AMS RADIOCARBON DATING OF THE TYPE PLAINVIEW AND FIRSTVIEW (PALEOINDIAN) ASSEMBLAGES: THE AGONY AND THE ECSTASY

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Plainview and Firstview are two of the principal post-Folsom Paleoindian artifact assemblages on the Great Plains, but good radiometric age control for these artifact styles is relatively poor, due in part to lack of reliable age control on the type collections. This study reports the results of AMS-radiocarbon dating of specific amino acids from Bison antiquus *bone associated with the type Plainview and Firstview assemblages from the Plainview and Olsen-Chubbuck sites, respectively. Seven samples of bone and teeth from Plainview produced a surprisingly wide array of ages. As a result, the age of the bone bed and the type Plainview collection remain uncertain, but it is most likely ≥ 10,000 B.P. (but late or post-Folsom) given the dating and stratigraphic relationships at Plainview and other sites. Seven samples of bone from Olsen-Chubbuck yielded a tight cluster of ages averaging ca 9400 B.P., fitting well with other dated Firstview features on the Southern Plains. These results show that much better age control from more sites is needed in order to understand the Paleoindian record. AMS-radiocarbon dating of specific amino acids from bone has revolutionized such issues of chronology in archaeology, but like any other method, it can provide confusing results and must be used in conjunction with other chronometric data.*

Plainview y Firstview son dos de los principales ensamblages de artefactos Paleoindios post-Folsom en las Grandes Llanuras de Norte America, pero el control radiometrico de la edad de los estilos de estos artefactos es relativamente pobre, debido en parte a la falta de un control confiable de edad de las colecciones tipo. El presente estudio reporta los resultados del fechado por AMS (Espectometria Aceleradora de Masa)—radiocarbono de ciertos amino acidos en los huesos de Bison antiquus *asociados con ensamblages de tipos Plainview y Firstview de los sitios Plainview y Olsen-Chubbuck, respectivamente. Siete muestras de huesos y dientes provenientes de Plainview dieron una gama sorprendentemente amplia de edades. Como resultado, la edad exacta del lecho de huesos y de la coleccion tipo Plainview continua siendo incierta, aunque muy probablemente sea ≥ 10,000 A.P. (Pero tardia o post-Folsom) dadas las relaciones entre fechado y estratigrafia en Plainview y otros sitios. Siete muestras de hueso provenientes de Olsen-Chubbuck produjeron un grupo compacto de edades promediando approx. 9,400 A.P., lo cual se ajusta bien con otros yacimientos Firstview ya fechados en el sur de las Grandes Llanuras. Estos resultados muestran la necesidad de contar con un mejor control de edad para otros sitios a fin de apreciar el registro Paleoindio. El fechado por AMS-radiocarbono de amino acidos especificos de huesos ha revolucionado areas tales como la cronologia en arqueologia, mas como cualquier otro metodo, es suceptible de proveer resultados confusos y debe ser utilizado en conjunto con informacion cronometrica adicional.*

Plainview and Firstview are two of the principal post-Folsom Paleoindian artifact assemblages on the Great Plains of North America. Moreover, Plainview is one of the best-known late Paleoindian assemblage in North America. Good radiometric age control for these artifact styles is relatively poor, however, in comparison to other classic Plains assemblages such as Folsom or Cody (Frison 1991a; Haynes 1992, 1993; Haynes et al. 1992; Hofman 1989, 1996) due in part to lack of reliable age control on the type collections. This poor age control has contributed to the confusion over the chronology of late Paleoindian occupations on the Great Plains (Hofman 1989; Holliday 1997). This paper describes the results of AMS-radiocarbon dating of specific amino acids from bone associated with the type Plainview and Firstview assemblages. The new dates clarify some issues of post-Folsom artifact chronologies, but also raise some new issues of artifact typology. The dating process also demonstrates both the advantages and disadvantages of AMS-radiocarbon dating of bone.

The Plainview Site and Plainview Assemblage

The Plainview site is in Running Water Draw on the Southern High Plains of northwestern Texas (Figure

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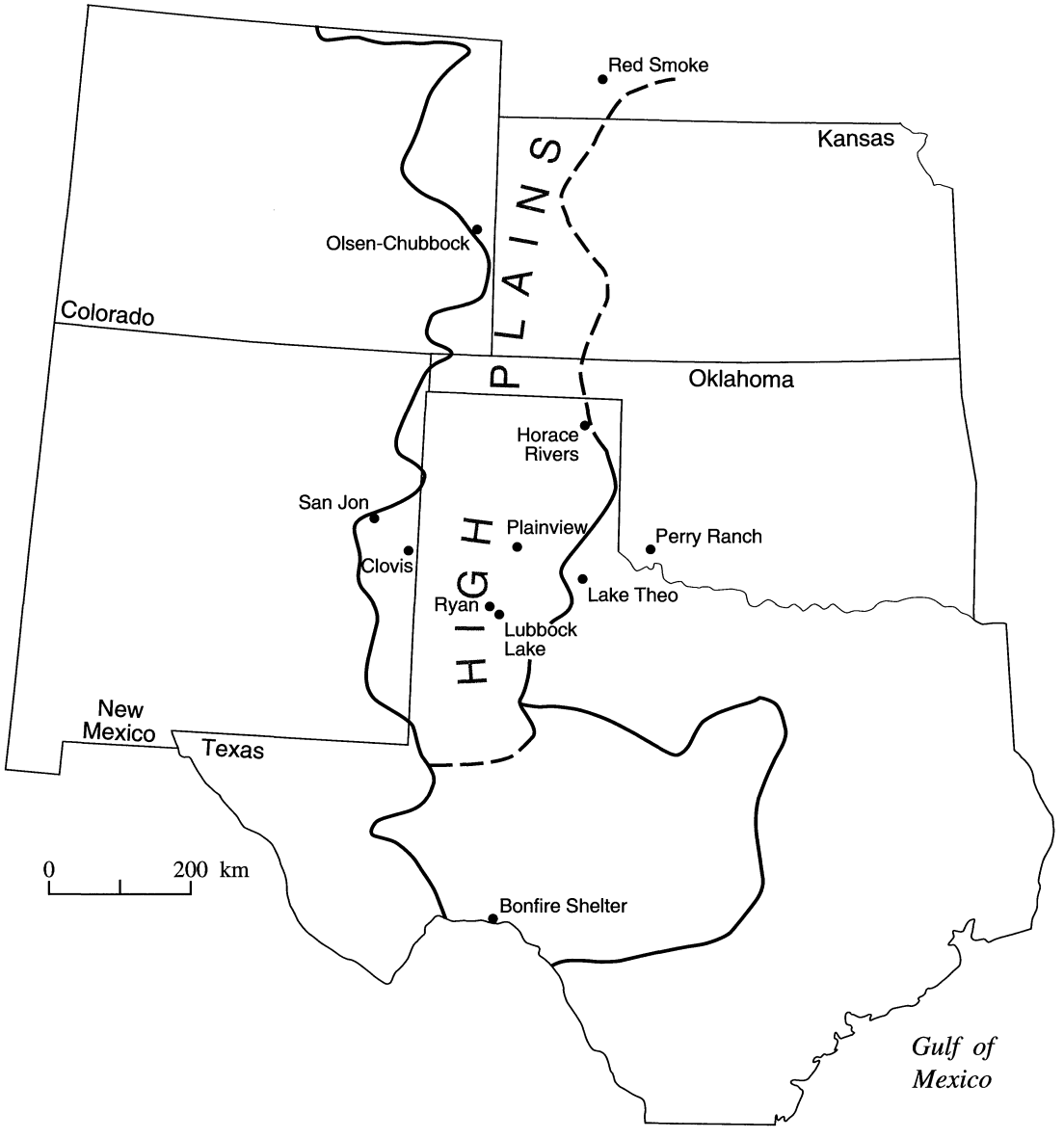

Figure 1. The Central and Southern Plains with the locations of the physiographic regions and archaeological sites mentioned in the text.

1). The site was discovered in the early 1940s after a quarry was opened along the draw, exposing an extensive bed of *Bison antiquus* bone (Sellards et al. 1947; Speer 1990). The site was excavated in 1945 by a team from the Texas Memorial Museum (Austin) led by Glen Evans and Grayson Meade under the direction of E.H. Sellards (Sellards et al. 1947). Sellards returned to the site in 1949 to recover additional bone and stone artifacts (Speer 1990).

The Plainview bone bed was "a mat of closely spaced, disarticulated bones and skeletons...of approximately 100 bison...in an area of about 500 square feet" and "an average thickness of scarcely a foot" (Sellards et al. 1947:934). At least 28 projectile points and 15 other stone artifacts were recovered from the bone bed during and subsequent to the 1945 excavations; an unknown number of artifacts probably were removed by collectors (Knudson 1983; Speer 1990). The projectile points became the type specimens for the Plainview artifact style, the

first unfluted Paleoindian point type to be formally described and proposed based on a sizeable collection. Through the years, however, Plainview became a catch-all term for unfluted, lanceolate, concave-base projectile points (Holliday 1997; Knudson 1983; Wheat 1972).

The bone bed originally was interpreted to be the result of a single-event kill (Sellards et al. 1947). Knudson (1983:27), in her study of Plainview lithic production, states that "There is a remarkable uniformity in raw materials and technique in the Plainview collection, suggesting only a few individuals were involved in its production...perhaps only one and at the most two individuals made these tools." Such technological uniformity suggests contemporaneity among all of the artifacts and the kill, but such uniformity also would be likely if the same group repeatedly used the site as a kill. The bone bed was subjected to postdepositional alteration, which complicates interpretations of the feature. Some bone is coated with $CaCO_3$. This coating ranges from light to a well-developed encrustation. At least three conditions exist then: no coating, light coating, heavy coating. Distribution of $CaCO_3$-coated bones across the bone bed is impossible to determine due to the lack of provenience for the elements. Nevertheless, the pattern does not necessarily indicate more than one event because the $CaCO_3$ coating is postdepositional. The differences, more likely, are related to microenvironment and microtopography than to different events being represented. Postdepositional mixing of the bone also is indicated (Guffee 1979; E. Johnson 1989). These data are concordant with trampling (most likely by bison), but trampling marks were not identified on the bones. However, marks in general are rare due to cortical erosion and other conditions (E. Johnson 1989:464). However, the age structure of the bison suggests fall and spring kills (E. Johnson 1989), indicating that the bone bed resulted from multiple kills.

Dating the Plainview bone bed has proven difficult. The feature was largely destroyed by quarrying subsequent to the excavations. The quarry pit was then filled with garbage and the original excavation area and related exposures were buried. The original excavation area is no longer accessible, but Guffee (1979) determined that some of the bone bed still is preserved. Shell and bone from the bone bed were submitted for radiocarbon dating in 1953 and additional bone was submitted in 1980 (Table 1). Evaluating the resulting ages is difficult, however, given the problems associated with radiocarbon dating of shell and bone, particularly in the early years of the method (Taylor 1987, 1992), but these previously obtained ages suggest that the feature may be ca. 10,000 years old. More recent studies show that sediments stratigraphically below the bone level date to at most ca. 11,000 B.P., and deposits at or stratigraphically above the bone level have a minimum age of ca. 8900 B.P. (Table 1) (Holliday 1995, 1997).

Age control for Plainview occupations elsewhere on the Southern High Plains has relied on stratigraphy and radiocarbon dating. Stratigraphically, Plainview artifacts were roughly coeval with a Folsom point at Bonfire Shelter (Dibble and Loraine 1968), and were found above Folsom at Lubbock Lake (Johnson and Holliday 1980; Johnson 1987), the Lake Theo site (Harrison and Killen 1978), and Anderson Basin #2, just east of the Clovis site (Hester 1975; Holliday 1997) (Figure 1).

The Plainview levels at several sites in the region contain organic-rich sediments and soils which generally provide reliable radiocarbon results in arid and semiarid settings such as at the Great Plains (Haas et al. 1986; Martin and Johnson 1995). Large collections of Plainview artifacts (e.g., Ted Williamson site; Johnson et al. 1986) and related styles such as Milnesand (Sellards 1955) are poorly dated, but sediment samples associated with the Plainview assemblages at Lubbock Lake (Holliday and Johnson 1981; Johnson and Holliday 1980) and the Lake Theo site (Harrison and Killen 1978; Johnson et al. 1982), and charcoal from the Plainview level at Bonfire Shelter (Dibble and Loraine 1968; Dibble 1970) suggest a radiocarbon age range of roughly 10,000 ± 500 B.P. for Plainview (Table 1; Figure 1) (Holliday 1997). The Plainview point from Anderson Basin #2 is just above lake sediments (with Folsom artifacts) correlated with palustrine muds in Anderson Basin #1 with an age of ca. 10,600 B.P. (Holliday 1997). At Ryan's site, a Plainview cache was above radiocarbon samples dating between ca. 10,700 B.P. (the middle of three samples) and ca. 9200 B.P. (the uppermost of three samples) (Hartwell 1995) (Table 1). An age of ca. 10,300 B.P. (the lowermost of three samples) probably is in error given that it is below an older sample. The cache, therefore, is < ca. 10,700 B.P. It may be < ca. 9200 B.P. if the sample was not contaminated due to its proximity (20 cm) to the base of an overlying pothole (Table 1), but the like-

Table 1. Radiocarbon Ages from Plainview or Possible Plainview Features on the Southern Plains.

Site	^{14}C Age Years B.P.	Lab No.	Material Dated and Remarks
Plainview			Conventional Ages
	9800±500	L-303	Fresh-water snail shell from bone bed[a,b]
	7100±160	O-171	"Organic portion of bones"[a,c]
	8,860±110	SMU-2341	Humates at or overlying bone level[d,e]
	9,860±180	TX-3908	Bone apatite[d,f]
	10,200±400	TX-3907	Bone apatite[d,f]
	10,940±70	SMU-1359	Humates below bone level[e]
	11,970±140	SMU-1376	Humates below bone level and below SMU-1359[e]
			AMS Ages
	8380±100	NSRL-3466 CAMS-38694	Tooth gelatin; Plainview bone bed[a]
	8790±60	NSRL-1881 CAMS-16166	Bone gelatin; Plainview bone bed[d]
	8790±80	NSRL-3469 CAMS-38695	Tooth gelatin; Plainview bone bed[d]
	9110±90	NSRL-3464 CAMS-38693	Tooth gelatin; Plainview bone bed[d]
	10,170±100	NSRL-2060 CAMS-35909	Bone gelatin; Plainview bone bed[d]
	10,660±70	NSRL-2061 CAMS-35910	Bone gelatin; Plainview bone bed[d]
	11,440±80	NSRL-2059 CAMS-35908	Bone gelatin; Plainview bone bed[a]
Lubbock Lake			
	9990±100	SMU-728	Humates; Plainview bone bed[g]
	9960±80	SMU-275	Humates; stratigraphic equivalent of Plainview level[g]
	10,015±80	SI-3203	Residue; stratigraphic equivalent of Plainview level[8]
	10,360±80	SI-3200	Residue; below Plainview bone bed[8]
Ryan[h]			
	9220±220	SMU-2448	Humates; below Plainview cache; upper sample
	10,380±140	SMU-2446	Humates; below Plainview cache; lower sample[a]
	10,650±120	SMU-2447	Humates; below Plainview cache; middle sample
Horace Rivers[i]			
	9,000±70	Beta-55909	Charcoal; Plainview (?) level
	9,040±70	Beta-55908	Charcoal; Plainview (?) level
	9,060±90	Beta-55907	Charcoal; Plainview (?) level
	9,290±80	AA-9367	Charcoal; Plainview (?) level
Bonfire Shelter			
	9920±150	TX-657	Charcoal; uppermost of three bone beds[j]
	10,100±300	TX-658	Charcoal; uppermost of three bone beds[j]
	10,230±160	TX-153	Charcoal; uppermost of three bone beds[k]
	10,280±430	AA-346	Charcoal; uppermost of three bone beds[l]
Lake Theo			
	9420±85	SMU-856	Humates from top of buried A-horizon; above Plainview (?) bone bed[m].
	9950±110	SMU-866	Humates from base of buried A-horizon; Plainview (?) bone bed; above Folsom level[m].
	11,040+270	TX-4663	Humates? top of first buried A-horizon below Folsom level[n].
	11,980+320	TX-4664	Humates? base of first buried A-horizon below Folsom level[n].
Rex Rodgers			
	9120±80	SMU-274	Bone apatite; Plainview (?) and Rex Rodgers/Dalton/San Patrice[a,o]

[a]Unreliable, [b]Broecker and Kulp 1957, [c]Brannon et al. 1957:149, [d]Reliability uncertain, [e]Holliday 1995, [f]Speer 1990, [g]Holliday et al. 1983, [h]Hartwell 1995, [i]Mallouf and Mandel 1997, [j]Dibble 1970, [k]Dibble and Loraine 1968, [l]Bement 1986, [m]Johnson et al. 1982, [n]Caran and Baumgardner 1986, [o]Speer 1978

lihood of such contamination cannot be evaluated due to continued erosion of the site.

Several other sites provide further hints on the age of the basic Plainview style. At the Rex Rodgers site, projectile points that may be Plainview were found in a *Bison antiquus* bone bed in association with side-notched points (Willey et al. 1978). A radiocarbon age of ca. 9400 B.P. was determined on bone apatite from the extinct bison (Speer 1978:94) (Table 1), but apatite can yield problematic results (Hassan et al. 1977). A better assessment of the age of the Rex Rodgers artifacts is provided by the side-notched points which have striking morphological similarities to various southeastern styles such as Dalton, San Patrice, and Brazos Fish-tail dated between 10,500 and 9600 B.P. (Ensor 1986; Goodyear 1982, 1991; Hofman 1989; Redder 1985; Watt 1978; Willey et al. 1978:66–67; Wyckoff 1989; see also L. Johnson 1989:13–26; Ray et al. 1998). None of the artifacts from Rex Rodgers have been subjected to morphological or technological analyses, however. The Horace Rivers site (Figure 1) produced a dated assemble of artifacts reported to be Plainview (Mallouf and Mandel 1997), though the artifacts have not been described or illustrated. If they are Plainview, the radiocarbon ages suggest that the Plainview tradition may have continued until as late as 9000 B.P. (Table 1). All of these data plus the stratigraphic position of Plainview above Folsom at Lubbock Lake, Lake Theo, Bonfire Shelter, and probably Clovis run counter to the assertion that Plainview is not dated (Haynes 1993:223).

East of the High Plains, two sites produced artifact assemblages widely considered to be Plainview: Perry Ranch, Oklahoma (Hofman 1989:39–40, Hofman and Todd 1997; Saunders and Penman 1979) and Red Smoke, Nebraska (Davis 1953; Hofman 1996:65) (Figure 1). Perry Ranch was a near-surface bone bed that yielded an age of ca. 7030 B.P. (Saunders and Penman 1979) (Table 1). Reinvestigation of the site and the collections showed that the bone was poorly preserved and unlikely to provide a reliable radiocarbon age (Hofman and Todd 1997). Red Smoke "has perhaps the best known and documented Plainview assemblage in the Central Plains region" (Hofman 1996:65). Unfortunately, the site was never fully reported. The only radiocarbon ages are from above the Plainview level and are confusing (Valastro et al. 1967:451) and thus provide no clues to the age of the Plainview occupation.

The Olsen-Chubbuck Site and Firstview Assemblage

The Olsen-Chubbuck site, on the High Plains of eastern Colorado (Figure 1), also produced a substantial collection of late Paleoindian, unfluted, lanceolate projectile points associated with an extensive bone bed of *Bison antiquus* remains (Wheat 1972). The site was initially tested in 1958 by the collectors who discovered the site, Sigurd Olsen and Jerry Chubbuck (Chubbuck 1959), and then fully excavated in 1958 and 1960 by Joe Ben Wheat (1967, 1972). The site represented a single event where about 190 animals were driven into an arroyo and killed. The bone bed yielded 27 projectile points. Wheat (1967) originally classified the points as Eden and Scottsbluff, part of the Cody Complex, the classic late Paleoindian assemblage of the Northern Great Plains. However, "the Cody complex...is a complicated archaeological construct having multiple interpretations" (Hofman 1989:42). "Sites assigned to the Cody Complex have a vast distribution, from Wisconsin to Alberta to Texas, over a 3,000-year period.., suggesting a rather unusual post-Pleistocene cultural stability...There are few detailed published reports of the sites and assemblages assigned to Cody, and many comparative generalizations have been based on preliminary comments and hearsay" (Knudson 1983:1).

Closer examination of the Olsen-Chubbuck assemblage and other "Cody" collections from the region led Wheat (1972) to conclude that distinctive typological and technological differences exist between the classic Cody Complex materials of the Northern Plains and the late Paleoindian lanceolate styles of the Southern Plains although gross morphological similarities are apparent. This conclusion was supported by Knudson (1983) in her study of late Paleoindian assemblages. Wheat (1972) proposed the term "Firstview" in lieu of Eden and Scottsbluff for the Olsen-Chubbuck materials, and "Firstview Complex" in lieu of "Cody Complex" for this Southern Plains tradition based on systematic morphometric and technological analysis.

The age of the type Firstview collection is unclear. Only a single radiocarbon age is available from the Olsen-Chubbuck site: 10,150 ± 500 B.P. obtained on bone collagen (Table 2). This radiocarbon assay is problematic because it is a single age with a very large standard deviation. Dating bone also has long

been problematic, although bone collagen can yield reliable results (Haynes 1967, 1968; Taylor 1987).

Other sites on the southern Great Plains with Firstview or probable Firstview assemblages include Lubbock Lake (Johnson 1987; Johnson and Holliday 1981), Clovis (Haynes 1995; Hester 1972; Johnson and Holliday 1997; Wheat, 1972;), San Jon (Hill et al. 1995; Knudson 1995; Roberts 1942; Wheat 1976), and Seminole-Rose (Collins et al. 1997). The dated assemblages fall between 9000 and 8300 B.P. (Table 2), significantly younger than the date from Olsen-Chubbuck. At the Clovis site, however, strata containing features identified as Cody Complex range in age from 10,000 to 8,500 B.P. (Haynes 1995). These features and their artifacts have not been fully described, but many if not all probably can be considered Firstview, and the only directly associated radiocarbon ages are < 9000 B.P. (Table 2). In any case, the wide range of ages for Firstview has contributed to its becoming another catchall artifact category.

Sampling and AMS Radiocarbon Dating of the Bone Beds

The bone beds yielding the Plainview and Firstview artifact assemblages are now gone or inaccessible, and the only tangible remains of the sites are the stone tools and the bone. The development of the AMS radiocarbon method combined with advances in extraction techniques for carbon now provide a means of reliably dating bone, provided adequate collagen is preserved (Stafford et al. 1987, 1991). These methodological developments seemed to be the only way to resolve the decades-old debates concerning the chronology of late Paleoindian occupations on the Great Plains. Samples of bone from both the Plainview and Olsen-Chubbuck collections were assessed for their suitability to be dated. Analyses of bone-protein preservation from both collections indicated that the bone was dateable and should provide reliable results.

Sampling and dating the Plainview and Olsen-Chubbuck bone was part of a more comprehensive effort to better date Paleoindian artifact assemblages on the Southern High Plains and adjacent areas. Bone also was sampled from the San Jon (Firstview) bone bed (Hill et al. 1995; Roberts 1942), the Lake Theo (Folsom) bone bed (Harrison and Killen 1978), the Rex Rodgers (Dalton/San Patrice? and Plainview?) bone bed (Speer 1978; Willey et al. 1978), and the Milnesand (type Milnesand) bone bed (Johnson et al. 1986; Sellards 1955). None of these samples proved adequate for radiocarbon dating.

Seven radiocarbon assays were run on samples of Plainview bone and teeth (Table 1). The relationship of the samples to the bone bed cannot be determined. The only documentation of the bone bed is a map showing the outline of the extent of the feature, and the locations of some skulls, some blocks of bone, and some stone artifacts (Sellards et al. 1947: Figure 4; Sellards 1952: Figure 28). No other bone was plotted and the extant collection of bone and teeth cannot be related to the map. Sellards et al. (1947:934) note some differential preservation of "larger bone" which could suggest that the bone bed represents at least two kills separated by a significant period of time (perhaps several generations to several centuries). Evidence from teeth eruption studies indicates that the bone bed represents kills during at least two different seasons (E. Johnson 1989). Sellards et al. (1947:934) believed that the "bone accumulated either all at one time or within a short period of time" because of the "homogeneous character of the bone bed, which contains no separating layers of sediments." Available evidence suggests, therefore, that the bone bed probably formed over a few years or a few decades; at most over a few generations. In any case, little difference in subaerial weathering was noted among the bone sampled for dating, indicating that the samples represent just one kill or a series of kills that are not resolvable using radiocarbon dating.

Seven ages were secured on samples of bone from the Olsen-Chubbuck collection (Table 2). The sampled bone was not keyed to the bone bed. However, Wheat (1972) presents convincing evidence that the bone bed represents a single event.

Discussion and Conclusions

The seven radiocarbon assays on samples of Plainview bone and teeth yielded a surprisingly wide range of ages (Table 1). In general, the approach to interpreting such an array of ages is to assume that the older ages are closer to the true age because it is more difficult to introduce older contaminants. However, at least two lines of evidence suggest that the oldest age of ca. 11,400 B.P. is falsely old, although the mode of contamination is unknown. First, if this age was accepted, it would argue that the type Plainview site is as old or older than the

Table 2. Radiocarbon Ages from Firstview Features on the Southern Plains.

Site	^{14}C Age Years B.P.	Lab No.	Material Dated and Remarks
Olsen-Chubbuck			Conventional Age
	10,150±500	A-744	Bone collagen[a]
			AMS Ages
	9290±60	NSRL-2801 CAMS-31812	Bone gelatin; Firstview bone bed
	9340±60	NSRL-2797 CAMS-31813	Bone gelatin; Firstview bone bed
	9350±70	NSRL-2797 CAMS-32682	Bone gelatin; Firstview bone bed
	9370±60	NSRL-2799 CAMS-32683	Bone gelatin; Firstview bone bed
	9420±60	NSRL-2798 CAMS-24968	Bone gelatin; Firstview bone bed
	9460±50	NSRL-2801 CAMS-32684	Bone gelatin; Firstview bone bed
	9480±60	NSRL-2799 CAMS-31814	Bone gelatin; Firstview bone bed
Clovis			
	8830±160	Y-2488	"Sediment organic residue"[b]
	8690±70	SMU-1671	Humates; Firstview bone bed[c]
	8970±60	SMU-1672	Humates; Firstview bone bed[c]
Lubbock Lake			
	8210±240	SMU-830	Humates; Firstview bone bed[d]
	7980±180	SMU-827	Humates; base of Firstview bone bed[d]
	8655±90	SI-4177	Residue; base of Firstview bone bed[d]
San Jon			
	7300±800	A-713B	Humates; approx level of Firstview bone bed; probably unreliable[e]
	8275±65	A-7438.1	Humates (AMS); Firstview bone bed[f]

[a]Wheat 1972; [b]Age determined by Yale University radiocarbon lab in the late 1960s, but never published by the lab or original excavator (see Haynes 1995:Table 4 & p. 375); [c]Johnson and Holliday 1997; [d]Holliday et al. 1983; [e]Haynes et al. 1967; Hester 1975. Sample collected 100 m east of excavations; [f]Hill et al. 1995

early Clovis occupation of the Plains, which is the oldest firmly established occupation in the Southern High Plains and in North America and dated 11,200–10,900 B.P. (Haynes 1993; Holliday 1997) (although perhaps as old as 11,500 B.P.; see Ferring 1995). A pre-Clovis or early Clovis age for the Plainview type collection does not seem to be a reasonable interpretation given that all other Plainview assemblages in stratigraphic or geochronological contexts are late Folsom age or younger. Second, sediments below the level of the bone bed provide a maximum age of 11,000 B.P. (Table 1). Also, the alluvium on which the bone bed rested is no older than 11,000 B.P., based on an investigation of draw stratigraphy at over 100 localities in 10 draws including Running Water (Holliday 1995). The age of 11,400 B.P. is similar to the average age of 11,360 B.P. for one set of radiocarbon ages from the Mill Iron site in Montana (Frison 1996:8; Haynes 1992:364), which produced stylistically similar artifacts called "Goshen points." However, this older set of ages from Mill Iron may be affected by contamination from Cretaceous lignite (Haynes 1992:364).

Dealing with the younger AMS ages on Plainview is more difficult. The youngest age of ca. 8,400 years probably can be rejected as falsely young because it is substantially younger than any other in the group and is younger than most radiocarbon ages for late Paleoindian sites in the region (Holliday 1997). Statistically, the remaining five ages are not part of the same population (chi square test of contemporaneity = 553.87, p = .00000) (following the method of Hietala 1989; D. J. Meltzer, personal communication 1998). Visual examination of the ages suggests that they can be grouped into two sets: an older set of ca. 10,170 and ca. 10,660 B.P., and a younger set of ca. 8790, ca. 8790, and ca. 9100 centered just under 9000 B.P. The younger set of ages is statisti-

cally part of the same population (chi square value = 9.84, p = .0204, significance set at .01) and average 8861 ± 42 B.P. (after the method of Hietala, 1989). These three younger ages nicely fit several other lines of evidence noted above:

1) The age of ca. 8900 B.P. on sediment stratigraphically equivalent to or just above the position of the Plainview bone bed, but sampled approximately 400 m from the original excavations (Table 1) (Holliday 1995:45; 1997:103–106);
2) The suggestion that the age of the cache from Ryan's site is < 9200 B.P.; and
3) The Horace Rivers suite of ages of just over 9000 B.P., although the typological relationships of the Horace Rivers collection is unclear and may have no bearing on the age of the type Plainview collection.

The older set of AMS ages seems to provide the most likely age range for the Plainview type collection given the dating of Plainview at most sites discussed earlier and the technological affinities between the Plainview type collection, the artifacts from Bonfire Shelter (dated ≥ 10,000 B.P.), and the Plainview assemblage from Lubbock Lake (dated ca. 10,000 B.P.) (Knudson 1983). Statistically, however, the two ages are not part of the same population (chi square value = 16.11, p =.0003), and the most likely age among the two in the older set cannot be determined. The issue of the age of the Plainview assemblage is unresolvable at this point, but an age of ≥ 10,000 B.P. seems most probable at this stage.

If the Plainview type collection is ≥ 10,000 B.P., if Horace Rivers also is Plainview, and if the cache from Ryan's site is < 9200 B.P., then an age range of 1,000 years or more (≥ 10,000 to 9000 B.P.) would not be unreasonable for the Plainview type. The basic lanceolate shape (unfluted, collateral to transverse flaking, concave base, and parallel sides) may well have a longer age range than the apparent span for Plainview. Elsewhere on the Great Plains, the late-Clovis/early-Folsom-age Goshen style exhibits a similar morphology (Frison 1991b; 1996:13, 66, 205–207; Haynes 1993:225). The basic shape, therefore, dates to at least 11,000 B.P. on the northern Great Plains and persisted during post-Folsom times on the southern Great Plains, lasting until perhaps ca. 9000 B.P., making it the longest-lived of any Paleoindian point forms. Lanceolate shape does not mean that the style is Plainview, however. The particular design type called "Plainview" within this general lanceolate shape category has a more specific age range, centered around ca. 10,000 B.P., but perhaps continuing to 9,000 B.P.

The seven samples from Olsen-Chubbuck yielded a very tight cluster of ages (Table 2). A chi square test of contemporaneity yielded a value of 10.64 (df = 7) suggesting that the values are statistically equivalent (p ≥ .10). Averaging the results yields a radiocarbon age of 9395 ± 20 B.P. (after Hietala 1989). This age estimate places the Firstview type assemblage within two standard deviations of the original age of 10,150 ± 500 B.P. This indicates that the original age is reliable, but of little use in resolving the artifact chronology owing to its large standard deviation. The new age combined with the ages of ca. 8700, ca. 8800, and ca. 8900 B.P. from Clovis, ca. 8600 B.P. at Lubbock Lake, and ca. 8300 B.P. at San Jon (Table 2), establishes an age range of 9400–8300 B.P. for Firstview.

These data raise several issues of temporal and spatial continuity of Paleoindian artifact styles. The fluted Clovis and Folsom styles appear to have essentially the same age range in both the northern and southern Great Plains and occupy relatively discrete time intervals (at least 300 radiocarbon years for Clovis, 900 radiocarbon years for Folsom) (Frison 1991a; Haynes 1992, 1993; Haynes et al. 1992; Holliday 1997). The unfluted lanceolate styles, however, vary in their geographic distribution through time. Unfluted, lanceolate points with parallel sides, concave bases, and collateral to transverse flaking first appeared as the Goshen style on the Northern Plains during the Clovis-Folsom transition, and then as Plainview on the Southern Plains during late Folsom and early post-Folsom time, and perhaps persisted until or reappeared at ca. 9000 B.P. The Cody style, the Northern Plains equivalent of Firstview, is dated to a narrow interval between 9200 and 8800 B.P. (Frison 1991a:66; Hofman 1996:69). Firstview on the Southern Plains, however, like Plainview, lasted longer; at least 1100 radiocarbon years.

The new radiocarbon ages for Plainview and Firstview styles as well as previously published ages and newly emerging age control for other styles clearly point out the dangers in the application of typological terms across broad geographic areas. In defining or assessing types and typological relationships, the concept of an artifact type must be clearly spelled out and specific types must be clearly described in terms of both technology and mor-

phology, and variations therein. These new radiocarbon data also show that much better age control from more sites is needed in order to understand the Paleoindian record. AMS radiocarbon dating, especially the dating of specific amino acids from bone, clearly has revolutionized the approach to chronological issues in archaeology. But like any other method, it can provide confusing results and must be used in conjunction with other chronometric data.

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