Ann. Zool. Fennici 28:329–340
Helsinki 19 February 1992

ISSN 0003-455X

The Avenue Local Fauna, Late Pleistocene vertebrates from terrace deposits at Austin, Texas

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Received 2 May 1990, accepted 2 August 1990

Alluvial deposits from the late Pleistocene First Street Terrace of the Colorado River at Austin, Texas, U.S.A. have produced fossils representing a diverse vertebrate fauna. Four extinct forms, *Mammut americanum*, *Mammuthus* sp., *Glossotherium* sp. and *Equus* sp. are represented. In the deposit are fossils of six extant taxa of mammals that no longer occur in the Austin area. They currently occur to the north and/or east in either cooler or more humid climates. The taxa represented suggest a marsh-like situation. Three radiocarbon dates give an approximate age of 15 000 years BP.

1. Introduction

In January 1985 excavations connected with the construction of the Temple-Inland Building at 301 Congress Avenue in Austin, Texas, resulted in the discovery of an alluvial deposit containing a diverse late Pleistocene fauna. Although isolated specimens of *Bison antiquus* and *Equus* sp. have been previously recovered from this terrace, this deposit contains the first coherent fauna from any of the terraces of the Colorado River in central Texas, The faunal diversity, precise stratigraphic data and radiocarbon dates give the site considerable significance.

2. Location and age

The fossiliferous deposit, here designated the Avenue Site after a long-standing custom of calling this main thoroughfare "The Avenue", is located at 301 Congress Avenue in the main busi-

ness district of Austin, Texas (Fig. 1). The bones were encountered at a depth of eighteen feet (5.5 meters) below the surface of the First Street Terrace of the Colorado River (Weeks 1941). The surface of this terrace at this site has an elevation of 450 feet (138 meters) and is 40 feet (12 meters) above the river today. The larger fossils were collected according to standard paleontological techniques. Detailed location data for each specimen were not obtained because of the time constraints imposed by the excavation schedule. The small bones were recovered by wet sieving matrix from area B using 1 mm screen. Small bones were recovered from the resulting concentrate.

The terraces of the Colorado River can be reliably traced for short distances both upstream and downstream as topographic surfaces underlain by alluvium. (Weeks 1941, Urbanec 1963, Weber 1968, Looney 1977, Looney & Baker 1977, Frederick 1987, Baker & Penteado-Orellano 1977, 1978, Collins et al. 1990). Upstream from Austin the river is deeply entrenched into the limestones of the Edwards Plateau and the valley and its terraces are narrow. Downstream from Austin the valley widens and the terraces are broader.

Six terraces have been identified along the Colorado River at Austin (Fig. 1). Each is underlain by alluvium up to forty feet (12 m) thick. From highest to lowest they are:

1) The Asylum Terrace which has an elevation of 620 feet (191 m) and is 190 feet (58 m) above the river;
2) The Hornsby Terrace, which is not preserved in the central city area is of limited extent. Its elevation is about 560 feet (172 m) and is about 150 feet (46 m) above the river (Weber 1968);
3) The Capitol Terrace has an elevation of 550 feet (170 m) and is 130 to 140 feet (40 to 43 m) above the river;
4) The Sixth Street Terrace has an elevation of 480 feet (148 m) and is 70 feet (21 m) above the river;
5) The First Street Terrace has an elevation of 460 feet (142 m) and is 40 feet (12 m) above the river;
6) The lowest terrace is the Fish Hatchery Terrace which has an elevation of 435 feet (134 m) and is 20 to 35 feet (6 to 10 m) above the river.

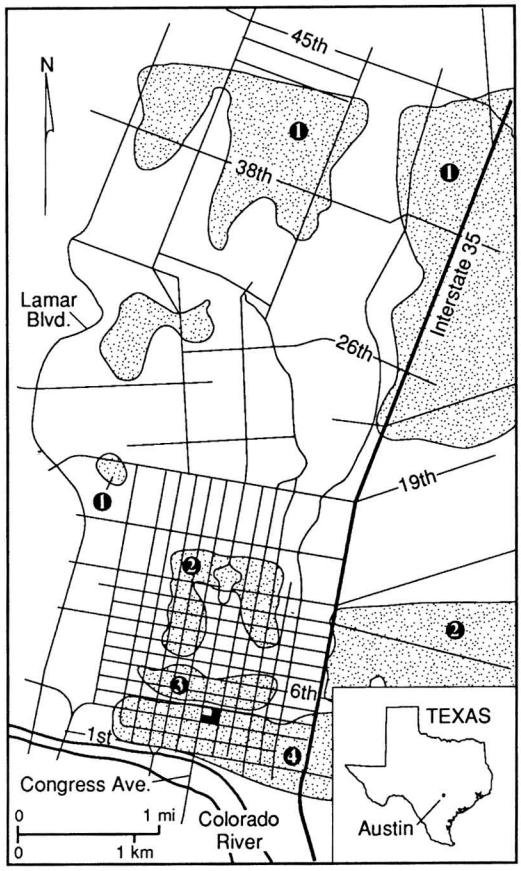

Fig. 1. Map showing the location of the Avenue Site (solid polygon) and the areas of outcrop of the Asylum Terrace (1), Capitol Terrace (2), Sixth Street Terrace (3) and First Street Terrace (4). The Hornsby and Fish Hatchery Terraces are not in the area depicted by the map.

All have been considered to be Pleistocene but, with the exception of the First Street Terrace, the specific ages of each terrace have not been determined.

Vertebrate fossils have been found in the following alluvial deposits in the Austin area. Two horse teeth (*Equus* sp.) were recovered from the Asylum Terrace gravel (Deussen 1924, Quinn 1957). Deposits underlying the Capitol Terrace have produced several horse teeth representing at least two species. In addition one tooth of a mammoth (*Mammuthus* sp.) has been recovered. While the horse teeth do not provide useful in-

formation on the age of the deposit, the mammoth tooth demonstrates that this deposit is either Irvingtonian or Rancholabrean (Lundelius et al. 1987).

The Sixth and First Street Terrace deposits also have produced scattered material. The tooth of a large horse was found 40 feet (12 m) below the surface of the First Street Terrace at Del Valle, 3 miles (4.8 km) down stream from the Avenue Site. A partial skull of *Bison antiquus* was recovered from 23 feet (7 m) below the surface of the First Street Terrace, a few hundred meters southeast of the Avenue Site (Buckley, unpubl.). In the collections of the Vertebrate Paleontology Laboratory, Texas Memorial Museum are other specimens from alluvial deposits of tributary streams that can be correlated with those of either the Sixth or First Street terrace deposits. They include mammoth, *Mammuthus* sp., American mastodon, *Mammut americanum* and horse, *Equus* sp.

None of the fossils provides a precise age determination for the various terrace deposits but they do demonstrate that the highest and presumably oldest, the Asylum Terrace, is Pleistocene. They also show that the Capitol Terrace cannot be older than Irvingtonian. The mammoth from these deposits is not referable to the earliest mammoth known from North America, *Mammuthus meridionalis*, which entered North America about 1.5 million years ago (Lundelius et al. 1987). The more advanced *Mammuthus* from the Capitol Terrace presumably indicates that these deposits are somewhat younger than 1.5 million years. The presence of bison in the First Street Terrace deposits indicates a Rancholabrean age. It is not known at present whether its absence in the higher terrace deposits is a result of inadequate sampling or the actual absence of the species from this region.

The three additional radiocarbon dates reported here are based on organic material from the clay immediately surrounding the fossil bones. Recent work has shown that fine-grained alluvial sediments usually contain organic material that can give reliable ages for the sediments (Blum & Valastro 1989, Haas et al. 1986, Brown et al. 1989, White & Valastro 1984). The dates from the Avenue site are as follows: from area A, lower red-brown clay TX5266 17 220 ± 1870; overlying grey-green clay TX5267 12 170 ± 3060; from area B grey-green clay TX5287 15 970 ± 860 (Fig. 2). These radiocarbon dates are consistent with the dates on similar faunas in central Texas (Lundelius 1967). They are also consistent with a radiocarbon date of 11 000 years BP from the middle part of the older deposits of the equivalent terrace at the confluence of the Colorado River and Barton Creek at Zilker Park 1.25 miles (2 km) upstream (Collins et al. 1990).

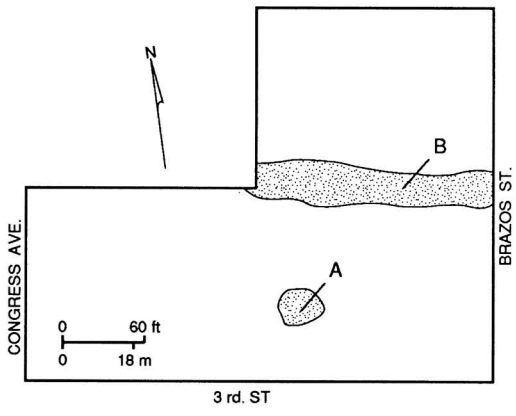

Fig. 2. Map of the excavation showing the two areas, A and B, from which the fossils were obtained.

3. Taphonomy and environment of deposition

Bones were recovered from two different areas (A and B) in the Congress Avenue excavation (Fig. 2). No observations exist that demonstrate that the bone bearing sediments of the two areas were originally continuous because all sediment between areas A and B was removed before the bones were discovered. However, the nature of the sediments at the two locations and the fact that they were at the same elevation indicates that the bone bearing unit was continuously distributed across the pit prior to its removal.

The sediments of area B have been described in detail by Frederick (1987) and consist of two units. The lower part of the sequence consists of reddish-brown (10 YR 5/4 to 10 YR 6/4), overbank silts and sandy silts. The grain size decreases upward to

the contact with the bone bed. The contact between the bone bearing grey (10 YR 6/2) clay and the underlying reddish brown clay was undulating but sharp. Frederick interprets this as a change from oxidized to reduced sediments. The same sequence appears in area A but no samples were analyzed in detail.

In one part of area A, however, there was evidence of mixing of the two materials from the two units. In this area there were fragments of bone whose long axes were not horizontal but had appreciable but random dips. This deposit is interpreted as a pond margin where animals trampled the bone fragments into the mud. Frederick (1987) interprets these sediments as having been deposited by slow moving, possibly perennial water that decreased in volume through time.

The fossil material from area A consisted of four tusks, three molars, ribs, vertebrae and other smaller skeletal elements that represent at least three individuals of the mastodon, *Mammut americanum*. The bones were disassociated and scattered. One of the tusks showed extensive cracking on one side indicating that it lay on the surface of the ground for some time before being buried (Behrensmeyer 1978).

Area B contained a partial skeleton of a mammoth, *Mammuthus* sp., and most of the small animal remains which were recovered by wet sieving the matrix in the vicinity of the mammoth bones. The mammoth skeleton was not articulated and lacked the smaller elements of the skeleton but it could not have been transported any appreciable distance. The lack of the smaller elements of the skeletons of both the mammoth and the mastodon, plus the lack of articulation, suggests that there may have been some movement by water. It is more likely that the carcasses lay on the surface for some time before burial during which time the smaller elements of the skeleton could have been removed by scavengers. The same agents could have scattered the larger bones. However, the relative abundance of bones of small animals that were recovered by the sieving of the sediments from area B indicates either a general lack of fluvial effect on the bones or the clay with the small bones was deposited after the large bones had come to rest in the positions in which they were found.

4. Paleoecology

The fossils in the Avenue Site (here designated the Avenue Local Fauna) give information on the environmental conditions prevailing in the Austin area circa 15 000 years BP. A consideration of the distributions of two now extinct species is informative. Remains of the American mastodon, *Mammut americanum*, are widespread in the eastern part of North America. In Texas they are common on the Gulf Coastal Plain but are rare west of the Balcones Escarpment which runs through Austin. The mammoth, *Mammuthus jeffersonii*, is not confined to the coastal plain but are found over most of Texas. The mastodon, with its low crowned teeth, apparently utilized much less abrasive food than did the mammoth, and indicates the presence of abundant soft vegetation at the Avenue locality. The mammoth suggests the presence of harsher vegetation nearby. The other extinct species represented, such as horse and sloth, occur over large areas of North America and do not provide any environmental information.

At least six and possibly seven extant species do not occur in the Austin area today. They are: the mole, *Scalopus aquaticus*; the short tailed shrew, *Blarina carolinensis*; the meadow vole, *Microtus pennsylvanicus*; the bog lemming, *Synaptomys cooperi*; the muskrat, *Ondatra zibethicus*; and microtines assignable to either the pine vole, *Microtus pinetorum*, or the prairie vole, *Microtus ochrogaster*. All of these species now live to the east and/or north of Austin in areas with more humid climates. Their presence indicates more humid conditions at this locality in the past.

One feature common to most Pleistocene faunas that is not dramatically shown in the Avenue Local Fauna is the presence of species that are now allopatric. These associations that seem ecologically incompatible have been termed "disharmonious" by Semken (1974) and "intermingled" by Graham (1985). The specimen of *Neotoma* is probably either *N. albigula* or *N. micropus*. Neither of these species have distributions that overlap that of *Synaptomys cooperi*. If identification of the *Neotoma* is correct, this fauna would have at least one disharmonious pair. The scarcity of such associations is probably a result of a relatively small sample of the fauna.

Other more extensive Pleistocene faunas from central Texas have numerous intermingled associations. Examples are: the occurrence of both the ermine *Mustela erminea* and the hispid pocket mouse *Perognathus hispidus* from Cave Without A Name in Kendall County, Texas (Lundelius 1967); the vagrant shrew *Sorex vagrans*, the eastern chipmunk *Tamias striatus* and the masked shrew *Sorex*

cinereus are found together in the Schulze Cave fauna in Edwards County, Texas (Dalquest et al. 1969) and the southern bog lemming *Synaptomys cooperi*, the eastern chipmunk *Tamias striatus* and the short tailed shrew *Blarina carolinensis* are associated with the hispid pocket mouse *Perognathus hispidus* from Friesenhahn Cave in Bexar County, Texas (Graham 1976).

An examination of the ranges of the species involved in the intermingled faunas of North America indicates that the northerly distributed species such as *Sorex cinereus*, *Tamias striatus* and *Synaptomys cooperi* are probably limited in their present southward distribution by the summer extremes of temperature and aridity. The southern species such as *Perognathus hispidus* seem to be limited to the north by the winter extremes. The presence of these mixtures in Pleistocene faunas has been interpreted as an indication of a more equable climate that lacked the seasonal extremes of the present (Hibbard 1960).

Intermingled associations are found in Pleistocene faunas in all parts of the world for which there is adequate data. They have been reported for North America and Australia by Lundelius (1974, 1983), for Eurasia by Graham (1985) and for Africa by Graham & Lundelius (1984). These associations imply a more equable climate than the present one at this locality.

The presence of aquatic and semi-aquatic animals (e.g. frogs and emydid turtles) indicate the presence of water, at least at times. The fish scale suggests that the site was not a large pond or channel. A marsh seems more likely. This is consistent with the interpretation of the sediments.

5. Systematic descriptions

Class Osteichthyes

Order Lepososteidae

Lepisosteus sp.

Material: From area B: one scale (TMM 43067-59). The diamond-shaped scale with an outer layer of ganoine is characteristic of the gar fishes. Three species of gar fishes are present in the Colorado River today and other species may have been present during the Pleistocene. Species identification on the basis of a single scale is not possible.

Class Amphibia

Order Anura

Rana cf. *R. catesbeiana* Shaw

Material: From area B: left radius-ulna (TMM 43067-1); right angulo-splenial (TMM 43067-2), anterior end of urostyle (TMM 43067-36).

Description: The material is assigned to *Rana catesbeiana* on the basis of size and morphology. This species is widespread in Texas and is found in the Austin area today (Dixon 1987).

Order Urodela

Material: From area B: right humerus (TMM 43067-3); right femur (TMM 43067-4).

Description: The two limb bones resemble those of *Ambystoma*. Salamanders of this genus are widespread in Texas today (Dixon 1987).

Class Reptilia

Order Testudinata

Family Emydidae

Material: From areas A and B: More than 30 fragments of carapace and plastron from all parts of the excavation (TMM 43067-60). The material is too fragmentary to allow assignment to genus but the ornamentation on the surface of the fragments indicates that they are referable to emydids. Emydid turtles are well represented in most parts of Texas today. They inhabit most aquatic environments (Dixon 1987).

Order Squamata

Family Colubridae

Material: From area B: seventeen colubrine vertebrae (TMM 43067-61); twelve natricine vertebrae (TMM 43067-63).

Description: The natricine vertebrae have been distinguished from viperid vertebrae by their thinner hypapophyses which are less than one-third the width of the condyle and the colubrine vertebrae have been identified by their lack of hypapophyses (Holman 1981). Both groups are

width 6.5 mm. This species is widespread in Texas today and is known from numerous Pleistocene faunas (Lundelius et al. 1983).

Spilogale sp.

Material: From area B: right mandibular ramus with P_4, M_1, alveolus for P_3 (TMM 43067-14); left mandibular ramus with alveoli for M_{1-2} (TMM 43067-41).

Description: These specimens show no morphological or size differences from modern specimens from Texas. Dimensions of TMM 43067-14 are: P_3 length 3.2, width 2.2; M_1 length 7.3; anterior width 3.3; posterior width 3.2. The ranges of two species of *Spilogale*, *S. putorius* and *P. gracilis* meet in central Texas. It is impossible to distinguish them on the basis of the characters preserved in the Avenue specimen. This genus is a common member of Pleistocene and modern faunas of Texas.

Order Rodentia

Peromyscus sp.

Material: From area B: left mandibular ramus with M_{1-3} (TMM 43067-15); left maxillary with M^{1-2} (TMM 43067-45).

Description: The specific identification of *Peromyscus* mandibles and dentitions is difficult. Dalquest et al. (1969) have pointed out that the capsule for the lower incisor is not bulged labially in *P. boylii* and *P. pectoralis* as it is in *P. leucopus* and *P. maniculatus*. Dalquest et al. (1969) used the strong development of the secondary lophs and styles of the molars to distinguish *P. boylii* from *P. pectoralis*. The mandible from the Avenue Site does not show a strongly bulged capsule for the lower incisor and the molars do not show strong development of the secondary styles and lophs and resemble *P. pectoralis*. However, Schmidley (1973) has shown that these dental characters are variable within the *Peromyscus boylii* complex making the identification of a single specimen uncertain. Schmidley also showed that the subspecies *Peromyscus boylii attwateri* is a separate species from the other taxa of the *boylii* complex. It is very likely that the *boylii* sample used by Dalquest is referable to *Peromyscus attwateri*. The measurements of the dentitions of Avenue Site specimens are given in Table 1.

Table 1. Measurements (mm) of dentitions of *Peromyscus* sp. from the Avenue Site.

	Length	Ant. width	Post. width
TMM 43067-15			
M_1	1.61	0.87	1.03
M_2	1.36	1.02	1.07
M_3	1.12	0.90	0.72
TMM 43067-45			
M^1	1.64	1.08	1.13
M^2	1.30	1.12	1.02

Onychomys leucogaster (Wied)

Material: From area B: left M^2 (TMM 43067-16).

Description: The simple structure of the tooth with high cusps and wide valleys lacking any of the secondary lophids or stylids distinguishes this tooth from those of *Peromyscus* or *Reithrodontomys*. The measures are: length, 1.61 mm; anterior width, 1.10 mm; posterior width, 1.16 mm. The grasshopper mouse occurs in the central part of Texas today from the Gulf Coast to the Panhandle.

Reithrodontomys sp.

Material: From area B: left mandible with lower incisor, M_1, alveoli for M_2 (TMM 43067-43).

Description: This specimen agrees with specimens of *Reithrodontomys* in size and the low crown height of the teeth. The dimensions of the M_1 are: length, 1.39 mm; anterior width, 0.80 mm; posterior width, 0.90 mm. Specific identification is not possible.

Neotoma sp.

Material: From area B: left M_1 (TMM 43067-17), left calcaneum (TMM 43067-46).

Description: Three species of *Neotoma* occur in central Texas today and are known to have

been elements of the Pleistocene fauna. The specimen from the Avenue site is too small to be *Neotoma floridana*. It could be either *N. albigula* or *N. micropus*. It is impossible to assign this specimen to a species.

Synaptomys cooperi Baird

Material: From area B: left M^1 (TMM 43067-18), from the east wall M_1 (TMM 43067-44).

Description: The M^1 is assigned to *Synaptomys (S.) cooperi* on the basis of its size, in having extremely deep re-entrants on the buccal side of the tooth, the presence of cement in the reentrant angles and in having the third alternating triangle much smaller than the second. The first and second alternating triangles of the M_1 are not confluent as in *S.* (*Mictomys*) and *S.* (*Metaxomys*). The length of the M^1 is 2.62 mm. The length of the M_1 is 2.76 mm. *Synaptomys cooperi* is now found living in the northeastern United States with isolated populations in southwestern Kansas and Nebraska. It is known from a number of late Pleistocene faunas from central and north Texas (Lundelius 1967).

Microtus pennsylvanicus (Ord)

Material: From area B: left M_1 (TMM 43067-19).

Description: The M_1 has five closed triangles which is typical of *M. pennsylvanicus*. The anterior loop is simple with enamel absent on the anteroexternal surface. Two open triangles lie between the anterior loop and the closed triangles. The length is 2.96 mm. This microtine is distributed through the northern part of North America in areas that currently have more humid climates than are found in central Texas. It has been found in a number of Pleistocene faunas in central and northern Texas (Graham 1976, Lundelius 1967). Its presence in the Avenue Local Fauna is not unexpected.

Microtus pinetorum or *Microtus ochrogaster*

Material: From area B: right M_1 (TMM 43067-20); left M^1 (TMM 43067-21); left M_2 (TMM-43067-22).

Description: The first lower molar has a simple anterior loop with enamel absent from the anteroexternal margin. Triangles one through three are closed; four through seven are open. The seventh triangle is larger than the sixth. The isthmus is less than 4 mm wide which is considered by some (Johnson 1972) to be a characteristic of *Microtus ochrogaster*. The enamel of the posterior borders of the first four triangles is markedly thinner than that of the anterior borders which is cited by Van der Meulen (1978) as a characteristic of *M. ochrogaster* The anterior border of the fourth triangle is oriented at a steep angle to the long axis of the tooth. According to Martin & Webb (1974) this is characteristic of *M. ochrogaster*. The M_2 has the third triangle not closed off from the fourth triangle as in *M. pennsylvanicus*. The M_2 has three closed triangles and lacks the posterolingual "button" characteristic of *M. pennsylvanicus*. The lengths of these specimens are: right M_1, TMM 43067-20, 3.03 mm; left M^1, TMM 43067-21, 2.14 mm; left M_2, TMM 43067-22, 1.44 mm.

The material available does not permit positive assignment of the tooth to either species although the M_1 shows many characters of *Microtus ochrogaster*. *Microtus ochrogaster* is not known as a living animal from central Texas although a relict population is known from Hardin County in east Texas. *Microtus pinetorum* is known from east Texas and from a relict population in Kerr County, Texas. Both are known from late Pleistocene and early Holocene faunas in central Texas (Lundelius 1967).

Ondatra zibethicus (Linnaeus)

Material: From area B: right M_2 (TMM 43067-23).

Description: This specimen shows no differences from modern specimens of this species. The muskrat is currently distributed along the Gulf Coast and the Pecos River valley (Davis 1974). It is not currently known in the Austin area but is known from Pleistocene faunas in central Texas (Lundelius 1967).

Geomys cf. *bursarius*

Material: From area B: right P_4 (TMM 43067-49), left P_4 (TMM 43067-58); lower molar (TMM 43067-50); two upper fourth premolars (TMM 43067-56,-57).

Description: The P_4 has the bilobed form with the anterior lobe much smaller than the posterior. The lower molar has the enamel missing on the anterior face. These features are characteristic of the genus *Geomys*. Recent work by Honeycutt &

Schmidley (1979), Heaney & Timm (1983, 1985) and Baker et al. (1973) has shown that gophers of the genus *Geomys* formerly assigned to *G. bursarius* are divisible into a number of biological units on the basis of chromosomes. These have been given species rank. It is not possible to assign the material considered here to any of these units. Consequently they are assigned to *G.* cf. *bursarius*.

Pocket gophers are currently present in eastern Travis County where there are sandy soils of sufficient depth. They were more widespread in central Texas during the Pleistocene and most of the Holocene. Their disappearance from many areas seems to be the result of soil removal by erosion since European settlement (Semken 1961, 1967).

Order Lagomorpha

Sylvilagus sp.

Material: From area B: left upper molar (TMM 43067-51); right lower molar (TMM 43067-52); distal end of left humerus (TMM 43067-53); right astragalus (TMM 43067-54); left P^2 (TMM 43067-55).

Description: This material is assigned to this taxon on the basis of size. The teeth are too small to belong to *Lepus*. The two species of *Sylvilagus*, *S. floridanus* and *S. audubonii* have dentitions that are virtually impossible to differentiate. Consequently this material is assigned to *Sylvilagus* sp.

Order Proboscidea

Mammut americanum (Kerr)

Material: From area A: four tusks (TMM 43067-65,-66 and two retained by the Trammell Crow Company); third molar (TMM 43067-38); three second molars (TMM 43067-39,-40,-42); miscellaneous bones.

Description: The tusks do not show as high a degree of curvature that is characteristic of *Mammuthus* tusks. One was evidently from a young individual. The pulp cavity is very extensive.

The second molars are trilophodont. The third molars tetralophodont with an incomplete fifth ridge and four small tubercles posterior to it. None of the molars are choerodont.

Mammuthus sp.

Material: From area B: a partial skeleton from a very limited area of the excavation (Fig. 2), probably representing one individual (TMM 43067-37). The following elements were recovered: a pair of tusks; pelvis; partial mandible with right M_2 or M_3; scapula; humerus; femur; six vertebrae; and a rib. The exact position of the mandible is not known as it was recovered from the lot of matrix that was wet sieved.

Description: The lower molar is complete and is almost completely erupted to judge from the degree of wear. The length is 220 mm, the width is 93 mm. Fifteen plates are preserved. At least one, possibly two, posterior plates are missing which would mean the the tooth originally had as many as 17 plates. The lamellar frequency is 5.5 to 6.0 plates per 100 mm. The enamel thickness is 2.3 mm. There is a thin layer of cement on the external surface of the tooth. These values place it in the range of values of M_2's of *Mammuthus* from the Ingleside fauna (Lundelius 1972) and somewhat below those for the M_3's of that sample.

The specific identification of *Mammuthus* is based primarily on the size, number of plates, number of plates per 10 cm and enamel thickness of the M_3 (Osborn 1942, Maglio 1973, Kurtén & Anderson 1980). The M_2's are not as useful. The close correspondence of the M_2 of the Avenue Site specimen with those of the Ingleside fauna suggest that they are assignable to the same species. The Ingleside material was assigned to *Mammuthus columbi* (Lundelius 1972) on the basis of plate numbers given for that species by Osborn (1942).

According to Kurtén & Anderson (1980) the late Pleistocene mammoths of North America are assignable to *Mammuthus jeffersonii* They give plate counts and number of plates per 10 cm higher than those late Pleistocene mammoths from the Ingleside fauna. According to Skeels (1962) the mammoths from the southern United States had lower plate counts and fewer plates per 10 cm than did the animals from the northern part of the United States and should be referred to *Mammuthus columbi*. It is not clear whether the *columbi-jeffersonii* complex represents two species or one species with considerable geographi-

cal variation. Because of the problems outlined above the Avenue Site specimen is assigned to *Mammuthus* sp.

Order Edentata

Glossotherium harlani (Owen)

Material: From area B: a second upper or a first lower tooth (TMM 43067-24), dermal scute (TMM 43067-25).

Description: The tooth is D-shaped in cross section. It has high angle wear surfaces on both the anterior and posterior ends which come together at an angle of 55 degrees at the crown. The second upper tooth develops sloping wear surfaces on the anterior and posterior surfaces where it wears against the first and second lower teeth. The first lower tooth may develop a sloping wear surface both anteriorly and posteriorly if the first upper tooth is present (Stock 1925). The anteroposterior length is 26.7 mm; transverse width is 17.9 mm. The size is within the size range of second upper teeth from the Ingleside sample (Lundelius 1972) and for the Rancho la Brea sample (Stock 1925), but slightly above the size for the first lower teeth. On the basis of size it is considered more likely that it is a second upper tooth.

The dermal scute is diamond-shaped, thickest in the center and thins toward the edges. It is 13.5 mm long, 8.0 mm wide and 5.0 mm thick. The edges are not heavily sculptured.

Glossotherium harlani is found in Pleistocene faunas in many parts of North America.

Order Perissodactyla

Equus sp.

Material: From area A: right upper deciduous premolar (TMM 43067-31); from area B: left dP_3 (TMM 43067-30); unworn left lower premolar or molar (TMM 43067-29); upper incisor (TMM 43067-28); labial half of a left upper molar (P^3 to M^2; area unknown: left dP_3 (TMM 43067-26).

Description: These teeth all come from a fairly large horse. The species level taxonomy of the Pleistocene horses is confused with the result that specific identification is not possible on the basis of isolated teeth.

Order Artiodactyla

Odocoileus sp.

Material: From area B: left upper molar (TMM 43067-35).

Description: The molar shows no differences from teeth of *Odocoileus virginianus* inhabiting central Texas today. The two species of *Odocoileus* that inhabit North America today cannot be distinguished on the basis of isolated teeth. For this reason this specimen is referred to as *Odocoileus* sp. *Odocoileus* is a common member of both Pleistocene and Holocene faunas of this region.

Acknowledgements. The author thanks the Trammell Crow Company, Austin, Texas, for their permission to recover the fossils, and for their assistance in the excavation, subsequent processing of the material and the donation of the specimens to The University of Texas. This project would not have been possible without this assistance. Mr. Charles Ball of the Trammell Crow Company aided in innumerable ways during and after the excavation phase of the project. Mr. Alton Briggs of Lone Star Archaeological Services, Austin, and his staff, particularly Mr. Bill Bryant, helped in the excavation and the recording of data. Dr. Michael Collins made available his studies of the terraces at the confluence of Barton Creek and the Colorado River. Dr. John Buckley allowed me to report the *Bison antiquus* specimen from the First Street terrace deposits at First and San Jacinto Streets. Mr. Rickard Toomey assisted with the identification of the bird remains. Dr. Holmes A. Semken Jr. and Dr. Ralph Eshelman reviewed the manuscript and made helpful suggestions. Financial assistance was provided by the Geology Foundation, Department of Geological Sciences, The University of Texas at Austin.

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