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Appendix A

Descriptions of sites

The following is a list of all sites that produced stratigraphic data used in this investigation. Information presented includes: basic locational data (county, state, 7.5' topographic quadrangle, latitude and longitude [determined at the centers of large sites]); width (W) and depth (D) of the respective draw at each site; the history of sites that were investigated prior to 1988; and basic locational information for all sections and cores examined. See Figure 4 for map locations.

Amoco Pit (Yoakum Co, Texas; Plains 1 SW quad; 33°16'18"N 102°39'00"W): The site is a large borrow bit excavated in a gently curving reach of Lost Draw, just north of FM 2196 and 3.7 km west of the intersection with FM 1780. The site is just above a large, unnamed playa basin along Lost Draw (Fig. 7).

Anderson Basin #1 (Roosevelt Co, NM; Arch NW quad; 34°14'00"N 103°13'19"W) & **Anderson Basin #2** (Roosevelt Co, NM; Arch NW quad; 34°13'40"N 103°11'38"W): These two sites are archaeological localities ca. 1 km apart in blow-outs of the Muleshoe Dunes on the north side of Blackwater Draw (W = 350 m; D = 3 m), downstream from the Clovis site (Fig. 10A). The sites were first investigated by Howard (1935) and subsequently by Hester (1975) and others, as part of the High Plains Paleoecology Project (Wendorf and Hester, 1975). A.B. #1 covers a roughly rectangular area of ca. 400,000 m^2. Deflation removed valley fill down to the Blackwater Draw Formation in many areas. The described section (Bw-71) is from an erosional remnant of valley fill. A.B. #2 was a blowout covering a roughly ovoid area of ca. 130,000 m^2. Valley fill was removed locally down to Pleistocene lake carbonates. The western two-thirds of the blowout was destroyed by agricultural activity and was not investigated as part of this study. The profile (Bw-58) is from a core on the northeast side of the blowout but also includes data from a natural exposure.

Anton (Hockley Co, TX; Anton quad; 33°48'27"N 102°12'12"W): The site is in a straight reach of Yellowhouse Draw (W = 437 m; D = 6 m), at the FM-597 crossing. Three cores were taken from the south right-of-way: Yh-19 midway up the west valley wall, Yh-20 on the west side of the valley floor, and

Yh-21 just east of the valley axis.

Archer-McKenzie (Martin Co, TX; Wolcott Ranch quad; 32°26'50"N 102°07'09"W): The site is along a meandering reach of McKenzie Draw (W = 200 m; D = 3 m), just above the confluence with Mustang Draw. Three cores were taken: Mk-1 was on the axis of a wide meander in the draw, Mk-2 was on the axis of a nearly cut off meander, and Mk-13 is was on a narrow divide between McKenzie and Mustang.

Bailey Draw (Bailey Co, TX; Birdwell Ranch quad; 34°14'40"N 102°54'5"W): This site is along a straight, narrow (W = 244 m), and very shallow (D = 2 m; almost imperceptible) reach of Bailey Draw at the intersection of FM 1731 and FM 1760. Topographic maps identify the draw as Blackwater, but this drainage is clearly a tributary of the main draw, which swings to the south, through the Muleshoe Dunes. Core Bw-39 was recovered from the center of the draw on the southwest side of the intersection.

Baker (Roosevelt Co, NM; Arch NW quad; 34°13'37"N 103°11'13"W): This site is along a straight reach of Blackwater Draw (W = 366 m; D = 6 m) as it runs through the Muleshoe Dunes. Two cores were taken: Bw-46 was in the center of the draw, 5 m south of the main ranch road that follows the draw, and Bw-47 was on the north valley margin, 150 m north of the ranch road.

Barwise (Floyd Co, TX; Sandhill quad; 33°58'15"N 101°28'40"W): The site is in a deeply incised (D = 11 m), straight reach of Running Water Draw (W = 640 m) at the FM 378 crossing about 2.5 km above the beginning of Blanco Canyon. Two cores were taken in the east right-of-way: Rw-14 on the valley axis, just south of the channel, and Rw-15 1/4 way up the south valley wall.

Ben (Lubbock Co, TX; Abernathy SW quad; 33°49'05"N 101°53'50"W): The site is in a broad (W = 1280 m), deep (D = 14 m) meandering reach of Blackwater Draw, immediately adjacent to the Hale County line. Five profiles were described at the site. Bw-7 and Bw-8 are sections in an abandoned quarry excavated in a bench composed of lacustrine carbonate on the south side of the draw ("Locality 9" of Evans and Meade, 1945; yielded mammoth remains): Bw-7 was on the northwest side of the pit where it makes a right-angle bend; Bw-8 was on the extreme northeast side of the pit, 25 m east of the access road. The other three profiles are cores were from the draw floor proper, all taken about 20 m east of the access road to the pit: Bw-9 on the south valley margin, just north of the bench, Bw-10 in the center of the draw, 20 m south of the

small channel in the draw, and Bw-11 halfway between the channel and the county road bordering the north side of the draw.

BFI (Lubbock Co, TX; New Deal quad; 33°39'30"N 101°51'00"W): This landfill is in a broad (W = 700 m), deep (D = 11 m), curving reach of the draw, ca. 2 km below the Lubbock Landfill. Three large pits (north, middle, south) were excavated through the valley fill and into bedrock along the western side of the draw. These excavations exposed a series stratigraphic sections that were subsequently covered as the landfill expanded across the draw. Two dated sections are described in Appendix 1A presented below out of 19 examined: profile 1, in the middle of the south wall of the north pit and profile 2, in the middle of the east wall of the south pit. Initial investigations are reported by Holliday (1983, 1985a).

Birdwell (Bailey Co, TX; Birdwell Ranch quad; 34°12'28"N 102°54'31"W): The site is in a shallow (D = 3 m), meandering reach of Blackwater Draw (W = 213 m) in the Muleshoe Dunes. Two cores were taken in a line parallel to and 50 m west of FM 1731: Bw-37 was in the center of the draw and Bw-38 was on the north valley margin.

Bledsoe (Cochran Co, TX; Bledsoe quad; 33°34'42"N 102°02'42"W): This site is in a wide (W = 800 m), shallow reach (D = 3 m) of Sulphur Draw covered by the Lea-Yoakum Dunes at the FM 125 crossing. The site is at the upstream end of Sulphur Draw according to topographic maps, but close inspection of maps and air photos shows the draw continuing to the northwest above the Milnesand site. In the Bledsoe area the draw appears to consist of several anastomosing channels. Three cores were recovered from the east right-of-way: Su-1 and Su-3 were taken through divides between the channels and Su-2 was in one of the channels. At Su-1 a pit also was dug in a road-cut exposure.

Boone (Boone Ranch) (Midland Co, TX; Spraberry quad; 31°57'00"N 101°47'30"W): This site is on a gently curving reach of Midland Draw (W = 250 m; D = 6 m), adjacent to a small earthen dam. One core, Md-2, was taken from the valley axis.

Bovina (Parmer Co, TX; Bovina quad; 34°34'49"N 102°53'07"W): The site is in a wide (W = 762 m), deeply incised (D = 14 m) meander of Running Water Draw at the FM 1731 crossing just south f the town of Bovina. Three cores were taken in the east right-of-way: Rw-5 on the valley axis, just south of the channel:

Rw-6 on the south valley margin, and Rw-7 on a bench of lacustrine carbonate high on the north valley wall.

Brooks (Hockley Co, TX; Lums Chapel quad; 33°47'14"N 102°19'37"W): The site is in a gently curving reach of Yellowhouse Draw (W = 351 m; D = 5 m), just east of the US Highway 385 crossing. The feather-edge of a lunette drapes over the north valley wall. Three cores were examined: Yh-22 high on the south valley wall, Yh-23 on the south side of the valley floor, and Yh-24 just north of the valley axis.

Brownfield (Terry Co, TX; Brownfield West quad; 33°11'30"N 102°17'30"W): This site is in a meandering reach (W = 335 m; D = 9 m) of Sulphur Draw at the FM 137 crossing on the northwest side of the city of Brownfield. Three profiles were described: two cores, Su-15 along the valley axis and Su-16 on the north valley margin; and a section on the east end of the south wall of a quarry on the south valley margin (Su-20).

Brownfield Lake (Terry Co, TX; Brownfield East quad; 33°08'48"N 102°08'08"W): The site is at the north end of the flat floor of Brownfield Lake, a dry, saline playa. One core (Su-17) was taken in the east right-of-way of FM 168, due east of the mouth of Sulphur Draw (Lost Draw).

Cannon (Hale Co, TX; Anton NE quad; 33°54'23"N 102°03'39"W): This site is in a broad (W = 1768 m), deep (D = 21 m) gently curving meander of Blackwater Draw. One artificial exposure (Bw-91) was examined along the north valley wall. Three cores were taken: one on either side of the valley-axis (Bw-29 and Bw-30) and one along a low bench on the north valley wall (Bw-28).

Carley-Archer (Martin Co, TX; Wolcott Ranch quad; 32°25'42"N 102°07'09"W): The site is in a deep (D = 7 m) valley (W = 305 m) at the confluence of Mustang Draw and McKenzie Draws. Two cores were taken: Mu-7 was on the axis of Mustang Draw, 20 m south of the oilfield access road and Mk-3 was on the axis of McKenzie Draw, 30 m north of the oilfield road.

Cedar Point (Cedar Point Ranch) (Gaines Co, TX; Cedar Point Ranch quad; 32°37'04"N 102°26'50"W): The site is in a deeply incised (D = 10 m) meander of Seminole Draw (W = 457 m) at the FM 1429 crossing. Two cores were taken in the west right-of-way: Se-4 was on the south margin or the valley floor and Se-5 was on the valley axis.

Claunch (Bailey Co, TX; Baileyboro quad; 34°03'46"N 102°45'18"W): The site is in a deep (D = 5 m), narrow (W = 244 m), entrenched meander of the North Fork of Yellowhouse Draw. One core (Yh-41) was

taken on the valley axis.

Clovis Site (Roosevelt Co, NM; Oasis State Park quad; 34°16'40"N 103°19'30"W): The Clovis site, also known as Blackwater Draw Locality 1, is one of the best known archaeological sites in North America. The locality is just west of State Highway 467, in a small basin on the north edge of the Muleshoe Dunes, 2 km north of and draining into Blackwater Draw (Figs. 10A, 12A). The site has been investigated intermittently since 1933, after its discovery during gravel mining in 1932. Hester (1972), Stevens (1973), Boldurian (1990), and Stanford et al. (1991) present summaries of the research history of the site as well as contemporary interpretations. Mining destroyed much of the site; a large pit now occupies most of the topographic basin that originally marked the site (Fig. 12A). Remnants of the basin fill are exposed along the margins of the pit and extensive deposits remain in the "outlet channel" that connected the basin with the draw proper (Stanford et al., 1990) (Fig. 12A).

Data on the stratigraphy and geochronology of the basin fill come from the many previous investigations of the site, relying primarily on Haynes and Agogino (1966), Haynes (1975, 1995), Haynes et al., (1992), and Stanford et al. (1990). New sections of the Blackwater Draw Formation and other deposits that pre-date the basin fill were described along the "North Bank" (Bw-59) and "West Bank" (Bw-72) of the gravel pit and in the "Silage Pit" (Bw-60) (Haynes, 1975), southeast of the gravel pit (Fig. 12A). Three cores (Bw-73, 74, 75) also were taken across the uplands south of the gravel pit, between the north end of the outlet channel and the Silage Pit (Fig. 12A).

Clovis - Highway Intersection (Roosevelt Co, NM; Oasis State Park quad; 34°15'30"N 103°19'04"W): This site is on the floor of Blackwater Draw (W = 1875 m; D = 9 m) (Fig. 12A) at the intersection of State Highway 467 and the Mayfield Dairy road (east) and the Oasis State Park road (west). Core Bw-51 was taken on the northwest side of the intersection in the right-of-way; Bw-52 was a pit dug during construction of a dairy, 30 m west of 467 and 1.3 km south of the intersection.

Clovis - Mayfield Dairy Road (Roosevelt Co, NM; Oasis State Park quad; 34°15'35"N 103°18'13"W): This site is along the north side of Blackwater Draw, on the Mayfield Dairy Road, 1.3 km east of the intersection with State Highway 467 and ca. 4 km west-southwest of the McCullum Ranch Locality of Haynes (1975).

The section, Bw-70, is the cut on the south side of the road.

Clovis - Silage Pit (Roosevelt Co, NM; Oasis State Park quad; 34°15'54"N 103°19'00"W): This section is in a large cut on the north wall of Blackwater Draw, 100 m east of State Highway 467. The exposure was first reported by Haynes (1975). Bw-60 is a description of the exposure. Bw-50 is a core taken along the 467 right-of-way due west of the pit.

Clovis - Museum Pit (Roosevelt Co, NM; Arch NW quad; 34°14'54"N 103°14'51"W): This section is an exposure in pits excavated on uplands 1.7 km north of Blackwater Draw. The pits are just behind the "Blackwater Draw" Museum on US Highway 70.

Cut-Off Meander (Gaines Co, TX; McKenzie Lake SE quad; 32°32'04"N 102°20'26"W): The site is in a deep (D = 8 m) cut-off meander of Seminole Draw (W = 250 m) (Fig. 16). Two cores were examined: Se-3 was taken along the south margin of the valley axis, in the south right-of-way of the county road, and Se-15 was taken on the valley axis in the north right-of-way.

Davis (Roosevelt Co, NM; Arch NE quad; 34°12'30"N 103°06'36"W): This site is in a broad (W = 792 m), deep (D = 11 m), straight reach of Blackwater Draw as it passes through the Muleshoe Dunes. Three cores were recovered: near the valley axis (Bw-43); near the north valley-margin (Bw-44); and on a bench (possibly a low dune) along the north valley-margin (Bw-45).

Dean (Dean Ranch) (Cochran Co, TX; Plains 1 NW quad; 33°19'03"N 102°44'19"W): The site is in a deeply incised (D = 8 m) meander of Sulphur Draw (W = 305 m) at the FM 1585 crossing. One core (Su-14) was taken in the north right-of-way on the valley axis.

Denver City (Yoakum Co, TX; Plains SE quad; 33°00'14"N 102°49'09"W): The site is in a straight reach of McKenzie Draw (W = 400 m; D = 6 m) at the FM 214 crossing. Five trenches in a line parallel to and 100 m west of the highway were examined: Mk-14 was on the uplands on the north, Mk-15 was at the foot of the north valley wall, Mk-16 was on the valley axis, Mk-17 was near the south margin of the valley floor, and Mk-18 was on the uplands to the south.

DePrange (Lamb Co, TX; Corry & Fieldton quads; 34°01'14"N 102°07'12"W): The site is in a wide (W = 640 m), very deep (D = 25 m), straight reach of Blackwater Draw. Three cores were recovered: Bw-12 was

midway up the east valley wall; Bw-13 was on the east side of the valley floor; and Bw-13 was on the floor of the draw just east of a small channel that follows the valley axis.

Edmonson (Hale Co, TX; Edmonson quad; 34°16'30"N 101°57'25"W): This site is in a broad (W = 732 m), deep (D = 13 m) gently curving reach of Running Water Draw at the FM 179 crossing. The locality probably is the site of Jones Springs (Brune 1981, p. 203). Standing water accumulates at the site during wet years. The draw is significantly wider at and below the spring area than it is above the springs. Three cores were taken in the east right-of-way: Rw-18 on the valley axis, Rw-19 near the north valley-margin, and Rw-20 near the south valley margin.

Edwards Road (Yoakum Co, TX; Ink Basin quad; 33°03'25"N 102°59'26"W): The site is in a narrow (W = 152 m; D = 6 m), straight reach of McKenzie Draw at a paved county road crossing. One core (Mk-12) was taken in the west right-of-way.

Eiland (Martin Co, TX; Germania quad; 32°05'54"N 101°53'54"W): The site is in a gently curving reach of Mustang Draw (W = 244 m; D = 6 m) on the east side of a county road crossing 1.4 km above the Interstate 20 crossing. Three cores were taken: Mu-12 on the north side of the valley floor, Mu-13 just south of the valley axis, and Mu-14 near the base of the south valley wall.

Enochs (Bailey Co, TX; County Line quad; 33°52'20"N 102°44'17"W): This site is in a deep (D = 6 m), gently curving reach of Yellowhouse Draw (W = 457 m) at the FM 54 crossing. Three cores were recovered from the south right-of-way: Yh-31 on the east valley-margin, Yh-32 near the east valley-margin, and Yh-33 along the valley axis.

Enron (Gaines Co, TX; Denver City & Seagraves NW quads; 32°52'30"N 102°45'00"W): The site is in a meander of McKenzie Draw (W = 250 m; D = 3 m) due south of the Enron gas plant. Four trenches in a line 30 m south of and parallel to the Yoakum County line: Mk-19 was on the uplands to the west, Mk-20 was on the west margin of the valley floor, Mk-21 was just northeast of the valley axis, and Mk-22 was on the east uplands.

Evans (Lamb Co, TX; Cofferville quad; 34°03'28"N 102°19'16"W): This site is along a deep (D = 21 m), very broad (W = 1006 m), gently curving reach of Blackwater Draw. Four cores were taken: Bw-15 half-way

up the west valley wall, probably on a small alluvial fan; Bw-16 low along the west valley wall, and Bw-17 and 18 along either side of the valley axis.

Evans & Meade (Midland Co, TX; Stanton SE quad; 32°03'18"N 101°47'00"W): The site is in a deep (D = 10 m), incised meander of Mustang Draw (W = 500 m) at the intersection of FM 137 and FM 307. The site is just west of a pit excavated in lacustrine carbonate that yielded late Pleistocene megafauna ("Locality 32" of Evans and Meade, 1945). Two cores were taken in the right-of-way on the north side of FM 307: Mu-8 was low on the west valley margin and Mu-9 was on the valley axis.

Fourway Gin (Gaines Co, TX; Seagraves NW quad; 32°57'03"N 102°42'32"W): The site is in a gently curving reach of McKenzie Draw (W = 213 m; D = 5 m), at a county road crossing due north of Four-Way Gin. One core (Mk-11) was taken from the valley axis.

Flagg (Castro Co, TX; Flagg quad; 34°23'02"N 102°25'50"W): This site is in a very wide (W = 1113 m), deeply incised (D = 24 m), straight reach of Running Water Draw at the FM-145 crossing. Two cores were taken in the south right-of-way: Rw-11 taken near the valley axis and Rw-10 from the eastern valley-margin.

Florey (Andrews Co, TX; Florey quad; 32°28'11"N 102°35'38"W): The site is in an incised meander of Monument Draw (W = 450 m; D = 6 m) at the US Highway 385 crossing, just south of the intersection with the paved county road. Two cores were taken in the east right-of-way. Mt-1 was just north of the valley axis and Mt-2 was midway up the south valley wall.

Gaines County Park (Gaines Co, TX; Seagraves SW quad; 32°49'45"N 102°38'31"W): The site is in a deep (D = 9 m), gently curving meander of McKenzie Draw (W = 427 m) at the US Highway 62/385 crossing. Three cores were taken in the west right-of-way, between the highway and Gaines County Park: Mk-8 was on the valley floor south of the valley axis, Mk-9 was just north of the valley axis, and Mk-10 was on the north margin of the valley floor.

Gibson (Gibson Ranch) (Lamb Co, TX; Earth quad; 34°08'00"N 102°23'55"W): This locality occupies a long (5 km), wide (W = 732 m), deep (D = 9 m) meandering reach of Blackwater Draw near the south edge of the Muleshoe Dunes (Fig. 29A). One segment of this reach flows east-to-west (Figs. 18, 29A), the only such segment identified for any draw on the Llano Estacado. Along the north side of this segment is an elliptical

blow-out in the valley fill covering ca. 175 m (east-west) x 80 m (north-south) (Fig. 29A); probably the Marks Beach archaeological site of Honea (1980). Two auger holes and one section were examined in the blow-out (Bw-56, 61, and 78), two auger holes were placed in the dune (Bw-20 and 79), and 26 cores (Bw-19,21,22,31,49,57,62-69,76,77,80-90) were taken on the floor of the draw. The 2 sections described in Appendix 1A were in the blow-out (Bw-78) on the north valley margin and from a core (Bw-31) taken near the valley margin south of the blow-out (Fig. 29A).

Glendenning (Martin Co, TX; North Curtis Ranch quad; 32°14'10"N 102°01'01"W): This site is along a narrow (W = 152 m), shallow (D = 4 m) reach of Mustang Draw, in a small entrenched meander at a crossing of FM 1212. Section Mu-3 is exposed in a quarry on the south valley-margin and core Mu-33 was taken from the valley axis.

Halbrook (Gaines Co, TX; Loop SW quad; 32°47'55"N 102°24'52"W): The site is in a straight reach of McKenzie Draw (W = 213 m; D = 5 m). One core (Mk-7) was taken on the valley axis, just south of the county road 100 m east of the FM 303 crossing. The water table was just below the surface due to artificial damming.

Halsell (Lamb Co, TX; Earth quad; 34°13'20"N 102°29'19"W): This site is along a shallow (D = 2 m), narrow (W = 244 m), straight reach of Blackwater Draw, 1.2 km below Spring Lake, a spring-fed pond that existed in the draw historically (Brune, 1981). The locality is on the draw immediately south of the former site of the Halsell Ranch headquarters, which was formerly the Spring Lake headquarters of the XIT Ranch (Haley, 1953). Five cores were recovered: Bw-23 along the north valley-margin, Bw-24 and 25 on either side of the valley-axis, Bw-27 near the south valley-margin, and Bw-26 on the south valley wall.

Haston (Hale Co, TX; Plainview SE quad; 34°05'18"N 101°34'18"W): The site is in a broad (W = 762 m; D = 4 m), gently curving reach of Running Water Draw, below the FM 2883 crossing. The section (Rw-1) was exposed in the middle of the east wall of an abandoned quarry on the east side of a county road.

Hobbs (Lea Co, NM; Hobbs E quad; 32°43'34"N 103°04'13"W): The site is in a very wide (W = 945 m), shallow (D = 5 m), gently curving reach of Seminole Draw at the US Highway 62/180 crossing, 0.7 km west of the state line. One core (Se-6) was taken in the south right-of-way on the valley axis.

Houck (Curry Co, NM; Ned Houck quad; 34°31'40"N 103°11'15"W): This site is in a very wide (W = 2103 m), very deeply incised (D = 27 m), weakly meandering reach of Running Water Draw where it is crossed by State Highway 209. Three cores were taken in the east right-of-way, adjacent to Ned Houck Memorial Park: Rw-2 along the valley axis, Rw-3 near the southern valley-margin, and Rw-4 along the southern valley margin.

Howard (Martin Co, TX; Lenorah West quad; 32°17'08"N 101°59'27"W): The site is in a gently curving reach of Mustang Draw (W = 600 m; D = 4 m). One core (Mu-21) was taken on the valley axis.

Huckleby (Cochran Co, TX; Lehman quad; 33°33'05"N 102°48'57"W): The site is in a broad (W = 305 m), deep (D = 6 m), gently curving reach of Sulphur Draw, just east of the FM 214 crossing and due north of the Lehman gasoline plant. Three cores were taken: Su-11 was midway up the north valley wall, Su-12 was on the north margin of the valley floor, and Su-13 was just southwest of the valley axis.

Jorde (Roosevelt Co, NM; Arch NW quad; 34°14'38"N 103°09'30"W): This site is and abandoned quarry ca. 3 km north of Blackwater Draw in the Muleshoe Dunes. The pit is 100 m north of NM 202, 13 km west of the Texas state line. Profile Bw-92 was in the southeast corner of the pit.

Lariat Draw (Bailey Co, TX; Lariat quad; 34°15'47"N 102°54'52"W): The site is in a very shallow (D = 2 m), very narrow (W = 70 m), gently curving reach of Lariat Draw, a tributary of Blackwater Draw. Two cores were taken on the east right-of-way where FM 1731 crosses the draw: Bw-40 on the floor of the draw just south of the highway culvert and Bw-41 high on the north valley wall.

Lazbuddie (Parmer Co, TX; Lazbuddie quad; 34°27'26"N 102°35'42"W): The site is in a wide (W = 884 m), deeply incised (D = 20 m), gently curving reach of Running Water Draw at the FM 1171 crossing. Two cores were taken in the north right-of-way: Rw-8 just west of the valley axis and Rw-9 1/4 way up the west valley wall.

Lingo (Roosevelt Co, NM; Garrison quad; 33°47'02"N 103°07'54"W): The site is in a narrow (W = 183 m), shallow (D = 3 m), straight reach of the South Fork of Yellowhouse Draw, 1.6 km west of the State Highway 114 crossing. One core (Yh-40) was taken from the valley axis.

Lower Curtis Erwin (Midland Co, TX; Stanton SE quad; 32°04'02"N 101°49'05"W): The site is in a deeply

incised (D = 10 m), very gently curving reach of Mustang Draw (W = 300 m). Two cores were taken, both along the valley axis: Mu-23 was 0.7 km below a prominent quarry on the south side of the draw, and Mu-26 is 0.3 km above the quarry, on the floor of a wider reach of the draw that occasionally ponds.

Lubbock County Caliche Pit (Lubbock Co, TX; Shallowater quad; 33°39'52"N 101°57'36"W): The site is in a broad (W = 396 m; D = 4 m), straight reach of Yellowhouse Draw, 1.2 km southeast of the US Highway 84 crossing and just northeast of a large caliche quarry. Four cores were taken in the south right-of-way of a county road: Yh-8 high on the east valley wall at the county road intersection, Yh-9 on the east side of the valley floor, Yh-10 on the valley axis, and Yh-11 on the west side of the valley floor.

Lubbock County Line (Lubbock Co, TX; Roundup quad; 33°46'36"N 102°04'43"W): The site is in a deeply entrenched (D = 11 m) meander (possibly cut-off) of Yellowhouse Draw (W = 500 m) 0.5 km east of the Hockley County line. One core (Yh-38) was taken on a bench of incised lacustrine carbonate on the inside of the meander on the west side of the county road.

Lubbock Lake (Lubbock Co, TX; Lubbock West quad; 33°37'13"N 101°53'31"W): Lubbock Lake is an archaeological site occupying a meandering, 2-km reach of Yellowhouse Draw (W = 305 m; D = 10 m) on the northwestern edge of the city of Lubbock. The site was discovered in 1936, following excavation of a U-shaped reservoir on the inside of one of the meanders (Fig. 28A). Research was conducted intermittently from 1939 to 1960 and a continuing research program began in 1972. Black (1974) and E. Johnson (1987b) discuss the history of investigations and E. Johnson (1987b) summarizes the research results. The stratigraphy and geochronology of the site is thoroughly described and discussed by Stafford (1981), Holliday (1985c), and Holliday et al. (1983, 1985). Only a stratigraphic and summary is presented in Appendix 1A (modified from Holliday 1985c, Table 2).

Lubbock Landfill (Lubbock Co, TX; New Deal quad; 33°40'33"N 101°51'51"W): This site is along an S-shaped series of deep (D = 10 m) entrenched meanders (Fig. 27A) of Blackwater Draw (W = 640 m). The exposures were in 42 backhoe trenches and 6 cores in the western half of the "S" (A1-A17, B1-B9, C1-C10, and D1-D6), 5 cores, and in one deep pit (the "Wind Pit") on the eastern end (Fig. 27A) (sections E1-E6 on the east wall and W1-W8 on the west wall). The descriptions are for 4 key sections: C-3 and D-4 (Fig. 27B),

E-4 (Fig. 11), and W-4 (Fig. 27B). All other exposures are located, described, and discussed in Brown et al. (1993).

Lupton (Lubbock Co, TX; Wolfforth NE quad; 33°41'20"N 102°00'35"W): This site is in a straight reach (W = 457 m; D = 8 m) of Yellowhouse Draw, southwest of the intersection of US Highway 84 and FM 1294 in the town of Shallowater and 1 km below Trench 114 of Stafford (1981). Three cores were recovered: Yh-1 along the east valley margin, on a bench formed of lake sediments dissected by the draw (Fig. 13A), Yh-2 near the east valley-margin, and Yh-3 along the valley axis.

Maple (Bailey Co, TX; Maple quad; 33°51'27"N 102°53'53"W): The site is in a broad (W = 610 m; D = 6 m), straight reach of the South Fork of Yellowhouse Draw at the FM 596 crossing. Two cores were taken in the east right-of-way: Yh-35 in the valley axis and Yh-36 on the north valley wall.

Mandrell (Lamb Co, TX; Hart SW quad; 34°16'34"N 102°07'57"W): The site is in a broad (W = 732 m), deep (D = 17 m), straight reach of Running Water Draw at the FM 168 crossing. Two cores were taken about 30 m west of the highway: Rw-12 just north of the channel and Rw-13 in the middle of the valley floor at the gas line crossing.

MacKenzie State Park (Lubbock Co, TX; Lubbock East quad; 33°35'33"N 101°50'00"W): The site is in a deeply incised (D = 13 m) reach of Yellowhouse Draw (W = 396 m) at the confluence with Blackwater Draw in the city of Lubbock. Two cores were taken: Yh-37 is on the south side of the channel and the valley floor, northwest of the 4th St. overpass and opposite the entrance to "Joyland" amusement park; Yh-39 is on the valley floor at the confluence of the draws and in the MacKenzie Golf Course between the 30th and 35th fairways.

McMorris (McMorris Ranch) (Martin Co, TX; Merrick quad; 32°24'56"N 101°50'51"W): The site is in a deep (D = 6 m), gently curving reach of Sulphur Springs Draw (W = 500 m). One core (SS-1) was taken on the east margin of the valley floor at the northeast end of a natural (?) dam that separates two saline lakes. The water table was just below the surface.

McNeese (Lamb Co, TX; Cofferville quad; 34°04'35"N 102°18'30"W): The site is in a wide (W = 1000 m), deep (D = 8 m), meandering reach of Blackwater Draw at the US Highway 385 crossing. Core Bw-48 was

recovered from the center of the valley floor 50 m east of the highway.

Midland (Midland Co, TX; Southeast Midland quad; 31°52'54"N 102°06'46"W): This archaeological site is located in a narrow (W = 122 m; D = 5 m) bend of Monahans Draw, adjacent to and partially buried by a dune field (Fig. 24A). The site was discovered in 1954 as a result of deflation of the dune sediments along the draw (Locality 1) and away from it (Locality 3 West). Most of the archaeological research occurred in 1954 and 1955 (Wendorf et al., 1955; Sellards, 1955b; Wendorf and Krieger, 1959). The site is best known for yielding human remains that may be early Holocene in age or older. Thirtyfive cores and sections were investigated between 1988 and 1992, including: 8 cores, 5 auger holes, and 12 trenches in Locality 1; 1 section and 1 auger hole in Locality 3W; 4 auger holes between the two localities; 1 core in the draw below Locality 1; 1 core in the draw above Locality 1; 1 core on the uplands south of Locality 1; and 1 core on the uplands north of Locality 3W (Fig. 24). Descriptions in Appendix 1A are for Mn-5 on the northwest side of the Locality 1 blowout and Mn-19 for the middle of the west wall of Locality 3W.

Milnesand (Roosevelt Co, NM; Milnesand quad; 33°40'40"N 103°18'09"W): The site is in a narrow (W = 70 m), shallow (D = 2 m) reach of Sulphur Draw. The draw is largely obscured by sand dunes and lunettes between this site and the Bledsoe site downstream, and is not labeled as a draw on topographic maps. In the field and on maps, however, the draw is obvious for some kilometers upstream and downstream from the Milnesand site. One core (Su-4) was taken on the valley axis 0.5 km north of the Milnesand archaeological site (Sellards, 1955a).

Muleshoe (Bailey Co, TX; Muleshoe quad; 34°14'37"N 102°40'12"W): The site is in a broad (W = 671 m; D = 4 m), meandering reach of Blackwater Draw in the east right-of-way of FM 3269. Three cores were recovered: Bw-33 high on the north valley wall, Bw-34 on the north side of the valley floor, and Bw-35 on the south side of the valley floor.

Mustang Springs (Martin Co, TX; Dickenson Ranch quad; 32°08'20"N 101°56'20"W): This archaeological site is in a deep (D = 15 m), straight reach of Mustang Draw (W = 305 m) (at the FM 1212 crossing), although the drainage is significantly more narrow and also more meandering upstream and downstream (Fig. 30A). The site was discovered during archaeological testing and subsequent research is reported by Collins

and Meltzer (1987) and Meltzer (1991). The site was long known for its now-dry springs (Brune 1981), and the presence of these springs may be related to the dramatic variation in the widths of the draw (Meltzer, 1991). Fourteen sections were studied during and since the archaeological research, including 4 trench exposures and 10 cores (Fig. 30A). Trench 5 (Appendix 1A) was south of the highway on the east side of the valley floor.

Nadine Road (Gaines Co, TX; Paynes Corner quad; 32°40'00"N 102°45'20"W): The site is in a deep (D = 12 m), gently curving reach of Seminole Draw (W = 488 m) at a county road (Nadine Road) crossing 4.6 km west of FM 181. One core (Se-10) was taken in the south right-of-way on the valley axis.

Narrows (Hockley Co, TX; Anton quad; 33°48'44"N 102°14'12"W): The site is in a narrow (W = 170 m), deeply incised (D = 11 m) reach of Yellowhouse Draw where the drainage cut through a high in the Ogallala Caprock. Two cores were taken along county roads that cross the draw at either end of the Narrows: Yh-17 was in the valley axis at a county road intersection at the west end of the site and Yh-18 was in the valley axis at the east end where the draw begins to widen.

New Moore West (Terry Co, TX; New Moore quad; 33°02'42"N 102°06'02"W): The site is in a narrow (W = 152 m), deeply incised (D = 8 m), straight reach of Sulphur Draw (Lost Draw) at the FM 213 crossing. One core (SU-18) was taken in the north right-of-way on the valley axis. The water table was just below the surface.

New Moore South (Terry Co, TX; Welch East quad; 32°58'58"N 102°02'00"W): The site is in a deep (D = 7 m), gently curving reach (W = 427 m) of Sulphur Draw (Lost Draw) at the FM 179 crossing. One core (SU-19) was taken in the west right-of-way on the valley axis. The water table was just below the surface.

North Carley-Archer (Martin Co, TX; Scharbauer Ranch & Wolcott Ranch quads; 32°27'05"N 102°07'30"W): The site is in a shallow (D = 3 m), gently curving reach of Mustang Draw (W = 350 m), 2 km above the confluence with McKenzie Draw. One core (Mu-6) was taken along the valley axis.

Oklahoma Flat (Hockley Co, TX; Oklahoma Flat quad; 33°45'30"N 102°24'05"W): The site is a very broad, shallow (almost imperceptible), gently curving reach of Yellowhouse Draw at the FM 1490 crossing below Yellow Lake. One core (Yh-34) was taken from the valley axis west of the highway.

Palmer-Wheeler (Martin Co, TX; Knott SW quad; 32°19'20"N 101°44'40"W): The site is in a deep meander of Sulphur Springs Draw (W = 600 m; D = 5 m). One core (SS-2) was taken on the southeast margin of the valley floor. The water table was just below the surface.

Patricia (Dawson Co, TX; Patricia SW quad; 32°33'21"N 102°10'02"W): The site is in a deep (D = 8 m), straight reach of McKenzie Draw (W = 396 m). Two cores were taken in the east right-of-way of a county road: Mk-4 was on the valley axis and Mk-5 was on the south margin of the valley floor.

Payne (Lubbock Co, TX; Wolfforth NE quad; 33°43'21"N 102°04'19"W): This site is in a narrow (W = 213 m), straight reach (D = 5 m) of Yellowhouse Draw 1 km below a large playa intersected by the draw. Four cores were recovered: Yh-4 on the east valley-margin, Yh-5 and 6 on either side of the valley axis, and Yh-7 on the west valley-margin.

Petit (Hockley Co, TX; Petit quad; 33°44'43"N 102°31'58"W): The site is in a wide (W = 823 m), straight reach of Yellowhouse Draw (D = 5 m) at the FM 303 crossing. Three cores were taken in the east right-of-way: Yh-28 was on a bench high on the south valley wall, Yh-29 was on the valley axis, and Yh-30 was on the north margin of the valley floor.

Plains Paving (Hale Co, TX; Wasson quad; 34°12'10"N 101°50'20"W): This site, in a broad (W = 1036 m; D = 7 m) entrenched meander of Running Water Draw, consists of two large pits opened for quarrying caliche and first reported by Hughes and Guffee (1976). Excavations cut through the valley fill and into the Ogallala Formation. One pit is located in the center of the draw and is the older of the two, with most exposures obscured by slumping and vegetation. The other, younger pit (active in 1992) is on the eastern side of the draw, intersecting the valley margin. The section described in Appendix 1A is at the west end (toward the valley axis) of the north wall of the newer pit, where quarrying provided an excellent look at the valley fill from the valley margin to near the valley axis. Huges & Guffee

Plainview (Hale Co, TX; Plainview quad; 34°10'50"N 101°42'45"W): The well-known Plainview archaeological site is in a broad (W = 792 m; D = 9 m), curving reach of Running Water Draw just west of the US Highway 87 crossing in the city of Plainview, Texas. The site, discovered in 1944 during caliche quarrying along the south margin of the draw, consisted of an extensive bone bed of Bison antiquus

associated with stone tools (Sellards et al., 1947; Guffee, 1979; Speer, 1990). Continued quarrying resulted in excavation of three deep pits that cut through the valley fill and into the upper Ogallala Formation. The pit that exposed the bone bed (Pit 1, Fig. 26A) now is filled and the largest pit (Pit 2, Fig. 26A) was undergoing filling between 1982 and 1992. Twelve sections and 2 cores were studied. Most field work focused on Pit 3 (Fig. 26A) although some sections in Pit 2 were studied (Holliday, 1985b). The west wall of Pit 3 provided an excellent cross section of the late Quaternary valley fill (Fig. 26B) and most data and radiocarbon ages come from that exposure, with some data from the south wall of Pit 2 (Holliday, 1985b). The four sections described in Appendix 1A are from the west wall of pit 3 (Fig. 26) and provide good examples of facies variability across the draw.

Plainview Landfill (Hale Co, TX; Plainview quad; 34°10'16"N 101°40'18"W): This site is along a wide (W = 900 m) gently curving reach of Running Water Draw (D = 5 m). The exposures (Rw-31 - Rw-35) were in five backhoe trenches excavated perpendicular to the trend of the draw on its north side. The transect provided by these trenches included about 1/4 of the width of the draw. The stratigraphy essentially is the same as that at Quincy Street and the Plainview site. Trenching of Running Water Draw 3 km below the landfill site revealed an identical stratigraphic record (E. Schroeder, personal communication, 1994).

Plant X (Lamb Co, TX; Earth quad; 34°04'40"N 102°29'19"W): The site is in a meandering reach of Blackwater Draw (W = 400 m; D = 3 m) east of the Plant X power generating facility. One core (Bw-32) was taken from the valley axis near the northwest edge of the large cooling pond on the floor of the draw.

Pool (Terry Co, TX; Pool quad; 33°16'35"N 102°24'43"W): The site is in a deep (D = 7 m), gently curving reach (W = 305 m) of Sulphur Draw at the FM 303 crossing. Four cores were taken: on the west right-of-way, Su-7 was just south of the valley axis, Su-8 was on the north margin of the valley floor, and Su-9 was on the valley axis; on the east right-of-way Su-10 was on the south valley margin.

Progress Draw (Parmer Co, TX; Lariat quad; 34°21'00"N 102°53'45"W): This site is along a gently curving, shallow reach (W = 600 m; D = 4 m) of Progress Draw, a tributary of Blackwater. One core (Bw-42) was recovered from the center of the draw.

Quincy Street (Hale Co, TX; Plainview quad; 34°10'50"N 101°43'24"W): Quincy Street is a north-south

road in Plainview, Texas, that crosses a curving reach of Running Water Draw (W = 600 m; D = 3 m) 800 m west of the west margin of the Plainview site (Fig. 26A). Along the section of the street that crosses the draw, archaeologists excavated 12 deep trenches in an effort to determine presence or absence of archaeological remains prior to some construction. The trenches provided excellent exposures of the valley fill from the valley margin to the valley axis and 7 trenches were described. The stratigraphy along the Quincy Street section is essentially the same as that exposed at the Plainview site and Plainview Landfill except for Rw-26 (Appendix 1A), from the northern-most trench near the valley axis.

Ranger Hill (Martin Co, TX; North Curtis Ranch quad; 32°14'32"N 102°01'10"W): The site is in a shallow (D = 2 m) meander of Mustang Draw (W = 300 m) at a crossing of FM 1212 0.5 km southwest of Ranger Hill and just north of a county road intersection. One core (Mu-30) was taken in the west right-of-way on the valley axis.

Roundup (Hockley Co, TX; Roundup quad; 33°47'10"N 102°05'10"W): The site is in a broad (W = 823 m), deep (D = 6 m), gently curving reach of Yellowhouse Draw at the FM 2130 crossing. Five cores were taken in the west right-of- way: Yh-12 high on the north valley wall, Yh-13 half way up the north valley wall, Yh-14 on the valley axis, yh-15 on the south margin of the valley wall, and Yh-16 halfway up the south valley wall.

Sand (Gaines Co, TX; Sand quad; 32°42'03"N 102°13'52"W): The site is in a gently curving reach of McKenzie Draw (W = 305 m; D = 5 m) at the US Highway 180 crossing. One core (Mk-6) was taken on the valley axis in the right-of-way 30 m south of the highway.

Sagebrush Stables (Gaines Co, TX; Paynes Corner NW quad; 32°43'33"N 102°54'42"W): The site is in a wide (W = 823 m), deep (D = 13 m), straight reach of Seminole Draw at the US Highway 62/180 crossing. Three cores were taken in the north right-of-way: Se-7 just east of the valley axis, Se-8 near the west margin of the valley floor, and Se-9 low on the west valley wall.

S Bar-3 (Lubbock Co, TX; New Deal quad; 33°41'25"N 101°51'27"W): The site is in a wide (W = 800 m), deep (D = 11 m), entrenched meander of Blackwater Draw on the south side of FM 1294. Evidence suggests that the floor of the draw and the valley walls were substantially modified by heavy earth-moving equipment.

Three cores were taken in a line running east from a water well on the west side of the draw: Bw-53 was on the west side of the valley floor, Bw-54 was against the west valley wall at the base of a high, artificial scarp; Bw-55 was on the valley axis.

Seminole (Gaines Co, TX; Seminole quad; 32°38'37"N 102°38'39"W): The site is in a deeply incised (D = 6 m) meander of Seminole Draw (W = 305 m) at the US Highway 385 crossing. Two cores were taken in the west right-of-way: Se-11 was near the north margin of the valley floor and Se-12 was on the valley axis.

Seminole SW (Gaines Co, TX; Seminole quad; 32°39'10"N 102°42'54"W): The site is in a deep (D = 10 m), gently curving reach of Seminole Draw (W = 305 m) at the FM 181 crossing. One core (Se-14) was taken in the west right-of-way on the valley axis.

Seminole-Rose (Gaines Co, TX; McKenzie Lake SE quad; 32°32'10"N 102°19'55"W): This site is along a broad (W = 427 m), deeply incised (D = 9 m) reach of Seminole Draw with several entrenched meanders (Fig. 16). The valley fill is in a relatively narrow channel cut into the floor of the much wider valley. Cores were recovered from the axis of the valley fill (Se-2) and from the north margin of the valley fill (Se-1). These coring localities are in the area of an extensive bed of bone from extinct Bison antiquus, associated with Firstview (Paleoindian) projectile points, exposed on the floor of the draw by wind deflation (Richard Rose, personal communication, 1983). Sand dunes are extensive throughout the floor of the valley. A third section (Se-13) was described along the valley wall where a roadcut exposed lake sediments dissected by downcutting of the valley (Figs. 9B, 13B, 16).

Shallow Draw (Hockley Co, TX; Lums Chapel quad; 33°47'07"N 102°20'00"W): The site is a narrow (W = 170 m), very shallow (almost imperceptible), gently curving reach of Yellowhouse Draw at the FM 597 crossing 600 m west of US Highway 385. Three cores were taken in the north right-of-way: Yh-25 just west of the valley axis, Yh-26 on the valley axis, and Yh-27 on the east valley margin.

Spraberry (Midland Co, TX; Spraberry quad; 31°57'00"N 101°50'07"W): The site is in a gently curving reach of Midland Draw (W = 350 m; D = 5 m) at a paved, county road crossing. One core (Md-1) was taken in the south right-of-way on the valley axis.

SR-158 (Midland Co, TX; Stephenson Lake quad; 31°56'37"N 101°54'02"W): The site is in a deep (D = 6

m), gently curving reach of Monahans Draw (W = 335 m) at the County Road SR 158 crossing. One core (Mn-1) was taken in the north right-of-way on the valley axis.

SR-181 (Gaines Co, TX; Paynes Corner SE quad; 32°34'02"N 102°51'51"W): The site is in a wide (W = 500 m), incised, straight reach of Monument Draw (D = 6 m), at the FM 181 crossing. One core (Mt-3) was taken in the east right-of-way on the valley axis.

Sundown (Cochran Co, TX; Plains 1 NE quad; 33°25'06"N 102°36'40"W): This site is in a broad (W = 427 m), deep (D = 12 m), gently curving reach of Sulphur Draw at the FM 1780 crossing. Two cores were recovered from the west right-of-way: Su-5 along the valley axis and Su-6 along the north valley-margin.

Sunnyside (Castro Co, TX; Dodd SE quad; 34°20'30"N 102°18'30"W): The site is in a very wide (W = 1341 m), deeply incised (D = 20 m) meander of Running Water Draw, west of US Highway 385 and 0.8 km southwest of the town of Sunnyside. Three cores were taken: Rw-16 was at the northwest corner of the roadside park south of town, and Rw-17 and Rw-21 were on the floor of the draw on either side of the valley axis and just north of the artificial channel.

Tarzan (Martin Co, TX; Lenorah West quad; 32°18'23"N 101°59'39"W): The site is in an incied meander of Mustang Draw (W = 244 m; D = 4 m) at the FM 176 crossing. Three cores were taken in the south right-of-way: Mu-18 was on the valley axis, just southeast of the county road intersection, Mu-19 was on the east valley margin, and Mu-20 was on the west valley margin on the west side of the intersection.

Tolk (Lamb Co, TX; Muleshoe NE quad; 34°13'20"N 102°33'45"W): This site is along a gently curving, very shallow (almost imperceptible) reach (W = 274 m) of Blackwater Draw along the north side of the Muleshoe Dunes. One core (Bw-36) was recovered from the center of the draw on the west side of FM 2910 leading to the Tolk power generating plant.

Tower Road (Midland Co, TX; Southeast Midland quad; 31°53'51"N 102°05'07"W): The site is in a shallow (D = 3 m), straight reach of Monahans Draw (W = 600 m) at the Tower Road crossing. One core (Mn-2) was taken in the east right-of-way on the valley axis. The local water table was just below the surface.

Upper Curtis Erwin (Martin Co, TX; Stanton SE quad; 32°05'20"N 101°51'59"W): The site is in a wide (W = 750 m), deep (D = 10 m), entrenched meander of Mustang Draw. Two cores were taken: Mu-24 was in

about the center of the meander and Mu-25 was on the east side of the valley floor.

Walker (Martin Co, TX; Germania quad; 32°06'00"N 101°54'00"W): The site is in a broad (W = 244 m; D = 6 m), gently curving reach of Mustang Draw on the west side of a county road crossing 1.6 km above the Interstate 20 crossing. Two cores were taken along the valley axis: Mu-16 was 50 m west of the county road and Mu-17 was 100 m west of the county road.

Welch (Dawson Co, TX; Welch West quad; 32°53'40"N 102°08'25"W): The site is in a deep (D = 8 m), gently curving reach of Sulphur Springs Draw (W = 600 m). Four trenches were described: SS-3 was high on the west valley margin, SS-4 was at the foot of the west valley margin, SS-5 was on the valley axis, and SS-6 was high on the east valley margin.

Wroe (Wroe Ranch) (Midland Co, TX; Stanton SE quad; 34°04'30"N 101°50'18"W): This site is in a wide (W = 427 m), deep (D = 12 m), very gently curving reach of the draw. Five cores were taken: Mu-15 was on the valley axis, 20 m east of the county road crossing; Mu-33 was on the valley axis 170 m east of the county road; Mu-34 was on the valley axis 270 m east of the county road; and Mu-35 was an abandoned well on the north side of the valley floor at the mouth of a small reentrant.

Yater (Midland Co, TX; Stanton SE quad; 32°05'00"N 101°51'27"W): The site is in a wide (W = 720 m), deeply incised (D = 12 m) meander of Mustang Draw east of the FM 829 crossing. Two cores were taken: Mu-10 was in about the center of the meander, near the valley axis, and Mu-11 was on the southwest side of the valley floor.

Geological Society of America
Memoir 186

Appendix B

Laboratory methods and data

Peter M. Jacobs

Samples for laboratory analyses were collected from most cores and exposures examined in the draws. The samples were placed in sealed plastic bags and brought to the soil and geomorphology lab on the Department of Geography, University of Wisconsin - Madison. Laboratory data are available for over half of the cores and sections. In this section, data are presented, if available, for the cores and sections described in Appendix 1.

Samples selected for laboratory investigation were analyzed for particle-size distribution, and organic-carbon and calcium carbonate content. Selected samples also were analyzed for bulk density, pH, and clay mineralogy. All samples to be analyzed were air-dried and then crushed with a ceramic mortar and pestle, sieved through a 2 mm sieve, and stored in sealed plastic bags.

Particle-size analysis was performed by the pipette procedure as modified from Day (1965) and Janitzky (1986a). Approximately 25 g samples were placed in 250 mL centrifuge tubes and pretreated to remove calcium carbonate and organic matter. Carbonates were removed by repeated digestion with 0.5 N HCl in a 60°C water bath (Jackson, 1969). A sink aspirator and pipette apparatus were used to remove the neutralized acid solution. Organic matter was oxidized by the addition of 5-10 mL H_2O_2 (30%) while in a hot water bath. Following pretreatment, the samples were washed with distilled water (DI) and centrifuged to remove any remaining acid or peroxide solution. Samples were dispersed with exactly 25 mL sodium pyrophosphate (50 g/L solution) and shaken overnight on a reciprocating shaker.

Dispersed samples were wet sieved through a 63 μm sieve using DI. The sand was oven dried and fractionated in to very fine (63-125 μm), fine (125-250 μm), medium (250-500 μm), coarse (500-1000 μm), and very coarse (1000-2000 μm) fractions on a sonic sifter. The silt and clay suspension passed into 1 L cylinders that were placed on a bench around a swinging pipette rack. At appropriate depths and times

(Tanner and Jackson, 1947), 25 mL aliquots were drawn with a vacuum driven pipette, oven dried at >100°C, and weighed to the nearest thousandth gram on a digital balance.

Other determinations include: organic carbon contents by wet combustion (Walkley-Black method) (Janitzky, 1986b) using 1 N ferrous sulfate; calcium carbonate contents by gasometry with a Chittick apparatus (Machette, 1986); bulk density by the clod method (Singer, 1986); and pH with a 1:1 soil-water paste (Janitzky, 1986c).

Clay mineralogy of the <2 μm clay fraction was examined on samples pretreated to remove calcium carbonate with 0.5 N HCl. Samples were dispersed with 10-15 mL sodium pyrophosphate and the clay fraction was removed by pipetting. Approximately 8 mL of the clay suspension was saturated with 0.1 M MgCl and concentrated into a slurry by centrifugation. The slurry was placed on porous clay tiles and washed with DI. Glass slides (27 x 45 mm) were prepared for X-ray diffraction by smearing the clay paste on a labeled slide with another slide. The coated slides were glycolated overnight at 60°C then X-rayed from 2-30 degrees two-theta on a microvax-driven SCINTAG/USA diffractometer using Cu-Kα radiation at 40 mA and 45 kV with 1° and 2° divergence and receiving slits respectively.

Table B1. Laboratory data for the Anderson Basin #1 site (Bw-71).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
C	0-18	0	1	7	34	39	81	14	5	LS	17	0.1
Agb1	18-28	0	2	15	45	21	83	11	6	LS	1	0.1
C1b1	28-50	0	1	11	47	34	93	4	3	S	0	0.0
C2b1	50-52	0	1	8	28	33	70	21	9	SL	2	0.1
C3b1	52-87	0	3	30	48	16	96	2	1	S	1	0.0
2Ab2	87-104	0	1	3	12	17	33	50	17	SiL	13	0.6
3C1b2	104-108	0	1	6	36	36	80	19	1	LS	3	0.2
3C2b2	108-115	0	3	21	53	19	97	3	0	S	1	0.0
3C3b2	115-140	0	4	27	51	15	98	1	0	S	1	0.1
3C4b2	140-148	0	5	29	50	13	97	3	0	S	1	0.0
3Btgb3	149+	0	5	24	46	18	93	5	3	S	2	0.0

Table B2. Laboratory data for the Bailey Draw site (Bw-39).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
A	10-43	0	0	2	16	34	52	23	25	SCL	0	0.5
AB	43-62	0	0	1	11	28	41	31	27	CL	0	0.3
Bt1	62-92	0	0	1	11	29	41	32	27	CL	1	0.4
Bt2	92-102	0	0	2	14	28	44	28	28	CL	1	0.3
A1b	102-122	0	0	2	16	29	48	25	27	SCL	1	0.5
A2b	122-143	0	1	3	21	30	55	21	24	SCL	1	0.5
ACb	143-163	0	1	5	28	35	70	15	16	SL	1	0.3
C1b	163-184	0	2	7	36	37	81	9	10	LS	1	0.1
2C2b	184-198	0	6	8	21	19	54	41	4	SL	9	0.2
3C3b	198-208	0	4	9	30	35	78	10	12	SL	16	0.2
4C4b	208-229	9	10	8	12	13	53	32	16	SL	49	0.3
5Cgb	229-264	0	2	7	33	26	68	9	24	SCL	1	0.0
6Cb	264-290	14	10	6	11	10	50	36	14	L	66	0.0

Table B3. Laboratory data for the BFI site (North Pit).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
A	0-16	0	1	8	37	39	84	6	10	LS	3	0.5
BA	16-40	0	0	8	38	38	85	7	9	LS	4	0.6
Bk	40-86	0	0	7	36	37	81	9	10	LS	7	0.4
BAb	86-123	0	0	12	42	18	73	14	13	SL	9	0.5
Ab	123-147	0	0	5	28	34	67	20	13	SL	7	0.5
Akb	147-184	0	0	4	30	36	70	18	13	SL	6	0.5
Bkb	184-220+	0	0	4	31	41	77	15	8	LS	12	0.2

Table B4. Laboratory data for the Bledsoe site (Su-1).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
4Btb3	164-181	0	2	31	34	12	80	6	14	SL	1	0.0
4Btkb3	181-194	0	1	13	34	18	66	11	23	SCL	3	0.0
5C1b3	194-236	1	2	4	13	10	30	37	33	CL	53	0.0
5C2b3	236-326	0	1	4	17	12	34	35	31	CL	46	0.0
6Btkb4	326-349	0	1	7	28	19	55	20	25	SCL	23	0.0
7Cb4	349-360	3	3	4	13	7	31	43	26	L	58	0.1
8Btb5	360-370	0	0	6	42	19	68	14	18	SL	4	0.1

Table B5. Laboratory data for the Boone site (Md-2).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
Bt	60-82	0	1	22	23	16	63	29	9	SL	6	0.7
Bk	82-120	11	14	10	9	16	60	27	13	SL	6	0.6
Btkb1	120-200	0	2	13	17	16	49	43	8	L	16	0.8
Cb1	200-215	5	8	15	17	13	57	28	15	SL	47	0.8
Ab2	215-265	1	3	14	23	19	59	30	11	SL	31	1.0
C1b2	265-400	0	1	27	24	17	70	19	11	SL	22	0.6
2C2b2	400-425	1	3	45	27	10	87	9	4	LS	18	0.4

Table B6. Laboratory data for the Brownfield site (Su-16).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
Btk2	360-430	0	0	6	24	23	54	32	14	SL	14	0.3
Ab	430-455	3	8	10	23	18	62	25	13	SL	30	0.6
C1b	455-480	1	2	4	29	40	76	18	6	LS	14	0.0
C2b	480-540	0	0	6	42	33	81	15	4	LS	11	0.0
C3b	540-550	0	0	4	41	39	84	13	3	LS	3	0.1

Table B7. Laboratory data for the Cannon site (Bw-29).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
ABt	40-62	0	0	1	20	9	31	54	14	SiL	3	0.8
Bt	62-104	0	0	2	6	11	19	50	31	SiCL	13	0.5
Btk	104-118	0	0	2	9	9	20	39	40	C	11	0.5
Bt'	118-150	0	0	4	9	12	25	45	30	CL	11	0.3
Btk'	150-166	0	0	4	20	10	35	42	23	L	6	0.2

Table B8. Laboratory data for the Clovis site (Bw-60).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
Silage Pit												
A	0-40	0	3	21	33	19	77	13	10	SL	4	0.4
ABtk	40-90	0	4	24	28	18	74	16	10	SL	4	0.2
Btk	90-130	0	7	28	31	15	81	11	8	LS	2	0.2
2C1	130-160	1	8	39	37	10	95	4	2	S	8	0.0
3C2	160-195	0	9	43	36	8	96	2	2	S	1	0.0
4Btkb	195+	0	5	28	41	13	87	6	6	LS	1	0.0

Table B9. Laboratory data for the Davis site (Bw-45).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
A	20-55	0	9	24	28	22	82	10	7	LS	1	0.4
Bt	55-100	0	11	29	28	18	87	7	6	LS	3	0.2
C	100-146	0	8	24	33	26	92	4	5	S	2	0.0
C1b1	185-250	0	2	14	30	29	75	17	9	SL	10	0.3
Akb2	300-330	1	4	5	20	28	57	33	10	SL	6	0.2

Table B10. Laboratory data for the Edmondson site (Rw-19).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
A	75-120	0	1	17	32	25	74	15	11	SL	7	0.7
Bt	120-145	0	0	11	34	29	75	16	9	SL	5	0.5
Bw	145-175	0	0	14	40	30	83	10	6	LS	5	0.8
Akb1	175-255	0	2	17	30	21	70	16	14	SL	7	0.4
Btb1	255-300	0	0	6	39	28	73	14	13	SL	6	0.4
C1b1	300-308	0	1	7	27	30	64	20	16	SL	10	0.9
3Ab2	311-350	0	1	5	11	18	35	36	29	CL	4	0.9
3C1b2	350-360	0	4	15	13	14	45	31	24	L	48	0.8
4C4b2	400-420	0	4	17	29	35	85	9	5	LS	1	0.1

Table B11. Laboratory data for the Enochs site (Yh-33).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
A	130-142	0	0	1	11	45	56	24	20	SCL	2	0.2
Bt1	142-180	0	0	1	19	46	65	20	15	SL	1	0.1
Bt2	180-215	0	0	1	12	50	62	23	15	SL	1	0.1
BAt1	215-250	0	0	1	9	40	51	34	15	L	1	0.2
BAt2	250-270	0	0	1	7	31	40	42	19	L	1	0.2
Ab	270-274	0	0	1	9	36	47	35	18	L	1	0.3
C1b	274-300	0	1	3	9	31	44	23	33	CL	19	0.1

Table B12. Laboratory data for the Evans site (Bw-17).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
Ab1	140-195	0	0	4	32	43	79	15	6	LS	1	0.5
2A1b2	205-245	0	0	2	22	54	78	18	3	LS	4	0.5
2A2b2	245-280	0	0	2	11	28	42	47	11	L	5	0.4
2C1b2	305-360	0	0	3	8	12	22	49	28	CL	16	0.3
2C2b2	360-410	0	1	2	3	8	15	48	37	SiCL	48	0.1
marl	520-535	0	1	6	24	26	57	28	15	SL	32	0.2
marl	550-590	0	0	2	16	31	49	40	11	L	19	0.1

Table B13. Laboratory data for the Flagg site (Rw-11).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
A	0-25	0	1	3	10	25	39	45	16	L	4	1.4
Bt	25-72	0	1	10	24	31	66	22	13	SL	5	0.8
Ab	72-104	0	0	4	14	30	48	38	13	L	1	1.5
ABt1b	104-145	0	1	9	21	31	62	25	13	SL	1	0.7
ABt2b	145-164	0	1	9	20	28	57	28	14	SL	2	0.7
Bt1b	164-195	0	1	11	24	29	65	20	16	SL	3	0.7
Bt2b	195-261	0	2	10	19	27	58	24	18	SL	5	0.5

Table B14. Laboratory data for the Gibson site (Bw-31, Bw-78).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
						Bw-31						
2C1	75-100	0	1	25	49	17	93	5	3	S	3	0.4
2C2	100-125	1	2	28	51	12	93	4	3	S	5	0.4
4C4	280	3	5	20	36	11	75	17	8	SL	10	0.0
4C4	300	5	9	22	29	7	72	19	9	SL	15	1.6
4C4	320	2	3	28	39	7	79	15	6	LS	12	0.4
						Bw-78						
C1	0-12	0	0	12	45	29	86	11	3	LS	7	0.5
C2	12-25	0	0	16	55	21	93	6	1	S	2	0.1
Ck	25-70	0	0	28	56	13	97	2	0	S	1	0.2
Ab1	70-85	0	0	26	56	14	97	2	0	S	2	0.2
C1b1	85-110	0	1	31	55	11	98	2	1	S	4	0.1
C2b1	110-171	0	0	24	56	16	95	3	1	S	7	0.4
Ck1b1	171-230	0	1	28	55	13	97	3	0	S	2	0.0
Ck2b1	230-265	0	1	30	53	13	96	3	1	S	2	0.0
Ck3b1	265-273	0	0	22	51	20	94	5	2	S	1	0.2
A1b2	273-280	0	0	24	51	17	92	7	2	S	1	0
A2b2	280-310	0	0	24	54	15	93	5	2	S	1	0

Table B15. Laboratory data for the Glendenning site (Mu-3).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
Ap	14-42	0	1	4	37	1	43	47	10	L	6	0.4
BA	42-81	0	1	5	43	1	50	42	8	L	9	0.3
Bw1	81-108	1	1	5	37	17	61	33	6	SL	12	0.3
Bw2	108-137	1	2	6	42	1	52	41	7	L	12	0.3
2Bw3	137-170	4	4	6	39	6	59	34	7	SL	15	0.2
2Akb	170-213	29	15	9	23	2	78	16	6	LS	22	0.2
2ACgkb	213-230	4	5	7	37	14	67	32	1	SL	32	0.1
2Cgkb	230-263	9	4	11	41	0	65	29	6	SL	14	0.0
3Cgb	263-298	0	1	6	47	0	54	39	7	SL	19	0.1
4Cgb	298-328	0	1	4	46	4	55	41	4	SL	15	0.1
5Cb	328-360	1	9	23	48	8	89	7	4	S	36	0.0

Table B16. Laboratory data for the Halsell site (Bw-27).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
Bt	35-80	0	0	8	29	32	70	19	11	SL	2	0.3
BC	80-100	0	1	5	31	35	72	12	16	SL	8	0.2
C1b	115-150	0	0	6	24	21	50	24	25	SCL	14	0.4
C2b	150-212	0	3	8	25	23	59	27	14	SL	28	0.2

Table B17. Laboratory data for the Houck site (Rw-2, Rw-3).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
						Rw- 2						
A	50-85	0	6	18	29	27	80	11	10	SL	4	0.4
Bt	85-128	0	4	16	29	28	76	13	11	SL	4	0.3
C1	128-146	0	5	21	32	24	82	9	9	LS	4	0.4
2C2	146-155	1	6	13	28	32	80	9	12	SL	17	0.5
3C3	155-210	0	3	13	26	31	74	14	12	SL	8	0.4
3C4	210-230	0	2	11	30	32	76	12	12	SL	4	0.3
3C5	230-250	0	3	14	28	32	77	12	11	SL	8	0.4
3Ab	250-285	0	2	13	23	25	64	16	21	SCL	2	0.7
3C1b	285-320	0	38	14	31	32	79	10	11	SL	2	0.4
4C5b	450+	14	2	18	10	6	86	5	8	LS	18	0.2

Table B17 cont'd.

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
						Rw-3						
A	60-110	0	0	3	19	42	64	20	16	SL	2	0.7
Btk1	120-150	0	0	1	6	31	39	39	22	L	7	0.4
Btk1	190-220	0	0	1	7	31	39	47	14	L	3	0.3
Btk2	240-270	0	0	2	7	25	34	45	20	L	4	0.4
Btk3	290-320	0	0	1	7	19	28	52	20	SiL	3	0.6
Btk4	330-360	0	0	5	17	33	56	28	16	SL	3	0.2
Ab	360-418	0	0	3	11	24	38	48	14	L	5	0.5
2C1b	418-430	0	1	7	37	36	81	12	7	LS	13	0.3
2C2b	500-530	0	2	8	31	38	80	16	5	LS	10	0.1

Table B18. Laboratory data for the Lubbock Landfill site (D-4, W-4, W-2).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
						D-4						
C	0-23	0	0	8	35	34	77	15	8	SL	4	0.2
Ab1	23-45	0	0	5	30	34	70	21	9	SL	10	0.4
Bwb1	45-74	0	0	4	28	34	67	21	12	SL	11	0.2
Akb2	74-100	0	0	2	13	25	40	47	13	L	7	0.4
Btk1b2	100-125	0	0	2	14	26	43	46	12	L	3	0.4
Btk2b2	125-150	0	0	1	10	28	40	51	9	SiL	0	0.2
Akb3	150-225	0	0	2	12	20	34	56	10	SiL	1	0.3
Btkb3	225-280	0	0	6	28	25	59	33	8	SL	4	0.2
Ab4	280-310	0	0	5	36	31	72	19	9	SL	31	0.4
C1b4	310-380	0	1	24	35	22	82	12	6	LS	14	0.2
2C2b4	380-400+	4	11	11	27	24	76	17	7	SL	18	0.2
						W-4						
A	0-30	0	1	17	55	39	83	8	9	LS	3	0.3
Akb1	30-65	0	0	6	23	44	75	17	8	SL	9	0.3
Btk1b1	65-105	0	0	6	30	30	73	16	10	SL	10	0.3
Btk2b1	105-155	0	0	8	28	34	72	15	13	SL	8	0.3
Bwb1	155-174	0	0	12	51	34	80	11	9	LS	3	0.1
ABkb2	174-245	0	0	5	22	40	73	19	8	SL	10	0.2
ACb2	245-320	0	0	4	23	25	69	22	9	SL	12	0.1
A1b3	320-393	0	0	4	20	31	64	27	10	SL	11	0.4
						W-2*						
Ab4	273-285	0	0	2	6	10	59	31	11	SL	27	0.7
Ab4	285-330	0	0	2	7	14	63	37	0	SL	29	1.2
C1b4	330-358	0	0	8	33	30	80	14	7	LS	20	0.1
2C2b4	358-373	0	0	13	45	40	81	15	4	LS	1	0.1

*Data for strata 3 & 4 from section W-2, 21m south of W-4.

Table B19. Laboratory data for the Lupton site (Yh-1).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
C1	50-105	0	0	4	22	45	71	25	5	SL	12	0.1
Ab	140-160	0	0	3	19	49	71	26	2	SL	4	0.0
2C2b	170-275	1	0	2	11	19	33	21	46	C	52	0.0

Table B20. Laboratory data for the Midland site (Mn-5, Mn-19).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
						Mn-5						
A	0-5	0	1	33	44	17	95	2	3	S	1	0.7
ABw	7-15	0	0	42	47	2	91	2	7	S	1	0.2
Bw1	15-25	0	0	51	23	17	92	2	6	S	1	0.0
Bw2	50-60	0	0	66	26	2	93	2	5	S	1	0.0
Bw2	85-95	0	0	27	44	23	95	1	4	S	0	0.1
C1	96-105	0	0	67	25	1	92	2	6	S	1	0.0
C1	110-122	0	0	19	38	35	92	3	5	S	1	0.0
C2	125-130	0	0	63	28	1	92	2	5	S	1	0.0
C2	132-138	1	2	19	30	31	84	7	9	LS	13	0.3
C2	135-140	0	0	10	77	1	88	6	6	LS	1	0.1
C3	145-150	0	0	2	24	54	81	13	6	LS	6	0.2
						Mn-19						
C	0-15	0	1	27	47	21	96	3	1	S	0.1	0.2
Ab1	15-55	0	1	39	44	12	95	3	2	S	0.0	0.3
Bw1b1	55-100	0	0	39	41	15	96	2	2	S	0.2	0.0
Bw2b1	100-170	0	0	32	56	10	97	1	2	S	0.0	0.0
Btb1	170-180	0	1	62	25	9	98	1	1	S	0.0	0.0
Ab2	180-250	0	1	38	42	11	93	5	2	S	0.0	0.0
Btb2	250-300	0	1	37	46	10	94	1	5	S	0.0	0.0
Bwb2	300-350	0	1	40	46	10	96	2	2	S	0.0	0.3

Table B21. Laboratory data for the Mustang Springs site (Trench 5).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
Ap	0-26	3	3	10	17	19	52	32	16	L	12	1.8
A	26-62	0	1	4	11	24	40	45	15	L	13	0.8
2Bt1	62-110	2	3	8	15	21	50	36	14	L	23	0.3
2Bt2	110-126	2	5	11	18	22	57	29	14	SL	28	0.4
3C1	126-175	3	8	8	7	6	31	32	37	CL	55	0.5
3C2	175-185	1	5	7	5	5	25	41	34	CL	70	0.6

Table B22. Laboratory data for the Payne site (Yh-6, Yh-7).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
						Yh-6						
ABt	0-76	0	0	2	40	8	51	30	19	L	6	0.7
C1b	125-330	1	2	14	28	19	64	18	18	SL	26	0.2
						Yh-7						
C	115-145	0	0	2	52	6	60	29	11	SL	4	0.6
Btb	175-210	0	0	4	32	22	58	29	13	SL	8	0.3
Btkb	210-290	0	0	3	47	3	53	31	17	SL	10	0.1
2C1b	290-370	0	0	2	11	29	42	38	20	L	27	0.1
2C2b	370-400	2	6	5	25	2	40	45	15	L	55	0.6

Table B23. Laboratory data for the Plains Paving site (North Wall).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
Ap	0-16	0	2	8	8	12	31	36	32	CL	3	1.5
ABt	16-59	0	3	12	13	17	45	27	28	CL	1	1.1
2BAt	59-77	0	6	20	18	20	63	19	18	SL	1	0.6
2Bt	77-96	0	6	19	20	21	65	19	16	SL	2	0.6
2Bw	96-123	0	6	21	22	22	71	17	12	SL	7	0.3
2CB	123-134	0	4	18	25	30	78	13	9	SL	16	0.4
2C1	134-162	0	3	16	23	39	81	12	7	LS	15	0.3
3C3	172-185	0	6	38	31	19	94	4	2	S	6	0.2
4C4	185+	1	19	51	18	7	97	1	2	S	8	0.2

Table B24. Laboratory data for the Plainview site (Sections 2, 3).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
						Section 2						
A	0-18	0	0	2	7	18	28	51	21	SiL	6	0.9
AB	18-34	0	0	1	4	13	18	60	21	SiL	7	0.7
BAt	34-46	0	0	2	12	10	24	56	19	SiL	5	0.7
Bt	46-87	0	1	5	10	11	27	52	22	SiL	5	0.7
Btk1	87-100	0	1	18	24	6	48	28	23	L	4	0.4
2Btk2	100-117	0	2	16	26	19	63	24	13	SL	2	0.3
2Bt	117-157	0	2	30	33	5	70	20	10	SL	4	0.3
3Bw	157-185	0	2	25	38	14	80	15	6	LS	8	0.1
3C1	185-213	0	1	6	63	16	86	12	3	LS	9	0.2
4C3	227-273	0	2	17	66	14	99	2	0	S	2	0.1
5C4	273+	0	11	73	10	3	97	3	0	S	8	0.2

Table B24 cont'd.

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
						Section 3						
A	0-24	0	0	5	11	7	23	53	24	SiL	3	1
BA	24-48	0	0	4	7	8	19	43	38	SiCL	7	1
Bt	48-70	0	0	1	3	6	10	45	45	SiC	6	1
BAb	70-95	0	0	2	2	1	5	48	47	SiC	3	1
Ab	95-135	0	0	4	8	15	27	52	21	SiL	2	1
Btkb	135-175	0	0	12	15	10	37	37	26	L	1	0
Bkb	175-210	0	0	13	16	10	39	36	25	L	14	0
2Cb	210-248	0	0	26	22	18	66	29	5	SL	9	1
3C2b	248-266	0	0	50	15	12	77	21	2	LS	10	0
4C3b	266-288	0	0	68	15	4	87	12	1	S	8	0

Table B25. Laboratory data for the Progress Draw site (Bw-42).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
A	64-90	0	0	2	19	40	62	26	12	SL	3	0.7
ABt	90-117	0	1	3	16	34	54	33	13	SL	1	0.6
Btk1	117-174	0	1	2	17	33	53	31	16	SL	3	0.5
Ak1b	190-240	0	0	2	13	33	48	38	13	L	2	0.3
Ak2b	240-285	0	0	1	12	32	45	40	14	L	2	0.6
Ak3b	285-330	0	0	2	14	33	50	37	14	L	5	0.3

Table B26. Laboratory data for the Seminole-Rose site (SE-13).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
C		0	0	8	59	25	92	5	3	S	1	0.2
Bwb1	35-100	0	0	3	31	48	81	16	2	LS	9	0.2
Bkb1	100-180	0	2	4	23	50	79	17	4	LS	27	0.2
Ab2	180-215	3	8	11	28	30	80	15	5	LS	13	0.2
Ckb2	215-240	0	0	5	39	29	73	19	8	SL	31	0.4
2C1b2	240-295	0	0	10	59	24	93	6	2	S	1	0.0
3C2b2	295-330	0	3	9	47	28	88	7	5	S	32	0.2
4C3b2	330-360	3	8	10	28	16	65	12	23	SCL	40	0.2
5C4b2	360-390	1	1	7	37	28	74	13	13	SL	27	0.1
6Bkb3	390+	0	0	7	35	35	77	15	8	SL	19	0.1
7Kb4	390+	15	16	21	25	10	87	7	6	LS	62	0.2

Table B27. Laboratory data for the Sundown site (Su-5).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
ABt	41-115	0	0	2	10	31	43	37	20	L	0	1.1
BAt	115-158	0	0	2	10	24	35	46	18	L	0	0.7
Btk1	158-213	0	0	2	10	18	31	48	21	L	3	0.0
Btk2	213-284	0	0	4	16	18	38	38	23	L	8	0.0
Ab	284-310	1	3	5	13	15	36	46	17	L	32	0.3
C1b	310-375	7	8	6	6	8	35	41	24	L	33	0.3

Table B28. Laboratory data for the Tolk site (Bw-36).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
A	20-50	0	1	5	19	30	54	36	10	SL	6	0.6
C1	50-100	0	2	5	12	12	31	27	42	C	37	0.6
C2	133-155	7	8	7	27	26	76	13	11	SL	33	0.3

Table B29. Laboratory data for the Walker site (Mu-17).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
A	17-48	0	1	11	36	24	72	17	11	SL	1	0.4
BAw	48-70	0	0	9	34	23	67	24	9	SL	0	0.4
Bw	70-97	0	1	8	34	27	70	21	9	SL	2	0.2
Bk	97-155	0	0	8	34	24	67	24	8	SL	8	0.2
Akb	155-180	4	9	14	26	21	74	17	9	SL	16	0.5
Cgb	180-275	11	18	14	13	9	65	19	16	SL	19	0.2
2Cb	300-335	0	1	14	54	23	92	6	2	S	8	0.1

Table B30. Laboratory data for the Wroe site (Mu-15).

Horizon	Depth	% of < 2 mm Fraction								USDA Texture	% $CaCO_3$	% Org. Carbon
		VCOS	COS	MS	FS	VFS	Sand	Silt	Clay			
A	100-125	0	0	1	5	10	17	60	23	SiL	3	1.8
BAtk	125-180	0	0	1	2	6	9	74	17	SiL	1	0.6
Btk1	180-195	0	0	1	5	10	17	64	20	SiL	14	0.4
Btk2	195-205	0	0	1	3	8	11	72	17	SiL	19	0.3
Ab1	205-230	0	0	2	6	15	23	56	21	SiL	34	0.4
C1b1	230-280	0	0	1	3	8	12	69	19	SiL	38	0.3
C2b1	280-350	1	2	1	4	8	17	61	22	SiL	61	0.6
C3b1	350-395	1	5	7	9	11	32	47	20	L	43	0.5
C4b1	395-465	0	7	10	13	12	44	35	21	L	43	0.6
Ab2	465-485	1	5	6	8	11	31	50	19	SiL	32	0.5
2Cb2	485-500	1	5	7	13	17	43	40	17	L	23	0.3

Geological Society of America
Memoir 186

Appendix C

Paleontological and paleobotanical methods

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BIOSILICATES

Biosilicates (phytoliths, siliceous algal bodies, and sponge spicules) were isolated from sediment samples using a procedure based on heavy-liquid (zinc bromide) flotation and centrifugation (Bozarth 1991). Biosilicate isolates were mounted on microscope slides and studied at 400x with a research-grade Zeiss microscope. At least 200 phytoliths, as well as other biosilicates, were counted in the samples from Edmonson, Flagg, Lubbock Landfill (4A), and Sundown sites. Because of relatively low concentrations, a minimum of 50 phytoliths, in addition to other biosilicates, were counted in the Mustang Springs samples. The other samples did not contain sufficient numbers of phytoliths to warrant analysis. Only complete (versus fragmented) diatoms were counted to insure comparable data.

DIATOMS

Diatom analyses included study of fossil samples and substrate-specific samples collected from modern lakes and marshes on the Southern High Plains. Diatomite sections from selected cores were analyzed in finely divided intervals estimated to represent a diatom population integrated over a period of several years. This strategy allowed identification of overall paleoenvironmental conditions and long- and short-term climatic and hydrological changes, because it averages out the vagaries of diatom seasonal succession and short-term biological succession related to colonization stages and habitat maturity. The modern samples provided a baseline of local diatom characteristics. Primary sources of autecological information include: Hustedt (1930); Hustedt (1927-1966); Patrick and Reimer (1966, 1975); Lowe (1974); Koivo (1976); Foged (1981, 1984); Gasse (1986, 1987); Krammer and Lange-Bertalot (1986, 1988, 1991a, 1991b).

Counts of 500 cells were done on each of the modern and fossil samples that were adequately diatomaceous following the methods of Hohn and Hellerman (1961). Percent relative abundances were calculated on the 500 cells counted. Those species that represent 1% or more of the total population, in at least one sample, have been included in the lists of species for each location. The common and dominant species (those representing at least 5 and 10% relative abundance, respectively, in any one sample) are used to define the association and as ecological indicators of the conditions at the time of sediment deposition.

A volume of approximately 1 cm^3 of each sample was cleaned with HCL to remove the carbonates and oxidized with H_2O_2 and $K_2Cr_2O_7$ to remove the organics. Cleaned material was air-dried onto glass coverslips and mounted on glass slides with HYRAX resin. Counts and identifications were done at a magnification of 1500X, with an Olympus BHT microscope. The five hundred diatom cells that were counted on each slide were recorded as each cell was encountered in randomly selected fields. In the case of sparsely diatomaceous samples, all the diatoms on the slide were recorded.

INSECTS

Samples for insect fossil analysis were taken from organic-rich sediments, in quantities ranging from 5-50 kg, depending on the content of organic detritus (greater amounts of sediment were taken from organic-poor zones). The sediments were washed through a 300 µm sieve and the organic detritus in the >300 µm fraction was sorted under a low-power binocular microscope. Insect fossil fragments were stored in vials of alcohol, and many robust specimens were mounted onto micropaleontology cards with gum tragacanth, a water-soluble glue. Fossil identifications were made by comparisons with modern, identified insect specimens in the U.S. National Museum of Natural History (Smithsonian Institution, Washington, D.C.).

MOLLUSCS

Mollusc samples were wet-screened through a series of nested standard soil sieves (#4, #8, #16, and # 30). After the resultant material was air dried, the shell was manually separated and placed into closed containers while awaiting identification. Identification was generally accomplished by direct examination,

drawing on previous personal experience in either field collection of live material or lab identification of shell material from previous studies of molluscan paleoassemblages. Shell not immediately identifiable was compared to standard identification manuals (Pilsbry 1939-1948; Burch 1962, 1972, 1975, 1982) and the author's personal reference collection. Use of the latter resource was particularly valuable when only portions of the original shell remained in the paleoassemblage.

Paleoenvironmental reconstruction techniques involved comparison of the preferred habitats and autecologies of extant populations of the constituent species with knowledge of the geographical and geological location of the source of the particular paleoassemblage. Stratigraphic nomenclature follows the scheme presented in Chapter 3, except for a few unusual situations where the molluscan samples indicated a slightly different or more detailed subdivision of the stratigraphy at a particular site.

OSTRACODES

The extraction of ostracodes from sediment followed procedures outlined by Forester and others (1994). Ostracode samples were frozen, placed in a steel beaker, weighed, and allowed to thaw. About 500 mL of boiling, deionized water was then added to the beaker, followed by about 5 to 7 grams of sodium bicarbonate. Once the solution cooled to room temperature about 5 to 7 grams of commercial sodium hexametaphosphate soap was added. The sampled stood for at least one day to promote disaggregation. The raw sediment was then suspended in the beaker and slowly poured through stacked 100 (150 um) and 230 (63 um) mesh sieves held under a gentle shower-type flow of hot tap water. Any remaining sediment lumps were disaggregated with a red sable brush. The remaining sand-size sediment was rinsed with deionized water. If the washed sediment was rich in organic matter, it was freeze-dried. Otherwise it was placed in folded paper towels to dry. Calcareous fossils were hand-picked from this sediment for study.

POLLEN

The laboratory procedures used for pollen analysis of lacustrine and fluvial sediments in the south-central U.S. generally differ from those applied to peat deposits. Carbonates and silicates were removed

through sequential acid washing using hydrochloric and hydrofluoric acids, respectively. Hydrofluoric acid treatment seldom removes all quartz silt and sand particles, so the sediment is separated using heavy liquids (such as zinc bromide or zinc chloride with a specific gravity of 2.0) in a centrifuge, where the organic fraction floats and the heavier mineral fraction sinks. The resulting organic fraction may be treated to a second hydrofluoric acid wash followed by acetolysis, staining, and slide preparation.

An important innovation in palynology is the introduction of a spike of exotic marker grains to each sample (Benninghoff, 1962), allowing calculation of pollen concentrations (grains per unit volume or weight) and pollen accumulation rates (when sedimentation rate is known), and, more recently, for establishing criteria of reliability of pollen assemblages that exhibit deterioration, such as those applied in the studies discussed here. Pollen assemblages characterized by low pollen concentration, low taxa diversity, and high proportions of corroded grains, may have been altered by differential destruction of pollen and, as a result, may not be reliable for vegetation reconstruction (Bryant and Hall, 1993). Most of the late Cenozoic deposits in the south-central U.S. fall, unfortunately, into this category.

A further application of the exotic spike is quality control during lab work. If an abundance of marker grains is recovered in a residue that is barren of pollen, the presence of the markers testifies that the absence of pollen is real and not an artifact of faulty laboratory techniques. In all of the above analyses, a spike of lycopod-spore marker grains was added to each sample at the beginning of laboratory processing, and, at the completion of lab work, all of the residues contained abundant lycopod markers.

Geological Society of America
Memoir 186

Appendix D

Historic springs in the draws of the Southern High Plains

Throughout most of historic time on the Southern High Plains, for both European explorers and Anglo-American settlers, springs were very important sources of water given the lack of perennial streams and the often brackish character of local lake waters. Springs and draws also were significant as landmarks to the explorers traveling the otherwise featureless plains. The significance of springs in the region declined beginning early in the 20th century with the advent of irrigation. Pumping of ground water provided ready and conveniently located sources of water and it also led to the demise of most springs on the Llano Estacado through excessive ground water withdrawal. An often-told story, water was and continues to be mined, largely from the Ogallala Formation, more rapidly than it is replaced by recharge (e.g., Cronin, 1964, 1969).

Because active springs can no longer be identified in most reaches of the draws, historic records and oral history must be relied upon for documentation. Springs are frequently mentioned in the many historic records of the region and were known to most of the early settlers (e.g., Holden, 1959; Bolton, 1990). For a comprehensive inventory of springs in Texas, however, the single best source is Brune (1981). He conducted a systematic search of old records and an exhaustive field study, including scores of interviews with local informants, to produce a superb record of historic springs in the draws, as well as elsewhere in the region and throughout Texas. In New Mexico no comparable study is available, unfortunately. Brune (1981, p. 482) identifies only one spring in a draw in New Mexico: Oho Springs on upper Sulphur Springs Draw in Lea County, New Mexico. The only other data for springs in New Mexico are for the Portales Valley and Blackwater Draw. A document published by the Bureau of Immigration (1903) in the Territory of New Mexico (1903), intended to attract businesses and settlers, mentions "a considerable number of... springs" (p. 5). Bolton (1990, p. 273) notes springs at Portales and near Melrose (35 km due west of Clovis), and spring-fed ponds were reported historically in the Anderson Basin area of Blackwater Draw (G. Agogino, personal communication, 1993).

The accompanying table (D1) is a summary of Brune's work. The list includes all springs in all draws investigated as part of the draw study, as well as springs along Wardswell and Sulphur Springs Draws, which were not investigated. The list does not include springs on tributaries or nearby lake basins except those close to the main draw and draining directly into it. The springs in the Portales Valley are not included because they are not adequately located.

Brune's study is organized by county and he numbered most springs within each county, beginning with number 1. For example, the historic spring at the Lubbock Lake site is #2 in Lubbock County and the historic spring at Mustang Springs is #5 in Martin County. Some springs are unnumbered and for the purposes of this monograph they are lettered within each county beginning with letter "a." On the map of historic springs (Fig. 17) all springs are identified with a letter-number or letter-letter code based on the county-number or county-letter identification in Table D1. For example, the spring at Lubbock Lake is L2 and that at Mustang Springs is M5. Several counties begin with the same letter (Lamb and Lubbock, Midland and Martin), but the springs can be identified by going down the list in Table D1 and following the draw downstream. The list is organized by draw from north to south and then by county moving downstream. Within each county the springs are arranged in numerical order. Additional location information is provided under "Remarks", taken directly from Brune. Latitude and longitude also are listed if provided by Brune. Information regarding the demise of the springs is presented if available. Stratigraphic localities at or very near the springs are indicated in brackets.

Table D1: Historic springs along draws, Southern High Plains of Texas, from Brune (1981).

Draw	County	Brune No.	Name	Remarks
Blackwater	Bailey	2	Blackwater Lake	10 km W of Muleshoe; dried in 1940s.
		3	----	17 km W of Muleshoe; dried in 1930s [Bailey Draw].
		4	Jumbo or Turnbo	3 km NE of Muleshoe; dried in 1925.
	Lamb	a	Mustang Lake	Spring-fed lake 1.5 km E of Bailey Co. line.
		3	Alamosa	7 km E of Bailey Co. line; dried by 1940 [Tolk].
		4	Soda	Soda Lake, 2 km SE of L3.
		5	Sod House	10 km N of Amherst; dried in 1950s.
		6	----	2 km below #5.
		7	Spring Lake	8 km W of Earth; dried by 1942, seeped until 1960s [Halsell].
		8	Gibson	Dried in 1952 [Gibson].
		9	Rocky Ford	Just above US 285 crossing; dried in early 1950s [McNeese; updraw of Evans].
		10	----	6 km WSW of Fieldton; dried in 1930s.
		11	Fieldton	S of Fieldton; dried by 1949.
		12	Hart	1 km SE of Hart Camp; dried in 1930s.
	Hale	5	Eagle	12 km WNW of Abernathy; dried in 1930s, seeped until 1940s.
	Lubbock	a	----	Series of springs in lower 25 km reach of draw [S Bar-3, Lubbock Landfill, BFI][1].
McKenzie	Gaines	5	Balch	S of Cedar Lake; 32°44'N lat, 102°18'W long; Still flowing in 1977.
		4	----	3 km updraw of #5.
Midland	Midland	7	----	Near Glasscock Co. line [Boone].
Monahans	Ector	1	----	Just S of Odessa.
Monument	Andrews	2	----	2 km E of Florey.
Mustang	Martin	4	Baldwin	3 km above Midland Co. line; dried by 1940 [Walker].
		5	Mustang	13 km W of Stanton; dried in early 1940s [Mustang Springs].
		7	Kilpatrick	Series of springs 2-7 km SSW of Tarzan; dried in 1920s [Glendenning].
	Midland	9	----	7 km SW of Stanton; dried in 1950s [Wroe].
Running Water	Parmer	1	----	6 km E of Bovina; dried early 1940s.
	Castro	4	----	Water 1 m deep in 1920s [updraw from Sunnyside].
		5	Flagg	5 km S of Flagg; dried in late 1930s [Flagg].
	Lamb	1	King	11 km N of Olton; dried in 1954, seeped into 1960s [Mandrell].
		2	----	10 km ESE of Sunnyside.

Table D1 (cont'd)

Draw	County	Brune No.	Name	Remarks
Running Water	Hale	1	----	Dried in mid 1940s [Plainview & Quincy; updraw of Plainview Landfill].
		2	----	7 km SW of Aiken.
		6	Running Water	4 km S of Edmonson; dried by 1930s [updraw of Plains Paving].
		7	Jones	5 km W of Edmonson [Edmonson site].
		8	Ojo de Agua	8 km W of Edmonson; dried in 1950s.
		9	Morrison	10 km W of Edmonson; dried by 1948.
		10	Norfleet	2 km from Lamb Co. line; dried ca. 1945.
Seminole	Gaines	9	Indian Wells	9 km S of Seminole.
		6	----	32°39'N lat, 102°30'W long; Dried by 1925.
Sulphur	Cochran	6	----	10 km SSE of Lehman; 33°32' N lat, 102°46'W long.
		7	----	Where draw and Highway 125 cross state line [Bledsoe].
	Hockley	6	----	SW corner of county.
	Terry	2	----	5 km W of New Moore.
		4	----	11 km N of Johnson.
		9	----	Confluence of S. Lost and Sulphur Draws; dried before 1917 [Brownfield].
		10	----	11 km ESE of Brownfield.
		11	Seven Lakes	17 km SE of Brownfield [Brownfield Lake].
		14	----	7 km W of New Moore [New Moore West].
Sulphur Springs	Lea, NM	a	Oho	1-5 km W of state line.
	Yoakum	2	Ulou	Halfway betw Bronco & Plains.
		3	----	In Plains.
	Terry	13	----	10 km ESE of Wellman.
		a	----	7 km NW of Wellman.
	Dawson	5	----	5 km S of Welch; dried by 1900.
	Martin	10	Sulphur or Ojo Piedra	11 km N of Lenorah; still flowing in 1979.
Wardswell	Gaines	8	Wards Well	4 km S of Seminole.
		10	Boar's Nest	NW Gaines Co; 32°57'N lat, 102°57'W long.
Yellowhouse	Bailey	8-10,14	---	Springs in salinas draining into draw [updraw of Enochs].
	Cochran	4	----	Just S of Bailey Co. line and 7 km E of state line.
	Hockley	4	----	
	Lubbock	2	Lubbock	Intersection of Loop 289 and US 84; dried in 1940s [Lubbock Lake].

[1] Brune, 1981, p. 298; Bolton, 1990, p. 273.