooks, and rockshelters.

Folsom lifeways and lithic technology appear markedly different than preceding Clovis strategies (Bradley 1993; Collard et al. 2010). Folsom toolkits were more diverse than Clovis toolkits, and contain larger numbers of formal end scrapers (Collins 1999b). Finally, while Clovis hunters appear to have exploited many different types of large (and smaller) animals, Folsom hunters appear to have focused predominantly on bison procurement (Collard et al. 2010; but see Hill 1994). Since at least the 1950s, the geographic distribution and abundance of Folsom technology has been equated with “the range of abundance of the bison of that time” (Sellards 1952:49; see also Anderson and Faught 2000; Bonnicksen et al. 1987; Fagan 1995; Fiedel 1992; Hofman 2002:402; Munson 1990; Willey 1966a). This classic view of Folsom peoples as bison specialists still holds weight in Paleoindian archaeology, though it has become more nuanced and couched in foraging theory (e.g., Sellet 2017). However, some archaeologists have suggested that Folsom subsistence may have been characterized by a highly mobile, generalized, broad spectrum foraging economy rather than bison specialization, especially in foothill-mountain areas (Kornfeld 1988, 2002:51; see also Amick 1994a).

There is debate as to whether Folsom peoples intentionally created frozen meat caches to ensure subsistence security through the winter (Frison 1982b; Grunwald 2016:191-192; Zeimens 1982) or whether they aggregated in locations where highly ranked prey was abundant in the late winter and early spring to take advantage of high concentrations of locally dispersed game resources (Hill 2008b:45). Either way, “scheduling and seasonality played a critical role in Folsom settlement/subsistence dynamics” (Hill 2008b:45).

One early question in Folsom archaeology recognized similarities between Folsom and Midland point types, asking whether or not Midland points should be considered unfluted Folsoms and/or part of the same cultural complex (e.g., Agogino 1969; Blaine 1968, 1971, 1991; Irwin 1971; Taylor 2006:163). W. James Judge (1970) wrote a classic paper on this topic, where he suggested slightly different production sequences for Folsom and Midland points. The production sequence was perhaps constrained by raw material availability; while Folsoms were reduced from large flake blanks, Midland points were reduced from small flake blanks. The

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implication here is that the original size of the raw material dictated whether a Folsom or a Midland point was the end product (Amick 1995); however, Judge (1970) interpreted these differences as resulting from distinct technological/cultural traditions.

Others have suggested that perhaps Midland points were transitional between fluted and unfluted lanceolate point styles (Hofman et al. 1990), though Folsom and Midland points have been found in stratigraphic association at many sites, including Hanson (Frison and Bradley 1980:15, 80), Lindenmeier⁹⁴ (Wilmsen and Roberts 1978:112), Blackwater Draw No. 1 (Hester et al. 1972:124), Agate Basin (Bradley 1982:194), and the Gault site in Texas (41BL323; Lassen 2015). Additionally, Folsom and Midland might have been contemporary at Scharbauer (the Midland type site; Holliday and Meltzer 1996; Wendorf and Krieger 1959; Wendorf et al. 1955). At Hell Gap, Midland points were identified by the original investigators and were purportedly found in a component that was sandwiched between two Folsom levels (Irwin-Williams et al. 1973). More recently, Frédéric Sellet (2001:53) suggested that the Hell Gap site's "Midland" points should actually be referred to as Goshen, but this is debated (Marcel Kornfeld, personal communication 2018).

By the 1990s, consensus existed among Paleoindian archaeologists that Folsom and Midland points should be considered the same type, or at least part of the same cultural complex (Amick 1994a, 1994b, 1995; Hofman 1992), and that "we should maintain a definition of Midland as an unfluted Folsom point" (Frison 1996:207). More recently, nuanced quantitative studies of Folsom subtypes, including classic Folsoms, Midlands, unifacially fluted, pseudo-fluted, and miniature points, show that differences exist among types but morphology and flaking patterns also overlap, leading to the conclusion that these varieties should all be considered subtypes of Folsom or Folsom variants (Amick 2002; Lassen 2013, 2015, 2016; Lassen and Williams 2015). Others disagree, arguing that Midland points should be considered a distinct type, discrete from unfluted Folsoms (Bradley 2009, 2010:474-5). Regardless of these equivocal typological distinctions, "fluted" Folsoms appear more commonly in northerly/colder sites, while "unfluted" Folsoms/Midlands appear at higher frequencies in southerly/warmer sites across the Great Plains (Lassen 2016; Pelton et al. 2016:173), which begs the question—why flute? And why flute more often in the north than in the south?

The preponderance of fluting might be explained as stylistic variation from the north to south (Lassen 2016:157), chronological variation (Folsom points may have emerged earliest in the north and spread southward through migration; Collard et al. 2010), by differences in raw material variability (Judge 1970); or other hypotheses. When fluted and unfluted Folsoms co-occur within a single assemblage or geographic area, similar arguments are made to explain why some points are fluted while others are not. On the symbolic side, it has been suggested that fluting might serve as an ethnic marker and/or had other ritual or social significance (Ahler and Geib 2000; Frison 1988:94; Frison and Bradley 1982:211; Frison and Stanford 1982:365; Bradley 1991:375-379, 1993:255-256). Part of these symbolic explanations rest on the notion that Folsom point production, and specifically the fluting process, requires sufficient skill that flintknapping specialists may have been in charge of point production (Bradley 1982:197; Bamforth 1988). However, at Stewart's Cattle Guard, a Folsom site in Colorado (5AL101), fluting occurred in every hearth-centered activity area. This finding refutes the "fluting

⁹⁴ Some of the "Midland" points from Lindenmeier are now considered possibly Goshen (Lassen 2016:152).

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specialist” hypothesis while supporting that each hearth-nucleated social group fluted their own points (Jodry 1997, 1999a; Jodry and Stanford 1992). Whether they were manufactured by specialists or not, the fluting of Folsom points may have had some kind of symbolic significance.

Many technofunctional explanations for fluting have also been proposed. Flutes may be preferred because they provide a flat surface for hafting, and might compensate for a lack of mastic or the knowledge to produce it (Wilmsen 1974:52; Wilmsen and Roberts 1978:176-177). Flutes may have allowed for multiple points to interchangeably fit within a single foreshaft (Judge 1973). Other functional arguments suggest that Folsom flutes may have increased weapon performance by decreasing the point’s weight, increased penetration potential, enhanced bloodletting, and/or allowed for increased ability to maintain points by resharpening (Ahler and Geib 2000, 2002; Buchanan 2006; Crabtree 1966; Geib and Ahler 2002; Hunzicker 2008; Roberts 1935).

Assuming that fluting has some technofunctional benefits, the most common functional argument to explain the *absence* of fluted Folsoms suggests that choosing not to flute favors conditions where raw material is scarce (Amick 1994b, 1995, 1999; Hofman 1992). This expectation is closely associated with the observation that fluting results in extremely high failure rates that inadvertently destroy the point during the fluting process (Akerman and Fagan 1986; Boldurian et al. 1985; Ellis and Payne 1995; Flenniken 1978; Geib and Ahler 2002:268; Gryba 1988; Ingbar and Hofman 1999:101; Sellet 2004:1558; Sollberger 1985; Winfrey 1990). Indeed, flutes may have required significant investment of time, specialized equipment, and skill to produce efficiently (Bamforth 1991:311-314; Frison and Bradley 1981). An additional consideration is whether (and how) Folsom fluting might have evolved from Clovis fluting (Ahler and Geib 2002; Asher 2015; Buchanan and Collard 2008; MacDonald 2010; Morrow and Morrow 1999).

If fluting had clear technofunctional benefits, it is likely it would have been invented or adopted elsewhere in the world at one time or another. However, fluting is unique to Clovis and Folsom times in North America (Robert L. Kelly, personal communication 2018). Purely functional arguments to explain fluting behaviors tend to fall apart in light of the observation that bison killing appears to be just as (or more) effective using unfluted lanceolate styles as it with fluted point types (Frison 1991b; Hayden 1982; MacDonald 2010). Recently, a paper by Spencer Pelton and colleagues (2016) attempted to explain differences in the frequency of Folsom fluting from north to south by suggesting that Folsom peoples in colder environments experienced “bored” down-time, which provided them with an enhanced time budget for indoor activities (such as fluting) when outdoor subsistence behaviors were not possible due to the weather. This intriguing hypothesis probably requires further refinement and testing, but is fascinating nonetheless.

“By far the greatest amount of effort expended on the study of Paleoindian flaked stone technology, both on paper and in replication efforts, has focused on Folsom point manufacture” (Bradley 2010:475-476). An enormous proportion of that time has been devoted to understanding and explaining Folsom fluting. Though lithic studies dominate the literature, our understanding of the Folsom cultural complex extends far beyond Folsom projectile point manufacturing processes. In recent years, much attention has focused on Folsom intrasite spatial patterning. At Stewart’s Cattle Guard in Colorado, a detailed study of spatial patterning allowed

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for the identification of multiple hearth-centered and other activity areas, perhaps representing gendered segregation of space (Jodry 1992, 1997, 1999a; Jodry and Stanford 1992). Contra the findings at Stewart's Cattle Guard, intrasite spatial patterning at Lindenmeier "suggest[s] an integrated suite of activities undertaken across the site with logical segmentation of space and association of tools into specific toolkits" (Chambers 2015:ii). At Hanson, intrasite patterning using GIS revealed the presence and extent of activity areas, including hearths, potential lodge structures, and secondary butchering areas (Arnold 2007:95). Multi-scalar syntheses of intra- and inter-site patterning suggest that Folsom adaptive systems may have been more variable and regionally specific than is generally recognized (Andrews et al. 2008).

In perhaps the most novel and innovative of these spatial patterning studies, analysis of artifact density across space allowed for the identification of several Folsom-aged structures at Barger Gulch in Colorado, even in the absence of post-holes or other obvious dwelling-related evidence (Surovell et al. 2005; Waguespack and Surovell 2014). Incidentally, several other Folsom sites in Wyoming and Colorado have yielded evidence of habitation structures. Post molds were identified at Hell Gap Locality II Midland level (Irwin-Williams et al. 1973:50), and lodge floors were identified at Hanson (Frison and Bradley 1980). Another Folsom structure was described at the Mountaineer site in Colorado (5GN2477; Stiger 2006). Recently, two more were documented in southwestern Wyoming (Smith and McNees 2016). The identification of Folsom complex activity areas and households could lead to comparative studies that would potentially allow for a suite of archaeological questions to be addressed, including Folsom family composition, task differentiation, presence/absence of social stratification between households, seasonal group fissioning/fusioning, and many other topics. Archaeologists have barely scratched the surface of the research questions suggested by these intrasite household patterning studies.

Additionally, comparisons among Folsom households and activity areas could potentially be used to test some expectations for Folsom behavior suggested by ethnographic analogies. For example, Douglas H. MacDonald (1998, 1999) posited that we should expect that Folsom groups were patrilineal and patrilocal, characterized by low population densities and high residential and logistical mobility. They would have traveled long distances to find mates. Children would have learned from many teachers within each group, resulting in a slow mode of cultural transmission. The Folsom bison hunting specialization suggests that males disproportionately contributed to group subsistence, which may have encouraged a male-biased juvenile sex ratio due to female infanticide. These expectations were drawn from ethnographic inferences and are obviously equivocal. But many of the social and demographic patterns expected to characterize Folsom peoples' behavior (MacDonald 1998, 1999) could be tested through intra- and inter-site comparisons of household composition and task differentiation.

Beyond lithics, numerous painted, incised or engraved bone, stone, ivory, and personal ornamentation objects have been identified at Folsom-aged sites across the Great Plains (Lemke et al. 2015). Notably, a painted bison skull was identified at the Cooper bison kill in Oklahoma; it is the oldest known painted object in North America (Bement 1999:37-39, 177). On Northwest Plains, Lindenmeier yielded many incised bone pieces and a bone bead (Wilmsen and Roberts 1978: 132-133). The Folsom level at the Agate Basin site also produced many incised bone fragments (Frison and Craig 1982:168-170). Ochre also appears to have been important to Folsom peoples at numerous Northwestern Plains sites (e.g., Hanson [Frison and Bradley 1980],

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Lindenmeier [LaBelle and Newton 2010], Agate Basin [Frison 1982:69], and Hell Gap [Ćurčija 2015]). Like Clovis and possibly Goshen cultural complexes, the Folsom complex is also known to contain osseous points.⁹⁵ Bone points were associated with the Folsom component at the Agate Basin site, for example (Frison and Craig 1982:162-5; Frison and Zeimens 1980). In 2014, a mammoth tusk tool was excavated from the Folsom level at Hell Gap Locality I (Kornfeld et al. 2015).⁹⁶

Folsom/Midland lithic technology description. The Folsom/Midland cultural complex includes several types of diagnostic lithics. The presence of Folsom-style channel flakes provides direct evidence that Folsom projectile points were manufactured at a site even if the points themselves are no longer present in the archaeological record (e.g., Sellet 2004; see also Kornfeld et al. 2010:59). Channel flakes are sometimes modified into other tools or used as tools in an unmodified form (Frison 1982:53; Frison and Bradley 1980:103).

The Folsom complex is also associated with diagnostic, ultrathin bifaces. These bifaces have flat cross-sections and may have been reduced from large flake blanks or bifacial cores. Bifaces are diagnostically “ultrathin” when a reduction process of “opposed diving flaking” is employed (Lassen 2016:26). This entails removing flakes from each edge of the biface that terminate in hinge fractures near the center, resulting in a biface that is actually thinner in its center than towards its edges (Collins 1999b:21-24; Lassen 2013:25-6; Root et al. 1999:152-154; Frison and Bradley 1980:31-42). Since Folsom ultrathin bifaces tend to be found predominantly at camp rather than kill sites, they may have been used for fine butchering work rather than preliminary dismemberment, potentially functioning as fillet knives (Jodry 1998).

Classic Folsom projectile points (Meltzer 2006c; Wilmsen 1974) are simply defined as “bifacially fluted, with channel flakes extending up the majority of their length” (Lassen 2016:150), or “more than 50% of their total surfaces” (Taylor 2006:164). They are lanceolate in form, usually with margins that contract slightly towards the base, are usually smaller than Clovis points and exhibit “more refined workmanship” (Stanford 1999:300). The greatest widths are approximately two-thirds of the way between the base and the tip. The bases are concave, with “ears” flaring slightly laterally on each side. Tips may be abruptly or gradually tapered (Frison and Bradley 1980:80).

Folsom point production begins with the manufacture of blanks. Eventually, preforms are pressure flaked perpendicular to their edges in a parallel, collateral fashion, creating a central ridge. Once the point’s outline is shaped, a “nipple” platform at the center of the basal ridge is created to remove the first flute. This process is then repeated to remove the second flute. After fluting, final marginal retouch and tip shaping take place. Sometimes retouch is selective, and only affects marginal areas left between the pre-fluting pressure flake scars; this style is done bifacially, and the retouch flakes do not run to the edge of the channel flake scars. On other Folsom points, retouch is finely spaced, runs to the edge of the channel flake scars, and produces

⁹⁵ Alan Osborn suggests that weapons may have been fashioned out of osseous materials in response to wood scarcity during this paleoclimatic regime (Osborn 1999).

⁹⁶ There are several possible explanations for this. Perhaps that mammoth persisted on the Northwest Plains longer than generally accepted, the item is an heirloom, or the tusk was collected and subsequently shaped into a tool by Folsom peoples (Kornfeld et al. 2015).

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a steep edge-bevel. Tip shaping may occur by pressure thinning the distal end of the point, often removing step or hinge fractures present at the channel flake termination scar. After retouch, points were ground from the proximal ends of the ears to the widest place on the point. The basal edge may also be ground, but not always (Frison and Bradley 1980:46-52; Lassen 2013). Interestingly, according to some lithic analysts, Folsom points are “extremely homogeneous” compared to the variation found in other post-Clovis point types (Stanford 1999:298). For images and photos of points from the Folsom type site in New Mexico, see Meltzer (2006c:262-265).

As mentioned in a previous discussion, some lithic analysts define Midland points as unfluted Folsoms (e.g., Frison et al. 1996:207). In these cases, the above definition for classic Folsom points can be applied to Midland points, minus the channel flake scars. Others suggest that Midland points are distinct from unfluted Folsoms based on differences in final shaping/thinning and marginal retouch reduction strategies (Bradley 2009, 2010:475). Bruce Bradley suggests that Midland points are distinguishable from unfluted Folsoms in that they are characterized by wide, shallow flake scars and very flat cross sections. These flat cross sections were created by collateral flaking that overlaps across the center of each point, rather than comedial flaking terminating in a medial ridge (Lassen 2016:151). Like some Folsom points, Midlands are characterized by noninvasive, abrupt, continuous marginal retouch that narrowed them so that ridges left by thinning flake scars were mostly obliterated (Bradley 2010:475). Finally, Lassen (2016:151) suggested that Midland points are generally thought to be thinner than Folsoms, with maximum thicknesses often less than 4 mm; however, in a sample of approximately five hundred Folsom and Midland points, the same researcher (Lassen 2013:116) found that there was no significant difference in thickness between them.

Since Folsom and Midland points are often found together, and there are no sites that unequivocally contain Midland points that do not also contain Folsoms (Bradley 2010:474), the two point subtypes are considered part of the same cultural complex for the purposes of this historic context. Lumping them into the same cultural complex currently makes sense based on the limited evidence available today, but this could potentially change in the future if two conditions are met: lithic analysts must quantitatively show that Midland points are distinct from unfluted Folsoms, and Midland points must be clearly identified in contexts separate from Folsom points.

Folsom/Midland radiocarbon dates. Folsom points have been identified in context with radiocarbon dates at ten sites in and adjacent to Wyoming: Lindenmeier and Barger Gulch Locality B in Colorado, Indian Creek and MacHaffie in Montana, and Agate Basin, Hanson, Two Moon, Hell Gap Locality I, China Wall, and Carter/Kerr-McGee in Wyoming. The youngest known and dated Folsom site in this region is Two Moon rockshelter in the Bighorn Mountains of northern Wyoming, with an uncalibrated date of $10,060 \pm 60$ ^{14}C BP (Finley 2008:103-115; Finley et al. 2005:229-238; Kornfeld et al. 2010:366-371). This young date suggests that Folsom may have persisted longer in foothill-mountain regions than on the open

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plains, but the sample of dates is not large enough to test this hypothesis. The estimated age range for Folsom/Midland based on dates from these ten sites is 12,700-12,000 cal BP.⁹⁷

Surovell and colleagues (2016) recently estimated the temporal range of Folsom on the Great Plains as 12,610-12,170 cal BP. They produced this estimate using very selective, precise radiocarbon dates and excluded the two oldest and the youngest date in their sample. Additionally, the young date from Two Moon did not meet their stringent selection criteria. While Surovell and colleagues' (2016) approximation likely underestimates the true time span during which the Folsom complex manifested on the Great Plains, the methods used in this historic context may overestimate it. Regardless of the methods used, Folsom seems to have persisted in this region for somewhere on the order of 440-670 calendar years.

⁹⁷ The estimated age range for the Folsom/Midland complex in and adjacent to Wyoming was calculated by first creating a pooled mean or "average" of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for Folsom/Midland complex ages. The summed 1 σ probability range (12,676-12,007 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age range for Folsom/Midland in and adjacent to Wyoming (circa 12,700-12,000 cal BP). This date range should be viewed as a hypothesized approximation. The addition of more dates might broaden the temporal span of the Folsom/Midland complex, and re-dating the sites already included with more precision might shrink its temporal range. Furthermore, it was assumed that the Midland point type spans the same temporal range as the Folsom point type for the purposes of this analysis, but future data might show that this is not necessarily the case.

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Table -2. Key Folsom/Midland Sites in and Adjacent to Wyoming and Radiocarbon Dates

Site Name	Site Number	Radiocarbon Dates (¹⁴ C BP)	Calibrated (2σ, Intcal13; cal BP)	Lab	Material	Citation(s) and Notes
Lindenmeier [†]	5LR13	10,560 ± 110	12,708-12,131	TO-337	Charcoal	Haynes et al. (1992:89, 90);
		10,500 ± 80	12,650-12,117	TO-342	Charcoal	Haynes et al. (1992:89, 91)
		(Average: 10,521 ± 65)	(12,663-12,371; 12,353-12,230; 12,208-12,150)			
		10,780 ± 135 (not used)	12,996-12,419	I-141	Charcoal	Haynes and Agogino (1960) for fractionation (Haynes et al. date was not used because the clear association with Folsom and Roberts 1978:40-41).
		11,200 ± 400 (not used)	13,966-120,99	GX-1282	Charcoal	Wilmsen and Roberts (1978) (1992:89, 91). This date was sample was possibly contaminated by preservative.
Indian Creek ^{p†}	24BW626	10,630 ± 280	13,084-11,606; 11,524-11,502	Beta-13666	Bulk sediment	Davis (1984:10); Davis and Davis and Thompson [Greis (1992:94)
		10410 ± 60	12,529-12,453; 12,444-12,061	TAMS-Unpublished number	Bison bone	Davis and Baumler (2000:17)
		(Average: 10,420 ± 60)	(12,533-12,076)			
Agate Basin [†]	48NO201	10,780 ± 120	12,976-12,521; 12,476-12,428	SI-3733	Charcoal	Frison (1982b:179); Haynes and Stanford (1999:297). Recovered from Area 2 of the site.
		10,430 ± 25	12,519-12,475; 12,427-12,121	UCIAMS-122570	XAD Collagen	Carlson et al. (2016:92; 2016:4)
		10,135 ± 25	11,987-11,852; 11,849-11,696; 11,673-11,628	UCIAMS-122571	XAD Collagen	Carlson et al. (2016:95; 2016:4)
		(Average: 10,293 ± 17) ³	(12,152-11,970) ³			
Hanson [†]	48BH329	10,626 ± 77	12,712-12,421	AA-106384		Surovell et al. (2016:4) redated; they produced are used here; Bradley (1980:10); Haynes et al. (1991b:25); Ingbar (1992:17)

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		10,600 ± 77 10,688 ± 77 <i>(Average: 10638 ± 44)</i>	12,715-12,394 12,736-12,528; 12,461-12,438 <i>(12,705-12,546)</i>	AA-106385 AA-106386		Surovell et al. (2016:4) Surovell et al. (2016:4)
Two Moon	48BH1827	10,060 ± 60	11,946-11,879; 11,830-11,315	Beta-164002	Charcoal	Finley (2008:103-115); Finley and Kornfeld et al. (2010:366-371)
Hell Gap Locality I [†]	48GO305	10,490 ± 62	12,603-12,126	AA-77592UF	Collagen	Surovell et al. (2016:4) re-dated component, and that date is consistent with Haynes (2009) and Stanford (2009)
Barger Gulch Locality B [†]	5GA195	10,770 ± 70	12,767-12,572	Beta-173385	Charcoal	Surovell et al. (2016:4; 2005) and Waguespack (2007); Surovell et al. (2016:4; 2005)
		10,470 ± 40	12,588-12,371; 12,354-12,229; 12,208-12,138	Beta-173381	Charcoal	Surovell et al. (2016:4; 2005) and Waguespack (2007); Surovell et al. (2016:4; 2005)
		<i>(Average: 10,544 ± 35)²</i>	<i>(12,620-12,415)²</i>			
Carter/Kerr-McGee [†]	48CA12	10,600 ± 25	12,653-12,539	UCIAMS-122572	XAD Collagen	Carlson (2015:139)
		10,520 ± 25	12,561-12,417	UCIAMS-122573	XAD Collagen	Carlson(2015:139)
		<i>(Average: 10,560 ± 18)²</i>	<i>(12,631-12,626; 12,624-12,522; 12,486-12,429)²</i>			
		10,400 ± 600 (not used)	13,408-10,480; 10,466-10,427	RL-917	Charcoal	Frison (1984:300); Haynes et al. (1999:298)
MacHaffie	24JF4	10,390 ± 40	12,418-12064	Beta-159167	Bone collagen (bison)	Davis et al. (2002:19); Forbis and Sperry (1952); Malouf (1963:1963) (1999:298).
		10,090 ± 50	11,970-11,864; 11,840-11,395	Beta-159058	Bulk soil	
		<i>(Average: 10,273 ± 31)²</i>	<i>(12,159-11,933; 11,889-11,834)²</i>			
Rattlesnake Pass	48CR4520	9950 ± 150	---	TX-6304	Bulk sediment	Smith and McNees (1990:27) too young due to contamination associated paleosols, so they are not used
(not used)		9770 ± 150	---	TX-6305		

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		(not used)			Bulk sediment	
Wasden/Owl Cave ^P (not used)	10BV30	12,250 ± 200 12,850 ± 150 10,920 ± 150 (Due to unclear association, these dates were not used)	--- --- ---	WSU-1259 WSU-1281 WSU-1786	Bone collagen (mammoth) Bone collagen (mammoth) Bone collagen (mammoth)	Miller (1978, 1982); Butler (1977); Miller (1977); Lohse and Armitage (1996:517) publishes a different interpretation but the origins of this young site from the first investigations at this site. The points in apparent association with some of which were anthropogenic. In real, this association would not be a site with Folsom cultural context with proboscidean remains. Archaeologist Suzann Henriksen is currently re-investigating the site. Henriksen et al. 2013; Henriksen et al. 2013.
Krmpotich	48SW9826	No associated dates	---	---	---	Kornfeld et al. (2010:409-411) (2002); Peterson (2001)
Fowler-Parrish	5WL100	No dates	---	---	---	Agogino and Parrish (1971) small, predominantly redeposited
Rocky Folsom	48CK840	No dates	---	---	---	Kornfeld (1988). This is a small
Adobe	48CA2162	No dates	---	---	---	Hofman and Ingbar (1988). as a "hunting overlook" activity
Montgomery	42GR1956	No dates	---	---	---	Davis (1985). This is described
Johnson	5LR26	No dates	---	---	---	Galloway (1961). This is a Folsom many quartzite points.
Chain Lakes	---	No dates	---	---	---	Frison et al. (2015). These are sites in southwestern Wyoming
Sites in Alberta	Alberta, Canada	Various	---	---	---	Synthesis of academic and Canadian sites in Alberta, Canada (Pecqueur)
48SW97	48SW97	No dates	---	---	---	Two Folsom structures associated (Smith and McNees 2016).
KibRidge Yampa (not used)	5MF3687	10,260 ± 90 (not used)	---	Beta-111327	Charred material	The investigators identified excavated from sediments and included an image of the artifact. However, the small artifact was independently confirmed as a photograph. Hauck and Hauke (Appendix B).
China Wall ^P	48AB1	10,630 ± 50	12709-12529; 12457-12441	Beta-14719	Soil organics	Waitkus (2013:8-3)
Forest Canyon Pass	5LR2	No dates	---	---	---	This large multicomponent known Folsom artifact from

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						National Park, a reworked p 2007b:275).
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[†] Indicates that other relevant radiocarbon dates exist but were excluded in favor of the most reliable/applicable dates.

^p Indicates probable (not definite) association between diagnostic artifacts and the radiocarbon date(s) listed.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with caution or not at all.

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StateMiddle Paleoindian: Agate Basin (circa 12,400-11,600 cal BP)

Agate Basin cultural complex description. Agate Basin points occur on the open plains, in foothill-mountain areas, and in southwest Wyoming. They have occasionally been found outside their home range on the Plains in the Midwest, and potentially as far east as New Jersey⁹⁸ (Schneider 1982a, 1982b; Stanzas 1996). “Despite the widespread occurrence of the Agate Basin cultural complex along the Rocky Mountain Front Range and northern Plains, the absolute age of this complex is poorly defined—only a handful of chronometric dates, many with large uncertainties [...] have been published” (Lee et al. 2011:243) and “it remains today among the least well understood Paleoindian technocomplexes in North America because of a paucity of recorded Agate Basin components in stratified contexts” (Mandel et al. 2014:91).

Though precisely when Agate Basin fits into the Paleoindian chronology remains debatable, many archaeologists now agree that the Agate Basin cultural complex overlaps at least partially with the preceding Folsom complex (as well as Goshen) and the ensuing Hell Gap complex (Sellet et al. 2009). Partial or full coevality with Goshen, Folsom and Hell Gap are supported by both radiocarbon dates and stratigraphic relationships at multiple sites. At Beacon Island, a short-term *Bison antiquus* kill/camp site in North Dakota, a Goshen point was uncovered with an otherwise single-component Agate Basin kill (Ahler 2003; Ahler et al. 2006; Mitchell 2012; Sellet et al. 2009:753). At the Jim Pitts site, a multicomponent campsite with butchered bison in South Dakota, a single archaeological unit contained Goshen, Folsom, Agate Basin, and Fishtail points (Sellet 2001; Sellet et al. 2009). At the Allen site, a multicomponent campsite in Nebraska, an Agate Basin point was found in the same occupational level as a possible Hell Gap point (Bamforth 2002b:63, 2007:151). At the Jones-Miller Hell Gap site in Colorado (Stanford 1974, 1978) the Hell Gap points “tend to have slight shoulders, which approach the Agate Basin type (Stanford 1978:92), and Sellet and colleagues (2009:753) suggest that one of these points is clearly Agate Basin.

In Wyoming, Goshen, Folsom, and Agate Basin may co-occur at Hell Gap Locality I (Sellet 1999, 2001; but see Irwin 1967, Irwin-Williams et al. 1973, Larson et al. 2009), and Hell Gap points were found in several Agate Basin components at Hell Gap localities (Bradley 2009:264). A Hell Gap point was recovered from an Agate Basin level at the Agate Basin site Area 2 (Frison 1982:140). At Carter/Kerr-McGee, Agate Basin points are stratigraphically inseparable from Hell Gap points (Frison 1984:300). All of these relationships comprise mounting evidence that refutes the traditional, unilineal view of Early and Middle Paleoindian culture history (Sellet et al. 2009). Avocational archaeologist Jeb Taylor (2006:187) suggested that we might consider recognizing this relationship between Agate Basin and Hell Gap points by terming them “co-complexual.” In his recent culture-historical synthesis of Alberta, Canada, Peck (2011:55) likewise defines Hell Gap and Agate Basin as separate point types within the same cultural complex. Bruce Bradley (2009:264) disagrees, suggesting that the Agate Basin and Hell Gap points occasionally co-occur because of post-depositional mixing. If Paleoindian complexes overlapped and for how long remains debatable, but the state of the evidence does

⁹⁸ Some scholars have cautioned that similar leaf shaped points found over much of central North America are often called Agate Basin points but are not “true Agate Basin points [which are] rarely found outside of Wyoming and immediately adjacent states” (Bryan 1980:77).

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suggest that the Early and Middle Paleoindian chronologies do not exhibit perfect unilineal succession from one point type to the next. Agate Basin points in particular appear at least partially coeval with multiple Early and Middle Paleoindian complexes over time and possibly space. However, these examples are largely anecdotal, and the possible association of point types at these sites is debatable (Marcel Kornfeld, personal communication 2018).

Known Agate Basin site types in and around Wyoming include single and multi-component bison kills or butchery areas that may be associated with short-term camps (Frazier, Agate Basin, Carter/Kerr-McGee, Beacon Island) and open, multi-component campsites (Hell Gap, Jim Pitts, Allen). Several recent zooarchaeological studies have recently expanded on previously sparse information pertaining to Agate Basin lifeways (Byers 2001, 2002b, 2009; Hill 2001, 2007, 2008a, 2008b). This sample of Agate Basin sites suggests that Agate Basin complex peoples were large game hunting specialists that focused predominantly on bison for subsistence, sometimes using intensive secondary processing to maximize the calories obtained from each animal (Byers 2001, 2002b, 2009), and sometimes not (Hill 2008b:61).

However, this apparent bison specialization might simply be a product of sampling bias. Most Agate Basin complex sites in this region that have contributed to our understanding of Agate Basin lifeways tend to occur on the open plains, and are “highly visible and intensively investigated megasites” (Hill 2008b:100), suggesting an imbalance in research emphasis and a biased understanding of the archaeological record (LaBelle 2005). Hill (2008c) proposed that Early, Middle, and Late Paleoindian (including Agate Basin) foragers targeted different types of prey depending on which habitat they occupied (i.e., foothill-mountain versus open plains regions). In homogenous grassland environments, subsistence strategies tended to focus almost exclusively on hunting large prey such as bison. In more diverse, foothill-mountain type settings, foragers exploited large prey when possible but more commonly utilized a wide variety of smaller prey items (Hill 2008c).

On the other hand, this apparent bison specialization might accurately reflect Agate Basin complex lifeways in general. At the Hell Gap and Agate Basin sites, occupations preceding and following the Agate Basin phase appear to have relied less heavily on bison than Agate Basin peoples (Rapson and Niven 2009:120; Walker 1982:281).⁹⁹ Indeed, the number of animals at bison kills seems to increase from Folsom to Agate Basin phases, perhaps indicating larger human groups or greater seasonal, cooperative, interband hunting (Stanford 1999:313). Cooperative hunting during the Agate Basin phase is independently supported by the results detailed in Michael Guarino’s (2014) Master’s thesis. Guarino (2014:iii) reported that Agate Basin points’ hafted-area morphologies from the Agate Basin site are standardized and

⁹⁹ At Hell Gap, this assertion was based on the percentage of Bison MNI as compared to other medium and large-bodied mammals excavated during the 1960s Hell Gap excavations: elk, pronghorn, and deer. Level 1 (Goshen/Folsom) contains 67% bison, Levels 2 and 2E (Agate Basin/Folsom) contain 75% bison, and levels 3-6 (Hell Gap) contain 57% bison. These values were calculated from a table presented in Rapson and Niven (2009:120). At the Agate Basin site, Bison comprise roughly 13% of the total Folsom faunal assemblage, 93% of the total Agate Basin assemblage, and 15% of the total Hell Gap assemblage based on MNI and calculated from a table presented in Walker (1982:281). This trend may exist simply because the Folsom level at Agate Basin was a camp and activity area while the Agate Basin level was a kill/processing area (Walker 1982:281). Confirming the validity of these statements would require systematic and comprehensive quantitative testing of all known, provenienced faunal remains from each site. See also Hill (2001).

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“consistent with expectations we might have if sharing of weaponry elements was planned for in preparation for a communal hunt.” Clovis points, on the other hand, do not have standardized bases (Buchanan et al. 2012).

In a comparative study of Folsom and Agate Basin lifeways based on the Agate Basin type site assemblages, Hill (2008b:59) suggested that both Folsom and Agate Basin peoples were “almost certainly bison specialists,” occasionally executing unplanned mass kills in an opportunistic manner, but predominantly conducting kills of smaller magnitude by targeting only a few individuals at a time. To test whether these impressions accurately reflect general patterns in Agate Basin peoples’ behavior, investigations focused on smaller, short-term sites with lower artifact densities and located in varied microenvironments should be conducted in the future, as they will broaden our understanding of Agate Basin lifeways and help fill out a more complete picture of settlement, subsistence, and mobility strategies.

Few osseous tools have been identified and/or reported from Agate Basin contexts. One bone artifact which resembles part of a bone harpoon was recovered from the Agate Basin level at the type site (Frison and Craig 1982:172). If other Agate Basin sites yield evidence of fishing in the future, this behavior would make an interesting addition to Agate Basin complex lifeways on the Northwest Plains.

Agate Basin sites often include art objects. An incised bone object, for example, was identified at the Agate Basin site (Frison and Craig 1982:172). Three bone beads, likely manufactured from small- to medium-sized mammal long bone shaft sections, were found at Beacon Island (Mitchell 2012:201-202). The surfaces of the beads appear carefully smoothed, and are uniformly shaped; the investigators suggest “it seems highly likely that all three originally belonged to a single string, which came apart during the Agate Basin occupation” (Mitchell 2012:202). A variety of pigments were also identified at Beacon Island, including red ochre, yellow ochre, and other “soft, chalky lumps” of white, pink, and orange (Mitchell 2012:202). Two stone beads were excavated from the Agate Basin levels at Hell Gap in the 1960s (Irwin 1967:Figure 104).

Agate Basin lithic technology description. The only Agate Basin diagnostic is the Agate Basin point type and possibly preforms (Roberts 1961). Irwin-Williams and colleagues (1973:47) described Agate Basin points as “relatively long and slender, lanceolate, and with convex edges reaching maximum width somewhat above the midpoint.” They also noted that initial flaking and shaping appeared to occur via percussion, while final retouch combined pressure and percussion flaking in a very regular, centrally-directed pattern, creating “flake scars that are at right angles to the longitudinal axis of the projectile point” (Frison 1982:81) that terminate comedially and rarely cut across the medial section of the point (Bradley 2010:483). Agate Basin points tend to be ground on the edges, usually around up to 40% of their length (Irwin-Williams et al. 1973:47) or up to their maximum width, while the bases are usually not ground (Frison 1982:81). George Frison (1982:81) added that Agate Basin points’ transverse cross-sections are usually smoothly lenticular, while longitudinal cross-sections lack the “twist” that is common to Hell Gap points. Bases are usually convex, but can also be concave or flat (Stanford 1999:312).

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Agate Basin radiocarbon dates. Five archaeological sites in and around Wyoming contain Agate Basin diagnostics in context with radiocarbon dates: Frazier in Colorado, Beacon Island in North Dakota, the Allen site in Nebraska,¹⁰⁰ Hell Gap in Wyoming, and Agate Basin in Wyoming. Two localities from the Agate Basin site included diagnostics in situ with radiocarbon dates (Area 2 and the Brewster Locality), and were treated as two separate sites for the purposes of this analysis. The summed probability distribution for dates from these sites yields an estimated temporal range for the Agate Basin complex spanning 12,400-11,600 cal BP.¹⁰¹

¹⁰⁰ The Allen site might be more properly affiliated with the Central Plains but is nevertheless used here because of the already small sample size.

¹⁰¹ The estimated age range for the Agate Basin complex in and adjacent to Wyoming was calculated by first creating a pooled mean or “average” of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for Agate Basin complex ages. The summed 1 σ probability range (12,388-11,621 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age range for Agate Basin in and adjacent to Wyoming (circa 12,400-11,600 cal BP). This date range should be viewed as a hypothesized approximation. The addition of more dates might broaden the temporal span of the Agate Basin complex, and re-dating the sites already included with more precision might shrink its temporal range.

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Table -3: Key Agate Basin Sites in and Adjacent to Wyoming and Radiocarbon Dates.

Site Name	Site Number	Radiocarbon Dates (¹⁴ C BP)	Calibrated (2σ, Intcal13; cal BP)	Lab	Material	Citation(s) and Notes
Frazier [†]	5WL268	10,200 ± 30	12,048-11,765	CURL-11668	Charcoal	Lee et al. (2011); see also B (2007); Slessman (2004); St Wormington (1988).
		10,100 ± 30	11,968-11,871; 11,831-11,598; 11,554-11,474; 11,437-11,408	CURL-11671	Charcoal	
		(Average: 10,150 ± 21) ³	(11,995-11,711) ³			
Beacon Island [†]	32MN234	10,330 ± 45	12,388-12,257; 12,253-11,986	CAMS-90966/SR-6231	Bison bone	Ahler (2003:Table 21); Ahle (2011:244); Mandel et al. (2
		10,305 ± 45	12,384-12,264; 12,246-11,947; 11,868-11,844	CAMS-90967/SR-6232	Bison tooth	
		10,338 ± 82	12,522-12,470; 12,430-11,924; 11,900-11,826	ETH-26779	Charcoal	
		10,371 ± 80	12,534-11,964	ETH-26780	Charcoal	
		(Average: 10,326 ± 28)	(12,379-12,327; 12,310-12,271; 12,242-11,990)			
Agate Basin: Area 2	48NO201	10,430 ± 570	13,384-10,558	RL-557	Charcoal	Frison and Stanford (1982:1 Holliday (2000a:262); Lee e (1999:314) One Hell Gap point was reco Basin level at this locality (F
Agate Basin: Brewster Locality ^p	48NO201	9990 ± 225	12,389-11,063; 11,028-11,000; 10,969-10,790	M-1131	Charcoal	Frison and Stanford (1982:1 (2000a:262); Lee et al. (201 (1999:314).
		9350 ± 450	12,013-9481	O-1252	Charcoal	
		(Average: 9862 ± 201)	(12,037-10,702)			

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Hell Gap [†]	48GO305	10,260 ± 95	12,411-11,619	AA-16608/AA-16108	Charcoal	Haynes (2009:339, 1967); L. Sellet (2001:59); see also Byrnes and Trautman (1964). At Hell Gap Locality I, Goshute Basin artifacts may coexist with Folsom (2001).
Allen ^{pt}	25FT50	10,600 ± 620 10,270 ± 360 (Average: 10,353 ± 311)	13,708-13,667; 13,636-10,578 12,799-11,065; 11,023-11,005; 10,964-10,793 (12,781-11,200)	TX-6594 TX-6596	Charcoal Charcoal	Bamforth (2002b, 2007:151; 2007:149); Davis (2007:24). In terms of diagnostics, this site is one Agate Basin point and one Folsom point (Bamforth 2002b:63, 2007:149).
Carter/Kerr-McGee	48CA12	No dates	---	---	---	Agate Basin points are stratigraphically below Folsom from Hell Gap projectile point (Bamforth 1984:300).
Jim Pitts	39CU114 2	No dates	---	---	---	Sellet et al. (2001, 2009) This level could not be unambiguously identified as part of an archaeological unit. It may be Folsom, Agate Basin, and Folsom.
Chain Lakes	---	No dates	---	---	---	Frison et al. (2015). These are Folsom sites in southwestern Wyoming.
Sites in Alberta and Saskatchewan	---	Various	---	---	---	Benders (2010) lists dates for Folsom and Agate Basin sites in Alberta. Sellet (2011:55-67) includes a synthesis of CRM findings on Agate Basin sites in Canada.
Forest Canyon Pass	5LR2	No dates	---	---	---	This large multicomponent site in Grand National Park includes an Agate Basin point (Brunswick 2007b:283).

[†] Indicates that other relevant radiocarbon dates exist but were excluded in favor of the most reliable/applicable dates.

^p Indicates probable (not definite) association between diagnostic artifacts and the radiocarbon date(s) listed.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with caution or not at all.

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StateMiddle Paleoindian: Hell Gap (circa 11,950-11,100 cal BP)

Hell Gap cultural complex description. Known Hell Gap complex sites primarily occur in open plains settings, but have also been identified in foothill-mountain areas and west of the Rocky Mountains (Pitblado 2003:89-92). Known Hell Gap complex site types in and around Wyoming include: 1) butchery/small occupation areas (i.e., the Hell Gap levels at the Agate Basin site, and Carter/Kerr-McGee), 2) large open-air occupation sites (i.e., Hell Gap and Helen Lookingbill [Haskett]), 3) seasonal camps (i.e., Indian Creek, and Sister's Hill), bison kills (i.e., Jones-Miller, and Casper), 4) surficial lithic scatters (i.e., Seminoe Beach) and 5) a human burial of possible Hell Gap affiliation (Gordon Creek).

Like peoples bearing Folsom and Agate Basin diagnostics, many of the peoples that produced Hell Gap points relied heavily on bison for subsistence (e.g., Hill 2001, 2008a). However, there appear to have been changes in the way bison were exploited beginning in Hell Gap times. While Folsom and Agate Basin peoples occasionally extracted marrow for "snack" consumption during bison processing, there seems to have been a trend towards more intensive processing, possibly beginning during Agate Basin times (Byers 2001, 2002b, 2009), and more clearly present during the Hell Gap phase, that continued into later Paleoindian phases (Hill 2008a:103). This shift towards more intensive processing was likely in response to changes in Early Holocene paleoclimatic conditions (Hill 2008b:102). Indeed, reconstructing paleoclimate at the Agate Basin site using micromammal faunules, Danny Walker (1982:307) noted that "the difference between glacial and modern times was [partially] reached by the time of Hell Gap occupation." It comes as no surprise that these significant paleoclimatic changes were associated with significant subsistence adaptations.

At other sites, Hell Gap lifeways apparently included little to no large game exploitation, indicating that Hell Gap peoples may have responded in regionally variable ways to these changes in paleoclimate and/or other environmental or demographic variables. Rather than intensifying processing, some Hell Gap peoples appear to have adapted by broadening diet breadth and focusing on other types of subsistence resources. At Sister's Hill, for example, people bearing Hell Gap points practiced a subsistence strategy that relied heavily on medium and small game, such as antelope, mule deer, porcupine, ground squirrel, and other rodents. There is no evidence for bison hunting at Sister's Hill (Agogino and Galloway 1965; see also Kornfeld and Larson 2008). Little is known about Hell Gap-aged floral resource exploitation, but Hell Gap assemblages do not include large grinding stones for intensive plant processing¹⁰² as have been found at some Late Paleoindian sites (e.g., Medicine Lodge Creek) and that are commonly associated with Archaic occupations. Detailed studies of Hell Gap complex social organization, use of space, and variability in subsistence practices require further research.

Like all other Paleoindian complexes, osseous tools were manufactured and used by Hell Gap peoples. Notably, the tip of an elk antler tine that may have been used as an atlatl hook was recovered from the Hell Gap complex bison bonebed at the Agate Basin site (Frison 2004:109; Frison and Craig 1982:164). However, its function as an atlatl hook remains conjectural (Frison 2004:109). Like other Paleoindian complexes, Hell Gap osseous technology potentially includes expediently manufactured bone tools. For example, some artifacts recovered from the Casper site

¹⁰²With at least one possible exception, the Allen site in western Nebraska (Bamforth 2007:184-187).

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were interpreted as tools manufactured out of green bones collected from the freshly killed bison (Frison 1974:49). Later studies have cast doubt on this interpretation, and suggest these may have been produced through natural taphonomic processes. No osseous points or rods have yet been identified in Hell Gap contexts on the Northwest Plains. This would make an important addition to the Hell Gap cultural complex if identified in the future.

The Powars II ochre mine was frequented by Hell Gap peoples, presumably to collect pigment and perhaps to practice other symbolic activities (Frison et al. 2018), but few portable art objects have been published from Hell Gap complex sites on the Northwest Plains. Hell Gap peoples certainly had the capacity for complex symbolic behavior and must have produced some forms of art, but few have been recovered by professional archaeologists. One possible exception is the burial at Gordon Creek in north-central Colorado. Gordon Creek Woman was interred with burial objects in a pit coated with red ochre. Her grave goods include elk teeth and worked bone (Breternitz et al. 1971:179). She and these artifacts may be Hell Gap in affiliation (Muñiz 2004). One bone bead was recovered from the same stratigraphic unit possible Hell Gap diagnostics at the Allen site on the central plains (Bamforth 2007:188). Finally, a post mold at Jones-Miller near the center of the bison bone concentration has been identified as a possible “medicine post” (Stanford 1978:96).

Hell Gap lithic technology description. The only Hell Gap diagnostics are Hell Gap points and possibly preforms. Hell Gap points are lanceolate in form and similar to Agate Basin, but are uniquely characterized by a constricted section located around two-thirds of the length from the base to the tip of each point, and edges that curve inward towards the base (Irwin-Williams et al. 1973:47-8). This stem is the “hallmark” of Hell Gap points, and represents the first true stem of any recognized Plains Paleoindian projectile point type (Pitblado 2003:89). Hell Gap points are also characterized by relatively “blunted” tips (Irwin 1968:89; Irwin-Williams et al. 1973:48). Hell Gap points are characterized by carefully executed flaking patterns, but Hell Gap flaking is usually less regular than is observed on most Agate Basin points (Irwin-Williams et al. 1973:47-48; Pitblado 2003:89). Hell Gap flaking patterns are generally collateral and comedial, producing a median ridge and lenticular cross-section. Bases may be slightly concave, straight, or convex (Irwin-Williams 1973:48; Pitblado 2003:92). Basal grinding generally extends up the sides of Hell Gap points, sometimes longer than half their length (Irwin-Williams 1973:48; Pitblado 2003:92). Unlike Agate Basin points, Hell Gap points often twist longitudinally (Frison 1974, 1982:81).

Bruce Bradley (2010:485) notes that Hell Gap point manufacturing technology was “a continuation of the well-developed Agate Basin technology.” Though the Hell Gap production sequence was halted at an earlier phase than the Agate Basin production sequence, Hell Gap points were apparently finished with the “same degree of care” as Agate Basin points (according to Bradley 2010:485). The notion that Hell Gap points evolved from Agate Basin points has been widely disseminated for decades (beginning with Agogino and Galloway 1965; see also Agogino 1983). Regardless of the degree to which this assertion is true, the shift from Agate Basin-style to Hell Gap-style points begs further explanation.

George Frison (2004:110; see also Frison 1982:81) notes that, in his experience, no single Paleoindian projectile point type appears “significantly more lethal than another,” though he

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personally prefers Agate Basin points for their structural strength and penetrative qualities. Frison has been:

[U]nable to understand the popularity of the Hell Gap projectile point [as compared to Agate Basin;] it adds a shoulder, which transfers much of the shock of impact there rather than to a tapered base. [It does not] penetrate as deeply as does the Agate Basin point, but it cuts a larger hole on impact and may have had other advantages (Frison 2004:110).

Functional explanations for why a shift from lanceolate to stemmed projectile point styles occurred during the Middle and Late Paleoindian periods require further research (Bryan 1980). Hell Gap points may be better designed than Agate Basin points for hafting into a socket (Frison 1974:83-84, 1978:172). Inspired by this proposition, Bryan (1980:96) suggested that perhaps thin lanceolate points (i.e., Clovis, Folsom, Goshen, Midland, and perhaps James Allen/Frederick and Angostura/Lusk) were hafted onto split stick shafts, whereas thick and/or stemmed points (i.e., Agate Basin, Hell Gap, and Cody points) were hafted into sockets. This hypothesis still requires testing.

Hell Gap radiocarbon dates. Seven sites in and around Wyoming contain radiocarbon dates in reasonable association with Hell Gap cultural complex diagnostics: Agate Basin, Casper, Hell Gap, Indian Creek, Sister's Hill, Helen Lookingbill (Haskett type), and Jones-Miller. Dates from these seven sites provide an estimated temporal range for the Hell Gap complex spanning 12,550-11,200 cal BP.¹⁰³ While the young end of this estimation coincides with prior conceptions of Hell Gap's temporal range, the old end of this estimation seems too old based on prior conceptions and known stratigraphic relationships between Hell Gap and other cultural complexes. When the dates are examined in more detail, it becomes apparent that they produce a bimodal probability distribution. Three sites yield older dates (Hell Gap, Agate Basin, and Helen Lookingbill [Haskett]) and four sites yield younger dates (Casper, Indian Creek, Sister's Hill, and Jones-Miller). Two of the older dates were taken from bulk sediment without secure association between the dates and Hell Gap artifacts (at Hell Gap and Helen Lookingbill [Haskett]). Furthermore, the relationship between Hell Gap and Haskett at Helen Lookingbill and elsewhere remains unclear, and the dated component at Helen Lookingbill may be Folsom (Marcel Kornfeld, personal communication 2018). When these two dates are removed from the analysis, the calculated time range for Hell Gap shrinks slightly but yields the same result when rounded to the nearest fifty calendar years (12,550-11,200 cal BP).

¹⁰³ The estimated age range for the Hell Gap complex in and adjacent to Wyoming was calculated by first creating a pooled mean or "average" of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for Hell Gap complex ages. The summed 1 σ probability range (12,541-11,211 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age range for Hell Gap in and adjacent to Wyoming (circa 12,550-11,200 cal BP). Data hygiene and outlier removal further refined this range to 11,939-11,109 cal BP (circa 11,950-11,100 cal BP). These date ranges should be viewed as hypothesized approximations. The addition of more dates might broaden the temporal span of the Hell Gap complex, and re-dating the sites already included with more precision might shrink its temporal range.

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The old end of this range still seems too old based on prior conceptions of the Hell Gap temporal span. There is no obvious reason to remove the remaining older Hell Gap complex date from the Agate Basin site from this analysis, except that it is the only remaining old outlier. This date may be questioned because it could have an old wood problem, or because the Agate Basin site is known to contain components older than Hell Gap and the burned log that was dated might be associated with a pre-Hell Gap component. If the date on the Hell Gap component from the Agate Basin site is indeed too old, then it is disproportionately skewing the estimated temporal span of Hell Gap to appear older than it should since the sample size of available dates is so small. Throwing out a date because it seems too old based on prior conceptions of a cultural complex's time span is circular reasoning, but all things considered, it seems justified to remove the Agate Basin date from analysis in this case.

When estimated only from the four younger sites' dates, the Hell Gap time span changes considerably. Dates from only Casper, Indian Creek, Sister's Hill, and Jones-Miller yield an estimated time span of 11,950-11,100 cal BP for the Hell Gap cultural complex. It seems unreasonable to extend the estimated span of Hell Gap by six hundred years based on a single date from the Agate Basin site. Therefore, the more conservative estimate of 11,950-11,100 is reported here as the most realistic estimated temporal range of the Hell Gap cultural complex given currently available data. In light of these discrepancies, re-dating the Hell Gap components at the Hell Gap and Agate Basin sites and producing radiocarbon dates in association with Hell Gap artifacts from new sites should comprise particularly important research agendas for Wyoming-area archaeologists. Despite its fame, the Hell Gap cultural complex is still poorly and ambiguously dated.

No matter how the estimated calendar ages for Hell Gap are calculated, calibrated Hell Gap radiocarbon dates overlap at least partially with the "preceding" Agate Basin cultural complex. Hell Gap points have also been found in close or inseparable stratigraphic association with Agate Basin points at several sites, including Indian Creek, Allen, Jones-Miller, and Carter/Kerr-McGee. Since Hell Gap and Agate Basin points occasionally co-occur in stratigraphic context and produce overlapping calendar age ranges, it appears that the Hell Gap cultural complex at least partially co-occurs with the Agate Basin complex in time and space. The interpretation that Hell Gap co-occurs with Agate Basin at any of the site-specific examples is questionable and debatable (Marcel Kornfeld, personal communication 2018). Describing the extent and meaning of the relationship between the Hell Gap and Agate Basin cultural complexes and deciding whether or not they are "co-complexual" (Taylor 2006:187) should comprise significant Middle Paleoindian research agendas.

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Table-4:Key Hell Gap Sites in and Adjacent to Wyoming and Radiocarbon Dates.

Site Name	Site Number	Radiocarbon Dates (^{14}C BP)	Calibrated (2σ , Intcal13; cal BP)	Lab	Material	Citation(s) and Notes
Agate Basin: Area 3	48NO201	10,445 \pm 110	12,652-11,987	SI-4430	Charcoal; "burned log"	Frison and Stanford (1982:1 (2000a:262); Sellet (2001:59)
Casper	48NA304	10,060 \pm 170	12,376-12,340; 12,301-12,282; 12,237-12,195; 12,190-11,192	RL-208	Bone	Frison (1974:108); Holliday (2003:90); Sellet (2001:59);
		9830 \pm 350	12,413-10,369; 10,357-10,297	RL-125	Charcoal	Frison (1974:108); Holliday (2003:90); Stanford (1999:3
		(Average: 10,016 \pm 153)	(12,112-11,177)			
Indian Creek: Upstream Locality	24BW626	10,010 \pm 110	11,966-11,860; 11,845-11,231	Beta-5118	Bulk charcoal	Davis (1984); Davis and Th (1992:266-269); Pitblado (2 Three Hell Gap Points were stratigraphically close to a s
		9860 \pm 70	11,602-11,529; 11,496-11,427; 11,413-11,170	Beta-5119	Bulk charcoal	
		(Average: 9903 \pm 60)	(11,603-11,527; 11,498-11,424; 11,415-11,207)			
Sister's Hill [†]	48JO314	9650 \pm 250	11,796-11,789; 11,773-10,257	I-221	Bulk charcoal	Agogino and Galloway (196 (2003:90); Sellet (2001:50);
Jones-Miller	5YM8	10,020 \pm 320	12,575-10,688	SI-1989	Charcoal	Bonnichsen et al. (1987); H Pitblado (2003:90); Stanford also Stanford (1974, 1978), These points were labeled as most approach the Agate Ba least one specimen appears t point (Sellet et al. 2009:753)
Hell Gap ^p	48GO305	10,240 \pm 300	12,718-11,135	A-500	Carbonaceous silt	Haynes (2009:339); Haynes Holliday (2000a:262); Pitbla (1999:316). The original description stat "[c]arbonaceous silt of Leve below datum) [is] believed t Gap and Alberta occupation (Haynes et al. 1966:15).

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Carter/Kerr-McGee	48CA12	No dates	---	---	---	Agate Basin points are stratified from Hell Gap projectile points (1984:300).
Gordon Creek* (not used)	5LR99	9650 ± 50 (not used)		NSRL-13179/CU RL-6724	Carbonized sap	Muñiz (2004) argues that lithic and morphology of two bifacial Creek Woman suggest Hell Gap. Irrefutable diagnostics are lacking.
Chain Lakes	---	No dates	---	---	---	Frison et al. (2015). These are sites in southwestern Wyoming.
Helen Lookingbill [†]	48FR308	7360 ± 640 (not used) 10405 ± 95	12,576-11,958	RL-1570a Beta-28877	Bison bone Bulk sediment	Frison (1983a:8). This site is of Hell Gap but probably more Haskett as identified in Idaho (Frison 1983a:15), although he lumps them into the same culture. A radiocarbon date was obtained associated with the Haskett but believed to be too young" (Frison 1983a:8). Kornfeld et al. (2001:312); Larson (1995:4); Larson et al. (1995). See also Wasilik (2006).
Seminole Beach	48CR116 6	No dates	---	---	---	Bradley (1991:385) studied production sequences at this site. At least six Hell Gap collections were described in the literature.
Sites in Alberta, Canada	---	Vary				Peck (2011:55-67) includes Hell Gap and CRM findings on Hell Gap in Alberta, Canada.
Forest Canyon Pass	5LR2	No dates	---	---	---	This large multicomponent site in National Park includes a Hell Gap Stemmed component (Bruns

* Indicates the site appears contemporary with Hell Gap but lacks diagnostics to establish cultural affiliation.

[†] Indicates that other relevant radiocarbon dates exist but were excluded in favor of the most reliable/applicable dates.

^p Indicates probable (not definite) association between diagnostic artifacts and the radiocarbon date(s) listed.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with caution or not at all.

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StateMiddle Paleoindian: Cody Complex (Alberta, Eden, Scottsbluff) (circa 11,200-9700 cal BP)

Cody cultural complex description. Cody sites occur in a wide variety of biomes and latitudes. Most excavated Cody sites occur on the open plains, but many are also known to exist in foothill-mountain areas, including at high elevations (Knell and Muñiz 2013:13-14; see also Brunswig 2007b; Dawe 2013; Frison et al. 1996; Hill and Knell 2013; Hofman 1996; Hofman and Graham 1998; Jodry 1999b; Justice 1987; Pitblado 2003). Consequently, Cody land-use and subsistence patterns often varied by region, but did not always. On the subject of Eden point distributions, for example, Bonnie Pitblado noted that “Eden/Firstview only rarely occurs in the Rockies, [...] and when it does, it generally adheres to Plains patterns of raw material use and technology, suggesting that such instances represent short-term visitation by Plains-based groups” (Pitblado 1999; 2000:127).

Like previous Paleoindian cultural complexes, Cody peoples in many places relied heavily on bison for subsistence. Many well-known Cody sites are classified as bison kill and/or processing locations (Olsen-Chubbuck, Jerry Craig, Horner I and II, Scottsbluff Bison Quarry, Finley, Frasca, Lamb Spring, Jurgens Area 3, Carter/Kerr-McGee, and possibly the Hudson-Meng, Nelson, and Wetzel sites). However, bison were not always the focus of Cody peoples’ subsistence practices. At Blue Point and Osprey Beach, for example, Cody peoples relied heavily on smaller game, with an absence of evidence supporting bison exploitation.

Known types of Cody sites in and around Wyoming also include camps and/or lithic workshops (i.e., Lime Creek, Claypool, Mammoth Meadow, Jurgens areas 1 and 2, Osprey Beach, Laddie Creek, MacHaffie, Medicine Lodge Creek, Hell Gap, and Lindenmeier) and caches (i.e., the Larson and Harmon caches). At many of the campsites, Cody peoples appear to have relied heavily on bison, but exploitation of smaller fauna evidently occurred as well. Lower ranked species exploited by Cody peoples included pronghorn, mule deer, bighorn sheep, elk, lagomorphs, canids, and birds. In general though, Cody peoples appear to have relied more heavily on bison than Late Paleoindian groups, even in foothill-mountain areas (Hill and Knell 2013; Knell and Muñiz 2013:14-16).

Like earlier Paleoindian complexes, ground stone tools occur in limited frequencies at Cody sites but were generally not used for heavy processing of food. Cody complex ground stone found at Osprey Beach, for example, includes adzes and abraders for softening hide or shaping wood and osseous tools (Johnson and Reeves 2013:39, 54). However, at the Jurgens site, twelve fragments of shallow-basin sandstone grinding slabs were recovered; two of these were found in context with diagnostic Cody artifacts at the short-term campsite identified at Area 2 (Wheat and Scott 1979:129-130). Six manos were also identified across all three areas at the Jurgens site (Wheat and Scott 1979:130). The date from Jurgens was produced from combined charcoal pieces out of the Area 3 bonebed (Wheat 1979:151-2). According to Wheat (1979:151-2), the bonebeds in Areas 1 and 2 appear slightly younger, geologically, than that of Area 3. Therefore, an estimated date on the in situ grinding slabs from Area 3 is “slightly later” than 9070 ± 90 ^{14}C BP (10,495-9918 cal BP, 2σ range). Wheat and Scott (1979) do not speculate on what was ground on the grinding slabs. It is possible that they were used for plant processing. It

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is also possible that they were used to process meat¹⁰⁴ to make some sort of pemmican (Mulloy 1954:33, 59; Renaud 1947; Shepherd 1992; Zier 1981). Pemmican production has been speculated for Late Paleoindian cultural complexes on the Northwest Plains (e.g., the Allen/Frederick complex at Clary Ranch; Hill 2005:256; see also Reust et al. 2002), so it is not unreasonable to suggest that it might have begun slightly earlier. Likewise, two fragments of ground stone slabs were recovered from a Cody component at Deadman Wash (48SW1455) in southwestern Wyoming (Sall 1982:136, Figure 48a). This component also produced a Scottsbluff point and an Eden drill, but has not been radiocarbon dated (Armitage, Newberry-Creasman, et al. 1982:52, 57, 189, 1982b; Armitage and Creasman 1981; Creasman et al. 1981; Sall 1982).

Whether the grinding slabs at Jurgens and Deadman Wash are evidence of plant and/or meat processing, they indicate an intensification of resource processing during Cody times as compared to earlier periods. If pemmican was indeed being produced on these grinding slabs, their presence might also indicate the beginnings of long-term food storage in this region, since pemmican can be stored for several years and is therefore useful for safeguarding against future food shortages (Oetelaar and Beaudoin 2016:33). In earlier Paleoindian phases, there is potential evidence for food storage, but this appears to have been limited to short-term frozen storage of large fauna through the winter (as might have occurred at, for example, Colby, Hanson, and Casper; Grunwald 2016). In addition to possible long-term food storage suggested by some of the artifacts from Jurgens, some Cody complex peoples continued to use frozen meat caches as a form of short-term storage during the Cody phase (such as seen at Carter/Kerr-McGee; Grunwald 2016).

Prior to the Cody phase, Hill (2008b:102-3) observed that Hell Gap peoples processed bison more intensively than in earlier Paleoindian phases. The grinding slabs at Jurgens comprise an independent line of evidence suggesting that this trend in subsistence intensification continued into Cody and later times, and seems to have manifested in regionally diverse ways. Indeed, equivocal evidence for ground stone technology exists slightly earlier than Cody on the Central Plains at the Allen site in western Nebraska. Though the provenience of the ground stone artifacts at this site is questionable, some of these specimens may have come from the same stratigraphic unit as the Hell Gap cultural complex (Bamforth 2007:184-187). The role of Cody complex ground stone in the intensification of food processing and storage, if any, and regional diversity in these behaviors, require further investigation.

Cody peoples' land use patterns have been studied at local and regional scales at many different sites across the Northwest Plains. Knell and Muñiz (2013:17-19) divide postulated Cody complex land-use strategies into four groups. In some areas, Cody complex peoples restricted their mobility to focus on localized resources for long periods of time throughout the year, sometimes as part of a seasonal round or a long-term overwintering strategy (Blackmar 2001; Johnson et al. 2004; Johnson and Reeves 2013; Knell 2007, 2013; Knell and Hill 2012; Richings-Germain 2002). In other places, Cody groups seasonally exploited different resource patches, following changes in seasonal abundance of resources and/or to avoid cold, high altitude areas in the winter (Amick 2013; Frison 1992; Frison and Bonnicksen 1996; Hill and Knell 2013; Johnson et al. 2004; Knell 2013; Knell and Hill 2012; Root et al. 2013). Some Cody

¹⁰⁴ Perhaps bison meat but more likely smaller animals found at the site such as rabbit, muskrat, birds, turtle, and fish.

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groups may have practiced a seasonally transhumant resource exploitation/mobility strategy, returning to the same resource patches during a set yearly round (Blackmar 2001; Johnson et al. 2004) while others may have dispersed into small family groups throughout the majority of the year, traveling large distances to converge and conduct large-scale bison kills during the fall (Muñiz 2005). The relationships between these different land use strategies, the presence and degree of subsistence intensification, and the social implications of these behavioral changes among Cody groups are topics that could drive significant future studies. In that vein, Cheryl Fogle-Hatch (2015) argued that there was a high degree of interband contact among Cody groups across the Great Plains, because Cody projectile points vary more over time than space.

Though atlatls were probably used for terrestrial hunting throughout the Paleoindian period, they were almost certainly in use by the Cody phase. Compelling evidence for Cody-aged atlatl hunting consists of an atlatl dart recovered from an ice patch in the Rocky Mountains near Yellowstone National Park. It dates to 9230 ± 25 ^{14}C BP (10,496-10,283 cal BP, 2σ range; Lee 2010), placing it squarely within the estimated temporal range of the Cody complex. Additionally, five atlatl hooks were identified at Jurgens. The least questionable of these hooks was manufactured out of deer antler. The other four possible hooks were made from bison molars (Wheat and Scott 1979:95, 136-137). Frison (2004:109) doubts that the bison molars were actually used as atlatl hooks because his experiments indicate that bison molars were too brittle to withstand pressure from throwing a dart.

Several bone rods similar to those identified from Clovis, Folsom, and possibly Goshen components elsewhere are known from probable Cody contexts. One, named the Grenfell artifact, is made of bison bone and was collected as an isolated find around a century ago in Saskatchewan, Canada (Ives et al. 2014). Recent analysis of this long-curved museum artifact suggests that it was probably manufactured from bison bone. The rod produced a date of 8425 ± 40 ^{14}C BP, which calibrates to 9527-9320 cal BP (2σ range; Ives et al. 2014:789). Based solely on the radiocarbon date, Ives and colleagues (2014) suggested that this rod could have been associated with the Cody complex in Canada, but it dates younger than the time frame calculated for Cody in this historic context. Alternatively, the investigators suggest that the rod could potentially be more closely related to Agate Basin or Angostura/Lusk complex manifestations in Canada. Regardless of whether this artifact is affiliated with Cody or another Paleoindian complex, Ives and colleagues (2014:789) highlight its importance by suggesting that “[t]his relatively unique aspect of earliest prehistoric technology in the Americas—osseous rods—therefore persist[ed] throughout the entire Paleoindian time frame, or roughly 4,000 years.” Another bone rod recovered during the 1960s excavations at Hell Gap recently produced a date of 9590 ± 35 ^{14}C BP (calibrated to 11,123-10,757 cal BP; 2σ range; Holen and Holen 2009). Despite some uncertainties regarding its original provenience,¹⁰⁵ the date from the Hell Gap rod is unambiguously contemporaneous with the Cody complex.

Like other Paleoindian phases, Cody peoples may have manufactured impromptu bone tools for use in bison butchering (i.e., at Jurgens; Wheat and Scott 1979:138-146). These types of

¹⁰⁵ This artifact was initially thought to have come from the Cody occupation at Lindenmeier, but subsequent investigation by Kathleen Holen, Steve Holen and Marcel Kornfeld revealed that it was actually excavated from the Hell Gap site (Ives et al. 2014:783-784; Steve Holen, personal communication 2018).

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tools “appear to [have been] a frequent part of the tool kit of Paleo-Indian hunters” (Wheat and Scott 1979:138). Alternatively, these “expedient tools” may be a product of nonhuman taphonomic processes (Kornfeld et al. 2010:185-6). Also similar to other Paleoindian cultural complexes, Cody peoples produced an array of osseous artifacts, such as needles, awls, and billets. The only widely known art object from Cody contexts (Knell and Muñiz 2013) is a bison ulna from the Jurgens site that may have been incised with geometric designs (these might be root etchings; Wheat and Scott 1979:137-138). Another unique object is the only known Paleoindian pipe, affiliated with the Cody complex at Jurgens (Knell and Muñiz 2013:19). The possible pipe was manufactured from an iron silicate concretion (Wheat and Scott 1979:129). This important object, if it was indeed a pipe, demonstrates that pipe smoking may be as old as the Paleoindian period on the Northwest Plains. Such an object likely had some kind of social, ritual, or religious meaning to the Cody people that made and used it, but our current understanding of Cody complex social life does not allow for speculation beyond this basic observation (Knell and Muñiz 2013:19).

Cody lithic technology description. Unlike earlier Paleoindian cultural complexes on the Northwest Plains, the Cody complex contains a wide variety of diagnostic point and tool types. These different point types may or may not represent differences in language, ideology, social organization, subsistence patterns, and/or ethnic groups amongst the Cody peoples that manufactured them. This research question has yet to be addressed beyond basic conjecture. Depending on whether they identify as a “lumper” or a “splitter,” scholars disagree on the number of typological categories that Cody point types should fall into (Bamforth 2013a, 2013b:68, 1991; Fogle 2013; Knell and Muñiz 2013; Knudson 2013; Muñiz 2005). Furthermore, variation between point types grades from one type into the next. Cody points comprise an “intergrading series in which some specimens can be categorized only with difficulty” (Wheat 1972:142; see also Richings-Germain 2002:21-31).

Knell and Muñiz (2013:4-5) define the primary point types associated with the Cody complex on the Northwest Plains as Alberta, Alberta/Cody I, Alberta/Cody II, Kersey, Eden, Firstview, Scottsbluff I, and Scottsbluff II. Nuanced divisions between point types are rather subjective at present, and no one has created an unequivocal, comprehensive, quantitatively replicable typology to differentiate between the wide variation observed in Cody diagnostics. Wheat (1972:140-152) made one such attempt, splitting Cody points into many typological categories, including new types, based on small morphological variations. Another study lumped many Cody variants together (Pitblado 2003:81-89). In Bonnie Pitblado’s (2002:81-89) typology, Scottsbluff variants are considered a single type, Eden, Firstview, and Kersey are lumped together, and all of the Alberta types are lumped together.

Defining typological distinctions is not a new problem in Cody archaeology. In 1957, for example, Marie Wormington (1957:136) remarked that, “[i]t might appear that the term Cody points should be used exclusively and that the terms Eden and Scottsbluff should be dropped altogether. This, however, would be unwise, for distinct types are represented, and distributional and typological studies suggest that in some cases these differences may be of chronological significance.”¹⁰⁶ Knudson (2013:309-310), who was more of a lumper than Wormington (1957),

¹⁰⁶ For a summary of early archaeological conceptions of Cody complex point types, see Ruthann Knudson (2013).

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Wheat and Scott (1979), and others, defined the Cody complex as “a set of northern Plains and perhaps northern Great Basin sites and assemblages characterized by bifacial points with parallel collateral flaking... [T]he parallel-oblique flaked tool assemblages in the northern Plains (e.g., James Allen [and Angostura types]) [comprise] an overlapping but generally younger technological pattern which may represent another sociocultural unit or units but which is presently still very poorly known.”

Our understanding of Cody complex variation is further complicated by uncertainty surrounding whether or not Alberta points should be included in the Cody complex at all, or if instead they represent a precursor to the Cody complex (Muñiz 2005:47-52; Peck 2011:75-79). On the Northwest Plains, Alberta points often occur stratigraphically lower than Scottsbluff and Eden points, such as at Carter/Kerr-McGee (Frison 1984:292). At other sites, Alberta style points occur within the same stratigraphic level as Eden and/or Scottsbluff, such as at Blue Point (Johnson and Pastor 2003:63) and Horner I (these components may be palimpsested at Horner; Bradley and Frison 1987). For the purposes of this historic context, Alberta is included within the Cody complex and Cody diagnostic projectile point styles are lumped into three general categories: Alberta, Eden, and Scottsbluff.¹⁰⁷

All Cody projectile point varieties are stemmed, and most have shoulders that are angular and abrupt. Cody stems are different from those seen on Hell Gap points. Cody stems are proportionally shorter and are parallel-sided or expanding towards the base (Irwin-Williams et al. 1973:48). Muñiz (2005:54) recently defined Cody complex points as “a series of projectile point styles that have a square base, subtle to distinct shoulders, parallel sided or triangular blade outlines, and lack deep basal concavities and patterned diagonal flaking.” Most Cody points are characterized by collateral and comedial flaking patterns. More specifically, Scottsbluff points have parallel-sided or triangular blades with thick oval to slightly lenticular cross-sections and broad, square or slightly flaring stems that are often ground along the edges. Scottsbluff points are usually comedially to transmedially flaked, but can be characterized by somewhat irregular flake scars (Davis 1962:77-85; Wormington 1957:266-267). Scottsbluff points are generally shorter and stubbier than other Cody varieties; they are usually only 3-4 times as long as they are wide (Davis 1962:78; Wheat et al. 1972:148-149). Pitblado (2003:83) sums up the differences between Scottsbluff and Eden varieties, suggesting that Scottsbluff points are distinguishable from Eden by their more “prominent stems” and “greater overall width.”

Eden points resemble Scottsbluff varieties but are much narrower relative to their length (Davis 1962:78; Wheat et al. 1972:148; Wormington 1957:266-267). Eden points have less marked shoulders than Scottsbluff points, and slight stemming may be present solely due to basal grinding in some cases (Wormington 1957:266-267). Edens are almost always collaterally and comedially flaked, with diamond-shaped cross-sections and pronounced median ridges (Pitblado 2003:85; Wormington 1957:266-267). They are more slender than other Cody varieties in terms of total length to blade width (Wheat 1972:151). According to Wheat and colleagues (1972:148),

¹⁰⁷ For a more nuanced understanding of the lumping/splitting debate regarding Cody complex point types, see Agenbroad 1978a, 1978b; Bamforth 1991, 2013a, 2013b; Beck and Jones 1997; Bradley and Frison 1987; Bradley and Stanford 1987; Forbis 1968; Frison 1991b; Hill et al. 1995; Hofman and Graham 1998; Justice 1987; Knell and Muñiz 2013; Knudson 2013; Mason 1997; Stanford 1999; Theler and Boszhardt 2003; Wheat et al. 1972, Wheat and Scott 1979).

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Edens are often 5-7 times as long as they are wide, and generally have a longer blade length to stem length ratio than Scottsbluff points (Wheat et al. 1972:150-151).¹⁰⁸ However, the meaning of these measurements is ambiguous when dealing with resharpened points (*a la* the Frison Effect; Dick and Mountain 1960; Wheat et al. 1972:144).

Finally, Alberta points are larger than Eden and Scottsbluff variants. They have longer stems with slightly convex bases and somewhat blunted tips (Wormington 1957:134-135). They are collaterally flaked and have diamond-shaped cross-sections (Irwin-Williams et al. 1973:48). Alberta points have no type site; the category was originally created to describe surface finds in southern Alberta and Saskatchewan (Wormington 1957:134). However, Alberta points were eventually recovered in depositional context from Hell Gap and some now consider Hell Gap as the Alberta type site (Pitblado 2003:89). Others have suggested that the Fletcher site in Alberta, Canada, should be considered the type site for Alberta points, since it produced a large assembly of the point type (George C. Frison and Marcel Kornfeld, personal communication 2018).

Based on the original investigations at the Horner site (Jepsen 1951), Wormington (1957:128) suggested that other types of stone tools were also diagnostic of the Cody complex. In particular, she drew readers' attention to "a form of knife which has a transverse blade and is usually stemmed on one side" (Wormington 1957:128). Thus, thanks to Wormington, Cody knives have been considered diagnostic of the Cody complex since early in the history of Paleoindian studies. Cody knives have subsequently been identified in situ with Cody projectile points at many other sites, including Claypool, Finley, Medicine Lodge Creek, Laddie Creek, and Osprey Beach. Though other types of knives were used throughout the Paleoindian and Archaic periods, "the distinctly shouldered Cody knife does not develop until Alberta times" (Bradley and Stanford 1987:431). Recently, Knell and Muñiz (2013:5; Muñiz 2005:45) defined Cody knives as having "a plethora of morphological varieties [... but] generally have square bases and asymmetrical blades, and are usually—but not always—stemmed on at least one margin." Use wear analysis equivocally suggests that some Cody knives may have been used as bison butchering implements (Muñiz 2005:401-402).

Other tool types might be diagnostic of the Cody complex as well, but these have only recently been suggested and require further research. At Osprey Beach, Johnson and Reeves (2013:47, 60) identified "corner-notched hafted lance heads" in context with other Cody diagnostics. They suggested that "this tool form belongs in the Cody complex. If the corner-notched hafted lance head were found without classic Cody complex tools, it would be easy to misidentify this tool as a Pelican Lake point on steroids, ceremonial in nature, or something else, which would miss a data opportunity" (Johnson and Reeves 2013:60).

Cody radiocarbon dates. There are twenty-two Cody localities from twenty sites in and around Wyoming that contain Cody diagnostics in context with radiocarbon dates. These sites are Horner, Finley, Medicine Lodge Creek, Hell Gap, Osprey Beach, Carter/Kerr-McGee, and Blue

¹⁰⁸ See Wheat and colleagues (1972:140-152) for specific measurements quantitatively describing his definitions of Eden, Scottsbluff I, San Jon, Firstview, and Milnesand point varieties and Wheat and Scott (1979) for a description of Kersey. Today, Firstview and Milnesand are still used as typological labels on the Southern Plains, but not frequently employed on the central or northern Plains. Kersey is usually only used to refer to projectile points recovered from the Jurgens site (Muñiz 2005:47).

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Point in Wyoming. In northern Colorado, Nelson, Olsen-Chubbuck, Frasca, Lindenmeier, Lamb Spring, Jurgens, and Jerry Craig have dated Cody components. Dates in southern Montana come from the MacHaffie, Malin Fishing Hole, and Mammoth Meadow I sites. From western Nebraska, Cody complex dates from Scottsbluff Bison Quarry, Hudson-Meng, and Lime Creek were used in this analysis. Dates from Horner I and Horner II, as well as Hell Gap Locality I and Locality IIIS/V were all treated as separate sites for the purposes of this analysis. Dates from these twenty-two localities provide an estimated temporal range for the Cody complex in and around Wyoming that spans approximately 11,200-9700 cal BP.¹⁰⁹ This time span includes Alberta, Eden, and Scottsbluff dates. It might be possible to calculate separate temporal estimates for different Cody point types if more dates were available on components that contained only one type of point rather than mixed assemblages.

Recently, Knell and Muñiz (2013:13) suggested that the Cody complex spanned 2,815 calendar years, from 11,600 to 8785 cal BP. The time span calculated here covers a smaller geographic area than Knell and Muñiz (2013), but uses many of the same dates. Primarily because the Cody time range was calculated differently in this historic context, the estimated time span for Cody presented here is much shorter than that suggested by Knell and Muñiz (2013:13). The methods in this study suggest an estimated 1,500 calendar years for the Cody complex, from 11,200 to 9700 cal BP. This does give Cody a longer estimated time span than all preceding Paleoindian cultural complexes (except the poorly dated Goshen complex), but does not approach the temporal magnitude suggested by Knell and Muñiz (2013).

¹⁰⁹ The estimated age range for the Cody complex in and adjacent to Wyoming was calculated by first creating a pooled mean or “average” of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for Cody complex ages. The summed 1 σ probability range (11,214-9693 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age range for Cody in and adjacent to Wyoming (circa 11,200-9700 cal BP). This date range should be viewed as a hypothesized approximation. The addition of more dates might broaden the temporal span of the Cody complex, and re-dating the sites already included with more precision might shrink its temporal range.

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Table -5. Key Cody Sites in and Adjacent to Wyoming and Radiocarbon Dates.

Site Name	Site Number	Cody Point Type(s)	Radiocarbon Dates (^{14}C BP)	Calibrated (2σ , Intcal13; cal BP)	Lab	Material	City
MacHaffie ^{p†}	24JF4	Scottsbluff; Wheat (1972:143-145 calls them San Jon)	8620 \pm 200 8280 \pm 120 7905 \pm 435 (Average: 8345 \pm 100) 8100 \pm 300 (not used)	10,203-9238; 9220-9205; 9175-9141 9516-9509; 9504-9006 9885-9877; 9865-9848; 9790-7845 (9527-9089; 9044-9039) 9686-8329	GX-15152-AMS GX-15153-G-AMS GX-15153-A L-578A	Charcoal flecks Bison bone Apatite Wood	Dav For Spe (20 (19 (19 Knu Mac
Larson Cache	48SW1121	Scottsbluff	No dates	---	---	---	Fris and incl poin othe incl poin Ag diff (Ing
Harman Cache	No number	Alberta/Cody-Scottsbluff continuum	No dates	---	---	---	Bar (20 Coc pos pre best Plai
Horner I [†]	48PA29	Eden, Scottsbluff, Alberta/Cody	8750 \pm 120 8840 \pm 140	10,157-9540 10,214-9555	UCLA-697A UCLA-697B	Bison bone	Ber and Hol Pit

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			(Average: 8788 ± 91)	(10,155-9982; 9968-9558)		Bison bone	
Horner II [†]	48PA29	Alberta/Cody	10,060 ± 220	12,522- 12,471; 12,430- 11,086; 10,921-10,891	I-10900	Charcoal	Fris Toc (20 (20
			9875 ± 85	11,700- 11,671; 11,636- 11,634; 11,629-11,157	SI-4851A	Charcoal	
			(Average: 9899 ± 79)	(11,697- 11,673; 11,626- 11,187)			
Nelson [†]	5WL4872	Alberta/Cody, Eden	9260 ± 20	10,520- 10,372; 10,354- 10,340; 10,326-10,299	UCIAMS- 26939	Bison bone	Kor et a (19
Olsen- Chubbuck [†]	5CH1	Eden, Scottsbluff; Taylor (2006:229) says they are all Eden; Holliday et al. (1999) and Wheat (1972:140) say they are Firstview and San Jon	9290 ± 60	10,652- 10,621; 10,602-10,274	NSRL- 2801/CAMS- 31812	Bone gelatin	Bra et a Wh (20 (20 (19
			9340 ± 60	10,714- 10,376; 10,349- 10,345; 10,320-10,301	NSRL- 2797/CAMS- 31813	Bone gelatin	
			9350 ± 70	10,741- 10,371; 10,355- 10,339; 10,329-10,298	NSRL- 2797/CAMS- 32682	Bone gelatin	
			9370 ± 60	10,743-10,418	NSRL- 2799/CAMS- 32683	Bone gelatin	
			9420 ± 60		NSRL- 2798/CAMS- 24968	Bone gelatin	
			9460 ± 50	11,064- 11,025;		Bone gelatin	

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			9480 ± 60 <i>(Average: 9393 \pm 22)</i> $10,250 \pm 500$ (not used)	11,005-10,966; 10,792-10,496; 10,449-10,444 11,068-10,955; 10,864-10,850; 10,804-10,567 11,080-10,934; 10,879-10,572 <i>(10,693-10,567)</i> ---	NSRL-2801/CAMS-32684 NSRL-2799/CAMS-31814 A-744	Bone gelatin Bone collagen	
Claypool	5WN18	Scottsbluff, Eden	No radiocarbon dates. Malde (1960) geologically placed the site between 10,000-7,000 BP.	---	---	---	Bra Dic (19 (19 Star (19 (19
Scottsbluff Bison Quarry	25SF2	Scottsbluff	8938 ± 85 8680 ± 85 <i>(Average:8809 \pm 60)^g</i>	10,239-9762; 9752-9745 10,115-10,076; 9922-9515; 9514-9502 <i>(10,157-9656; 9645-9631)^g</i>	AA-67443 AA-67442	Bison bone Bison bone	Hill Knu (20 (19
Finley	48SW5	Scottsbluff, Eden	8950 ± 220 9026 ± 118	10,583-9528 10,494-10,451; 10,443-9762; 9752-9745	RL-574 SMU-250	Bison bone Apatite	Fris Fris (20 Hof (20 (19

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			<i>(Average: 9009 ± 104)</i>	<i>(10,415-9763; 9752-9746)</i>			
Medicine Lodge Creek: Area 2 [†]	48BH499	Eden or Alberta/Cody	9030 ± 470	11,603- 11,527; 11,499-11,422	RL-439	Bison bone	Fris
Medicine Lodge Creek: Area 3 ^p	48BH499	Probable Eden	8600 ± 250 (not used)	---	RL-1107	Bison bone	Fris was 20 c prob be y cult
Hell Gap: Locality I ^p	48GO305	Alberta, Eden, Scottsbluff	8590 ± 350	10,494- 10,451; 10,443-8696; 8674-8651	A-707	Charcoal	Hay Hay Knu (20 (20
		Scottsbluff	9120 ± 490 <i>(Average: 8769 ± 285)</i>	11,758-9023 <i>(10,558-9133)</i>	AA-29675	Charcoal	Hay (20
Hell Gap: Locality IIIS/V ^{†p}	48GO305	Eden	8890 ± 110	10,234-9653; 9648-9630	A-753A	Collagen	Hay (19 Knu
			9050 ± 160	10,641-10635; 10,588-9675	A-753C	Apatite	(20 al. (
			8665 ± 70	9887-9871; 9869-9841; 9832-9528	AA-35655	Residue	(20 (20
			<i>(Average: 8768 ± 55)²</i>	<i>(10,123- 10063; 10,006-9994; 9940-9554)²</i>			
Frasca [†]	5LO19	Eden, Scottsbluff	8910 ± 90	10,229-9730; 9722-9705	SI-4848	Bone	Ful Hol Kon Pitb (19 (20 may was

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Lindenmeier p	5LR13	Alberta	9690 ± 60 9880 ± 100 (Average: 9740 ± 51)	11,231- 11,062; 11,030- 10,994; 10,970-10,788 11,751-11,127 (11,248- 11,081; 10,930- 10,880)	TO-341 TO-339	Charcoal Charcoal	Hay Hol
Lamb Spring	5DO201	Eden, Scottsbluff	8870 ± 350 7870 ± 240 (not used)	11,068- 10,955; 10,865- 10,848; 10,804-9086; 9049-9034 ---	M-1463 SI-45	Bison bone Bison bone	Ran et a Kon Fish Ran Star Hol (19 (19 thou (Ra Kon beli you pub esta prot
Jurgens: Area 3	5WL53	Kersey; Pitblado (2003:86) calls them Eden.	9070 ± 90	10,495- 10,450; 10,444- 10,114; 10,083-9918	SI-3726	Combined charcoal pieces from bonebed	Bra et a (20 (19 (19
Hudson- Meng	25SX115	Alberta, Eden, Scottsbluff	8990 ± 190 9380 ± 100 9820 ± 160	10,551- 10,532; 10,523-9556 11,070- 10,952; 10,867- 10,844; 10,822-10,274	SMU-52 SMU-102 SMU-224	Apatite Collagen Combined charcoal	Age 197 Star (20 (19 Son the poin

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			9380 ± 70	11,820-10,713	Beta-64322	Charcoal	are this are elev bon whe wer Pale cau is fr late natu sub Coc Rap 201
			9600 ± 60	11,057- 11,035; 10,989- 10,980;	Beta-65278	Charcoal	
			9630 ± 60	10,786- 10,383;	Beta-10364	Bone	
			9720 ± 80	10,316-10,302	Beta-12841	Bone	
			(Average: 9556 ± 30) ³	11,168-10,746 11,185-10,767 11,257- 11,055; 11,037-10,779 (11,084- 10,922; 10,885- 10,726) ³			
Osprey Beach ^{p†}	48YE409/ 48YE410	Eden, Scottsbluff	9359 ± 60	10,739-10,405	Beta-148567	Charcoal	John (20 (20
Mammoth Meadow I	24BE550	Eden, Scottsbluff	9390 ± 90	11,069- 10,953; 10,866- 10,846; 10,817- 10,367; 10,359-10,296	TO-1976	Charcoal	Bon Pith poin asso note site 199
Lime Creek ^{p†}	25FT41	Scottsbluff	9120 ± 510	11,929- 11,892; 11,826-9006	TX-6778	Humates	Bar (20 Cor (20 prob Cen
Carter/Kerr- McGee	48CA12	Alberta/Cody, Eden, Scottsbluff. The dates are associated with Eden and Scottsbluff.	8950 ± 220 9026 ± 118	10,583-9528 10,494- 10,451; 10,443-9762; 9752-9745	RL-574 SMU-250	Un- published Un- published	Fris 199 (20 The stra Ede this

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			(Average: 9009 ± 104)	(10,415-9763; 9752-9746)			
Laddie Creek	48BH345	Cody	No associated dates. Cody level is older than 6650 ± 480 (not used)	---	RL-692	Charcoal	Lar Kar
Jerry Craig	5GA639	Morphologically variable. Some are reminiscent of Eden or Scottsbluff, while others are similar to Firstview, Kersey, and San Jon (Richings-Germain 2002:57).	9310 ± 50 8490 ± 50 (not used; may post-date Cody)	10,660- 10,612; 10,609- 10,371; 10,355- 10,339; 10,329-10,298 ---	Beta-109467 Beta-109466	Charcoal Charcoal	Kor 101 (20 Sur
Wetzel	No number	Cody	7160 ± 135 (not used)	---	SI-4849	Bison bone	Cas (19 info con
Chain Lakes	---	---	No dates	---	---	---	Fris an a sou
Malin Fishing Hole	24YE353	Scottsbluff	8880 ± 50 9530 ± 50 (Average: 9205 ± 35) ³	10,182-9779 11,091-10,683 (10,491- 10,455; 10,439- 10,252) ³	Un-published Beta-196111	Un- published Un- published	Viv Am Mur
Blue Point	48SW5734	Alberta, Scottsbluff	9540 ± 40	11,086- 10,920; 10,891-10,703	Beta-133208	Charcoal	Joh 63); (20
Clary Ranch (not used)	25GD106	Intermediate between Scottsbluff and Jimmy Allen	9040 ± 45 (not used)	---	CAMS- 105849	Bison bone collagen	Hill (20 tech indi Ran betw Jam (20

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Sorenson (not used)	24CB202	Alberta, Scottsbluff	7960 ± 150 (not used)	---	SI-308	Charcoal	Hus Hus 11), date sanc 1 (H usec
Rocky Mountain National Park sites	---	---	---	---	---	---	Br seve Mo proc poin
Plains sites	---	---	---	---	---	---	LaE 139 Coc and
Pictograph Cave I	24YL0001	Eden	No dates	---	---	---	Mu 6.1, Val iden leve
Sites in Alberta, Canada	---	Variable					Pec syn CRI in A Coc in V (19 Alb
Deadman Wash	48SW1455	Scottsbluff, Eden	No dates	---	---	---	Two iden com (Ar Cre 189 198 Sall
Forest Canyon Pass	5LR2	Firstview-Kersey and Eden	No dates	---	---	---	This cam Nat Coc 200

[†] Indicates that other relevant radiocarbon dates exist but were excluded in favor of the most reliable/applicable dates.

^p Indicates probable (not definite) association between diagnostic artifacts and the radiocarbon date(s) listed.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with caution or not at all.

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James Allen/Frederick cultural complex description. It is debatable whether James Allen/Frederick should be considered a cultural complex or simply a type of lanceolate projectile point characterized by parallel-oblique flaking, with parallel or expanding bases that are slightly to deeply concave. For example, Wiesend and Frison (1998:20) advised that “[o]ne should not exclusively consider... James Allen points as pertaining to a completely distinctive, separate late Paleoindian group. Rather, one should take into account the diversity of cultural groups, and possible overlapping with other late Paleoindian sequences in space and time.” Kornfeld et al. (2010:92), on the other hand, consider James Allen/Frederick points diagnostic of the “Frederick and/or James Allen [c]ultural [c]omplex.”

It is also debatable whether or not the projectile point type (or types) generally referred to as “James Allen,” “Frederick,” and variations thereof should be lumped into a single point type or divided into several point types (e.g., Borchert 1989). This confusion has been exacerbated by the fact that many of the points from the James Allen type site are fragmented in nature, and some exhibit atypical flaking patterns that approach horizontal-parallel (see Mulloy 1959:114) rather than the oblique-parallel flaking pattern observed on the majority of what are currently conceived of as James Allen points.

Bonnie Pitblado, the scholar that has written the most on this typological issue, conducted quantitative analyses to distinguish between James Allen, Frederick and other similar point types including Angostura. Her results suggest that James Allen and Frederick points should be lumped into a single category that she calls Jimmy Allen/Frederick, Jimmy Allen, or JAF¹¹⁰ which is distinct from Angostura as a typological category (Pitblado 1999, 2003, 2007, 2016). After Pitblado (1999, 2003, 2007, 2016) and Hofman (1989:44), this historic context lumps James Allen and Frederick points into a single type, since they grade together. Historically, though, it is worth mentioning that the term James Allen is traditionally applied to relatively shorter, broader specimens on the James Allen/Frederick spectrum that usually have slightly deeper basal concavities and flare outward towards the base more often and to a greater degree than points that have traditionally been labeled Frederick (Irwin 1968:215; Irwin-Williams et al. 1973:50).

Pitblado (1999, 2003, 2007, 2016) also examined the spatial distribution of James Allen/Frederick points and Angostura points, which overlap temporally (Angostura points will be described in the next section). Pitblado found that James Allen/Frederick points tend to occur at low elevations on the open plains and at high altitudes in the mountains, whereas Angostura points tend to be found in foothills and at moderate montane elevations. This pattern suggests that “makers of Angostura points are virtually, by definition, a particular manifestation of the ‘Foothills-Mountain groups’ Frison has long argued occupied the Rockies after 10,000 RCYBP” (Pitblado 2007:326). It also presents the hypothesis that James Allen/Frederick peoples exploited both the open plains and high altitude montane areas as part of a seasonal round while Angostura peoples practiced a year-round montane adaptation, remaining in low to mid altitudes of the Rocky Mountains (Pitblado 1999, 2003, 2007; but see Brunswig 2007b:285-286). Groups wielding both Late Paleoindian projectile point styles appear to have exploited a diversity of

¹¹⁰ Brunswig (2007b:282).

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resources and “subsisted upon a highly varied diet” (Pitblado 1999:28). Though persuasive, one potential weakness of this hypothesis is that it is driven by an aquatic view of culture (*sensu* Binford 1972:197) that associates ethnic groups with projectile point types. Unfortunately, this assumption is often unavoidable in Paleoindian archaeology in lieu of other diagnostic indicators or conclusive evidence establishing cultural affiliation. Pitblado (2007:323; see also Pitblado 2016) also mentions that sample sizes are small, so her “findings must be considered tentative until substantiated with more data.”

A wide variety of James Allen/Frederick complex site types have been investigated on the open plains and in mountainous areas. Short-term hunting camps have been identified at Fourth of July Valley, Caribou Lake, and Carey Lake in Colorado. Red Smoke in Nebraska was interpreted as a logistical camp to obtain lithic raw material. Long-term, open-air campsites with James Allen/Frederick occupations are known at Forest Canyon Pass and KibRidge-Yampa in Colorado, at Hell Gap and China Wall in Wyoming, O.V. Clary in Nebraska, and possibly at Ray Long in South Dakota. Long-term, rockshelter occupation sites include Eagle Shelter and possibly Medicine Lodge Creek in Wyoming. Several James Allen/Frederick bison kills and/or butchery locations are also known, including the James Allen site in Wyoming, Clary Ranch in Nebraska, and Slim Arrow in Colorado. Devil’s Thumb Valley and Flattop Mountain are game drives with stone alignments at high altitude in Colorado. At both of these sites, James Allen/Frederick projectile points have been identified on the surface near the game drive features, suggesting that an association between the game drives and Late Paleoindian cultural complexes is possible but equivocal (Benedict 1996:6, 2000; Brunswig 2007b:289-290; Kinneer 2007:29). Recent excavation within the kill area at Devil’s Thumb Valley uncovered a frost-displaced James Allen/Frederick point associated with charcoal that produced reasonable James Allen/Frederick radiocarbon dates (Benedict 2005:830). This is “the best evidence to date of direct late Paleoindian association with high-altitude hunting features” (Brunswig 2007b:289). One James Allen/Frederick lithic cache, the Buffman Creek Cache, is known. It was discovered in Larimer County, Colorado, and contains one James Allen/Frederick projectile point as well as other stone tools (Burns 1996:10-23, Figure B23).

A trend towards subsistence intensification, diversification, and increased food storage activities commences during Cody complex times and continues through the Late Paleoindian period. Subsistence investigations at a limited number of James Allen/Frederick sites, mostly conducted by Matthew G. Hill, provide evidence of this trend. At Clary Ranch, a bison butchery location in Nebraska, “the intensive character of carcass exploitation [...], involving defleshing and marrow extraction, suggests that the bulk of the yield was destined for storage in anticipation of impending winter food shortages” (Hill et al. 2008:115; see also Hill 2008b). The O.V. Clary site, a residential camp in the vicinity of Clary Ranch, includes a hearth area with bison remains, as well as coyote, box turtle, and several avian genera with cut marks, spiral fractures, and/or evidence of burning, suggesting that faunal diet breadth broadened during the James Allen/Frederick phase. The same trend was observed at Hell Gap, where the Frederick phase was described as exhibiting “a radical shift from earlier occupations, especially in typology and character of faunal remains” (Irwin-Williams et al. 1973:50). While bison continued to dominate the faunal remains, “smaller species were represented to a greater degree in the Frederick level than in any of the lower levels at Hell Gap” (Byrnes 2009:218; see also Irwin-Williams et al.

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1973:45; Rapson and Niven 2009). Also at Hell Gap, ground stone was recovered from Late Paleoindian levels of unspecified cultural affiliation (Irwin and Brew 1968; Byrnes 2009:218).

At Medicine Lodge Creek, at least six manos were recovered from Area 2, around the same depth as possible Angostura, possible James Allen/Frederick, and Pryor Stemmed levels. These manos could have been used for processing flora or fauna. One of them is stained with red ochre, so it might have been used for processing pigment rather than food (Frison 2007b:57-8). Twelve storage pits were identified in the same level as the possible James Allen/Frederick point from Medicine Lodge Creek, and interpreted as food caches (Frison 2007b:61-2). If they were truly used as food caches, these features provide further evidence of planning for future periods of potential food scarcity during the James Allen/Frederick era. It is interesting that these prepared storage pits manifested during Late Paleoindian times, since similar features are generally considered characteristic of Archaic rather than Paleoindian lifeways (Reed and Metcalf 1999:81).

Limited evidence suggests that these changes in subsistence behaviors may have been accompanied by decreased mobility, or a change in mobility patterns, between earlier Paleoindian phases and the James Allen/Frederick phase. Byrnes (2009:218) reported that 99.09% of unmodified debitage and 100% of cores and tools of known association with the Frederick component at Hell Gap were manufactured from local raw materials. Many of the James Allen/Frederick tools from Hell Gap were informally and/or expediently manufactured, whereas earlier Paleoindian toolkits appear to have been comprised of larger proportions of highly curated tools made from exotic raw materials (Byrnes 2009:226). As at Hell Gap, all twenty-eight James Allen/Frederick points from the Phillips-Williams Fork Reservoir site were manufactured from local raw materials (Wiesend and Frison 1998). At Clary Ranch, however, both local and non-local toolstones were used (Hill et al. 2008:118). Metcalf (2011:147) also found that site occupational intensity increases overall between Early and Middle/Late Paleoindian periods. Patterns of James Allen/Frederick subsistence, mobility, and lithic procurement all require further investigation.

Several James Allen/Frederick occupations have yielded evidence of possible structures. Two post holes were identified in proximity to the storage pits at Medicine Lodge Creek, but speculating on their purpose would be “entirely conjectural” (Frison 2007b:62). During the 1960s excavations at Hell Gap, a stone circle was identified in the Frederick level (Irwin 1967:106-107, 233-235; Irwin-Williams et al. 1973:45; Knudson 2009:26), but was later demoted to a “potential stone circle structure” (Byrnes 2009:218). Other stone circles have been identified from earlier Paleoindian phases (e.g., Smith and McNees 2016). Our understanding of James Allen/Frederick structures, as well as structures that may have been associated with Paleoindian phases other than Folsom, remain particularly unclear.

The only published art objects known to be of James Allen/Frederick affiliation were identified at Hell Gap during the 1960s. Irwin (1967:106) described “very finely carved” or incised bone beads (Irwin 1968: Figure 104). Irwin (1967:106) also noted that the Frederick level at Hell Gap contained “well-made” bone awls.

James Allen/Frederick lithic technology description. The first published description of James Allen points appeared in 1959, with Mulloy’s account of the James Allen bison kill site. James

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Allen points are lanceolate in form with distal tips that are somewhat rounded, edges that tend to be parallel at the midsection and that may incurve slightly towards the base. Bases are concave, and these basal concavities were ground smooth. Sometimes the base expands slightly; along with the basal concavity, these two traits often combine into the “suggestion of a fishtail” at the proximal end of many James Allen points (Mulloy 1959:114). The edges are thin, sharp, and regular, and cross-sections are “uniformly lenticular” (Mulloy 1959:114). James Allen points are characterized by a parallel-oblique flaking pattern that Mulloy (1959:114) admired. He suggested that “The uniformity of the flaking and the length of the flakes both reflect a skill in pressure flaking far out of the ordinary.” These parallel-oblique flakes were produced from both margins of the point. Pressure flakes from one margin were produced to match up with flakes from the other margin. At a distance, this process often gives the false appearance of single, continuous flake scars that span the entire face of the point. The flaking pattern on James Allen points is similar to that seen on many Angostura specimens (described below), but Angostura points are discernable from James Allen by their convergent basal sides and greater thickness (Pitblado 2003:113; but see Borchert 1989). James Allen points from the type site vary from 0.25-0.56 cm thick (Mulloy 1959:114), and from the Phillips-Williams Fork Reservoir site, from 0.40-0.67 cm thick (Wiesend and Frison 1998:13).

Frederick points were described at Hell Gap in Irwin’s (1968:233-236) dissertation and subsequent early publications about that site (Irwin and Wormington 1970; Irwin-Williams et al. 1973:50). They are “lanceolate in outline with a slightly to markedly concave base” (Irwin 1968:236). Frederick points are also characterized by parallel-oblique flaking patterns that usually run from the top left to the lower right. This trend might exist because most people are right handed and knappers must execute the pressure flaking process from the distal tip to the proximal base (see Irwin 1968:233-236). Frederick points have “perfectly lenticular” cross-sections, and most points are “quite thin, about 1/8 of an inch thick” (or 0.32 cm; Irwin 1968:236). In his dissertation, Irwin (1968:236) suggested that Frederick points “are very close in type to points found at the Jimmy Allen site.” Furthermore, Wiesend and Frison (1998:11) reported that “[i]n unpublished notes pertaining to the Hell Gap site, Henry Irwin claim[ed] that the Frederick designation should not have been used, and what they named Frederick should have been James Allen.” These comments are in broad agreement with Pitblado’s (2003:112) assertion that, given the current state of the data, we are justified in considering Frederick and James Allen as a single typological unit.

Another consideration concerning James Allen/Frederick complex typology is the potential addition of a second projectile point type, in addition to James Allen/Frederick, as a diagnostic indicator of this cultural complex. One James Allen/Frederick bison kill in northeastern Colorado, the Slim Arrow site (5YM240), was originally investigated by avocational archaeologists in the late 1920s (LaBelle 2002, 2005, 2014; Taylor 2006:248-253). The site’s early investigators worked carefully and meticulously documented their excavations, artifacts, and contextual information. Jason LaBelle thoroughly studied and was impressed by these avocationalists’ work, stating that their “contribution to science” produced “among the finest records kept for the early 1930s Paleoindian work – either professional or otherwise” (LaBelle 2005:304).

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The Slim Arrow site produced sixty-five projectile points, the majority of which easily fall into the James Allen/Frederick point typological category, and apparently functioned as both projectiles and butchery tools (LaBelle 2002; see also Myers 1989).¹¹¹ Along with the James Allen/Frederick points, Slim Arrow also produced a unique, single-shouldered, parallel-oblique flaked projectile point and several similar lanceolate points that lack distinctive single shoulders. Some suggest that “[t]here is no valid reason why this morphologically unique and significant projectile point type should not be recognized” (Taylor 2006:250; see also Andersen 1990). Taylor (2006:250) proposed that this type should be named Andersen in recognition of its discoverer, Perry Andersen. Andersen points are briefly addressed in this historic context for the purpose of comprehensiveness, and it might be possible to officially designate “Andersen” as a point type pending future archaeological research. However, it would not be prudent to consider “Andersen” an established point type until it is discovered in situ and documented at additional archaeological sites.

James Allen/Frederick radiocarbon dates. There are ten sites in and around Wyoming that contain radiocarbon dates in reasonable association with James Allen/Frederick diagnostics: Fourth of July Valley, Devil’s Thumb Valley, Slim Arrow, and Caribou Lake in Colorado, Hell Gap, James Allen, and possibly Medicine Lodge Creek in Wyoming, and Clary Ranch, O.V. Clary, and Red Smoke in Nebraska. Using dates from all of these sites produces an estimated temporal range for James Allen/Frederick that spans 10,500-9400 cal BP. Medicine Lodge Creek produced the youngest of these dates, which also has a large standard error and is only possibly associated with a possible James Allen point. Removing Medicine Lodge Creek from the analysis significantly changes the estimated time span, reducing it by 250 years, from 10,300-9450 cal BP¹¹² and leaving a recent date from the James Allen type site (8405 ± 25 ¹⁴C BP; Knudson and Kornfeld 2007) as the youngest known manifestation of the James Allen/Frederick complex in this study area. Therefore, 10,300-9450 cal BP is presented as the estimated time span for the James Allen/Frederick complex in this historic context.

In 2005, Hill (2005:254) suggested that the best age estimate for Allen/Frederick was 9100-8800 ¹⁴C BP (which translates to approximately 10,300-9700 cal BP). This corresponds well with the estimated time span presented here, with the exception that Allen/Frederick appears to last several hundred years longer than estimated by Hill (2005:254) based on the compilation of dates used in this analysis. This is largely due to the inclusion of the new date from the James Allen type site, which is younger than other known James Allen/Frederick complex dates.

¹¹¹ The site also yielded a single Scottsbluff point and a single Hell Gap point in apparent context with the James Allen/Frederick points (LaBelle 2002, 2014).

¹¹² The estimated age range for the James Allen/Frederick complex in and adjacent to Wyoming was calculated by first creating a pooled mean or “average” of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for James Allen/Frederick complex ages. The summed 1 σ probability range (10,276-9426 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age range for James Allen/Frederick in and adjacent to Wyoming (circa 10,300-9450 cal BP). This date range should be viewed as a hypothesized approximation. The addition of more dates might broaden the temporal span of the James Allen/Frederick complex, and re-dating the sites already included with more precision might shrink its temporal range.

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Table-6: Key James Allen/Frederick Sites in and Adjacent to Wyoming and Radiocarbon Dates.

Site Name	Site Number	Radiocarbon Dates (^{14}C BP)	Calibrated (2σ , Intcal13; cal BP)	Lab	Material	Citation(s) and Notes
Fourth of July Valley [†]	5BL120	9170 \pm 40 8920 \pm 50 (Average: 9072 \pm 31) [†] 6045 \pm 120 (not used) 5880 \pm 120 (not used)	10,482-10,465; 10,429-10,237 10,218-9890 (10,254-10,195) [†]	Beta-170169 Beta-163670 I-6545 I-6544	Wildfire charcoal Wildfire charcoal Wildfire charcoal Wildfire charcoal	Benedict (1981, 2002, 2005, (1973); Pitblado (2003:110, dates were originally thought James Allen complex hearth showed the association was actually dated a tree throw c wildfire (Benedict 2005). Cu the site indicates that its true older dates reported at left.
Devil's Thumb Valley [†]	5BL3440	9270 \pm 40	10,569-10,366; 10,361-10,296	Beta-129167	Charcoal	Benedict (2000:32-83, Figure Brunswig (2005:830). This s James Allen/Frederick point morphologically, and technologically indistinguishable from point July Valley (Benedict 2005: at left is considered the most site, but its true age is probably to the old wood effect (Bene
Flattop Mountain	5LR6	No associated dates	---	---	---	Benedict (1996:21-75, Figure
Caribou Lake	5GA22	8460 \pm 140 9080 \pm 75 7985 \pm 75 (Average: 8942 \pm 66) ²	9743-9030 10,492-10,453; 10,441-10,134; 10,061-10,038; 10,026-10,011; 9990-9943) 9020-8626; 8619-8609 (10,234-9886; 9874-9868; 9845-9816; 9807-9794) ²	I-5449 AA-18821 AA-21984	Hearth charcoal Hearth charcoal Hearth Charcoal	Benedict (1974, 1985, 2002, Kornfeld (2013:193-194); P 2002:110, 2007); Stanford (identified as Scottsbluff/Ker 1985). Pitblado (2000; 2002 Cassells (1997:87) call them

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Carey Lake	5LR230	No dates	---	---	---	Morris and Metcalf (1993); has not been tested for subsoil (Pitblado and Brunswig 2000)
KibRidge-Yampa	5MF3687	---	---	---	---	Cummings et al. (2007); Haynes (2002:162-163, Figure 3C); the site contains stratified Paleoindian; the James Allen point was dated to the middle of an arroyo.
Sites/collections	---	---	---	---	---	Pitblado (2007:324-325) lists James Allen points in Colorado; (116, 132-139) lists notable James Allen/Frederick points across the Central Plains and radiocarbon dates
Hell Gap: Locality I ^{tp}	48GO305	8690 ± 380 8820 ± 60 9030 ± 260 8630 ± 370 (Average: 8823 ± 57)	10,704-8715; 8666-8663 10,165-9669 11,065-11,024; 11,004-10,965; 10,792-9516; 9509-9504 10,573-8691; 8689-8683; 8677-8649 (10,160-9680)	A-501 AA-28776 AA-38209 AA-38210	Mixed charcoal and earth Charcoal Carbon residue Humates	Pitblado (2003:110); Haynes (1968:106-108, 233-235, Figure 3C); et al. (2010:92); Knudson (2010:92) have been interpreted as associated with the Frederick level (Stratum F2);
James Allen	48AB4	8405 ± 25 7900 ± 400 (not used)	9491-9403; 9342-9328	UCIAMS-19330 M-304	Bison bone Charred bison bone	Knudson and Kornfeld (2000:92) (2010:92) Mulloy (1959:113-114); Pitblado (2010:92) date has subsequently been revised (2010:92).
Eagle Shelter	48BH657	8140 ± 40 (not used; not directly associated with diagnostics) 7,300 ± 400 (obsidian)	---	Beta-183837 ---	Charcoal ---	Finley (2008:89-102) describes the site as "9/12 Contact." The James Allen point is located within Stratum 9 (Chomko 1982, 1990)

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		hydration date, not used)				
Ray Long	39FA65	No known associated dates	---	---	---	Borchert (1989); Hughes (1995[1959]:436-437, Figure 1). This artifact was previously misidentified as a James Allen point (Hughes 1949). Wheeler (1949) believed it to be a large, narrow point. However, from the figures of the point, it fits within the range of variable Allen points. This artifact was dated to the younger components dominating the site.
Clary Ranch	25GD106	9040 ± 32	10,242-10,185	SR-6602/CAMS-105849	Bison bone collagen	Bamforth (2013b:71); Hill (2008b:70); Hill et al. (2008:121); Frison (2013:306) notes that the technology of the individual tools at Clary Ranch is intermediate between Scottsbluff and James Allen points.
Chain Lakes	---	No dates	---	---	---	Frison et al. (2015). These are the only sites in southwestern Wyoming with dates.
O.V. Clary	25GD50	9043 ± 52	10,366-10,361; 10,294-10,137; 10,060-10,039; 10,024-10,013; 9989-9943	AA65422	Charcoal	(Hill et al. 2008:121); Bamforth (2013b:71); Frison (2013:306) notes that the technology of the individual tools at Clary Ranch is intermediate between Scottsbluff and James Allen points.
		9076 ± 62	10,479-10,467; 10,426-10,152; 9984-9965	AA65421	Charcoal	
		8993 ± 54	10,245-10,116; 10,072-9920	AA65425	Hearth charcoal	
		(Average: 9034 ± 32)	(10,240-10,182)			
Medicine Lodge Creek: Area 2 ^{p†}	48BH499	8010 ± 340	9680-8160; 8082-8071	RL-384	Charcoal and dark soil	Frison (2007b:Figures 3.2j, 3.2k) dated this point within a specific context that fits comfortably within a lump of the James Allen type. Pitblado (1995) dated the James Allen/Frederick point from Medicine Creek, though did not specifically refer to Frison's (2007b) dates as the most likely candidate. This point is supported by radiocarbon dates, reported as 8010 ± 340 (both run on the same sample as the 8082-8071) (Frison 2007b:62), and considered to be younger than the point. The point from Area 1 (Frison 2007b:62) seems that a great deal of point material was
		8570 ± 230	10,193-9073; 9062-9032	RL-384a	Charcoal and dark soil	
		(Average: 8394 ± 191)	(9900-8952; 8919-8862; 8832-8780)			

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						occurred in this area (see Frison 1998:153) so radiocarbon dates from Allen points are not used here.
Phillips-Williams Fork	5GA1955	No dates	---	---	---	Kornfeld et al. (2010:93, 94, 1998). Twenty-eight James Allen points were collected by avocationalists from a 100-year period. "This collection is the largest assemblage of the James Allen type" (Wiesend and Frison 1998:153).
Red Smoke [†] p	25FT42	8830 ± 130 8910 ± 130 (Average: 8870 ± 92)	10,196-9557 10,252-9582; 9573-9562 (Average: 10,220-9665)	Tx-7558 (split sample) Tx-7558 (split sample)	Charcoal and burned bone Charcoal and burned bone	Hill (2005:153); Knudson (2005:7.10, Table 7.3). This might be considered a Central Plains site. James Allen points were identified here. Also produced the two dates for an additional point that could be from the Frederick side of the James Allen continuum was recovered from this site (currently radiocarbon dated 10,196-9557, Figure 7.11e). Knudson (2005) suggests these points should all fall within the "Medicine Creek complex" (Allen/Frederick).
Buffman Creek Cache	Colorado	No dates	---	---	---	Burns (1996:10-23, Figure B.1).
Seminole Beach	48CR116 6	No dates	---	---	---	Two James Allen points from this site were described in Miller (1998:153).
Slim Arrow	5YM240	9110 ± 50		Un- published	Dentin	LaBelle (2002, 2005, 2014); Frison (2005:153). James Allen/Frederick points were found in context with a single Hell Gap/Scottsbluff point, and possibly associated with this site. The radiocarbon dates for material recovered during James Allen investigations during the 1990s (Frison 2005:153).
48LN1185 (not used)	48LN118 5	8180 ± 70 (not used) 8570 ± 220 (not used)	--- ---	Beta-56835 Beta-43189	Hearth charcoal Hearth charcoal	Possibly associated with Frederick points, similar, southwest Wyoming (MacDonald 1993; Thompson 1998). These dates were not used due to typology and association.
48SW8842 (not used)	48SW884 2	10,140 ± 885 (not used)	---	Un- published	Un- published	Mullen (2009:29). Date is very young and not used.
China Wall	48AB1	No associated dates	---	---	---	Waitkus (2013:8-1 - 8-14). James Allen/Frederick points were

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Forest Canyon Pass	5LR2	No dates	---	---	---	This large multicomponent c National Park produced a Ja component (Brunswig 2007)
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[†] Indicates that other relevant radiocarbon dates exist but were excluded in favor of the most reliable/applicable/verifiable dates.

^P Indicates probable (not definite) association between diagnostic artifacts and the radiocarbon date(s) listed.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with caution or not at all.

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State*Foothill/Mountain Regions*Late Paleoindian: Foothill/Mountain Complex, Angostura/Lusk Points (ca 10,250-9250 cal BP)

Angostura/Lusk description. As mentioned in the discussion of the James Allen/Frederick cultural complex with which Angostura/Lusk is partially contemporaneous, Angostura/Lusk points are considered one manifestation of Frison's "Foothill-Mountain" groups (Pitblado 2007:326; see also Kornfeld et al. 2010:94).¹¹³ Angostura/Lusk is the earliest named point type that marks the divergence between open plains and Foothill/Mountain cultural complex lifeways in Wyoming. Preceding Early and Middle Paleoindian cultural complex diagnostics appear in both open plains and mountain settings, although local adaptations varied across space and by ecoregion.

Although it is accepted as a named point type, some archaeologists do not consider Angostura/Lusk to represent its own cultural complex; rather, Angostura/Lusk may be defined as one particular manifestation of a larger suite of foothill-mountain adaptations. In other words, Angostura/Lusk is sometimes considered one form of projectile point morphology that is subsumed within a broader Foothill/Mountain cultural complex.¹¹⁴ Other diagnostic indicators of the Foothill/Mountain complex include Lovell Constricted (described below), an array of unnamed projectile point varieties (see especially Frison and Walker 2007; Husted and Edgar 2002; Kornfeld et al. 2010:104-106), and possibly Pryor Stemmed (described below), depending on whether it is considered its own cultural complex or subsumed into the Foothill/Mountain category. Frison (2007a:8) suggested that of the Foothill/Mountain point types, only Pryor Stemmed should be elevated to the level of its own cultural complex. According to Frison (2007a), other Foothill/Mountain points, including Angostura/Lusk and Lovell Constricted, have not been recovered at enough sites with sufficient integrity to warrant formal designations. However, in Kornfeld et al. (2010), all of these point types are described as complexes. Whether Angostura/Lusk represents a point type and/or cultural complex is largely a semantic debate that has little to no bearing on understanding Paleoindian lifeways. Academic obfuscations like this could be easily resolved if archaeological terms such as *point type* and *cultural complex* were clearly and explicitly defined in the Paleoindian literature.

Another challenge with Angostura/Lusk is establishing a satisfactory description of the point type. In 1989, Borchert suggested that "[i]n using the terms Angostura, Lusk, Frederick, and James Allen, distinguishing between the types is difficult as artifact attributes do not vary considerably" (1989:76). In 1995, Banks and colleagues noted that "[o]ne of the most vexing aspects of [the Angostura] type site is the inconclusive nature of the Angostura point typology" (Banks et al. 1995:n.p.). The Angostura type site (Ray Long in South Dakota) was salvaged as part of the River Basin Surveys project in 1950, under the direction of Richard P. Wheeler. Though he provided the Lincoln River Basin Surveys office a publication-ready report on the Angostura-Boysen-Keyhole reservoirs, it was not actually published until 1995 (Banks et al.

¹¹³ "We know more today relevant to a Paleoindian foothills/mountains adaptation than when the idea was first proposed [in 1987], but the idea is still not well defined [...] [W]e believe that the idea still retains some merit, but [...] we see it as an oversimplification of the Paleoindian archaeological record" (Frison and Walker 2007:229-230). Our understanding of Late Paleoindian regional adaptations still requires a great deal of work.

¹¹⁴ Comprehensive work conducted primarily by Bonnie Pitblado (1999, 2003, 2007) over the last few decades has clarified and elucidated the Angostura/Lusk typological category and associated lifeways. It might be time to consider elevating Angostura/Lusk to its own cultural complex.

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1995; Wheeler 1995[1959]; see also Buhta et al. 2012; Buhta et al. 2013; Hannus et al. 2012; Wheeler 1954). The absence of this published report contributed to decades of confusion surrounding the Angostura point type (Banks et al. 1995). This problem was exacerbated by the fact that in Wormington's (1957:138-141) *Ancient Man in North America*, an image of a point from Nebraska rather than the type site was given as an example of an Angostura point (Husted and Edgar 2002:115; Pitblado 2007:317; Wormington 1957:139). In the photograph, this specimen appears more similar to the Frederick side of the James Allen/Frederick typological spectrum than it does to Angostura points from Ray Long.

In his dissertation, Henry Irwin (1967) used the term Lusk to describe Angostura-like specimens at Hell Gap (see also Irwin-Williams et al. 1973:51). The Lusk type was conceived after investigations at the Betty Greene site near Lusk, Wyoming, where nineteen projectile points that "conform to one morphological type" (Greene 1967:22, 27) were recovered. Ann Monseth Greene wrote a thesis on the Betty Greene site in 1967. In her thesis, Greene concluded that she would:

[R]esist the impulse to add yet another point type to the already overlong list of paleo-Indian point types. Inclusion of the point types from the Betty Greene site in some already defined category, or the establishment of a new point type must await a projected study of the entire oblique-flaked point problem (Greene 1967:71-72).

Greene's (1967:71-72) cautious interpretation of the projectile points from Betty Greene site is somewhat surprising considering that in the same year, Henry Irwin (1967:236-237), "[u]pon the council of H.M. Wormington," dubbed the points recovered from Betty Greene "Lusk" points. According to Irwin, "[t]he term 'Lusk' replace[d] in part a point type entrenched in the literature, Angostura, whose exact nature [was] unknown" (1967:236). This was a valid strategy at the time; in his dissertation, Irwin (1967:236) mentioned the difficulties inherent in dealing with Wheeler's (1995[1959]) unpublished report. However, most subsequent studies of the "oblique-flaked point problem" agree that Lusk should be dropped from the literature as a typological category "because it only confuses the issue" (Borchert 1989:68) of parallel-oblique flaked point typology. Lusk should be dropped because, in terms of nomenclature, the "Angostura" label takes precedence over the "Lusk" label. Angostura points were described at Ray Long at least a decade prior to Lusk point descriptions at Betty Greene and Hell Gap (Pitblado 2003:113; 2007:318). In hopes of alleviating rather than exacerbating these semantic issues, Angostura and Lusk types are lumped into the same typological category, Angostura/Lusk, for the purposes of this historic context.

Despite its precarious history, the Angostura/Lusk point type has now been identified in context at several different site types. Concordant with its classification as a Foothill/Mountain complex, Angostura/Lusk occupations are commonly, but not always, found in rockshelters. Rockshelters with in situ Angostura/Lusk diagnostics include Mummy Cave (North Fork Cave #1) and possibly Little Canyon Creek Cave, Bush Shelter, Bass Anderson, Medicine Lodge Creek, and Southsider Shelter in Wyoming¹¹⁵ and Mangus in Montana. Open Angostura/Lusk

¹¹⁵ If the diagnostics at these latter sites are truly Angostura/Lusk points.

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camps include Ray Long in South Dakota, Myers-Hindman¹¹⁶, Barton Gulch (Alder/Hardinger points),¹¹⁷ and possibly Sheep Rock Spring in Montana, Helen Lookingbill, Betty Greene, Hell Gap, Game Creek, and Pine Spring in Wyoming, Pretty Butte in North Dakota, Cathedral Butte,¹¹⁸ and a short-term, warm-season hunting base camp, Lawn Lake, in Colorado.

Some Angostura/Lusk peoples clearly continued hunting large game, including bison (e.g., at Cathedral Butte; Stucky 1977; see also Sellet 2008). Several lines of evidence also suggest that Angostura/Lusk peoples continued “readapt[ing] toward a broad-spectrum economy, more consistent with shifting climatic-environmental conditions” (Irwin-Williams et al. 1973:52). At Betty Greene, this interpretation of Angostura/Lusk peoples was supported by a more varied tool assemblage than older levels, including a mano and metate (Greene 1967:57-59; Irwin-Williams et al. 1973:51). Ground stone implements, including milling slabs and/or manos are associated with Angostura/Lusk components, have also been identified at many other sites, including Lawn Lake (Brunswick 2007b:291-292), Ray Long (Wheeler 1995[1959]:424-426; Winham and Banks 2012:46-49),¹¹⁹ and Mangus (Husted 1969:27-41,122). This broadening of diet breadth is also supported by Susan Hughes’ zooarchaeological study of Mummy Cave (North Fork Cave #1). Based on faunal, isotopic, and paleoclimatic analyses, Hughes (2003:285-286) concluded that climatic change produced increasingly arid conditions before 8000 ¹⁴C BP, which may have reduced the abundance of bison on the Plains and Front Range of the Rockies and subsequently led Foothill/Mountain groups such as Angostura/Lusk to pursue broader subsistence economies that were relatively less reliant on bison (see also Lovvorn et al. 2001; but see Mullen 2008).

Hearths and thermal features at many Angostura/Lusk sites appear to increase in frequency and extent compared to previous phases (see LaBelle 2005:212-221 for comparable, quantitative data). For example, at Mummy Cave (North Fork Cave #1), the Angostura/Lusk levels include two types of hearths: “shallow basin-shaped depressions” and “deeper bowl-shaped pits” (Husted and Edgar 2002:117). These thermal features range from a quarter meter to just over a meter in maximum width, and are 6-25 centimeters deep (Husted and Edgar 2002:37-43). Contemporary Angostura/Lusk levels at Ray Long included “unprepared, heavily fired hearths,” a “large and shapeless” “burned area” at least one square meter in size. The fire hearth features at Ray Long range from approximately one half to one meter in maximum width and are 3-15 centimeters deep (Wheeler 1995[1959]:410-411, 432-433). Similar but slightly smaller features were also identified at Mangus (Husted 1965:8).

At Ray Long, a “small oval mass of charred vegetal remains” including burned fragments of wood and herbaceous stems other than grasses in soil was recovered in close proximity to a hearth (Wheeler 1995[1959]:426). Wheeler (1995[1959]:449) speculated that this vegetal mass could have functioned as tinder, but might be related to floral resource exploitation in some way.

¹¹⁶ Myers-Hindman was interpreted primarily as a lithic retooling and procurement station.

¹¹⁷ Barton Gulch may not actually be affiliated with Angostura/Lusk.

¹¹⁸ Cathedral Butte is considered an open-air camp at the top of a butte with an associated bison butchering area.

¹¹⁹ A pollen wash on one of the groundstone implements from Ray Long indicated the presence of *Apiaceae* and grass seed pollen. The artifact was also tested for protein residue. None of the blood antisera the sample was tested against produced a reaction, indicating that “it is possible that [the groundstone artifact] was not used to process animal remains” (Cummings and Puseman 1995:4).

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The plant species were never identified. Extensive evidence of plant use was documented at the Barton Gulch site in Montana during the Alder complex (Armstrong 1993; Davis et al. 1994; LaBelle 2005:203-4), which is similar to Angostura/Lusk (Pitblado 2003:116) but might date slightly earlier. Determining whether this apparent increase in plant use, hearth frequency, and hearth extent is related primarily to cultural or preservational processes requires further investigation.

Increased incidence of ground stone along with more extensive thermal features and varied tool assemblages suggest that Angostura/Lusk peoples may have broadened their resource base to include the exploitation of more floral resources. Very few formal zooarchaeological analyses have been conducted on Angostura/Lusk assemblages in and around Wyoming. However, evidence from several sites indicates that Angostura/Lusk peoples also broadened their faunal diet breadth. At Mummy Cave (North Fork Cave #1), for example, fauna from the Angostura/Lusk levels include predominantly bighorn sheep. Additionally, several aves, deer, bear, marmot, porcupine, and leporid remains are represented in these cultural levels (levels 8, 9, 10, and 12 according to Husted's system [Husted and Edgar 2002:168] or levels 20, 19, 18, and 16, respectively, according to Edgar's system [Hughes 2003]). A broad diet breadth focusing on bighorn sheep and a variety of fauna smaller than bison is characteristic of Foothill/Mountain subsistence adaptations, including Angostura/Lusk.

Several interesting artifacts and features have been recovered from Angostura/Lusk occupations. At Barton Gulch in Montana, two stone tablets incised with rectilinear designs were recovered in context with the Alder complex (Davis et al. 2009). The functional purpose and/or symbolic meaning of these tablets are unknown (Davis et al. 2009). At Ray Long in South Dakota, mineral pigments (ochre) and a palette were recovered from Angostura/Lusk levels (Wheeler 1995[1959]:424,426,439). Also at Ray Long, the tip fragment of a belemnite fossil was found (Wheeler 1995[1959]:439). This specimen was almost certainly a manuport. Further speculation suggests that it might have been intended for use as an atlatl weight (e.g., see Kornfeld et al. 2010:441, Figure 8.7c). However, the belemnite did not necessarily have any intended utilitarian purpose, since baculite fossil manuports were also identified in context with the Angostura occupation at this site (Wheeler 1995[1959]:449) and these have no known tool-related function(s).

At Mummy Cave (North Fork Cave #1), one of the Angostura/Lusk occupations contained a rock alignment described as a "continuous line of three stone slabs set on edge" (McCracken et al. 1978:80). The alignment was 1.68 meters in length and averaged 25.4 centimeters in height (Husted and Edgar 2002:39). Both McCracken et al. (1978:80) and Husted and Edgar (2002:39-40) argued that the slabs appear purposefully erected, since the probability of the slabs naturally aligning and resting on edge is extremely low. However, the purpose of the stone alignment is conjectural. Part of a bighorn sheep skull was found lying just upslope of the alignment, but the association of the skull with the feature is "tenuous at best" (Husted and Edgar 2002:40; McCracken et al. 1978:80). If the skull is associated, McCracken and colleagues (1978:80) suggested that the alignment and cranium might have had some sort of symbolic meaning. Alternatively, Husted and Edgar (2002:40) suggested that the stones might have served as a retaining wall to prevent water or talus from sliding into the Mummy Cave living area.

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Angostura/Lusk lithic technology description. In Wheeler's initial but brief Ray Long site description, he characterized Angostura points as having:

[C]onvex sides and a concave or straight, thinned base, and they bear parallel, diagonal flake scars, running from upper left to lower right and extending from the tip to the base. They are flat and are lenticular in cross section. The sides of the points are ground at the proximal end but the base itself is seldom ground (Wheeler 1954:4).

In the 1995 publication of his comprehensive report, Wheeler (1995[1959]:415) added that the symmetrical sides of Angostura points incurve towards the tip and taper towards the narrow base. The flake scars generally extend from each lateral edge towards the midline (comedial) but occasionally reach across the entire face (transmedial). He also added that, although most Angostura points are lenticular in cross section, they can be rhomboidal if the flake scars on both point faces meet asymmetrically; that is, if flake scars are shorter from one lateral edge of the point than the other and the point is beveled (Wheeler 1995[1959]:415).

Wheeler also implied that large, narrow, lanceolate knives with straight bases, as well as small ovate knives with straight bases, might be diagnostic of the Angostura/Lusk complex, but did not provide any images of these knives (Wheeler 1995[1959]:449). The possibility of including knives in the suite of known Angostura/Lusk diagnostics therefore requires further research. Such a suggestion might be complicated by the finding that on the Southern Great Plains (Texas), Angostura points themselves were probably used interchangeably as projectile points *and* butchering knives, based on microscopic and macroscopic use-wear analyses (Anderson 2013:292). Similar use-wear studies have not been conducted for Angostura/Lusk on the Northwest Plains.

Pitblado's (2007) definition of Angostura/Lusk is based on and broadly agrees with Wheeler (1995[1959]). Pitblado (2007:315-318) concurs that Angostura/Lusk flaking patterns are typically parallel-oblique, but adds that they can sometimes be collateral, irregular, or (rarely) horizontal. One side of an Angostura/Lusk point might show flaking patterns different from its opposite face. Consequently, cross-sections are usually symmetrical but can be "D-shaped," "twisted," or asymmetrical in other ways (Pitblado 2007:316). She also notes that, contra Wheeler (1995), finished Angostura points usually *do* have ground basal edges (Pitblado 2007:315).

Irwin's (1967:236-237) definition of Lusk points is broadly concordant with Pitblado's (2007) and Wheeler's (1995[1959]) definitions of the Angostura type. At Hell Gap, though, it is worth noting that Irwin (1967:237) included the added observation that Lusk points "are always of a lower width/length ratio than Frederick points." That is, Angostura/Lusk points are generally narrower than James Allen/Frederick points. When viewed from the edge, however, Angostura/Lusk points (~4.75-8.00 mm thick) are generally thicker in cross section than James Allen/Frederick points (~2.5-6.7 mm thick; see "James Allen/Frederick" section). At Betty Greene, Angostura/Lusk maximum thickness ranges from 6-8 mm thick (Greene 1967:22). At Ray Long, Angostura points range from 4.75-8 mm thick (Wheeler 1995[1959]:413-414). Concerning the Ray Long point measurements, it is important to note that "no complete specimens in pristine condition were recovered from the Ray Long type site" (Wheeler

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1995[1959]:416). This means that the actual thickness of complete points from Ray Long could potentially be higher than the values reported by Wheeler (1995[1959]:413-414). In summary, Angostura/Lusk points are differentiable from James Allen/Frederick in that Angostura/Lusk are generally narrower and thicker, and their edges incurve towards the base (i.e., the basal margins converge at the proximal end of the point; Pitblado 2007:321).

Angostura/Lusk radiocarbon dates. There are twelve sites in and around Wyoming that include probable or definite Angostura/Lusk points in reasonable association with radiocarbon dates. These sites are Little Canyon Creek Cave, Bush Shelter, Helen Lookingbill, Medicine Lodge Creek, Mummy Cave (North Fork Cave #1), Game Creek, and Pine Spring in Wyoming. The Ray Long type site in South Dakota is also dated. In Colorado, Lawn Lake has a date associated with Angostura/Lusk points. Barton Gulch, Myers-Hindman, and Mangus in Montana all have Angostura/Lusk or similar components associated with radiocarbon dates. Together, these sites produce an estimated temporal range for Angostura/Lusk in and immediately adjacent to Wyoming that spans circa 10,250-9250 cal BP.¹²⁰ This age range is partially contemporaneous with the Cody complex. The estimated temporal span of the James Allen/Frederick complex falls almost completely within the range estimated for Angostura/Lusk.

A study in Texas recently estimated the temporal span of Angostura on the Southern Plains, finding that Angostura occurs from 9880-8880 cal BP in that region (Anderson 2013:196; see also Bousman and Oksanen 2012:Figure 9.5). This suggests that the Angostura/Lusk manifestation on the Northwest Plains may have started and ended earlier than the Angostura manifestation on the Southern Plains. The youngest Angostura date used in this Wyoming-area regional study was produced at Lawn Lake, Colorado (8000 \pm 170 ¹⁴C BP), which also happens to be one of the southernmost sites. In light of these observations, an interesting topic of future research might include spatiotemporal analysis of Angostura/Lusk dates across the Northern, Central, and Southern Plains to determine whether Angostura truly manifested earlier in the north than in the south.

¹²⁰ The estimated age range for the Angostura/Lusk manifestation of the Foothill/Mountain cultural complex in and adjacent to Wyoming was calculated by first creating a pooled mean or “average” of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for Angostura/Lusk point ages. The summed 1 σ probability range (10,226-9266 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age range for Angostura/Lusk in and adjacent to Wyoming (circa 10,250-9250 cal BP). This date range should be viewed as a hypothesized approximation. The addition of more dates might broaden the temporal span of the Angostura/Lusk manifestation of the Foothill/Mountain cultural complex, and re-dating the sites already included with more precision might shrink its temporal range.

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Table-7: Key Angostura/Lusk Sites in and Adjacent to Wyoming and Radiocarbon Dates.

Site Name	Site Number	Radiocarbon Dates (^{14}C BP)	Calibrated (2σ , Intcal13; cal BP)	Lab	Material	Citation(s) and Notes
Ray Long	39FA65	9380 \pm 500 7715 \pm 740 (not used) 7073 \pm 300 (not used) 9060 \pm 50 9040 \pm 50 8970 \pm 50 8880 \pm 50 (Average: 8988 \pm 25)	12,375-12,346; 12,297-12,290; 12,236-12,201; 12,184-9432	M-370 C-454 C-604 GX-2465 GX-24607 GX-24603 GX-24604	Bulk, composite charcoal Charcoal Charcoal Charcoal Charcoal Charcoal	Buhta et al. (2012:20); Cranford (2000a:261); Pitblado (2003:115) (1995[1959]:440). Area A, Lusk points associated with this zone. Pitblado (2003:115); Wheeler (1995[1959]:447) lists this date as [cultural complex] association (1995[1959]:427) mentions contaminated. Area B. Pitblado (2003:115); Wheeler (1995[1959]:447) mentions contaminated. Area B. Buhta et al. (2012:20). Area A. Buhta et al. (2012:20). Area A. Buhta et al. (2012:20). Area A. Buhta et al. (2012:20). Area A.
Little Canyon Creek Cave ^p	48WA323	8790 \pm 210	10,400-9426	RL-640	Un-published	Frison (1978:23); Miller (1988:116) (2000a:261); Pitblado (2003:115) projectile point associated with "oblique" rather than placing Angostura/Lusk typological
Bush Shelter	48WA324	9000 \pm 240 9530 \pm 100	10,722-9526 11,169-10581	RL-1407 UCR-2048	Hearth charcoal Burned packrat midden	Frison (1983b:120); Miller (1988:116) (2000a:261); Pitblado (2003:115). Frison projectile point associated with "transverse" flaking. He does not identify specific Angostura/Lusk type might be better described as James Allen/Frederick and A. image in Miller (1988:116; from right). There is another from this level at Bush Shelter be pictured in Miller (1988). Miller (1988:12); Pitblado (2003:115)

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		(Average: 9452 ± 92) ²	(11,103- 10,489;10,457- 10,437) ²			
Barton Gulch (Alder / Hardinger complexes) [†]	24MA171	8690 ± 210 (Hardinger)	10,249-9258	RL-1377	Charcoal	Davis (1989); Davis et al. (1989:115)
		8960 ± 190 (Hardinger)	10,503-9549	Beta-37205	Charcoal	One point identified from the site at this site appears to have reworked morphology. "It is lanceolate in cross-section, and widest at body mid-section, transverse-parallel flaking. . . . It strongly resembles an Angostura point termed the "Metzal" point type. The older "Alder complex" points are distinguished by flaking patterns similar to those closer to Hell Gap or Agate points, though they do not seem to be distinguished significantly by resharpening (Davis 1989:8); some Angostura points from this type site do have a somewhat different shape after resharpening (see Wheeler 1995[1959]:380,390). Consequently, these complex dates are not used for a time span estimate for Angostura points, though Pitblado (2003:116) suggests that the Hardinger complex points "may be" Angostura points found elsewhere (2006:269-270) for other data. This communication with Davis. These points are included here because they were included in the provenience information.
		8780 ± 260 (Hardinger)	10,545-10,535; 10,521-9253; 9161-9154	RL-1376	Charcoal	
		(Average: 8825 ± 124)	(10,189-9560)			
		9410 ± 140 (Alder, not used)		Beta-23215	Charcoal	
		9340 ± 120 (Alder, not used)		Tx-7565	Charcoal	
		9340 ± 120 (Alder, not used)		Tx-7564?	Charcoal	
Bass Anderson	48GO9	8900 ± 310 (not used)		Beta-28876	Un- published	Eisenbarth and Earl (1989:115) (2003:115). There is no published confirmation that this date is associated with a diagnostic(s). This date might be associated with Angostura/Lusk, Pryor Stemmed, or other complexes (see Kornfeld et al. 2006:269-270).
Helen Lookingbill [†]	48FR308	8980 ± 80	10,262-9883; 9878-9862; 9849-9786	Beta-61992	Charcoal	Frison (1983a; 1983b:124, Frison and Barrows (1995:4, 18); Lovell and Pitblado 2003:115). See also Lovell and Wasilik (2006). Some associated with the Alder complex rather than the Lookingbill, the dates associated with those containing Lovell Constricted points, those containing points similar to the "Alder complex" (Kornfeld and Barrows 2006:269-270).
		8880 ± 60	10,190-9761; 9754-9744	Beta-69787	Charcoal	
		8525 ± 100	9761-9754; 9745-9280	Beta-28116	Charcoal	

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		7860 ± 90 (Average: 8658 ± 39) ²	8988-8510; 8497-8474; 8469-8459 (9692-9540) ³	Beta-61993	Charcoal	Kornfeld et al. 2010:102). S (2006:273).
Betty Greene	48NO203	7880 ± 430? (not used)		WSU-670	Charcoal	Pitblado (2003:115) and Fris that this date came from unc (1967:69) lists a different pr WSU (6,750 ± 800), and doe within a typological categor was not used. Some label the described by Greene (1967:2 label them as such. See also Knudson (2009:29), and Tay
Medicine Lodge Creek: Area 2 [†]	48BH499	8760 ± 400 8730 ± 40 8320 ± 220 (Average: 8717 ± 39)	11,068-10,956; 10,864-10,849; 10,801-8768 9887-9872; 9869-9844; 9831-9556 9769-8608 (9885-9876; 9866-9848; 9818-9802; 9798-9550)	RL-379 Beta- 200488 RL-152	Unspecifie d Charcoal Unspecifie d Charcoal Unspecifie d Charcoal	Frison (2007b:31-32, 36); P dates mark the beginnings o flaking pattern at Medicine L date is associated with a poi parallel-oblique flaked point These three points (Frison 2 could comfortably be classif Pitblado's (2003:112-116) " though Frison does not place typological category.
Mummy Cave (North Fork Cave #1)	48PA201	8100 ± 130 8430 ± 140 8136 ± 90 8307 ± 78 8465 ± 90 (Average: 8292 ± 44) ² 8740 ± 140	9403-9342; 9329-8631 9681-9030 9401-9347; 9324-8770 9479-9088; 9047-9036 9609-9250; 9165-9151 (9429-9190; 9189-9137) ³	I-2354 I-2355 AA-42677 AA-42678 AA-42679 I-2353	Charcoal Charcoal Un- published Un- published Un- published Charcoal	Pitblado (2003:115); Hughe Husted and Edgar (2002:26, (1978); Wedel et al. (1968). projectile points from Cultur to the description of the Ang and Edgar 2002:96, 115). "T Layers 8–10 and 12 in Mum Wheeler's description [of A dated in a stratigraphic conte be related to later point type affinity with what I believe I (Husted and Edgar 2002:116

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		(not used) 7970 ± 210 (not used)		I-1589	Charcoal	Husted and Edgar (2002:117) is old for the stratum. According to Husted and Edgar, this date is not associated with Angostura.
Myers-Hindman	24PA0504	8291 ± 190 (8540 ± 190; uncorrected) 9126 ± 200 (9400 ± 200; uncorrected) (Average: 8687 ± 138) ³ 6740 ± 240 (uncorrected, not used)	9596-9570; 9564-8648 11,061-11,032; 10,994-10,974; 10,787-9627 (10,158-9,480) ³	GaK-2624 GaK-2627 GaK-2626	Hearth charcoal Bone	Lahren (1976:42); Pitblado (1976:42); Hindman (1976:42) Lahren (1976:42); Pitblado (1976:42) All three of these dates were calibrated using a Cambridge ¹⁴ C half-life of 5730 years (the standard Libby ¹⁴ C half-life of 5568 years (Lahren 1976:41). The dates were corrected to the proper half-life for analysis.
Pine Spring	48SW101	9695 ± 195 11,830 ± 410 (unreliable date; not used)	11,748-11,734; 11,721-10,503	GXO354 GXO355	Bone collagen Bone collagen	Pitblado (2003:115); Sharrock (1966:22) sources reject the older date, "there is too little collagen for a trustworthy date" (1966:22). Sharrock (1966:52) "Occupation 1 points at Pine Spring. These dates as Agate Basin, not Angostura, specimens encompass some of the Agate Basin and Angostura, respects from both" (Sharrock 1980:93) suggested the Pine Spring be classified into their own type. Pitblado (2003:115) classified them as Angostura.
Sheep Rock Spring	24JF292	9420 ± 220 (not used) 9380 ± 50 (not used)		Beta-12887 Beta-65825	Hearth charcoal Sheep bone collagen	Pitblado (2003:116); Wilson (1994:100). According to the investigator, this date is in context with these dates from the complex points identified at Sheep Rock and Davis 1994:100). There is a point in Wilson and Davis (1994) to independently evaluate whether it was lumped into the Angostura complex.

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						(2003:116) for the purposes therefore not included.
Southsider Shelter	48BH364	8500 ± 210 (not used)		RL-666	<i>Un-published</i>	Frison (1978:Figure 2.5b; 19 (2003:116). The projectile p date is “not representative of instead thought to be related according to Frison (1992:3 in Frison (1978:Figure 2.5b) could be classified as Angos (2003:112-116) “lumper” de except the base is slightly co concave.
Cathedral Butte	5MF625	No dates				Stucky’s (1977:34-38, 96-10 points; Pitblado (2007); Sell
Sites/ collections in Colorado	---	---	---	---	---	Pitblado (2007:324-325) list Angostura points in Colorado
Hell Gap	48GO305	No dates	---	---	---	Irwin (1968:236-237, Figure that were recovered stratigraph Frederick level at Hell Gap (2003:113), but early investigations never included a good definition (Knudson 2009:25). There a Lusk component(s) at Hell Gap considered the Lusk type site (Knudson 2009:14). If Lusk category, Betty Greene should site.
Pretty Butte	32SL100	5300 ± 60 (not used) 5570 ± 110 (not used)		SMU-1842 Beta-1720s	Charcoal Stained soil	Borchert (1989:6-8) reports younger than expected. Both from a single hearth feature so the feature may have been carbon. Alternatively, she su parallel-oblique flaked point Pretty Butte region than elsewhere therefore questionable and w analysis.
Patten Creek	48PL68	No dates	---	---	---	Borchert (1989); Irwin (196 “presence or absence of burial components at Patten Creek demonstrated” (Späth 1989:
Lawn Lake	5LR318	8000 ± 170	9395-9383; 9373-9362; 9308-8449	Beta-144867	Hearth charcoal	Brunswig (2001a:35-36, 53-1a, 2005:111, 2007b:291); E (2019); Yelm (1935). A Jam was also recovered at this site
Mangus ^P	24CB221	8960 ± 100	10,270 - 9700	SI-98	Hearth charcoal	At least one projectile point dates appears to be Angostura

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		8600 \pm 100 <i>(Average: 8780 \pm 71) ²</i>	9908-9425 <i>(10,148- 10,058;10,041- 9988; 9956- 9557) ²</i>	SI-101	Hearth charcoal	If, 1969:30-31, Figure 13), that this specimen “is an An and Edgar 2002:117 footnot
Sites/ collections	---	---	---	---	---	Pitblado (2007:324-325) list Angostura points in Colorad
Game Creek [†]	48TE157 3	8690 \pm 40	9669-9559	Beta- 343147	Charcoal	Cultural level 2 was associat Valley complex diagnostics 2017:281, 306, 308, A-3).

[†] Indicates that other relevant radiocarbon dates exist but were excluded in favor of the most
reliable/applicable/verifiable dates.

^p Indicates probable (not definite) association between diagnostic artifacts and the radiocarbon date(s)
listed.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with
caution or not at all.

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Lovell Constricted description. Like Angostura/Lusk, Lovell Constricted is currently considered one manifestation of the Foothill/Mountain cultural complex. If more Lovell Constricted occupations are identified and investigated, Lovell Constricted could potentially be considered its own cultural complex in the future. For now, the information available is currently inadequate to designate Lovell Constricted as its own cultural complex (Frison 2007a:8).

Lovell Constricted points have been identified at several different site types, including open camps (Pretty Creek in Montana and Helen Lookingbill, China Wall, and Steamboat Point in Wyoming). Characteristic of the Foothill/Mountain complex, known Lovell Constricted occupations predominantly occur in rockshelters, including Medicine Lodge Creek, Mummy Cave, North Fork Cave #1, and Bottleneck Cave in Wyoming as well as Sorenson and Pictograph Cave I in Montana, and Beta Rockshelter in Idaho.¹²¹ Possible Lovell Constricted (or “Fishtail”) points were also identified at Jim Pitts, a bison kill in South Dakota.

Several Lovell Constricted occupations are associated with relatively extensive, subsistence-related ground stone use compared to earlier Paleoindian cultural complexes. Helen Lookingbill contains numerous ground stone artifacts, but many of these are associated with later Archaic occupations of the site rather than the Lovell Constricted level (see Larson et al. 1995:33-34; Shepherd 1992, 1994). At Bottleneck Cave, several grinding stones were found in context with Lovell Constricted points (Husted 1969:47, Plate 27c, 25f). Fauna exploited at Bottleneck Cave are predominantly represented by species smaller than bison; deer/antelope, bighorn sheep, and one possible immature bison mandible were recovered from the Lovell Constricted occupation of that site (Husted 1969:47-48). Similarly, the Lovell Constricted level at Medicine Lodge Creek contained ground stone as well as the fragmented faunal remains of deer, bighorn sheep, and rabbit. The storage pits at Medicine Lodge Creek mentioned in the *James Allen/Frederick Cultural Complex Description* may also or exclusively be associated with Lovell Constricted, and/or other Late Paleoindian levels at that site, rather than James Allen/Frederick (Frison and Grey 1980:35). At both Bottleneck Cave and Sorenson, numerous circular or oval basin hearth features were identified and excavated (Husted 1969:12, 45), but Husted did not speculate on their function. These hearth features range around 34-55 centimeters in diameter and 6-30 centimeters in depth, making them generally smaller but deeper than the hearths described in the *Angostura/Lusk Cultural Description* section.

In the Colorado Rocky Mountains, Lovell Constricted and Pryor Stemmed (described below) assemblages consist of 100% local stone (Brunswick 2007b:296), potentially indicating that Lovell Constricted and Pryor Stemmed Foothill/Mountain manifestations are characterized by restricted mobility. Whether or not this pattern broadly applies to all Foothill/Mountain manifestations and/or all Lovell Constricted occupations requires further inquiry. Some investigators have noted that lithic tools associated with Lovell Constricted points tend to be “unimpressive and [...] characterized by a general crudeness” (Husted and Edgar 2002:98).

¹²¹ For a preliminary tabulation of the frequency of Late Paleoindian rockshelter components as compared to Middle and Early Paleoindian components, see Kornfeld (2007b:55). Closed rockshelter sites increase in frequency (with statistical significance) during Late Paleoindian times (Kelly 2015).

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Perhaps this is because Lovell Constricted tools were designed for expedient production and short use-lives, rather than components of long-term curation strategies that appear to have characterized lithic organization during the highly mobile, Early Paleoindian period. This hypothesis has not been tested.

Lovell Constricted lithic technology description. Lovell Constricted points were first described by Husted (1969) at Sorenson and Bottleneck rockshelters in the Bighorn Canyon. Husted described the Lovell Constricted point type as:

[M]edium to large in size with a concave base and a definite constriction of the lateral edges slightly distal to the base. The lateral edges above the constriction usually are smoothly convex. Basal edges vary from shallowly to moderately concave. Flaking is crudely parallel-oblique with the flake scars extending downward to the right. Lateral edges are retouched, and basal edges are bifacially thinned. Lateral edges are ground smooth from the base forward for up to one-half the length of the point. Cross sections are lenticular. Length ranges from 50 to 65 mm. (est.), width from 19 to 25 mm (est.), and thickness from 6.5 to 9 mm (Husted 1969:12-13).

This definition of Lovell Constricted points has not been seriously debated or modified by later scholars (e.g., Pitblado 2003:99-100). However, Pitblado (1999:162) notes that some Lovell constricted points lack the classic stems and “waisted” appearance as defined by Husted (1969). Some Lovell Constricted points that lack clear stems might grade into the Angostura point type (Pitblado 1999:162).

The stratified deposits at Mummy Cave (North Fork Cave #1) contain a Lovell Constricted level that overlies the Angostura/Lusk occupation. The investigators at this site wrote that some kind of relationship might have existed between these two Foothill/Mountain complex point types. They noted that, “Whether or not the Lovell Constricted point is directly descended from the Angostura point, as is suggested at Mummy Cave (North Fork Cave #1), is not known. If not, at least they appear to be related” (Husted and Edgar 2002:119). Understanding connections between Lovell Constricted, Angostura/Lusk, and other Foothill/Mountain point types requires further research.

Some archaeologists typologically debate “Fishtail” points, and whether or not some or all of the points classified as Late Paleoindian Fishtail should actually be considered Lovell Constricted (e.g., Pitblado 1999:477). In an unpublished report appendix from 1995, Kornfeld and Barrows suggested that “Paleoindian fishtail points resemble and are likely the same as the Lovell Constricted type defined by Husted (1969) in the Bighorn Basin” (Kornfeld and Barrows 1995:4). In a later publication, Kornfeld et al. (2001:322) suggested that “the Late Paleoindian fishtail projectile point varieties [from Helen Lookingbill are] probably Lovell Constricted”. Points referred to as “Fishtail” generally have a more pronounced fishtail shape on the proximal end than Lovell Constricted points from Sorenson and Bottleneck rockshelters. In other words, points referred to as “Fishtail” generally curve inward and then outward to greater degrees from their midsections towards their proximal bases than those labeled as Lovell Constricted. Additionally, the bases of points referred to as “Fishtail” are generally more concave than the

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bases on Lovell Constricted points from the type site. However, these differences probably represent two extremes on a spectrum of variation within a single point type rather than two separate point types. Limited chronological evidence supports this assertion. The “Fishtail” points from Helen Lookingbill (Kornfeld et al. 2001) have produced radiocarbon dates that are very similar in age to the Lovell Constricted level at Bottleneck Cave (Husted 1969:46, 82; Table 9). However, determining whether some, none, or all “Fishtail” points should be subsumed within the Lovell Constricted typological category will require future quantitative morphological and chronological investigations. It would also be interesting to investigate variation in Lovell Constricted and Fishtail points.

Lovell Constricted radiocarbon dates. Seven sites with Lovell Constricted or similar points in and around Wyoming have radiocarbon dates associated with diagnostics. These sites include Medicine Lodge Creek, Helen Lookingbill, Mummy Cave (North Fork Cave #1), and Bottleneck Cave in Wyoming, as well as Pretty Creek and Sorenson in Montana, and Beta Rockshelter in Idaho. Together, these sites produce an estimated time range for Lovell Constricted that spans 9700-8400 cal BP.¹²² These radiocarbon dates indicate that Lovell Constricted begins and ends later than both Angostura/Lusk and James Allen/Frederick, but may chronologically overlap with both of those cultural manifestations.

¹²² The estimated age range for the Lovell Constricted manifestation of the Foothill/Mountain cultural complex in and adjacent to Wyoming was calculated by first creating a pooled mean or “average” of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for Lovell Constricted point ages. The summed 1 σ probability range (9696-8376 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age range for Lovell Constricted in and adjacent to Wyoming (circa 9700-8400 cal BP). This date range should be viewed as a hypothesized approximation. The addition of more dates might broaden the temporal span of the Lovell Constricted manifestation of the Foothill/Mountain cultural complex, and re-dating the sites already included with more precision might shrink its temporal range.

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Table-8: Key Lovell Constricted Sites in and Adjacent to Wyoming and Radiocarbon Dates.

Site Name	Site Number	Radiocarbon Dates (¹⁴ C BP)	Calibrated (2σ, Intcal13; cal BP)	Lab	Material	Citation(s) and Notes
Medicine Lodge Creek: Area 2	48BH499	8340 ± 220	9885-9876; 9866-9847; 9816-9807; 9794-8638	RL-151	Charcoal	Frison (2007b:36, Figure 3.2 associated with a point that Husted's (1969:46) Lovell C
Pretty Creek	24CB4, 24CB5	7685 ± 180	9001-8164	UGA-957	Charcoal	Loendorf et al. (1981:191, 2
Helen Lookingbill [†]	48FR308	8980 ± 80	10,262-9883; 9878-9862; 9849-9786	Beta-61992	Charcoal	Same as Alder/Angostura co (Kornfeld and Barrows 1995 interpretations might be revised Kornfeld et al. (2010:102) s ± 100 date should be associated Lovell Constricted compone Nevertheless, the average is
		8880 ± 60	10,190-9761; 9754-9744	Beta-69787	Charcoal	
		8525 ± 100	9761-9754; 9745-9280	Beta-28116	Charcoal	
		7860 ± 90	8988-8510; 8497-8474; 8469-8459	Beta-61993	Charcoal	
		(Average: 8658 ± 39) ²	(9692-9540) ²			
Mummy Cave (North Fork Cave #1)	48PA201	7970 ± 210	9403-9342; 9330-8403	I-1589	Charcoal?	Culture Layer 14 (Husted and 117, Plate 10a); McCracken 60a).
Sorenson	24CB202	7800 ± 250	9368-9364; 9305-8156; 8116-8113; 8089-8058	I-612	Hearth charcoal	Husted (1965:8, Fig1g, h, 19 and Edgar (2002:96); Long See also Pitblado (2003:99).
		7560 ± 250	9006-7928; 7894-7873	I-689		
		(Average: 7680 ± 177)	(8996-8168)			
Pictograph Cave I	24YL000 1	No dates	---	---	---	Mulloy (1958:Figure 6, Nos Lovell Constricted points w of the lowest levels at this si
Bottleneck Cave	48BH206	8720 ± 180	10,230-9432	SI-237	Hearth charcoal	Husted (1969:46, 82); Assoc at this site. See also Pitblado
Beta Rockshelter [†]	10LH63	8175 ± 230	9549-8518; 8492-8481	WSU-402	Charcoal	Pitblado (2003:99); Swanson and Sneed (1966:12, 36, Fig

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		5600 ± 175 (not used)		WSU-403	Charcoal	date was rejected because of (Swanson and Sneed 1966:1 from the study area and possibly included in the Wyoming ch
Steamboat Point	48YE701	No dates	---	---	---	The investigators identified point at this site, excavated dated (Cannon and Hale 201
Camp Rayner	EgNr-2 (Saskatch-ewan)	7890 ± 30 (not used)	---	Beta-414919	Bone	Rychlo (2016:62-63, Figure associated with Cultural Zon identified as Lovell Constrict (Cahill 2012:Figure 12.2D; 6.1a), but because of its shor similar to Middle Archaic D However, northern variants points might have had shoul Camp Rayner is too far from included in the Wyoming Lo chronology, either way. The Lovell Constricted is from th possible Frederick points at d).
		7820 ± 30 (not used)		Beta-414914	Bone	Rychlo (2016:Figure 6.1a, 6
		7880 ± 40 (not used)		Beta-321403	Bison bone	Cahill (2012:Figure 12.2D, (2016:Figure 6.1a, 62-63)
Jim Pitts	39CU114 2	No associated dates	---	---	---	This site contains three fisht with Goshen, Folsom, Agate points (Sellet et al. 2009:745 g). In Sellet et al. (2009:Fig appear similar to Lovell Cor more characteristic of Pryor
China Wall	48AB1	No associated dates	---	---	---	Waitkus (2013:8-1 - 8-14). I Constricted/Fishtail points s at Helen Lookingbill were re

¹ Indicates that other relevant radiocarbon dates exist but were excluded in favor of the most reliable/applicable/verifiable dates.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with caution or not at all.

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Late Paleoindian: Pryor Stemmed (circa 9550-8650 cal BP)

Pryor Stemmed cultural complex description. According to Frison (2007a:8; Frison and Grey 1980:28), Pryor Stemmed is the only Foothill/Mountain manifestation that is sufficiently documented to be considered its own cultural complex. Pryor Stemmed occupations have been identified in depositional context almost exclusively at closed rockshelter sites, including Schiffer Cave, Medicine Lodge Creek, Bottleneck Cave, Grey-Taylor, Paint Rock V, Two Moon, and Granite Creek in Wyoming, as well as Sorenson in Montana. There are several exceptions to this pattern, but open-air Pryor Stemmed components are rare (Frison and Grey 1980:40). Fourth of July Valley, an open-air, short-term hunting camp in Colorado, includes three probable Pryor Stemmed points. Game Creek and the Hanson Pryor Stemmed (Edgar 1966) sites in Wyoming are open-air sites with Pryor Stemmed diagnostics. Several other open-air Pryor Stemmed occupations have been identified in the Big Horn Mountain area, but have not been thoroughly investigated and/or published in detail (e.g., 48JO303; Frison and Grey 1980:40-41). Additionally, one possible Pryor Stemmed point (called "Fishtail" by the investigators) was recovered in apparent context with several other Paleoindian point types at the Jim Pitts bison kill in South Dakota.

Like other Foothill/Mountain manifestations, Pryor Stemmed peoples exploited a wide range of floral and faunal resources. The Pryor Stemmed occupation at Medicine Lodge Creek is associated with a ground stone artifact that "could easily be placed in a Plains Archaic category" (Frison 2007b:58), and includes storage pits (Frison 2007b:62-63; Frison and Grey 1980:29, Figure 13) similar to those described above from the Angostura/Lusk or James Allen/Frederick level(s) at that site. Food storage pits were associated with Pryor Stemmed at Schiffer Cave as well (Frison and Grey 1980:34). Also at Schiffer Cave, charred flora including amaranth, yucca, wild rye, and other unidentified species of plants were interpreted as direct evidence of plant gathering. Some of these floral resources were identified in storage pits, while others were identified in fire pits at this site (Frison 1973a:305, 1991:Table 2.3; Frison and Grey 1980:34; LaBelle 2005:205). At Bottleneck Cave, Pryor Stemmed diagnostics were found in context with three grinding stones and seven hand stones (Husted 1969:53-54; Plates 25a, 25d, 26c, 26d, 27a, 27b, 28b). Unlike the Archaic-like ground stone specimen at Medicine Lodge Creek mentioned above, Frison and Grey (1980:33) noted that the ground stone from Bottleneck Cave is "not as sophisticated or as stylized as those of the later Archaic periods but they are functional tools." Two manos "similar" to those from Bottleneck Cave and Medicine Lodge Creek were also recovered from Schiffer Cave (Frison and Grey 1980:34). While Pryor Stemmed peoples manufactured a variety of utilitarian bone tools, such as awls and needles (e.g., Husted 1969:55), no art or symbolic objects are currently known from Pryor Stemmed sites.

Along with the increased plant processing implied by the presence and frequency of ground stone implements and charred vegetal remains, Pryor Stemmed levels, like other Foothill/Mountain manifestations, appear to have been characterized by relatively broad faunal diet breadth. Fauna from the Pryor Stemmed level at Bottleneck Cave include deer/antelope, bighorn sheep, fox, rabbit, and ground squirrel (Husted 1969:55). Small animal bones were recovered from Schiffer Cave as well (Frison and Grey 1980:34). At Paint Rock V, fauna was mostly comprised of mule deer (Frison and Grey 1980:36), also supporting the idea that the

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Pryor Stemmed subsistence adaptation relied less heavily on bison than prior Paleoindian strategies.

It seems that broadened diet breadth during Pryor Stemmed times was accompanied by decreased mobility compared to earlier Paleoindian phases. In 1980, Frison and Grey noted that there were “no exotic stone flaking materials” in Pryor Stemmed assemblages (Frison and Grey 1980:45). More recently, use of local toolstone was observed in the Colorado Rocky Mountains, where known Pryor Stemmed (and Lovell Constricted) assemblages are comprised of 100% local raw materials (Brunswig 2007b:296). Frison and Gray (1980:29) suggested that although Pryor Stemmed peoples were “excellent flint technologists, [they] often used inferior materials in an area abounding with excellent quality raw materials available with minimal efforts at quarrying.” Explaining Pryor Stemmed raw material choice and comparing it with preceding Paleoindian phases is an important question in Wyoming foothill-mountain archaeology.

Increased diet breadth, decreased mobility, and changes in subsistence and storage behaviors during Pryor Stemmed and Foothill/Mountain complex times indicate that Late Paleoindian peoples, at least in some areas, were beginning to lead a lifestyle more similar to the peoples of the Archaic than the Early Paleoindian period. In light of these changing behavioral patterns, Frison and Gray observed that:

The Pryor stemmed cultural complex is regarded as Paleo-Indian for reasons of convenience since the change from the lanceolate projectile point types to the notched types of the beginning Early Plains Archaic apparently coincides with the climatic changes of the beginning Altithermal. In reality, the foothill-mountain oriented cultural complexes here designated as Paleo-Indian were actually living more of a true Archaic way of life rather than what might be generally characterized as Paleo-Indian [Frison and Grey 1980:29].

These changes in subsistence and mobility towards more Archaic-style lifeways seem to have been accompanied by changes in social organization. During Middle Paleoindian phases, the prevalence of bison bonebeds and other evidence¹²³ imply that large-scale communal hunts and/or interband contact occurred on a regular basis. In contrast, during Pryor Stemmed times, small sites with evidence of butchering only one or a few animals at a time suggest that these Late Paleoindian groups probably consisted of only small extended families operating as economic units. As of 1980, there was “no evidence among these groups of communal animal kills such as the bison procurement sites known for the Plains-oriented Paleo-Indian groups” (Frison and Grey 1980:44).

Subsequently, the only potential evidence for communal hunting among Foothill/Mountain groups comes in the form of a large net recovered from a rockshelter or crevice cache on Sheep Mountain (48PA1022) in the Absaroka Mountains of north-central Wyoming. This artifact’s exact provenience is unknown (Kierson Crume, personal communication 2018). The net might have been used in conjunction with clubs to hunt bighorn

¹²³ For example, interchangeable projectile technology elements as discussed by Guarino (2014) and the finding that Cody points vary more across time than space (Fogle-Hatch 2015).

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sheep (Frison et al. 1986). This net originally produced a radiocarbon date of 8860 ± 170 ^{14}C BP, which would place it squarely within the temporal span estimated for multiple Late Paleoindian Foothill/Mountain manifestations, including Pryor Stemmed. However, the accuracy of this date is now in question; recent re-dating of a loose fiber in its storage box produced a radiometric age of 1320 ± 30 ^{14}C BP,¹²⁴ suggesting the possibility that it might be much younger than originally thought (Beta Analytic 2016; Danny N. Walker, personal communication 2018).

Communal gatherings probably did occur “from time to time” among peoples practicing Late Paleoindian Foothill/Mountain adaptations, but these events may have focused on the procurement of seasonal plant resources rather than large game (Frison and Grey 1980:44). While ground stone tools used for plant processing are archaeologically visible, plant procurement behaviors are less archaeologically perceptible than, for example, bison bonebeds. Future research able to identify large-scale communal plant procurement among foothill-mountain groups would vastly contribute to our understandings of terminal Paleoindian social organization. Whether or not such behavior actually occurred during Pryor Stemmed times is purely conjectural given the current state of our knowledge vis-à-vis foothill-mountain lifeways. In general, any research comparing, contrasting, and/or explaining Early, Middle, and Late Paleoindian social organization would make a significant contribution to Wyoming Paleoindian archaeology.

Pryor Stemmed lithic technology description. The only diagnostic for the Pryor Stemmed cultural complex is the Pryor Stemmed projectile point type. Pryor Stemmed assemblages do not include any other diagnostics that have been identified as such (Frison and Grey 1980:31). Pryor Stemmed points were first discovered in situ at the Grey-Taylor site (48JO303) by the Wyoming Archaeological Society in the early 1960s (Anonymous 1959a, 1960, 1961:5-6, 1963; Frison and Grey 1980:30) and again at the Hanson Pryor Stemmed site (Edgar 1966).

Bob Edgar should be credited as the first to academically define Pryor Stemmed, although he referred to the point type as “Pryor complex” (Edgar 1966). Edgar described the “Pryor complex” points from the Hanson Pryor Stemmed site as beveled on the right hand side when the point is facing up, with average lengths of 3-4 inches (7.6-10.2 cm), stems lengths of 1/2 to 5/8 inch (1.3-1.6 cm), slightly concave bases and stem edges, ground bases and stems, and crudely oblique to random flaking patterns. He also mentioned that the edges are often retouched to produce serrations, and that point cross-sections are rhomboidal (Edgar 1966). Although Edgar’s article (1966) was published slightly earlier, Wilfred Husted (1969:14, 51-52), working for the River Basin Surveys, named and defined the point almost contemporaneously based on excavations at rockshelters in the Bighorn Canyon. While Husted is often given sole credit for officially naming and describing Pryor Stemmed points, this credit should be shared with Bob Edgar and the Wyoming Archaeological Society. Husted produced a very similar definition of Pryor Stemmed:

Medium to large stemmed projectile points with alternately beveled edges [and a stem].
Lateral edges vary from parallel to convex and are alternately beveled with the bevel on

¹²⁴ 1320 ± 30 BP (Beta-443460; fiber; $\delta^{13}\text{C} = -25.7\text{‰}$). Sample submitted by Larry Loendorf.

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the right (tip up). Beveling extends at least from the tip to the shoulder, and on some specimens extends the full length of the stem. Serration of lateral edges ranges from fine and even through rough and irregular to nearly nonexistent. Serrations were made on the beveled edge; the amount of beveling and the quality of the material used determined the fineness of the serrations.

Stems vary in length from one-fifth to one-third the total length of the points. Edges range from concave through parallel to contracting, and bases are shallowly concave. The lateral and basal edges are ground smooth.

Shoulders range from straight and prominent through sloping to nearly lacking. In the latter instance, shoulders are represented by a slight angle between the stem and the blade portion.

Chipping varies from crude parallel-oblique to random, and the quality of the flaking is fair to good. Edges are retouched only on the beveled edge. Basal edges are thinned but wedge-like in appearance. Specimens with slight to moderate beveling are lenticular in cross section. Those with pronounced beveling are rhomboidal (Husted 1969:51-52).

Frison and Gray (1980:29) added that Pryor Stemmed cross-sections are highly varied, and generally range from rhomboid to "almost rectangular," but that the beveling is symmetrical because both blade edges are flaked in the same way. In addition to the blade, the stems are sometimes beveled as well (Frison and Gray 1980:29).

In 1991, Davis also added to and refined the definition of the Pryor Stemmed point type. Davis (1991:2) suggested that Pryor Stemmed points generally have "chisel-like" tips that are produced during the unifacial beveling/resharpening technique. He reiterated that significant variation in Pryor Stemmed points exists, but further wrote that "the term 'stemmed' is a misnomer," because some Pryor "Stemmed" complex points are actually lanceolate in form and these stemmed and lanceolate point types co-occur at some sites (Davis 1991:2). This assertion has not been resolved in subsequent literature. Also in regards to variability within the Pryor Stemmed point type, Davis (1991) attempted statistical, quantitative analyses of metric data on Pryor Stemmed points from several sites throughout the Wyoming area. He was "not [able to] confirm homogeneity" among Pryor-Stemmed tools from these different sites, suggesting that "geographical variation," "individual stylistic preference," and/or the possibility that Pryor Stemmed points were used as "multi-functional" tools might cause some of this variation (Davis 1991:11). As with many other Paleoindian point types, a replicable and quantitative definition of "Pryor Stemmed" that incorporates the point type's entire range of variation is sorely needed.

Pryor Stemmed radiocarbon dates. There are eight sites in the Wyoming area that contain Pryor Stemmed components in context with radiocarbon dates: Schiffer Cave, Medicine Lodge Creek, Bottleneck Cave, Grey-Taylor, Paint Rock V, Game Creek, Duck Creek, and Two Moon in Wyoming as well as Sorenson in Montana.

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The radiocarbon dates from these sites produce an estimated range of 9550-8650 cal BP for the Pryor Stemmed cultural complex.¹²⁵ This temporal span overlaps with the tail ends of James Allen/Frederick and Angostura/Lusk. Furthermore, the beginning and ending date for Pryor Stemmed fits completely within the age range estimated for Lovell Constricted (9700-8400 cal BP). However, stratigraphic relationships at multiple sites (e.g., Bottleneck, Sorenson, and Medicine Lodge Creek; Frison 2007b:36; Husted 1969) generally place Pryor Stemmed stratigraphically higher and therefore younger than Lovell Constricted occupations. This apparent disparity between the radiocarbon dating results presented here and stratigraphic relationships at archaeological sites might be an artifact of uncertainty inherent to the radiocarbon dating method, because the entire time span of Pryor Stemmed occurrences is not fully represented by these eight sites, or because the Lovell Constricted radiocarbon range is overrepresented because of the large uncertainties associated with some of the dates. More interestingly, these differences might *not* be a product of sampling or dating error, and could potentially reflect actual spatiotemporal differences in the occurrence of Lovell Constricted points. Explaining the slightly different chronological relationship between Pryor Stemmed and Lovell Constricted based on stratigraphy versus radiocarbon dates requires further research.

¹²⁵ The estimated age range for the Pryor Stemmed cultural complex in and adjacent to Wyoming was calculated by first creating a pooled mean or “average” of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for Pryor Stemmed point ages. The summed 1 σ probability range (9557-8663 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age range for Pryor Stemmed in and adjacent to Wyoming (circa 9550-8650 cal BP). This date range should be viewed as a hypothesized approximation. The addition of more dates might broaden the temporal span of the Pryor Stemmed cultural complex, and re-dating the sites already included with more precision might shrink its temporal range.

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Table-9: Key Pryor Stemmed Sites in and Adjacent to Wyoming and Radiocarbon Dates.

Site Name	Site Number	Radiocarbon Dates (^{14}C BP)	Calibrated (2σ , Intcal13; cal BP)	Lab	Material	Citation(s) and Notes
Schiffer Cave	48JO319	8360 \pm 160	9693-8977; 8879-8870; 8826-8806; 8803-8799	RL-100	Charcoal	Frison and Grey (1980:29);
		8500 \pm 160 (Average: 8430 \pm 113)	10,108- 10,101; 9915- 9030 (9603-9112; 9109-9092)	RL-99	Charcoal	
Medicine Lodge Creek: Area 2	48BH499	8160 \pm 220	9536-8547	RL-380	Charcoal?	Frison (2007b:36). Two Pryor points associated with this date (Frison 2007b:36). There is also at least one point from Area 1 at this site (Frison 2007b:3.8a), but this specimen is not a radiocarbon date. See also Frison (2007b) for previous dates associated with Medicine Lodge Creek.
Sorenson	24CB202	No dates	---	---	---	Husted (1969:10, 14). A Pryor point found stratigraphically above the level at this site, but was not dated.
Bottleneck Cave	48BH206	8160 \pm 180	9485-8626; 8619-8609	SI-240	Hearth charcoal	Husted (1969:52, 82). Associated with III. See also Pitblado (2003:100).
		8040 \pm 200 (Average: 8106 \pm 134)	9431-8509; 8498-8458 (Average: 9405-9337; 9334-8634)	SI-241	Hearth charcoal	
Fourth of July Valley [†]	5BL120	8920 \pm 50 (not used; probably associated with James Allen at this site)	---	---	---	Benedict and Olson (1973:Fig. 1) points might be Pryor Stemmed points (Allen points (Benedict 2005:100) (2002); Pitblado (1999:Fig. 1)).
Grey-Taylor	48JO303	7800 \pm 110	8978-8877; 8872-8824; 8812-8405	A-484	Combined but unmixed hearth charcoal	Grey (2004); Frison and Grey (2003:97). Pitblado (2003:97).

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Jim Pitts	39CU1142	No associated dates	---	---	---	This site contains three fish points with Goshen, Folsom, Agate points (Sellet et al. 2009:743). In Sellet et al. (2009:Figure similar to Lovell Constricted characteristic of Pryor Stemmed
Paint Rock V	48BH349	8140 ± 150 8340 ± 160 8220 ± 60 (Average: 8223 ± 53)	9443-8640 9662-9640; 9635-8972; 8915-8896; 8884-8865; 8829-8789 9400-9350; 9322-9021 (9399-9357; 9317-9025)	RL-391 RL-381 Beta-174826	Hearth charcoal Hearth charcoal Hearth charcoal	Frison and Grey (1980:29). (2008:157); Pitblado (2003: Frison and Grey (1980:29). (2008:157); Pitblado (2003: Finley (2008:158-159)
Two Moon	48BH1827	8570 ± 60	9673-9471	Beta-174825	Hearth charcoal	Finley et al. (2005:237); Finley Kornfeld (2007b)
48FR4070	48FR4070	---	---	---	---	Citing SHPO documentation (116) suggests that stone circle cairns might be associated with a point that was found on the site. review of the SHPO documentation Nelson 1999) suggests that the deflated, and the image of the quality to confirm that it is a typological description of Pryor Stemmed. Determining the relationship between Pryor Stemmed point and the site, if any, requires further investigation.
Granite Creek Rockshelter	48BH330	No dates	---	---	---	This site produced a "thin, b Stemmed level" (Frison and Maloney (1990).
Hanson Pryor Stemmed Site	48BH178	No dates	---	---	---	Edgar (1966); Frison and Grey. The air site produced lithic artifacts. Stemmed points, in a darkened
White Butte	48WA82	No dates	---	---	---	Frison and Grey (1980:40)
Company Springs	48WA7	No dates	---	---	---	Frison and Grey (1980:41)
Scotch Corrals	48JO701	No dates	---	---	---	Frison and Grey (1980:41)

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Pathfinder Reservoir	Surface collections	No dates	---	---	---	Davis (1991)
Game Creek [†]	48TE1573	8070 ± 40 7860 ± 40 (Average: 7965 ± 28) ²	9120-9102; 9093-8931; 8923-8860; 8834-8779 8931-8923; 8859-8834; 8778-8546 (8990-8702; 8668-8659) ²	Beta-316957 Beta-319997	Charcoal Charcoal	Three points in Cultural Level identified as Pryor Stemmed (3). A metate fragment was a component.
Duck Creek ^p	48AB2802	8009 ± 52	9017-8698; 8672-8653	D-AMS 015968	Charcoal	Charcoal was recovered in a vertical and 10 horizontal cr point (Pelton et al. 2017:19,
Forest Canyon Pass	5LR2	No dates	---	---	---	This large multicomponent c National Park produced a Pr (Brunswig 2007b:292).

[†] Indicates that other relevant radiocarbon dates exist but were excluded in favor of the most reliable/applicable/verifiable dates.

^p Indicates probable (not definite) association between diagnostic artifacts and the radiocarbon date(s) listed.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with caution or not at all.

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Southwest Wyoming (Wyoming Basin)

By the late 1980s, archaeologists working in southwestern Wyoming began to recognize that the chronology in that portion of the state differed from the traditional Plano chronology established on the eastern Wyoming plains (McKibbin et al. 1989; Metcalf 1987, 2011; Metcalf et al. 2005; Reed and Metcalf 1999; Thompson and Pastor 1995; Zier et al. 1983). Prior to this, the culture-historical sequence in the Wyoming Basin drew largely from Frison's (1978) Northwest Plains culture-historical sequence, as well as culture histories from the Great Basin and Northern Colorado Plateau (Heizer and Hester 1978; Schroedl 1976; Holmer 1978) where applicable (Metcalf 1987). Most of the Paleoindian complexes previously discussed (Clovis, Goshen, Folsom, Agate Basin, Hell Gap, Cody, and some Late Paleoindian variants) have been identified in southwestern Wyoming surface collections, but rarely occur in dateable contexts (Frison et al. 2015; Metcalf 1987, 2011; Reed and Metcalf 1999; Schroedl 1991; Thompson and Pastor 1995:21), indicating that preservation of Paleoindian-aged sediments may be a problem in this area (Thompson and Pastor 1995:21), with few exceptions¹²⁶.

A handful of archaeological sites in the Wyoming Basin have produced Paleoindian or Paleoarchaic-aged radiocarbon dates, but lack diagnostic artifacts (Thompson and Pastor 1995). These sites include Porter Hollow (48UT401; Hoefer 1987:4.22),¹²⁷ 48LN1658¹²⁸ and 48LN1679¹²⁹ (Miller 1985, 1987; Miller and Bower 1986), the Vegan site¹³⁰ (48LN1880; Polk et al. 2004; McKern and Creasman 1991), 48UT375 (Smith et al. 2003),¹³¹ and Blue Point (Johnson and Pastor 2003:107,116).¹³² Many of these sites indicate that "Late Paleoindian"-aged peoples in the Wyoming Basin were practicing Archaic-like subsistence strategies rather than "orthodox" Paleoindian lifeways focused on large game hunting.

Sixteen thermal features were identified in a Paleoindian-aged level at the Vegan site. Some of these features contained artifacts and/or ecofacts, including lithic debitage, small fragments of burned bone, and small quantities of charred seeds identified as *Chenopodium*, *Graminae*, and *Opuntia*, which are all edible plants. The Paleoindian-aged level also included ground stone artifacts and fauna. The faunal remains mostly consist of animals smaller than jackrabbits, and none of the species represented were larger than antelope. McKern and Creasman (1991:34) therefore commented that "animals were being gathered, apparently in very small numbers, and processed to retrieve the maximum amount of nutritional value. None of the

¹²⁶ These exceptions include site 48UT60, which produced intact Folsom and other Late Paleoindian levels and several Late Paleoindian-aged radiocarbon dates, but the dates are not in clear association with diagnostic artifacts (Metcalf 1981; Metcalf and Murray 2001). Site 48LN1185 produced possible Frederick points in possible association with Paleoindian-aged hearths and a berry fragment (McDonald 1993; Thompson and Pastor 1995:22).

¹²⁷ Radiocarbon date obtained from a thermal feature (10,090 ± 120 ¹⁴C BP; Beta-14638).

¹²⁸ Radiocarbon date obtained on charcoal (9530 ± 300; Beta-13871).

¹²⁹ Radiocarbon date obtained on a thermal feature (9650 ± 290; Beta-18531).

¹³⁰ Two radiocarbon dates on unlined basin hearths from the lowest identified cultural component at this site produced age estimates of 7570 ± 100 (Beta-35382-35387) and 8400 ± 130 (Beta-35383) ¹⁴C BP.

¹³¹ Component 1 produced charcoal radiocarbon dates of 8450 ± 40 (Beta-153340), 8470 ± 40 (Beta-153340), 8330 ± 40 (Beta-151914), 8640 ± 40 (Beta-151912), and 8490 ± 40 (Beta-1519113) ¹⁴C BP. Component 2 produced a single date on charcoal of 7890 ± 40 (Beta-151910; Smith et al. 2003:137-138, 142).

¹³² Component 2 at Blue Point yielded three radiocarbon dates out of three thermal features (Johnson 2003; Johnson and Pastor 2003:50-52, 78, 83). These dates are 8190 ± 50, 8340 ± 250, and 8330 ± 420 ¹⁴C BP.

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large game animals, such as bison or deer, usually associated with Paleoindian cultures were represented in this faunal assemblage.”

Like at Vegan, site 48UT375 also produced Late Paleoindian-aged radiocarbon dates but lacked diagnostics (Smith et al. 2003). The Late Paleoindian-aged components at 48UT375 yielded lithic artifacts comprised of entirely local toolstone and numerous thermal features associated with heat-altered rock concentrations. All of the features contained extremely fragmented rabbit, mouse, and packrat bone, the majority of which was burned. The features also produced a mano and metate fragment,¹³³ a single berry fragment, and several *Chenopodium* seeds, indicating that plant collection may have occurred during Late Paleoindian times at this site but “extensive processing of seeds was probably not an important component of subsistence activities” (Smith et al. 2003:142). However, the site’s location on a playa suggests that peoples may have frequented the area to collect various root or bulb plants such as biscuitroot or wild onion. Together, this evidence suggests that the Late Paleoindian/Early Archaic inhabitants of 48UT375 were practicing a subsistence strategy based on opportunistic small animal procurement for immediate consumption, and may have used the thermal features to heat up fire cracked rocks for boiling water to cook roots or bulbs (Smith et al. 2003). Like at the Vegan site, no evidence of large animal procurement or processing was observed at 48UT375.¹³⁴

Another important site in southwestern Wyoming, Blue Point (48SW5734), likewise produced Late Paleoindian-aged radiocarbon dates but no diagnostics were associated with that occupation (Johnson and Pastor 2003:107, 116). Some of the hearth and basin hearth features associated with the Late Paleoindian-aged component contained burned small animal bone (Johnson and Pastor 2003:50-52, 78, 83). Elevated levels of prickly pear (*Opuntia* sp.) pollen in some of the features suggest that they might have been associated with prickly pear cactus processing (Cummings 2001:B7-B8; Johnson and Pastor 2003:83); however, it is unclear whether the levels of prickly pear pollen significantly rise above expected background levels (Johnson and Pastor 2003:86). The component also contains small mammal remains, but virtually no evidence for medium to large mammal exploitation (Murcray 2003:D12; Johnson and Pastor 2003:125). The associated stone tool assemblage is comprised of entirely local raw materials (Johnson and Pastor 2003:76; Kautzman 2003).

As mentioned in the *Cody Cultural Complex Description*, Blue Point also contains a Middle Paleoindian Cody component. During both the Cody and Late Paleoindian-aged phases at Blue Point, occupations appear to have been short-term, with resource exploitation and processing activities focused on small- to medium-sized mammals and possibly floral resources (Johnson and Pastor 2003:123). The site investigators argue that in southwestern Wyoming, the Younger Dryas, which immediately pre-dates the Cody complex in their study, was characterized

¹³³ This is the oldest ground stone presumably used for heavy plant processing (or possibly pemmican production) known and dated in Wyoming (Spencer Pelton, personal communication, 2016). At Deadman Wash, two fragments of ground sandstone slabs were identified in context with Cody diagnostics but this component has not been radiocarbon dated (Armitage, Newberry-Creasman, et al. 1982:52, 57, 189; Armitage and Creasman 1981; Creasman et al. 1981).

¹³⁴ Other sites of similar antiquity in southwestern Wyoming have also produced ground stone for plant processing. A Late Paleoindian mano and metate were also identified in context with Deception Creek points (described below) at the Deep Hearth site (48UT786; Rood 1993; Rood et al. 1993). Flotation of hearth features and a pollen wash off the metate suggested limited evidence of *Chenopodium* exploitation and processing (Rood 1993; Rood et al. 1993).

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by increased aridity. Drought would have lowered the carrying capacity for large game (i.e., bison) and may have caused Cody peoples at Blue Point to increase their diet breadth by exploiting smaller fauna and possibly floral resources (Johnson and Pastor 2003:129-131, 133). After the Younger Dryas ended, paleoclimatic reconstructions suggest there was a return to more mesic conditions throughout Late Paleoindian times (which was then followed by much drier conditions leading into the Altithermal; Johnson and Pastor 2003:129-131, 133). Yet the Late Paleoindian-aged occupants of Blue Point did not narrow their diet breadth in response.¹³⁵ The broad-spectrum foraging behavior generally equated with Archaic-style lifeways therefore existed by Middle Paleoindian Cody times at Blue Point, and continued throughout “Late Paleoindian” times.

Evidence from Vegan, 48UT375, Blue Point, and other sites in the Wyoming Basin calls into question the division between Paleoindian and Early Archaic lifeways in this region, suggesting that the presence of traditional Plano “Paleoindian” projectile points, such as the Cody points at Blue Point, does not always imply that the peoples that produced and used those points were living a stereotypical, large game hunting, narrow diet breadth, highly mobile Paleoindian lifestyle. The presence of Archaic-style subsistence strategies throughout what are generally conceived of as “Late Paleoindian” times also highlights difficulties in determining when “Paleoindian” lifeways end and “Archaic” lifeways began, and whether our traditional labeling scheme actually makes sense for what might be more accurately described as the “Paleoarchaic” transition. As mentioned in the *Pryor Stemmed Cultural Complex* description, this question also plagues Late “Paleoindian,” foothill-mountain archaeology.

The divergence from Plano Paleoindian lifeways in southwest Wyoming also suggests the possibility that the “Wyoming Basin and southwest Wyoming may have been a part or extension of the Great Basin rather than the Northwestern Plains” (Anonymous 1985:14). Alternatively, similar to Frison’s Foothill/Mountain complex concept, it might be that “Late Paleoindian” groups in southwestern Wyoming around 9000-8500 ¹⁴C BP were becoming localized and regionally adapting to local conditions, producing “much variation” in the archaeological record (Smith et al. 2003:147; see also Rood 1993).

To highlight further issues with these spatial and chronological conceptions, other Wyoming Basin sites have produced Paleoindian-aged dates in context with what would normally be classified as “Archaic” diagnostics. At the Bozner site (48SW5809; Anonymous 1985:6; Mackey et al. 1985:14-15), for example, a radiocarbon date of 9080 ± 350 ¹⁴C BP (Beta-9098) was obtained on charcoal associated with pronghorn remains, ground stone slabs, and Pinto Basin points. Pinto Basin points are generally considered Early Archaic points in the Great Basin but are sometimes associated with what would normally be classified as Paleoindian-aged dates in that culture region (Hamilton 2012; Haynes 2004; Vaughan and Warren 1987; Mullen et al. 2009:27-29). Additionally, traditional “Plano” Late Paleoindian points have also been found in the immediate vicinity of the Bozner site (Anonymous 1985:11; Mackey et al. 1985:31, 37-

¹³⁵ The use of local toolstone throughout Paleoindian occupations at Blue Point also suggests that the site’s occupants did not adapt to climate changes by increasing their mobility in this region (Johnson and Pastor 2003:131).

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60).¹³⁶ Together, the age of the Bozner Pinto Basin component and the presence of other Late Paleoindian diagnostics in the vicinity would therefore “indicate that PaleoIndian [sic] big game hunting and Pinto Basin Desert Archaic wild plant collecting and hunting populations coexisted in the project area [southwestern Wyoming] 8,000 to 9,100 years ago” (Anonymous 1985:11; Mackey et al. 1985:31, 37-60). However, “Plano” Late Paleoindian occupations in the Wyoming Basin have not been well-dated and it remains to be demonstrated that these different lifeways existed contemporaneously, or that the point types represent different ethnic groups of people.

While Early and Middle Paleoindian cultural complexes in southwestern Wyoming appear to reflect a chronological sequence very similar to that observed in eastern Wyoming,¹³⁷ at least in terms of projectile point morphology,¹³⁸ it seems that some sort of divergence occurred between these regions during Late Paleoindian times. For one, the presence of both Great Basin-like and eastern Wyoming-like Late Paleoindian points requires explanation. Second, Archaic-style lifeways seem to appear earlier in southwestern Wyoming than on the open eastern Plains. Archaic-style, notched projectile points are known from the Bozner site, associated with a radiocarbon date that would place them squarely within the age range estimated for the late Middle or Late Paleoindian periods elsewhere. Finally, lanceolate, Middle/Late Paleoindian-style projectile points and/or “Late Paleoindian”-aged radiocarbon dates are associated with opportunistic rabbit- and pronghorn-sized animal exploitation, heavy faunal processing, ground stone, and/or possible plant collection and processing at Vegan, 48UT375, 48LN1185, Blue Point, Deep Hearth, and other sites in the Wyoming Basin.

Semantically, Metcalf and colleagues’ culture-historical synthesis of the Wyoming Basin suggests that the Paleoindian period should *not* be divided into Early, Middle, and Late sub-periods. Instead, these sub-periods should be lumped into a single “Paleoindian” period (Metcalf 1987, 2011; Reed and Metcalf 1999, 2009), which is followed by the Great Divide phase of the Archaic (Metcalf 2011:39). Regardless of how these phases are labeled, it appears that a transition into Archaic-style lifeways began around 9500 cal BP in the Wyoming Basin area (see especially Metcalf 1987, 2011:161; Thompson and Pastor 1995:27; see also McKibbin et al. 1989; Metcalf et al. 2005; Reed and Metcalf 1999; Zier et al. 1983). However, if one considers Foothill/Mountain complexes elsewhere in Wyoming as “transitional to the Archaic,” then a divergence from traditional Paleoindian lifeways in other portions of the state has also been

¹³⁶ Similarly, two Pinto Basin points were apparently recovered in the same cultural unit as Agate Basin points at the Myers-Hindman site in Montana (Anonymous 1985:16; Lahren 1976:63-65), potentially expanding the known range of “Late Paleoindian-aged” Pinto Basin point instances northward.

¹³⁷ Some Early and Middle Paleoindian point styles may exhibit regional variation in southwestern Wyoming. For example, the “Agate Basin” points from Pine Spring have been described as Agate Basin-like variants (Thompson and Pastor 1995:24, 27). A lanceolate point with both Hell Gap and James Allen/Frederick characteristics was excavated in context from a Paleoindian-aged level at 48SW8842 (Metcalf 2011:124). It is unknown whether the time periods represented by the traditional Plano projectile point types are the same in southwestern Wyoming as they are throughout the rest of the state. There are not enough dates associated with southwestern Wyoming Paleoindian diagnostics to test this hypothesis.

¹³⁸ Though projectile points were similar, Early and Middle Paleoindian subsistence strategies may have differed between southwestern Wyoming and the eastern open Plains. Large mammal remains are under-represented in Wyoming Basin Paleoindian sites in general (Thompson and Pastor 1995:21). Perhaps the relative paucity of large game hunting behavior in southwest Wyoming explains why they contain very few diagnostic projectile points in situ.

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observed at this early date (Metcalf 2011:39-40). Clarifying these trends and chronological and spatial relationships would provide fruitful avenues of future research.

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Late Paleoindian/Transitional: Deception Creek (circa 9550-9150 cal BP)¹³⁹

Deception Creek description. Deception Creek points were first recognized as a possible point type during the late 1970s and early 1980s (Collins 1980; Rood 1993:32) but were not identified in situ or dated at any archaeological sites until the 1990s, when Ronald Rood and colleagues found a single Deception Creek point base in context with “steep-sided, basin-shaped hearths with dense charcoal-stained fill,” two possible post holes,¹⁴⁰ ground stone, fire-cracked rock, and limited evidence of *Chenopodium* processing at the Deep Hearth site in southwestern Wyoming (Bruder and Rhodes 1992; Rood 1993; Rood et al. 1991, 1993). The investigators ran three radiocarbon dates on the component associated with the Deception Creek point. These dates suggested that this particular Deception Creek point base is Late Paleoindian-aged, but investigators cautioned that the point type’s temporal span was still unknown (Rood 1993).

Since then, Deception Creek points have been identified in context at a handful of other archaeological sites, predominantly in southwestern Wyoming and northwestern Colorado (Mullen et al. 2009:29-30), but they occasionally occur in northern Wyoming (e.g., at Osprey Beach; Johnson and Reeves 2013:19, 42) and central Colorado (e.g., Pitblado 2016:34). Deception Creek points are “similar to several Foothill-Mountain Paleoindian styles,” (Rood 1993:29), namely Pryor Stemmed and Lovell Constricted.

Deception Creek lithic technology description. Deception Creek points are slender and lanceolate with average lengths ranging from 3.5-4.4 cm and exhibit highly variable flaking patterns (uneven parallel-oblique to collateral to random, and anything in between). They are generally characterized by lenticular to subdiamond cross-sections. Deception Creek bases are straight to slightly concave. Point margins are usually convex but can be straight, and constrict towards the base. Characteristically, at the proximal end of Deception Creek points, the margins curve out sharply. This creates “distinctive ears which flare down or out from the vertical axis at an angle of 45-90°” (Collins 1980:n.p.; Collins qtd. Mullen et al. 2009:29-30; Pitblado 2003:115-116; Rood 1993:28).

Deception Creek radiocarbon dates. Most archaeologists agree that “Deception Creek points can be considered as a transitional style between the latest Paleoindian period and the early Archaic” (Metcalf 2011:132), but the temporal span of this point type is still very poorly understood. No one debates that the oldest Deception Creek points are approximately Late Paleoindian in age, but the younger end of the point type’s temporal span remains unclear. Several recent dates associated with possible Deception Creek components at sites in southwestern Wyoming and northwestern Colorado suggest that Deception Creek points might have persisted long into the Archaic. Based on dates from a feature at 5MF3572 (Mike Metcalf, personal communication 2017), Metcalf (2011:131-132) contends that points of the Deception Creek style “occur in

¹³⁹ This is only a partially representative estimate of what appear to be some of the oldest manifestations of Deception Creek components. See “Deception Creek Radiocarbon Dates” section.

¹⁴⁰ The oldest known and dated, unequivocal house pit in the Wyoming vicinity occurs at site 5MF6255 and radiocarbon dates to the Early Archaic (7285 ± 30 ¹⁴C BP, CURL-10327; 7225 ± 25 RCYP, CURL-10321; 7020 ± 25, CURL-10310; Pool and Moore 2011; Slaughter 2011).

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reliably dated contexts as young as 6,600 cal BP.” Deception Creek points, therefore, might have persisted into Early Archaic times. However, whether some Deception Creek points are associated with Early Archaic-aged dates because they were manufactured during that time, because they were curated and/or reused by Archaic peoples, or because they were resting on eroded or deflated surfaces remains an open question (Mike Metcalf, personal communication 2017).

Currently, reliable dates on Deception Creek components have been obtained from three sites: Deep Hearth in Wyoming and 5MF3003 and 5MF3572 in Colorado. Dates from the first two sites produce an estimated temporal span of 9550-9150 cal BP ago for Deception Creek points.¹⁴¹ The third date is much younger, and might represent an instance of curation, reuse, or a point that was exposed and resting on a stable, eroded, or deflated surface during Archaic times. Dates from the two older and one younger site produce a bimodal probability distribution. Due to an unacceptably small sample size of two (or three) dates and considering that many problematic but possibly younger Deception Creek dates exist, this two-date temporal “range” presented in this context should be viewed with extreme caution and skepticism. The range produced by the two older dates should only be considered a partially representative estimate of some of the oldest Deception Creek components known, and the range with three dates might significantly overestimate the younger end of Deception Creek’s span of manufacture.

Elsewhere in Wyoming, the older two dates would place Deception Creek squarely within the Late Paleoindian period. Indeed, Rood (1993) initially defined Deception Creek as a Late Paleoindian Foothill/Mountain variant. However, based on Metcalf and colleagues’ Wyoming Basin chronology (Metcalf 1987, 2011:123; Reed and Metcalf 1999), even dates from the two older sites alone place Deception Creek within the first phase of the Archaic as it occurs in the southwest Wyoming region. This is named the “Great Divide” phase, and spans approximately 9500-8400 cal BP (Metcalf 2011:151).

¹⁴¹ The estimated age “range” for Deception Creek points in and adjacent to Wyoming was calculated by first creating a pooled mean or “average” of dates for each individual site. Then the pooled means from each site were summed to produce a summed probability distribution for Deception Creek point ages. The summed 1 σ probability range for the two oldest dates (9538-9131 cal BP) was rounded to the nearest 50 calendar years to yield an estimated age for Deception Creek in and adjacent to Wyoming (circa 9550-9150 cal BP). This date “range” should be viewed as a hypothesized approximation, and only includes two dates. The addition of more dates will likely broaden the temporal span of the Pryor Stemmed cultural complex. Considering that there are many possible Deception Creek components that might date to much younger ages, these numbers should only be used as a partially representative estimate of the oldest portion of the Deception Creek temporal range.

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Table-10: Key Deception Creek Sites in and Adjacent to Wyoming and Radiocarbon Dates.

Site Name	Site Number	Radiocarbon Dates (^{14}C BP)	Calibrated (2σ , Intcal13; cal BP)	Lab	Material	Citation(s) and Notes
Deep Hearth	48UT786	8610 \pm 90	9888-9465	Beta-45003	Hearth charcoal	Bruder and Rhodes (1992); (1991)
		8220 \pm 130	9492-8930; 8924-8859; 8834-8778	Beta-55747	Hearth charcoal	
		8460 \pm 100	9651-9649; 9629-9233; 9225-9202; 9178-9139	Beta-55748	Hearth charcoal	
		(Average: 8475 \pm 59) ²	(9547-9402; 9344-9325) ²			
5MF3003	5MF3003	8190 \pm 110	9465-8950; 8939-8934; 8921-8861 8833-8779	Beta-213241	Charcoal	Mike Metcalf, personal communication; also Metcalf (2011:131); Mullen et al. 2000; O'Brien and McDonald (2000)
		8270 \pm 100	9468-9021	Beta-213242	Charcoal	
		(Average: 8,234 \pm 74)	(9413-9023)			
5MF6276 ^P	5MF6276	4170 \pm 40 (not used)	---	Un-published	Un-published	Metcalf (2011:165); Mullen et al. 2000; and Metcalf (2009: Appendix 1). The single point associated with this site was reevaluated to McKean Lane site from questionable context (Metcalf 2011:165) later not used as transitional between Deception Creek complex, or it might be a cultural point.
		4470 \pm 25 (not used)	---	Un-published	Un-published	
48UT375 ^P	48UT375	4030 \pm 70 (not used)	---	Beta-151917	Un-published	Questionable context. Smith et al. (2011:141) reports a single Deception Creek site that was excavated from a single component (Component III). "probably originated from the Deception Creek Component I" (Smith et al. 2011:141)
		4040 \pm 40 (not used)	---	Beta-151909	Un-published	
		4220 \pm 40 (not used)	---	Beta-151911	Un-published	
5MF2993 ^P	5MF2993	(Dates exist but lack solid context)	---	---	---	Questionable context (Mike Metcalf communication 2017; Mullen et al. 2000; Reed and Metcalf 2000)

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						Deception Creek point was i component.
5MF2990 ^P	5MF2990	(Dates exist but lack solid context)	---	---	---	Mike Metcalf (personal com Mullen et al. (2009:30); Ree Appendix 1, 2). One “Decep possibly curated/reused, pos type.
5MF2991 ^P	5MF2991	(No reliable dates that are directly associated with diagnostics)	---	---	---	Mike Metcalf (personal com also Mullen et al. (2009:30); (2009: Appendix 1, 2). Thre from this component.
5MF3572 ^P	5MF3572	6080 ± 90 5830 ± 90 (Average: 5955 ± 64) ²	7235-7220; 7177-6726 6853-6812; 6806-6432; 6428-6414 6947-6655 ²	Beta-58601 Beta-67423	Charcoal Charcoal	Metcalf reports that these da cultural level with reliable c may be reused or curated (M communication 2017). See a (2009:30); Reed and Metcal

^P Indicates probable (not definite) association between diagnostic artifacts and the radiocarbon date(s) listed.

² Indicates that the radiocarbon samples are statistically different ages, so the average should be used with caution or not at all.

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This section summarized radiocarbon dates and data from approximately one hundred and forty Paleoindian sites in and adjacent to the state of Wyoming. Synthesizing information from all of these sites hopefully provides a picture of our current knowledge, and highlights gaps in our understanding of Paleoindian chronology, typology, and lifeways on the Northwest Plains. The information presented in this historic context should not be viewed as the final word on Paleoindian archaeology in Wyoming, but rather a synthesis that can and should be built upon and revised as new data become available.

Despite my best efforts at cleaning the radiocarbon dates used to establish the chronology presented in this section, many cultural complex date ranges are based on old radiocarbon dates with large standard deviations from contexts that are not certainly associated with Paleoindian diagnostics. In the future, both previously investigated and newly discovered Paleoindian sites should be dated and re-dated, exploiting contemporary advancements in the method. Surovell and colleagues (2016:7) recently suggested that we should limit samples of Paleoindian radiocarbon dates to 1) high-quality bone dates on collagen or calcined bone apatite or 2) charcoal samples associated with hearth features:

Radiocarbon dates on charcoal have been the bread and butter of Paleoindian geochronology for more than 60 years, but there is good reason to believe that many charcoal dates in stratigraphic association with archaeological occupations are in error [...] With improvements in pretreatment methods coupled with isotopic counting by accelerator mass spectrometry, bone dating is becoming the gold standard for the field (Surovell et al. 2016:7).

Simply re-dating the sites already listed in this historic context using contemporary, high-precision methods would allow significant refinement of the chronology presented here, and would possibly elucidate whether or not some Paleoindian complexes actually overlapped temporally.

One glaring oversight in Northwest Plains Paleoindian archaeology is the absence of a quantitative, objective, and replicable point typology. This would clarify our understanding of chronology and provide a more precise language for discussing point types. We also need to make a greater effort to publish, present, or share information pertaining to important sites and finds and situate them in context with larger research questions. While an attempt was made to incorporate noteworthy site forms and reports into this historic context, much relevant information undoubtedly exists in the gray literature that is not synthesized here.

After the first quintile of the 21st century, the number of unanswered questions we have about Wyoming Paleoindians far outnumbers our answers. This will likely always be true, since the more we know, the more questions we think of to ask (Wormington 1957:260). Jerry Moore once suggested that “as an archaeologist, I face two options when I speak about the past: partial answers or silence” (Moore 2005:3). This is especially true of Paleoindian archaeology. Indeed, it seems as though one of the only sure things that can be said about the Paleoindian period is that we have a plethora of partial answers and equifinal hypotheses to explain what Paleoindians did, when they did it, and why. Almost everything we know about Wyoming Paleoindians is

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enveloped in some form of interpretive uncertainty or debate. At the risk of oversimplifying and overgeneralizing contentious interpretations, the remainder of this section briefly summarizes and compares each Paleoindian cultural complex.

Clovis peoples are the first universally recognized human inhabitants of the Americas. In the Wyoming area, Clovis peoples seem to have subsisted primarily on large game but may have exploited small game in some foothill-mountain regions. Though wild plants were probably consumed, no solid evidence of heavy plant processing exists during this phase. Clovis peoples may have produced frozen meat caches for short-term storage during the winter months (Frison and Todd 1986:60-61). Clovis peoples seem to have been highly mobile based on the preponderance of exotic toolstone in lithic assemblages as well as the results of behavioral ecological and computer models. Clovis is the only (known) Paleoindian stone tool tradition that unequivocally includes blades and was commonly cached. The meaning (if any) of ties between Clovis material culture and Upper Paleolithic cultures in Eurasia requires further research. Projectile point fluting was invented in the New World with Clovis technology. Why fluting originated has yet to be satisfactorily explained. Whether or not Clovis peoples used atlatls, handheld spears, or both is up for debate. Additionally, osseous rods and points were manufactured by Clovis peoples alongside stone points (O'Brien et al. 2016). Why this occurred and whether or not the two types of technologies were used to tip different types of weapons has not been addressed in the literature.

The Goshen cultural complex is poorly dated, poorly defined typologically, and poorly understood geographically. Goshen points may be morphologically indistinguishable from Plainview points on the southern plains. Goshen peoples seem to have focused on bison exploitation for subsistence. As yet, there is no evidence that Goshen points were used to hunt extremely large megafauna such as mammoths and mastodons. However, a mammoth rib tool fragment was associated with Goshen diagnostics at Mill Iron in Montana, which suggests the possibility that Goshen peoples *might* have hunted extinct megafauna at the end of the Pleistocene.

Folsom and Midland (unfluted Folsom) components have been identified at archaeological sites across the northern and southern plains. Whether Midland should be considered its own point type separate from Folsom is debatable. At known Folsom/Midland sites, there is a relationship between the preponderance of fluting and latitude/temperature. The ratio of fluted to unfluted points is higher in more northerly/colder sites. Experimental studies have shown that points are often broken during the fluting process. Whether or not Folsom fluting evolved from Clovis fluting, and why Folsom points were fluted at all given the high failure rate associated with this behavior, are questions that have not been fully answered. Folsom/Midland peoples appear to have been bison specialists, but may have practiced broader-spectrum subsistence strategies in some foothill-mountain regions. Some Folsom/Midland sites on the Northwest Plains have yielded evidence of possible frozen meat caches, suggesting that Folsom/Midland peoples practiced short-term (seasonal) food storage. The potential social implications of this behavior have not been addressed. Many spatial patterning studies have been conducted on Folsom/Midland sites, and household structures have been identified at several sites. Further study of Folsom/Midland households could potentially give important insights into social organization. Like Clovis and possibly Goshen complexes, osseous points are sometimes

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found associated with stone Folsom/Midland points. Existing studies have barely explored the implications of these coexisting technologies. Many art and/or symbolic objects are known from Folsom contexts. These include beads, incised bone, stone, and ivory, and the oldest painted object in North America (the Cooper bison skull; Bement 1999).

Like Folsom/Midland peoples, Agate Basin faunal assemblages are dominated by bison. Also like Folsom/Midland peoples, Agate Basin peoples in foothill-mountain areas may have exploited a wider range of fauna, including smaller bodied species. Agate Basin bison kills seem to be larger, and include more animals, than bison kills associated with Early Paleoindian cultural complexes. This might indicate a shift in social organization, suggesting that Agate Basin subsistence strategies may have included seasonal, cooperative inter-band hunting. This hypothesis is independently supported by evidence suggesting that Agate Basin points at some sites were morphologically standardized and interchangeable, potentially allowing hunters to retool their darts from a common pool of projectile points (Guarino 2014). Specifically how this might have affected Paleoindian social organization has not been fully addressed. Like most other Early and Middle Paleoindian complexes, artistic and symbolic objects are known from many Agate Basin contexts. These include ochre, beads, and incised bone objects.

Hell Gap projectile points appear to overlap temporally and spatially with Agate Basin points, although along with Agate Basin, Hell Gap is one of the most poorly dated Paleoindian complexes described in this historic context. Hell Gap peoples appear to have practiced regionally variable subsistence adaptations. At some sites, Hell Gap peoples focused on bison exploitation, but intensified processing as compared to earlier Paleoindian complexes. At other sites, Hell Gap peoples broadened diet breadth, subsisting on a wider range of faunal species, including smaller-bodied animals. They may have continued practicing short-term food storage with frozen meat caches (Frison 1982b). One possible atlatl hook was identified in association with a Hell Gap component at the Agate Basin site, but atlatl use during the Hell Gap phase is largely conjectural. Hell Gap is the first projectile point type to exhibit a stem. Why Paleoindian peoples shifted from lanceolate to stemmed projectile point varieties requires further explanation.

The Cody complex is one of the best represented Paleoindian cultural complexes, due in part to the sheer number of Cody complex sites on the Northwest Plains that have been identified and archaeologically investigated. The advent of the Cody phase is marked by an apparent diversification in stone point and tool types as compared to earlier phases. Explaining this diversification is a question that could potentially drive future research. In general, Cody peoples appear to have subsisted on bison, as well as smaller animals. While wild plant resources were probably consumed by earlier Paleoindian peoples, it is not until the Cody phase that evidence for heavy plant processing appears in the archaeological record, in the form of milling slabs identified at several Cody sites. Cody peoples may have intensified food storage practices, possibly producing pemmican for this purpose. At some sites, Cody components also include evidence of short-term, seasonal frozen meat caches, similar to the possible meat caches associated with earlier Paleoindian complexes. The potential social implications of shifts in dietary resource exploitation strategies and/or increased food storage practices need further investigation. Because stone Cody points vary more over time than across space, perhaps Cody peoples had regular interband contact (Fogle-Hatch 2015). The first unequivocal evidence for atlatl-use is contemporary with the Cody phase (Lee 2010). Like Clovis, Folsom, and possibly

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Goshen cultural complexes, several osseous rods have been identified in context with Cody diagnostics and/or are contemporary with the Cody complex (Ives et al. 2014). What these rods were used for and how they fit into Cody technological systems should be researched in the future. Another interesting Cody artifact is the possible stone pipe identified at Jurgens. Whether or not this artifact is actually a pipe, and what implications this has for Paleoindian ritual and/or symbolic behavior (if any) require further investigation.

James Allen/Frederick peoples may have practiced a seasonal round that included high elevation montane resource exploitation during warmer months, and open plains bison exploitation during colder months. Limited evidence suggests the possibility that James Allen/Frederick peoples might have constructed high altitude game drives, meaning that organized communal hunting behavior might have occurred in both montane and plains environments. James Allen/Frederick peoples seem to have continued trends seen throughout preceding Paleoindian phases: increased diet breadth, exploitation of relatively greater proportions of smaller faunal species, more intensive processing of faunal resources, increased food processing and possibly storage behaviors. Though ground stone for plant processing occurs in several Cody complex sites, it is not until the James Allen/Frederick phase that ground stone becomes relatively common in the Paleoindian archaeological record. James Allen/Frederick peoples seem to have decreased mobility as compared to earlier phases, and stone tool assemblages are predominantly comprised of local raw material. Future investigations should test how this change in mobility affected Paleoindian social organization, the division of labor, and potentially, household organization. One possible stone circle was identified in the Frederick level at Hell Gap; if it is a tipi ring, it would be the earliest known feature of this kind on the Northwest Plains.

Largely contemporary with James Allen/Frederick, the Angostura/Lusk cultural complex is predominantly a foothill-mountain adaptation. Angostura/Lusk peoples continued to exploit bison, but also exhibited broader diet breadth than preceding cultural complexes. Like James Allen/Frederick occupations, ground stone is commonly identified in association with Angostura/Lusk diagnostics. There seems to be an increase in the frequency and extent of hearths during the Angostura/Lusk phase, which is possibly related to greater floral exploitation and/or intensity of floral resource processing. Several unique art objects and features are affiliated with Angostura/Lusk or similar cultural complexes (i.e., the Alder complex). These include incised stone tablets from Barton Gulch, fossil manuports (including a possible atlatl weight) from Ray Long, and a stone alignment at Mummy Cave (North Fork Cave #1). The meanings of these, and their implications for Angostura/Lusk symbolic behavior, have not been speculated on.

Lovell Constricted points are also considered diagnostic of Foothill/Mountain complex adaptations. In general, Lovell Constricted sites exhibit evidence of broad diet breadth, exploitation of fauna smaller than bison, extensive ground stone assemblages used for plant processing, and smaller, deeper hearths than seem to have been used by Angostura/Lusk peoples. Lovell Constricted assemblages tend to be overwhelmingly comprised of local toolstone, suggesting that Paleoindians who manufactured Lovell Constricted points restricted their mobility as compared to Early and Middle Paleoindian groups.

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Most known Pryor Stemmed components, like other Foothill/Mountain manifestations, occur in rockshelters. Pryor Stemmed lifeways appear to have been very similar to those exhibited by Lovell Constricted peoples. Indeed, these two point types overlap almost completely in space and time. Pryor Stemmed occupations are marked by broad diet breadth, exploitation of fauna smaller than bison, plant exploitation and processing, and apparently low mobility based on an overwhelming preponderance of local lithic materials. Storage pits affiliated with Pryor Stemmed diagnostics have been identified at multiple archaeological sites.

Finally, Deception Creek was originally described as a Wyoming Basin point type, but has since been identified elsewhere, including at Osprey Beach in the Yellowstone area. Deception Creek is poorly understood temporally. While the point type is unambiguously classified as Late Paleoindian/Transitional in southwestern Wyoming, it may have been used throughout the first several thousand years of the Archaic as well. Our knowledge of Deception Creek peoples is currently limited but, at least in the Wyoming Basin, Deception Creek times seem to mark the transition between Late Paleoindian and Archaic lifeways. Deception Creek-aged components and sites in the Wyoming Basin tend to include very few projectile points, an emphasis on small game and plant processing, large and elaborate thermal features, and fire cracked rock. Broad diet breadth, intensive floral and faunal exploitation, and heavy resource processing are more characteristic of “Archaic”-style subsistence strategies than they are of Paleoindian lifeways.

Throughout the Early, Middle, and Late Paleoindian periods in the Wyoming area, several overarching trends emerge, and are described below. The following trends may be egregious overgeneralizations, and most should be viewed as hypotheses to be tested rather than unequivocal trends in Paleoindian behavior. In many regions and at most sites, Early Paleoindian diet breadth was relatively narrow. Early Paleoindian peoples focused on large game for subsistence, but do not seem to have participated in extremely large-scale, multi-band, cooperative, communal hunting behavior on a regular basis (see Carlson 2015; Carlson and Bement 2013; but see Wilmsen and Roberts 1978). Early Paleoindians were highly mobile, did not intensively process floral or faunal resources, and did not practice long-term food storage. Throughout four and a half thousand years of Paleoindian times in Wyoming, these lifeways shifted, presumably to adapt to changing environments. While bison exploitation was always utilized as a subsistence strategy by some Northwest Plains Paleoindians in some areas, especially on the easterly open plains, Paleoindian diet breadth *in general* broadened over time in regionally diverse ways to include more fauna smaller than bison. Paleoindian diets seem to have gradually shifted to include more floral resources as well (though this pattern may be heavily distorted by preservation bias). Throughout the Paleoindian period, both floral and faunal resources were processed with increasing intensity, and long-term food storage and planning increased in frequency. While there seems to have been a surge in large-scale communal hunting behavior during Middle Paleoindian times, this apparently dissipated during Late Paleoindian times as people generally decreased mobility, relied more heavily on local resources, and more commonly occupied closed rockshelter sites as compared to open-air locales (Kelly 2015).

These shifts in subsistence practices, planning and storage strategies, mobility, and settlement patterns would all have affected Paleoindian social organization, the division of labor, conceptions of kinship and family, how resources were shared and with whom, and the way that

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Paleoindian social networks were constructed. None of these topics have been adequately addressed by Paleoindian archaeologists. The future of Paleoindian archaeology will be rewarding if we creatively construct hypotheses to test these notions, remember that archaeology is about people (not artifacts), and ground our research questions within strong theoretical frameworks. In some cases, Paleoindian research has become polarized and personal. Paleoindian archaeology as a whole would benefit if we abandoned these practices and shifted towards an intellectual environment that favors hypothesis testing and data sharing, encourages critical evaluation of traditional assumptions, and fosters an atmosphere in which we are not afraid to admit when we were wrong.

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State**Section F: Associated Property Types**

Wyoming and surrounding regions include a diverse array of Paleoindian site types. This section divides these into eight categories: open-air camps, rockshelters, kill/butchery sites, short-term occupations/logistical forays, lithic/mineral resource procurement locales, stone tool caches, rock art, and human burials/remains. These conceptual categories blur together in some cases, so ought to be applied critically on a case-by-case basis. For example, a single Paleoindian site could be classified as both an open-air camp and a kill/butchery area if both of those activities occurred contemporaneously in one location.

These categories could potentially be expanded if other Paleoindian site types are identified in the future. One glaring omission from this list is a category for symbolic/ritual sites (excepting human burials). Such sites are known from later periods on the Northwest Plains (e.g., the Bighorn Medicine Wheel; 48BH302), but as yet, no sites primarily used for ritual or symbolic purposes have been identified and dated to Paleoindian times.¹⁴² The existence of ritual/symbolic Paleoindian sites in Wyoming is certainly within the realm of possibility, considering that they are commonly identified in contemporary Upper Paleolithic European contexts (e.g., Clottes 2016).

Open-Air Camps

Open-air Paleoindian camps in and around Wyoming often include long-term and/or repeated occupations where a variety of activities occurred. These sites may be stratified or palimpsested. Re-occupied habitation sites are common throughout Paleoindian and later phases on the Northwest Plains. This may be partially related to the notion that permanent water sources, lithic procurement areas (e.g., Reher 1991), game migration routes,¹⁴³ and successful hunting locations (Frison 1984) frequently remain stable in Wyoming over time, regardless of paleoclimatic fluctuations. The availability of floral resources, on the other hand, is highly sensitive to changes in precipitation, growing-season temperature, and other paleoclimatic variables (Benedict 2007). Synthesized paleoclimatic reconstruction data ought to be applied to test hypotheses like this on a site-specific basis.

Hell Gap, situated in the Hartville Uplift in eastern Wyoming, is one of the most iconic, stratified, open-air Paleoindian campsites in Wyoming (Larson et al. 2009). Hell Gap's significance was formally recognized in 2016 when the site was designated a National Historic Landmark. Re-occupied over thousands of years throughout various Paleoindian phases, the site includes numerous artifact types and activity areas. Lithics, faunal remains, and charcoal dominate Hell Gap assemblages. Other durable artifacts, including hammer stones, ground stone, objects manufactured from osseous materials (e.g., beads and a mammoth tusk tool), fire cracked rock, and ochre have also been identified at the site. Features at Hell Gap include possible structures, hearths, lithic scatters, and possible post holes. Though detailed spatial analysis to formally identify activity areas has not yet been conducted at Hell Gap, these artifacts and features appear to reflect a range of different activities including stone tool production/resharpening, cooking, hide preparation, and animal butchery. In general, other long-term camps

¹⁴² Except, perhaps, the Powars II ochre mine, which is classified here as a mineral resource procurement site.

¹⁴³ For example, see Fenner (2007, 2009) and Fenner and Frost (2009).

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should also include evidence for a wide variety of tasks, a diversity of tool and other artifact types, and exploitation of an array of different types of plants, animals, and/or other resources.

Activities at Hell Gap were identified based on the presence of durable artifacts and features that are typically found at Paleoindian open-air habitation sites in Wyoming. Preservation of fragile organics is generally poor at open-air sites on the Northwest Plains due to harsh and fluctuating seasonal conditions, exposure to wind, freeze/thaw, and wet/dry cycles. Wooden artifacts, macrobotanical remains, basketry, matting, cordage, and other archaeological perishables are rarely found at open-air sites. Archaeological interpretation, especially at sites subjected to poor preservation, must always consider differential preservation, taphonomic processes, and the adage that “absence of evidence is not evidence of absence.” That is, if perishables are not identified during excavations, this does not necessarily mean that they were never deposited at the site in the first place.

Open-air Paleoindian sites may also include portable art objects, floral remains, and possibly other organic artifacts or ecofacts. Phytoliths, pollen, gastroliths, and other ecofacts that function as paleoclimatic indicators are often successfully sampled from open-air campsites. Other identified features may include boiling pits, stacked faunal remains, probable/possible frozen meat caches, lithic scatters, occasionally post holes, stone circles, or other evidence of structures, hearths, and primary or secondary refuse disposal localities. If extensive, refuse disposal areas may be referred to as middens.¹⁴⁴

Site-specific research topics potentially applicable to open-air Paleoindian campsites include a potentially infinite number of subjects related to reconstructing Paleoindian lifeways. Some examples of research topics well-suited to this type of site include studies geared towards identifying activity areas, reconstructing mobility patterns, lengths of occupation, diet breadth, intensity of faunal/floral processing, resource procurement strategies, season of occupation, and/or task differentiation. If stratified diachronically, changes in behavioral patterns such as these can be tracked over time and correlated with other environmental or social variables such as resource scarcity, paleoclimate, population size, or other factors. Testing for these correlations contributes to explaining *why* diachronic changes in human behavior occurred.

Significant archaeological studies generally seek to explain human behavioral variation under different environmental conditions, across space, or over time. Therefore, open-air camps that lack a series of occupations for internal comparison generally need to be compared to other sites across the landscape in order to answer “why” and “how” questions about prehistoric behaviors. Comparative studies allow archaeological sites to be couched in frameworks that test hypotheses geared towards answering meaningful research questions.

Registration Requirements for Open-Air Camps**Area of significance: Archaeology (prehistoric)****Criteria: A and D**

¹⁴⁴ Oddly, the term “midden” is rarely colloquially applied to Wyoming Paleoindian sites even though it accurately describes some bonebeds (e.g., Kornfeld and Larson 2008), lithic scatters (e.g., Finley et al. 2005) and other features that are produced as a result of trash disposal behaviors.

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Open-air camps are eligible under criterion A where major new aspects of prehistory were *historically* discovered and subsequently contributed key information to scientific knowledge at that time. These types of historic events represent major discoveries that provided information important to the history of archaeology. Archaeological type sites for specific archeological complexes may also be eligible under Criterion A. Any site that significantly upsets or fleshes out our contemporary understanding of Paleoindian lifeways, mobility strategies, resource procurement strategies, typology, or chronology as presented in this historic context will be considered eligible under Criterion A.

In order to be eligible under Criterion D, open-air Paleoindian camps should contain or be likely to contain data that will provide pertinent insights into any of the research questions addressed in this context. This is the most important consideration when determining site eligibility under this criterion. At open-air camps, meeting this requirement generally entails that at least one feature, artifact type, or facet of human behavior evidenced within the site is exceptionally unique, exemplary, and/or well preserved and that one or more activity areas can be identified. An eligible open-air camp may contain single or multiple component occupation(s). Multiple component occupations must be clearly stratified. The site must contain datable materials that link it to the Paleoindian period, and should retain at least integrity of location, design, materials, workmanship, or association.

Table-11: Noteworthy Open-Air Paleoindian Campsites in and around Wyoming.

Site Name	Site Number	Major Citation(s)
Lamb Spring	5DO201	Rancier et al. (1982)
Barger Gulch	5GA195	Surovell and Waguespack (2007)
Lindenmeier	5LR13	Roberts (1935, 1936); Wilmsen and Roberts (1978)
KibRidge Yampa	5MF3687	Hauck and Hauck (2002)
Claypool	5WN18	Dick and Mountain (1960)
Indian Creek	24BW626	Davis (1984)
Mill Iron	24CT30	Frison (1996)
MacHaffie	24JF4	Davis et al. (2002, 1991)
Barton Gulch	24MA171	Davis (1989)
Myers-Hindman	24PA0504	Lahren (1976)
Lime Creek	25FT41	Bamforth (2007)
Allen	25FT50	Bamforth (2007)
Ray Long	39FA65	Wheeler (1995[1959])
China Wall	48AB1	Waitkus (2013)
Hanson	48BH329	Frison and Bradley (1980)
Laddie Creek	48BH345	Larson (1992); Reider and Karlstrom (1987)
Helen Lookingbill	48FR308	Frison (1983)
Hell Gap	48GO305	Larson et al. (2009)
Sister's Hill	48JO314	Agogino and Galloway (1965)

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Agate Basin	48NO201	Frison and Stanford (1982)
Betty Greene	48NO203	Greene (1967)
Sheaman	48NO211	Frison and Stanford (1982)
Deadman Wash	48SW1455	Armitage, Creasman, and Mackey (1982); Armitage, Newberry-Creasman, et al. (1982)
Blue Point	48SW5734	Johnson and Pastor (2003)
Krmpotich	48SW9826	Peterson (2001)
Game Creek	48TE1573	Page (2017)
Deep Hearth	48UT786	Rood (1993)
Osprey Beach	48YE409 / 48YE410	Johnson and Reeves (2013)
Shute Creek Plant	48LN373	Ficenec (2003)
48LN1185	48LN1185	McDonald (1993)
Pine Spring	48SW101	Sharrock (1966); Kelly et al. (2006)
Vegan	48LN1880	Polk et al. (2004)

Rockshelters

Rockshelters were commonly inhabited by Paleoindian peoples in the Wyoming area, on short- and long-term bases, especially during Late Paleoindian times (Kelly 2015). Rockshelters are protected from the elements, and therefore often contain a greater quantity and diversity of perishable artifacts than open-air sites. Like open-air sites, the same rockshelter localities are often repeatedly occupied over time. Rockshelters frequently maintain stratigraphic integrity and are rarely deflated or palimpsested. Good artifact preservation combined with clear stratigraphic separation means that many rockshelters comprise ideal locations for conducting archaeological studies. However, rockshelter archaeologists must keep in mind the “fallacy of the typical site.” The entire milieu of human behavior does not occur at one single location. Regional studies that focus *only* on rockshelters will almost certainly overlook key components of Paleoindian settlement and subsistence systems that took place elsewhere across the landscape.

One of the most well-known rockshelters in Wyoming that contains Paleoindian-aged cultural materials is Mummy Cave (North Fork Cave #1), near the eastern entrance to Yellowstone National Park (Husted and Edgar 2002; McCracken et al. 1978). Mummy Cave was placed on the National Register of Historic Places in 1981. Excavations of Mummy Cave’s Paleoindian levels revealed numerous hearths, charcoal pieces, a variety of stone tool types, many butchered bones with cut marks, bone tools (including awls and needles), worked and unworked wood, and a stone alignment possibly associated with a bighorn sheep cranium. Other Paleoindian-aged rockshelter occupations in the Bighorn Mountains have produced food storage pits and charred macrobotanical remains (e.g., Schiffer Cave [Frison and Grey 1980:34], Southsider Shelter [Freeland 2012b], and Medicine Lodge Creek [Frison and Walker 2007]). Ground stone is also associated with many Late Paleoindian rockshelter occupations (e.g., Bottleneck Cave [Husted 1969:53-54; Plates 25a, 25d, 26c, 26d, 27a, 27b, 28b], Medicine Lodge Creek [Frison and Walker 2007], and Mangus [Husted 1969:27-41, 122]).

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Due to superior preservation of perishables in rockshelter sites, Paleoindian levels could potentially contain artifacts and features that would degrade in contemporary open-air localities. Organic components of atlatls and darts, worked wood and bone tools, cordage, basketry, mats, hide, floral remains, and other organic artifacts are generally more likely to be preserved and recovered from closed rockshelters than open-air localities.

Research topics that lend themselves towards rockshelter studies are similar to those that can be addressed in open-air locations, but greater preservation allows for Paleoindian cultural systems to be reconstructed more completely. In general, greater artifact and feature preservation means that there are more lines of evidence to draw on when constructing archaeological arguments. In that vein, preserved perishables from rockshelters might be compared to open-air occupations of similar antiquity in order to better understand preservation bias at open-air sites and/or to test some of the assumptions commonly made about durable artifacts. Rockshelter studies might seek to answer questions such as when and why rockshelter use increased in frequency relative to open-air sites. Activity areas and spatial organization may be reconstructed and compared to other rockshelters and/or other Paleoindian site types. Like most studies in hunter-gatherer archaeology, mobility, subsistence, occupation span, seasonality, technological change, divisions of labor, and how all of these variables correlate with paleoenvironmental conditions are important research topics to address.

Registration Requirements for Rockshelters

Area of significance: Archaeology (prehistoric)

Criteria: A and D

Paleoindian sites are eligible under criterion A where major new aspects of prehistory were *historically* discovered and subsequently contributed key information to scientific knowledge at that time. These types of historic events represent major discoveries that provided information important to the history of archaeology. Archaeological type sites for specific archeological complexes may also be eligible under Criterion A. Any site that significantly upsets or fleshes out our contemporary understanding of Paleoindian lifeways, mobility strategies, resource procurement strategies, typology, or chronology as presented in this historic context will be considered eligible under Criterion A.

To be eligible under Criterion D, Paleoindian rockshelter sites must contain (or be likely to contain) data important for testing hypotheses or answering research questions discussed in this context. Generally, this requires that rockshelter sites contain intact archaeological deposits that are demonstrably intact. Such sites might contain single or multiple occupation episodes or components. Eligible rockshelters generally must exhibit exceptional preservation of one or more feature, artifact, or ecofact type(s) and usually include both diagnostic artifacts and materials that can produce absolute dates.

Many rockshelters in Wyoming were excavated in the 1960s-1980s, before high resolution excavation methodologies became standard archaeological practice. If portions of these sites remain intact they will be considered eligible under Criterion D because the application of modern excavation methods and analysis techniques will provide new insights into old questions, or allow researchers to investigate novel topics.

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Table-12: Noteworthy Paleoindian Rockshelter Sites in and around Wyoming.

Site Name	Site Number	Major Citation(s)
Wasden/Owl Cave	10BV30	Miller (1978, 1982)
Beta Rockshelter	10LH63	Swanson and Sneed (1966)
Sorenson	24CB202	Husted (1965, 1969)
Pictograph Cave	24YL0001	Mulloy (1958)
Mangus	24CB221	Husted (1965)
Bush Shelter	48WA324	Miller (1988)
Bentzen-Kaufmann Cave	48SH301	Grey (1962, 1963)
Two Moon	48BH1827	Finley et al. (2005)
Eagle Shelter	48BH657	Chomko (1982, 1990); Finley (2008); Rowe (2014)
Little Canyon Creek Cave	48WA323	Miller (1988)
Mummy Cave (North Fork Cave #1)	48PA201	Husted and Edgar (2002); McCracken et al. (1978)
Southsider Shelter	48BH364	Cooper (2002); Frison (1978)
Medicine Lodge Creek	48BH499	Frison and Walker (2007)
Bottleneck Cave	48BH206	Husted (1969)
Grey-Taylor	48JO303	Grey (2004); Frison and Grey (1980)
Paint Rock V	48BH349	Cannon (2017); Frison and Grey (1980); Rowe (2014)
Granite Creek Rockshelter	48BH330	Frison and Grey (1980)
B.A. Cave	48BH1065	Finley (2008); Kornfeld (2007); Rowe (2014)
Ditch Creek	<i>No number</i>	Kornfeld (2007); Kelly (2015)
No Name Shelter	48BH3168	Kornfeld (2007)
Alm Shelter	48BH3457	Finley (2008); Rowe (2014); Ostahowski (2011); Ostahowski and Kelly (2014)
Last Canyon Cave	24CB879	Fedorchenko et al. (2009)

Kill/Butchery Sites

Kill and butchery sites are another common site type throughout the Paleoindian period. Large-scale mass kills seem to be most common during Middle Paleoindian times, but this assertion should be quantitatively tested. Several scholars have suggested that Early and Middle Paleoindian investigations have preferentially investigated large megafaunal kill sites and/or megasites (Hill 2008b:100; Meltzer 2006a:45-6; Todd 1986). The preponderance of investigations into this site type during Early and Middle Paleoindian times may bias our understanding of these trends in the archaeological record (LaBelle 2005).

Kill and butchery sites vary in terms of the number, type, and size of animals involved, the hunting strategy used, and resource exploitation strategies employed (i.e., high versus low

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utility portions of animals and intensity of faunal processing). Paleoindian kill sites vary in size from one animal (e.g., the La Prele mammoth kill [Mackie et al. 2016] and the Dilts bison kill [LaBelle 2007]) to less than ten individuals (e.g., the Nelson site [Kornfeld et al. 2007] and Cattle Guard [Jodry and Stanford 1992]) to more than fifty (e.g., Olsen Chubbuck [Wheat et al. 1972:72] and the Agate Basin level at the Agate Basin site [Hill 2008b:53]). Some animals were taken opportunistically by small groups of hunters, while large mass kills would have required the planned and coordinated efforts of many participants. Paleoindian mass bison kills were sometimes implemented by driving herds of bison into natural features in order to pen or corral them (Frison 1978; Wheat et al. 1972). In some times and places, Paleoindians practiced a “gourmet” butchering strategy, utilizing only the highest utility portions of each animal and foregoing heavy faunal processing (e.g., at Horner [Frison and Todd 1987] and the Folsom level at Agate Basin [Hill 2004]). Elsewhere, presumably while under resource-stressed conditions, Paleoindians exploited both high and low utility bone elements and intensively processed fauna (e.g., at Clary Ranch [Hill 2005:256; Hill et al. 2002]).

Kill and butchery sites are often difficult to discern from one another in the field without extensive excavation and zooarchaeological study. This challenge exists partially because animals were sometimes butchered or partially butchered in the same location as they were killed. However, some general expectations to differentiate kill from butchery sites exist. Overall, kill sites will retain relatively higher percentages of articulated, low-utility portions of animals and/or complete or nearly complete skeletal units. At kill sites, bonebeds will usually be concentrated in a certain area. High utility portions of animals may be absent from kill sites because they were carried away from the kill. Secondary butchery locations will generally contain high utility elements while heavy, low utility portions (such as complete crania) will be absent. Skeletons will not be complete or fully articulated in secondary butchering areas, and bonebeds are relatively less concentrated than at kill sites (Todd 1986:231; Wheat 1978).

Archaeological questions revolving around kill/butchery sites may focus on explaining why resources were or were not intensively processed, why high and/or low utility portions of animals were exploited, which portions were transported from the kill site and why, and calculating the size of the kill. Explaining these behaviors by correlating them with paleoenvironmental fluctuations and/or resource scarcity are pertinent research topics. Regarding social reconstructions of the past, studies might also focus on determining the number of hunters involved in kills (Frison 1984:309; Wheat 1966), whether hunters were provisioning others, how a hunt might have been planned or organized, whether it involved multiple bands of people working together, and explorations into the demography of task allocation (i.e., who was doing the hunting, butchering, hide processing, etc.).

Registration Requirements for Kill/Butchery Sites

Area of Significance: Archaeology (prehistoric)

Criteria: A and D

Paleoindian sites are eligible under criterion A where major new aspects of prehistory were *historically* discovered and subsequently contributed key information to scientific knowledge at that time. These types of historic events represent major discoveries that provided information

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important to the history of archaeology. Archaeological type sites for specific archeological complexes may also be eligible under Criterion A. Any site that significantly upsets or fleshes out our contemporary understanding of Paleoindian lifeways, mobility strategies, resource procurement strategies, typology, or chronology as presented in this historic context will be considered eligible under Criterion A.

To be eligible under Criterion D, Paleoindian kill sites generally must contain intact in situ deposits and must have the potential to provide new data for answering big research questions. In general, faunal remains and possibly other artifact and feature types or ecofacts at eligible kill sites should exhibit good to exceptional preservation. Sites that provide evidence of seasonality or of unique hunting strategies, diet breadth, social organization patterns, or butchering techniques will generally be considered eligible if integrity is maintained.

Table-13: Noteworthy Kill/Butchery Sites in and around Wyoming.

Site Name	Site Number	Predominant Species	Major Citation(s)
Hawken	48CK303	Bison	Frison et al. (1976)
Trapper's Point (Early Archaic, possibly terminal Paleoindian)	48SU1006	Antelope	Miller et al. (1999)
Agate Basin	48NO201	Bison, antelope	Frison and Stanford (1982); Hill (2008b); Hill (1994)
Colby	48WA322	Mammoth	Frison (1986b)
Lange-Ferguson	39SH33	Mammoth	Hannus (1989, 1990, 2018)
Dent	5WL269	Mammoth	Brunswick (2007a)
Casper	48NA304	Bison, camel	Frison (1974, 2000)
U.P. Mammoth	48CR182	Mammoth	Haynes et al. (2013)
La Prele	48CO1401	Mammoth	Byers (2002a), Mackie et al. (2016)
Dilts	48CA4718	Bison	LaBelle (2007)
Mill Iron	24CT30	Bison	Frison (1996)
Jim Pitts	39CU1142	Bison	Sellet et al. (2009)
Upper Twin Mountain	5GA1513	Bison	Kornfeld et al. (1999), Kornfeld and Frison (2000)
Carter/Kerr-McGee	48CA12	Bison	Frison (1984)
Fowler-Parrish	5WL100	Bison	Agogino and Parrish (1971)
Frazier	5WL268	Bison	Slessman (2004)
Beacon Island	32MN234	Bison	Ahler et al. (2006)
Jones-Miller	5YM8	Bison	Stanford (1974, 1975, 1978)

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Horner	48PA29	Bison	Frison and Todd (1987)
Nelson	5WL4872	Bison	Kornfeld et al. (2007)
Olsen-Chubbuck	5CH1	Bison	Wheat et al. (1972)
Claypool	5WN18	Bison	Dick and Mountain (1960)
Scottsbluff Bison Quarry	25SF2	Bison	Hill (2008a)
Finley	48SW5	Bison	Haspel and Frison (1987), Hill (2008a), Todd and Hofman (1987)
Frasca	5LO19	Bison	Fulgham and Stanford (1982)
Jurgens	5WL53	Bison	Wheat and Scott (1979)
Hudson-Meng	25SX115	Bison	Agenbroad (1978a, 1978b), Todd and Rapson (1999, 2016)
Jerry Craig	5GA639	Bison	Richings-Germain (2002)
Wetzel	<i>No number</i>	Bison	Cassels (1997:85), Stanford (1999:323)
Clary Ranch	25GD106	Bison	Hill (2005)
James Allen	48AB4	Bison	Knudson and Kornfeld (2007), Mulloy (1959)
O.V. Clary	25GD50	Bison	Hill et al. (2008)
Slim Arrow	5YM240	Bison	LaBelle (2002, 2005, 2014)
Cathedral Butte	5MF625	Bison	Stucky (1977)

Short-Term Occupations/Logistical Forays

Short-term occupations and logistical foray locations are likely underrepresented in the archaeological record because of the ephemeral nature of many of these limited activity stations (Hofman and Ingbar 1988). Activities that took place at ephemeral sites may not leave obvious material residues, making it difficult to identify and document sites of this nature appropriately. It would behoove us to remain aware that “[s]mall ephemeral hunting camps, overlooks, or short-term hunting stands should have been at least as common as kill and major camp sites, and probably were more common” (Hofman and Ingbar 1988:340), even though comparative tabulations of site types do not reflect this.

Short-term hunting camps such as Rattlesnake Pass (Smith and McNees 1990) should theoretically include a narrower diversity of activities performed, greater homogeneity of tool types, sparser material residues, and have a higher preponderance of non-local toolstone than long-term campsites (Surovell 2009). They may include several species of fauna, with low MNI counts. Bones may be extremely fragmented due to intensive processing of the limited number of

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animals represented (Todd 1986:231; Wheat 1978). Logistical Paleoindian camps for processing floral resources have not yet been identified in the Wyoming area. This may be because such camps, if they did exist, would not include identifiable concentrations of preserved material residues (Frison and Grey 1980).

Other evidence of logistical hunting forays remains uniquely preserved in ice patches. Montane ice patch environments were often sought out by high altitude animals, such as bighorn sheep and mountain bison, in order to provide thermoregulation and relief from insects during the summer. At least some Paleoindian peoples targeted these microenvironments for seasonal, logistical hunting forays (Lee 2010). Few Paleoindian-aged artifacts have yet been dated from North American ice patch contexts (see Reckin 2013), but there is great potential for more to exist. Perishable organics are often preserved in frozen ice patches, and could provide pertinent information about artifact types that are rarely recovered from other settings. Due to contemporary climate change and global warming, artifacts are rapidly melting out of these locations. There is therefore a race against time to collect and preserve them before they degrade and disappear (Lee 2014).

Based on a small sample of sites, it seems that most short-term, ephemeral Paleoindian localities on the Northwest Plains have been identified in high altitude, montane areas, rather than at lower elevations. This may reflect seasonal use of the high country for hunting, plant gathering, lithic procurement, or travel through the region (Reckin 2013:325), as perhaps this is the only type of Paleoindian site that commonly occurs at high elevations. Any fruitful high altitude Paleoindian research would therefore record ephemeral sites out of necessity. This hypothesis needs to be tested in order to determine whether ephemeral sites are proportionally more common in high altitude environments, or if this apparent pattern is the product of recordation bias.

Overall, greater efforts to identify, record, and study short-term Paleoindian occupations and logistical forays are required. Our understanding of temporary, ephemeral Paleoindian sites is currently limited. In particular, greater efforts should focus on identifying locations that were used for collecting floral and other types of resources that would leave sparse material residues, if and when evidence for these behaviors exists.

Registration Requirements for Short-Term Occupations

Area of Significance: Archaeology (Prehistoric)

Criterion: D

It might be appropriate to nominate conglomerations of similarly aged ephemeral sites under Criterion D as discontinuous districts rather than individual resources when they represent either individual variation characterizing diversity in contemporary site types or repeated patterns in human behavior. Each ephemeral resource contributing to the discontinuous district would need to date to a time period of interest (using radiocarbon age determinations, diagnostic artifacts, or other means) and include preserved artifacts or features. Such sites would need to maintain demonstrable archaeological integrity and must retain horizontal associative relationships if vertical integrity has been lost.

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Table-14: Noteworthy Short-Term Paleoindian Sites in and around Wyoming

Site Name	Site Number	Major Citation(s)
48SW97	48SW97	Smith and McNees (2016)
Ice patches	Many	Lee (2014, 2012, 2010), Lee and Benedict (2012)
Rattlesnake Pass	48CR4520	Smith and McNees (1990)
Rocky Foolsn	48CK840	Kornfeld (1988)
Adobe	48CA2162	Hofman and Ingbar (1988)
Fourth of July Valley	5BL120	Benedict (1981, 1992, 2005)
Caribou Lake	5GA22	Benedict (1974, 1985), Pitblado (2000)
Carey Lake	5LR230	Morris and Metcalf (1993)
Porter Hollow	48UT401	Hoefer (1987)
Second Look	48SU1565	Hauck et al. (1996)

Lithic/Mineral Resource Procurement Sites

Lithic quarries on the Northwest Plains have not yet been examined from a site-specific, Paleoindian-centric perspective (but see Goodyear 1979). This is partially because most lithic procurement localities in this region were not exclusively used during Paleoindian times, but seem to have been continually exploited throughout prehistory (e.g., Spanish Diggings [48PL48]; Reher 1991). Furthermore, dating quarry locations is generally difficult as they contain few organics, a preponderance of primary and secondary reduction flakes without diagnostic artifacts, and even in best-case scenarios, quarries tend to exhibit complex stratigraphy. Around fifty quarry sites have been identified and recorded in Wyoming as of 2017 (based on the Wyoming Cultural Records Office database). Most of these sites have not been assigned to specific cultural historical affiliations, though many were undoubtedly exploited by Paleoindian peoples. Paleoindians are known to have utilized Obsidian Cliff, which was designated a National Historic Landmark in 1996 (Johnson et al. 1995).

Lithic sourcing studies, on the other hand, are commonly conducted at Paleoindian camps, kills, caches, and other site types across the Northwest Plains. Overall, these studies show a general decrease in the preponderance of exotic toolstone use over time, but this interpretation has been critiqued by some archaeologists (e.g., Bamforth 2009). In the future, it would be useful to confirm the existence of this trend with robust statistical analysis. For a summary of lithic sources on the Northwest Plains, see Miller (1996).

Another unique type of resource procurement location in Wyoming is the Powars II ochre mine (48PL330). This is the only known, Paleoindian-aged ochre mine in North America. Powars II contains prehistoric ochre mining tools as well as projectile points that span the entire Paleoindian period (Frison 1991b:368; Stafford 1990; Stafford et al. 2003). Ochre mined from Powars II was likely transported and used at many Paleoindian-aged sites throughout Wyoming and surrounding regions. At least one mineralogical ochre sourcing study using powder x-ray diffraction (XRD) is currently in progress (Mackie et al. 2016:Appendix D). Preliminary results of this study suggest that the mineralogical composition of the ochre stain at the La Prele

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mammoth site is consistent with ochre from Powars II (Mackie et al. 2016:Appendix D). This was recently confirmed by ICP-OES and ICP-MS geochemical analyses (Zarzycka et al. 2019).

Registration Requirement for Lithic/Mineral Procurement Sites

Area of Significance: Archaeology (Prehistoric)

Criteria: A and D

Paleoindian sites are eligible under criterion A where major new aspects of prehistory were *historically* discovered and subsequently contributed key information to scientific knowledge at that time. These types of historic events represent major discoveries that provided information important to the history of archaeology. Archaeological type sites for specific archeological complexes may also be eligible under Criterion A. Any site that significantly upsets or fleshes out our contemporary understanding of Paleoindian lifeways, mobility strategies, resource procurement strategies, typology, or chronology as presented in this historic context will be considered eligible under Criterion A.

Two challenging aspects for establishing that lithic raw material procurement locations are eligible under Criterion D are the general paucity of diagnostic artifacts and the lack of dateable organic materials at most quarries. Nomination to the NRHP requires that a site's period of significance is justified with archaeological evidence. An eligible resource procurement site should be dated somehow, so that it can be situated within an appropriate historic context. Overall, for a resource procurement locale to be eligible under Criterion D, it should also contain excellently preserved quarrying features and associated artifacts. Since landscape-level questions are often integral components of research designs geared towards prehistoric quarrying sites, eligible sites should usually maintain setting and feeling aspects of integrity, even when nominated under Criterion D.

Stone Tool Caches

Though Clovis complex peoples seem to be the only Paleoindians that regularly cached artifacts (Kilby 2008:3), Middle and Late Paleoindian peoples also occasionally produced caches of stone tools. Caches are defined as a group of tightly clustered items found in isolation on the landscape that were intentionally stashed in preparation for future retrieval and use (Bement 2014; Huckell and Kilby 2014). According to Kilby (2008:viii), caches may be divided into two varieties: ritual and utilitarian. Ritual caches are intentionally interred with human burials and have symbolic meaning (see also Morrow 2016). Utilitarian caches presumably had various functional purposes. Kilby (2008) divides utilitarian caches into three types. He names the first type "insurance caching." Insurance caches ensure that general materials and/or tools are available for some perceived future need. "Seasonal/passive" caches include specialized materials required to complete a certain task as part of a seasonal round. These items are stored in a static location so they can be retrieved during the next season. The third type of utilitarian cache, "load exchange," is relatively unplanned. These caches include items that were temporarily abandoned in order to lighten the current carrying load to make room for recently collected resources. Though Kilby (2008) specifically created these cache categories to classify

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Clovis caches, his definitions could potentially be applied and/or adapted to caches from later Paleoindian complexes as well.

Table-15: Kilby's (2008:206) "Archaeological Expectations for Four Cache Functional Types." Reprinted with permission from J. David Kilby.

Attribute	Cache Type			
	<i>Insurance</i>	<i>Seasonal/Passive</i>	<i>Load Exchange</i>	<i>Afterlife</i>
Raw material diversity	Low	High	High	High
Artifact diversity	Low	High	Low	High
Remnant utility	High	Variable	Variable	Variable
Use wear	Low	High	Variable	Variable
Distance to raw materials	High	Variable	Variable	Variable
Distance to subsistence resources	Variable	Low	Low	Variable
Site context	Variable	Base camp	Activity areas	Variable
Other	Permanent landmarks?	Specialized tools?	--	Human skeletal remains? Red ochre?

Cache features raise a number of pertinent archaeological questions, such as why a specific cache was created. Caching behavior may be linked to environmental conditions, resource exploitation strategies, seasonal rounds, lithic tool design requirements, lithic raw material distribution, diet breadth/patch choice decisions, or other factors (Huckell and Kilby 2014). Comparative perspectives on how cached tools fit into larger lithic assemblages, and using caches to understand land-use, mobility strategies, and technological organization, are all important research topics.

Registration Requirements for Stone Tool Caches

Area of Significance: Archaeology (Prehistoric)

Criteria: A and D

One difficulty inherent to arguing that stone tool caches may be eligible for the NRHP lies in the fact that they are usually completely excavated and removed from their original locations. Once stone tool caches are fully excavated, they are not eligible under Criterion D. However, such sites might be considered eligible under Criterion A if they were important to the history of archaeology. If the cache has not been completely excavated, it may be eligible under Criterion D if it is able to answer important research questions.

Table-16: Paleoindian Stone Tool Caches in and around Wyoming.

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Cache Name	Diagnostic Artifacts	Major Citation(s)
Crook County	Clovis	Tankersley (1998)
Fenn	Clovis	Frison and Bradley (1999)
Franey	Clovis	Grange (1964), Kilby (2008)
Mahaffy	Clovis	Bamforth (2013)
CW	Clovis	Muñiz (2014)
Drake	Clovis	Stanford and Jodry (1988)
Watts	Clovis	Kilby (2008), Patten (2015)
Larson	Primarily Cody; also contains Pryor Stemmed and Agate Basin-like diagnostics.	Ingbar and Frison (1987)
Harman	Primarily Cody; possibly Hell Gap.	Bamforth (2013b), Westfall (2009)
Buffman Creek Cache	James Allen/Frederick	Burns (1996)
Baller	Possibly Clovis	Osborn (2016)
Walsh	Possibly Hell Gap	Stanford (1997), Stein (2005:30-31)
Iva's (14SD1302)	Unknown; 10 large bifaces	Stein (2005:31)
Busse	Possibly Clovis	Hofman (1995), Stein (2005:31-32)
Simon	Clovis	Butler (1963), Woods and Titmus (1985)

Rock Art

Rock art is notoriously difficult to date, and few examples of rock art are known to be affiliated with the Paleoindian period. One possible exception is the extinct megafaunal motifs painted and pecked into rocks in the Colorado Plateau area (Agenbroad and Hesse 2004). If genuine, depictions of megafauna that went extinct at the end of the Pleistocene clearly link rock art to Early Paleoindian phases (but see Whitley 2013). Several other rock art panels on the Northwest Plains “provide tantalizing but controversial evidence that [... they] may have been made by Paleoindian people” (Keyser and Klassen 2001:84; see also Francis 1996, 2019).

Several absolute dating methods have been applied to identify Paleoindian-aged rock art in Wyoming. The most reliable of these methods is varnish microlaminations (VML; Alice Tratebas, personal communication 2019). This method relies on identifying moisture-related changes in rock varnish layers deposited on petroglyphs and correlating them to independently-dated paleoclimatic events. Relatively mesic times express as black varnish microlaminations, and relatively arid times express as orange varnish microlaminations.¹⁴⁵ Other methods, including cation-ratio dating¹⁴⁶ and AMS-WRO,¹⁴⁷ have also been attempted in Wyoming.

¹⁴⁵ See Liu (2003), Liu and Broecker (2007, 2008, 2013), Liu and Dorn (1996), Marston (2003), Phillips (2003), and Whitley (2012) for additional information relating to VML dating.

¹⁴⁶ See Dorn and Krinsley (1991); Dorn and Whitley (1984).

¹⁴⁷ See Dorn 1996; Dorn et al. 1989; Francis et al. (1993); Watchman (1991).

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However, these two dating methods have been intensively scrutinized by rock art researchers and may be less reliable.

Two radiocarbon and six cation ratio dates on rock art motifs at Whoopup Canyon (48WE33) suggested that some of the petroglyphs at this site may be Paleoindian-aged (Stanley Associates et al. 1987; Keyser and Klassen 2001:83-84; Tratebas 1993, 2019; Tratebas et al. 2004; see also Francis 2019). Petroglyphs at Whoopup Canyon were later re-dated using microvarnish laminations (VML). The VML dates indicate that some of the glyphs at Whoopup Canyon date minimally to Late Pleistocene ages (Alice Tratebas, personal communication 2019).

Tratebas (1993, 1997, 1999, 2000, 2006) conducted diachronic, stylistic studies of the early rock art at Whoopup Canyon. She argues that animals with ball-shaped feet are the most common motifs dating to Paleoindian-aged phases, followed closely by stick or rectangular anthropomorphs holding up large hands that have three to five digits (Tratebas 1993:167-169). Another early pattern that potentially dates to both Paleoindian and Archaic phases is defined by depictions of bighorn sheep and canids associated with leaping animals, potentially indicating how dogs were used to hunt (Tratebas 1997:170-171). These early motifs were produced predominantly by freehand pecking, rather than outlining.

At Legend Rock (48HO4), Panel 35 has been dated to Paleoindian times based on AMS (Liu and Dorn 1996)¹⁴⁸ and cation-ratios (Francis and Loendorf 2002:96-97). These dates were later corroborated by a VML date, which showed a black layer deposited during the Younger Dryas below an orange Holocene varnish (Alice Tratebas, personal communication 2019).

At the Black Rock site (48SU5952), sheep and elk figures produced a $11,650 \pm 50$ RCYBP year old radiocarbon date (Francis 2019; Keyser and Klassen 2001:84; Liu and Dorn 1996; Tanner et al. 1995; Tratebas 1997). The Paleoindian-aged panel at Black Rock was later re-dated with VML, which produced a matching date (Alice Tratebas, personal communication 2019).

Other rock art on the Northwest Plains may date to the Paleoindian era (Tratebas 2000), but innovative approaches to confirm the age of these features must be tested and widely accepted by the scientific community. For a bibliography of potential rock art dating methods, see Rowe (2012).

Registration Requirements for Rock Art

Areas of Significance: Archaeology (Prehistoric), Art
Criteria: C and D

Rock art is commonly listed under Criteria C and/or D. Rock art is frequently eligible under Criterion C when it exemplifies a particular style and/or possesses high artistic values. Rock art sites may also be eligible under Criterion D for their information potential. Even very direct research questions, such as developing reliable absolute dating techniques for rock art, may qualify as research potential at some of these sites. Rock art also provides nearly infinite research potential related to interpreting prehistoric symbolic behavior, rituals, and belief

¹⁴⁸ AMS dates of $10,660 \pm 50$, $10,700 \pm 1400$, and $11,000 \pm 2500$ RCYBP (as well as some younger dates) were obtained from weathering rind organics and varnish microlaminations at Legend Rock (Liu and Dorn 1996; see also Francis 2019).

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systems. In general, to be eligible under Criterion C or D, rock art must be exceptionally well preserved and maintain integrity of location, setting, design, materials, and workmanship. Rock art panels that have moved from their original locations by natural processes, such as sliding downslope due to the force of gravity, may be eligible under Criteria Consideration B: Moved Properties.

Human Burials/Remains

No Paleoindian-aged human remains are currently known from Wyoming, but have been identified in surrounding states. It is therefore possible that Paleoindian human remains exist in this state. Identification and investigation of prehistoric human burials, including Paleoindians, requires careful mediation between scientific interests, Native American religious beliefs, and human rights concerns.

Paleoindian burials are often associated with red ochre, symbolic objects, and/or stone tool caches. Most known Paleoindian human remains from this region were intentionally interred in pits.

Registration Requirements for Human Burials/Remains

Area of Significance: Archaeology (Prehistoric)

Criteria: A and D

Nationwide, no Paleoindian burials or human remains are listed in the NRHP. However, a few prehistoric interment sites are listed under Criterion D. Today, prehistoric burials are generally not formally nominated for listing in the NRHP because NAGPRA legislation applies to sites that include Native American human remains. However, sites where prehistoric humans were interred are not precluded from listing in the NRHP. Human Burial/Remain sites may be listed under Criterion D if they are able to answer significant research questions regarding burial practices or life patterns of Paleoindian peoples.

Table-17: Human Remains Relevant to the Wyoming Paleoindian Period.

Site Name	Site Number	Major Citation(s)
Buhl	10TF1019	Green et al. (1998), Neves and Blum (2000)
J. David Love (Early Archaic)	48SU4479	McKern (2007); McKern and Current (2004)
Gordon Creek	5LR99	Anderson (1966, 1967), Breternitz et al. (1971), Muñiz (2004), Owsley and Jantz (2001), Swedlund and Anderson (2003)
Anzick (two individuals)	24PA506	Canby (1979), Jones (1996), Jones and Bonnicksen (1994), Lahren and Bonnicksen (1974), Morrow (2006),

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		Owsley and Hunt (2001), Rasmussen et al. (2014), Wilke et al. (1991)
Hourglass Cave	5EA1009	Mosch and Watson (1997), Stone and Stoneking (1996)

Levels of Significance

All property types can be eligible at the national, state, or local level of significance depending on their associations and the types of research questions for which they can provide information.

Paleoindian property types will be eligible at the national level of significance if they can address the big picture research questions currently faced by archaeologists. These questions included the timing and shape of the events that led to the peopling of the Americas; explaining large-scale Paleoindian settlement patterns and mobility; how Paleoindians did, or did not, contribute to the extinction of end-Pleistocene megafauna; the effects of paleoclimate on human behavior; explaining continent-wide technological change; and exploring the effects that all of the above topics had on Paleoindian social organization.

Paleoindian property types will be eligible at the statewide level of significance if they can or have provided information on regional settlement patterns; regional subsistence behaviors; if they can yield data which helps to explain regional technological changes; or yield data which explains the effects of regional climate on human behavior. For example, studies of Paleoindian-age rockshelters could address research questions such as when and why rockshelter use in a region increased in frequency relative to open-air sites.

Paleoindian properties will be eligible at the local level of significance if they can or have provided information on adaptations to local conditions, or address localized questions on particular cultural complexes. For example, on a local level, studies of social reconstructions of the past at a Paleoindian-age bison kill site could address research questions regarding the number of hunters involved in kill; whether hunters were provisioning others; how a hunt might have been organized; whether the hunt involved multiple bands of people working together; or explorations into task differentiation.

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Statement of Historic Contexts

Wyoming Paleoindian archaeology emerged on strong culture-historical foundations. In the past few decades, processual theoretical approaches for studying Wyoming Paleoindian foragers have taken shape. Scientific questions are still heavily grounded in chronology, seeking to refine the timeline of Paleoindian occupations on the Northwest Plains, but also attempt to provide explanatory frameworks that elucidate why Paleoindians acted in the ways that they did.

Research topics specific to particular Paleoindian cultural complexes and site types were discussed earlier. This section highlights big questions, contemporary research themes, compelling hypotheses, and some prospective future directions for Northwest Plains Paleoindian studies. Paleoindian research has expanded and flourished in recent years, and a comprehensive synthesis of all modern works could fill multiple books. Therefore, out of necessity and for the sake of brevity, this section outlines a few contemporary themes and innovative studies but is by no means a comprehensive review of current Paleoindian investigations.

Colonization of the Americas, Colonization of Wyoming

The timing, route(s), speed, and shape of human colonization(s) of the Americas remain raging topics of debate within Paleoindian archaeology. In 2007, Nicole Waguespack (2007:63) suggested that the “central issues of [these] debate[s] have remained essentially unchanged for the last eighty years.” Our sample of Paleoindian archaeological sites will always remain incomplete. Issues of equifinality, the uncertainty associated with dating techniques, biased site sampling procedures, and disagreement over what constitutes valid evidence of human occupation are topics that will forever plague archaeological studies (Waguespack 2007). Recently, Holen and colleagues (2017) published a controversial paper in *Science* suggesting that pre-Clovis peoples occupied southern California 130,000 years before present. This unbelievably early date is based on tenuous (at best) artifactual evidence (Braje et al. 2017; Ferraro et al. 2018; Haynes 2017), and would place the human colonization of the Americas around 80,000 years prior to the evolution of modern human behavior at the onset of the Upper Paleolithic in the Old World. If accepted, Holen and colleagues’ (2017) assertion would require rewriting not only the prehistory of the Americas, but the entirety of world prehistory (Robert L. Kelly, personal communication 2017).

Much more compelling evidence for pre-Clovis cultures has been presented from sites elsewhere. If valid, archaeological evidence from these sites would push dates for human occupation back only about a thousand years prior to the advent of Clovis culture. Archaeologists “demand” that strict criteria are met before accepting the validity of a potential pre-Clovis site (Meltzer 2009:97). Those criteria include 1) undeniable human artifacts or skeletal remains, 2) undisturbed geological deposits with intact stratigraphy, and 3) indisputable radiometric ages in clear association with the artifacts (Meltzer 2009:97).

In recent years, several sites have come close to meeting these stringent criteria. According to Meltzer (2009:117-135), as of 2009, the only known archaeological site that unambiguously met these standards was Monte Verde in Chile (Dillehay and Collins 1988, 1991; Dillehay 1984, 1986, 1988, 1989, 1997; Erlandson, Braje, and Graham 2008), but not all archaeologists agree with this claim (e.g., Dickinson 2011). Another recently proposed but

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contentious pre-Clovis site is Paisley Caves in Oregon. Based on the presence of purportedly human coprolites in context with artifacts, investigators suggested that humans occupied the site a millennium prior to Clovis (Gilbert et al. 2008; Jenkins et al. 2012, 2014; Hockett and Jenkins 2013). Other scientists disagree, suggesting that the coprolites were produced by herbivores, not humans. Debunkers argue that human DNA isolated from Paisley Caves' coprolites is simply the result of post-depositional contamination, and that no artifacts are unambiguously associated with the pre-Clovis levels (Fiedel 2014b; Goldberg et al. 2009; Poinar et al. 2009; Sistiaga 2014; but see Rasmussen et al. 2009).

Other pre-Clovis sites have been suggested, including Cactus Hill (Virginia), Pendejo Cave (New Mexico), Topper (South Carolina), and Page Ladsen (Florida), but none are unanimously accepted. Perhaps the most parsimonious reason why indisputable pre-Clovis sites continue to elude "iconoclastic researchers struggl[ing] to prove their claims of very ancient peopling of the Americas" (Marshall 2001) is that such sites may not exist in the first place (Kelly 2003). As yet, no serious claims for pre-Clovis occupations have been put forward in Wyoming, but this certainly remains a future possibility.

Whether pre-Clovis or Clovis-first hypotheses are eventually accepted or rejected, future insights into this debate may hinge not on single-site discoveries, but on theoretical models and synthetic analyses of the archaeological record. Some processual archaeologists suggest that models "have the potential to provide far more insight into New World colonization than does any single site, assemblage, or date" (Waguespack 2007:72). Continent-wide evidence for human colonization would also provide more compelling evidence than any site-specific data. Such studies might include the timing of the end-Pleistocene megafaunal extinction event (Surovell and Grund 2012), widespread changes in fire regimes (Hardiman et al. 2016), or other pervasive signatures that might function as proxies for estimating the timing of human arrival(s). Synthesizing archaeological and genetic data is also an incompletely explored realm that could offer insights into this topic (e.g., Pitblado 2011; Raghavan et al. 2015; Rasmussen et al. 2014; Rasmussen et al. 2015).

In addition to the timing of New World colonization, hot debates over the initial migration route(s) traversed by America's first peoples continue to pervade the Paleoindian literature. In the past, spatial analyses have provided valuable insights into and clarified the structure of migration route hypotheses (Anderson and Gillam 2000). Two decades have passed since Anderson and Gillam (2000) published a pivotal Geographic Information Systems (GIS) paper on possible colonization routes. Given advances in GIS computational techniques and spatial modeling theory over the last twenty years, the time is ripe for an update on human colonization from a deductive spatial analysis perspective, in a format that proposes and tests multiple working hypotheses. That being said, spatial analysts have not been idle for the last two decades. For example, in conjunction with archaeological data, several novel approaches to calculating wave-of-advance directions and speeds have been used to determine where Clovis (Hamilton and Buchanan 2007) and Folsom (Collard et al. 2010) cultures originated and subsequently spread. There is room for much more work in this arena, at both continental and local scales of study.

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Today, four major hypotheses exist to explain how America's first peoples colonized this continent. These are, in the chronological order by which they were academically popularized, the 1) Bering land bridge, 2) coastal migration, 3) Solutrean, and 4) kelp highway hypotheses.

The Bering land bridge hypothesis is not new. The notion that humans colonized the Americas by walking across a bridge of land spanning Siberia to western Alaska after the Last Glacial Maximum (LGM) has been put forward in academic publications for at least a hundred years. Despite over a century of consideration, the feasibility of this hypothesis remains in doubt. There certainly was a land bridge between Siberia and northwest North America and an ice-free corridor or "icy corridors" between Alaska and the American heartland, but exactly when these geographical features were passable and biologically viable for human migration is debated (see Dawe and Kornfeld 2017). Some of the most recent work on this topic suggests that a flooded ice-free corridor opened by 15-14 kcal BP, but that it did not become a terrestrial environment supporting plant and animal life until 12.6 kcal BP, which post-dates the first known appearances of Clovis technology (Pedersen et al. 2016). If correct, this research suggests that America's first peoples must have entered the continent by some route other than the ice-free corridor (Pedersen et al. 2016). Colonization might have occurred in two main pulses. The first pulse would have consisted of a single wave of colonization along the Alaska coastline. Later, subsequent colonization event(s) would have taken place through the ice-free corridor. Clovis peoples, Pedersen and colleagues (2016) argue, must have travelled into the Americas via the coast. This conclusion may or may not be concordant with recent genetic evidence suggesting that modern Native Americans are divided into northern and southern branches, depending on how one interprets the genetics (Raghavan et al. 2015).

Coastal migration hypotheses were put forward by the 1980s (Fladmark 1979) and popularized by Jim Dixon in the 1990s. Dixon (1999, 2001) argued that humans first reached the Americas by traveling from eastern Asia to the Northwest Coast of North America by floating watercraft along the deglaciated Alaskan and Canadian coastlines after the LGM. Coastal migration hypotheses have gained support in recent decades, especially since the tentative acceptance of Monte Verde as the oldest (or one of the oldest) known sites in the Americas. Speedy travel down the coastline might explain the rapidity with which America's first colonizers reached the southern tip of South America. Some scholars suggest that the pre-Jomon ancestors of the Hokkaido Ainu, indigenous hunter-gatherers in Japan, already possessed the seafaring technology required to complete such a voyage. Ancestral Ainu are therefore likely candidates to have comprised the first colonizing population in the Americas. This hypothesis is supported by some genetic parallels between modern Ainu and Native American populations (Adachi et al. 2009). On the other hand, different scholars contend that Early Paleoindians did not regularly use watercraft (at least not in the midcontinent of North America; Morrow 2014b).

The Solutrean hypothesis is the most contentious of the four colonization hypotheses addressed here, and is least supported by scientific data. A small minority of archaeologists suggest that the Americas were colonized by boat when ancestral European population(s) sailed along the north Atlantic coastline to North America (Bradley and Stanford 2004; Stanford and Bradley 2000, 2012; see also Bradley 1993).

The kelp highway hypothesis is a variant of the coastal migration hypothesis (Erlandson 2001, 2002, 2013; Erlandson et al. 2015, 2011, 2008, 2007; Erlandson and Braje 2011; Steneck

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et al. 2002). This version suggests that kelp forests across the Pacific Rim are ecologically similar across wide swaths of space, from northern Japan to Baja California. American colonizers traveling by boat already possessed the knowledge and technology required to successfully exploit this kelp forest environment. Therefore, the ability to continue similar maritime lifeways across the kelp highway would have facilitated rapid migration of peoples across the Pacific Rim.

The geographical location of Wyoming is relevant to testing these hypotheses, particularly the role of the ice-free corridor or “icy corridors” in human migrations, because the gap between the Cordilleran and Laurentide ice sheets opened into North America just north of Wyoming on the northern Northwest Plains. There seems to be a north-to-south temporal trend in the appearance of Clovis-aged sites across the North American continent (Hamilton and Buchanan 2007). Dates from several Northwest Plains sites in or near Wyoming provided data integral to the analysis used to establish this pattern (Anzick, Casper, Colby, Dent, Indian Creek, Lange-Ferguson, and Kanorado). Notably, the camel from the Casper site yielded one of the oldest dates potentially associated with Clovis diagnostics in North America (Hamilton and Buchanan 2007; however, this date may not be associated with diagnostics, see Frison 2000). Paleoindian sites in Wyoming can therefore provide important contributions to larger debates revolving around the peopling of the Americas.

Besides pre-Clovis, another interesting topic of discussion is whether or not peoples continued to migrate into the Americas gradually or in waves during post-Clovis times. One fascinating line of evidence supporting this consists of a paleoparasitological analysis of the hookworm lifecycle (Montenegro et al. 2006). Human-specific hookworms occurred prehistorically in North America. Hookworms must complete a portion of their lifecycle in soils (Montenegro et al. 2006). Yet, Montenegro and colleagues (2006) suggest that the end-Pleistocene soils in Beringia and northern North America would have been too cold for human hookworms to survive. Therefore, people must also have arrived in the midcontinent of North America by some warmer route, possibly during post-Clovis times.

Settlement Patterns and Mobility

Since Kelly and Todd’s (1988) pivotal paper on Early Paleoindian subsistence, migration, and mobility, other archaeologists have scrambled to test the hypothesis that Paleoindians were high-tech, high-mobility foragers. In recent years, as more site-specific and localized studies are conducted, Paleoindian scholars increasingly recognize that Paleoindian mobility strategies were perhaps more flexible and regionally variable than this simplified overarching model suggests (e.g., Pitblado 2016). At least in some times and places, “mobility for First Americans did not invariably require traversing hundreds if not thousands of kilometers per year as conventionally thought” (Pitblado 2016:54).

To summarize broad swaths of literature in a few sentences, numerous exceptions to Kelly and Todd’s (1988) model have been identified as higher resolution archaeological data become available, especially during post-Clovis phases (Bamforth et al. 2005; Pitblado 2016). However, now that these data exist, it is necessary to synthesize small scale studies to determine whether, at state-wide or continent-wide scales, the nomothetic patterns hypothesized by Kelly and Todd (1988) emerge as an archaeological reality (for example, see Speth et al. 2013). While

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outliers and exceptions to rules can be informative, overarching patterns in human behaviors make equally if not more important contributions to our understanding of prehistory. To accomplish this, we must synthesize our understanding of mobility patterns, seasonal rounds, and resource exploitation strategies across time and space (Hill et al. 2011). In the future, it would also behoove us to emphasize multiple lines of evidence in mobility reconstructions, rather than focusing solely on lithic raw material sourcing and the preponderance of exotic toolstone (Bamforth 2009; Bamforth et al. 2005).

Another important aspect of Paleoindian settlement patterns and mobility relates to social organization. We poorly understand Paleoindian family, kinship, group size, and social networks. For example, explaining why and how multi-band, cooperative hunting behavior increased during Middle Paleoindian times and then decreased during Late Paleoindian times could provide interesting insights into human social behavior in general.

Subsistence Behaviors

Many archaeological studies over the past several decades present evidence that Paleoindians did not subsist exclusively on megafauna (e.g., Kornfeld 2013; Kornfeld and Larson 2008). However, it still seems that most Early and Middle Paleoindian peoples focused *predominantly* on megafaunal species for subsistence (Jodry 1999a; Pitblado 2016), while Late Paleoindian foothill-mountain and southwest Wyomingites relied on a wider array of plant and animal resources (e.g., Frison 1992; Thompson and Pastor 1995).

The diet breadth model from human behavioral ecology suggests that humans choose which resources to exploit based on maximizing the number of calories they can obtain per hour of work. This model can be used to inform archaeological debates on Paleoindian prey choice and test why large or small faunal species were targeted. Though consensus on Paleoindian plant and animal exploitation strategies has not been reached, these debates remain lively. Although more data are always desired, speculations on Paleoindian faunal resource procurement are usually heavily grounded in archaeological data (Byers and Ugan 2005; Hill 2008b; Speth et al. 2013). In contrast, we lack sufficient knowledge of Paleoindian floral exploitation to discuss the role of plants in Paleoindian subsistence beyond making very general and/or hypothetical statements (Speth et al. 2013). To fill some of the biggest gaps in our knowledge of Paleoindian subsistence practices, future studies must identify evidence of Paleoindian plant usage (or confirm the lack thereof) and/or produce robust models to simulate floral exploitation strategies (Walker and Driskell 2007).

Understanding Paleoindian subsistence behaviors has implications that stretch far beyond answering what Paleoindians ate, when they ate it, and why they made those choices. One example is determining how Paleoindian subsistence patterns were tied into social organization and the division of labor. Based on ethnographic evidence from contemporary hunter-gatherer groups, it is often assumed that Paleoindian men hunted large game as a form of costly signaling or an optimal way to distribute risky behaviors between the sexes. Paleoindian women, on the other hand, may have focused on low-ranked resources or performed other tasks (MacDonald 1998; Speth et al. 2013; Waguespack 2005). However, Paleoindian peoples lived in environments and practiced lifeways that have no modern analogs. The “tyranny of the ethnographic record” (Wobst 1978) shapes many of the assumptions that we make about

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Paleoindian social organization through ethnographic analogy and human behavioral ecological models. While hypothetical analogies grounded in modern ethnographic data inform our understanding of how Paleoindian peoples *might* have lived (Anderson and Gillam 2001), we have learned almost nothing about Paleoindian social organization from actual material evidence collected from the archaeological record itself.

Instead of relying on the same old ethnographic data, we need new and creative research approaches to help us recognize how non-analog Paleoindian environments, technologies, mobility, and subsistence strategies shaped the organization of labor in Paleoindian societies. For example, most modern foragers hunt with bow-and-arrow technology, whereas Paleoindian peoples likely hunted with atlatls. Recent research suggests that atlatl technology may be inherently more accessible to women, juveniles, and the elderly than bow technology. If true, Paleoindian hunting groups might therefore have been characterized by less sex- and age-based divisions of labor than most contemporary hunter-gatherers (Grund 2017; but see Breslawski et al. 2018). Though speculative, studies like this can help expand our thinking to imagine and test a wider range of feasible scenarios that are not suggested by the inherently biased ethnographic record.

Megafaunal Extinctions

Whether human overkill, climate change at the end of the Pleistocene, or some combination of the two caused the extinction of over 30 genera of North American megafauna around 12,000-10,000 BP remains a subject of intense debate in Paleoindian archaeology. Though we have plenty of evidence that Early Paleoindians commonly exploited proboscideans (Surovell and Waguespack 2008), direct proof of human predation on other extinct Pleistocene megafauna is sparse. Recently, several examples of Paleoindian exploitation of camel (Frison 2000) and Jefferson's Ground Sloth (Redmond et al. 2012) have emerged in North America. Site 48LN1679 produced camel and horse bones in apparent association with a hearth and Paleoindian-aged radiocarbon date (9650 ± 290 ^{14}C BP; J. Miller 1987). The evidence from 48LN1679 is suggestive, but should be reinvestigated. Any new sites or evidence of extinct megafaunal exploitation would provide important stand-alone contributions to the overkill/climate change debate. Likewise, paleoclimatic studies, especially high resolution regional and continent-wide syntheses of paleoclimatic reconstructions, may shed light on this question in the future.

Paleoclimate and Human Behavior

Paleoclimatic reconstructions and environmental fluctuations remain integral components of most Paleoindian research. In the 1990s-2000s, archaeological consensus suggested that site-specific paleoclimatic reconstructions, rather than vague regional generalizations, are essential for explaining human behavior and site occupation patterns in particular locations (Bryson and Bryson 2009). Since then, various governmental organizations have compiled data and results from paleoclimatic studies conducted nationwide. These compilations are now available online and searchable (e.g., National Centers for Environmental Information 2017). Similarly, the FAUNMAP database (Faunmap Working Group 1996; Graham and Lundelius 2010), which is also freely available online, includes a compilation of known paleontological localities and age

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estimates for extinct and extant Pleistocene and Holocene fauna. These sources can be used to bolster insights gained by site-specific paleoenvironmental work.¹⁴⁹

In order to answer larger scale questions about human behavior, some Wyoming archaeologists, including Robert L. Kelly and colleagues, have recently called for state-wide, regional, or even global syntheses of high resolution paleoclimatic data (Naudinot and Kelly 2017). These studies, once combined, can be considered in tandem with past human population proxies (such as summed probability distributions of radiocarbon dates; Zahid et al. 2016), in order to help us explain Paleoindian (and later) shifts in human behavior on the Northwest Plains and beyond. Interpreting one source of paleoclimatic information correctly is difficult, since multiple equifinal mechanisms can “account for virtually any physical relationship represented in a stratigraphic sequence” (Caran 1998). Amalgamating different sources of paleoclimatic information is an even more challenging endeavor, since it involves combining and correlating dissimilar types of individual paleoclimatic proxies that represent various scales and resolutions. However, recent advances in statistical methods and earth systems modeling are improving our ability to synthesize paleoclimatic datasets (e.g., Goosse 2016; Ho et al. 2014; Tingley 2012).

Paleoclimatic reconstruction techniques still rely heavily on old standbys, including palynology, phytolith analysis, dendrochronology, and stable isotopes analysis. Recently, many novel paleoclimatic proxies have also been suggested. Some of these proxies have been refined to the extent that they could actually be applied to appropriate archaeological contexts. For example, advances in paleosol analysis suggest that paleopedology might be useful for reconstructing past mean annual precipitation, temperature, and vegetation during the time of soil formation, among other useful indicators (Sheldon and Tabor 2009). Several studies indicate that viable or fossil microorganisms isolated from stratified deposits might reflect paleoclimatic conditions contemporary with the formation of soils or marine sediments (e.g., Cosentino et al. 2017; Grund et al. 2014). In many cases, the need to understand paleoclimatic conditions at various archaeological sites has led to the invention and development of innovative methods useful for accomplishing this task in locally specific ways (Sandweiss and Kelley 2012). Prehistoric archaeologists and researchers in earth systems and biological sciences therefore have and continue to provide mutually beneficial, interdisciplinary contributions to our knowledge of earth and human history.

Technological Change

By far, the greatest amount of research on Paleoindian technological change is focused on lithic technologies and stone tool production behaviors (e.g., Surovell 2009; Wernick 2015). Though classic studies in Paleoindian technological change focused predominantly on characterizing and speculating on variation in projectile point forms, archaeologists have recently shown increased interest in other lithic varieties, such as blades (Collins 1999a), scrapers (Eren Jennings, and Smallwood 2013; Morrow 1997), crescents (Sanchez et al. 2017), cores (Jennings et al. 2010; Prasciunas 2007), and debitage (Surovell 2009).

Innovative analysis methods that take advantage of modern technologies continue to shed light on old debates (e.g., Buchanan et al. 2014; Sholts et al. 2012), but most major questions in

¹⁴⁹ See also Kornfeld et al. (2010:35) for a list of paleoenvironmental studies conducted on the Plains and in the Rocky Mountains.

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Paleoindian lithic technology have not been put to rest. Paleoindian lithic analysts still dispute why certain points were fluted, what the advantages of different core morphologies are, why certain points were beveled and/or stemmed, how much of Paleoindian projectile point variation reflects changes in style versus function, why greater time and effort was expended to produce certain projectile point types over others, and which Paleoindians were doing the flintknapping (men, women, novices, or experts; e.g., Bamforth and Finlay 2008). Future research into these and other lithics-oriented topics remain relevant to enhancing our understanding of Paleoindian technological change.

While many lithics-related questions remain insufficiently answered, there is a gaping paucity in research on technological change and variation in regards to other aspects of Paleoindian material culture. A number of Folsom structures have been identified, for example, but no one has published a synthetic comparison of these features. Differences in Paleoindian hearth morphologies could be quantified and compared across space and time. Paleoindian osseous technologies, including projectile points, needles, awls, and other bone and antler tools have been described at numerous sites but not systematically compared or explained (Moore and Schmidt 2009; but see Osborn 2014; Pelton et al. 2016). We know little about why and how Paleoindian ground stone was manufactured and used, or how it compares to ground stone from Archaic occupations. Our knowledge of Paleoindian art and symbolic objects has grown considerably over the past half-century, but few synthetic or systematic studies of Paleoindian symbolic behavior exist (but see Lemke et al. 2015; Morrow 2016). Even more important than filling these gaps in research will be determining the effects that these technological changes had on Paleoindian social organization and vice versa.

Summary of Research Themes

Despite strong Paleoindian research foci on the Northwest Plains over the last sixty years or so, reconstructing Paleoindian lifeways remains a challenging endeavor. This is due in part to poor and biased preservation of archaeological materials and sites, which skew our perspectives of Paleoindian behaviors. One of the most straightforward ways to contribute to gaps in our understanding of the Paleoindian period will be to focus on identifying, documenting, describing, and comparing previously neglected artifact and site types. In particular, these include osseous artifacts, perishable organics including floral remains and tools, floral resource exploitation strategies, symbolic sites, and ephemeral sites.

Big picture questions faced by Paleoindian archaeologists today include the timing and shape of the event(s) that led to the peopling(s) of the Americas, describing and explaining Paleoindian settlement patterns and mobility, subsistence behaviors, how Paleoindians did (or did not) contribute to the extinction of end-Pleistocene megafauna, the effects of paleoclimate on human behavior and vice versa,¹⁵⁰ explaining technological change, and exploring the effects that all of the above topics had on Paleoindian social organization. Small-scale local and regional studies will play important roles in contributing to continent-wide syntheses that address these questions on large geographic and chronological time scales. Equally important, at least within Northwest Plains archaeology, will be addressing localized questions specifically geared towards particular Paleoindian cultural complexes.

¹⁵⁰ For example, see Doughty et al. (2010) and Smith et al. (2010).

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This section explains how NRHP criteria relate to Wyoming Paleoindian archaeological resources. It establishes guidelines for assessing the significance of Paleoindian resources, evaluating their integrity, and delineating site boundaries. Considerations for incorporating Paleoindian resources into historic districts are discussed. Finally, examples of eligible Paleoindian properties in Wyoming are provided.

Standard procedure for evaluating NRHP eligibility of historic properties follows five steps: 1) categorize the property, 2) contextualize the property, 3) evaluate the property's significance, 4) when appropriate, apply criteria considerations and exceptions, and 5) assess the property's integrity.

Categorizing and Contextualizing Paleoindian Properties

As a general rule, the vast majority of Paleoindian resources should be classified as sites for the purposes of evaluating NRHP eligibility. Sites are locations where one or more significant events, occupations, or activities occurred, or places where buildings or structures stand or once stood. The location itself must possess historic, cultural, or archaeological value, regardless of whether resources are still visible aboveground.

Districts include significant concentrations of sites, buildings, structures, or objects. Prehistoric districts are commonly comprised of a group of archaeological sites in close proximity to each other or that are continuous across space. These sites are normally linked because they contain similar archaeological components. There are currently less than ten archaeological districts with prehistoric significance listed in Wyoming.

Once a historic resource is categorized as a building, structure, object, site, or district, it should be evaluated within its historic context. In this case, a historic resource should be interpreted in context with this document only if it produced absolute age determinations or diagnostic artifacts that situate it chronologically within the Paleoindian period. Sites that lack both dates and diagnostics might comprise significant prehistoric resources, but must be considered more generally unless they can be specifically linked with the Northwest Plains Paleoindian period.

Situating a prehistoric resource within this context entails not only establishing that it shares common themes, geography, and temporality with other Northwest Plains Paleoindian sites, but also requires a consideration of how that resource fits into, adds to, and/or changes our current understanding of prehistory. In other words, evaluating a property within this context also requires contemplating how the property might bolster, refine, or contradict the status quo interpretations of the Paleoindian archaeological record that are presented in this document.

Assessing the Significance of Paleoindian Resources

For any historic or prehistoric site to be considered significant, it must meet at least one of four criteria lettered A-D and possess integrity of location, design, setting, materials, workmanship, feeling, and/or association. While all four significance criteria are described in this section, prehistoric resources are most commonly considered eligible under Criterion D.

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Criterion A: Event

Paleoindian resources that are eligible for the NRHP under Criterion A must be associated with single or multiple (patterned) events, repeated activities, or prehistoric trends. In the case of Paleoindian resources, properties associated with single events are not always significant because of a prehistoric event itself; rather, these single events generally describe sites where major new aspects of prehistory were *historically* discovered and subsequently contributed key information to scientific knowledge at that time. These types of historic “events” represent major discoveries that provided information important to the history of archaeology. For example, the Folsom site in New Mexico is significant under Criterion A as a single event because it is the first location where unequivocal evidence of association between humans and extinct megafauna was discovered. Archaeological type sites for specific archeological complexes may also be eligible under Criterion A.

In that vein, other potential Paleoindian sites that could be eligible under Criterion A as single events might include evidence that indisputably establishes a pre-Clovis colonization of the Americas or shows which migration route America’s earliest colonizers traversed. Eligible single-event sites might also contain clear evidence that Paleoindians were hunting extinct megafauna other than proboscideans and bison, or a site that includes extensive evidence for Early/Middle Paleoindian floral resource exploitation. Any site that significantly upsets or fleshes out our contemporary understanding of Paleoindian lifeways, mobility strategies, resource procurement strategies, typology, or chronology as presented in this historic context might be considered eligible as a single event under Criterion A.

Archaeological resources may also be eligible under Criterion A when they are associated with important patterns of events. To be eligible under Criterion A as a prehistoric pattern of events, archaeological sites must retain intact deposits with well-preserved artifacts, features, and intra-site patterning.

One example of a Wyoming prehistoric site in the NRHP based on multiple criteria, including Criterion A, is the Hanson Folsom site. Hanson is classified as a prehistoric village with lodge structures (Frison and Bradley 1980). Excavated in 1973, along with a few other early investigations of Paleoindian occupation sites including Lindenmeier and Hell Gap, Hanson provided new insights into Paleoindian settlement patterns and “the details of [Folsom peoples’] existence as human social groups” (Frison 1977:Significance). Medicine Lodge Creek is also listed in the NRHP under multiple criteria, including Criterion A, because of the insight it provided into foothill-mountain lifeways (Junge 1973c: Statement of Significance). The Finley site is listed solely under Criterion A because of its significance to chronology and typology building in Paleoindian archaeology. Information excavated from the Finley site played an integral role in defining Eden, Scottsbluff, and the Cody complex and confirming the antiquity of Early Man (Laughlin 2009:Statement of Significance). Finley was not listed under Criterion D because it is unknown whether significant intact Cody-aged deposits remain at the site.

Criterion B: Person

For any historic or prehistoric resource to be eligible under Criterion B, it must be associated with a *named* individual whose activities made specific and significant contributions to history. In general, these properties should illustrate rather than commemorate the person’s

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work and/or achievements. Birthplaces, graves, and monuments are not eligible unless there are no other significant properties associated with that individual's productive life. Because individuals must be named, resources that are associated with important prehistoric individuals and/or mythological figures are not eligible under Criterion B. Human skeletons, human remains, or grave sites associated with prehistoric individuals are not eligible under Criterion B because these individuals' names are unknown. However, these and other Paleoindian sites would be eligible under Criterion B if and only if they are associated with an important historic figure, such as an archaeologist, that contributed significantly to our understanding of prehistory by excavating that property. The eligible site must *best* represent that archaeologist and his or her contributions to the field. These sites would also be eligible under Criterion D. As such, sites will not be listed under Criterion B as part of this context.

Criterion C: Design/Construction

Prehistoric properties are eligible for the NRHP under Criterion C if they exemplify a distinctive type, period, or construction method; are a masterwork; have high artistic values; or represent a significant and distinguishable entity whose components lack individual distinction. In order to be eligible under Criterion C as exemplifying a distinctive type, period, or construction method, historic sites should contain architectural remains or structures. Resources without architectural remains or structures may be considered eligible under Criterion C for their artistic values or if they are a masterwork. For districts, patterns of behavior might be evident in a collection of sites even though they might not exhibit stand-alone significance.

Resources that represent a distinctive type, period, or construction method must contain architectural remains or structures and illustrate one of four categories. The resource might exhibit 1) a pattern of features common to that particular class of resources, 2) individuality or variation within the class of resources, 3) evolution of that class of resources, or 4) the transition between different classes of resources. Distinctive characteristics might embody specific characteristics of form, proportion, structure, plan, style, materials, or particular combinations thereof, or might refer to more general planning ideas or concepts of construction.

Yucca House in Colorado is a habitation site with a pattern of public architecture associated with the Great Pueblo period. This National Monument was nominated under Criterion C because "[t]he community planning represented in the layout of these sites and individual architectural elements, such as Great House, tri-walled structures, or great kivas, embody the distinctive characteristics of Great Pueblo Period architecture. The architectural remains are also representative of the highest level of architectural skill and artistry achieved in the prehistoric Southwest" (Rudy et al. 1990:Significance).

A well-known example of a prehistoric site that exhibits "individuality or variation" within a class of resources is Montezuma's Castle in Arizona. At this site, "the architectural remains of the monument, from the preserved pithouse at NA4616 to the restored and reconstructed pueblos and cliff dwellings, are representative of unique and varied architectural styles, and are worthy of preservation and further study if only for their aesthetic qualities." (Anderson 1978:Continuation 2).

One hunter-gatherer site that is listed in the NRHP based partially on "individuality or variation" within a class of resources is the Yarmony House site in Colorado. This Early Archaic

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site includes pit house features, animal butchering areas, and trash middens (Metcalf and Black 1991). The habitation features at Yarmony are unique examples of Early Archaic features that are dissimilar to other known Early Archaic architecture (Metcalf and Black 1991:207-209).

Few prehistoric resources have been nominated to the NRHP under Criterion C that are said to demonstrate the “evolution of” or “transition between” particular classes of resources. Acoma Pueblo in New Mexico is an example of a prehistoric site listed under Criterion C which exemplifies the evolution of a class of resources. There, investigators argued that the “long continuous span of use” exemplified by architectural remains combined with “[a]n analysis of the pottery types indicates some of the developmental trends occurring at Acoma throughout its 750 year or so existence”.

Resources may also be eligible under Criterion C if they represent the work of a master or have high artistic value. A master craftsman or craftswoman does not need to be identifiable by name. Rather, the work of a master must rise above the level of workmanship observed in similar properties in the region. For example, rock art is frequently eligible under Criterion C because it is said to possess high artistic values. Some prehistoric architectural features, such as room blocks, structures, walls, and game drives may also be eligible for exhibiting a high level of architectural or engineering skill and/or artistry.

Rock art sites across the United States are commonly listed in the NRHP under Criterion C for multiple reasons; several rock art resources from Wyoming are currently listed. The Torrey Lake Petroglyph District is one example. Torrey Lake’s NRHP nomination form suggests that “[t]he Dinwoody style petroglyphs which dominate the rock art [...] represent a highly distinctive rock art tradition that is geographically discrete [...] and the petroglyphs] possess high artistic values. In general, the rock art is visually impressive, complex, compositionally intricate, and very well executed.”. This district is therefore eligible under Criterion C because it exemplifies a “pattern of features” distinctive to the Dinwoody type of rock art, and also because the resources have “high artistic values.”

The Tolar Petroglyph site in Wyoming is also listed under Criterion C, as well as Criterion D. The site is considered eligible under C because it includes “exceptional illustrations of Ceremonial and Biographic tradition[s;] extremely fine craftsmanship of subjects [...], preservation of panel composition and manufacture technique; and [...] distinctive representations” (Lynch and Loendorf 2014:26).

In Wyoming, Paleoindian resources could potentially be nominated under Criterion C if they illustrate a pattern of features, individuality or variation within a class of resources, or the evolution of or transition between classes of resources. Wyoming cultural resources may also be eligible under Criterion C if they represent the work of a master or have high artistic values.

Criterion D: Information Potential

The vast majority of eligible prehistoric resources are eligible under Criterion D. To be considered eligible under this criterion, a resource must contain, or be likely to contain, *important* information that contributes to our understanding of human prehistory. Sites eligible under Criterion D must have been associated with human activity and contain intact archaeological deposits, including configurations of artifacts, stratigraphy, structural remains, or other natural or cultural features that might be used to test one or more prehistoric hypotheses

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that bear on important research questions, corroborate or add to a body of information that has already been used to test a hypothesis, or will contribute to our understanding of culture history so that changes in archaeological cultures can be identified and explained within a particular geographic region. Properties eligible under Criterion D must be related to a particular time period or cultural group (in this case, the Paleoindian period) so that they can be evaluated within an appropriate historic context.

The information that a resource is likely to contain must be explicitly linked to important research questions, and the potential for a site to contain this data must be assessed with appropriate investigation techniques. Assessment might include remote sensing, intensive subsurface testing, or analogy to a similar property that has already been investigated. If a site has been completely excavated, it is not eligible under Criterion D because it no longer contains data important to our understanding of prehistory.

Many archaeological resources with Paleoindian components in Wyoming have been listed in the NRHP (or as National Historic Landmarks) under Criterion D alone, or multiple criteria including Criterion D. These include the Black Mountain Archeological District, Hell Gap, Hanson, Medicine Lodge Creek, Paint Rock Canyon Archeological Landscape District, Southsider Shelter, Helen Lookingbill, Casper, Agate Basin, Horner, Mummy Cave (North Fork Cave #1), Trappers Point, and Obsidian Cliff.

Prehistoric resources need only meet one of the four eligibility criteria (A-D) in order to be considered eligible for the NRHP. Most Paleoindian-aged resources and archaeological sites are primarily evaluated for eligibility under Criterion D because Criteria A, B, and C only apply to archaeological properties under limited circumstances. It is always best to list an eligible resource under the criterion or criteria for which the strongest case can be made, but other criteria should be considered and discussed within the nomination where applicable. Again, it is important to consider the applicability of all four criteria when evaluating archaeological resources.

Evaluating the Integrity of Paleoindian Resources

To be eligible or listed in the NRHP, a Paleoindian property must meet at least one of the significance criteria *and* retain integrity, which is defined as “the ability of a property to convey its significance”. The assessment of integrity is somewhat subjective, but is organized into seven aspects: location, design, setting, materials, workmanship, feeling, and association. Some of these seven aspects overlap to a certain degree. To have integrity, a Paleoindian resource must possess at least several of these aspects. Because integrity of feeling and association both depend heavily on subjective individual perceptions, these two aspects of integrity alone are never sufficient to support NRHP eligibility. Determining which aspects of integrity are most important to a particular property requires knowing why, where, and when the property is significant.

Location

Location is defined as the place where a property was constructed or a historic event occurred. When a building or structure is moved, it no longer possesses locational integrity. In situ archaeological sites with stratified components, by their very nature, retain their original

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location. An archaeological site that has lost its stratigraphic context or is in secondary depositional context because resources were moved from their original location by cultural or natural post-depositional processes would not retain integrity of location.

Design

Design is defined as a “combination of elements that create the form, plan, space, structure, and style of a property”. When dealing with archaeological sites and districts, design refers to organization of space and preservation of construction materials, features, and artifacts. Topics such as the proportion of the site that remains preserved, overall preservation of artifacts and features, and spatial relationships between features and/or activity areas within the site might be considered under the design aspect. When defining districts, design also refers to the spatial relationships of archaeological sites to each other across a landscape.

Setting

Setting is an aspect of integrity that considers a resource’s context within its surrounding landscape. An assessment of setting requires a consideration of whether and to what degree the surrounding landscape within and outside the resource boundary has changed since its period of significance. Because of the great antiquity of Paleoindian sites, paleoclimate, paleoenvironment, vegetation, and topography have almost certainly changed since these sites’ period of significance. These inevitable climatic and environmental shifts do not preclude a Paleoindian site from retaining integrity of setting. However, if modern development affects a resource’s viewshed, this level of setting alteration would detract from the setting aspect of integrity.

Materials

The artifacts and features that were constructed or deposited in prehistory and their configuration in space comprise the materials aspect of integrity. This aspect of integrity includes assessing the degree of artifact, ecofact, and feature preservation as well as whether and to what degree a Paleoindian resource maintains its original depositional context.

Workmanship

Workmanship is defined as the physical evidence of crafts produced by a particular culture or people during prehistory. Workmanship may be exhibited by Paleoindian artifacts or features that show evidence of artisans’ labor and skill while producing an archaeological site. These might include projectile points, bone tools, symbolic objects, features, or construction techniques.

Feeling

A property has integrity of feeling if “its features in combination with its setting convey a historic sense of the property during its period of significance”. In other words, if a person from the site’s period of significance were to travel forward in time and visit the site today, would they recognize it? If the answer to that question is yes, then the site maintains integrity of feeling.

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Integrity of association is retained when a direct link between an important historic event or person and the property remains clear. Criteria A, B, and D require integrity of association. Under Criterion D, integrity of association is judged by the strength of the relationship between the site's content and the important research questions. Under Criterion D, association also requires that a resource contains temporal diagnostics or datable materials that link it to a specific prehistoric time frame, and that artifacts, features, and ecofacts clearly retain their in situ associative relationships.

Overall, these seven aspects of integrity are meant to establish whether the property retains a historic identity that defines both the time period for which it is considered significant and exemplifies why that resource is considered significant. Generally, archaeological sites must have intact subsurface deposits with excellent preservation of artifacts and features. Criterion D integrity assessments usually focus on aspects of location, design, materials, workmanship, and association. A direct link between a site, its features and artifacts, and the resource's ability to answer significant research questions is central to establishing integrity under Criterion D.

Delineating Paleoindian Site Boundaries

There is no single method for defining and documenting the boundaries of an archaeological property because unique environmental and topographical characteristics require that boundaries are tailored to each individual resource. However, resource boundaries are necessary for resource management purposes. The specific method used to define the boundaries of each resource should be clearly described and justified with information presented in the resource's documentation form. Though methods used for establishing boundaries are relative to each resource, there are several guidelines that should be employed when establishing these boundaries. Boundaries should encompass the full extent of significant resources, but not exceed them; buffer zones shall not be included. The boundary may include landscape features that are important for understanding the property or that contribute to its integrity. Peripheral regions of the property that no longer retain integrity should be excluded. The boundary should represent a single contiguous entity unless the resource is nominated as a discontinuous district.

When delineating Paleoindian site boundaries, careful consideration of the property's setting and topography should be used to help guide boundary placement. Concrete evidence through archaeological survey and testing should also justify boundary locations. This evidence might consist of surface observation, subsurface testing, remote sensing, analysis of site formation processes, observation of post-depositional land alterations, and/or study of historic documents, such as maps and journals, to obtain a clearer picture of historic alterations to the site. When these techniques cannot be applied, *conservative* estimates of the site boundaries should be proposed. It is acceptable to set resource boundaries at legal property lines when landowners deny access to certain portions of the site, but boundaries should encompass the full extent of significant resources when an objective assessment is possible. Landowner objections may prevent listing eligible portions of a property, but this should not affect the establishment of property boundaries.

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State*Incorporating Paleoindian Resources into Historic Districts*

Districts possess a “significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development”. There are many archaeological landscapes in Wyoming that are carpeted in archaeological resources. In these regions of the state, site boundaries are difficult to define and it may be more appropriate to nominate these geographical regions as contiguous or discontinuous districts rather than individual resources or stand-alone sites. There are several examples of prehistoric districts in Wyoming that include Paleoindian components, including the Black Mountain Archeological District and the Paint Rock Canyon Archeological Landscape district.

To define a district, each site located within the geographical area of interest must be listed as contributing or non-contributing to the district. To contribute to the district, an archaeological site must retain integrity sufficient to reflect its prehistoric character and independently meet NRHP criteria, or have been occupied during the period of significance, or relate to the significance of the district in some way, or have good information potential. District boundaries may be contiguous or discontinuous, depending on the resources nominated and the degree and kind of post-depositional disturbance and/or development that has occurred in the region. Discontinuous districts can only be nominated if the space between eligible resources is not an important aspect of the significance of contributing properties. Districts with prehistoric archaeological significance usually must represent a significant and distinguishable entity whose individual components may lack distinction *and* have or are likely to yield information important in prehistory.

What Makes a Wyoming Paleoindian Property Eligible?

Though the basic requirements for NRHP eligibility and nomination have remained relatively static since the NHPA was legislated in 1966, the standards for documenting resources and justifying NRHP eligibility have risen substantially over the past half-century. For example, many of the early NRHP nominations in Wyoming did not specifically address the seven aspects of integrity or provide detailed and specific research plans or questions. Any contemporary cultural resource nomination must include detailed and explicit discussions of these topics.

This section summarizes examples of Paleoindian sites that have been listed in the NRHP or elevated to NHL status. It also lists attributes generally required to establish different Paleoindian property types as eligible for the NRHP. This section is geared heavily towards establishing significance under Criterion D, since this criterion is most commonly applied to Paleoindian resources.

Eligible Open-Air Camps

Hanson is an open-air Folsom occupation site that was originally investigated in the early 1970s. The site included extensive evidence of stone tool production, fire hearths, bone fragments, and compacted circular activity areas that were interpreted as lodge floors (Frison 1977; Frison and Bradley 1980). Hanson was nominated for listing in the NRHP under Criteria A and D, and became the first open-air Paleoindian campsite in Wyoming to be listed. In the 1970s, the Folsom complex was poorly understood, and most studies of this Paleoindian phase had focused exclusively on projectile point manufacturing techniques. Few large, well-preserved

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Folsom sites were known, and the full report on Lindenmeier was not yet published (Frison 1977; Wilmsen and Roberts 1978).

Hanson was therefore listed under Criterion A as an event because the site consisted of a stratigraphically sealed Folsom component with a large number of cultural activity areas that provided a fuller picture of Folsom social organization and settlement strategies than kill sites had (Frison 1977). Hanson was eligible under Criterion D because it was incompletely excavated and contained data likely to be important to future Folsom complex research. Frison (1977:Item 8 p. 2) wrote that “[t]he Hanson site should provide study for students of the Paleo-Indian for a long time in the future” because it was incompletely excavated. Future samples of the activity areas, Frison (1977) argued, would provide greater insight into Folsom cultural systems. Further excavation would produce additional well-preserved faunal material that would shed light on Folsom resource procurement and subsistence strategies, and the geological and soil deposits in situ with organic materials would allow radiocarbon dates to be correlated with paleotopography and/or paleoclimatic reconstructions. While this early nomination form did not explicitly discuss the seven aspects of integrity, Frison (1977) established Hanson’s integrity by stating that the area had not been affected by modern development, the site had never been looted, the site was not subjected to major erosional processes and has remained sealed stratigraphically since its original deposition, and the entire assemblage was in situ with a relatively high degree of organic material preservation (Frison 1977).

The Helen Lookingbill site is a stratified, open camp that was repeatedly re-occupied from Middle Paleoindian until Late Prehistoric times. The site was recently listed in the NRHP under Criterion D (Freeland 2012a; Frison 1983a; Kornfeld et al. 2001; Wasilik 2006). Multiple, long-term re-occupations of the site in stratified context will allow future researchers to address questions regarding the evolution of high altitude land use strategies, hunting strategies, and changes in intrasite patterning and social organization over time. Helen Lookingbill may also provide insights into heat treatment of lithic raw material and how this relates to diachronic changes in the organization of lithic technology. More specifically, in regards to its Paleoindian occupations, Helen Lookingbill is the only known site to demonstrate stratigraphically that Ruby Valley points (similar to Angostura/Lusk) pre-dated Lovell Constricted. Helen Lookingbill may also provide insights into chronological differences between Alder complex components (also similar to Angostura/Lusk) in Montana and Wyoming, and may clarify the relationship between Alder and Lovell Constricted types. Another typological question that could be answered at Helen Lookingbill involves whether or not the Middle Paleoindian occupation is characterized by Hell Gap or Haskett projectile point diagnostics. Assigning these points to a typological category may open the door to understanding other aspects of Hell Gap versus Haskett complex lifeways (Freeland 2012a).

Helen Lookingbill retains integrity based primarily on aspects of design, location, materials, and association, although the nominator also addressed setting, feeling, and workmanship (Freeland 2012a). Freeland established integrity of design based on clear stratigraphic separation of deposits combined with a lithic refitting analysis demonstrating that stone artifacts had not substantially moved vertically or horizontally since the site was deposited. Helen Lookingbill remains in its original location. The preservation and context of radiocarbon dates, paleoenvironmental indicators, and chipped stone, ground stone, and faunal assemblages

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mean that the site retains the materials aspect of integrity in regards to these classes of objects, which are the primary focus of Freeland's (2012a) potential future research questions. Helen Lookingbill retains integrity of association because the deposits include diagnostic artifacts and sediments are clearly separated and clearly dated (Freeland 2012a).

Hell Gap, another open-air campsite, was recently listed as a National Historic Landmark (Freeland et al. 2014). Hell Gap contains over 4,500 years of continuous re-occupations, and includes stone tools and manufacturing debris, floral and faunal remains, organic artifacts, hearth features, and occupational features (Larson et al. 2009). Nominators established Hell Gap's significance under NHL Criterion 6 based on the long stratigraphic duration of the deposit and its repeated occupations, which allow diachronic research questions to be addressed by comparing archaeological materials of different ages. For example, the site contains multiple occupation structures from different Paleoindian components which could be compared over time. Hell Gap also contains well-preserved medium-bodied faunal remains as well as floral remains, which have the potential to provide insights into Paleoindian subsistence practices and upsets the stereotype that all Paleoindians were large game specialists. Hell Gap includes predominantly local toolstone, with evidence for local tool production and use. This usurps conceptions that paint early Paleoindian peoples as exclusively highly mobile foragers that always utilize exotic toolstone and practice highly curated lithic organization strategies (Freeland et al. 2014).

The Hell Gap nominators convincingly argued that the site retains three aspects of integrity: location, setting, and feeling. Location is retained because the site is in place, and its depositional context has not been subjected to major post-depositional disturbances. Integrity of setting is retained because Hell Gap is still located on an ecotone between plains and Rocky Mountains. Views from the site and the hills above are largely unaffected by modern development, with the exception of a few two-track roads, power lines, one modern building, and one modern structure. Feeling is retained because an observer standing at the site feels nestled within a protected valley, on a boundary between plains and montane environments (Freeland et al. 2014).

In summary, to be eligible under Criterion D, open-air Paleoindian camps should contain or be likely to contain data that will provide pertinent insights into any of the research questions addressed in this context. This is the most important consideration when determining site eligibility under this criterion. At open-air camps, meeting this requirement generally entails that at least one feature, artifact type, or facet of human behavior evidenced within the site is exceptionally unique, exemplary, and/or well preserved and that one or more activity areas can be identified. An eligible open-air camp may contain single or multiple component occupation(s). Multiple-component occupations must be clearly stratified. The site must contain datable materials that link it to the Paleoindian period, and should retain at least integrity of location, design, materials, workmanship, or association.

Eligible Rockshelters

Mummy Cave (North Fork Cave #1) was the first rockshelter site with Paleoindian components to be listed in the NRHP in Wyoming (Riggs and Sigstad 1979). The rockshelter contained stratified deposits from Paleoindian through Late Prehistoric times that produced lithic tools and debitage, bone tools, hearth features, floral and faunal remains, and was characterized

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by exceptional preservation of perishables including cordage, hide, feathers, grass, bark, and wood (McCracken et al. 1978; Hughes 2003; Husted and Edgar 2002). Mummy Cave is currently listed in the NRHP under Criterion D, although this could be revised to include Criterion A and/or B.

In the 1970s, Mummy Cave's nominator argued that the site was significant because of a long-term prehistoric occupation sequence that reached back into Late Paleoindian times, because the well-preserved faunal remains had the ability to yield much information about animal populations and paleoenvironmental reconstructions, and because the dry conditions in the rockshelter allowed for a remarkably high level of organic artifact preservation throughout the entire sequence. Because of its well-stratified deposits and preserved organic materials, the site's occupational sequence was securely situated in temporal context with a long list of radiocarbon dates. Riggs and Sigstad wrote that "so complete a prehistoric sequence is rare anywhere and Mummy Cave provides the reference point for most of the archeology in northwestern Wyoming". Riggs and Sigstad's (1979) early nomination form did not specifically address the seven aspects of integrity, but they did establish that the site was well-stratified and in situ, and that artifacts were exceptionally well preserved. Riggs and Sigstad (1979) also mentioned that the site had been extensively looted by pothunters, and they should probably have addressed this more fully in this nomination. However, Mummy Cave contains intact deposits today, and is therefore still eligible under Criterion D. The site might also be considered eligible under Criterion A if it was argued to be the best example of a site in the region that provided data important for elucidating patterns of prehistoric occupational events. Mummy Cave could also be considered eligible under Criterion A because of the role it played in establishing the prehistoric chronological sequence in northwestern Wyoming.

The Paint Rock Canyon Archaeological Landscape encompasses at least 26 rockshelters and 12 open-air sites. Though chronological understanding of these sites was poor at the time of the district's nomination to the NRHP (Späth 1988), many sites contained diagnostic artifacts that made it possible to state that the region was occupied at least as far back as the Late Paleoindian period. One of the rockshelters included in the district is Paint Rock V, a site pertinent to any discussion of Late Paleoindian resources in Wyoming. Späth (1988) argued that the Paint Rock Canyon Archaeological Landscape had the potential to contribute to our understanding of prehistory, so the district was nominated under Criterion D. Späth (1988) proposed a number of potential research questions that could be answered with data that was likely to be contained in sites throughout Paint Rock Canyon. Several of his research topics specifically related to the Paleoindian period. Archaeological excavations at Paint Rock V revealed that a wide variety of small mammals were consumed during Late Paleoindian times. In light of this information, Späth argued that archaeological research in the Paint Rock Canyon district had the potential to contribute to our knowledge of Late Paleoindian subsistence practices and foothill-mountain lifeways, and add to other bodies of work that were successively chipping away at the "big game hunter" stereotype (1988). He also suggested that this group of sites and its surrounding landscape could provide information on settlement, seasonality, and subsistence patterns in terms of how activities were mapped in relation to resources and how those patterns changed over time.

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Späth (1988) argued that non-site areas within the canyon itself were essential to understanding human land use and interpreting the entire archaeological system, so the immediate physiographic and visual landscape were important contributing elements to the district. To answer the research questions he envisioned, Späth (1988:Section 8 p. 5) argued that the Paint Rock Canyon Archaeological Landscape “is more important as a landscape than any of its individual sites,” thus justifying its nomination as a district. Späth also stated that “[in]dividually, many of these sites might not be considered eligible for the National Register of Historic Places. However, when viewed as a part of a larger system, the entire cultural landscape and its component sites are viewed as containing valuable data useful towards understanding aboriginal cultural systems”. In other words, he argued that Paint Rock Canyon cultural resources possessed a significant concentration, linkage, and continuity between archaeological sites, some of which lacked individual distinction.

The Paint Rock Canyon Archaeological Landscape maintains five aspects of integrity, according to the nominator (Späth 1988): location, setting, materials, feeling, and association. Though he specifically named these aspects of integrity, Späth (1988) did not address them independently. He established integrity by arguing that the landscape shows evidence of long-term occupation, many of the sites are well-stratified and contain well-preserved cultural materials, and the cultural landscape is relatively undisturbed.

The Black Mountain Archaeological District is a discontinuous district that consists of five rockshelters, an open-air camp, and two chert quarry areas. Several of the rockshelter sites, including Two Moon and B.A. Cave, include Paleoindian components, and the quarries and open-air camp have produced Paleoindian diagnostics. Together, these resources represent most of the site types presently known from this region of Wyoming. This district was nominated under Criterion D (Späth 1986). The nominator argued that the rockshelters and campsite could yield significant information about prehistoric activities in good association with datable materials, and that the rockshelters in particular could provide well-preserved perishables. Perishable artifacts are rarely preserved in open-air sites, and are extremely important for understanding prehistoric lifeways, resource exploitation, and paleoclimatic reconstruction. The nominator suggested that although the area has experienced some looting, the sites maintain integrity because many subsurface cultural materials remain in situ and their spatial and contextual associations have been preserved (Späth 1986). Today, a discontinuous district nomination would need to explicitly frame sites’ data potential in context with specific research questions, and fully address the seven aspects of integrity. It would also need to explain why areas between sites do not contribute to the significance of the district.

Southsider Shelter was excavated by George Frison in the 1970s. The site included well-stratified deposits with occupations dating from the Late Paleoindian to Late Prehistoric periods and produced lithic tools and artifacts, diagnostic projectile points, ground stone, faunal remains, hearths, and storage pits. Frison left portions of Southsider Shelter unexcavated. Southsider Shelter was listed in the NRHP under Criterion D (Freeland 2012b). Pertinent research questions to be addressed at this site include how seasonality of site use changes diachronically throughout its periods of significance and how that relates to prehistoric settlement and subsistence patterns and diet breadth. Investigators also ask how the intensity of rockshelter use changed between Late Paleoindian and Early Plains Archaic periods (Freeland 2012b). Though these questions

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have previously been addressed at Southsider Shelter, the nominator argued that advances in excavation techniques, methodologies, and technologies targeted at specific portions of intact sediments at the site will flesh out our current understanding of these questions. New methods for analyzing high resolution, stratigraphically controlled data will allow novel insights into site occupation spans, paleodemography, seasonality, raw material use, and diet over time at Southsider Shelter and in comparison with surrounding areas (Freeland 2012b).

Southsider Shelter's nominator (Freeland 2012b) emphasized that the site retained integrity based primarily on its aspects of association, design, location, and materials. The site retains association because artifacts are in place within well-stratified deposits. This was confirmed by an analysis of lithic refits, which indicated that artifacts had not significantly moved vertically or horizontally throughout the deposits. Integrity of design is retained because the site remains mostly intact, although some krotovinas (rodent burrows) were observed. In this vein, analysis of artifact and feature patterning suggests that different activity areas at the site can be spatially differentiated. Southsider Shelter possesses integrity of location because the site has not moved since its period of significance. Many pertinent research questions at Southsider Shelter revolve around lithic and faunal artifacts as well as hearth and storage pit features. The site has integrity of materials in regards to these artifact and feature types, as they are well preserved (Freeland 2012b).

In summary, to be eligible under Criterion D, Wyoming Paleoindian rockshelter sites must contain (or be likely to contain) data important for testing hypotheses or answering research questions discussed in this context. Generally, this requires that rockshelter sites contain intact archaeological deposits that are demonstrably well-stratified. Such sites might contain single or multiple occupation episodes or components. Eligible rockshelters generally must exhibit exceptional preservation of one or more feature, artifact, or ecofact type(s) and usually include both diagnostic artifacts and materials that can produce absolute dates.

Many rockshelters in Wyoming were excavated in the 1960s-1980s, before high resolution excavation methodologies became standard archaeological practice (e.g., Southsider Shelter; Freeland 2012b). Portions of many of these sites remain intact and could be considered eligible under Criterion D because the application of modern excavation methods and analysis techniques will provide new insights into old questions, or allow researchers to investigate novel topics.

Eligible Kill/Butchery Sites

Agate Basin is a multi-component bison kill/butchery location that was possibly also a campsite (Frison and Stanford 1982; Junge 1973a). Agate Basin is also the type site for the Agate Basin complex. In the early 1970s, it was listed in the NRHP under Criterion D. The nominator argued that the site had been incompletely investigated and much cultural evidence remained (Junge 1973a). The nominator suggested that the site was "very much in need of further research through the implementation of a long-term, well-planned project" (Junge 1973a), but did not describe what that project might be. He also did not specifically address integrity of the intact deposits. Contemporary nominations require a specific and detailed evaluation of the types of data the site is expected to yield, an explanation of how that data will

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be used to answer important research questions, and detailed assessment of the seven aspects of integrity.

The Casper site is a unique Paleoindian bison kill at which a herd of buffalo was driven into a parabolic sand dune (Frison 1974; Junge 1973b). Casper was listed under Criterion D in the 1970s. Due to its location in the midst of the modern city of Casper, George Frison completely excavated the site in the 1970s (Junge 1973b). Casper “no longer contains the bones of the prehistoric bison” (Junge 1973b:Statement of Significance). Casper’s nominator argued that after the excavated materials were fully studied, they would provide insight into prehistoric human migration patterns, seasonality, hunting strategies, and social organization practices revolving around communal group hunting. Since the site was completely excavated, it should not have been listed under Criterion D. However, it might still be considered eligible under Criterion A because the site represents a significant and unique prehistoric bison kill event that yielded data important to our understanding of Northwest Plains archaeology.

The Horner site was originally excavated in the late 1940s and early 1950s under the supervision of Glen L. Jepsen, Loren Eiseley, and Waldo R. Wedel. George C. Frison and colleagues returned and conducted additional site investigations in the late 1970s (Frison and Todd 1987), and others have conducted more recent archaeological investigations (e.g., Cannon et al. 2010; Grunwald 2016; Todd 1983). Horner is generally considered a short-term animal processing and butchering area. The site produced Eden and Scottsbluff points, Cody knives, and shallow pit and hearth features, in context with at least 200 extinct bison and small numbers of deer, antelope, wolf, rabbit, turtle, and bird remains. Horner is considered the type site for the Cody complex, and is the only known site with evidence of large-scale Paleoindian bison hunting in the Bighorn Basin (Corbyn 1978). Horner was listed as a National Historic Landmark in 1961 before the implementation of the NHPA and the NRHP. In 1975, personal communication between Corbyn and Frison suggested that Frison estimated that approximately half of the Horner site remained intact and unexcavated, though portions of the site had been looted (Corbyn 1978). Horner was therefore listed under Criterion D for its information potential.

The Finley site was originally investigated in the mid-1900s but was not listed in the NRHP until the 2000s (Laughlin 2009). Finley is a bison kill that contained Eden and Scottsbluff projectile points, and played an important role in defining the Eden projectile point type and the Cody complex (Laughlin 2009). Because of archaeological investigations and looting since its discovery in 1940, Finley contains very few intact deposits. Finley was therefore nominated under Criterion A for its importance to 1940s archaeological theory and chronology building (Laughlin 2009). While the nominator admits that integrity of design, materials, and workmanship are “fair to poor” at Finley, the site does retain integrity of location, setting, feeling, and association. The site is located in the same place as it was in the 1940s. By comparing a series of photographs of the site from the 1940s and 2009, the nominator concluded that the setting and feeling remain virtually the same today as during Finley’s period of significance (the 1940s). Finally, Finley has integrity of association because historic documents directly link the site to historic archaeological investigations that made significant contributions to the development of Early Man studies (Laughlin 2009).

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Trapper's Point is a multicomponent pronghorn kill site that was likely used as early as the terminal Paleoindian period based on radiocarbon determinations, making it the oldest known mass pronghorn kill in North America. Trapper's Point was nominated under Criterion D, with a period of significance between 8,000 and 2,900 BP (Miller 2006). Partial excavation of the site established that it contains one of the most intact Early Archaic chronological sequences known in southwestern Wyoming and also includes rich and diverse feature and artifact assemblages. Based on a series of nine test units, the nominator estimated that likely over 60% of the site remains intact (Miller 2006). Trapper's Point has already provided important insights into prehistoric pronghorn procurement practices, organization of group communal hunting efforts, and chronology. Future research questions could focus on estimating site seasonality, reconstructing mobility patterns by sourcing lithic raw materials, differentiating natural bone from butchering modifications, and/or estimating how many people the butchered pronghorn meat would have sustained. The site is also expected to yield insights into pronghorn migration patterns, which would help guide wildlife management decisions regarding impacts to (pre)historic pronghorn migration corridors (Miller 2006).

Miller (2006) suggests that Trapper's Point retains location, design, materials, and association aspects of integrity. Trapper's Point still exists in its original location, and the area is rural without much modern development. The site also maintains subsurface spatial integrity, based on an analysis of bone refits. Miller (2006) argues that the site's chipped stone, bone, and features retain integrity of materials because they are well preserved. Since certain artifact types are well preserved and maintain in situ spatial relationships, the site retains integrity of association.

In summary, to be eligible under Criterion D, Wyoming Paleoindian kill sites generally must contain well-stratified, in situ deposits and must have the potential to provide new data for answering big research questions. In general, faunal remains and possibly other artifact and feature types or ecofacts at eligible kill sites should exhibit exceptional preservation. Sites that provide evidence of seasonality or of unique hunting strategies, diet breadth, social organization patterns, or butchering techniques in combination with the other attributes listed above should generally be considered eligible if integrity is maintained.

Many Wyoming Paleoindian kill sites listed in the NRHP were nominated decades ago. In these early nominations, the vague presentation of research questions and inexplicit nature of integrity assessments mean these early documents do not meet today's NRHP nomination standards. However, a few Paleoindian kill sites were recently listed in Wyoming. These documents provide excellent examples of how this site type can be nominated to the NRHP. Miller's (2006) nomination of Trapper's Point demonstrates how to nominate a kill site under Criterion D, while Laughlin's (2009) Finley site nomination illustrates how to nominate under Criterion A's history of archaeology.

Eligible Short-Term Occupations/Logistical Forays

Although several open-air, short-term Paleoindian camps in Wyoming have been listed in the NRHP (e.g., Helen Lookingbill), no short-term, shallow, surface, or ephemeral Paleoindian sites without significant features are currently listed. This cultural resources management oversight should be remedied in the future (Talmage et al. 1977). Many CRM organizations

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automatically mark sites with subsurface deposits as eligible under Criterion D while surface sites or sites with only shallow deposits are automatically marked ineligible. However, “[o]verlooking the significance of small sites may skew our understanding of past lifeways as those sites not only receive less research attention, but are also destroyed without being recorded thoroughly because they are ‘written off’ as ineligible for listing in the National Register”. Small, ephemeral sites have the potential to expand our understanding of prehistoric subsistence strategies, settlement patterns, and lifeways in general. Sites like short-term hunting overlooks (e.g., Hofman and Ingbar 1988) or wild plant gathering and processing locales (e.g., Sullivan 1996) may be less “impressive” than bonebeds or sites with clear architectural features, but are equally important to providing a complete perspective on the archaeological record and Paleoindian land use patterns. Small sites like the Adobe hunting overlook should not be casually dismissed as ineligible simply because of their small size and/or lack of deeply stratified deposits (see Hofman and Ingbar 1988).

Sites that are shallowly buried or deflated may still retain integrity and research potential. For example, over approximately 11,000 years, the Folsom camp at Barger Gulch Locality B in Colorado was shallowly buried, deflated, buried again, deflated again, and buried again. These disturbance processes affected the vertical distribution of artifacts, but “horizontal spatial patterning at the site appears to have remained intact, suggesting that vertical movement of artifacts was associated with relatively little horizontal displacement” (Surovell et al. 2005:646). Horizontal spatial patterning was so well preserved at Barger Gulch Locality B that spatial analysis of artifacts revealed the presence of several hearth-centered activity areas that might represent Folsom dwellings (Waguespack and Surovell 2014). Though Barger Gulch Locality B is a large open-air camp, similar horizontal integrity arguments could also apply to small ephemeral sites. Ephemeral sites could be analyzed or compared horizontally on large and small spatial scales and might subsequently provide new or complementary insights into human mobility and/or subsistence systems.

It might be appropriate to nominate conglomerations of similarly aged ephemeral sites under Criterion D as discontinuous districts rather than individual resources when they represent either individual variation characterizing diversity in contemporary site types or repeated patterns in human behavior. Each ephemeral resource contributing to the discontinuous district would need to date to a time period of interest (using radiocarbon age determinations, diagnostic artifacts, or other means) and include preserved artifacts or features. Such sites would also need to maintain demonstrable integrity. As at Barger Gulch Locality B, sites may retain horizontal associative relationships even if vertical integrity has been lost.

Eligible Lithic/Mineral Resource Procurement Sites

Obsidian Cliff is a lithic raw material procurement site within the current boundaries of Yellowstone National Park. The site was used as a source of obsidian by many groups of prehistoric peoples, extending back at least 11,000 years (Johnson et al. 1995). The site is currently listed as an NHL. Thousands of years of archaeological deposits and features, including chipped stone cores, blocks, nodules, primary and secondary reduction debris, and hammerstones exist in the vicinity of a natural obsidian outcrop. Features include depressions associated with quarrying, such as trenches, ovular pits, and terraced pits (Johnson et al. 1995). Since obsidian

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can be sourced, it is known that raw material from Obsidian Cliff was utilized at sites throughout the American West and Midwest, thus providing major insights into prehistoric mobility and/or trade networks. Nominators argued that although obsidian from Obsidian Cliff has been studied far from its source, the resource procurement site itself has not yet been researched in detail. Potential investigations at Obsidian Cliff include reconstructing prehistoric mining techniques, estimating quarrying intensity and the quantities of obsidian extracted, examining the technological attributes of discarded artifacts and debitage, documenting the morphology of quarry features, and explaining how all of these resource procurement strategies changed over time (Johnson et al. 1995).

Obsidian Cliff's nominator argued that the site maintains high degrees of location, setting, feeling, and association aspects of integrity. Obsidian Cliff is relatively untouched in terms of looting and modern development disturbances, since its location within Yellowstone National Park has granted it federal protections for over 120 years (Johnson et al. 1995). Obsidian Cliff is therefore a uniquely well-preserved example of a prehistoric raw material procurement locale. Several other quarry sites with Paleoindian diagnostics in Wyoming are also listed on the NRHP as part of the discontinuous Black Mountain Archaeological District (Späth 1986).

Two challenging aspects of establishing that lithic raw material procurement locations are eligible for listing in the NRHP are the general paucity of diagnostic artifacts and the lack of dateable organic materials at most quarries. Nomination to the NRHP requires that a site's period of significance is designated and justified with archaeological evidence. An eligible resource procurement site should be dated somehow, so that it can be situated within an appropriate historic context. Overall, for a resource procurement locale to be eligible under Criterion D, it should also contain excellently preserved quarrying features and associated artifacts. Since landscape-level questions are often integral components of research designs geared towards prehistoric quarrying sites, eligible sites should usually maintain setting and feeling aspects of integrity, even when nominated under Criterion D. Other resource procurement locations in Wyoming that are eligible but not yet listed include Spanish Diggings and the Powars II Paleoindian ochre mine.

Eligible Stone Tool Caches

As mentioned in the "Eligible Short-Term Occupations/Logistical Forays" section, small, ephemeral sites are generally overlooked but should be considered for NRHP eligibility because they provide us with a more complete picture of the archaeological record and prehistoric human behavior than large megasites alone. Stone tool caches represent yet another small site type that is generally written off as ineligible. One difficulty inherent to arguing that stone tool caches may be eligible for the NRHP lies in the fact that they are usually completely excavated and removed from their original locations. Once stone tool caches are fully excavated, they are not eligible under Criterion D. However, such sites might be considered eligible under Criterion A if they were important to the history of archaeology. No prehistoric stone tool caches are currently listed on the NRHP nationwide, so precedence for nominating a site like this does not exist.

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State**Eligible Rock Art**

The petroglyphs at Whoopup Canyon are eligible for listing in the NRHP. Other Paleoindian-aged rock art in Wyoming, if identified and dated, might also be eligible. Rock art is commonly listed under Criterion C and/or Criterion D. Rock art is frequently eligible under Criterion C when it exemplifies a particular style and/or possesses high artistic values. Rock art sites may also be eligible under Criterion D for their information potential. Even very direct research questions, such as developing reliable absolute dating techniques for rock art, may qualify as research potential at some of these sites. Rock art also provides nearly infinite research potential related to interpreting prehistoric symbolic behavior, rituals, and belief systems. For a good example of a rock art nomination in Wyoming, see the Tolar Petroglyph Site NRHP Registration Form (Lynch and Loendorf 2014). In general, to be eligible under Criterion C or D, rock art must be exceptionally well preserved and maintain integrity of location, setting, design, materials, and workmanship. Rock art panels that have moved from their original locations by natural processes, such as sliding downslope due to the force of gravity, may be eligible under Criteria Consideration B: Moved Properties.

Eligible Human Burials/Remains

Nationwide, no Paleoindian burials or human remains are listed in the NRHP. However, a few prehistoric interment sites are listed under Criterion D. For example, a site called Burial Platform in Hawaii was listed in the NRHP as a structure in 1973. Some burial mounds in the Midwest are also listed, such as Grave Creek Mound in West Virginia. Today, prehistoric burials are generally not formally nominated for listing in the NRHP because NAGPRA legislation applies to sites that include Native American human remains. However, sites where prehistoric humans were interred are not precluded from listing in the NRHP. For example, a Late Archaic/Late Prehistoric burial was excavated at Mummy Cave (North Fork Cave #1) prior to its listing (McCracken et al. 1978).

Section G: Geographical Data

The geographic area covered by this document is the State of Wyoming.

Section H: Summary of Identification and Evaluation Methods

This document is the result of exhaustive research. A thorough search was done of the Wyoming State Historic Preservation Office's WyoTrack system to find Paleoindian sites that have been located and recorded in the state. The author also undertook a comprehensive search of primary and secondary sources related to Paleoindian sites and interpretation. Research was done through local and university libraries, state and regions archives, and online databases. No new sites were identified or recorded as part of this document.

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