

Medicine Creek Is a Paleoindian Cultural Ecotone

The Red Smoke Assemblage

Ruthann Knudson

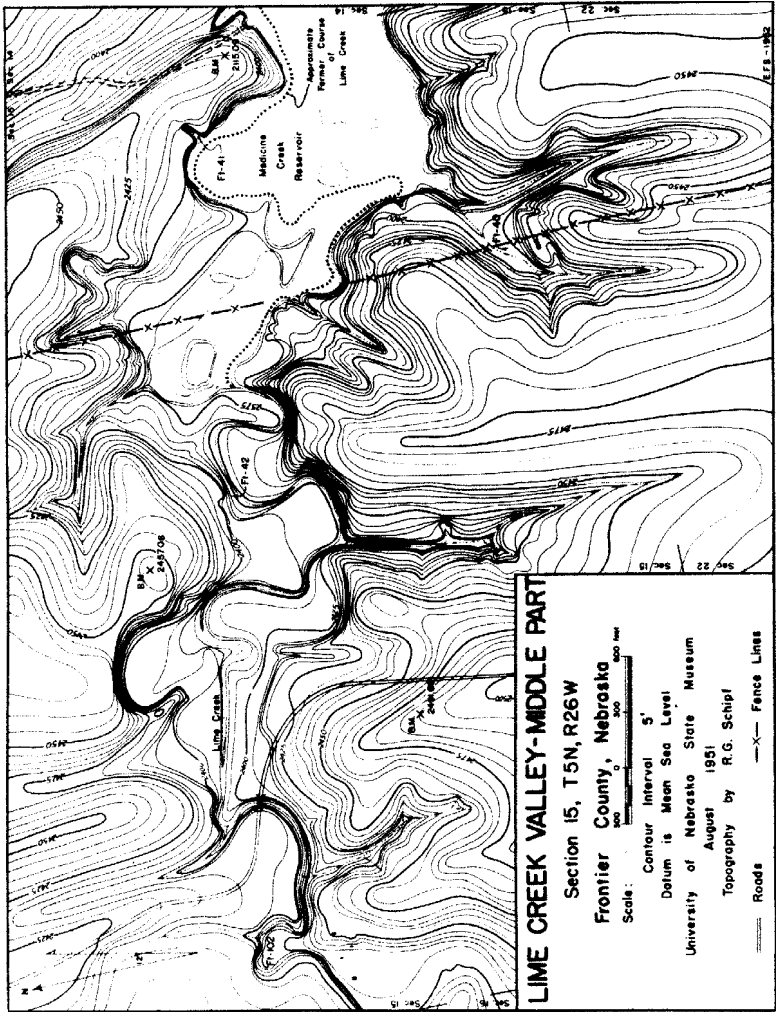
The southwestern Nebraska Paleoindian Red Smoke site (25FT42) is in the upper reaches of a gallery-forested river that flows east to the Mississippi, in a sheltered, well-watered niche abundant in deer, small game, vegetable foods, and local high-quality knappable tabular stone (Smoky Hill jasper). It is a westward penetration into the High Plains, where bison were plentiful but water and good tool stone were less abundant. An estimated 98 percent of the flaked stone tools found in the Red Smoke assemblage are of local jasper. The most common artifacts are debitage, bifaces reflecting several stages of reduction, and bifacial cutting and chopping tools. The site's Zone 88 assemblage is dated to between 9000 and 8700 RCYBP. The site appears to reflect flaked stone reduction activities while people were camped at the site, which was adjacent to exposed jasper bedrock. Most of the well-reduced Red Smoke bifaces are fragments that exhibit unregimented 1-cm-wide facial flake scars. A dozen or more alternate beveled Zone 88 points (that may have served as both projectiles and knives) have strong stylistic similarities to the Dalton materials found in the Mississippi River drainage farther east and south, and two of these Red Smoke tools are identical in material, technology, and reshaped form to the two artifacts found at the Meserve site in eastern Nebraska. Two "Eden" point midsections, one of Alibates agatized dolomite and the other of Hartville Uplift quartzite, are associated. There is also one relatively complete point, which may or may not be of local jasper, with regimented parallel oblique flaking. Most of the points are stylistically and technologically similar to tools from the Lime Creek and Allen sites just east of Red Smoke, to the Clary Ranch and Scottsbluff

sites in the North Platte valley to the northwest, and even to the Ray Long (Angostura) site assemblage on the Cheyenne River in western South Dakota. A few Red Smoke tools display similarities to artifacts from the Hell Gap site, an ecotonal quarry workshop and habitation site on the Wyoming boundary of the High Plains, and with bison kill sites, such as Claypool and Frasca, west of Red Smoke. Comparable point styles are also found at the Packard site in Oklahoma and the Acton site in Texas. Following Irwin, the Medicine Creek and North Platte valley Paleoindian sites discussed here are labeled the Medicine Creek complex. Detailed analysis of the Red Smoke assemblage and site is incomplete, but some thoughts of patterns are offered.

The Red Smoke Site

The Red Smoke site in southwestern Nebraska is a deep, well-stratified Late Paleoindian (*sensu* Haynes 1969) and later record of human adaptations to the early Holocene environment in what appears to have been both a natural and a cultural ecotone. The site is located on Lime Creek, a tributary to Medicine Creek; Medicine Creek is itself a major tributary to the Republican River in the Missouri River drainage of the Central Plains of North America. The site may have been found by 1929 (Howe 1929:Figure 8.5, site no. 12), but it was not generally known until 1947. It was investigated from 1948 through 1953 as part of the U.S. Bureau of Reclamation's (USBR) post-World War II Medicine Creek Reservoir (Harry Strunk Lake) construction project (Kivett and Metcalf 1997). The Medicine Creek project included research on three Paleoindian sites along Lime Creek, including the Allen site (25FT50) and its Frontier complex, near the confluence of Lime and Medicine Creeks; the Lime Creek site (25FT41), just upstream on that tributary; and the Red Smoke site, farther west up Lime Creek.

Research at Red Smoke was conducted by the University of Nebraska State Museum under a cooperative agreement with the National Park Service Midwest Regional Office, Omaha, coordinated with the Smithsonian Institution's Missouri Basin Project (Davis 1951, 1952, 1953a, 1953b, 1954a:Appendix, 1954b; Schultz and Frankforter 1948). The Archaeological Conservancy (Stewart 1998-1999) acquired the site from private landowners in 1998. This author visited the site several times in the early 1970s (Davis 1977; Knudson 1974b), and again during the 1997 Medicine Creek Reservoir anniversary, and noted few impacts to the postexcavation site other than natural erosion and erosion caused



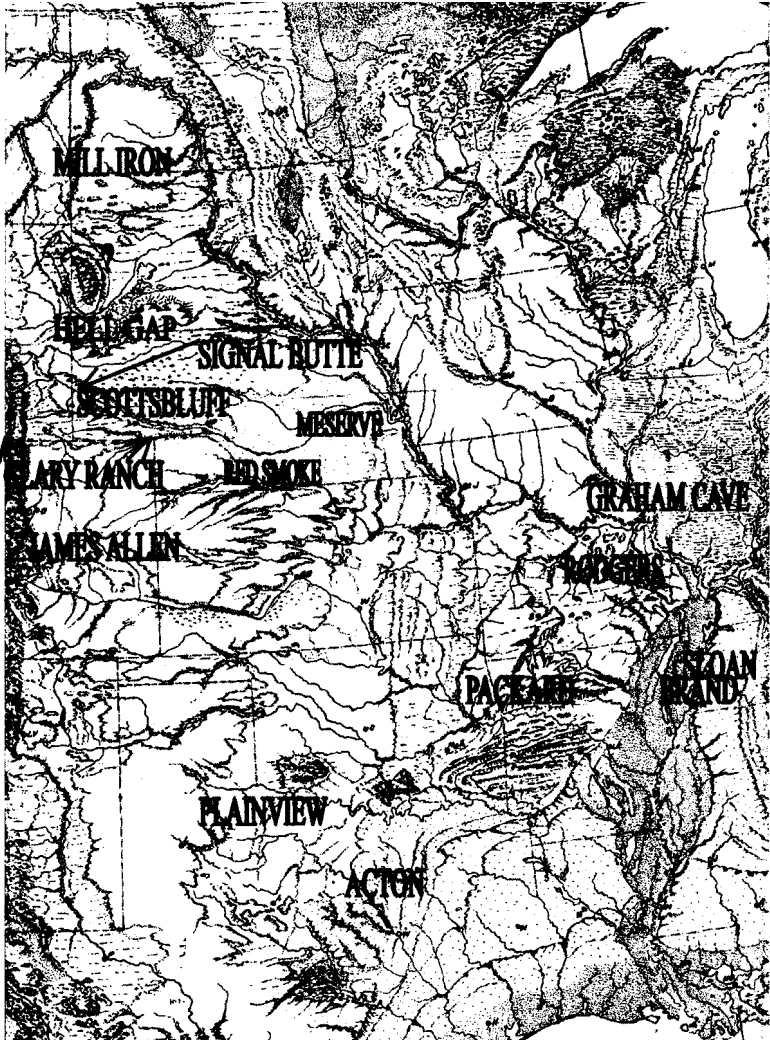
7.1. Topographic map of the middle part of the Lime Creek indicating location of the Red Smoke site (Davis 1954:Figure 3). Used with permission of Beth Ogden Davis.



7.2. The Red Smoke site, August 9, 1952, Donald J. Lehmer, photographer. From the collections of the Anthropology Division, University of Nebraska State Museum, Lincoln. Used with permission.

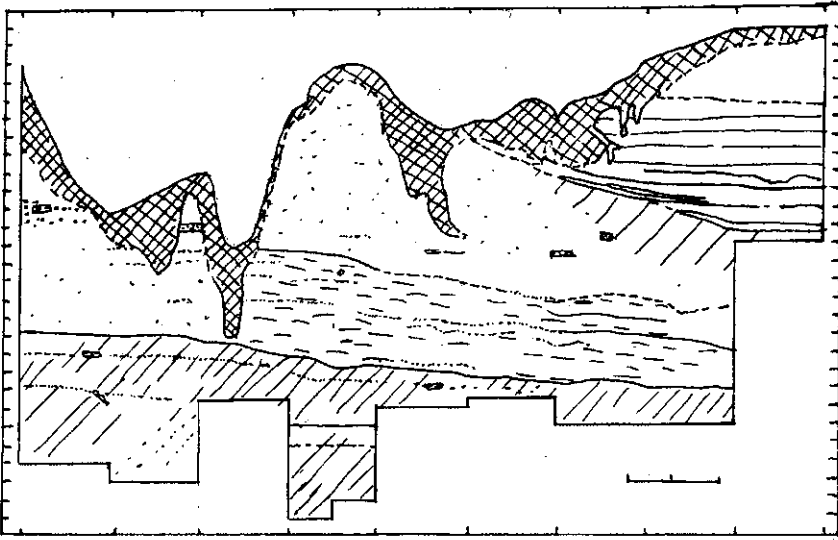
by relatively continuous cattle grazing throughout the past nearly 50 years. If present (see discussion of site stratigraphy below), intact deposits of the site are likely to remain.

The Red Smoke site as investigated extended over the northeast triangular half of an area at least 140 ft (42.7 m) east-west and 60 ft (18.3 m) north-south, with the excavations facing south around a curve of Lime Creek and the back wall of the excavations cut 20–40 ft (6–12 m) into the loessial slope (Figures 7.1 and 7.2). This is at the base of what was identified as the T-2A terrace (Reed and Dreeszen 1965; Schultz et al. 1948, 1965; Schultz and Tanner 1965), with a complex stratigraphy in which Davis identified eight cultural zones dispersed among five sedimentary units.¹ Zone 88 yielded the densest concentration of materials. Note that these are cultural “zones” not assumed to be components that might each reflect a single period of human use. The site yielded over 1,800 whole or fragmentary flaked stone tools (Knudson 1979b, 1979c), including 64 points, although the majority of the “tools” are relatively thick bifacial knives/choppers, well over 100,000 (and perhaps over 200,000 [see note 2]; Knudson 1979a) debitage pieces, and an unquantified number of unworked bone fragments. However, there were only a few “finished” stone tools and only a few bone or ground stone artifacts. It is estimated that most (98 per-



7.3. Physiographic map of the Great Plains province with locations of selected archaeological sites (Lobeck 1975). Used with permission of the Hammond World Atlas Corp.

cent) of the used and stylized tools are fabricated of Smoky Hill jasper. A machine-excavated trench dug in 1952 (Davis 1954a:379-384) into Area B in the northeast corner of the known site area displayed eight cultural zones. These zones coalesced at the back of the trench, but Davis thought that there was an intact cultural sequence in the trenched area that could aid in solving future stratigraphic questions.



7.4. Red Smoke site, profile on east-west baseline, 10E to 100E (Davis 1954b:Figure 1).

The Medicine Creek drainage provided a variety of resources to its Late Paleoindian users. The drainage is at the edge of Lobeck's (1975) Plains Border subprovince of his Great Plains Province (Figure 7.3). Lobeck describes this subprovince as a transitional zone—an ecotone—and certainly the Medicine Creek drainage, with its sheltering gallery forests; its reliable supply of water, vegetable foods, and probably deer and other small game; and its high-quality knappable cryptocrystalline bedrock, must have looked like heaven to people who hunted bison out on the High Plains. On the Plains water sources were widely spaced and often unreliable; stone for making long, thin, sharp edges was rare; and the continental climate had to be endured. But the wide grazing lands there probably meant that bison (an abundant source of food, hides, bone, and sinew) were available.

Site Stratigraphy and Radiocarbon Determinations

Table 7.1 summarizes the site stratigraphy, correlating Davis's original sedimentary units, cultural zone designations, and Roman numeral zone designations ascribed after completion of considerable laboratory analysis of the collected materials. Figure 7.4 is Davis's baseline (0N/S) profile from west (10E) to east (100E). As noted, the site was deposited

Table 7.1 Red Smoke (25FT42) Site Stratigraphy

Cultural Zone (Original) ^a	Cultural Zone (Final)	Sedimentary Unit	Description	Distribution
—	—	5	Massive loess, a brown loessic silt heavily eroded during creation of modern hill slope; topped with a modern soil (p. 47, Fig. 7).	
92	VIII		Main body of unit is made up of thinly laminated brown silt in which the laminations are frequently carbonaceous as if vegetation growth alternated with periods of intermittent shallow water deposition; apparently extensive slope wash throughout this period of deposition (pp. 47–48, Fig. 7).	Only 70 ft. ² in central part of site (p. 64, Fig. 13); Zone 90 cultural material appears to extend into the east wall of the excavations.
91	VII	4	Zones 91 and 92 are meager cultural manifestations in the lower part of the laminated silts (p. 47).	
90	VI		A meager Zone 90 is included within the unit's basal sand and silt stratum above an erosional unconformity in the eastern portion of the site (p. 47); the cultural material from this zone is described as being "just above, on, and just below the unconformity" (Davis 1954b:11).	

[89; never used after its original definition (Davis 1953b:11)]	V-A	3	<p>Brown silt of colluvial and eolian origin that becomes gray and clayey upward as if part of a weathering profile; no carbonaceous zones (p. 48, Fig. 7).</p> <p>Zone 89 is limited to the northwest portion of the site.</p> <p>Zone 88, the primary site cultural zone (averages 1 ft. thick), is in lower part of the unit (p. 46) and appears to have been a fairly level surface (Fig. 12) but with interspersed thin colluvial silt lenses (p. 67). Occupation must have occurred when grass cover was not thick and slope wash and loess were steadily accumulating (p. 47).</p>	<p>In western portion of the site, Unit 3 is highest in the sequence, is capped by modern sod, and extends north into the hill beyond the excavation limit; farther east, the top of Unit 3 is marked by an indistinct erosional unconformity representing local topography (p. 51) that dips southeastward and could represent centuries or millennia (pp. 46-48, 67).</p>
88	V		<p>Zone 83 is a carbonaceous zone in the upper part of this unit (p. 47, Fig. 7). Gray-brown to brown silt, with dark streaks in its lower part and carbonaceous zones (immature paleosols?) in its upper part; seems to reflect a fluctuating climate with humid soil-forming conditions alternating with drier periods of colluvial silt accumulation (p. 47). Zone 80 is in the lower streaked part of the unit (p. 47, Fig. 7) and may be multicomponent (p. 78).</p>	<p>Zone 83 cultural material is found between grid lines 85E to 113E and may be found beyond eastern excavation limit.</p>
83	IV	2		<p>Zone 80 was below the Medicine Creek reservoir level in 1951 but above it later; only a 5-ft.² unit was dug down to 75 ft. above datum (p. 78).</p>
80	III			

Table 7.1 *Continued*

Cultural Zone (Original) ^a	Cultural Zone (Final)	Sedimentary Unit	Description	Distribution
78	I & II (Davis 1954b:9)	1	Zone 78/II is in the upper part of the unit (p. 46, Fig. 7; Davis 1954b:19). Gray clayey silts, representing a soil formed under moist, perhaps boggy conditions (p. 46); lower part of T-2A terrace fill (p. 78). Zone 78/I is the lower portion of the unit (Davis 1954b:19-20).	Zone 78 was below the Medicine Creek reservoir level in 1951 but above it later; only a 5-ft. ² unit was dug down to 75 ft. above datum (p. 78).

Note: All strata are within the local Terrace-2A fill, and all references are to Davis 1954a unless otherwise noted.

^aHeight of a stratum containing evidence of human occupation when that stratum was first encountered, in feet above original site datum (near Lime Creek) (p. 43).

in the base of what Schultz et al. (1948, 1951, 1965; cf. Schultz et al. 1994; May, this volume) termed the Terrace-2A (Mankato) silt and loess. In these publications Schultz used the stratigraphic section from the Lime Creek site (Figures 7.1 and 7.2; Davis 1962) as the Terrace-2A type section, identifying a basal blue-gray clay stratum (Schultz et al. 1948:37 [section 8]) that was present in many regional exposures.

The excavated Red Smoke site stratigraphy was a complex array of alluvial and colluvial deposits, draped over an eroding hillside that sloped to the southeast and, apparently, bedrock deposits of Smoky Hill jasper that are located at the nadir of the past and present stratigraphic column. Davis (1954a:48-49) concluded that

The impression gained from the sedimentary sequence is that the material was deposited under climatic conditions of increasing aridity, since the carbonaceous zones, which imply relatively humid times, are relatively thick in Unit 2, much thinner in Unit 4, and absent altogether in Unit 5. The change toward aridity was not a constant one, since there is an alternation of carbonaceous zones and non-carbonaceous silt suggesting a fluctuating climate. Nevertheless, the general situation from the dark clay at the bottom to the loess at the top [and pulmonate gastropod distribution] indicates increasingly inhospitable conditions for plant and animal life.

Davis (1954a:51) commented on parallels between the Red Smoke and Lime Creek sites stratigraphy, noting that both had "a dark clayey silt at the bottom, a series of alternating silt and carbonaceous zones above, and a deposit of loess at the top," although Red Smoke's Unit 3 brown silt and the partial unconformity between Units 3 and 4 were unique. He suggested that the latter differences resulted from local topographic conditions.

Over the past decade or more David May's investigations of the Medicine Creek geomorphology (1992, n.d., this volume) have added significant new understanding of the landforms and alluvial chronology of the Red Smoke site depositional context.

Six radiocarbon determinations (more if the split samples are counted separately) have been completed for the Red Smoke site (Table 7.2). The most widely acknowledged of these (C-824) was assessed during the first generation of ^{14}C dating (Arnold 1995; Taylor 1997:70) and does not fit well with the series of dates evaluated during the 1960s (Tx-333) and 1990s (other Texas assessments). Libby (1954:738, 1955:110) commented on the earliest date as follows: "The charcoal was from a hearth

Table 7.2. Red Smoke [25FT42] Radiocarbon Dates

Laboratory Number	Date [B.P.]	Dated Material	Provenience	Reference
C-824 ^a [UNSM 859-50]	8862 ± 230 (average of split sample [8570 ± 230, 9153 ± 230], uncorrected)	Charcoal	Zone 92/VIII	Libby 1954:738, 1955:110
Tx-333 [Red Smoke 1076]	7970 ± 210 (uncorrected)	Charcoal	Feature 867 at grid point 10S/90E, 88.89 to 89.60 ft. above site datum, above the unconformity, Zone 90/VI	Valastro, Pearson, and Davis 1967:451
Tx-6729 UNSM 1504-51]	8050 ± 500 (uncorrected)	Small fragments of charcoal	Feature 857 and 863, from Zone 90/VI above or at the unconformity	May 1992: Table 3; UTRL RAP
Tx-6730 [UNSM 1343-51]	8270 ± 80 (uncorrected)	Small fragments of charcoal	Feature 1007 and 1224, Zone 88/V or 90/VI above or at the unconformity	May 1992: Table 3; UTRL RAP
Tx-7517 [UNSM 1532-52]	9220 ± 90 and 9206 ± 90 (δ ¹³ C corrected split sample)	Charcoal fragments mixed with earth, stored in glass jar from 1952 until dated	Below Zone V in same relative position of Zone IV, in NE corner of 5N/35E, 26.67–26.93 m below datum near Units 2/3 contact	UTRL RAP
Tx-7558 [UNSM 1780-52]	8830 ± 130 and 8910 ± 130 (δ ¹³ C corrected split sample)	Charcoal with some burned bone fragments	Feature 1593 [hearth], south part of square 0/60E, 26.97–27.13 m above site datum and within Zone V, principal site occupation	UTRL RAP

^aThe UTRL RAP (University of Texas Radiocarbon Laboratory Radiocarbon Analysis Reports, undated) for Tx-7517 notes that this date [C-824], "one of Libby's screen wall carbon-black dates, probably should be ignored."

in the middle portion of the Terrace 2A fill. . . . This sample was collected in 1950 by E. Mott Davis and associates. It bears the field number 'UNSM 859-50.' It would give a date which would be near to what is probably the climax of the Mankato. All the samples from Terrace 2A which previously have been run are from lower levels. Submitted by C. B. Schultz." Further, Davis and Schultz (1952:2) note, "The fill from a hearth in the 92-ft zone was removed and was brought to the laboratory in hopes enough charcoal for a Carbon-14 date can be recovered." This is apparently the Zone 92 hearth Davis (1954a:62) described as follows:

Zone 92 . . . is a thin carbonaceous zone containing a hearth, several workshop concentrations, artifacts, ochre stains, and some fragments. This material occurs in the lower part of sedimentary Unit 4, the laminated silts. Three hundred square feet of this zone have been excavated. . . . The hearth was an irregular area about two feet in diameter, heavily carbon-stained. Around it were strewn broken and burned bison bone. . . . There are no clear evidences of Zone 92 in the western part of the site, but test pits show that it extends at least as far east as line 140E.

In complement, the 1960s date on the Zone 90 Feature 867 charcoal was assessed by the University of Texas Radiocarbon Laboratory (Valastro et al. 1967:451):

Zones VI, VII, and VIII, probably representing one component, are the most recent cultural strata at site (called Zones 90, 91, 92 in Davis 1953[a] p. 383; see also Wormington 1957, p. 117-118). Grinding stones (probably for ocher), a crude stemmed point, and a pentagonal flake point came from these zones. The deeper Zone V, containing Plainview points, is distinct culturally from Zones VI-VIII and an erosional unconformity intervenes. One C¹⁴ date has previously been determined from site, 8862 ± 230 from Zone VIII (C-824 . . .); Tx-333 should be about the same age. Coll. 1951 and subm. by E. M. Davis, this lab. δC¹⁴= [missing symbol] 629 ± 6. *Comment* (E.M.D.): date difference from C-824 by more than 2σ. Non-Paleo-Indian stemmed point from Zone VIII makes more recent date seem more likely. Obviously, we need more dates.

A comparison of Davis's 1954 distribution plots for Zones 92 (his Figure 13) and 88 and 78 (his Figure 14) indicate that they were stacked stratigraphically in a triangular southwest-facing area that extended

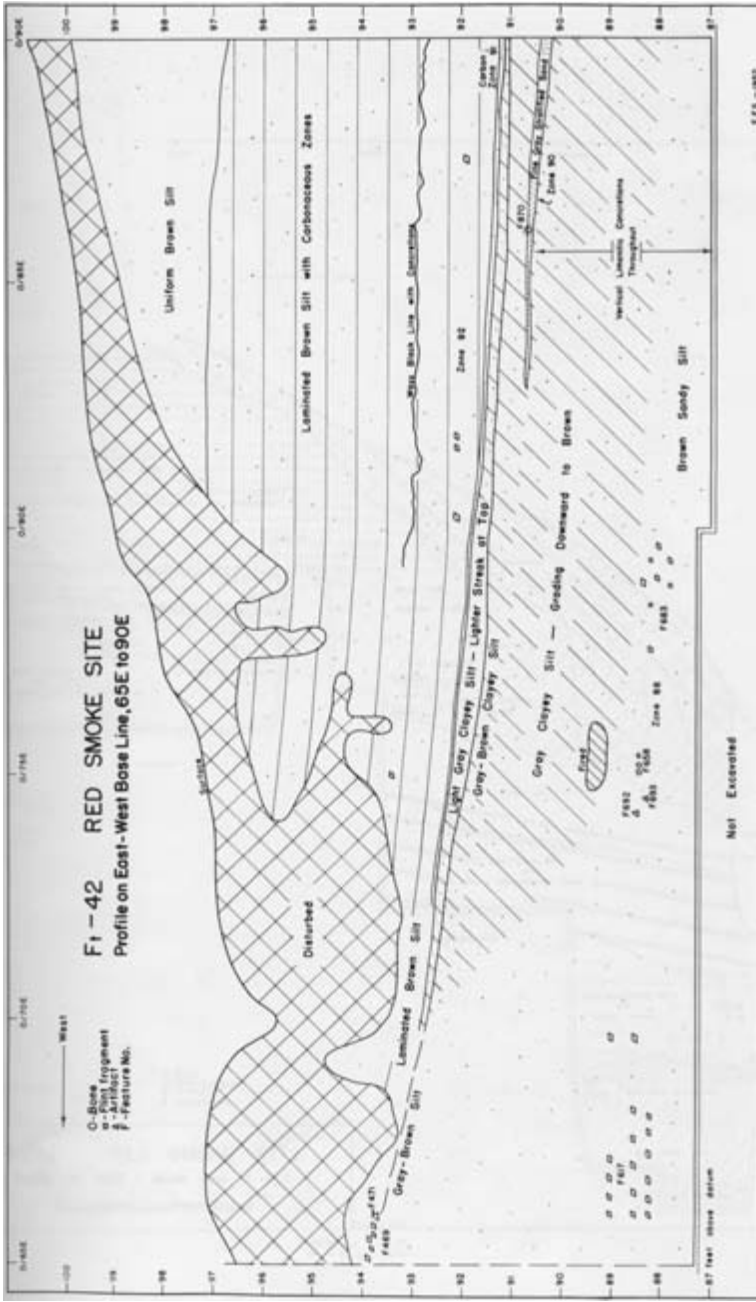
from ~75E to a wall at 90E, and from the north wall on the baseline to ~17S, and that Zone 92 was confined to this area other than the above-mentioned test units to the east. The north wall of this section through Zone 88 is illustrated in Figure 7.5, and the north-south section along the eastern wall is illustrated in Figure 7.6.

In the early 1990s (May, this volume) E. Mott Davis and Sam Valastro of the University of Texas Radiocarbon Laboratory completed radiocarbon analyses of four Red Smoke samples collected from the site during the 1951 and 1952 excavations (University of Texas Radiocarbon Laboratory n.d.; Table 7.2).² Two of these are particularly important in dating the principal occupation of the site in Zone V. Tx-7517 is from just below Zone V and dated to between 9,300 and 9,100 years ago, and Tx-7558 from a hearth within Zone V dated to 9,000 to 8,700 years ago. Thus, the culturally rich Zone 88 appears to date from about 9,000 to 8,700 ¹⁴C years ago. The calibration figures in Stuiver et al. (1998:Figures A9 and A10) indicate that this assessment is the equivalent of 10,200–9700 cal B.P.

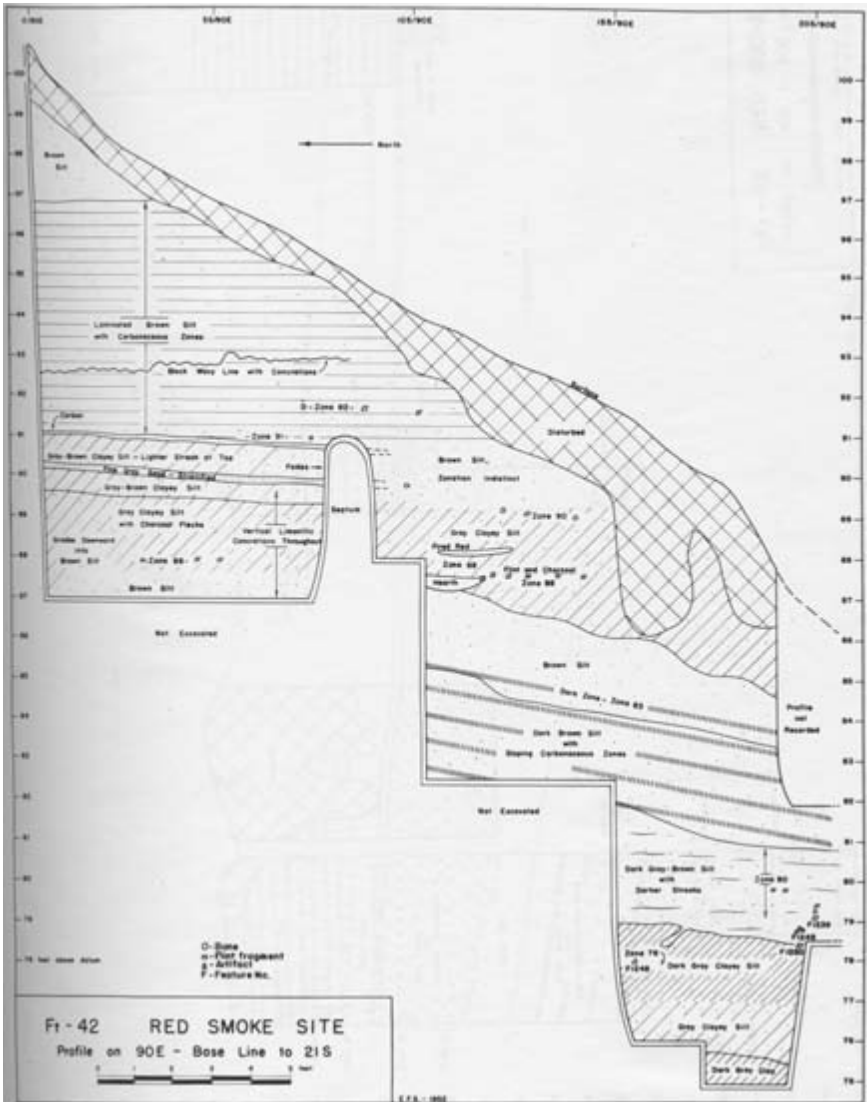
Bryson and Bryson (2000) have recently modeled the precipitation history at McCook and Cambridge and the McCook temperature history using uncalibrated dates. Their data indicate that at 9,000 years ago the annual precipitation in the area was the same as at present, although the summers were quite dry as compared with today, the intensity of July precipitation was lower, and the annual precipitation intensity was significantly lower. The annual temperature was ~1.5°C cooler and the July temperature was 1°C warmer. The modeled water supply in the McCook area reflected a slightly lower annual potential evapotranspiration rate than at present.

Fauna and Features

Nonhuman vertebrate remains were found in all cultural zones of the site, but none in noncultural deposits (Davis 1954a:49–50). More than half of the faunal material in all zones was *Bison*, and C. Bertrand Schultz believed the remains to be more comparable to *B. antiquus* than to modern *B. bison* (Davis and Schultz 1952:289). The entire collection has not been analyzed, but Schultz commented that the unanalyzed faunal remains represented “a variety of smaller animals” (Davis 1954a:49); they included at least coyote (Davis and Schultz 1952:289). Pulmonate gastropods from the site were at least preliminarily analyzed when Davis filed his dissertation, and he reported (Davis



7-5. Red Smoke site profile on east-west baseline, 65E to 90E [Davis 1954:Figure 9]. Used with permission of Beth Ogden Davis.



7.6. Red Smoke site profile on 90E north-south line, 0N/S to 21S (Davis 1954a:Figure 10). Used with permission of Beth Ogden Davis.

1954b:4) that they suggested a climatic change from relatively warm and moist to cold and dry as the fill accumulated.

Davis did not have any focused discussion of features as loci of specific cultural activity in his writings about 25FT42, perhaps because there weren't many such locations. The label *feature* was a major or-

ganizing unit for structuring provenience data within the Medicine Creek excavations, without any necessary relationship with a specific kind of cultural evidence, and this can be confusing. No cultural feature was identified in Zone 78, but Davis (1954a:78-79, 1954b:16) noted the presence of two carbon-stained areas in Zone 80. Four distinct burned areas, suggesting fireplaces, and "a number of charcoal-stained lenses" were identified in Zone 83 in 1953 (Davis 1954b:12). There was a lot of flaked stone debris throughout the level, and one pile of chips, "denoting a small workshop area," was found near a hearth. Two charred mud-dauber wasp nests were also found in Zone 83.

Zone 88 was the major occupational stratum at Red Smoke, averaging 1 ft (0.3 m) thick. Approximately 1000 ft² (93 m²) of the zone were excavated (Davis 1954a:67). Within Zone 88 there were piles of lithic debitage, often mixed with fragmentary bison bones, and there were four or more fireplace areas with carbon staining and baked earth but no evidence of specific feature preparation. Davis did not think there was any specific association of the piles or charcoal areas, noting the density of cultural materials throughout this zone (see Bamforth, this volume). There were silt lenses within Zone 88, indicating Lime Creek overflow and suggesting discontinuous human use of the site area even within the deposits of a single "zone." In the report on the 1952 excavations Davis (1953b, 1954a:376) noted that a hearth had been found in Zone 89. This may be the same hearth dated as Tx-7558 (Table 7.2), but a search of the records has not been completed to confirm this.

Davis noted the presence of an unprepared hearth in Zone 90, where there were also yellow and red ochre stains. A well-defined, prepared 1-ft-deep (0.3 m) firepit was identified in Zone 91 (Davis 1954a:64-65, 1954b:7), with large fragments of burned bone in it. A few small scraps and yellow and red ochre stains were found in the "vicinity" of the firepit. Zone 91 was a small (70 ft² [6.5 m²]) area in the center of the site. Zone 92 had ochre stains but no identified cultural features.

Available Lithic and Mineral Resources SMOKY HILL JASPER

The Red Smoke site may have been occupied intermittently during the early Holocene primarily because of its proximity to outcrops of Smoky Hill jasper (Knudson 1976a; cf. Holen 1991; Myers 1995) and reflects both workshop and habitation use. As Bamforth discusses elsewhere in this volume, Red Smoke is one of several Paleoindian sites identified in the Medicine Creek drainage that together provide evi-

dence of valley use in response to a broad range of socioeconomic needs.

The jasper that outcrops just above the modern water table in Lime Creek south of the Red Smoke site is bedded within the Smoky Hill member of the Niobrara formation (Hattin 1981; Loetterle 1937), which regionally dips to the west. Banks (1990:96) described this member as being "the principal chert-bearing formation of the central Great Plains." In the Medicine Creek vicinity the member's surface exposure is affected by the presence of the northwest-southeast trending Cambridge Arch (Condra 1907:19; Condra et al. 1950), which extends from the southern end of the Black Hills to the Kansas-Nebraska border southeast of Cambridge, Nebraska. In the Cambridge vicinity and the adjacent Medicine Creek drainage the arch crests and lifts the Smoky Hill member and its included jasper 200 feet or more; at the Colorado-Nebraska border, 100 miles west of Cambridge, the member is 2000 feet below the ground surface. In the Lime Creek area Smoky Hill jasper is relatively thinly bedded, with laminar exposures often no more than one foot thick and frequently thinner and/or with internal laminae. Condra (1907:27) commented that near Cambridge the "flinty beds of the Niobrara are quarried for building purposes." This observation reflects the strength of this material—cryptocrystalline enough to knap easily but strong enough to maintain good cutting edges.

Thin sections of the jasper have been prepared, representing each of the brown, yellow, red, and green variations in the thinly bedded jasper, which sometimes includes opal threads, but have not been described to date. The color variations appear to reflect the occurrence of oxidized to gleyed conditions in the original sedimentary environment. Preliminary x-ray diffraction, x-ray fluorescence, and neutron activation have been completed with the jasper (Hudson 1975), but the analyses were inconclusive. David Ives (1975; cf. Ives 1984; Luedtke 1992) also completed preliminary neutron activation analysis of the jasper. He noted that compared with other materials with which he had worked (e.g., Hartville Uplift, Flattop, Alibates, Flint Ridge, Knife River stone), the Smoky Hill jasper (1) was far more difficult to fracture into lamellar flakes, (2) was extremely difficult to grind to a powder, and (3) had a higher arsenic, iron, and antimony content. Myers (1995:63) has noted that Smoky Hill jasper samples seen under normal light as an opaque yellow-brown-red are black under either long-wave (366 NM) or short-wave ultraviolet (254 NM) light. Except for one point of an apparently aberrant design (Figure 7.11e), this author has noticed no convincing evidence that the Smoky Hill jasper was prehistorically pretreated or thermally altered, nor is there any documentation of such activities.

Brice's (1966) study of erosion and deposition in the Medicine Creek drainage identified the T-2A terrace in which the Red Smoke site is deposited as the Stockville terrace (cf. May 1992). Prior to the site's occupation Lime Creek had been subjected to major late Pleistocene stream degradation and erosion, and the archaeological deposits date to the period when the valley was beginning to aggrade again. This is true of most known Paleoindian sites in the Plains (cf. Knudson 1991). Hence the Smoky Hill jasper that is now just above the water table would have been exposed and available to knappers for exploitation from the first occupation of the Red Smoke site. Throughout the early and middle Holocene the valley continuously aggraded, covering the jasper exposures. Only in the past thousand years or so has the valley again eroded down to the Smoky Hill jasper bedrock exposures.

GREEN QUARTZITE

The Cambridge and Medicine Creek Reservoir area is the westernmost edge of Kansan period glacial drift, including boulders of green Sioux quartzite, and there is a Tertiary green Ogallala quartzite (Banks 1990:94-96; Barbour 1915; Church 1994) that outcrops in the region. Hurst and Rebnegger (1999) have noted the use of green quartzite for Oklahoma Paleoindian tools, but all of their described materials originate in secondary gravel deposits. The source of the green quartzite material used for some of the Red Smoke artifacts has not been determined.

SILICIFIED WOOD

Silicified wood is found in glacial gravels in the local area but in small amounts.

RED AND YELLOW OCHRE

Davis (1954a:63-64; cf. Roper 1991b, 1996b; Tankersley et al. 1995) noted that the Red Smoke inhabitants "were using red and yellow ochre, which like the jasper is available nearby." This author is currently unaware of such bedrock source locations.

The Red Smoke Assemblage

Detailed analysis of the Red Smoke assemblage has not been completed, but it has been reactivated.³ This researcher's evaluation of the assemblage identifies more tools than did Davis in 1954 because many of the 1952- and 1953-collected artifacts were not included in his dissertation. For example, Davis (1954a) notes only 28 points in the Red

Smoke assemblage; Table 7.3 documents 64 of them. In lieu of a detailed technological evaluation of the entire collection, experience with the collection provides a basis for some generalizations about the overall organizational variability in the multizone assemblage.

Absent a computer-aided sort of the more than 1,800 described tools (Knudson 1979b, 1979c), some of Davis's 1954 (1954a:Tables I and II) relative frequencies of artifacts are noted here. Davis identified 41 percent of the Red Smoke assemblage's tools as used flakes, 18 percent as "knives," 16 percent as "thin side scrapers," 8 percent as used cores, 6 percent as "chopper/hand axes," and only 1.5 percent as projectile points. However, in discussing the Zone 88 assemblage Davis (1954a:68) noted, "The most common artifacts are blades [1950s terminology referring to bifaces, not true blades] and choppers, making up 267 fragments and complete artifacts, or 53% of the total worked flint from this zone." Figure 7.7 illustrates the diversity of designed bifacial tools and some of the tools made from flakes removed from bifacial cores relatively early in the design execution process.

Very few artifacts of materials other than flaked stone were found at Red Smoke. A bone tube was found in Zone 78 (Davis 1954b:5). In 1953 (Davis 1954b:6) a grinding stone with red ochre stains was identified in Zone 83, and another grinding stone with quantities of yellow and red ochre was found in Zone 90. Davis (1954a:376, 1954b:6) noted that the polished tip of a bone awl or needle had been found in Zone 88 in 1952, and red and yellow ochre were also found in cultural zones 91 and 92. Careful analysis of the faunal materials from the site might identify more bone artifacts because preservation was apparently good.

LITHIC RAW MATERIALS

Lithic materials are significant clues in interpreting the cultural interrelationships of the people who used and left debris at the Red Smoke site (cf. Andrefsky 1994). Whereas most of the assemblage is made of Smoky Hill jasper (Figures 7.7-7.9) and is presumed to be from local outcrops, jasper from the Smoky Hill member could have been acquired from bedrock sources 100 or more miles to the south in Trego, Gove, and Logan counties, Kansas (Hattin 1981).

Several "foreign" materials are represented in the Red Smoke collection (Figures 7.10 and 7.11). A 25FT42 point midsection, point base, and worked thin flake tool are made of Alibates agatized dolomite (Banks 1990:91-92) that lies as bedrock 300 miles to the south, and a worked thin flake tool is of Edwards Plateau chert (Banks 1990:58-61; cf. Hofman 1996) that outcrops 600 miles south of Medicine Creek. Two finished points are made of Nehawka flint (Blackman 1907) that

Table 7.3. Red Smoke (25FT42) Assemblage Points and Point Fragments (Knudson 1971-1975, 1979b, 1979c)

Data ^a	Perm. No. ^b	Field No.	Feat. No. ^c	Davis Ref.	Material ^d	Artifact Condition	Bevel	Zone	Depth ^e
C	—	1628-51	—	—	Unknown color SHJ	Proximal half	Present	—	—
C	—	1632-51	—	—	Unknown color SHJ	Proximal half, apparently broken in reworking	—	—	—
UI	—	943-52	1360	—	Brown-yellow SHJ	Distal fragment	Present	88	89.9
UI	—	982-52	1375	—	Red SHJ	Split midsection	—	—	—
P, RK, UI	—	1163-52	1399	—	Yellow SHJ	Base fragment	—	88	91.0-91.5
C, P, RK	—	1167-52	1400	—	Brown SHJ	Complete	Present	88	90.1
UI	—	1528-52	1531	—	Brown SHJ	Medial and terminal segment ^f	—	—	—
C, UI	—	1529-52	1548	1954a:82; 1954b:6	Hartville Uplift quartzite	Midsection w/top of stem; "Eden" point	—	88 ^g	89.7
UI	—	1958-52	1644	—	Green-black SHJ	Medial and terminal segment	—	—	—
C, P, RK	—	1829-52	1604	—	Orange SHJ	Mid and proximal segment	—	88	88.85
C, P, RK	—	1869-52	1612	—	Brown-yellow SHJ	Complete	Present	88	88.1
UI	—	1986-52	1652	—	Brown-yellow SHJ	Complete	No data	—	—
UI	—	2019-52	1668	—	Brown SHJ	Medial and terminal segment	No data	—	—
P, RK	—	2020-52	1669	—	Green SHJ	Base fragment	—	88	90.0-90.5
P, RK	—	2102-52	1699	—	Orange-yellow SHJ	Base fragment	—	88	88.9

Table 7.3. *Continued*

Data ^a	Perm. No. ^b	Field No.	Feat. No. ^c	Davis Ref.	Material ^d	Artifact Condition	Bevel	Zone	Depth ^e
C, P, RK	—	2121-52	1710	—	Red SHJ	Complete except for distal tip, not a finished piece	—	—	Spoil dirt
P, RK, UI	—	2061-52	1685	—	Red-brown SHJ	Proximal fragment, being reworked	—	88	90.1
C, UI	—	2294-52	1729	—	Hartville Uplift chert	Base fragment	—	88	88.8
C, P, RK	—	2295-52 ^b	—	—	SMJ, color not specified	Complete	Present	—	—
UI	—	635-53	—	1954b:13	Green SHJ	Complete	Present?	83	—
UI	—	1513-53	—	—	Brown-yellow SHJ	Medial and terminal segment	Present?	—	—
C,RK	A7555 ⁱ	634-47	—	1954a: Table II	Nchawka flint	Nearly complete point, converging heavily ground proximal edges, broken tip may have been a drill	Present	—	—
UI	A7601	719-47	—	—	Silicified wood	Medial and terminal segment	—	—	—
P, UI	A8223	804-51	—	—	Yellow SHJ	Complete picce, probably still unfinished ⁱ	—	88	89.7
UI	A8233	1000-49	2	1954a: Table II	Brown-yellow SHJ	Complete	No data	—	—
—	A8235	—	—	1954a:66, Table II, Pl. XIIa	Yellow SHJ	Nearly complete but one edge broken, pentagonal	No data	90	88.3

UI	A8236	552-51	656	1954a:Table II, Pl. XIj	Brown SHJ	Medial and terminal segment	—	91	91.0
UI	A8237	570-51	670	1954a:Table II, Pl. XIi	Brown SHJ	Medial and terminal segment	—	91	91.0
UI	A8238	1695-51	1070	1954a: Table II	Brown-yellow SHJ	Complete	No data	90	91.8
UI	A8240	635-47	—	—	Green SHJ	Medial and terminal segment	—	—	—
—	A8241	—	—	1954a: Table II	Yellow SHJ	Slender distal fragment	No data	88	89.6
C,UI	A8243	558-51	—	1952:Pl. VIIa; 1954a:73, Table II, Pls. XIVh, XVb; Meserve pt.	Silicified wood	Complete	Present	88	88.25
UI	A8244	792-51	796	1952:Pl. VIId; 1954a:71, Table II, Pls. XIVa, XVc	Green SHJ	Medial and terminal segment	—	88	89.3
C, RK	A8245	607-51	—	1952:Pl. VIIE; 1954a:72, Table II, Pls. XIVb, XVd	Brown SHJ	Proximal half	None	—	—
C, RK	A8246	1628-51	1224	1952:Pl. VIIf; 1954a:72-73, Table II, Pl. XIVd	Brown SHJ	Proximal half, w/rough oblique parallel flaking on one face	Suggestion only	88	88.97

Table 7.3. Continued

Data ^a	Perm. No. ^b	Field No.	Feat. No. ^c	Davis Ref.	Material ^d	Artifact Condition	Bevel	Zone	Depth ^e
C, RK	A8247	1632-51	—	1952:Pl. VIIg; 1954a:Table II, Pl. XIVf	Brown-yellow SHJ	Proximal half, being reworked?	—	88?	Backdirt
C, RK	A8248	1201-51	—	1952:Pl. VIIc; 1954a:72-73, Table II, Pls. XIVe, XVe	Brown SHJ	Complete except for distal tip; oblique parallel facial flaking	Present	88	90.42
C, RK	A8249	1216-51	1008	1952:Pl. VIIb; 1954a:Table II, Pl. XIVk	Brown SHJ	Complete	Apparently	88	90.02
C, P, RK	A8250	1162-51	—	1952:Pl. VIIk; 1954a:Table II, Pl. XIVq	Flattop chalcedony	Base fragment	—	88	90.8
C, P, RK, UI	A8251	1688-51 ^k	—	1952:Pl. VIIa; 1954a:Table II, Pl. XIVt	Green SHJ	Base fragment	—	88	89.0
C, P, RK	A8252	1210-51	—	1952:Pl. VIIo; 1954a:Table II, Pl. XC, P, CaCO ₂ RKIVl	Granular jasper, heavily covered with CaCO ₂	Base with small portion of midsection	—	88	87.5
P, RK, UI	A8253	—	—	1952:Pl. VIIm; 1954a:Pl. XIVs	Green-black SHJ	Base fragment	—	88	90.0-90.5
UI	A8254	569-51	669	1951:Pl. VIIq; 1954a:Pl. XIVw	Brown-yellow SHJ	Medial and terminal segment	—	88	88.3

P, RK	A8255	700-51	—	1952:Pl. VIIi; 1954a:Table II, gravel source? Pl. XIVp	Olive gray chert; 1954a:Table II, gravel source? Pl. XIVp	Base fragment	—	88	88.5–89.9
C, P, RK	A8256	643-50	—	1954a:Table II, Alibates agatized Pl. XIVm	Alibates agatized dolomite	Midsection with top of stem; Eden?	—	88	91.7
P, RK	A8257	1118-51	—	1952:Pl. VIIp; 1954a:Table II, Pl. XIVv	Red-brown SHJ	Base fragment	—	88	87.9
P, RK, UI	A8258	609-50	384	1951:Pl. VIIIm; Red SHJ 1954a:73, Table II, Pl. XIVu	Red SHJ	Base fragment	Present	88	91.0– 91.75
P, RK, UI	A8259 ¹	1208-51	990-	1952:Pl. VIII; 1954a:Table II, Pl. XIVr	Yellow-brown SHJ	Base fragment	—	88	90.3
P, RK, UI	A8260	1407-51	1052	1952:Pl. VIIr; 1954a:Table II, lustrous Pl. XIVx	Yellow-red jasper, lustrous	Proximal half, reworked on break and one edge	—	88	89.4
C, P, RK	A8261	815-50	—	1951:Pl. VIIIi; 1954a:Table II, dolomite Pl. XIIz	Alibates agatized dolomite	Base fragment	—	88	88.4
C, P, RK	A8262	1215-51	—	1951:Pl. VIIh; 1954a:73, Table II, Pl. XIVg	Yellow-brown SHJ	Complete except for distal tip and proximal corner	Present	88	90.1
P, RK, UI	A8263	1200-51	971	1952:Pl. VIIIi; 1954a:Table II, Pl. XIVo	Green SHJ	Base fragment	—	88	90.2
C, UI	A8264	813-50	—	1951:Pl. VIIIj; 1954a:73, Table II, Pls. XIVi, XVa; Meserve pt.	Nehawka flint	Complete	Present	88	88.37

Table 7.3. Continued

Data ^a	Perm. No. ^b	Field No.	Feat. No. ^c	Davis Ref.	Material ^d	Artifact Condition	Bevel	Zone	Depth ^e
UI	A8441	1732-51	—	—	Green-black SHJ	Medial and terminal segment	—	—	—
C, RK	A8786	1046-52	—	1953b:Pl. III, <i>top left</i>	Brown SHJ?	Complete	Slight	88	90.5–91.0
C, P, RK	A8787 ^m	1687-52	88	1953b:Pl. III, <i>top right</i>	Green SHJ	Complete	Present	88	—
P, RK	A8788	1688-52	—	—	Brown SHJ	Proximal half, perhaps reworked midsection; heavy use wear on lateral edges, no basal grinding	—	88?	Disturbed gully fill
C, RK	A8789	1937-52	—	1953b:Pl. IIIa; 1953b: Pl. III, bottom (<i>a</i>)	Silicified wood	Complete, w/thicker lenticular x-sec, stubby distal end, converging ground basal edges w/unground concave base	None	83	84.1
P, RK, UI	A8790	2101-52	1698	1953b:Pl. IIIb	Brown-yellow SHJ	Base fragment	—	80	79.4
C, RK	A8792	639-50	—	1954a:73, Table II, Pls. XIV <i>j</i> ; Meserve pt.	Unidentified chert or moss agate	Complete	Present	—	Slump
C, P, RK	A8793	555-50	—	1951:Pl. VIII <i>k</i> ; 1954a: 72–73, Table II, Pl. XIV <i>c</i>	Yellow-brown SHJ	Proximal half of a complete unfinished point broken in manufacture process; rough oblique parallel facial flaking	—	88	88.6

UI	A8801	515-53	—	1954b:16-17	Red-brown jasper, perhaps SHJ	Complete except for extreme tip; material flaw near tip may have resulted in discard of the piece; oblique parallel facial flaking	None	80	84.2
—	A8802	—	—	1954b:18	Yellow jasper	Apparently complete	No data	78	—
P, RK	R3036	512-53	—	1954b:12	Red-brown SHJ	Complete; reworked midsection of longer tool, restemmed and edge ground, strong alternate beveling	Present	88	—

^aC = casts available; P = black-and-white photograph and negative held by R. Knudson; RK = tool illustrated and described by R. Knudson at the University of Texas in 1971 or in Lincoln or Moscow through 1975; UI = item included in the electronic database generated at the University of Idaho in the 1970s.

^bInsofar as R. Knudson was aware in the 1970s, the 1952- or 1953-excavated points had not yet been assigned permanent numbers.

^cR. Knudson has no identification of these numbered features at present.

^dSHJ = Smoky Hill jasper. All identifications are based on macroscopic evidence.

^eMeasurements in feet.

^fThe UI database (Knudson 1976a) was designed to run SPSS programs on data from 80-column data sheets and had limited flexibility as compared with today's systems. A single column was used to record Artifact Condition with attributes that didn't identify distal vs. proximal end being present when combined with a midsection remnant.

^gDavis's dissertation (1954a:82) and the catalog cards disagree regarding whether the parallel collaterally flaked point midsection was found in Zone 91 or 89, but his 1953 field report places the "Eden" piece in Zone 88 (Davis 1954b:6).

^hThis is of a "classic" Red Smoke design with marked beveling and beautiful workmanship.

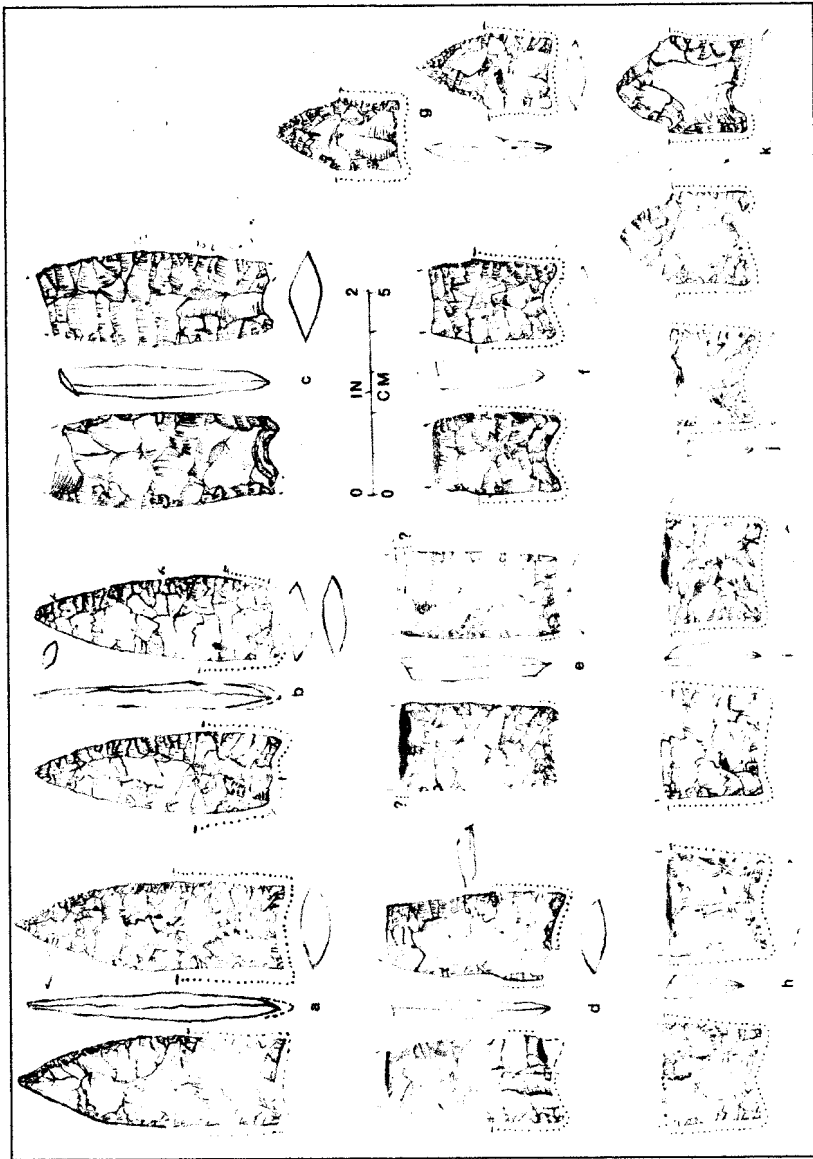
ⁱOriginal find at Red Smoke, found by Allen Graffham, and called a "Yuma" point.

^jThe UI catalog erroneously identifies this as an 01 (used flake) instead of a 17 (projectile point).

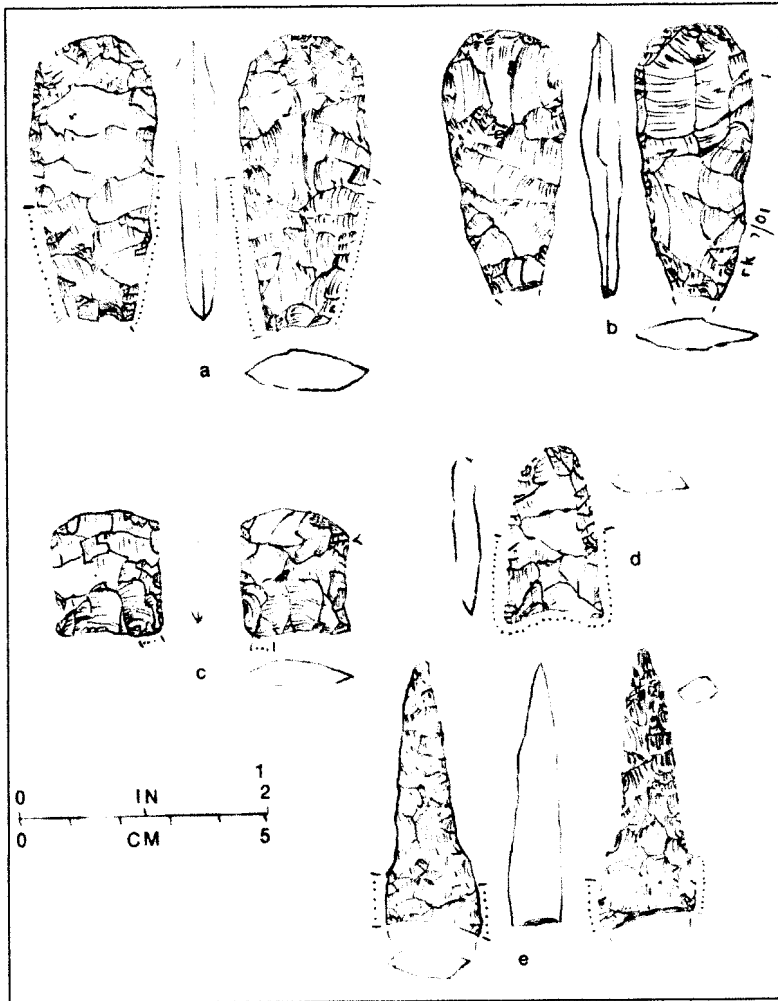
^kThe UI catalog (Knudson 1979b, 1979c) erroneously lists this field number as 1658-51.

^lThe UI catalog erroneously transposed numbers and listed the permanent number for this piece as A8529.

^mThis is the "classic" Red Smoke design.



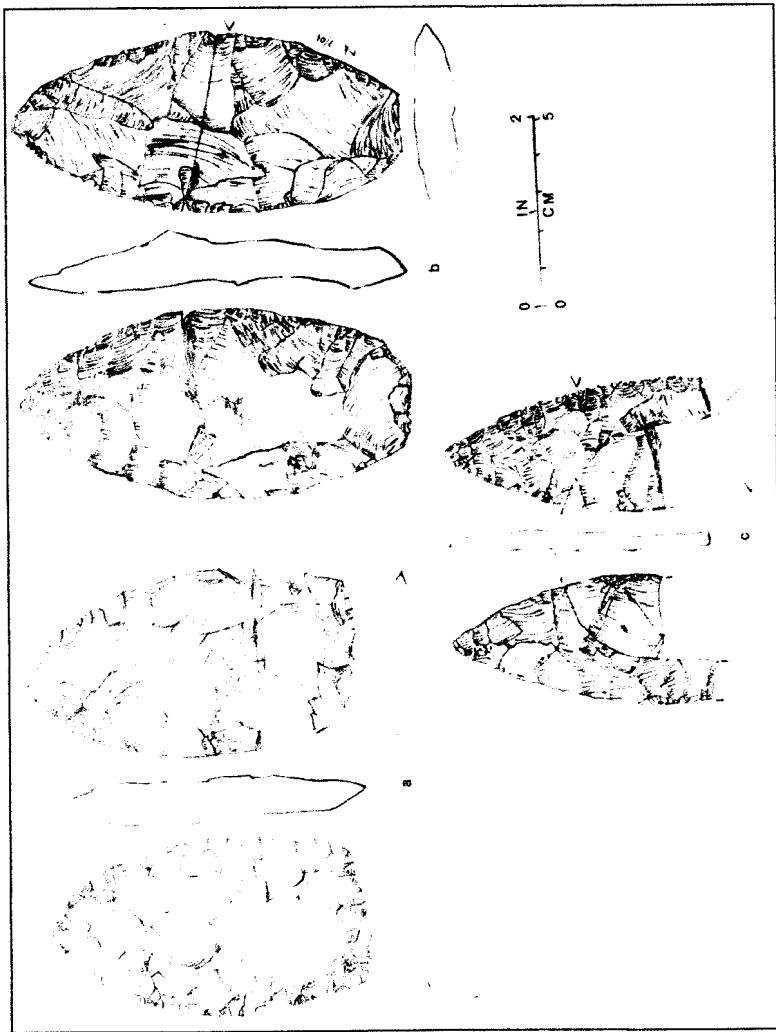
7-7. Red Smoke points or point fragments, Smoky Hill jasper: (a) A8787/1687-5I; (b) 2295-52; (c) 2121-52; (d) A8262/1215-5I; (e) A8793/555-50; (f) A8252/1210-5I; (g) 1167-52; (h) A8263/1200-5I; (i) A8253; (j) A8251/1688-5I; (k) 1869-52.



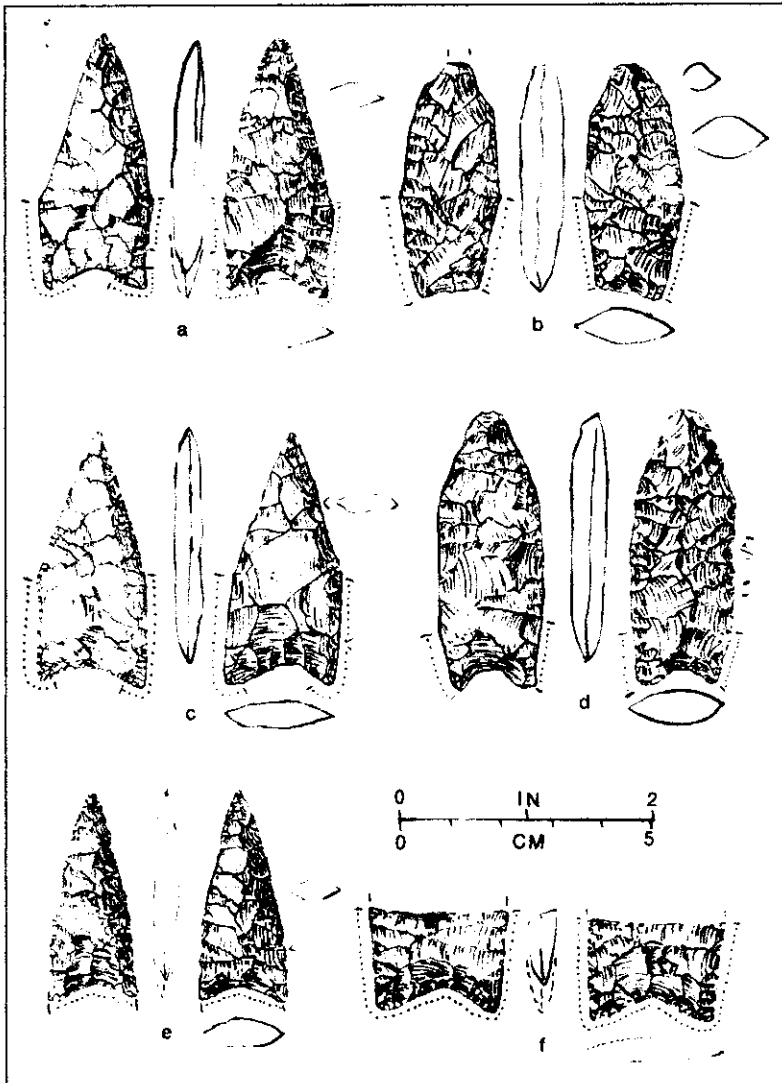
7.8. Red Smoke gouges and drills, Smoky Hill jasper: (a) 2362-52; (b) 2328-52; (c) A8257/III18-51; (d) R3036/512-53; (e) 2295-52.

outcrops 300 miles to the east of Red Smoke, and two other Meserve-like points (Table 7.3) of an unlabeled chert or moss agate may also be of material from the Nehawka outcrops.

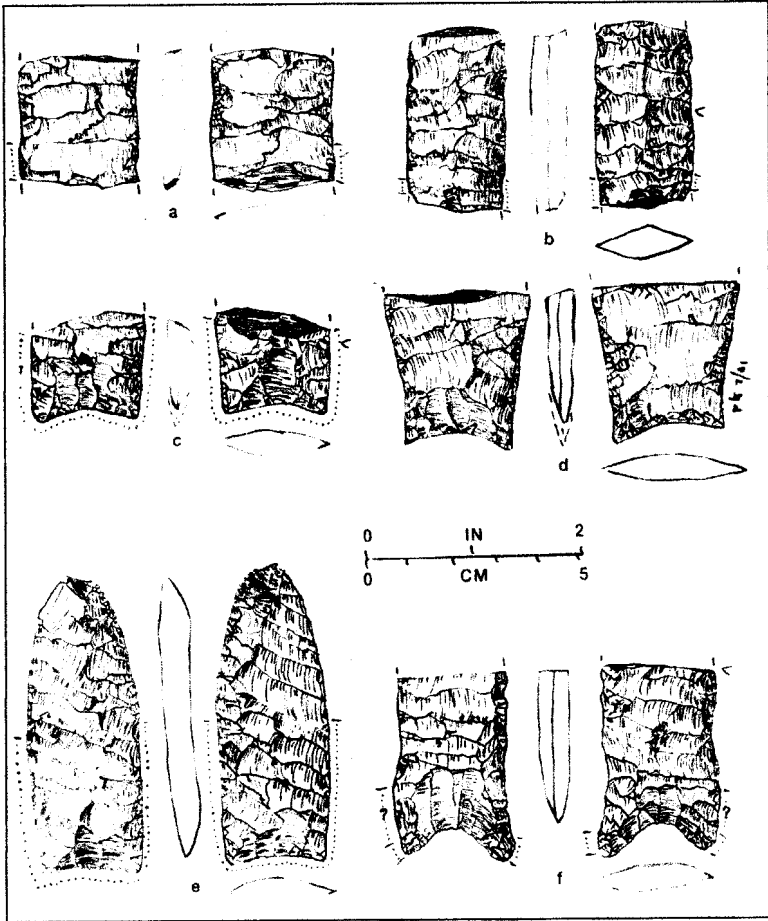
Distinctive lithic materials probably from the west are also found in the Red Smoke assemblage. The assemblage has several pieces of silicified wood, including two points and two worked flake tools. Both of the flake tools could have been made on river cobbles or from surface remains. Both points fit well within the Red Smoke design and reshap-



7-9. Red Smoke blanks or preforms, Smoky Hill jasper: [a] A8222/I1788-5 I; [b] A2028I/I766-52 and A20942/I764-52; [c] A8495/I205-5I.



7.10. Red Smoke points or point fragments, nonlocal material: (a) A8264/813-50, Nehawka flint; (b) A7555/634-47, Nehawka flint; (c) A8243/558-51, silicified wood; (d) A8789/1937-52, silicified wood; (e) A8792/639-51, unidentified chert; (f) A8250/1162-51, Flattop chalcedony.



7.11. Red Smoke points or point fragments of nonlocal material and/or aberrant styles: (a) A8256, Alibates agatized dolomite; (b) 1529-52, Hartville Uplift quartzite; (c) A8261/815-50, Alibates agatized dolomite; (d) 2294-52, Hartville Uplift chert; (e) A8801, high quality jasper that may be from the Smoky Hill member; (f) 1829-52, high quality jasper that may be from the Smoky Hill member.

ing pattern discussed below. There is a wide distribution of silicified wood eroding from Tertiary deposits in northeastern Colorado, west of the Medicine Creek drainage (Toepelman 1924:14), with collectors taking particular note of collecting localities in the upper reaches of the Arikaree and Republican rivers in Yuma County, Colorado (Voynick 1994:200-201). Henderson (1920:49) noted that in the Wildcat Creek District (north of Fort Morgan on the South Platte River), "[t]he divides between gulches are usually strewn with large pebbles of jasper, chal-

cedony, silicified wood and other debris, probably derived from weathering of Tertiary conglomerates, perhaps the Arapahoe formation." The same was true for the high ground south of the South Platte at Julesburg, Colorado. Renaud (1931:56-63) noted the presence of "Lower Dakota Formation petrified wood . . . [which is] also found in Tertiary Gravels throughout [eastern Colorado]." Silicified wood is frequent in the Late Paleoindian Claypool site Cody assemblage (Dick and Mountain 1960) from northeastern Colorado, some 150 miles west of Medicine Creek, as are tools made of Smoky Hill jasper. In 1971 this author had the opportunity to document Harold Andersen's collection of materials from Claypool (cf. Wormington 1957:128-132; now curated at the University of Nebraska State Museum, Lincoln) and recorded several point tips and bases of the Smoky Hill jasper, as well as one poorly made jasper point that fits well within the Red Smoke point design variations. More than a dozen finely made points of silicified wood were in the Andersen Claypool collection, complementing Renaud's 1931 observations of the use of such wood for designed Paleoindian points.

Smoky Hill jasper was a common raw material in the Hell Gap complex assemblage from the Jones-Miller bison kill site in the Arikaree valley near the Colorado-Nebraska border (Stanford 1974, 1975, 1978, 1979a, 1984), as was Hartville Uplift chert, Flattop chalcedony, Alibates agatized dolomite, and silicified wood. However, the small Frasca site assemblage in the Pawnee River drainage north of the South Platte valley, which was assigned to the Cody complex (Fulgham and Stanford 1982), is identified macroscopically as being made of Flattop chalcedony (Greiser 1983; cf. Hoard et al. 1992, 1993; see below) or local quartzite or chert. The Frasca site is 25-30 miles south of the Flattop quarry.

The Red Smoke assemblage has a few artifacts of light to pinkish gray chalcedony that could come from glacial gravels or from bedrock sources to the west and northwest. There are a number of identifiable agate or chalcedony sources in the Oligocene Chadron formation of the Nebraska Panhandle and its bordering states, the White River Group Silicates (WRGS) (cf. Miller 1996:47; Myers 1995). There are at least three documented prehistoric WRGS quarry areas, including locations on Nelson Butte and West Horse Creek in the southern Black Hills in the vicinity of the Ray Long site in the Cheyenne River drainage, on the Wyoming side of Table Mountain west of Signal Butte, and at the above-referenced Flattop Butte or Mesa (Hoard et al. 1992:Figure 1). The Flattop quarries are found on the far northern Colorado border

southeast of Cheyenne, some 200 miles northwest of Lime Creek. Hoard et al. (1992, 1993) comment that the WRGS are generally macroscopically indistinguishable and are best differentiated by neutron activation analysis. Although not disagreeing with that premise, this author has macroscopically identified one well-made point base and another worked flake tool from Red Smoke as being made of Flattop chalcidony. In my experience the Flattop materials are somewhat denser and pinker than are materials from other WRGS sources.

Two fragments of well-worked points in the Red Smoke assemblage are probably of materials from the Hartville Uplift in Wyoming (Dorsey 1900; Duguid and Bedish 1968; Francis 1991; Knight 1898; Miller 1991; Reher 1991; Saul 1969; cf. Myers 1995), some 300 miles northwest of the site. One of the Hartville Uplift pieces is a quartzite mid-section of a stemmed point, and the other is a fine-grained dendritic chert (see below).

LITHIC TECHNOLOGY

The Red Smoke assemblage is difficult to analyze because of its (1) size, (2) relative paucity of "diagnostic" artifacts, (3) stratigraphic and horizontal depositional complexity, (4) temporal breadth, (5) assumed socioeconomic variability of its occupants as they adapted to changing ecologies and resource availabilities, and (6) the now historic nature of its original investigations. The basic Red Smoke flaked lithic reduction strategy represented in Zone 88 artifacts focuses on production of bifaces from the generally tabular Smoky Hill jasper found adjacent to the site. A lot of knapping was done at Red Smoke over the centuries. At the same time, the frequency of point bases and tips (Table 7.3) suggests that quite a few hunters were bringing carcasses or joints back to the site for processing (food, bone, hides, sinew?) while replacement points were being made.

Although there are not a lot of complete or nearly whole designed bifacial points in the Red Smoke collection, most of them share some striking attributes. The Red Smoke assemblage is characterized by a bifacial reduction technology applied to relatively thin slabs of local high-quality cryptocrystalline raw material and secondarily by bifacial reduction of cobbles and blocks of relatively coarse-grained quartzite and perhaps stream cobbles. No detailed technological analysis of the collection has been conducted to date, but a pattern of final jasper point production by relatively unregimented 1-cm-wide bilateral and bifacial thinning to produce a lenticular cross section is evident. No attempts have been conducted to replicate these tools in the local jas-

per, but it appears that even the final thinning could have been done by soft percussion; it might also have been done by pressure flaking with a relatively wide flaking tip.

There is strong evidence that recycling (Wyckoff 1999:46)—that is, alteration of a tool's edge or shape so it can be used to perform a new function—was part of the Red Smoke technology (Figure 7.7). This is in contrast to resharpening, which allows a tool to continue to perform the same function that it did or for which it was intended before becoming broken or damaged. The complete or thinned/shaped Red Smoke bifacial points are designed and well-executed tools, whose symmetrical longitudinal and general cross sections reflect considerable time investment (material selection, initial reduction, and final facial thinning and edging) by skilled knappers. There is marked alternate beveling on the distal lateral edges of the lanceolate bifaces of several "points" made of either Smoky Hill jasper or Nehawka flint (Figures 7.7 and 7.10), which would have different ballistics than do unbeveled points when used as a projectile. Beveling provides a stronger and more abrupt cutting edge for use as a symmetrically balanced and relatively thin knife and also conserves tool stone for a longer period if it was indeed reduced from a tool with a smoothly lenticular cross section. O'Brien and Wood (1998:93) question whether the "Dalton" alternate beveling wasn't a primary engineering-design feature of projectile points, that like modern arrow points there are a variety of point sizes, configurations, and weights with different uses made by people represented by that "complex." The fact that the beveling occurs on artifacts that appear to represent the largest (and presumed desired original tool form) of the Red Smoke points (e.g., Figures 7.7a, 7.9c, and 7.11e) would support initial construction of at least some of the beveling as a primary design element; those points could have been reworked to either resharpen or recycle them. Note that there is marked alternate beveling on a well-finished piece that has been classified as a "knife" rather than a "point" (Figure 7.9c). Sollberger (1968a, 1968b) noted that bifacial edging was probably an important factor in resharpening bifacial points used as knives.

Proximal edges of the Red Smoke points are generally slightly concave and may be more or less thinned, in a manner common to the Plainview site assemblage (hence the original appellation). However, the tools with beveled edges tend to have more indented bases. Basal and proximal lateral edge grinding is generally light, and there is no evidence of shoulders on the designed tools or tool fragments.

This author has been involved in comparisons of Plains Paleoindian

point typology for more than 30 years (cf. Wormington and Knudson 1967 [Red Smoke was identified with the Meserve-Dalton complex]). The complete Red Smoke point represented by artifact no. 8787 (Figure 7.7a), which appears to represent many of the jasper-made Red Smoke points in Zone 88, stands out as unique in known Paleoindian assemblages. It may have been the basis for Irwin's (1967:67) recognizing a unique Medicine Creek complex in the Red Smoke and Allen sites.

Bifacially reduced points in the Red Smoke assemblage have a predominant style—relatively undistinguished facial flaking with patterned tool reshaping. This description is not intended to be used as a type in traditional Paleoindian systematics but is the dominant assemblage trait. However, a few aberrant pieces in the assemblage have caught scholars' attention over the past half-century and have been used to characterize the whole collection. These merit notation.

- A diagonally flaked point of a perhaps thermally altered high-quality jasper that may be from the Smoky Hill member [catalog number 8801, in Zone III (Zone 80; Figure 7.11e; Table 7.3)]
- A parallel collaterally flaked pinkish Hartville Uplift quartzite midsection with a 4–8 mm suggestion of a proximal stem [field number 1529-52; Zone V (Zone 88); Figure 7.11b; Table 7.3]
- A wide, smoothly lenticular-cross-sectioned, converging base proximal point fragment with a concave thinned proximal edge, facial flaking tending to wide diagonal patterning, probably of Hartville Uplift chert [field number 2294-52, Zone V (Zone 88); Figure 7.11d; Table 7.3].

The temporal significance and original manufacturing site of these unusual Red Smoke assemblage pieces is questionable. The Zone 80 piece could be fit somewhere in the Agate Basin Angostura rubric of the western Plains, as could the fine jasper base that is probably from Zone 89 (see Table 7.1). The Zone 89 quartzite midsection has been labeled "Eden" (Davis 1954b:6) or "Cody" (Irwin 1967:67) but is unique within the Red Smoke site. Note that a stemmed parallel collaterally flaked point fragment of Hartville Uplift chert was a unique item in the neighboring Lime Creek assemblage's Level I (Davis 1962:63–65; Figures 10A and 24 "Scottsbluff point" [no. 7554]). The points demonstrate only that the layers in which they were found cannot be older than the period for which they are considered characteristic elsewhere around the Plains. None of them was recorded as being found in a

krotavina; they are assumed to be part of the cultural debris of the people who left the other artifacts with which the points are associated.

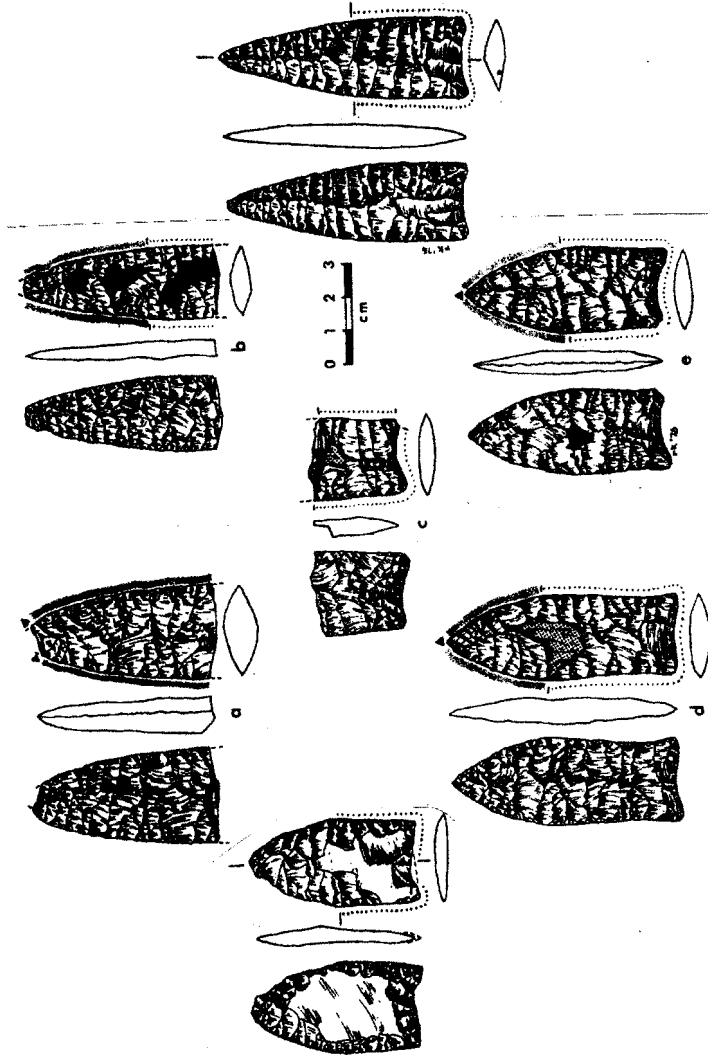
Several of the bifaces in the assemblage (e.g., Figure 7.8a–b) could be labeled “gouges,” and there are a few “drills” (e.g., Figure 7.8e).

Assemblage Comparisons

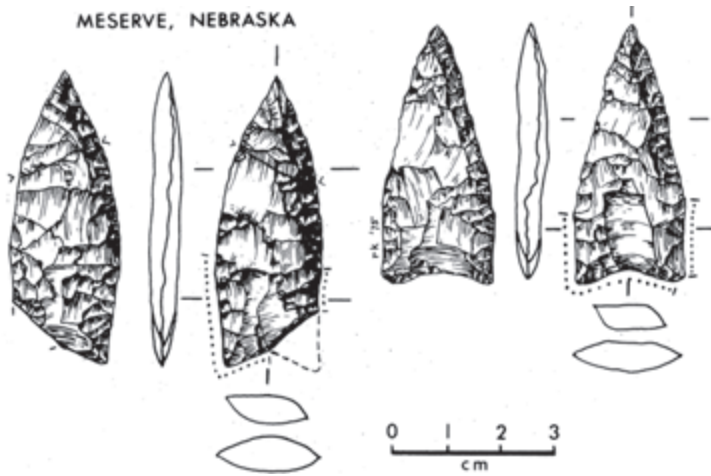
PLAINVIEW

When Davis was excavating and reporting on the Red Smoke site, he was doing so in the context of identifying an overall preceramic culture history of the central High Plains (Davis 1954a). Over a decade and a half, Harvard professor J. O. Brew had guided Davis, H. Marie Wormington (1957), and Henry T. J. Irwin (1967) to complete doctoral studies that would make sense of what in the 1940s had been identified as the Folsom-Yuma question (Knudson 2000a; Wormington 1944, 1948). Paleoindian excavations had been recognized as such for only a generation or so, there were very few reliable data sets, and radiocarbon dating was in its infancy (cf. Taylor 1997). The Plainview site (41HA1) in Texas was a striking example of well-documented lithic analysis by a respected scholar in typology (Krieger 1947), working with a single-component small collection supported by well-respected geomorphologists. It was the ideal comparative collection for Davis’s Medicine Creek artifact analyses in a geomorphic context. Striking similarities between the Red Smoke and Plainview artifact designs (especially unregimented, relatively unpatterned final facial thinning; basal thinning) can be noted. But there are overall technological, functional, and design differences between the two assemblages that make the comparison problematic.

The Plainview site (Figure 7.3) is a bison-butcherer locale in Running Water Draw on the eastern edge of the Llano Estacado, Texas Panhandle, south of the town of Plainview and 500 miles south of Red Smoke (Guffee 1979; Knudson 1973, 1983; Sellards et al. 1947). Shell from the site was radiocarbon dated to 9800 ± 500 years ago and two Plainview bone apatite samples have been dated to $10,200 \pm 400$ and 9860 ± 180 years ago (Hofman 1989:38; all Plainview dates are uncalibrated). Plainview lithic technology (Knudson 1973, 1983; Figure 7.12) apparently involved prepared polyhedral cores and specialized flake production, with maximum technical conservation. Bifaces were rare, and final point form depended first on the form of the flakes struck from cores of high quality cryptocrystalline rock (e.g., Edward Plateau



7.12. Selected points from the Plainview Bison Quarry (41HAr) assemblage [Knudson 1973, 1983; (far left) Texas Memorial Museum [TMM] catalog number 725-9; (a) Everett Bryan collection no. 5; (b) TMM 725-12; (c) TMM 725-13; (d) TMM 725-5; (e) Carson Stambaugh collection no. 1; (far right) TMM 724-4.



7.13. The complete collection of artifacts from the Meserve site (25HA1), Hall County, Nebraska. University of Nebraska State Museum catalog numbers 7079 (left) and 7080 (right).

chert, Alibates agatized dolomite). When long blades were struck, they were bifacially reduced enough that they had narrow, well-regimented parallel collateral flakes laid down both faces. When only thin small flakes were removed, they were made into points as well—but sometimes they were only flaked around the edges because they did not need thinning. Flakes that were wider than long—that is, not blades—were thinned or otherwise reduced in whatever manner was needed to result in a pointed tool that could be used either as a projectile, stabbing tip, or cutting edge. The Plainview site tool kit may have been made by a single highly skilled artisan. There was no evidence of tool rejuvenation or recycling at the site, but there is a lot of edge damage on the artifacts. Other assemblages that share these attributes, especially the reduction strategy and technology, have been included under the Plainview complex (Knudson 1998). The Red Smoke assemblage does not fit this model.

MESERVE

The Meserve site (25HA1; Meserve and Barbour 1932; Schultz 1932; Wormington 1957:113–114; Figure 7.3) is in Hall County, Nebraska, on the south bank of the Platte River, some 90 miles east of Lime Creek. A flaked stone point (Meserve and Barbour 1932:Figure 151; Figure 7.13 *left*) associated with skeletal remains of what was identi-

fied as *Bison occidentalis* was found in 1923, well before the Folsom site evidence of the contemporaneity of artifacts and extinct animals had been accepted. The site was investigated in 1931 (Schultz 1932), and another tool (Figure 7.13 right) was also found in association with the *Bison* remains. Both artifacts are made of Nehawka flint and have alternate beveling on their distal edges. The concave-based lanceolate Meserve biface (Figure 7.13 left) duplicates in form, facial flaking, and beveling the Red Smoke Zone 88 point A8787 (Figure 7.7a; Table 7.3) in all but material; the Meserve piece is of Nehawka flint, whereas the Red Smoke piece is of Smoky Hill jasper. The reworked alternate-beveled Meserve point (Figure 7.13 right) has marked similarities to several Red Smoke artifacts; point no. 8264 (Figure 7.10a) is Nehawka flint and no. 8792 (Figure 7.10e) is an unidentifiable chert that may be from the Nebraska Flint Hills that produce the Nehawka materials (Table 7.3; cf. Myers and Lambert 1983:111). The site has been dated only by its extinct faunal materials, which were deposited in a highly carbonaceous clay silt. The Meserve site artifacts have been included within the Dalton complex (Goodyear 1982; Myers and Lambert 1983; cf. Klippel 1971), which Goodyear (1999) currently dates to 10,500–9,900 years ago in the southeastern United States.

ALLEN AND LIME CREEK

As mentioned, Red Smoke has at least two companion sites along Lime Creek in the Medicine Creek drainage in southwestern Nebraska, the Allen (25FT50) and Lime Creek (25FT41) locations.

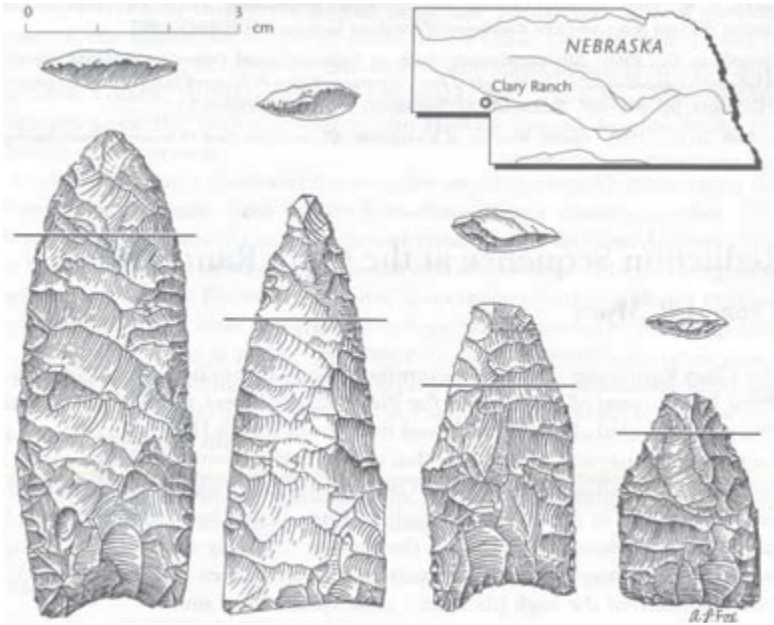
The Allen site is on Medicine Creek just below the Lime Creek confluence and has been the subject of analysis since 1947, first by Preston Holder and Joyce Wike (1949) and more recently by Douglas Bamforth (n.d., this volume). Bamforth has concluded that the Allen site was occupied intermittently between 11,000 and 8,000 years ago, with two major components at either end of that continuum. Twenty projectile points, 132 bifaces, 5 drills, and 29 scrapers constitute the full site assemblage, including two points ascribed to the Agate Basin style in the lower level and parallel obliquely flaked points in the upper (Bamforth 1991b:361). Most of the points have thick cross sections and no patterned facial flaking and are made of Smoky Hill jasper, although one point is made of Alibates agatized dolomite (Bamforth 1991b:363). Holder and Wike (1949) identified “trapezoidal scrapers” as an Allen assemblage tool class, and Bamforth (1991b:362) notes that these are commonly “made on end-shocked biface fragments, with the broken

edge worked uniaxially to form the bevel" and comments on their similarity to Clear Fork gouges of the southern Plains (Howard 1973; Ray 1941; Wormington 1957:116). Most of the bifaces represent early stages of biface tool reduction, reflecting the site's proximity to bed-rock deposits of Smoky Hill jasper.

The Lime Creek site (Davis 1962) was excavated in 1949 and 1950 and has many similarities to the Red Smoke site, with intermittent use throughout the overall period in which Red Smoke was used (May 1992, this volume). Its interpretation has suffered from the same dilemma as has Red Smoke: a few points whose shape was immediately recognizable a half century ago as fitting a "type"—Scottsbluff, Plainview, Milnesand—without good recognition of the full range of variation in the assemblage. The Zone I stemmed tool with relatively wide parallel collateral facial flaking and one lateral edge somewhat angled (no. 1313-47/7554, Wormington 1957:Figure 39 *left*; Davis 1962:Figure 10A) is made of red to dark red-gray Hartville Uplift chert. There is a relatively thick, parallel obliquely flaked tool base with beveled proximally converging lateral edges from the upper level, which could have been either a point or a gouge/scrapper. The assemblage is dominated by Smoky Hill jasper reduction debitage and bifaces in various production stages. The assemblage merits a detailed description and analysis before more can be said about it.

RED WILLOW GRAVEL PITS AND OTHER CENTRAL NEBRASKA LOCATIONS

Paleontological and archaeological excavations in Gillen and Davidson wet gravel pits in Red Willow County, immediately southwest of Medicine Creek (Corner and Myers 1976), identified a variety of faunal remains and three isolated jasper bifaces that mirror some of the attributes found in the Red Smoke assemblage. No detailed description of these pieces is available, but they are indicators that other sites may be located in T-2A terraces around southwestern Nebraska. Myers (1995) has noted the presence of similarly designed isolated finds from the upper Loup River drainage of the eastern Nebraska Sand Hills, several of them made of Smoky Hill jasper, as well as of WRGS, Hartville Uplift, and Knife River (Ahler and VanNest 1984; Clayton et al. 1970) material. In complement Roper (1998:Figure 5a-a') collected a lanceolate point made of silicified wood, which appears to be beveled with unregimented parallel-oblique facial flaking, from deposits at the Schudel site (25GY12) on the North Loup River. This minimally diag-



7.14. Projectile points from the Clary Ranch site (25GD106), Garden County, Nebraska. University of Nebraska State Museum field numbers, from left to right, A79-28-2, A83-5-4, A79-28-1, A83-5-6 (Myers 1997 and museum catalog records). Used with permission of the Center for the Study of the First Americans, Corvallis, Oregon.

nostic artifact was tentatively labeled an “Angostura” point and compared to verbal descriptions of materials from the Medicine Creek Allen site.

CLARY RANCH AND ASH HOLLOW

The Clary Ranch site (25GD106; Hill et al. 1997; Myers 1997; Myers et al. 1980, 1981; Figure 7.4) is a Paleoindian bison-butcher site off the Ash Hollow valley on the south side of the North Platte River some 110 miles northwest of the Lime Creek valley. The Medicine Creek drainage reaches north some 30 miles to a flat loessial divide that drains further north 15 miles to the Platte River—an easy traverse between the two areas. The Clary Ranch site has not been radiocarbon dated. The archaeological remains reflect a secondary meat processing area, where at least 17 bison carcasses were intensively stripped in the late spring to early summer. Thirteen points (Figure 7.14) were found



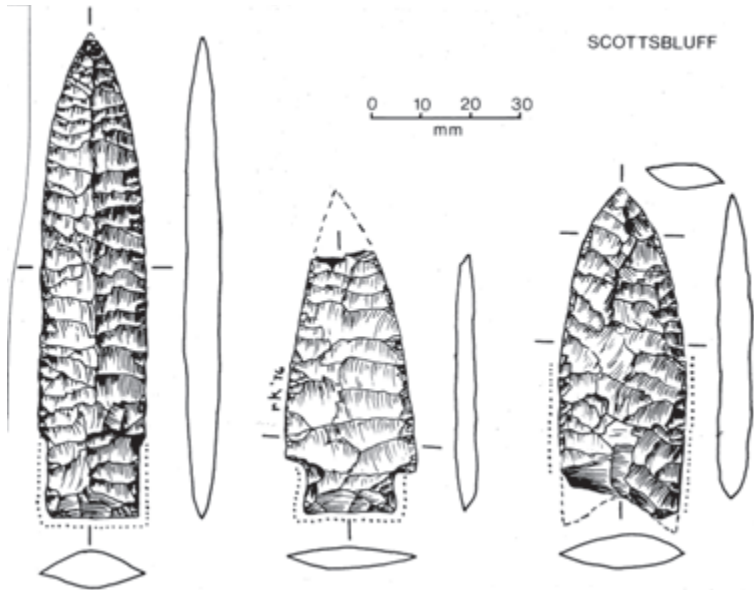
7.15. The Scottsbluff Bison Quarry (25SF2), from the north in May 1971, with Signal Butte (25SF1) in the background. Photograph by Ruthann Knudson.

among the bones, with retouch debitage and scrapers. The tools are made of Smoky Hill jasper, White River Group chalcedonies, or Hartville Uplift chalcedonies, and the points are facially thinned with relatively wide oblique facial flaking and alternate beveling at their distal ends.

The Ash Hollow site (25GD4), John Champe's (1946) dissertation site, is located in the Ash Hollow valley at the southern edge of the North Platte valley and was excavated in 1939. The undated Lens G, the lowermost level at the site, included fireplaces and charcoal but no culturally diagnostic materials. An oblique flaked chalcedony point and a parallel collateral flaked brown jasper point midsection (Champe 1946:38) were found elsewhere in the site. These two artifacts probably represent prehistoric artifact collectors but reflect the interplay of Paleoindian material and design selection in the region.

SCOTTSBLUFF AND SIGNAL BUTTE

The Scottsbluff Bison Quarry (25SF2; Barbour and Schultz 1932, 1936; Bell and Van Royen 1934; Knudson 1997; Schultz and Eiseley 1935; Figures 7.3 and 7.15) is along Spring Creek, just below Signal Butte on the south side of the North Platte valley, some 200 miles northwest of Red Smoke. It was excavated in 1932. The site apparently repre-

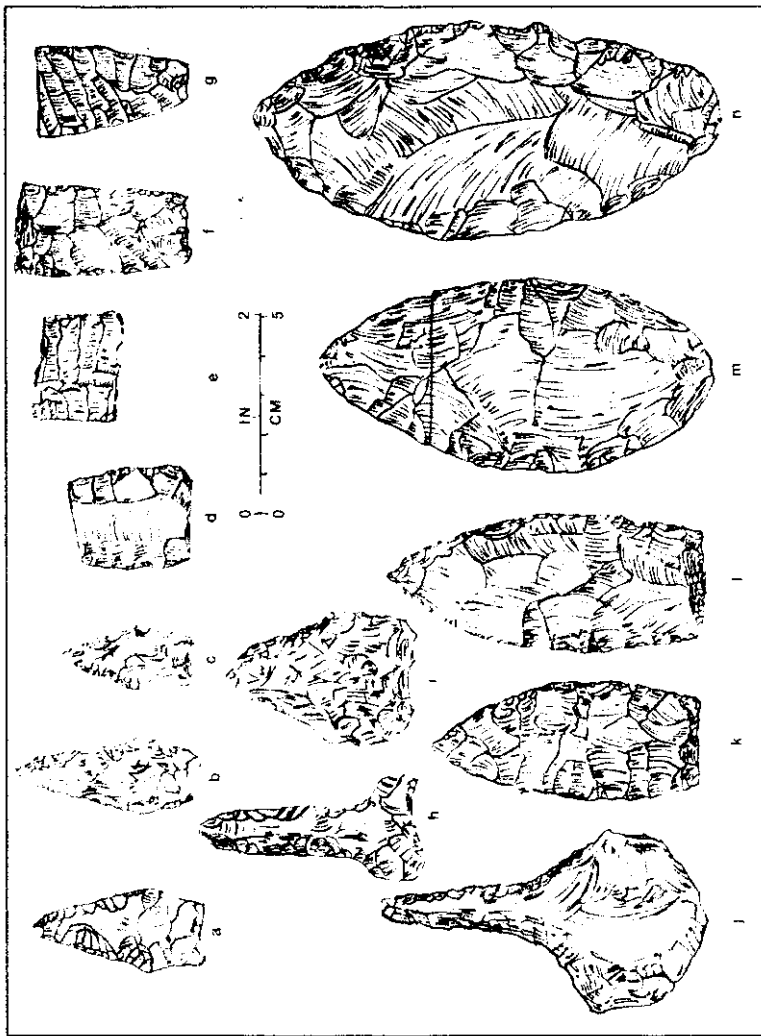


7.16. Three of the four points from the Scottsbluff Bison Quarry (25SF2), Scottsbluff County, Nebraska. University of Nebraska State Museum catalog numbers, from left to right, 7071, 7073, 7072.

sents a spring or early summer single-event kill of 30 *Bison antiquus* (Todd et al. 1990), and eight artifacts including four “points” were associated. Three of these points are illustrated in Figure 7.16 (cf. Barbour and Schultz 1936:Figure 202; Wormington 1957:Figure 38), one of which (Figure 7.16 center) has been used for over two generations as the *Scottsbluff Type Point*. Wormington (1957:118–119, 137) referred to this artifact as a Scottsbluff Type II point, labeling the longer point a Scottsbluff Type I point (Figure 7.16 left), and ascribing both to the newly identified Cody complex. The third complete point from the Scottsbluff Bison Quarry (Figure 7.16 right) was identified as a “Plainview” point by Wormington (1957:117–118), who also noted that the point has similarities to points in the Lime Creek and Red Smoke site assemblages and has a slight alternate bevel on its proximal end and facial flaking that varies between irregular collateral to oblique. The distal end and midsection of a fourth point, a relatively thick piece with relatively unregimented facial flaking that also varies between irregular collateral to oblique, has strongly serrated proximal edges (perhaps retouched?).

The four points from the Scottsbluff site, with three used flake tools, are apparently White River Group Silicate material (Forbis et al. n.d.:5). There is a major WRGS outcrop within a few miles of the quarry and veins of the silicate atop Signal Butte (see below); but the shouldered point's pinkish hue (probably not from annealing) suggests its material originated in the Flattop area, and the brown-beige tone of the long point suggests it may be from the Chadron area. Whatever, the materials are all probably relatively local. The remaining Scottsbluff site artifact is a scraper made of a red-brown to dark gray chert that probably originated in the Hartville Uplift—this author has found such cherts in North Platte River gravels dredged up in the Scottsbluff area. Barbour and Schultz (1936:434, 440) noted that a number of red-brown flinty chalcedony (WRGS?) flakes were found in the excavations but that those had subsequently been lost.

The Signal Butte site (25SF1; Forbis et al. n.d.; Strong 1933, 1935; Figures 7.3 and 7.15) sits atop an isolated butte at the northern edge of the Wildcat Hills just southwest of the Scottsbluff Bison Quarry site, where loess has blown upslope, settled and been covered with vegetation, and weathered to form several soil horizons over time. The site is at approximately 4,500 feet a.m.s.l. elevation. The site is underlain by a thin layer of Pleistocene gravels and a caprock that includes veins of WRGS chalcedony (Bliss 1950), and most of the flaked stone in the lower level is of that material. William Duncan Strong excavated the site in 1931–1932 under the sponsorship of the Smithsonian Institution. The site's stratigraphic and artifactual complexity mirrors Red Smoke in some ways, although with a greater extent of time, compressed temporal units, and subject to the forces of wind rather than riverine erosion. The site is a privately owned National Historic Landmark and may have considerable intact deposits remaining, but its extant archaeological collections provide evidence of use of the butte top throughout the Holocene. A number of the artifacts (Figure 7.17) suggest that the site was used during the early Holocene, and some of the bone from the lowest Level I was partially mineralized (Strong 1935:228). Medium-sized lanceolate or leaf-shaped points with concave bases were frequent in Level IA, many of which were classified as "McKean" by Bliss, and the level included bone knapping tools, awls, gouges, incised fragments, and beads. There was a large quantity of debitage and flake tools, and Strong concluded that Level I represented a workshop, as well as a habitation site. It is impossible to determine whether some of the Paleoindian-looking tools represent tool users on-



7.17. Selected tools from Signal Butte 1, redrawn from Forbis, Strong, and Kirby (n.d.), with what appear to be associated catalog numbers: (a) no. 779 [Figure 30v]; (b) no. 850 [Figure 30t]; (c) no number [Figure 30u]; (d) no. 429 [Figure 28f]; (e) no. 1186 [Figure 28g]; (f) no. 1175 [Figure 28h]; (g) no. 202 [Figure 28i]; (h) no. D-1656 [Figure 29d]; (i) no. 874 [Figure 30s]; (j) no. 397 [Figure 29e]; (k) no. 702 [Figure 26g]; (l) no. D1624 [Figure 26f]; (m) no. 1170 [Figure 26r]; (n) no. 861 [Figure 26s].

site or whether they also represent prehistoric artifact collectors. However, the assemblage and site merit more attention than they have had in the recent past.

HELL GAP AND JAMES ALLEN

The Hell Gap site (48GO305; Irwin 1967; Irwin and Wormington 1970; Irwin et al. 1965; Irwin-Williams et al. 1973; Sellet 1999; Figure 7.3) consists of at least five localities in a sheltered valley draining the Haystack Range in the Hartville Uplift of eastern Wyoming. This is some 300 miles northwest of the Red Smoke site via the North Platte valley, on the western edge of the High Plains. The site was discovered in 1958, tested in 1959 and 1960, and excavated by Harvard University in 1961 through 1966 (Knudson 2000b); it was reinvestigated by George Frison and Vance Haynes in 2001. The site was occupied from the Folsom period through Archaic times, and its assemblages were used to define the Goshen, Hell Gap, and Frederick point types (Agogino 1961; Agogino et al. 1964; Frison 1991; Irwin 1967). Locality V contains an extensive Cody component, complementing a Locality I Cody assemblage. The Cody complex, including Eden and Scottsbluff points, has been dated to between 9,300 and 8,800 years ago (Frison et al. 1996:15). The Locality V Cody remains represent a residential campsite of people knapping Hartville Uplift cherts and quartzites and processing bison from late spring to early winter (Knell 1999).

A post-Cody Frederick complex was identified at Hell Gap Locality I in 1962 (Irwin 1962) and dated to between 8,400 to 8,000 years ago in the original investigations (Irwin-Williams et al. 1973:50-51). A Frederick point type was identified in the 1962 field investigations report (Irwin 1962:Figure 1), where a plan view of an associated circular rock structure was illustrated. Irwin (1967:46) described the Frederick level as being "a rich, living surface isolated from the Cody material by 2-5 inches of sterile alluvium and colluvium." The Frederick point type was described at an international symposium of the American Association for the Advancement for Science in the early 1960s (Agogino et al. 1964:Figure 1D, no. 1352) as

large, wide, unstemmed, and lanceolate with a long slender tip and a wide concave base . . . laterally asymmetrical "diamond" shape in cross section. . . . [Bifacial flaking is] typically wide, shallow, oblique, and parallel, but with significant variation which includes both horizontal and oblique collateral orientation. . . . [F]laking runs from the lateral edges commonly beyond the mid-

line . . . fine retouch on the lateral edges . . . basal edges are usually thinned by the removal of small flakes longitudinally from the base toward the tip. . . [B]ase and proximal portions of the blade are commonly heavily ground.

From the Frederick component Irwin illustrated two points (Figure 8 [1 and 2]; cf. Irwin-Williams et al. 1973:Figure 4 [9]), two side scrapers (Figure 8 [7 and 8]), an end scraper (Figure 9 [1]), and an asymmetrical knife (Figure 9 [4]) in his 1967 dissertation; the knife is also illustrated in Irwin-Williams et al. 1973:Figure 5(6). Note that Irwin considered the Frederick component to be "post-Itama." *Itama* (a Blackfoot word meaning "good hunting" [Irwin 1967:7, 1971]) was the label Irwin used to characterize the remains of the Paleoindian hunting culture that he saw as extending from the post-Clovis Folsom through the Plano period, ending with the Cody assemblages. In contrast, Irwin (1967:9) considered the Red Smoke assemblage to be contemporary with the Itama Culture but to be "typologically quite foreign," based on his handling of the Red Smoke materials. Irwin (1967:9, 66-67) did not associate the Red Smoke materials with Hell Gap's Frederick component. Ongoing analysis of the Frederick component from Locality I of the Hell Gap site will provide important new data for understanding these interrelationships (George Frison, personal communication 2001).

The James Allen site (48AB4; Mulloy 1959; Wormington 1957:144-146; Figure 7.3) lies in the upper Laramie River drainage just south of Laramie, Wyoming, at an elevation of about 7,400 feet a.m.s.l. in open country just north of a minor ridge. The Laramie River drains into the North Platte, debouching into that river at Fort Laramie just south of the Hartville Uplift. The James Allen site is 300 air miles from Red Smoke (and probably another 50 river miles when routed up the North Platte and Laramie valleys). It was excavated by William Mulloy of the University of Wyoming between 1951 and 1954 and yielded remains of *Bison antiquus* or *B. occidentalis* with flaked stone tools and debitage. Charred bison bone from the site was dated to 7900 ± 200 years ago (M-304; Mulloy 1959:113; Wormington 1957:146) in the early era of radiocarbon assays. The site's tools include fragments of 30 points, only three of which are nearly complete tools, each characterized by oblique parallel flaking that extends about two-thirds of the way across the face, leaving a lenticular cross section with thin, sharp edges. Mulloy and Wormington characterized the facial flaking as "excellent" and "extremely well flaked," even in quartzite, but Mulloy's

illustrations (1959:Figure 1) exhibit considerable variation in the obliquity and regularity of the facial flaking. Bases are typically indented and ground, with a barely perceptible constriction of the proximal third of the points. Mulloy notes, "There is a tendency for small chips to break off the edges of the distal third of the point" but also comments that there is little or no edge retouch. The assemblage includes six scrapers and two scraper/knives. The materials are fine-grained quartzite, jasper, or agate and are probably from the Hartville Uplift, a hundred or so miles north-northeast of James Allen. Mulloy suggested that the assemblage points be used to define an "Allen" point type. Irwin (1967:51) assigned the James Allen site to the Frederick complex. However, this author believes that the uncertain nature of the radiocarbon date, fragmentary nature of the tools, and lack of detailed description and illustration of them indicate that this assemblage should be used as a single comparative point and should not be considered "typical" of any specific technology and adaptation.

RAY LONG (ANGOSTURA), SIOUX COUNTY,
AND NOLAN BLOWOUT?

The Ray Long site (39FA65), in the Angostura Reservoir on the Cheyenne River at the south end of the Black Hills in southwestern South Dakota, was excavated between 1948 and 1950 by Richard Wheeler (1995) as part of the Smithsonian Institution's River Basin Survey project. The reservoir is some 275 air miles north-northwest of Red Smoke, around the western end of the Nebraska Sand Hills across the Pine Ridge and White River to the Cheyenne River valley. The site was reinvestigated at various times between 1985 and 1992 by the Office of the South Dakota State Archeologist and Augustana College (Albanese 1986; Hannus 1986; Scott and Lewis 1986); these investigations included an evaluation of the "Angostura" points from the site by Marvin Kay and Bruce Bradley. Radiocarbon dates from the site have varied from 11,000 to 7,000 years ago, without good control of the contexts of dates, stratigraphy, and artifacts. Hughes (1949:270) identified a "Long" point from the site, which Wheeler subsequently relabeled the "Angostura" point: "These may be characterized briefly as large lanceolate specimens with narrow, straight to concave bases; fine sometimes oblique flaking; and ground edges near bases."

Hughes (1949:Figure 68s) and Wheeler (1995:Figure 43b) illustrated several artifacts from Area C of the Ray Long site, including a small apparently reworked point that appears to be alternate beveled. One knife (Wheeler:Figure 43a) and perhaps a second (Wheeler:Figure 43d)

appear to be beveled, as does a drill with oblique facial flaking (Wheeler: Figure 43h). Hughes (1949:270) noted the presence of an assemblage artifact that resembled a Clear Fork Gouge.

A cache of Burlington chert Dalton-like bifaces has been found in the Black Hills of South Dakota (Michael Fosha, personal communication, 2002).

Over the years the Angostura point label has come to include anything with oblique flaking, no matter how regimented or haphazard. The tool illustrated in Agogino et al.'s American Association for the Advancement of Science (AAAS) paper (1964:Figure 1A) has only haphazard oblique flaking if that—the drawing isn't very good. But it is definitely not the tightly regimented obliquely flaked "Angostura point" illustrated in Wormington (1957:Figure 45), which was actually found on the surface by Wheeler in Dawes County, Nebraska (University of Nebraska State Museum, no. 7278). Barbour and Schultz (1936:Figures 201 and 202) illustrate a long, narrow (Eden-like?) point whose tightly regimented parallel facial flaking looks oblique in its overlapping pattern, as well as one with obliquely directed flake scars, apparently an isolated find from Sioux County in the far northwestern corner of Nebraska. The White River breaks there yielded dozens of Plano points in the 1920s and 1930s. The Wormington-illustrated "Angostura" point looks to this author most similar to points from the Nolan Blowout (25CH4) in Chase County, southwestern Nebraska (Barbour and Schultz 1936:444). The blowout was collected and tested by T. M. Stout in the 1940s and is housed in the University of Nebraska State Museum. Its assemblage includes 29 points or knives, 11 of which are Folsom; but many of the rest have finely regimented oblique facial flaking and at least 30 flakes, used flakes, or debitage pieces. The Nolan Blowout tools are predominantly made of WRGS (Flattop) chalcedony although at least one point is made of a dendritic strong brown Hartville Uplift chert. We do not know much about "Angostura" points either (even in their area of original labeling, much less those from the southern Plains), but there are intriguing hints of similarities between the Ray Long and Red Smoke assemblages.

Patterns and Thoughts

Throughout his writings on the Red Smoke site, E. Mott Davis characterized many of the project points as being of the Plainview type (Krieger 1947). In fact, this author first encountered the Red Smoke materials at the University of Texas while working on a dissertation on the

Plainview site collection (Knudson 1973, 1983; Figure 7.12). Collections from both Plainview and Red Smoke were then stored at the University's Balcones Research Laboratory in Austin. When the Plainview analysis was completed, it was apparent that the Plainview complex (Knudson 1998) was characterized by a very specialized lithic reduction, design, and use system and that the Red Smoke materials did not fit that rubric. Based on personal experience with both the Red Smoke and Plainview assemblages, Henry Irwin (1967:66-67) concurred in that opinion, as did LeRoy Johnson (1989:42).

DALTON

The alternate beveled points from Red Smoke, most of them apparently from Zone 88, are evidence of ties to craftspeople whose artifacts are labeled the Dalton complex east and south of the Medicine Creek drainage (Figure 7.3). In fact, a few of the Red Smoke points mirror both the lithic raw material and point designs found in the Meserve (Knudson 1974a, 1975; Meserve and Barbour 1932; Schultz 1932; Figure 7.13) tools. The similarities of the Meserve and Dalton materials (Logan 1952) have been noted many times in the past (e.g., Goodyear 1982; cf. Myers and Lambert 1983). The Red Smoke and Meserve points appear to reflect the broad Dalton pattern of artifact reduction, design, use, and recycling or resharpening accompanied by hunting and gathering exploitation of a mosaic of grasslands and forests (McGahey 1996:372-375, O'Brien and Wood 1998:93; cf. Schiffer 1995; Wood and McMillan 1976). Johnson (1989:41-44) noted that the Red Smoke artifact assemblage had strong similarities to Woodland Dalton assemblages and characterized the Woodland influences into the High Plains as being "plains interlopers." The undated Acton site from the T-2 terrace in the Brazos River valley west of Fort Worth (Blaine et al. 1968) has an assemblage that was originally characterized as Plainview, Angostura, Scottsbluff, San Patrice, and Meserve, and there is a suggestion of "gouge"-like tools in the assemblage. The Packard site (34MY66) assemblage of northeastern Oklahoma (Wyckoff 1985) is another apparent example of the interrelatedness of Woodland-oriented Dalton and Plains-oriented people and again is a stratigraphically complex lithic workshop (Saline Creek gravels) and habitation site. The Packard complex is associated with a hearth dated at 9,400 years ago; is characterized by collaterally flaked, edge-and-base-ground, and unfluted lanceolate bifaces; and underlies Dalton remains at that site. The pre-Dalton tools share design similarities with the Lubbock assemblage from the Lubbock site on the edge of the Texas High Plains (Knudson et al. 1998)

and with the Golondrina complex (Johnson 1989) but not obviously with the Plainview site assemblage (Knudson 1973, 1983). In their recent overview of Great Plains Paleoindian materials, Hofman and Graham (1998:115–116) noted the Dalton era prairie-woodland interaction in the southern Plains; the Red Smoke assemblage demonstrates a comparable pattern in the Central Plains area.

THE MEDICINE CREEK COMPLEX

In Nebraska the Dalton influence, as it is reflected in alternative-beveled distal lateral edges on projectile points, is apparent at the Meserve site, at Red Smoke, and at the Clary Ranch site in western Nebraska. It may be evident in the Lime Creek assemblage (e.g., Davis 1962:Figures 19B and 20A). In general, based on the available information, the Allen, Lime Creek, or Red Smoke collections seem to reflect the same range of point and other tool design, production technology, and use and discard patterns even if the proportions of various forms differ among the sites and their various components. Because of the lack of detailed artifact analysis at any of these collections, it is currently impossible to compare with any confidence those whole assemblages with Dalton whole assemblages from the east and southeast.

In complement to the Dalton connections, the Red Smoke assemblage has similarities to apparently contemporary materials on the western edge of the central High Plains. Greiser (1985:85) characterized the Red Smoke assemblage as reflecting Frederick materials from the Hell Gap assemblage, and the "Frederick" assemblage there is in the process of being described and defined based on new data (George Frison, personal communication 2001). Irwin personally reviewed all the assemblages to which he compared the Hell Gap collections (including Red Smoke, Lime Creek, and Allen) and had a prodigious memory, many notes, and a synthesizing perspective. He noted (Irwin 1967:66–67, 109–110) that the Red Smoke materials were more related to Meserve than to Plainview and that a possible "Frederick" point had been found in the cultural unit two levels beneath the "Meserve" occupation, that is, presumably in Zone 80 (Irwin 1967:70; apparently Figure 7.11E here). He noted the presence of the parallel collateral points at Red Smoke and Lime Creek, considered typical of the Cody complex. Overall, Irwin thought that the dominant assemblages in the Red Smoke and Allen sites merited their own "Medicine Creek complex" label (Irwin 1967:67), and this author would extend that label to all three of the Medicine Creek Paleoindian sites discussed in this chapter. Their combination of "eastern" and "western" attributes in

that locale appears to be more than fortuitous. Indeed, this author would include the known assemblages from Red Smoke, Allen, Lime Creek, Clary Ranch, and Scottsbluff under that rubric and recommends that researchers take a close look at the relationships among those assemblages and post-Folsom deposits in southwestern South Dakota, western Nebraska, and southeastern Wyoming and at the evidence of eastern southern Plains "interlopers."

In that context, is there a relationship to the alternate beveling characteristic of Dalton in the east and Cody knives in the west, which appear to have overlapping temporal and geographic ranges?

THOUGHTS

The current literature places lanceolate, unfluted, relatively thin bifacial points with a variety of facial flaking, proximal form, and basal thinning patterns, with or without stems or even notches, around the edges of the Great Plains from the tundra to the Rio Grande throughout a period of 2,000 to 3,000 years at the late Pleistocene–early Holocene paleoecological transition. What does it all mean? Hofman (1996:75–83) has provided an excellent summary of problems in Central Plains Paleoindian and Mesoindian archaeology, with citations of various arguments and discussions about those issues. All that need not be repeated here, although some insights specifically related to Red Smoke and a cultural ecotone are introduced here.

Kill sites often tell us little about complex hunter-gatherer adaptations and interconnections (cf. Bamforth 1994); I suspect their tool kits may reflect individual artisans more than they do broader sociocultural patterns (cf. Bamforth 1991a; Bradley and Stanford 1987; Knudson 1973, 1983, 1998), and the tools frequently are intensively used discards. However, the habitation sites (e.g., Lindenmeier, Lubbock Lake, Wilson-Leonard), including those that are also quarry/workshop sites (e.g., Allen [NE], Hell Gap, Lime Creek, MacHaffie, Packard, Ray Long, Red Smoke, Signal Butte), have much more sociocultural information, but their stratigraphic and deposition complexity is usually so great that they are minimally analyzed, much less published. This is particularly true of the quarry workshops, with their vast quantities of debitage. Note that most of these are at natural ecotones, either along the plains-prairie/woodland border or the mountain-plains edge area (cf. Frison 1992; Figure 7.3); this author is assuming that they represent original land use patterns more than they do recent erosion patterns.

Despite issues of chronology and typology, this author continues (cf. Knudson 1974a, 1976b) to hypothesize that in and around the Plains during the late Pleistocene–early Holocene paleoecological transition

at least two technologically and stylistically discrete but contemporary cultural patterns coexisted with relatively disparate geographical ranges but some shared cultural information. The Medicine Creek complex sites represent the prairie-plains border landscape of skilled flint knappers, hunters, and foragers, at least during the early Holocene period, when the Smoky Hill jasper was available for quarrying, supplemented by the WRGS materials, and whose range extended west and north onto the Plains. There was a similar cultural landscape in the Hell Gap vicinity, where people were focused on the availability of Hartville lithic material, complemented by a range oriented primarily north and west into the northwestern Plains but also extending east to overlap the Medicine Creek complex landscape. These landscapes may have been established when the grasslands reached their maximum extent at the end of the Younger Dryas and were maintained for two to three millennia (Johnson and Park 1996), with minimal need for changes in human subsistence patterns and hence tool technologies until the latter part of that period, when climates were again changing and foraging became more common. Throughout this period changes in design elements may reflect individual knappers and lithic design fashions more than they do subsistence changes or major sociocultural identifications, with a relatively "fat" economy supporting lithic artisans who invested extra energy to find the right materials for the right tool design. Knives and spoons have not changed function for millennia; their technologies have had long periods of continued use, but their designs or styles have shown frequent changes in both individual artisans' preferences and cultural fashion variations. Interaction of members of different landscapes could have led to the sharing of artifact and other styles and trade and exchange across regions. This could have resulted in such distinctive archaeological remains as a Cody-style stemmed point midsection of Hartville material from Wyoming in the Red Smoke site, along with two to four small alternately beveled points of eastern Nebraska Nehawka flint.

In sum, Red Smoke and the Medicine Creek complex assemblages appear to reflect a Late Paleoindian cultural as well as natural ecotone in the eastern central High Plains of North America, as well as a transition to what today we call "Archaic."

MORE THOUGHTS

How do we use the information from assemblages such as Red Smoke and the other Medicine Creek Paleoindian assemblages to write a history of people's use of the region and, within that historical frame-

work, the anthropology of those people (cf. Lyman and O'Brien 2000)? H. Marie Wormington's chronological framework of Plains Paleoindian prehistory was a major contribution when completed in 1957, but nearly a half-century later we have learned that its unilineal evolutionary framework reflecting early paleontological and archaeological approaches does not work well or tell us much about the involved people. Review of the Medicine Creek Paleoindian assemblages gives a strong signal that we need to move away from Wormington's set of labels. Researchers need to consider the information and insights that could be provided by taking the time and effort to do the detailed attribute and modal analysis espoused in ceramic analyses such as those by Irving Rouse (1939), complemented by tool wear analysis following Semenov (1964; cf. Kay 1999) and a suite of ethnographic and experimental studies. If we describe an assemblage and its context, including dates and associations where possible, with explications of its technological and use patterns, we can avoid assignment of a label that comes to have a life of its own. Statements of comparison with other assemblages, noting the distribution of attributes and associates, doesn't need a label. That requires an acceptance of uncertainty with which many researchers are uncomfortable, but it provides more opportunities for learning and understanding the anthropology of the past.

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Jonathan O. Davis was a graduate student at the University of Idaho when he participated in the 1974 Red Smoke field trip with his parents, E. Mott and Beth Ogden Davis, and provided me with evaluations of site soils and geomorphology. Throughout the 1970s he assisted me with leads to the geological literature, the computerization of the arti-

fact and debitage data, and staff problems. He was a close friend and colleague, and I miss him as well. Carl Phagan joined the Davises and me at Red Smoke in 1974 and provided insights about the knappability of the Smoky Hill jasper and green quartzite. Loren Eiseley and Warren Caldwell of the University of Nebraska Department of Anthropology directed me to the Red Smoke collection location in the museum. At the University of Nebraska State Museum in 1974, former director C. Bertrand Schultz and then-new director Jim Gunnerson assisted in getting the Red Smoke materials transferred from Mott Davis in Texas and incorporated into the museum collections. Curator for Anthropology Gail Loper and Associate Curator Art Wolfe helped arrange for the debitage inventory; Lloyd Tanner was, as usual, a central point of sanity during my several-week stay in Lincoln. Loper and Wolfe and F. A. Calabrese, director, National Park Service Midwest Archeological Center (MWAC), Lincoln, helped me find students to complete the required debitage inventory. While the inventory was being completed, I had an opportunity to complete detailed evaluations and illustrations of collections from the Lipscomb, Scottsbluff, and Meserve sites. Since 1974, whenever I have had questions about the collections or regional Paleoindian studies in general, Museum Curator of Anthropology Thomas P. Myers has been most helpful with information about Red Smoke, the Red Willow gravel sites, and the Clary Ranch materials.

Thomas J. Hudson was an undergraduate anthropology student at the University of Idaho in 1974–1975, and he took the lead in the physical and chemical evaluations of the jasper; he continues to be a good friend. Charles R. Knowles, Robert Lottman, William Sylvies, J. A. Smetana, and Samuel Chan of the UI staff and faculty provided material analysis support. Stephen Balogh, Missoula, Montana, prepared the petrographic thin sections, and Bill Motzer, a UI geology graduate student, completed a petrographic description of the green quartzite. Several undergraduate students, including Kara Brooke and Dan Darouin, served as work-study students or part-time employees on the project. Diana Rigg was administrative assistant for the Northern Idaho Regional Archaeological Center during the late 1970s and provided project support.

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USBR, U.S. Geological Survey (Tom G. Lovering, Robert D. Miller), McCook Chamber of Commerce, Kansas Geological Survey (Charles K. Bayne), and Beaver City Chamber of Commerce (R. E. Fisher, county agent) were of assistance, as were private citizens Charles S. Osborn of McCook and Max Wendland of Arapahoe.

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Notes

This paper is dedicated to E. Mott Davis, who for 30 years as my friend and mentor encouraged me to work on the Red Smoke assemblage analysis, and to his son Jonathan, who was also a friend, graduate school cohort, and colleague on the Red Smoke project.

1. Understanding the placement of artifacts across the Red Smoke site across six seasons of excavation is complicated because Davis used varying labels in either Roman and Arabic numerical systems and either stratigraphic or cultural designations. In his 1953 field report (Davis 1954b:5) he provided correlations included here in Table 7.1.

Note that in his final evaluation of these levels he chose to separate Zone 78 within Sedimentary Unit 1 into Zone I and Zone II “for purposes of description” (Davis 1954b:9) and that he was uncertain about how to handle the 1952-differentiated Zones 88 and 89. Zone II was identified in 1953 (Davis 1954b:17–19) as the dark humic upper one foot on top of the gray clayey silt of Sedimentary Unit 1, and Zone I is the lower portion of this unit (Davis 1954b:19–20. Cultural materials were found in both zones in 1953, including a projectile point (catalog number 8802; Table 1) in Zone II.

2. The numbers cited in Table 7.2 and the text vary from those in May’s paper (this volume), but this author has cited only that information available on the University of Texas Research Laboratory Radio-carbon Analysis Reports currently available at the university.

3. The Red Smoke artifact assemblage, especially including the debitage, is so large as to be daunting as a research project. E. Mott Davis’s 1954 Harvard dissertation was an overview of the Medicine Creek materials in the context of a further overview of all Plains Paleo-indian materials known to that date and includes the best available summary information on Red Smoke until now. However, it apparently did not include all the information collected during the 1952 and 1953 field seasons, other than an appendix generally describing the 1952 season results. The dissertation was a tremendous and quite successful undertaking. Davis moved to the University of Texas in 1956 as a lecturer and researcher, and in 1962 he published an analysis of the Lime Creek site. He compiled notes and records for a detailed analysis of the Red Smoke site and assemblage while he was teaching and conducting Texas archaeological research, and he encouraged other researchers to take on some of the aspects of the Red Smoke project. From 1971 to 1974, when I had just completed a dissertation (Knudson 1973) that focused on the Plainview and MacHaffie assemblages, with some comparisons to the Red Smoke collection, Davis encouraged me to seek funding for detailed 25FT42 research. Between the time I applied for and was granted support from the National Science Foundation (Knudson 1974a), the site’s extant debitage was found in the basement of the University of Nebraska State Museum—more than 100,000 items with provenience on the paper-bag labels. Future researchers working with this collection should know that in 1974 I was told that half of the original Red Smoke debitage collection had been used to “pave” someone’s residence driveway. The museum required that I inventory all the discovered material before loan forms would be completed that would allow me to take the materials to the University of Idaho, where I had

a research appointment. After the inventory was completed in Lincoln, one of the pages was lost in the museum's administration office; hence I was requested to reinventory the materials once I had them in place in Idaho. This was in the days before PCs! I spent the next year reinventorying and then even re-reinventorying as the work-study student assigned to the task was found to be creating fictitious records out of boredom. I have learned to do quality assurance checks ever since! In the meantime I developed an SPSS database structure for inputting records in the University of Idaho mainframe computer (Knudson 1976a) and hired students to describe, document, and photograph the Red Smoke tools. I completed line illustrations of selected tools. I was unable to acquire second-year NSF funding for the project (Knudson 1976b) and submitted a project report to NSF in 1978 (Knudson 1978). The work has awaited completion since then. However, between Mott Davis and me there is a great deal of information available on the collection (Knudson 1979a, 1979b, 1979c), including a characterization of 1,861 tools (provenience, metrics, material, use wear evidence) and bag weight and associated field numbers for 1,132 bags of debitage (with provenience data from 201 of those bags). To date there has been no quality assurance check on these data. In 2002 I had the data keyed into an ACCESS database, which is on file with Hamline University, St. Paul, Minnesota, and the University of Nebraska State Museum Anthropology Division. Casts were made of some 50 artifacts and donated to the Smithsonian's National Museum of Natural History and to the University for long-range curation (Knudson 1981), and the author has line drawings and black-and-white photographs for those and many more artifacts.