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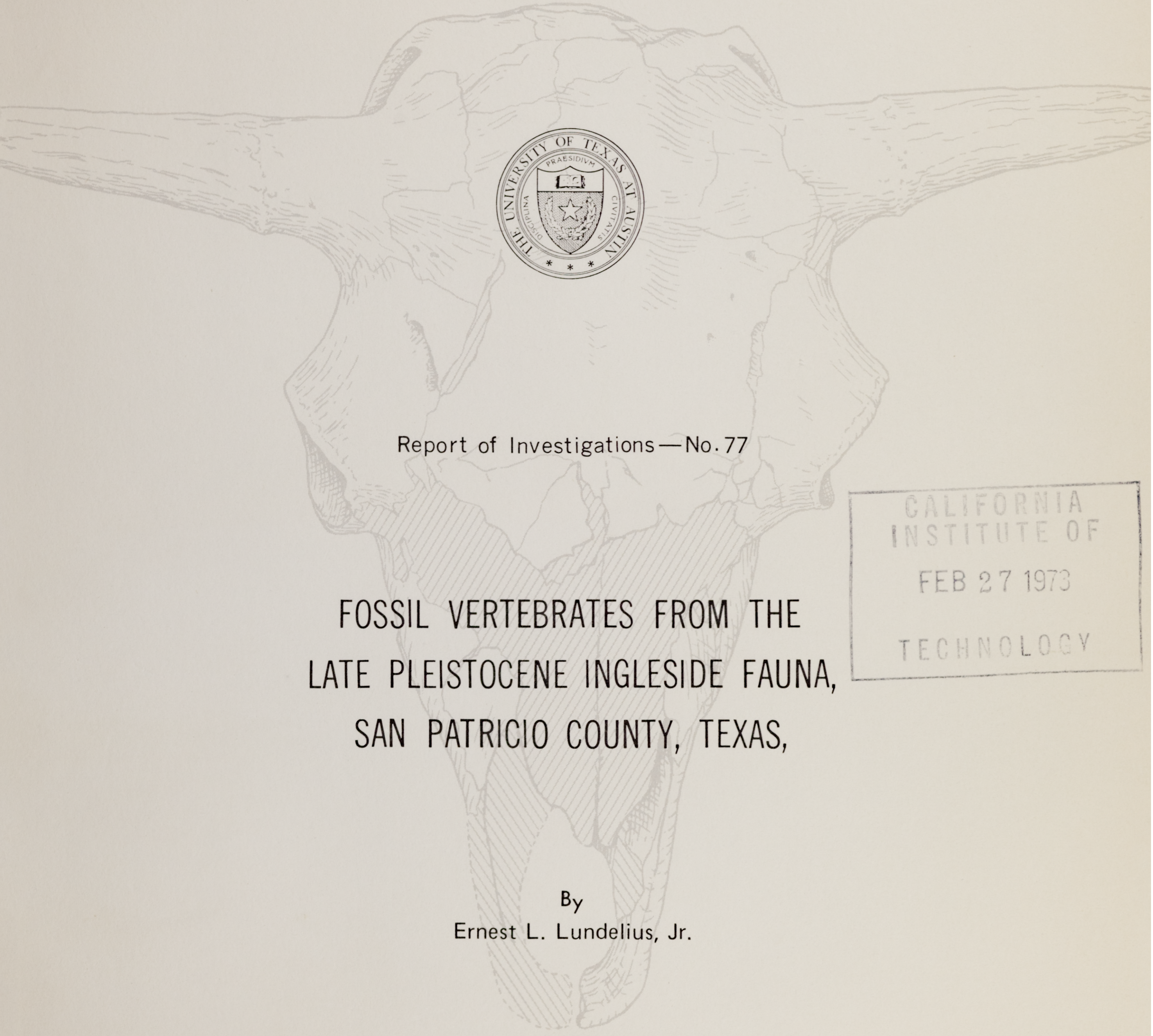

Report of Investigations—No. 77

FOSSIL VERTEBRATES FROM THE LATE PLEISTOCENE INGLESIDE FAUNA, SAN PATRICIO COUNTY, TEXAS,

By
Ernest L. Lundelius, Jr.

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CONTENTS

Page
Abstract 1
Introduction 1
Location 2
Acknowledgments 2
Stratigraphy and age 5
Comparison with other faunas 7
Moore Pit local fauna, Dallas County, Texas 7
Clear Creek local fauna, Denton County, Texas 7
Trinidad local fauna, Henderson County, Texas 7
Iron Bridge and Pitt Bridge local faunas 7
Berclair Terrace local fauna, Bee County, Texas 7
Sims Bayou local fauna, Harris County, Texas 8
Ecological interpretation 9
Systematic descriptions 10
Class Chondrichthyes 10
Family Carcharhinidae 10
Carcharinus sp. 10
Class Osteichthyes 10
Family Lepisosteidae 10
Lepisosteus cf. *spatula* Lacépède 10
Lepisosteus sp. 10
Family Cyprinidae 10
Family Ictaluridae 10
Ictalurus melas (Rafinesque) 10
Ictalurus natalis (Leseuer) 10
Ictalurus sp. 10
Family Centrarchidae 10
Family Sciaenidae 10
Aplodinotus grunniens Rafinesque 10
Class Amphibia 10
Order Anura 10
Family Ranidae 10
Rana catesbieana Shaw 10
Class Reptilia 10
Order Chelonia 10
Family Testudinidae 10
Chrysemys scripta (Schoepff) 10
Gopherus hexagonata (Cope) 10
Terrapene carolina putnami x^t *triunguis* Milstead 10
Geochelone cf. *crassiscutata* (Leidy) 11
Family Trionychidae 11
Trionyx sp. 11
Order Crocodilia 11
Family Alligatoridae 11
Alligator mississippiensis (Daudin) 11
Class Aves 11
Class Mammalia 11
Subclass Theria 11
Infraclass Metatheria 11
Order Marsupicarnivora 11
Family Didelphidae 11
Didelphis marsupialis Linnaeus 11
Infraclass Eutheria 12
Order Carnivora 12

Page
Family Canidae 12
Canis dirus Leidy 12
Canis latrans Say 20
Family Ursidae 21
Tremarctos floridanus (Gidley) 21
Family Felidae 21
Felis sp. 21
Lynx rufus (Schreber) 21
Panthera atrox (Leidy) 22
Smilodon fatalis (Leidy) 22
Family Mustelidae 24
Mephitis mephitis (Schreber) 24
Order Lagomorpha 24
Family Leporidae 24
Sylvilagus sp. 24
Order Rodentia 24
Family Sciuridae 24
Cynomys ludovicianus (Ord) 24
Family Cricetidae 25
Peromyscus sp. 25
Family Geomyidae 26
Geomys sp. 26
Order Edentata 26
Family Mylodontidae 26
Paramylodon harlani (Owen) 26
Family Megalonychidae 31
Megalonyx jeffersonii (Desmarest) 31
Family Dasypodidae 34
Chlamytherium septentrionale (Leidy) 34
Family Glyptodontidae 36
Boreostracon floridanus Simpson 36
Order Proboscidea 42
Family Gomphotheriidae 42
Cuvieronius sp. 42
Family Mastodontidae 42
Mammut americanum (Kerr) 42
Family Elephantidae 43
Mammuthus columbi (Falconer) 43
Order Artiodactyla 44
Family Tayassuidae 44
Platygonus compressus Le Conte 44
Family Camelidae 45
Camelops sp. 45
Tanupolama mirifica Simpson 48
Family Cervidae 55
Odocoileus virginianus (Zimmerman) 55
Family Antilocapridae 56
Breameryx minor (Taylor) 56
Genus and species indeterminate 57
Family Bovidae 57
Bison antiquus Leidy 57
Order Perissodactyla 60
Family Tapiridae 60
Tapirus excelsus Simpson 60
Family Equidae 63
Equus complicatus Leidy 63
Equus pacificus Leidy 69
Equus fraternus Leidy 70
References 72

ILLUSTRATIONS

FIGURES— PAGE

1. Index map 2
2. Geologic sketch map of the eastern part of San Patricio County showing the location of the Tedford Pit 3
3. Cross sections through Tedford Pit showing the topographic and stratigraphic relationships of the fresh-water pond deposits to the Ingleside Barrier, Ingleside Lagoon, and the modern barrier and lagoon 3
4. *Canis dirus.* Scatter diagram of basal length of skull vs. zygomatic width 12
5. *Canis dirus.* Scatter diagram of basal length of skull vs. width of palate at P^4 12
6. *Canis dirus.* Lateral view of skull 13
7. *Canis dirus.* Ventral view of skull 13
8. *Canis dirus.* Occlusal view of mandibles . . 15
9. *Canis latrans.* Palatal view of maxilla . . . 20
10. *Canis latrans.* Scatter diagram of length vs. mid-width of P^4 20
11. *Canis latrans.* Scatter diagram of length vs. width of M^1 20
12. *Tremarctos floridanus.* Occlusal view of M_2 and M_3 21
13. *Panthera atrox.* Lateral view of upper canine 22
14. *Smilodon fatalis.* Lateral view of right mandibular ramus 23
15. *Cynomys ludovicianus.* Occlusal view of left mandibular ramus 25
16. *Peromyscus* sp. Occlusal view of right mandibular ramus 25
17. *Paramylodon harlani.* Palatal view of skull . 26
18. *Paramylodon harlani.* Scatter diagram of length of skull vs. width of post-orbital constriction 28
19. *Paramylodon harlani.* Scatter diagram of length of palate vs. width of palate between anterior lobes of fifth superior teeth . . . 28
20. *Paramylodon harlani.* Scatter diagram of length of skull vs. width of muzzle 28
21. *Paramylodon harlani.* Scatter diagram of length of palate vs. width of palate between second superior teeth 28
22. *Paramylodon harlani.* Scatter diagram of length vs. width of anterior lobe of third superior teeth 29
23. *Paramylodon harlani.* Occlusal view of mandible 30
24. *Paramylodon harlani.* Scatter diagram of total length vs. length of anterior lobes of the fourth inferior teeth 30
25. *Megalonyx jeffersonii.* Molariform teeth . . 31
26. *Megalonyx jeffersonii.* Caniniform teeth . . 31
27. *Megalonyx jeffersonii.* Dorsal and lateral views of right mandibular ramus 33
28. *Boreostracon floridanus.* Lingual view of left mandibular ramus 36
29. *Boreostracon floridanus.* Lateral view of pelvis 37

FIGURES— PAGE

30. *Boreostracon floridanus.* Lateral view of pelvis 39
31. *Cuvieronius* sp. Occlusal view of right M_3 . 42
32. *Camelops* sp. Ventral view of skull 45
33. Scatter diagram of total length of skull vs. length of canine to P^3 in various specimens of *Camelops* 46
34. Scatter diagram of P^3 through M^3 length vs. length from canine to P^3 in various specimens of *Camelops* 47
35. Scatter diagram of minimum post-canine width vs. length from canine to P^3 in various specimens of *Camelops* 47
36. *Camelops* sp. Occlusal view of left M_3 . . 47
37. *Tanupolama mirifica.* Occlusal view of left maxilla 49
38. *Tanupolama mirifica.* Occlusal view of P^3's . 50
39. *Tanupolama mirifica.* Occlusal view of dP^3 and dP^4 50
40. *Tanupolama mirifica.* Occlusal view of partial mandible 50
41. *Tanupolama mirifica.* Occlusal and labial views of P_4's 51
42. *Tanupolama mirifica.* Occlusal view of juvenile left mandibular ramus 52
43. *Tanupolama mirifica.* Frequency histogram of crown heights of M_3's 53
44. *Tanupolama mirifica.* Left lateral view of axis 53
45. *Tanupolama.* Scatter diagram of distance from the lower canine to P_4 vs. length of P_4 through M_3 54
46. *Breameryx minor.* Occlusal and lateral view of M_3 56
47. *Bison antiquus.* Dorsal view of male skull . 57
48. *Bison antiquus.* Posterior view of male skull 58
49. *Bison antiquus.* Dorsal view of female skull . 58
50. *Bison antiquus.* Posterior view of female skull 58
51. *Tapirus excelsus.* Ventral view of palate . . 61
52. *Tapirus excelsus.* Occlusal view of lower dentition 61
53. *Tapirus excelsus.* Occlusal view of juvenile lower dentition 63
54. *Equus complicatus.* Ventral view of skull . 65
55. *Equus complicatus.* Occlusal view of upper dentition 65
56. *Equus complicatus.* Occlusal view of mandible 67
57. *Equus complicatus.* Occlusal view of lower dentition 67
58. *Equus pacificus.* Occlusal views of upper and lower teeth 69
59. *Equus fraternus.* Occlusal views of upper teeth 71

PLATES—

I. *Boreostracon floridanus* 40

TABLES

TABLES— PAGE

1. Measurements of skulls and upper dentitions of *Canis dirus* . . . 14
2. Measurements of mandible and lower dentition of *Canis dirus* . . . 15
3. Measurements of post-cranial elements of *Canis dirus* . . . 17 - 19
4. Measurements of upper dentition of *Canis latrans* . . . 21
5. Measurements of mandible and lower dentition of *Smilodon fatalis* . . . 23
6. Measurements of left radius of *Smilodon fatalis* . . . 23
7. Measurements of metacarpals of *Smilodon fatalis* . . . 24
8. Numerical data on samples of *Cynomys ludovicianus* . . . 25
9. Cranial measurements of *Paramylodon harlani* 27
10. Mandibular measurements of *Paramylodon harlani* . . . 27
11. Numerical data on dentitions of *Paramylodon harlani* . . . 29
12. Measurements of humeri of *Paramylodon harlani* . . . 32
13. Measurements of femora of *Paramylodon harlani* . . . 32
14. Measurements of tibiae of *Paramylodon harlani* . . . 32
15. Measurements of humeri of *Megalonyx jeffersonii* . . . 34
16. Measurements of ulna of *Megalonyx jeffersonii* . . . 34
17. Measurements of tibia of *Megalonyx jeffersonii* . . . 34
18. Measurements of axis of *Chlamytherium septentrionale* . . . 35
19. Measurements of humerus of *Chlamytherium septrionale* . . . 34
20. Measurements of right femur of *Chlamytherium septentrionale* . . . 35
21. Measurements of lower teeth of *Boreostracon floridanus* . . . 38
22. Measurements of M^3 of *Mammut americanum* 43
23. Measurements of M$_2$ and M$_3$ of *Mammut americanum* . . . 43
24. Measurements of first and second molars of *Mammut americanum* . . . 43
25. Measurements of upper molars of *Mammuthus columbi* . . . 44
26. Measurements of lower molars of *Mammuthus columbi* . . . 44
27. Measurements of teeth of *Platygonus compressus* . . . 44
28. Measurements of skulls of various species of *Camelops* from the Pleistocene of North America . . . 46
29. Dental measurements of *Camelops* sp. . . 47
30. Measurements of femora of *Camelops* sp. . 48
31. Measurements of metacarpals of *Camelops* sp. 48
32. Numerical data on upper dentitions of *Tanupolama mirifica* . . . 50
33. Numerical data on lower dentitions of *Tanupolama mirifica* . . . 52
34. Measurements of scapulae of *Tanupolama mirifica* . . . 54
35. Measurements of upper dentitions of *Odocoileus virginianus* . . . 55
36. Measurements of mandibles and lower dentitions of *Odocoileus virginianus* . . . 55
37. Measurements of skulls of *Bison antiquus* from Ingleside compared with measurements of *B. antiquus* and *B. occidentalis* . . . 59
38. Measurements of mandibles and lower dentitions of *Bison antiquus* . . . 59
39. Measurements of humeri of *Bison antiquus* . 59
40. Measurements of metapodials of *Bison antiquus* . . . 59
41. Numerical data on permanent dentitions of *Tapirus excelsus* . . . 62
42. Numerical data on deciduous dentitions of *Tapirus excelsus* . . . 62
43. Numerical data on ratios of upper dentitions of *Tapirus excelsus* . . . 62
44. Numerical data on ratios of lower dentitions of *Tapirus excelsus* . . . 63
45. Measurements of skull of *Equus complicatus* 64
46. Measurements of upper dentitions of *Equus complicatus* . . . 64
47. Number of plications on fossettes of upper cheek teeth of *Equus complicatus* . . . 66
48. Measurements of mandible of *Equus complicatus* . . . 66
49. Measurements of lower dentitions of *Equus complicatus* . . . 68
50. Measurements of phalanges of equids . . . 69
51. Measurements on upper teeth of *Equus pacificus* . . . 69
52. Measurements on upper teeth of *Equus fraternus* . . . 70

FOSSIL VERTEBRATES FROM THE LATE PLEISTOCENE INGLESIDE FAUNA, SAN PATRICIO COUNTY, TEXAS

Ernest L. Lundelius, Jr.[1]

ABSTRACT

Fresh-water pond deposits at Ingleside, San Patricio County, Texas, have yielded a large Pleistocene vertebrate fauna. The bones are derived from calcareous sands and marls which overlie a marine lagoonal clay. The locality is located just west of the axis of Live Oak Ridge. This ridge, along with the Ingleside Terrace to the east, was formed as a barrier island and lagoon when sea level was higher than at present.

The Ingleside barrier and lagoon are correlated with the Pamlico Terrace of the east coast of the United States, which is currently correlated with the Sangamon interglacial stage. The fresh-water pond formed after the barrier and lagoon, probably by wind deflation during a time when the water table was low, corresponding to a period of lowered sea level.

The fauna contains a diverse assemblage of Pleistocene mammals, birds, reptiles, amphibians, and fish; it consists of two principal elements: (1) extinct forms such as *Tanupolama*, *Camelops*, *Mammuthus*, *Mammut*, *Paramylodon*, *Megalonyx*, *Equus complicatus*, *Canis dirus*, *Platygonus*, *Bison antiquus*, *Geochelone crassiscutata*, and *Gopherus hexagonata;* and (2) extant forms such as *Odocoileus virginianus*, *Canis latrans*, *Peromyscus leucopus*, and *Mephitis mephitis*. A third element usually well represented in Pleistocene faunas—extant forms no longer found in the area—is represented by a very few forms such as *Cynomys*. The scarcity of this element is a result of the poor representation of the small-sized animals in the fauna.

Several species, such as *Tanupolama mirifica* and *Paramylodon harlani*, are represented by samples large enough to give information on variability.

The diversity of the large mammalian fauna indicates the presence of diverse habitats in the Ingleside area. The presence of large tortoises, such as *Geochelone* and *Gopherus hexagonata*, indicates mild winters. The age structure of the *Tanupolama mirifica* sample indicates the existence of seasonality of some climatic factor, probably rainfall.

INTRODUCTION

Pleistocene vertebrate fossils have been known from southern Texas since 1885 (Cope, 1885), but no comprehensive picture of the faunas has been available because the material occurs in small, widely scattered collections. The faunal sequence is unknown because the absence of geological information has made relative age determinations of the deposits at these widely separated localities impossible.

During the period 1939-1941, a State-wide Paleontologic-Mineralogic Survey sponsored by The University of Texas at Austin and directed by the Bureau of Economic Geology (Works Projects Administration Project No. 665-66-3-233) made extensive collections of vertebrate fossils at several localities in southern Texas. One of these localities, from which the fauna reported here was collected, is on the former W. E. Tedford farm near the town of Ingleside, San Patricio County, Texas (figs. 1 and 2). The bones had been discovered during excavations of calcareous sand for use as road-surfacing material, and fossils were collected in 1939 and 1940 by a unit of the State-wide Paleontologic-Mineralogic Survey (work project no. 12592) under the supervision of Adolph Witte.

The site is referred to in the W.P.A. records as the Tedford Pit. It has been referred to as the Ingleside locality and Ingleside fauna by Sellards (1940) and Quinn (1957a) and this designation is used in this report. The fossils are catalogued in the collections of the Texas Memorial Museum, The University of Texas at Austin, under the number TMM-30967.

The pit has been allowed to fill with water since

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FIG. 1. Index map.

the collection of the fossils and is no longer accessible either for further collection or for examination of the stratigraphic sequence. Therefore, description of the stratigraphy is taken from published accounts (Evans, 1940, 1941; Price, 1958) and personal communications from W. A. Price.

This is one of the largest and most diverse Pleistocene faunas known from a single locality in Texas—forty-two taxa of vertebrates are represented. It has not previously been studied as a whole. Several faunal lists have been published (Sellards, 1940; Evans, 1941; McAnulty, 1941; Quinn, 1957a), and some specimens have been mentioned in connection with studies of other faunas (Stovall and McAnulty, 1950) or of various taxonomic groups (Quinn, 1957a; Milstead, 1956; Auffenberg, 1962).

Location.—The deposit from which the fossils were recovered is located just east of Farm Road 2725, 1¼ miles east of the town of Ingleside. It is shown as a pond in the north-central part of U. S. Geological Survey Port Ingleside 7.5-minute topographic quadrangle map.

The locality is just west of the axis of a low sand ridge known as Live Oak Ridge (fig. 2). East of this ridge is Red Fish Bay. Paralleling this ridge on the west is an elongate area 2 to 10 miles wide which is underlain by lagoonal and marsh sediments. This has been named the Ingleside Terrace by Price (1933). The Live Oak Ridge and the Ingleside Terrace represent a Pleistocene barrier island-lagoon complex similar to the Recent barrier island-lagoon complex along the Gulf Coast (Price, 1958; Bernard and LeBlanc, 1965). The stratigraphic relation of the pond deposits to other units is shown in figure 3.

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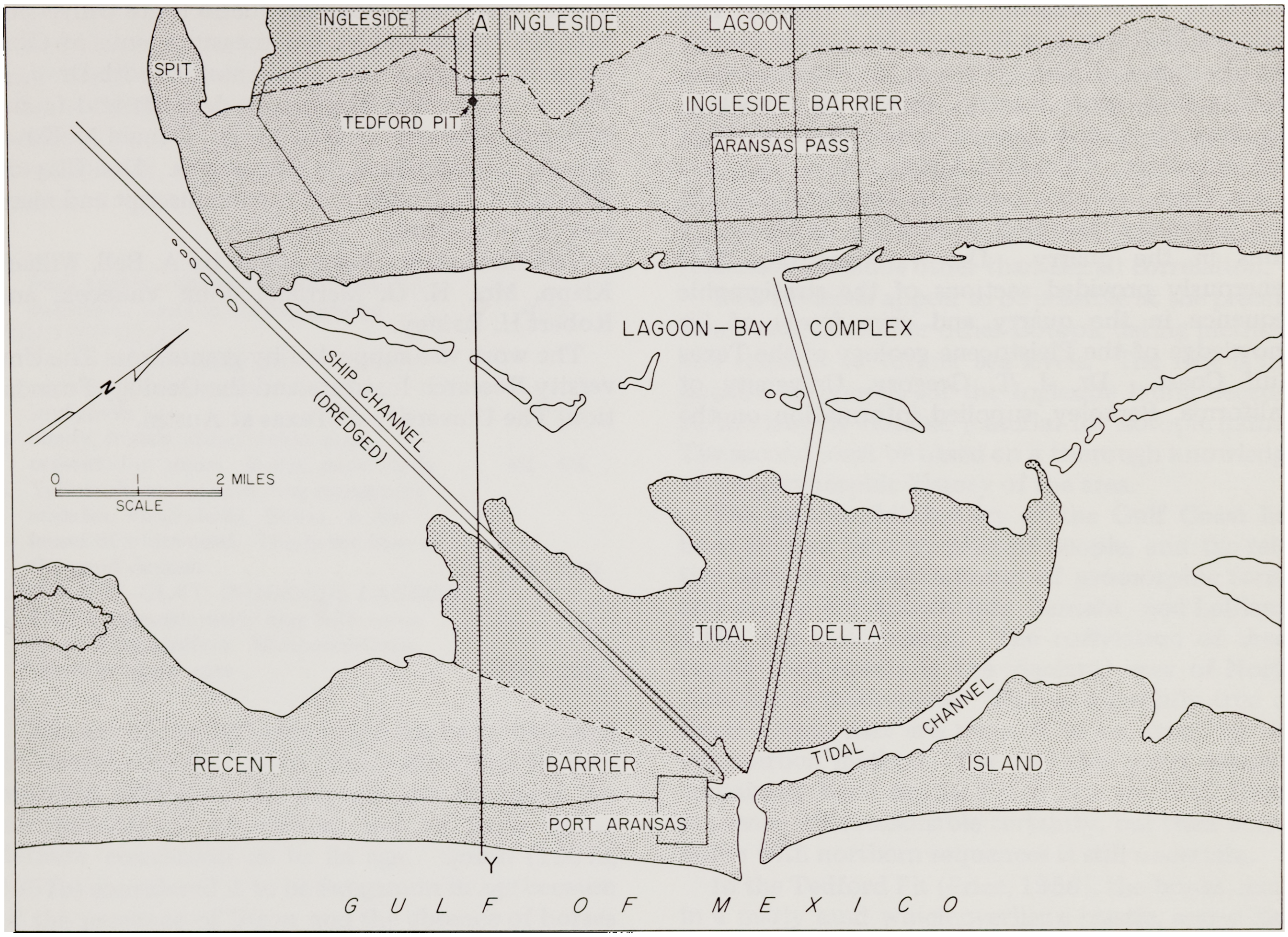

Fig. 2. Geologic sketch map of the eastern part of San Patricio County showing the location of the Tedford Pit, the major topographic features, and environments of deposition. A-Y is the line of section of figure 3. Simplified after Siler and Scott (1964).

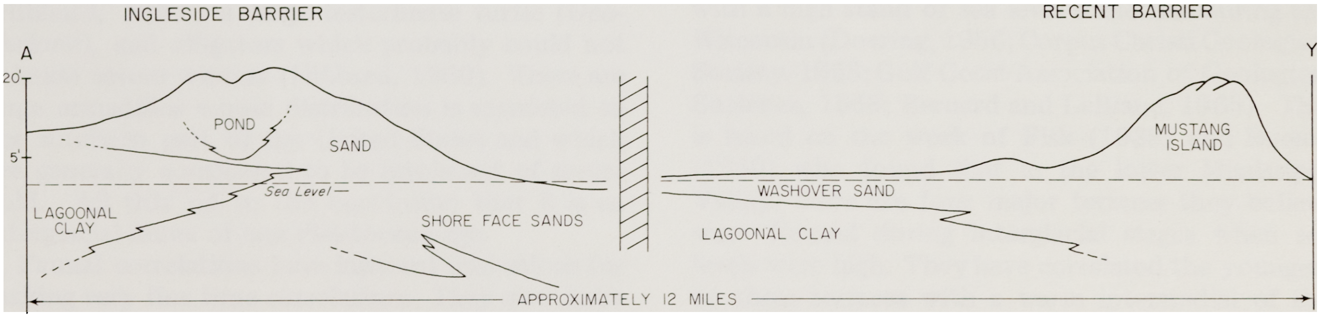

Fig. 3. Cross section along line A-Y of figure 2 showing the topographic and stratigraphic relationships of the fresh-water pond deposits of the Tedford Pit to the Ingleside Barrier, Ingleside Lagoon, and the modern barrier island and lagoon. Elevations of surface taken from U. S. Geological Survey 7.5-minute topographic maps of Port Ingleside and Port Aransas quadrangles.

Claude Hibbard, University of Michigan; Dr. W. D. Turnbull, Field Museum of Natural History; Drs. Malcolm McKenna and Richard Van Gelder, American Museum of Natural History; Mr. Stanley Olsen, Florida Geological Survey; Mr. B. H. Slaughter, Southern Methodist University; and Dr. W. F. Blair, The University of Texas at Austin.

Mr. Glen L. Evans, Louisiana Land and Exploration Company, provided information on the conditions in the quarry. Dr. W. Armstrong Price generously provided sections of the stratigraphic sequence in the quarry and gave freely of his knowledge of the Pleistocene geology of the Texas Gulf Coast. Dr. J. T. Gregory, University of California, Berkeley, supplied information on the carapace of *Boreostracon* as it was found in the field. Miss Marie Hopkins, Idaho State University, provided photographs and measurements of *Camelops* from Idaho. Many discussions with Dr. J. A. Wilson concerning Pleistocene deposits and faunas of Texas were very beneficial. Dr. Ronald McKown supplied information on *Chrysemys*. Drs. Clayton Ray and P. U. Rodda read the manuscript and made helpful suggestions.

The illustrations were drawn by A. Bell, William Klapp, Mrs. H. G. Merriam, John Vanecek, and Robert H. Rainey.

The work was supported by grants from The University Research Institute and the Geology Foundation, The University of Texas at Austin.

STRATIGRAPHY AND AGE

The stratigraphic sequence and distribution of fossil bones in the deposits have been published by Sellards (1940) and Price (1958).

The sequence given by Price (1958, p. 45) for the north wall, west center of pit, is from the ground surface:

	Depth in feet
1. Dark brown, sandy soil with prismatic structure. Land snails throughout . . .	0 - 3
POND DEPOSITS	
2. Yellowish, fine sandy with calcareous nodules. Bones, pond shells, and land snails	3 - 4¾
3. Sandy, friable, structureless marl, cemented in places. Bones, pond shells .	4¾ - 6¼
4. Yellowish, marly sand, bog manganese nodules. Pond shells. Bones. A few lenses of white sand. This is the base of the pond deposit	6¼ - 12¼
LAGOONAL CLAY, INGLESIDE LAGOON	
5. Plastic, greenish marly clay with some sand. Foraminifera. Marine molluscs. Bones in upper part	12¼ - 19¼

The age of the Ingleside fauna has been discussed by several authors. Price (1958) described the geomorphic setting of the deposit and discussed the environment of deposition, but he came to no definite conclusion as to its age. Quinn (1957a, 1957b) considered it to be Sangamon in age because of the presence of *Bison* and the absence of horses that he considered typical of either the older Pleistocene or the Wisconsin deposits of the High Plains.

The fauna also contains an anancine mastodont *(Cuvieronius)* that seems to have disappeared from the Great Plains by the middle of the Pleistocene (Hibbard, 1958), a large testudinate turtle *(Geochelone),* and alligators which probably could not tolerate severe winters (Hibbard, 1960). There are large armadillos whose distribution is restricted to the southern part of the United States and which are generally considered to be intolerant of severe cold. All this led to the conclusion that it is an interglacial fauna of late Pleistocene age.

Faunal correlations have inherent limitations for making very fine time correlations. They also make it difficult to recognize geographic differences in faunas at a given time. This is particularly important for Pleistocene faunas of southern Texas and northern and central Mexico because Mexico, Florida, and Baja California have been considered by many workers (Adams, 1902; Deevey, 1949; Blair, 1951, 1958) to have been refuges for warm-climate species during glacial stages. Some species may have survived longer in these areas than farther north. There is little known concerning the southward extent of cold climates during glacial stages, although most students would admit the continued existence of a tropical zone. For this reason it is important to attempt to date southern Pleistocene faunas by methods other than faunal correlation.

Two methods appear to be possible at the present time—radiocarbon or other isotopic dating methods and relation to former sea levels. The first is impossible at present for the Ingleside fauna because of the lack of suitable material for isotopic dating. The second must be based on a thorough knowledge of the geomorphic history of the area.

The geomorphic history of the Gulf Coast has been studied by a number of people, and the relative ages of a large number of geomorphic forms and events are known (*see* Bernard and LeBlanc, 1965, for a summary). The correlation of these events with events in the glaciated area of North America is incomplete. This is especially true of those events that are too old to be dated by the radiocarbon method. The Ingleside pond deposits containing bone can be fitted into the Gulf Coast sequence with reasonable certainty, but their correlation with northern sequences is still uncertain.

In the Tedford Pit (Price, 1958), the bones occur in a marly sand which overlies a plastic, marly clay containing the shells of invertebrates characteristic of the Recent lagoons in this area. The contact of these two units is 5 feet above present sea level.

The Ingleside lagoon and its barrier island (Live Oak Ridge) have been most commonly correlated with a high stand of sea level sometime during the Wisconsin (Doering, 1956; Corpus Christi Geological Society, 1958; Gulf Coast Association of Geological Societies, 1958; Bernard and LeBlanc, 1965). This is based on the work of Fisk (1938) and Russell (1940) who found that in the lower Mississippi Valley, there are four major terraces they believe were formed during interglacial stages when sea levels were high. They have correlated the youngest of these terraces with a warm interstadial of the Wisconsin.

On the Texas coast the Ingleside barrier system is thought by some (Bernard and LeBlanc, 1965) to be the youngest such system formed when sea level was higher than or equal to the Recent sea level and thus to be correlated with the youngest terrace of the Mississippi Valley.

The Ingleside barrier and its associated lagoon have been traced northeastward along the Texas coast to the north of Lake Charles, Louisiana. The surface of the lagoonal deposits maintains an elevation of 0 to 10 feet above sea level as far northeastward as Chambers County, Texas where it rises to 20 to 25 feet (Price, 1956, p. 161). It maintains this elevation until it is lost at the edge of the Mississippi Delta. East of the Mississippi Delta in Mississippi and Florida there are two barrier island systems. The inland one has lagoonal deposits at an elevation of 20 to 25 feet and seems to be correlative with the Pamlico of Georgia (W. A. Price, personal communication). The seaward barrier system has lagoonal deposits at an elevation of 12 to 15 feet and seems to be equivalent to the Princess Ann Level of Georgia. The Ingleside system has been correlated with the 25-foot terrace of Mississippi and Florida and with the Pamlico Terrace on the basis of its elevation in western Louisiana (Price, 1956). However, if the Ingleside system is correctly correlated with the Pamlico Terrace and has been lowered by downwarping along most of the Texas coast, it obviously cannot be correlated with the period of high sea level immediately preceding the present.

The correlation of these coastal features with the glacial sequence is still uncertain. All such correlations are based on the assumption that a complete sequence of events is known for both areas. Henry and Hoyt (1968) have reviewed briefly the evidence bearing on these correlations. On the basis of uranium-series dating of coral from the Bahamas, Florida, and Barbados (Broecker and Thurber, 1965; Newell, 1965; Broecker et al., 1968), higher sea levels are indicated for 19,000, 82,000, 122,000, and possibly 103,000 years ago. The Miami Oolite and Key Largo Limestone have been dated at approximately 122,000 years. According to Henry and Hoyt (1968) these two units are believed to have been formed during the Pamlico high stand of the sea. The 25-foot stand of sea level which dates approximately 120,000 years ago appears to be correlative with the Sangamon interglacial (Ericson et al., 1964; Zeuner, 1959).

The fresh-water pond deposits of the Tedford Pit which contained the fossil bones overlie the lagoonal deposits and are thus younger. There appear to be two possible mechanisms for the formation of fresh-water ponds and lakes associated with barrier islands and lagoons. Ponds can be formed by the isolation from the sea of part of the lagoon by the deltas of larger streams, such as the Nueces and Mission Rivers, or washover bays (*see* Bernard and LeBlanc, 1965, for a summary of the processes) late in the period of high sea level. This would allow the salt water to be replaced by fresh water.

It is also possible to form fresh-water ponds by wind deflation. There are several closed depressions on the Ingleside barrier. The long axes of these depressions are oriented northwest-southeast, suggesting they were formed as blowouts. Large, deep ponds like that represented by the Tedford Pit deposits probably could form only when the water table was lower than it is today. This would be the case when sea level was lowered during a glacial stage.

The age of the bone-bearing sediments is younger than the Ingleside barrier and, if the correlations suggested above are correct, younger than the Sangamon interglacial. A post-Sangamon age fits the faunal picture better than a Sangamon one. The bison in the Ingleside fauna is *Bison antiquus*, which is not known to be older than Wisconsin elsewhere in North America. It is probably not possible at present to determine more precisely the age of the pond deposits and of the faunas except to note that the presence of the large tortoises probably rules out a late Wisconsin age. The known late Wisconsin faunas indicate climatic conditions too severe for these animals.

COMPARISON WITH OTHER FAUNAS

The Ingleside fauna has been compared either in whole or in part to several other Pleistocene faunas by Evans (1940), Slaughter et al. (1962), Stovall and McAnulty (1950), and Quinn (1957a). All of these comparisons have shown that several late Pleistocene faunas have a large number of genera and species in common. The differences have been interpreted by some as age differences and by others as environmental differences.

Moore Pit local fauna, Dallas County, Texas.—This fauna, described by Slaughter et al. (1962) and Slaughter (1966b), from the T-2 terrace of the Trinity River has a large number of the same species that are present in the Ingleside fauna. The major differences are the presence of *Bison alleni, Equus scotti,*[2] *E. conversidens, E. francisci,*[3] *Camelops huerfanensis,* and *Dasypus bellus* in the Moore Pit fauna and their absence from the Ingleside fauna. *Bison alleni* is considered to be earlier than *B. antiquus* (Skinner and Kaisen, 1947). This difference in the species of *Bison* is taken to indicate a greater age for the Moore Pit fauna. Slaughter et al. (1962) assigned a Sangamon age to the Moore Pit fauna on the basis of the *Bison* and the general resemblance of the fauna to the Jinglebob fauna of Kansas.

The other differences in the faunas are less easily interpreted. The temporal distributions of the species of equids and camels are too poorly known to be of any use, and the differences could reflect environmental differences as well as age differences. The absence of *Dasypus* from the Ingleside fauna is probably a sampling accident. Its reported presence by McAnulty (1941) was based on the misidentification of two *Didelphis* vertebrae.

Clear Creek local fauna, Denton County, Texas.—This fauna is given a Sangamon age by Slaughter and Ritchie (1963) on the basis of the merging of the terrace with the T-2 terrace of the Trinity River and a report of the finding of a bison skull presumed to be *Bison latifrons.* A radiocarbon date of 28,840±4,740BP[4] based on mussel shells appears too young if the age is truly Sangamon. There is little else in the fauna that can be used to establish its age relative to the Ingleside fauna.

Trinidad local fauna, Henderson County, Texas.—Another fauna from the third and most extensive terrace of the Trinity River, at a site 80 miles downstream from Dallas near the town of Trinidad, has been described by Stovall and McAnulty (1950). Slaughter et al. (1962) correlated this terrace at Trinidad with the T-2 terrace at Dallas on the basis of lithology, position, and degree of development.

A comparison of the Trinidad and Ingleside faunas shows that they differ in the species of *Bison* present, as do the Ingleside and Moore Pit faunas. The *Bison* which is associated with the Trinidad fauna is *B. alleni.* Stovall and McAnulty (1950) identified the skull as *B. occidentalis* and stated that while it was not directly associated with the other material it was collected from the same terrace. As Slaughter et al. (1962) have pointed out, the measurements greatly exceed those of *B. occidentalis* given by Skinner and Kaisen (1947), and it is more likely that the skull should be referred to *B. alleni.*

Two species of horse, *Equus complicatus* and *E. fraternus,* are known from the Trinidad fauna. Both are present in the Ingleside fauna.

Iron Bridge and Pitt Bridge local faunas.—These two faunas are considered together because there has been no detailed study of either. A preliminary faunal list for the Iron Bridge fauna from Rains County, Texas has been published by Slaughter et al. (1962). Individual taxa for the Pitt Bridge fauna from Brazos County, Texas have been reported by various authors (*see* Hay, 1924, p. 245, for a summary and faunal list).

Both of these faunas differ from the Ingleside fauna in the presence of *Bison latifrons.* The Pitt Bridge fauna also differs in the presence of *Eremotherium* sp. The *Camelops* material from Iron Bridge seems to be more like that from Ingleside than any other fauna. Again, on the basis of the presence of *B. latifrons,* these faunas appear to be older than the Ingleside fauna. At this time a Sangamon age seems to be the likely age assignment for these faunas.

Berclair Terrace local fauna, Bee County, Texas.—This fauna was compared with the Ingleside fauna by Sellards (1940) who concluded on the basis of both the fauna and the relation of the Berclair Terrace to the Beaumont Formation that they were the same age. The Berclair Terrace was traced by Evans (1940) downstream where it apparently merged with the Beaumont Formation. This was

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[2] Slaughter et al. (1962) referred this material to *E. midlandensis.* It is considered here to be a synonym of *E. scotti.*

[3] Slaughter et al. (1962) referred this to *E. quinni.* Lundelius and Stevens (1970) considered it to be a synonym of *E. francisci.*

[4] This date is now known to be valueless and should be disregarded (Slaughter, 1968).

interpreted by Evans (1940) and Sellards (1940) as indicating that the stream was at grade and the Berclair Terrace was formed at the same time as the Beaumont Formation. The Ingleside pond deposit was also believed by Sellards and Evans to be the same age as the Beaumont Formation.

The faunal lists given by Sellards (1940) contain a great many species in common, and the differences (*Equus pacificus* at Ingleside, *E. giganteus* and *Hydrochoerus* at Berclair) could easily be the result of environmental differences.

The Berclair Terrace contains artifacts which are typologically not unlike Folsom and Yuma artifacts. Artifacts of this type have not been found elsewhere in North America to be older than 12,000 to 14,000 years. In view of the presumed Sangamon age of the Beaumont Formation a rather serious question arises concerning the correlation of the Berclair Terrace fauna and Beaumont Formation as well as the Ingleside fauna.

The two transverse profiles of Blanco Creek given by Evans (1940) show that the Berclair Terrace is unpaired. This suggests that the Blanco Creek was not graded at the time of deposition of the Berclair Terrace but slowly cut downward and laterally, leaving the terrace deposits as it did. It does not appear to be necessary to correlate the Berclair Terrace with the Beaumont Formation on the basis of its longitudinal profile. The evidence available indicates a Wisconsin age for the Berclair Terrace deposits.

Sims Bayou local fauna, Harris County, Texas.—This fauna, described by Slaughter and McClure (1965), has almost exactly the same species as does the Ingleside fauna where comparisons can be made. The Sims Bayou fauna contains a better representation of the small animals than does the Ingleside fauna and a poorer representation of the large animals. Horses are represented by one tooth which is very much like *E. fraternus* both in size and morphology. *Bison* is represented only by isolated teeth which are specifically indeterminate, although Slaughter and McClure (1965) stated that they are smaller than the teeth of *B. latifrons*, *B. chaneyi*, or *B. alleni*.

ECOLOGICAL INTERPRETATION

The Ingleside faunal assemblage has ecological implications for both the pond in which the bones accumulated and for the general area of that part of the Gulf Coastal Plain.

The fish remains have been studied by Swift (1968). They represent gars *(Lepisosteus spatula)*, catfish *(Ictalurus melas, I. natalis)*, fresh-water drum *(Aplodinotus)*, and a sunfish. These species are characteristic of small bodies of standing water or slowly moving water.

The presence of abundant material of *Rana catesbieana* and fresh-water snails such as *Planorbis* sp. indicates fresh-water conditions.

The ecologic importance of the large terrestrial tortoises such as *Gopherus hexagonata* and *Geochelone crassiscutata* has been discussed by several authors (Brattstrom, 1961; Hibbard, 1960). The consensus of these authors is that these species could not tolerate severe cold and probably could not survive the winters in that part of Texas today. There is no evidence that they were able to burrow to escape the cold, as do the smaller living turtles of that area. The conclusion is that the winters in southern Texas during the deposition of the pond sediments were warmer than at present or perhaps lacked the extremes experienced today.

The presence of *Terrapene putnami* x^t *triunguis* indicates more humid conditions than exist today. The present range of this species is through the eastern part of North America (Milstead, 1956).

The ecological interpretation of the mammalian fauna is less definite. The small animals are very poorly represented. Those that are represented *(Peromyscus, Geomys)* are widely distributed and yield little information. Many of the large species are extinct and nothing is known directly about their environmental requirements.

Some information can be obtained by an examination of the distribution of a number of the extinct genera and species. Several genera (glyptodonts, *Chlamytherium*) were restricted to the southern part of the United States for all of the Pleistocene (Hay, 1923; James, 1957; Melton, 1964). It seems likely that the factor responsible for their restriction was temperature, either directly or indirectly.

The mastodon *(Mammut americanum)* is abundantly represented. The relatively simple, low-crowned teeth of this species indicate a browser on relatively soft vegetation. Its abundance indicates forested conditions in the vicinity of the pond.

Tapirs, which are usually thought of as indicating forested conditions and abundant water (Simpson, 1945; Parmalee et al., 1969), are well represented in the fossil assemblage.

The Ingleside fauna, like other Pleistocene faunas, has a much greater species diversity than does the Recent fauna of the Gulf Coastal Plain. This is particularly true of the medium- to large-sized herbivores, of which there are seventeen in the Ingleside fauna and four in the Recent fauna. This implies the former existence in southern Texas of a considerable diversity of habitats of both browsers and grazers or a grazing succession like that described by Vesey-FitzGerald (1960) for part of Tanganyika.

The age distribution of the *Tanupolama* sample suggests that there was some seasonality of the climate either in the general area of Ingleside or in some adjacent region. Any seasonality in the vicinity of Ingleside must have been less severe than that experienced today in terms of both temperature and humidity.

SYSTEMATIC DESCRIPTIONS

The fish remains from the Ingleside pond have been studied by Swift (1968); his faunal list is repeated:

Class CHONDRICHTHYES
Family CARCHARHINIDAE
CARCHARINUS sp.

Class OSTEICHTHYES
Family LEPISOSTEIDAE
LEPISOSTEUS cf. SPATULA Lacépède
LEPISOSTEUS sp.

Family CYPRINIDAE

Family ICTALURIDAE
ICTALURUS MELAS (Rafinesque)
ICTALURUS NATALIS (Lesueur)
ICTALURUS sp.

Family CENTRARCHIDAE

Family SCIAENIDAE
APLODINOTUS GRUNNIENS Rafinesque

Class AMPHIBIA
Order ANURA
Family RANIDAE
RANA CATESBEIANA Shaw

Rana catesbeiana Shaw, 1802, Gen. Zool., vol. 3, p. 106, pl. 33.

Material.—Exoccipital (TMM 30967-100); 4 humeri (TMM 30967-1970); 16 radius-ulna (TMM 30967-1965); 6 ilia (TMM 30967-1967); 5 tibiafibulae (TMM 30967-1972); 12 coracoids (TMM 30967-1968); 8 vertebrae (TMM 30967-1977).

Remarks.—None of the Ingleside material differs from Recent material of *Rana catesbeiana.* The size range indicates the presence of a growth series. All are within the size range of Recent specimens of *R. catesbeiana.*

Class REPTILIA
Order CHELONIA
Family TESTUDINIDAE
CHRYSEMYS SCRIPTA (Schoepff)

Testudo scripta Schoepff, 1792, Hist. Test., pts. 1, 2, p. 16.
Pseudemys scripta Schoepff. Schmidt, 1953, A check list of North American amphibians and reptiles, 6th ed., p. 102.
Chrysemys scripta (Schoepff). Weaver and Rose, 1967, Tulane Studies in Zoology, vol. 14, pp. 63-73.

Material.—Three large nuchal plates (TMM 30967-2083 to 2085); carapace and plastral fragments.

Remarks.—The nuchal plates resemble those of Recent specimens of both *Chrysemys scripta* and *C. concinna* in shape but are larger and thicker. Weaver and Rose (1967) have pointed out that the nuchal scute extends farther posteriorly on the ventral surface of the nuchal bone (the nuchal scute underlap of Weaver and Rose, 1967) in *C. scripta* than in *C. concinna.* This is expressed quantitatively by calculating the following ratio: nuchal scute underlap x 100/maximum length of the nuchal bone. This ratio is 27 for TMM 30967-2085 and 27.3 (based on an estimated total length) for TMM 30967-2083. This is within the range given by Weaver and Rose (1967) for *C. scripta* (26-36) and outside the range for *C. concinna* (4-12).

The Ingleside nuchals are heavily sculptured as in *C. scripta.* The longitudinal ridges of the vertebral scute area are interrupted to form rows of small tubercles in the smallest of the three nuchal bones (TMM 30967-2085).

There are no sulci on any of the nuchal bones for the second marginal scute. Weaver and Rose (1967) found that this was always the case with *C. scripta* and that 85 percent of the nuchals of *C. concinna* had this sulcus.

GOPHERUS HEXAGONATA (Cope)

Testudo hexagonata Cope, 1893, Texas Geol. Surv., 4th Ann. Rept. (1892), p. 77.
Gopherus hexagonata (Cope). Auffenberg, 1962, Herpetologica, vol. 18, no. 1, pp. 25-35.

Material.—Complete carapace and plastron (TMM 30967-1817).

Remarks.—This specimen has been described and figured by Auffenberg (1962). The nuchal scute is as wide as it is long, the hyoplastron is longer than the hypoplastron, and the inguinal scute is restricted to the lateral part of the femoro-abdominal sulcus. These characters, according to Auffenberg (1962), place this species in the genus *Gopherus.*

TERRAPENE CAROLINA PUTNAMI x^{t} TRIUNGUIS Milstead

Terrapene canaliculata Hay, 1907, Bull. Amer. Mus. Nat. Hist., vol. 23, p. 850.
Terrapene canaliculata Hay. Milstead, 1956, Copeia, no. 3, p. 163.
Terrapene carolina putnami Hay. Auffenberg, 1958 (in part), Bull. Florida State Mus., Biol. Sci., vol. 3, p. 82.
Terrapene carolina putnami x^{t} *triunguis* Milstead, 1967, Copeia, no. 1, p. 174.

Material.—Two braincases (TMM 30967-99); 1 carapace and associated plastron (TMM 30967-660); 7 complete or nearly complete carapaces (TMM 30967-682, 363, 717, 1232, 475, 1612, 49); 1 complete plastron (TMM 30967-1905); 9 anterior plastral lobes (TMM 30967-270, 654, 466, 260, 945, 653, 193, 946, 2088); 11 posterior plastral lobes (TMM 30967-1617, 656, 1125, 539, 1248, 615, 622, 648, 612, 729, 2089); and some isolated limb bones.

Remarks.—This sample of *Terrapene* has been studied by Milstead (1956, 1967) and Auffenberg (1958). Although it has been assigned to *T. canaliculata* Hay (Milstead, 1956) and *T. carolina* (Auffenberg, 1958; Milstead, 1967) it was recognized by both authors that a close (probably ancestor-descendant) relationship exists between the fossil samples and the modern population of *T. carolina triunguis* of northeastern Texas.

Milstead (1967) has pointed out that the Ingleside sample is intermediate in size, length of interhumeral seams and plastral ratios and other characters between the early and middle Pleistocene *T. carolina putnami* and the Recent *T. carolina triunguis.* Milstead (1967, p. 174; 1969, p. 64) has expressed this relationship in his name for the Ingleside sample, *Terrapene carolina putnami* x^t *triunguis,* by the addition of the superscript "t" to indicate a chronological intermediate.

The present range of *T. carolina* is the eastern part of the United States including the northeastern part of Texas. It has not been recorded living on the Edwards Plateau or in southern Texas. The presence of a subspecies of *T. carolina* in these areas in the past implies that the climate in these regions at that time was more humid than now (Milstead, 1956; Auffenberg and Milstead, 1965).

GEOCHELONE cf. CRASSISCUTATA (Leidy)

Testudo crassiscutata Leidy, 1889, Wagner Free Inst. Sci., vol. 2, pp. 13-17.

Geochelone (Caudochelys) crassiscutata (Leidy). Auffenberg, 1963, Bull. Florida State Mus., Biol. Sci., vol. 7, p. 70.

Material.—A plastron with the posterior rim of the carapace, parts of the hind limbs and dermal scutes (TMM 30967-1816); plastra (TMM 30967-52, 1245, 202); partial carapace (TMM 30967-2087); partial skull (TMM 30967-1669).

Remarks.—This species is the more common of the two large tortoises in the Ingleside fauna. The Ingleside material is being studied by D. Bramble of the University of California, Berkeley, and a detailed description is not given here. This species is very similar to *G. crassiscutata* in its large size, smooth shell, and shallow xiphiplastral notch with obtuse angle (Auffenberg, 1963).

Family TRIONYCHIDAE

TRIONYX sp.

Material.—One left hyoplastron and hypoplastron (TMM 30967-2056); 3 complete and 2 incomplete left hypoplastra (TMM 30967-2057 to 2061, 2087); 1 complete right hyoplastron (TMM 30967-2062); 7 left and 4 right hyoplastra (TMM 30967-2063 through 2073); 3 right and 2 left xiphiplastra (TMM 30967-2077 through 2081); 3 incomplete nuchals (TMM 30967-2074 through 2076); carapace fragments (TMM 30967-2082).

Remarks.—It is not possible to make a specific identification on the basis of the material available. A considerable range of size is present; the length of the suture between the hyoplastron and hypoplastron range from 30 mm to 86.5 mm.

Order CROCODILIA
Family ALLIGATORIDAE

ALLIGATOR MISSISSIPPIENSIS (Daudin)

Crocodilus mississippiensis Daudin, 1803, Hist. Nat. Rept., vol. 2, p. 412.

Alligator mississippiensis [sic] Gray, 1831, Syn. Rept., p. 62.

Material.—Eleven dorsal dermal scutes (TMM 30967-2055); 21 teeth (TMM 30967-1531); 1 small vertebra (TMM 30967-1688); 1 phalanx (TMM 30967-1746).

Remarks.—The alligator material from Ingleside cannot be distinguished from Recent specimens of this species. The teeth are represented by both pointed and blunted types and range up to 16 mm in diameter.

Class AVES

A small number of bird bones representing several taxa were obtained from the Ingleside pit. They are being studied by A. Feduccia.

Class MAMMALIA
Subclass THERIA
Infraclass METATHERIA
Order MARSUPICARNIVORA
Family DIDELIPHIDAE

DIDELPHIS MARSUPIALIS Linnaeus

Didelphys marsupialis Linnaeus, 1758, Systema Naturae, ed. 10, p. 54.

Material.—A posterior thoracic vertebra (TMM 30967-1576); a posterior cervical vertebra (TMM 30967-1527).

Remarks.—No differences can be detected between this specimen and Recent material. Although *Didelphis* is very common in the United States at present, it is rare in Pleistocene deposits. Other records in Texas are the Lower Shuler member of the T-2 terrace in Dallas County, Texas (Slaughter et al., 1962), Trinity (3rd) terrace of the Trinity River in Henderson County, Texas (Stovall and McAnulty, 1950), and Friesenhahn Cave, Bexar County, Texas.

The first two of those occurrences are apparently of Sangamon age (Slaughter et al., 1962). The third is probably of Wisconsin age. Hibbard (1958) in his review of the well-known Pleistocene faunas from North America did not record *Didelphis* from the central or northern United States. It seems to have been restricted to the southern part of North America until the end of the Pleistocene.

These two vertebrae were originally labeled *Dasypus* and are probably the basis for the report of that genus (McAnulty, 1941, p. 80). No remains of *Dasypus* have been found in the collection from Ingleside.

Infraclass EUTHERIA
Order CARNIVORA
Family CANIDAE
CANIS DIRUS Leidy

Canis primaevus Leidy, 1854, Proc. Acad. Nat. Sci. Philadelphia, p. 200; Leidy, 1856, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 2, p. 167, pl. 17, figs. 11, 12. (Not *C. primaevus* Hodgson, 1833.)
Canis dirus Leidy, 1858, Proc. Acad. Nat. Sci. Philadelphia, p. 21.
Canis dirus Leidy, 1858. Merriam, 1912, Mem. Univ. California, vol. 1, pp. 215-272.
Canis ayersi Sellards, 1916, Rept. Florida Geol. Surv., vol. 8, pp. 121-140.
Aenocyon dirus (Leidy). Merriam, 1918, Univ. California Pub., Bull. Dept. Geol. Sci., vol. 19, pp. 531-533.

Material.—Two skulls (TMM 30967-1937; TMM 977-4); a mandible (TMM 977-4); a partial skeleton (TMM 30967-172); and miscellaneous isolated teeth and foot bones.

Remarks.—The two skulls from Ingleside show some variation in proportions but in general resemble one another and the Florida specimen described by Sellards (1916) more than they do skulls from Rancho La Brea. Scatter diagrams of the basal length of the skull vs. zygomatic width and basal length of the skull vs. width of palate at P^4 show this very well (figs. 4 and 5).

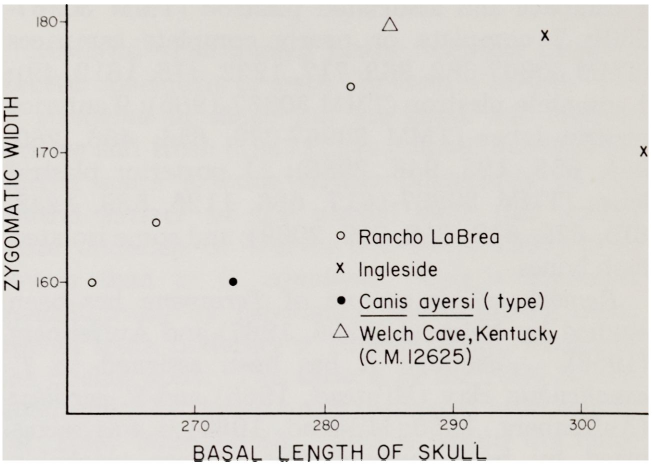

FIG. 4. Scatter diagram of basal length of skull vs. zygomatic width of *Canis dirus*.

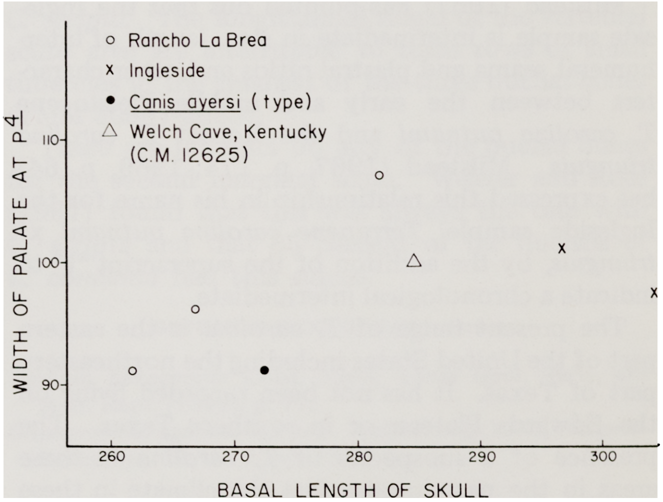

FIG. 5. Scatter diagram of basal length of skull vs. width of palate at P^4 of *Canis dirus*.

As in the skull proportions, the two Ingleside skulls also show some minor differences in the dentition, especially the development of the minor cuspules and tubercles on some teeth and in the spacing of the teeth. Merriam (1912) has noted similar variations in the Rancho La Brea material.

One skull (TMM 30967-1937) has larger, more massive teeth with the posterior cuspule and tubercle on P^3 well developed, large well-developed protocone on P^4, and a very wide M^2. The anterior premolars are missing but the alveoli indicate that they were closely spaced.

The other skull (TMM 977-4) (figs. 6 and 7) has smaller teeth in which the smaller cuspules and tubercles on P^3 and the protocone of P^4 are

FIG. 6. *Canis dirus.* Lateral view of skull (TMM 977-4). x 1/2.

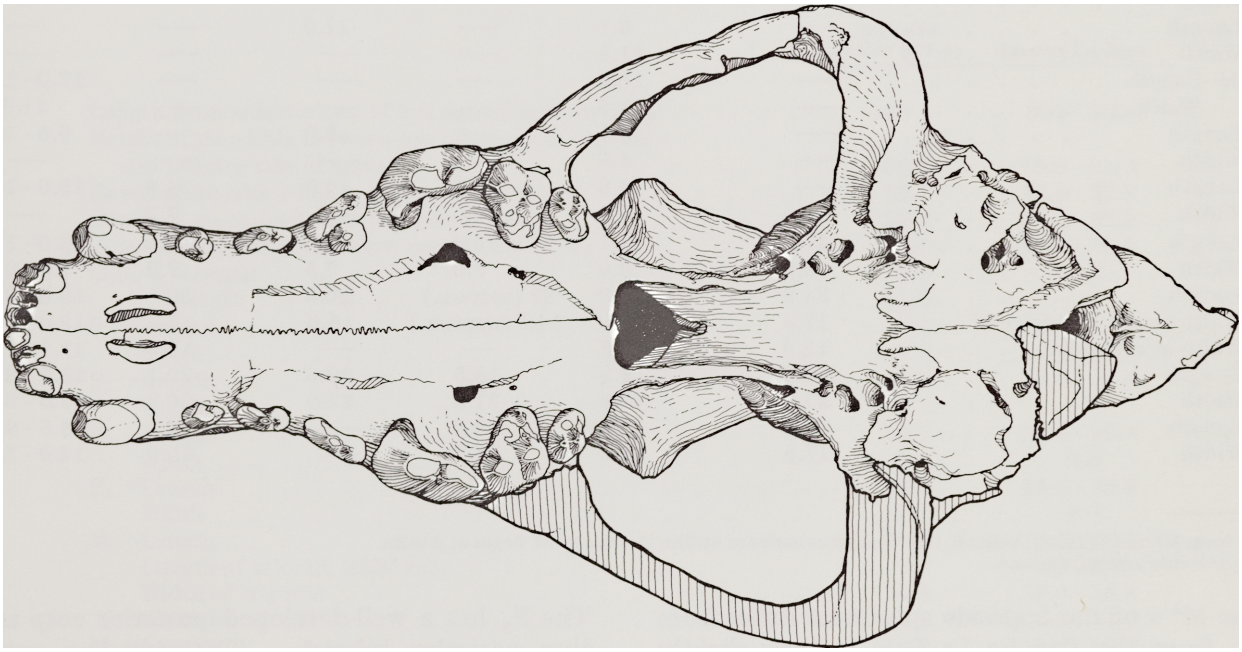

FIG. 7. *Canis dirus.* Ventral view of skull (TMM 977-4). x 1/2.

smaller (table 1). There is an extra tooth in this specimen located immediately lingual to the left P^3. This extra tooth is egg-shaped with the small end anterior. It is 11.7 mm long and 8.7 mm wide. There is one central cusp and a small shelf with an incipient cingulum on the postero-lingual border. The central cusp has a flat wear facet across the top as in the other premolars. The angular ridge on the lower side of the cingulum of P^4 noted by Merriam (1912) in many Rancho La Brea specimens is absent in both specimens from Ingleside.

The M^1's of both skulls are smaller relative to the upper carnassial than in the modern wolf. The hypocone is reduced and there is a metaconule on both specimens. The M^1 of TMM 30967-1937 has a small protoconule but TMM 977-4 lacks one. In all these characters the Ingleside specimens resemble the Rancho La Brea material.

TABLE 1. *Measurements (in mm) of skulls and dentitions of* Canis dirus *from various localities.*[1]

	Ingleside		**Type of** ***Canis dirus***	**Type of** ***Canis ayersi*** **(Fla. Geol. Survey No. 7166)**	**Carnegie Museum No. 12625**[2]	**Rancho La Brea**
	(TMM 30967-1937)	**(TMM 977-4)**				
Length, anterior end of premaxilla to posterior end of occipital condyle	297.0	305.0	------	273.0	285.0	262 - 282
Length, anterior end of premaxilla to anterior end of posterior nasal opening	158.0	166.0	------	153.0	156.0	141 - 155
Width across canines	58.7 (est.)	59.8	------	48.0	59.0	54.0 - 67.3
Width across P^4	101.3	97.9	------	91.0	100.0	91.0 - 107.5
Width across zygomatic arches	179.0	170.0	------	160.0	180.0	160 - 175
Interorbital width	65.9	63.1	------	56.0	66.2	54 - 64.9
Width of post-orbital processes	84.7	86.8	------	------	103.9	77 - 93.7
Length, from a line across posterior ends of glenoid fossae to posterior end of occipital condyle	61.0	63.1	------	------	60.0	54.0 - 57.0
I^1 —Length (parallel to tooth row)	------	5.7	7.0	6.0	------	------
Width	------	7.6	------	------	------	------
I^2 —Length	------	------	------	8.0	------	------
Width	------	------	------	------	------	------
I^3 —Length	------	9.1	------	11.0	------	------
Width	------	11.8	------	------	------	------
Canine—Length	------	16.6	------	------	------	17.0 - 17.3
Width	------	11.6	------	------	------	11.3
P^1 —Length	------	9.1	------	8.0	------	9.0 - 10.2
Width	------	6.6	------	------	------	------
P^2 —Length	------	14.8	14.8	14.5	14.6	15.0 - 16.2
Width	------	7.1	------	------	7.3	------
P^3 —Length	21.0	18.1	18.2	17.0	18.2	18.0 - 19.0
Width	8.9	8.0	8.0	7.5	7.9	7.8 - 8.0
P^4 —Length	34.9	31.0	32 (approx.)	30.0	30.5	30.0 - 32.0
Width across anterior end	17.4	15.0	14.5 (approx.)	15.0	15.4	13.0 - 16.0
Width at mid-point	12.9	12.8	------	------	13.0	11.7 - 12.1
M^1—Length	20.6	19.5	18.5	20.0	20.1	18.0 - 20.4
Width	27.6	25.8	21.5	23.0	26.9	23.0 - 25.3
M^2—Length	10.5	10.8	10.0	------	9.1	8.5 - 9.3
Width	17.5	16.0	14.9	------	15.3	14.0 - 15.0

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[1] Data from Merriam (1912), Sellards (1916), and collections at The University of Texas at Austin.

[2] Measurements taken from cast.

The M^2's of the Ingleside specimens differ from those from the Rancho La Brea in their slightly larger size. They resemble the Rancho La Brea sample in the reduction of the hypocone.

The lower teeth are essentially like those from Rancho La Brea (fig. 8; table 2). The anterior premolars are separated as in the skull. The P_4 is set en echelon with M_1, with the posterior end of the P_4 labial to the anterior end of the M_1. The M_1 and M_2 are in contact. P_1 is small and has a tiny basal tubercle which projects posteriorly. The left P_1 is missing and there is no alveolus. The left P_2 shows a small posterior cusp but the right does not. This is variable in the Rancho La Brea material. The P_3 has a well-developed posterior cusp and a tiny posterior tubercle. The cingulum extends around the entire tooth but is best defined posteriorly. The P_4 is almost exactly as described for the Rancho La Brea material. There is a large posterior cusp and a well-defined posterior tubercle which is set off from the cingulum by a notch. There is, in addition, a tiny tubercle on the postero-internal part of the cingulum.

M_1 and M_2 are similar to the California sample, although a small cingulum is present posterior to the M_1. There is a small alveolus for M_3 on the left side. It is absent on the right.

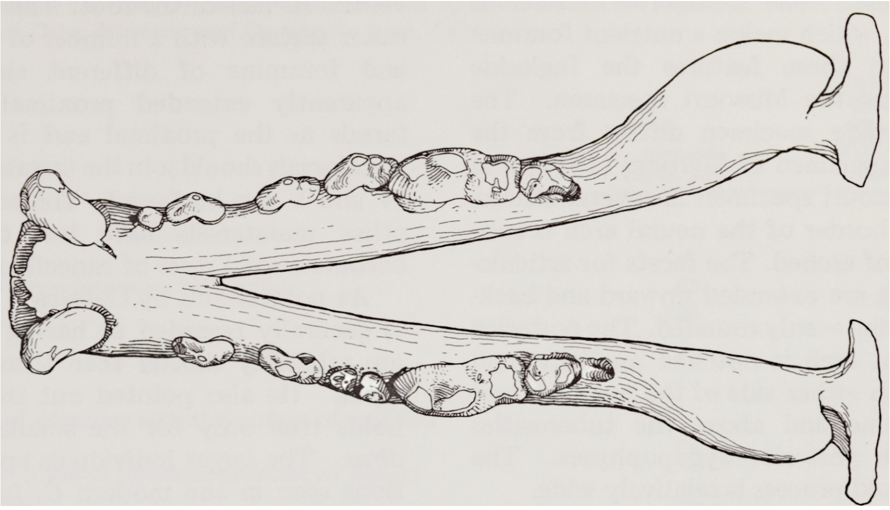

FIG. 8. *Canis dirus.* Occlusal view of mandible (TMM 977-4). x 1/2.

TABLE 2. *Measurements (in mm) of mandibles and lower dentitions of* Canis dirus *from Ingleside, Texas, and Rancho La Brea, California.*[1]

	Ingleside (TMM 977-4)	Rancho La Brea
Length from anterior end of left mandible to condyle	240	201 - 230.5
Height of mandible between top of coronoid process and inferior side of angle	94.6	79.8 - 91.3
Depth of mandible below hypoconid of M_1	39.8	33.3 - 39.7
Depth of mandible below protoconid of P_3	39.2	32.5 - 36.9
Thickness of mandible below protoconid of M_1	18.6	16.2 - 20.3
Canine—Length	17.3	17.5
Width	11.8	------
P_1 —Length	7.6	7.4 - 7.7
Width	5.7	5.5
P_2 —Length	15.2	15.0 - 15.4
Width	7.2	7.4
P_3 —Length	16.7	15.4 - 16.7
Width	8.1	7.8
P_4 —Length	20.2	19.1 - 20.0
Width	10.1	9.4
M_1—Length	36.5	34.5 - 37.4
Length of talonid, labial side	9.7	8.2 - 9.2
Width of trigonid	14.5	13.0 - 14.3
Width of talonid	13.6	12.3 - 14.3
M_2—Length	13.9	12.8 - 13.8
Length of talonid, labial side	4.9	4.5 - 5.5
Width of trigonid	4.8	9.3 - 10

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[1] Data from Merriam (1912) and collections at The University of Texas at Austin.

Post-cranial skeleton.—A partial skeleton from Ingleside makes it possible to determine some skeletal proportions of one individual. This is the second specimen known in which this is possible. Galbreath (1964) has described one from Missouri.

The post-cranial elements show minor differences from those of the Rancho La Brea material (table 3). The transverse processes of the atlas extend somewhat farther posteriorly than Merriam's (1912, fig. 16) figure indicates for the California material. The notches on the anterior border of the processes are deep and have spines that project toward the midline. The transverse foramen is enlarged medially, which makes a nutrient foramen visible. In both these features the Ingleside specimen resembles the Missouri specimen. The axis of the Ingleside specimen differs from the Rancho La Brea specimen of Merriam (1912) and resembles the Missouri specimen in several characters. The dorsal border of the neural arch is relatively flat instead of arched. The facets for articulation with the atlas are extended upward and backward instead of being evenly rounded. The posterior end of the neural arch is notched medially, and there is a notch on either side of the posterior end of the neural spine and above the tuberosities located above the posterior zygopophyses. The root of the odontoid process is relatively wide.

The third and fifth cervicals and a posterior thoracic are represented and show no appreciable differences from *Canis latrans* other than size and the relative development of various processes.

The baculum is represented by an almost complete specimen. The anterior tip is broken off. As preserved, it measures 195 mm in length. It is slightly curved in the vertical plane. The ventral profile is a smooth concave curve, while the dorsal profile has a short convex curve at the posterior end, then a concavity, then a long smooth convex curve to the anterior end. The center of the concavity is 60 mm from the posterior end. Shallow grooves extend along each side from the dorsal concavity anteriorly to about the mid-point of the bone, where they die out. This results in the formation of a rounded dorsal keel on the central part of the bone.

A deep open groove is present on the ventral surface. It extends from the posterior end to the anterior part of the bone. The ventral edges are pulled together somewhat at about the position of the concavity in the dorsal profile.

In all these characteristics the baculum of *Canis dirus* is similar to that of *Canis lupus*. The only significant difference appears to be that of size, which is in accordance with the greater size of *Canis dirus*.

The extremities are represented by a right humerus (TMM 30967-172L), right and left ulnae (TMM 30967-172M, 172N), a fibula (TMM 30967-1720), an articulated right pes (TMM 30967-172P), and parts of other feet.

The left foot of the partial skeleton (TMM 30967-172P) shows severe pathology. The proximal two-thirds of the metatarsals are completely fused, and considerable callous bone has been added on the ventral surface of the foot. This bone has a smooth outer surface with a number of smooth-walled pits and foramina of different sizes. The fusions apparently extended proximally to include the tarsals as the proximal end is broken where the metatarsals should join the tarsals and only remnants IV and V can be found. The proximal ends of the other metatarsals have lost their identity and become a solid mass of cancellous bone.

As pointed out by Galbreath (1964), *Canis dirus* is generally regarded as having metapodials which are relatively shorter than those of modern *Canis lupus*. He also pointed out that this relationship holds true only for the smaller individuals of *C. dirus*. The larger individuals approach the proportions seen in the modern *C. lupus*. The Missouri and the Ingleside specimens are both larger than the Rancho La Brea sample in most measurements. Galbreath (1964) showed that the ratios of the metapodial lengths to epipodial and propodial lengths of the Missouri skeleton were different from those of the Rancho La Brea sample and similar to those of Recent *Canis lupus*. The partial skeleton from Ingleside is slightly larger than the Missouri specimen (table 3). The only metapodial-epipodial or -propodial ratio that can be obtained, the metacarpal III/humerus x 100, is 44.0. This is higher than any reported by Galbreath (1964) for either *Canis dirus* or *Canis lupus*.

From the above it can be seen that the Ingleside material is more like the Florida, Missouri, and Kentucky specimens than the Rancho La Brea sample. The differences between the two groups are mainly the elongation of the preorbital portion of the skull, the spacing of the teeth, and possibly size. Galbreath (1964) was impressed with the large size of the skulls from Missouri. The specimen from Kentucky and the Ingleside specimens are also slightly larger than the Rancho La Brea specimens. The size differences are concentrated in the length measurements of the skull, dentition, and skeleton (*see* tables 1-3). Many of the width measurements of the Rancho La Brea skulls exceed those of the skulls from Texas, Missouri, Kentucky, and Florida, although the ranges of the samples overlap.

Several specific names have been applied to the large extinct Pleistocene wolves. Merriam (1912) showed that all the material known up to that date could be reasonably included in one species, for which the name *Canis dirus* was available. Later Sellards (1916) named another species *Canis ayersi* on the basis of a skull and post-cranial parts. The

TABLE 3. *Measurements (in mm) of post-cranial elements of* Canis dirus *from Ingleside, Texas, compared with specimens from Powder Mill Creek Cave, Missouri, and Rancho La Brea, California.*

	Ingleside (TMM 30967)	Powder Mill Creek Cave (Southern Illinois Univ. No. P-249)[1]	Rancho La Brea[2]
ATLAS			
Length: plane of transverse processes horizontal	63	58	
Width	125	113	120.5
AXIS			
Height of axis: plane of posterior articular surface of centrum perpendicular	64.9	62	
Length of neural arch: plane of posterior articular surface of centrum perpendicular	83.2	74	73.7
Length of neural arch regardless of orientation	83.5	74	
Width of neural arch at posterior end	44.9	44.6	
Length of centrum from tip of odontoid process to posterior articular surface of centrum: plane of posterior articular surface perpendicular	72.6	73	
Length of centrum from tip of odontoid process to posterior end of centrum regardless of orientation	80.2	74	
Width of anterior articular surface of centrum	47.8	44	
Height of posterior articular surface of centrum	19.9	19.5	
Width of posterior articular surface of centrum	28.4	30.1	
Width of transverse processes		55.4	
THIRD CERVICAL VERTEBRA			
Height of vertebra: plane of posterior articular surface of centrum perpendicular	52.9	52.5	
Length of neural arch: plane of posterior articular surface of centrum perpendicular	42.1[a] (63.2)[b]	55.2	
Length of neural arch regardless of orientation	42.9[a] (63.3)[b]	56.4	
Greatest width of neural arch	51.7	44.4	
Width of neural arch at pre-zygapophysis	44.8	40.1	
Width of neural arch at post-zygapophysis	51.7	43.8	
Length of centrum: plane of posterior articular surface of centrum perpendicular	41.8	39.5	
Height of anterior articular surface of centrum	18.5	17.9	
Width of anterior articular surface of centrum	27.0	26.8	
Height of posterior articular surface of centrum	21.5	21.4	
Width of posterior articular surface of centrum	26.0 (est.)	28.4	
Width of transverse processes	66.0	76.0	
FIFTH CERVICAL VERTEBRA			
Height of vertebra: plane of posterior articular surface of centrum perpendicular	76.6	68.0	
Length of neural arch: plane of posterior articular surface of centrum perpendicular	53.0	50.0	
Length of neural arch regardless of orientation	54.3	51.0	
Width of neural arch at anterior zygapophysis	55.0	51.7	
Width of neural arch at posterior zygapophysis	52.6	46.9	

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[1] Data from Galbreath (1964).

[2] Data from Merriam (1912), Nigra and Lance (1947), Stock and Lance (1948).

[a] Midline length.

[b] Length between pre- and post-zygapophyses.

TABLE 3—Continued

	Ingleside (TMM 30967)	Powder Mill Creek Cave (Southern Illinois Univ. No. P-249)[1]		Rancho La Brea[2]
FIFTH CERVICAL VERTEBRA (continued)				
Length of centrum: plane of posterior articular surface of centrum perpendicular	34.1	32.6		
Height of anterior articular surface of centrum	19.5	19.1		
Width of anterior articular surface of centrum	25.1	23.1		
Height of posterior articular surface of centrum	24.2	23.5		
Width of posterior articular surface of centrum	27.3	26.6		
Width of transverse processes	68.7	64.6		
HUMERUS				
Length	252	247		195 - 242
Antero-posterior diameter of head	71.7	68+		
Antero-posterior diameter of shaft at midpoint	26.1	24.5		
Transverse width of shaft at midpoint	21.4	23.8		
		Left	Right	
Transverse width of distal end	55.9	56.2	57.5	
ULNA				
Length		285.6		
Length from distal end to proximal lips semilunar notch		258		
Least antero-posterior diameter from distal border of radial facet to proximal lip of semilunar notch	34.3	32.5		
Transverse width at the coronoid process	27.0	27.5		
METACARPAL II				
Length	96.1	93.0		65.0 - 93.0
Depth of proximal end	17.9	19.2		
Width of proximal articular surface	13.4	11.2		
Width of distal articular surface	14.9	14.4		
METACARPAL III				
Length	110.9	105		72.0 - 105.0
Depth of proximal end	19.7			
Width of proximal articular surface	13.6			
Width of distal articular surface	14.0	13.5		
METACARPAL IV				
Length	110.8	104.7		74.0 - 100.0
Depth of proximal end	19.9	18.0		
Width of proximal articular surface	10.1	12.0		
Width of distal articular surface	13.9	13.2		
METACARPAL V				
		Left	Right	
Length	96.1	92	92	61.0 - 90.0
Depth of proximal end	19.1	17.1+	17.3	
Width of proximal articular surface	12.1	18.4	18.9	
Width of distal articular surface	15.0	15.1	14.5	

TABLE 3—Continued

	Ingleside (TMM 30967)	Powder Mill Creek Cave (Southern Illinois Univ. No. P-249)[1]	Rancho La Brea[2]
CALCANEUM			
Proximodistal length	71.4	71.0	
Mediolateral width	26.3	30.0	
Dorsoplantar width	32.9	32.0	
ASTRAGALUS			
Proximodistal length	41.5	41.5	
Mediolateral width	34.4	34.0	
Dorsoplantar depth	25.0	24.0	
Width of body	31.0 (est.)	29.0	
Width of tibular facet	24.2	24.2	
Transverse width of head	22.3	19.5	
Dorsoplantar depth of head	21.4	20.4	
CUBOID			
Proximodistal length	29.8	30.0	
Mediolateral width	21.3	22.5	
Dorsoplantar depth	23.4	22.0	
NAVICULAR			
Antero-posterior length	16.3	26.4	
Greatest height on outer surface	27.1	16.8	
METATARSAL II			
Length	102.3	99.8	71.0 - 100.0
Depth of proximal end	22.2	21.7	
Width of proximal articular surface	8.8	9.0	
Width of distal articular surface	14.4	13.5	
METATARSAL III			
Length	116.1		81.0 - 113.0
Depth of proximal end	21.7		
Width of proximal articular surface	15.0		
Width of distal articular surface	13.4		
METATARSAL IV			
Length	119.4	117.0	82.0 - 115.0
Depth of proximal end		19.5	
Width of proximal articular surface		15.1	
Width of distal articular surface	13.3		
METATARSAL V			
Length	102.6	104.4	75.0 - 106.0
Depth of proximal end	18.5	17.2	
Width of proximal end including processes	16.3	18.0	
Width of distal end including processes	12.3	12.5	

major differences between the Florida and California species are the more elongate slender skull and greater spacing of the teeth in the Florida material. Sellards pointed out that the spacing of the teeth in the California sample is variable and that some of the specimens have well-spaced teeth.

The differences between *Canis dirus* samples from the different parts of North America are no greater than those found between Recent samples of *Canis lupus* from different localities (Young and Goldman, 1944). There is no basis for considering *Canis ayersi* a separate species from *Canis dirus.*

CANIS LATRANS Say

Canis latrans Say, 1823, Long's Expedition to the Rocky Mountains, i. p. 168.

Material.—Left maxilla with P^3-M^2 (TMM 30967-1105); anterior half of a left mandible with P_3 (TMM 30967-1610); a P_2 (TMM 30967-1148); dorsal vertebrae (TMM 30967-1143A, 1251, 1250); 1 lumbar vertebra (TMM 30967-1142); distal half of a right humerus (TMM 30967-1348); 2 left femora (TMM 30967-1067, 52); 1 right femur (TMM 30967-1563); 2 metapodials (TMM 30967-1150, 1705); left metatarsal IV (TMM 30967-1253).

Remarks.—The M^1 and M^2 of the maxilla are so worn that the arrangement and relative size of the internal cusps cannot be determined with certainty (fig. 9). A comparison with a series of Recent *Canis latrans* skulls from Texas shows only very minor differences. The separation of P^3 and P^4 is somewhat greater than in the Recent sample. The Ingleside specimen shows no sign of a small cuspule on the ridge between the protocone and paracone of P^4. This cuspule is present in varying degrees on 35 percent of 23 Recent specimens from Texas.

The size of the teeth falls within the range seen in the Recent sample (table 4). Scatter diagrams of length vs. width of P^4 and M^1 show that the proportions of the Ingleside specimen are within the range found in the Recent sample (figs. 10 and 11).

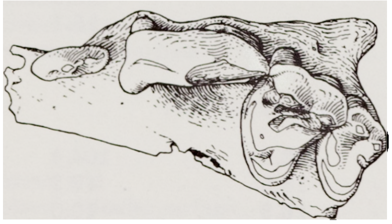

FIG. 9. *Canis latrans.* Palatal view of maxillary (TMM 30967-1105). x1.

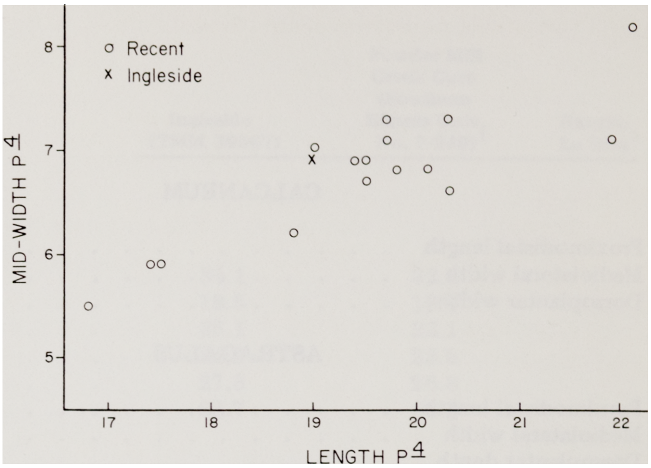

FIG. 10. Scatter diagram of length vs. mid-width of P^4 of *Canis latrans.*

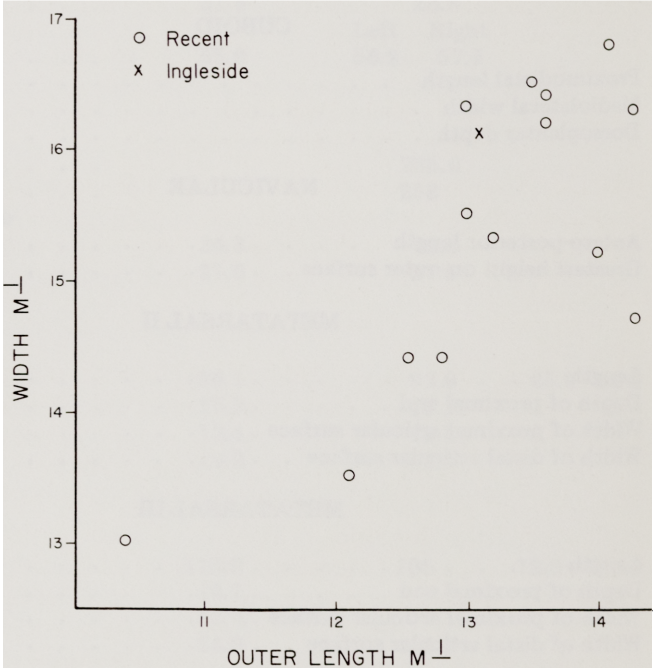

FIG. 11. Scatter diagram of length vs. width of M^1 of *Canis latrans.*

Comparison of the Ingleside material with other described fossil species of coyotes is difficult because of the small amount and fragmentary nature of the Ingleside material. A specimen from the Pemberton Hill—Lewisville terrace of the Trinity River (Elm Fork) in Denton County named *Canis latrans harriscrooki* by Slaughter (1961) has well-developed posterior tubercles on P_{2-3}. Two P_3's are present in the Ingleside collection and neither

TABLE 4. *Measurements (in mm) of upper dentitions of* Canis latrans *from Ingleside, Texas, and of a Recent sample of* Canis latrans *from north-central Texas.*

		Recent of north-central Texas				
	Ingleside (TMM 30967-1105)	No. of specimens	Observed range	Mean-standard error	Standard deviation	Coefficient of variation (%)
P^4 –						
Length	18.8	15	17.1 - 20.7	19.17±.29	1.14	5.9
Anterior width	8.0	15	9.0 - 10.8	9.78±.16	.636	6.5
Mid-width	7.0	15	6.1 - 7.6	6.98±.09	.355	5.08
M^1 –						
Outer length	13.2	14	11.1 - 13.7	12.75±.20	.809	6.34
Width	16.1	14	13.6 - 16.8	15.2 ±.25	.984	6.5

shows a posterior tubercle. The ascending ramus is not preserved in the Ingleside specimen.

The post-cranial material cannot be distinguished from that of the Recent sample.

In general the Ingleside coyote seems to be more closely related to the modern coyote of Texas than to any of the fossil forms.

Family URSIDAE

TREMARCTOS FLORIDANUS (Gidley)

Arctodus floridanus Gidley, 1928, Jour. Washington Acad. Sci., vol. 18, pp. 430-433.

Tremarctos mexicanus Stock, 1950, Jour. Washington Acad. Sci., vol. 40, pp. 317-321.

Tremarctos floridanus (Gidley). Kurtén, 1963, Texas Memorial Museum, Pearce-Sellards Ser. No. 1, pp. 9-11.

Material.—One M_2 (TMM 30967-1880); 1 M_3 (TMM 30967-1031); 2 first phalanges (TMM 30967-941, 970A).

Description and discussion.—These two teeth (fig. 12) are the only specimens of bears in the collection from Ingleside. The M_2 is rectangular with straight parallel sides and flattened ends. The trigonid area is higher than the talonid but occupies smaller area. It differs from the corresponding tooth of *Ursus americanus* in having less rounded corners and in the higher paraconid region.

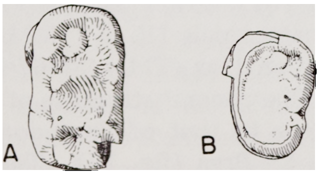

FIG. 12. *Tremarctos floridanus.* A, Occlusal view of M_2 (TMM 30967-1880). B, Occlusal view of M_3 (TMM 30967-1031). x1.

The M_3 is oval with a very broad, shallow-basined central area. The tuberculation is finer than in the M_3 of *Ursus americanus* (Kurtén, 1966). Kurtén pointed out that the two teeth from Ingleside are identical with homologous teeth of *Tremarctos* from Florida and Mexico, both in size and morphology. The dorsal surfaces of the proximal ends of the phalanges are flattened on one side that gives an asymmetrical shape to the proximal articular surface. They are somewhat more robust than the phalanges of a Recent *Ursus americanus* of comparable size. Kurtén (1966) stated that the metacarpals of *T. floridanus* are also more robust than those of *U. americanus.* The measurements of the Ingleside specimens are: M_2—length, 22.4 mm; width, 13.1 mm; M_3—length, 16.2 mm; width, 11.9 mm.

Family FELIDAE

FELIS sp.

Material.—A badly eroded right dP^4 (TMM 30967-1492); a left dP_4 (TMM 30967-1147).

Remarks.—The form of both these teeth is identical to the homologous teeth of *Lynx rufus* but they are approximately twice the size. The length of the right dP^4 is 16.5 mm, the length of the left dP_4 is 14.8 mm. The size is approximately that expected in a cat the size of *F. concolor* or *F. onca.*

LYNX RUFUS (Schreber)

Felis rufa Schreber, 1777, Die Saugethiere..., Teil 3, Heft 95, pl. 1096.

Lynx rufus (Schreber). Hall and Kelson, 1959, Mammals of North America, vol. 2, pp. 968-972.

Material.—A left humerus (TMM 30967-556) lacking the distal end.

Remarks.—The humerus has been compared with humeri of *Lynx rufus* and *Felis pardalis.* It is much more like that of *Lynx rufus* in the slight degree of antero-posterior curvature and the proximal extension of the supracondyloid ridge well past the junction of the deltoid and pectoral ridges. The Ingleside specimen is within the size range shown by the humeri of Recent *Lynx rufus*. The length from the head to the supracondyloid foramen is 114 mm. The corresponding lengths of the humeri of four specimens of Recent *L. rufus* from Texas are 122, 123, 114, and 112 mm.

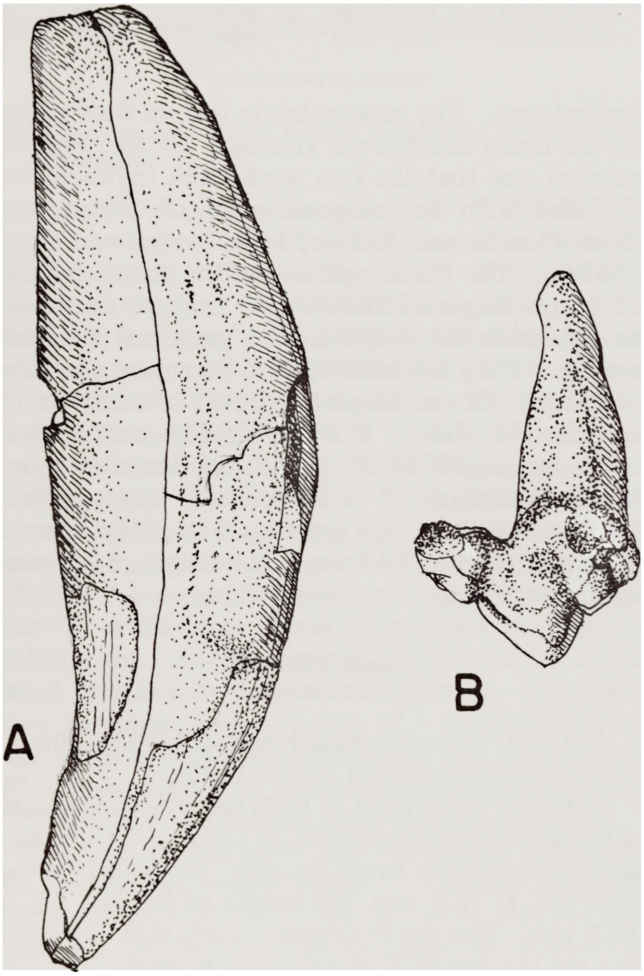

FIG. 13. *Panthera atrox*. A, Lateral view of right upper canine (TMM 30967-1613). B, Lateral view of right P^3 (TMM 30967-1697). x1.

PANTHERA ATROX (Leidy)

Felis atrox Leidy, 1853, Trans. Amer. Philos. Soc., vol. 10, p. 34.

Panthera (Jaguarius) atrox (Leidy). Simpson, 1941, Amer. Mus. Novitates 1136, p. 23.

Material.—A right upper canine (TMM 30967-1613); a right P^3 (TMM 30967-1697).

Remarks.—A comparison of the specimens and figures of Rancho La Brea material in Merriam and Stock (1932) shows a very close resemblance (fig. 13). The size of the canine (length, 126.5; antero-posterior diameter at base of enamel, 27.9; and transverse diameter at base of enamel, 21.0 mm) is within the range of size given by Merriam and Stock (1932).

The P^3 has two roots, as do the majority of the specimens from Rancho La Brea. There is no difference in morphology from the Rancho La Brea material. The length (28.6 mm) is within the range given by Merriam and Stock (1932) for the Rancho La Brea sample.

This animal had a wide distribution in North America during the Pleistocene (Harrington, 1969). Its association with many different assemblages over this wide area indicates a tolerance for a wide range of conditions and renders it useless as an indicator of environmental differences between different areas of North America.

SMILODON FATALIS (Leidy)

Felis (Trucifelis) fatalis Leidy, 1868, Proc. Acad. Nat. Sci. Philadelphia, p. 175.

Trucifelis fatalis Leidy, 1860, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, p. 366.

Smilodontopsis troglodytes Brown, 1908, Mem. Amer. Mus. Nat. Hist., vol. 9, no. 4, p. 188.

Smilodontopsis conardi Brown, 1908, Mem. Amer. Mus. Nat. Hist., vol. 9, no. 4, p. 190.

Smilodon nebraskensis Matthew, 1918, Bull. Amer. Mus. Nat. Hist., vol. 28, pp. 226-229.

Smilodon cf. *fatalis* (Leidy). Lull, 1921, Amer. Jour. Sci., 5th ser., vol. 2, p. 160.

Smilodon trinitiensis Slaughter, 1960, Jour. Paleont., vol. 34, p. 456.

Smilodon fatalis (Leidy). Slaughter, 1963, Texas Jour. Sci., vol. 15, p. 74.

Material.—A pair of mandibular rami (TMM 30967-198, 347); upper canine (TMM 30967-206); left radius (TMM 30967-1713); part of P^4 (TMM 30967-75); half of M^1, right P^3 and part of right P^4 (TMM 30967-751); lower canine (TMM 30967-1034); left metacarpals IV, V (TMM 30967-1017, 940); 1 second phalanx (TMM 30967-970B).

Remarks.—The general structure of the Ingleside material is close to that of *Smilodon californicus* from Rancho La Brea (fig. 14). The mandible is relatively weak compared to that of a lion. The coronoid process is low; the masseteric fossa is well developed with the ventral border broadened externally to form a prominent shelf. The ventral border of the mandible is straight. The mental

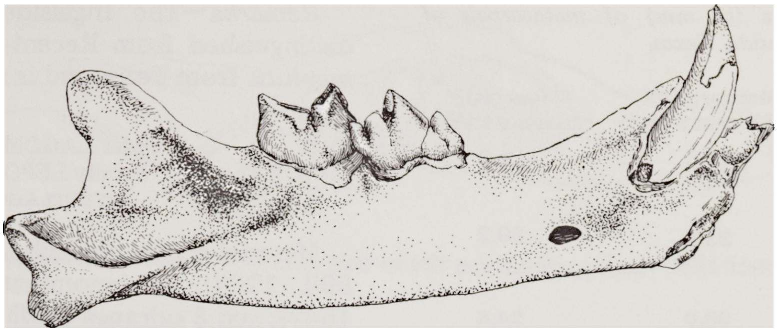

FIG. 14. *Smilodon fatalis.* Lateral view of right mandibular ramus (TMM 30967-198). x 1/4.

foramen is large and is located midway between the canine and P_4. The smilodont flange is broken but appears to have been small.

The P_3 is absent. P_4 and M_1 are both inclined backwards in the mandible but not to the extent that is seen in some Rancho La Brea specimens. The P_4 is large and has well-developed anterior and posterior basal cusps. There is a very indistinct postero-internal cingular tubercle.

The P_4 has the protoconid blade longer than the paraconid blade. There is no cingular cusp on either end of the tooth. There is a rounded bulge on the anterior edge of the paraconid but no cusp or tubercle is present.

The radius is short, heavy, and closely resembles the Rancho La Brea material. All dimensions are within the range for the California series.

A comparison with the Rancho La Brea series shows that almost all characters of the Ingleside specimen can be matched by one or more specimens from Rancho La Brea. The length of the symphysis and the transverse width of the mandibular condyle are the only characters whose measurements fall outside the observed range of the Rancho La Brea series given by Merriam and Stock (1932). In both cases it is below the observed range (table 5).

All measurements on the radius and metacarpals IV and V fall within the observed range of the Rancho La Brea series (tables 6 and 7).

Slaughter (1963) has observed that scatter diagrams of length of P_4 vs. width of P_4 and length of P_4 vs. length of lower canine show that except for the Florida material of late Wisconsin age, the specimens of *Smilodon* from eastern North America, Texas, and the Irvingtonian of California differ somewhat from those of the Rancho La Brea. The scatter diagrams show that the older specimens have P_4's which are narrower for a given length and lower canines which are smaller for a given P_4 length than do the California specimens. The differences are small but are consistent with little overlap between the two groups.

TABLE 5. *Measurements (in mm) of mandible and lower dentition of* Smilodon fatalis *from Ingleside, Texas.*

	TMM 30967-198
Length from anterior end of canine to posterior end of M_1	131.0
Length from P_4 to M_1	53.5
Length of diastema from C to P_4 (alveolar)	61.5
Canine—	
Length	15.9
Width	11.0
P_4—	
Length	26.5
Width	11.9
Basal length of principal cusp	10.3
M_1—	
Length	27.5
Width	13.3
Length of protoconid blade	14.9
Length from symphysis to condyle	208.0
Length of symphysis	46.0
Least depth of ramus below diastema	32.0
Depth of ramus at posterior end	41.7
Depth of ramus below M_1	35.1
Height from inferior border of angle to top condyle	73.9
Transverse width of condyle	40.0
Greatest depth of condyle	18.0

TABLE 6. *Measurements (in mm) of left radius of* Smilodon fatalis *from Ingleside, Texas.*

	TMM 30967-1713
Length along internal border	267
Long diameter of proximal end	47 (approx.)
Greatest diameter at right angles to long diameter of proximal end	37 (approx.)
Width of shaft at middle	38 (approx.)
Thickness of shaft at middle	20 (approx.)
Greatest width of distal end	61
Greatest thickness of distal end	40

TABLE 7. *Measurements (in mm) of metacarpals of* Smilodon fatalis *from Ingleside, Texas.*

	Metacarpal IV (TMM 30967-1017)	Metacarpal V (TMM 30967-940)
Maximum length . .	88.8	74.0
Maximum width of proximal end (transverse) . .	23.1	20.2
Maximum width of proximal end (dorso-ventral) .	23.0	24.6
Transverse diameter at middle of shaft .	14.2	14.2
Dorso-ventral diameter at middle of shaft .	14.4	15.2
Maximum transverse diameter at distal end . .	21.2	21.7

The older group ranges from Yarmouthian through early Wisconsinan. This is shown on the scatter diagram as a difference in size with the older specimens being smaller but lying on the same trend line as the later specimens. The Ingleside specimen is referred to *Smilodon fatalis*, which is the earliest name for the older Pleistocene eastern group, with the realization that future discoveries may provide morphologic and geographic intermediates between the two groups.

It has been suggested by Lammers (1959) that the differences between the late Wisconsin *Smilodon floridanus* and *S. californicus* do not warrant specific separation. The scatter diagrams prepared by Slaughter (1963) support this interpretation. Slaughter (ibid) also pointed out that all the material which could be confidently referred to the *S. californicus-floridanus* group is late Wisconsin, and that all specimens confidently referred to the *S. fatalis* group are pre-Wisconsin. The Ingleside specimen is the only known exception to this age grouping. As suggested by Slaughter, its age is early Wisconsin (*see* section on age, p. 6). Thus, it is the youngest known specimen of the *S. fatalis* group.

Family MUSTELIDAE

MEPHITIS MEPHITIS (Schreber)

Viverra mephitis Schreber, 1776, Die Saugthiere ....., Teil 3, Heft 17, pl. 121.

Mephitis mephitis (Schreber). Allen et al., 1902, Science, n.s., vol. 16, p. 115.

Material.—An edentulous mandible (TMM 30967-86).

Remarks.—The Ingleside specimen cannot be distinguished from Recent specimens of *Mephitis mephitis* from Texas and is referred to that species.

Order LAGOMORPHA

Family LEPORIDAE

SYLVILAGUS sp.

Material.—Two mandibular rami (TMM 30967-999, 1263); an innominate bone (TMM 30967-1547); and 3 calcanea (TMM 30967-1262).

Remarks.—The specific identification of mandibles of *Sylvilagus* is difficult. The postero-lingual corner of the P_3 is usually stated to be a right angle in *Sylvilagus floridanus* and more rounded in *Sylvilagus auduboni.* The one Ingleside specimen with P_3 has a right-angled postero-lingual corner. Specimen TMM 30967-999 has the following measurements: length of diastema, 17.9 mm; anterior height of mandible, 9.4 mm. This specimen is slightly larger than Recent specimens of *S. floridanus* and falls in the size range of a Pleistocene sample of *S. floridanus* reported by Pettus (1956).

Order RODENTIA

Family SCIURIDAE

CYNOMYS LUDOVICIANUS (Ord)

Arctomys ludoviciana Ord, 1815, Guthrie's Geogr., 2nd Amer. ed., Vol. II, pp. 292, 302.

Cynomys ludovicianus (Ord). Baird, 1857, Gen. Rept. North Amer. Mamm., pp. xxv, 331.

Cynomys ludovicianus (Ord). Hollister, 1916, North Amer. Fauna, vol. 40, p. 14.

Material.—Two skulls (TMM 30967-1014, 850); portions of 3 maxillae with teeth (TMM 30967-834A, 834B, 835); 9 right and 5 left mandibular rami (TMM 30967-834, 851, 933A-933L); and numerous isolated post-cranial bones.

Remarks.—The skulls have been somewhat distorted and the dorsal surfaces are not well preserved. However, the ventral surfaces and tooth rows are well enough preserved to allow detailed comparison with Recent material.

The Ingleside material (fig. 15) shows no important differences from a sample of nine recent specimens of *Cynomys ludovicianus.* The size and morphology of the teeth of the Ingleside sample from Texas are very similar (table 8). The posterior border of the inflected angular process of the mandible makes an angle of about 45° with the axis of the jaw, as in *Cynomys ludovicianus.*

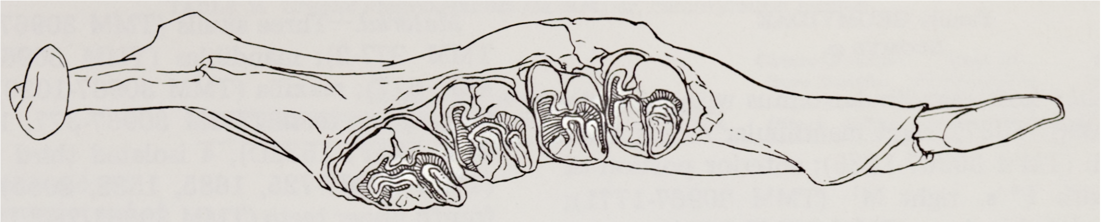

FIG. 15. *Cynomys ludovicianus.* Occlusal view of left mandibular ramus (TMM 30967-993H). x3.

TABLE 8. *Numerical data on samples of* Cynomys ludovicianus *from Ingleside, Texas and the Recent of Texas.*

	Ingleside Sample			Recent Sample		
	No. of specimens	Mean	Observed range	No. of specimens	Mean	Observed range
Total length of lower teeth	7	14.8	13.7 - 15.3	7	15.2	14.5 - 15.8
Total length of upper teeth	4	17.0	16.0 - 17.9	5	16.9	16.6 - 17.2
Length of lower diastema	1	9.9	-----	7	9.8	8.5 - 10.4

Family CRICETIDAE

PEROMYSCUS sp.

Material.—Right mandibular ramus with M_{1-3} (TMM 30967-1207).

Remarks.—The specific identification of mandibles of *Peromyscus* is difficult because of the overlap in size and dental characters.

The Ingleside specimen has simple teeth found in a number of species of *Peromyscus*, such as *P. leucopus*, *P. maniculatus*, and *P. gossypinus.* The re-entrant valleys on all the teeth are open; there are no lophids or stylids (fig. 16). The cingulum is well developed in the re-entrant valleys. There is no median groove on the face of the anteroconid of M_1.

The posterior end of the lower incisor is bent labially and is housed in a prominent capsule on the labial side of the mandible. Dalquest et al. (1969) have found that this character is almost invariably present in *P. leucopus* and *P. maniculatus* and absent in *P. boylii* and *P. pectoralis.* An examination of six specimens of *P. gossypinus* from East Texas showed it to be well developed in all six.

Dalquest et al. (1969) found that in the central and eastern parts of Texas the length of M_{1-2} was smaller in *P. maniculatus* (2.5 to 2.7 mm) than in *P. leucopus* (2.7 to 2.9 mm). The length of M_{1-2} of the Ingleside specimen is 2.86 mm. In six specimens of *P. gossypinus* from East Texas, the length of M_{1-2} ranged from 2.41 to 2.81.

The above comparisons indicate that the Ingleside *Peromyscus* is morphologically similar to both *P. leucopus* of Central Texas and *P. gossypinus.* It is impossible to make a definite assignment to one or the other because of their similarity. The presence of *P. gossypinus* in the Ingleside fauna would not be unreasonable in the light of the humid conditions indicated by the presence of *Tapirus.*

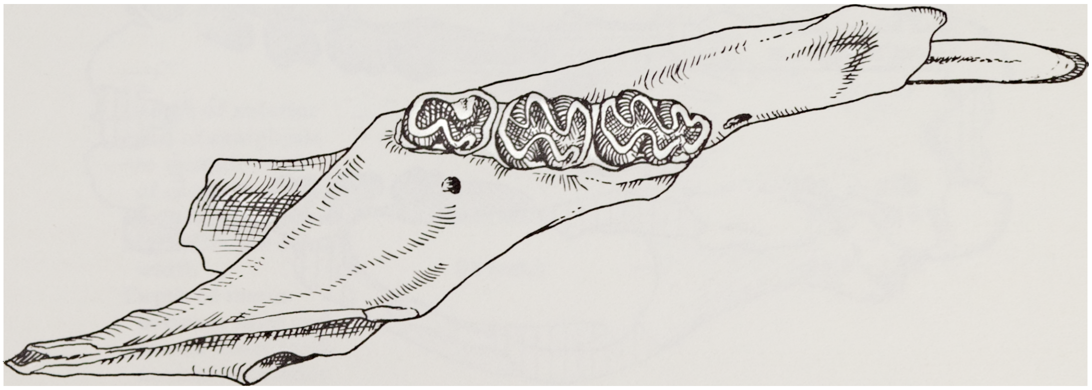

FIG. 16. *Peromyscus* sp. Occlusal view of right mandibular ramus (TMM 30967-1207). x10.

Family GEOMYIDAE

GEOMYS sp.

Material.—Left mandibular ramus without teeth (TMM 30967-1037); right mandibular ramus without teeth (TMM 30967-1335); anterior portion of palate with P^4's, right M^1 (TMM 30967-1771); several isolated incisors (TMM 30967-1671).

Remarks.—Two species, *Geomys personatus* and *Geomys bursarius*, are found today in the vicinity of Ingleside. The two species are extremely difficult to differentiate on the basis of skeletal material. As a result it is impossible to identify the Ingleside material. Measurements of the P^4 of TMM 30967-1771 from Ingleside are: length, 2.43 mm; anterior width, 2.23 mm; posterior width, 2.40 mm; width of neck, .27 mm. A comparison with ten specimens each of *G. bursarius* and *G. personatus* from South Texas shows that the Ingleside material is either larger than or lies at the upper limit of the size range of both Recent species.

Order EDENTATA

Family MYLODONTIDAE

PARAMYLODON HARLANI (Owen)

Mylodon harlani Owen, 1840, The zoology of the voyage of H.M.S. Beagle, etc., Part 1, Fossil Mammalia, p. 68.

Mylodon harlani Owen, 1840. Stock, 1925, Carnegie Inst. Washington Pub. 331, p. 120.

Paramylodon nebrascensis Brown, 1903, Bull. Amer. Mus. Nat. Hist., vol. 29, pp. 569-583.

Mylodon harlani tenuiceps Stock, 1917, Univ. California Pub., Bull. Dept. Geol. Sci., vol. 10, pp. 171-173.

Mylodon garmani Allen, 1913, Harvard Coll., Mem. Mus. Comp. Zool., vol. 40, no. 7, pp. 319-346.

Mylodon harlani Stock, 1925, Carnegie Inst. Washington Pub. 331, pp. 112-200.

Material.—Three skulls (TMM 30967-1813, 521; TMM 977-2); mandibles (TMM 30967-852, 871, 461, 677); maxilla (TMM 30967-1020); 7 isolated first upper teeth (TMM 30967-377, 1012D, 537, 914, 725F, 1532D); 4 isolated third upper teeth (TMM 30967-725, 1685, 1532, 2055); 8 isolated fourth upper teeth (TMM 30967-285, 1532, 1012B, 547, 220, 725C, 913, 908); 3 isolated fifth upper teeth (TMM 30967-912, 911, 1532A); 7 isolated second lower teeth (TMM 30967-1532B, 1012A, 1233, 1685, 1842, 907, 2056); 3 isolated third lower teeth (TMM 30967-1233A, 1021A, 2057); 6 isolated fourth lower teeth (TMM 30967-377A, 377, 1532C, 271, 1012F, 2058); 9 isolated second upper or first lower teeth (TMM 30967-1877, 1012C, 725, 285, 725D, 1532E, 725E, 1189, 1152); axis (TMM 30967-502); 4 humeri (TMM 30967-1226, 1414, 666, 1027; 4 femora (TMM 30967-1445, 1428, 420, 1421); 4 tibiae (TMM 30967-3054, 1154, 264, 197); 1 ulna (TMM 30967-1588); 1 scapula (TMM 30967-1420); and many isolated foot elements.

Remarks.—The Ingleside collection contains enough material of this species for study of variation in some features and warrants a detailed comparison with material from other areas.

SKULL.—Three skulls of this species are available. They closely resemble skulls from Rancho La Brea figured by Stock (1925) (fig. 17), and most measurements fall within the observed ranges of the Rancho La Brea sample (tables 9 and 10). In those characters in which the Ingleside specimens fall out of the observed range of the Rancho La Brea sample the deviations are small and of doubtful significance. Some proportions of the Ingleside skull are different from those of the majority of the

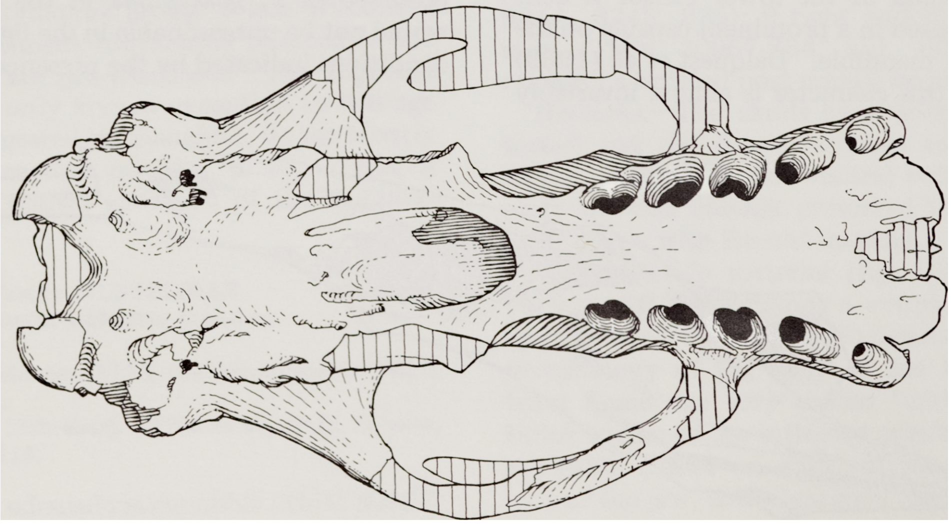

FIG. 17. *Paramylodon harlani.* Palatal view of skull (BEG 30967-1813). x¼.

TABLE 9. *Cranial measurements (in mm) of* Paramylodon harlani.

	Ingleside Specimens			Observed range from Rancho La Brea	Type of *Paramylodon nebrascensis*	Type of *Mylodon garmani*
	TMM 30967-1813	TMM 30967-521	TMM 30967-504	(Stock, 1925)	(Brown, 1923)	(Allen, 1913)
Length of anterior end of maxilla to posterior end of occipital condyle	494	500	502	424 - 527	470	485*
Length of palate from anterior end of maxilla to post-palatine notch . . .	225	-----	231	176 - 237	211*	223*
Width across ventral surface anterior to first upper tooth	154	-----	149	115 - 156	125*	131*
Width of palate between second upper teeth . . .	70	98	72	61.8 - 90.5	80*	69.6*
Width of palate between anterior lobes of fifth upper tooth	42	44	41.5	41.7 - 62.5	48.1*	50.3*
Least width posterior to fifth upper tooth	66	-----	71	57.8 - 77.3	-----	-----
Least distance from fifth upper tooth to middle of post-palatine notch . . .	32 (approx.)	-----	31.5	36.8 - 56.6	-----	-----
Mastoid width above stylohyal process	179	191	189	158.3 - 210	-----	-----
Greatest width of occipital condyle	123	138	131	120 - 143.8	-----	-----
Transverse diameter of foramen magnum . . .	43	-----	56	35.8 - 52.9	-----	-----
Dorso-ventral diameter of foramen magnum . . .	32.4	-----	41	32.9 - 42.0	-----	-----
Width of muzzle	155	-----	139	117 - 157	128	-----
Least width behind post-orbital process . . .	101	-----	111	94.5 - 134	89	-----
Height from basioccipital plane to dorsal plane . .	130	-----	132	123 - 157	-----	-----

---

*Measurements taken from figures.

TABLE 10. *Measurements (in mm) of mandibles of* Paramylodon harlani *from Ingleside, Texas, and Rancho La Brea, California.*

	Ingleside		Observed range from Rancho La
	(TMM 30967-677)	(TMM 30967-877	Brea (Stock, 1925)
Length of anterior end of symphysis to posterior end of condyle . . .	389	—	295 - 409
Length of symphysis	122 (est.)	—	90.9 - 116.4
Maximum pre-dental width	96 (est.)	—	95.9 - 154
Depth of ramus between third and fourth lower teeth normal to inferior margin	90	82.5	69 - 97.1

Rancho La Brea sample. A scatter diagram of skull length vs. post-orbital width (fig. 18) shows the Ingleside specimen to be more constricted in this region. It is similar to the skulls placed by Stock (1925) in a separate sub-species, *Paramylodon harlani tenuiceps*. It also resembles the type specimen of *Paramylodon nebrascensis* in this character.

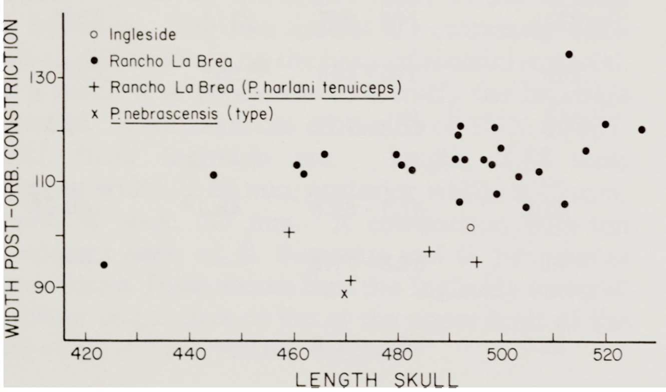

FIG. 18. Scatter diagram of length of skull vs. width of post-orbital constriction of various samples of *Paramylodon harlani*.

A scatter diagram of palatal length vs. palatal width at the fifth upper tooth (fig. 19) shows the Ingleside skull to be relatively narrower than most Rancho La Brea specimens and similar to the *Mylodon harlani tenuiceps* subsample. The type specimens of *P. nebrascensis* and *M. garmani* are similar to the majority of the Rancho La Brea specimens in this instance.

Scatter diagrams of skull length vs. muzzle width and palatal length vs. palatal width between the second upper teeth show no differences between various samples (figs. 20 and 21).

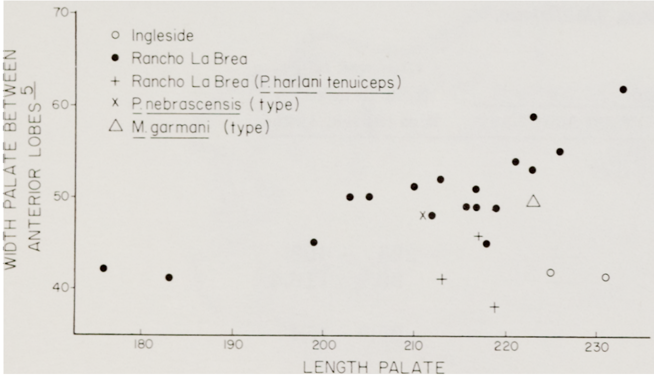

FIG. 19. Scatter diagram of length of palate vs. width of palate between anterior lobes of the fifth superior teeth of various samples of *Paramylodon harlani*.

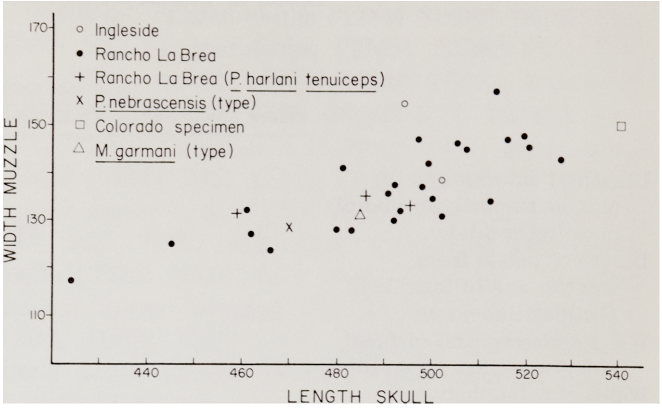

FIG. 20. Scatter diagram of length of skull vs. width of muzzle of various samples of *Paramylodon harlani*.

DENTITION.—One of the Ingleside skulls (TMM 30967-1813) contains alveoli for five upper teeth, the other (TMM 30967-321) contains only four. The first alveolus is missing. This tooth has been shown by Stock (1925) to be absent on one or both sides in approximately 58 percent of the Rancho La Brea sample. (*See* table 11 for metric data on the dentition.)

The first upper tooth is a long, strongly curved tooth with a circular cross section. It shows no difference from the other figured specimens of *Paramylodon harlani*.

The second upper tooth is relatively straight and elliptical in cross section. Some specimens have a shallow open groove on the lingual side. They show about the same degree of variability indicated by Stock (1925) for the Rancho La Brea

FIG. 21. Scatter diagram of length of palate vs. width of palate between second superior teeth of various samples of *Paramylodon harlani*.

TABLE 11. *Numerical data on dentitions of* Paramylodon harlani *from Ingleside, Texas.*

	No. of specimens	Mean	Observed range
Upper second tooth—			
Length	5	27.9	18.3 - 32.4
Width	5	13.9	9.2 - 16.3
Upper third tooth—			
Length	2	21.6	21.3 - 21.9
Width of anterior lobe	2	25.7	23.7 - 27.8
Width of posterior lobe	2	34.6	34.2 - 35.0
Upper fourth tooth—			
Length	5	17.8	15.8 - 20.4
Width of anterior lobe	5	24.3	20.8 - 25.9
Width of posterior lobe	5	32.8	20.2 - 35.5
Upper fifth tooth—			
Length (maximum)	2	19.6	26.6 - 32.6
Anterior width	2	22.2	20.4 - 24.0
Posterior width	2	15.1	14.0 - 16.2
Lower second tooth—			
Antero-posterior diameter	5	24.7	15.4 - 27.5
Transverse diameter	5	21.3	13.7 - 24.8
Lower third tooth—			
Length	3	35.3	33.9 - 37.4
Maximum width	3	20.1	18.9 - 20.9
Lower fourth tooth—			
Antero-posterior diameter	4	57.6	51.7 - 61.3
Maximum diameter of anterior lobe	6	34.4	29.2 - 35.8
Maximum diameter of posterior lobe	4	21.2	19.0 - 22.7

sample and the specimens of *P. nebrascensis* or *M. garmani.*

The upper third tooth has the antero-internal and postero-internal lobes much better developed, narrower, and more separated than the Rancho La Brea material. In this respect the Ingleside material is closer to the type of *P. nebrascensis* from Hay Springs, Nebraska, figured by Brown (1903) but is still more lobate. A scatter diagram of antero-posterior length vs. diameter of the anterior lobe shows a separation of the Ingleside specimens from the Rancho La Brea sample (fig. 22). There is a possibility that the transverse diameter of Stock (1925) is not strictly comparable to the one used here and that the difference is caused by this.

The fourth upper tooth shows some variation in shape but less than is indicated by Stock (1925) for the Rancho La Brea material. Most of the Ingleside specimens show a reduced antero-internal lobe and tend to be compressed. This shape is present in the Rancho La Brea sample, but other specimens have a more prominent antero-internal lobe and less compression. This latter type is not present in the known Ingleside material. Two specimens (TMM 30967-285 and 220), a left and a right, differ somewhat from the other fourth upper teeth. These teeth have grooves running the length of the crown on the anterior end and the antero-internal face. The shape of the anterior end of the wear surface is more complicated than the others. This is shown to a lesser degree by one specimen from Rancho La Brea. The fourth upper teeth from Ingleside differ from those of the type of *M.garmani* in having a more compressed antero-external lobe.

Three other teeth (TMM 30967-911, 912, 1532) are present whose positive identification is doubtful. They differ from the other specimens of fourth upper teeth in having the postero-internal lobes more differentiated and separated by sulci in a manner which resembles the fifth upper tooth.

The fifth upper tooth is shaped like an asymmetrical figure eight. A juvenile specimen shows almost the same shape as the larger adults, indicating little change in shape with growth. Constriction between posterior and anterior lobes is strong. It is similar to one type in the Rancho La Brea sample

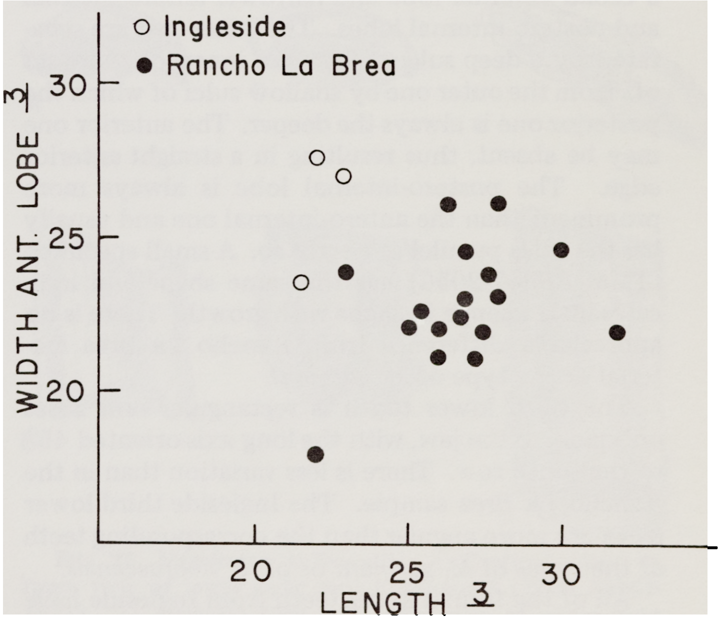

FIG. 22. Scatter diagram of length vs. width of the anterior lobe of the third superior teeth of *Paramylodon harlani.*

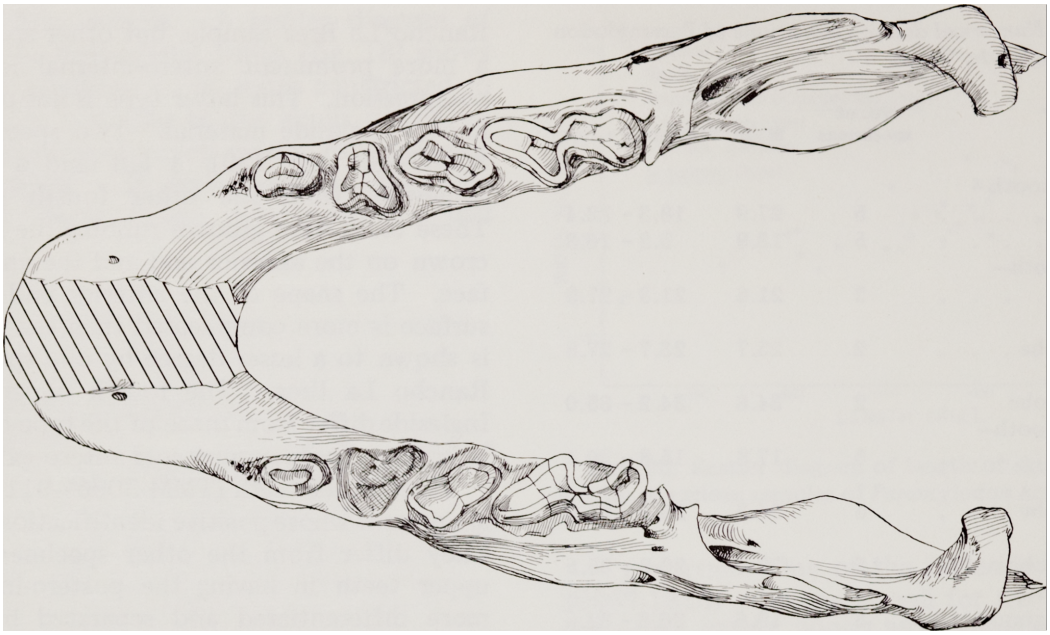

FIG. 23. *Paramylodon harlani.* Dorsal view of mandibles (TMM 30967-677). x1/3.

and to the corresponding tooth of the type of *M. garmani.* The fifth upper tooth of the type of *P. nebrascensis* is more elongate. The Ingleside material has both lobes elliptical in shape.

The first lower tooth is oval in cross section (fig. 23). Wear takes place in such a way as to bevel the anterior and posterior ends.

The second lower tooth is a trilobed tooth with a broad external lobe and narrower antero-internal and postero-internal lobes. The latter two are separated by a deep sulcus. The two inner lobes are set off from the outer one by shallow sulci of which the posterior one is always the deeper. The anterior one may be absent, thus resulting in a straight anterior edge. The postero-internal lobe is always more prominent than the antero-internal one and usually has the sides parallel or nearly so. A small specimen (TMM 30967-2056) has the same shape and indicates little change in shape with growth. There is no appreciable difference from Rancho La Brea material or the type of *M. garmani.*

The third lower tooth is rectangular and is set obliquely in the jaw, with the long axis oriented 45° to the tooth row. There is less variation than in the Rancho La Brea sample. The Ingleside third lower teeth are more angular than the corresponding teeth of the types of *M. garmani* or of *P. nebrascensis.*

All of the fourth lower teeth from Ingleside have a long and strongly constricted neck and most have a small but well-defined external bulge posterior to the tight constriction. A scatter diagram of total length vs. greatest diameter of the anterior lobe (fig. 24) allows a fairly good separation of the Ingleside and Rancho La Brea samples. The Ingleside specimens have a more elongate anterior lobe

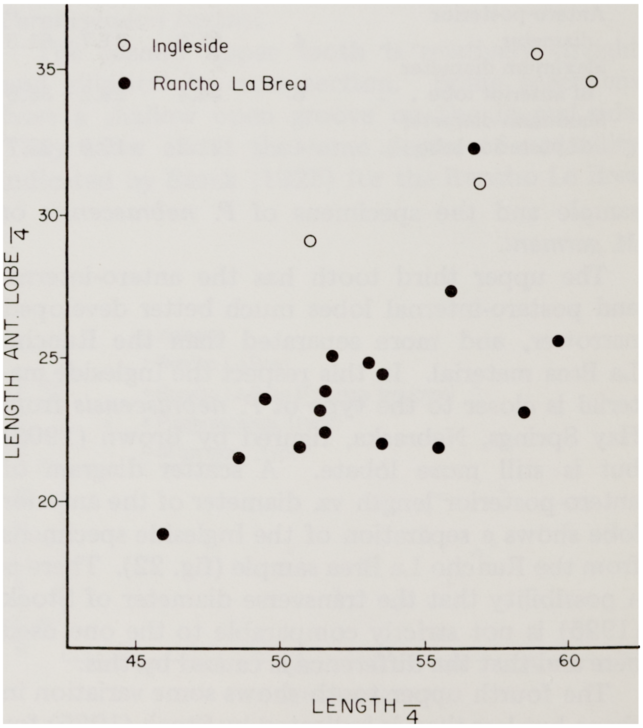

FIG. 24. Scatter diagram of total length vs. length of the anterior lobes of the fourth inferior teeth of *Paramylodon harlani.*

at a given total length. A comparison of the Ingleside sample with the sample from Rock Creek, Briscoe County, Texas, described by Lull (1915) shows the latter to have straighter lingual margins.

The differences noted above between various samples of *Paramylodon* are relatively minor. Although average differences between samples are apparent, there is a considerable amount of overlap in almost all characters that supports the conclusion of Lull (1915) that only one species of *Paramylodon* can be recognized in North America.

None of the post-cranial material shows any significant differences from other samples in size or morphology (tables 12-14).

Family MEGALONYCHIDAE

MEGALONYX JEFFERSONII (Desmarest)

Megatherium jeffersonii Desmarest, 1822, Mammalogie, p. 366.
Megalonyx jeffersonii Harlan, 1825, Fauna Amer., p. 201.
Megalonyx jeffersonii (Harlan). Leidy, 1855, Smithsonian Inst., Contr. to Knowledge, vol. 7, pp. 1-68.
Ereptodon priscus Leidy, 1855, ibid.

Material.—A pair of immature mandibular rami (TMM 30967-374); a pair of lower caniniform teeth (TMM 30967-1843, 1871); an upper caniniform tooth (TMM 30967-1673); an aberrant caniniform tooth (TMM 30967-1686); 2 first upper cheek teeth (TMM 30967-1532, 1687); 4 second upper cheek teeth (TMM 30967-1257, 1532, 2088, 1532A); 3 third upper cheek teeth (TMM 30967-1217A, 1491, 1217C); 3 fourth upper cheek teeth (TMM 30967-1685, 1897, 1623); 1 first lower cheek tooth (TMM 30967-909A); right and left humeri (TMM 30967-1597, 1290); a right ulna (TMM 30967-1390); a left tibia (TMM 30967-1331).

Remarks.—The upper dentition is represented by twelve isolated teeth which represent all the upper cheek teeth (fig. 25). The second and third cheek teeth are somewhat more compressed antero-posteriorly than most figured specimens. The fourth upper cheek tooth is represented by two specimens which differ in size and shape. The larger one is very much like those of other specimens of *M. jeffersonii*. The smaller one is compressed antero-posteriorly, and the internal lobe is relatively larger and better differentiated than in the larger. These differences are probably due to an age difference in the individuals from which the teeth were derived and thus give some indication of the amount of variation due to age.

Examination of published figures of various specimens of *M. jeffersonii* shows variation in the shape of the cheek teeth which very easily includes the Ingleside material.

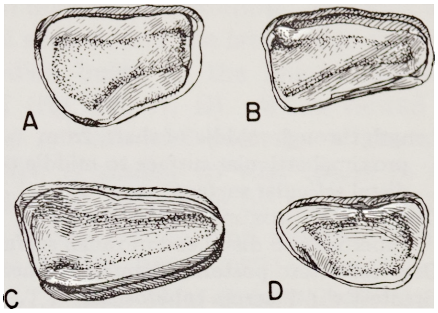

FIG. 25. *Megalonyx jeffersonii*. Occlusal view of right upper post-caniniform teeth. A, First upper tooth (TMM 30967-1687). B, Second upper cheek tooth (TMM 30967-1257). C, Third upper cheek tooth (TMM 30967-1217C). D, Fourth upper cheek tooth (TMM 30967-1623). x1.

The upper caniniform tooth (fig. 26, C, D) shows no significant variation from other specimens of *M. jeffersonii*. The bulge on the lingual side is prominent and bounded by definite grooves. It is located slightly anterior to the center of the tooth. The bulge itself is smoothly rounded with no irregularities. This tooth conforms in size with the other specimens of *M. jeffersonii*. It is 39.5 mm long, 20.7 mm wide.

The mandibular rami are incomplete and cannot be joined at the symphysis but are believed to be

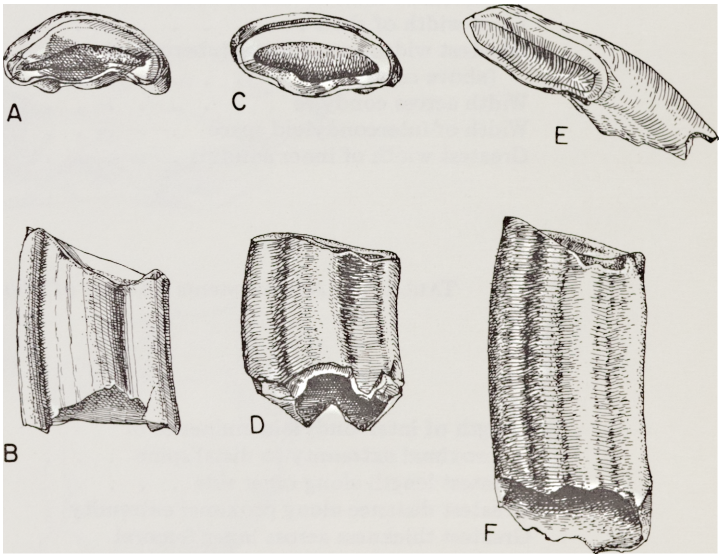

FIG. 26. *Megalonyx jeffersonii*. A, Occlusal view. B, Inner view of lower right caniniform tooth (TMM 30967-1871). C, Occlusal view. D, Inner view of upper right caniniform tooth (TMM 30967-1673). E, Occlusal view, F, Inner view of aberrant caniniform tooth (TMM 30967-1686). x0.5.

TABLE 12. *Measurements (in mm) of humeri of* Paramylodon harlani *from Ingleside, Texas.*

	Right (TMM 30967-1414)	**Right (TMM 30967-666)**	**Left (TMM 30967-1226)**	**Right (TMM 30967-1027)**
Length through middle of shaft, from proximal articular surface to middle of distal articular surface	426	438 (est.)	----	----
Length from proximal end of greater tuberosity to distal end of radial surface .	452	442 (est.)	----	----
Greatest antero-posterior diameter of head .	101	----	----	----
Greatest width across tuberosities	172	----	----	----
Distance from greater tuberosity to distal end of deltoid ridge	281	268	----	----
Greatest width of shaft measured at outer end of deltoid ridge	128	112	107	----
Antero-posterior diameter of shaft at distal end of deltoid ridge	67	70	68	70
Greatest distance between inner and outer tuberosities of distal end, measured obliquely across distal expansion . . .	259	----	238	----
Width of distal trochlea	129	122	124	120

TABLE 13. *Measurements (in mm) of femora of* Paramylodon harlani *from Ingleside, Texas.*

	Left (TMM 30967-1845)	**Left (TMM 30967-1428)**	**Left (TMM 30967-420)**	**Right (TMM 30967-1421)**
Total length, from head to inferior surface of inner condyle	520	476	----	----
Length from great trochanter to inferior surface of outer condyle	505	----	----	----
Transverse diameter of head	132	99	----	----
Thickness of shaft at middle of inner border .	57 (est.)	52	62	66
Least width of shaft	175	148	162	159
Greatest width across distal tuberosities (above condyles)	234	----	231	----
Width across condyles	179	----	180 (est.)	176 (est.)
Width of intercondyloid space	41	40	38	46
Greatest width of inner condyle	78	78 (est.)	82	73 (est.)

TABLE 14. *Measurements (in mm) of tibiae of* Paramylodon harlani *from Ingleside, Texas.*

	Left (TMM 30967-3054)	**Left (TMM 30967-1154)**	**Left (TMM 30967-264)**	**Right (TMM 30967-197)**
Length of intercondyloid eminence of proximal extremity to distal spine . . .	218	242	231	----
Greatest length along inner side	221 (est.)	237	223	222
Greatest distance along proximal extremity .	169 (est.)	167	178	----
Greatest thickness across inner femoral surface measured along principal axis . .	111	106	113	102
Least thickness of proximal extremity measured between femoral surface . . .	91	83	88	----
Least width of shaft	80	84	87	84
Greatest width of distal extremity	126	126	136	130
Greatest thickness of distal extremity . . .	79	93	96	----

from the same individual because of the correspondence in size, degree of wear on the teeth, and the presence of spongy bone in the same areas. The spongy bone and the tapered caniniform teeth indicate that the specimen is from an immature individual.

The right mandibular ramus (fig. 27), which is the more nearly complete, lacks only the coronoid process, condyle, and angular process. The left ramus consists only of the posterior part of the horizontal ramus with the last cheek tooth. The lower caniniform teeth of this specimen are similar in crown view to other specimens of *M. jeffersonii.* They are compressed, with the anterior end narrower than the posterior end. The long axis of the occlusal surface is very slightly curved and there is a distinct bulge on the lingual side. The anterior and posterior edges converge toward the occlusal surface. This is similar to the condition in a specimen from the Port Kennedy, Pennsylvania, bone deposit named by Cope (1871) *M. sphenodon.* Later Cope (1899) synonomized it with *M. wheatleyi,* stating it to be a juvenile specimen.

The Ingleside mandible with its tapered caniniform teeth and spongy surface bone supports this interpretation. A tapered tooth would be expected in a juvenile individual of a species with persistently growing teeth and no tooth replacement.

There are two additional lower caniniform teeth from the Tedford Pit which are considerably larger than the ones in the mandible. The long axis of the occlusal surface and the labial edge are curved, and the median bulge on the lingual side is well developed (fig. 26, A, B). When viewed from the side, the anterior and posterior edges are parallel. The shape is similar to that found in specimens referred to *M. jeffersonii* by Leidy (1853), Savage (1946), Stock (1925), and Guilday et al. (1969). The size (TMM 30967-1871: length, 40.2 mm; width, 17.9 mm; TMM 30967-1843: length, 39.9 mm; width, 17.7 mm) is at the upper end of the range of size of specimens of *M. jeffersonii* recorded in the literature. The Ingleside caniniform teeth differ from those from the Port Kennedy bone deposit in the larger size and the presence of a groove anterior to the internal bulge.

The lower cheek teeth resemble those of *M. jeffersonii* but show minor variations, notably more angular corners.

Another caniniform tooth (TMM 30967-1686) (fig. 26, E, F) is different from the ones described above. It is highly compressed with a straight outer edge. The inner edge has a very gentle flattened bulge which is set off by indistinct grooves. A faint, shallow groove is present in the center of the bulge. It is 40.0 mm in length and 16.0 mm wide.

The Ingleside tooth is the third specimen of this type to be found. The first was reported by Leidy (1853) from Natchez, Mississippi, and is the type of

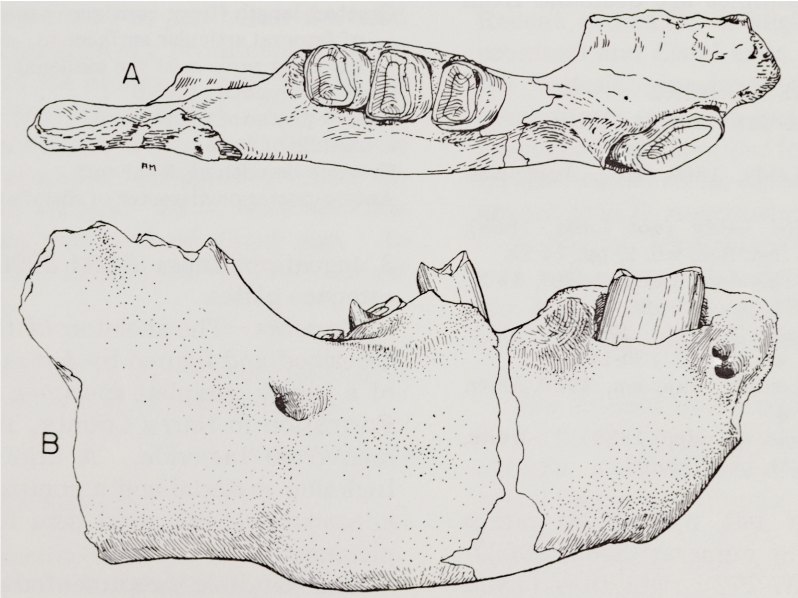

FIG. 27. *Megalonyx jeffersonii.* Right mandibular ramus (TMM 30967-374). A, Dorsal view. B, Lateral view. x1/2.

Ereptodon priscus. Later Cope (1899) reported another similar tooth from the Port Kennedy bone deposit and assigned the species to the genus *Megalonyx.*

There are small differences between the Ingleside specimen and the specimens from Natchez and Port Kennedy. The Ingleside tooth has a central bulge which the other two lack. The Port Kennedy specimen has a small anterior bulge, the Natchez specimen has very small ones toward each end.

In all three occurrences this type of tooth falls into the size range of the normal caniniform teeth. None of the localities has produced any cranial or post-cranial material that indicates the presence of another species of megalonychid. It probably represents an infrequent variant in at least two species of *Megalonyx.*

The post-cranial elements show no significant differences from the material figured by Stock (1925) or Leidy (1853). The dimensions of the humeri, ulna, and tibia are given in tables 15-17. The length of the humerus lies between those given by Leidy and Stock. The width across proximal tuberosities is less than either. The ulna from Ingleside is somewhat closer in size to the specimen described by Stock. Both are smaller than Leidy's specimen. The tibia of the Ingleside specimen is consistently smaller than the one described by Leidy. It is doubtful that these differences in size and proportions indicate more than geographic differences between populations, and this cannot be demonstrated until samples are available from the various localities.

Family DASYPODIDAE

CHLAMYTHERIUM SEPTENTRIONALE (Leidy)

Glyptodon septentrionalis Leidy, 1889, Proc. Acad. Nat. Sci. Philadelphia, p. 97.

Chlamydotherium humboldtii Leidy (not Lund, 1838), 1889, Trans. Wagner Free Inst. Sci., vol. 2, pp. 24-25.

Chlamytherium humboldtii Hay (not Lund, 1839), 1902, U. S. Geol. Survey Bull. 179, pp. 581-582.

Chlamytherium septentrionalis (Leidy). Sellards, 1915, Amer. Jour. Sci., 4th ser., vol. 40, pp. 139-145.

Holmesina septentrionalis (Leidy). Simpson, 1930, Amer. Mus. Novitates 442, pp. 1-9.

Chlamytherium septentrionale (Leidy, 1889). James, 1957, Jour. Paleont., vol. 31, pp. 796-808.

Material.—Condyle of left mandibular ramus (TMM 30967-1119); right humerus (TMM 30967-1079); axis (TMM 30967-772); right tibia (TMM 30967-1080); right femur (TMM 30967-870); thoracic vertebrae (TMM 30967-783, 861, 1343); caudal vertebrae (TMM 30967-775, 1074, 905); 3 ungual phalanges (TMM 30967-1484); numerous carapace plates.

Remarks.—The skeleton of this species has been described and figured by James (1957) on the basis of a nearly complete specimen from the Beaumont Formation in Harris County, Texas, and the specimen from Ingleside. A brief description of the Ingleside material and a comparison with *Dasypus novemcinctus* are given here for the sake of completeness.

The mandible is represented only by the condyle and a small part of the ascending ramus. The articular surface of the condyle of the mandible is rectangular (anterior-posterior length, 12.3 mm,

TABLE 15. *Measurements (in mm) of humeri of* Megalonyx jeffersonii *from Ingleside, Texas.*

	TMM 30967-1407	TMM 30967-1290
Greatest length . . .	472	476
Width at proximal tuberosities . . .	118	119
Width of shaft at middle	80	83
Least width of shaft . .	52	54
Thickness of shaft at end of deltoid crest .	58	59
Greatest width of distal expansion	226	228
Width of distal trochlea	116	118

TABLE 16. *Measurements (in mm) of ulna of* Megalonyx jeffersonii *from Ingleside, Texas.*

	TMM 30967-1390
Greatest length	406
Greatest width from summit of coronoid process	117
Width of shaft at middle	71
Thickness of shaft at middle	30
Greatest width of shaft at distal end . .	78
Thickness of distal articulating surface .	39
Distance from summit of coronoid process to end of olecranon	138

TABLE 17. *Measurements (in mm) of tibia of* Megalonyx jeffersonii *from Ingleside, Texas.*

	TMM 30967-1231
Length at antero-external surface . . .	260
Greatest length (from contiguous margin of femoral articular surfaces to trochlear process of the malleus) . .	310
Greatest breadth of head	175 (est.)
Antero-posterior diameter at middle of head	102
Greatest breadth of distal end	142
Antero-posterior diameter of distal end .	70

transverse length, 32.9 mm) and flat anteroposteriorly but slightly concave transversely. This is in contrast to the condition in *Dasypus novemcinctus* in which the articular surface is oval with the long axis oriented at 45° to the long axis of the mandible.

The axis is fused with the succeeding three cervical vertebrae. As pointed out by James (1957) the fusion is carried much farther in *Chlamytherium septentrionale* than in *Dasypus novemcinctus* (table 18). The centra and the transverse processes of the vertebrae posterior to the axis have completely lost their separate identities. The foramina appear to be in their original positions.

TABLE 18. *Measurements (in mm) of axis of* Chlamytherium septentrionale *from Ingleside, Texas.*

	TMM 30967-772
Greatest width	81.6
Width at posterior margin of transverse processes	96.1
Width at posterior margin of anterior articular processes	65.0

The humerus of *Chlamytherium septentrionale* differs from that of *Dasypus novemcinctus* only in size and some proportions (table 19). The head is relatively smaller and the articular surface of the head is broader than in *D. novemcinctus*. As noted by James (1957) the deltoid tuberosity is much better developed in *C. septentrionale* and extends from the deltoid tuberosity to just below the head of the humerus. This creates a prominent fossa on the lateral surface of the humerus. This area of the humerus in *D. novemcinctus* is flat. The greater tuberosity has two well-developed scars for muscle insertion. One is located on the lateral surface, the other on the dorsal surface. In *D. novemcinctus* these two scars are oval and of equal size. In *C. septentrionale* the lateral scar is much larger than the dorsal one.

TABLE 19. *Measurements (in mm) of right humerus of* Chlamytherium septentrionale *from Ingleside, Texas.*

	TMM 30967-1079
Length from greater tuberosity to external condyle	201.0
Transverse width of proximal end	53.4
Antero-posterior width of proximal end	56.2
Width of distal end	75.9
Antero-posterior width of shaft at deltoid tuberosity	41.0
Width of distal articular surface	48.2

The articular surfaces for the radius and ulna show minor differences from those of *D. novemcinctus*. The ulnar articular surface is more deeply concave than in *D. novemcinctus* and does not extend medially past the edge of the supracondylar foramen as it does in *D. novemcinctus*. The internal condyle is relatively larger than in the Recent armadillo.

The femur of *C. septentrionale* differs from that of the Recent armadillo in the larger size (table 20), the lesser development of the trochanteric fossa and the greater trochanter, and the flattening of the posterior surface of the femur below the third trochanter. James (1957) also noted that the lesser trochanter joins the head, but this is not preserved on the Ingleside specimen.

TABLE 20. *Measurements (in mm) of right femur of* Chlamytherium septentrionale *from Ingleside, Texas.*

	TMM 30967-870
Greatest length	286
Width of proximal end	93 (est.)
Width of distal end	90
Transverse width of shaft at third trochanter	68.9
Antero-posterior width of shaft at third trochanter	31.6

The tibia of *C. septentrionale* is proportionately shorter than that of *D. novemcinctus* with a more strongly developed crest that extends farther distally. The posterior surface of the tibia of the Recent armadillo is slightly convex only at the proximal and distal ends. The articular surfaces of the Ingleside specimen are poorly preserved and comparisons are not possible. The two cochlear grooves of the distal end form a continuous articular surface rather than being partly separated by a groove as in *D. novemcinctus*.

Numerous dermal scutes are present in the Ingleside collection. The dermal armor of this species has been described and figured by James (1957) and nothing can be added from the Ingleside material.

The known occurrences of *Chlamytherium* in the United States have been compiled by James (1957). His map shows that they are restricted to the southeastern United States. The occurrences are probably not all the same age, which indicates that the animal was never able to extend its range very far north or west, even during the warmer phases of the Pleistocene. This indicates the presence of environmental zonation at that time. James (1957) noted the similarity of the distribution of *Chlamytherium* and the Recent *Dasypus novemcinctus*. The latter animal is probably limited on the north by the winter temperature minima and on the west by aridity. It is possible that *Chlamytherium* was limited in much the same manner.

Family GLYPTODONTIDAE

BOREOSTRACON FLORIDANUS Simpson

Glyptodon petaliferus Cope. Hay, 1916, Proc. U. S. Nat. Mus., vol. 51, p. 107; Hay, 1926, Proc. U. S. Nat. Mus. vol. 68, p. 2.

Glyptodon petaliferus Cope. Sellards, 1940, Bull. Geol. Soc. Amer., vol. 51, p. 1637.

Boreostracon floridanus Simpson, 1929, Bull. Amer. Mus. Nat. Hist., vol. 56, p. 581.

Material.—Left mandibular ramus (TMM 30967-1814); part of carapace and tail armature (TMM 977-3); pelvis and 6 caudal vertebrae (TMM 30967-1926), all from the same individual. In addition there is a portion of the posterior part of another carapace with the marginal scutes (TMM 30967-2088).

Remarks.—The fortunate combination of anatomical parts permits comparison with several other species of North American glyptodonts. This adds to the known characters of *Boreostracon floridanus* and makes it possible to differentiate this species from *Glyptotherium*, *Brachyostracon*, and *Glyptodon fredericensis*.

The left side of the mandible is nearly complete. It lacks the anterior end with the first tooth, the angular process, and a part of the posterior edge of the ascending ramus. The horizontal ramus is deep (72 mm at the fourth tooth) with the ventral margin almost straight and parallel to the tooth row (fig. 28). The anterior border of the ascending ramus is located at the anterior border of the sixth tooth and slopes anteriorly at an angle of 60° to the occlusal surface of the tooth row as it rises. The posterior border makes an angle of approximately 40° with the occlusal surface of the tooth row.

The anterior end of the symphysis is broken off. The symphysis extends posteriorly to the level of the fourth tooth. The ventral side is slightly keeled.

Behind the last tooth is an oval canal, which runs downward and inward and emerges on the inner side of the mandible where it forms a semicircular groove about 4 mm across and half as deep. This canal was noted by Holmes and Simpson (1931) and was recognized as not being the true dental foramen which they thought to be below this canal. In the Ingleside specimen a broad groove on the inner surface of the mandible extends from the canal anteriorly and becomes a canal about 5 mm in diameter extending anteriorly into the jaw. The

FIG. 28. *Boreostracon floridanus*. Lingual view of left mandibular ramus (TMM 30967-1814). x1/2.

exact position of the change from an open groove cannot be determined because of breakage. This groove, which is the true dental canal, gives off two small branches downward at the level of the last tooth. The canal behind the last tooth apparently transmitted the nerves and blood vessels of the lower jaw. The development of the post-dental canal allows the formation of a buttress at the posterior end of the tooth row without crowding the nerves and blood vessels of the mandible between the posterior end of the tooth row and the posterior end of the jaw. Burmeister (1874) noted the post-dental canal in *Panochthus.* The mylohyoid groove apparently was very short and extended from the posterior canal to the inner face of the mandible.

The Ingleside mandible differs from that of *Glyptotherium arizonae* in the shape of the ventral margin of the horizontal ramus. In *G. arizonae* it is semicircular rather than straight and does not tend to parallel the occlusal surface of the tooth row. The mental foramen that is located at the anterior end of the second tooth is placed more laterally on the mandible of the Ingleside specimen rather than in *G. arizonae.*

A comparison with the mandible of *Glyptodon fredericensis* figured by Melton (1964) shows fewer differences. A ventral keel seems to be present on the symphysis of *G. fredericensis,* and although the ventral margin of the mandible appears to be incomplete, it does not appear to deepen steadily from the anterior end to the ascending ramus.

There are only seven teeth in the jaw of the Ingleside specimen, the first presumably having been lost with the anterior end of the mandible (fig. 29). The second tooth is not well preserved but shows a small rounded anterior lobe, a mid-lobe which is somewhat wider, and a posterior lobe which is virtually as wide as that of any of the posterior teeth but is set at an angle (80°) to the axis of the jaw. All the other teeth have three lobes of about equal width which are oriented at about 90° to the long axis of the jaw. The lobes of the posterior three teeth are rounded, those on the anterior teeth are more angled. The posterior borders on all the teeth are gently convex. There is no secondary branching of the osteodentine cores.

The teeth of the Ingleside specimen differ from those of *Glyptotherium arizonae* in the greater development of the inner part of the lobes on the anterior teeth, the more rounded outer lobes, and the convex outline of the posterior borders of all teeth. There is no marked elongation of the posterior external angle of the first four teeth. The second and third teeth of the Ingleside specimen

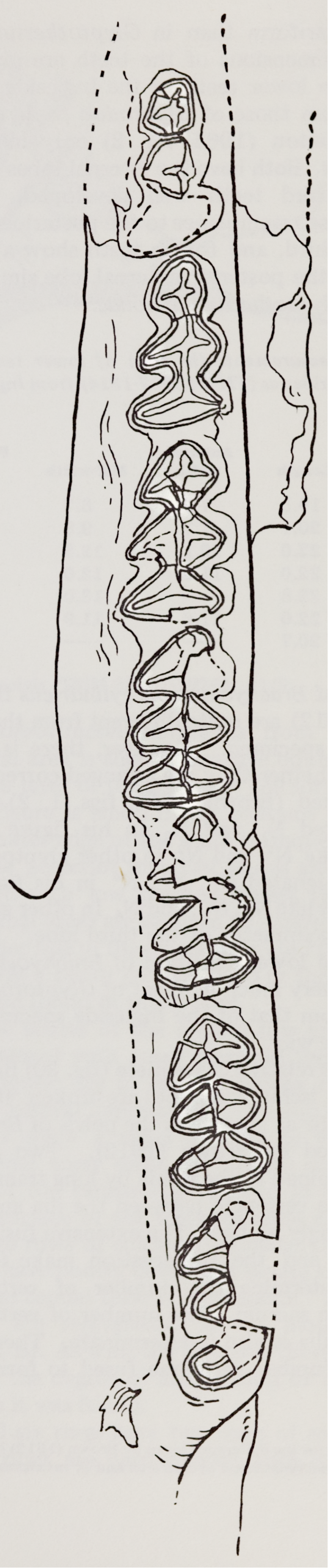

FIG. 29. *Boreostracon floridanus.* Occlusal view of left lower tooth row (TMM 30967-1814). x1.

are more molariform than in *Glyptotherium arizonae.* The dimensions of the teeth are given in table 21. The lower teeth of the Ingleside specimen differ from those of *Glyptodon fredericensis* figured by Melton (1964, fig. 2) only in being slightly smaller. Both have the internal lobes of the second and third teeth well developed, which results in a close resemblance to the posterior teeth. The second, third, and fourth teeth show a slight elongation of the posterior external lobe similar to the teeth of *Glyptotherium arizonae.*

TABLE 21. *Measurements (in mm) of lower teeth of* Boreostracon floridanus *(TMM 30967-1814) from Ingleside, Texas.*

	Length	Anterior width	Mid-width	Posterior width
Second . .	19.5	7.0	8.7	11.2
Third . .	20.1	7.1	9.8	11.5
Fourth . .	22.0	10.1	12.3	12.8
Fifth . . .	22.0	11.0	12.0	13.7
Sixth . .	22.8	------	13.0	13.5
Seventh . .	22.0	11.6	11.9	12.3
Eighth . .	20.7	-------	-------	11.0

The teeth of *Brachyostracon cylindricus* figured by Brown (1912) are quite different from those of the Ingleside specimen. However, there is some doubt as to whether they are arranged correctly as they are figured (Brown, 1912, figs. 1, 2). The teeth designated N_1 and N_2 in his figure 2 are much more like N^1 and N^2 in other glyptodonts, and those designated N^2, N^3, N^4 in his figure 1 are much more like N_2, N_3, and N_4 in other glyptodonts in the asymmetry of the third lobe.[5] If this is the case the lower dentition of *Brachyostracon cylindricus* is very much like that of *Glyptotherium* and differs from that of the Ingleside specimen in much the same way.

The pelvis is relatively complete (fig. 30) but the ends of the ilia, ischia, and pubes are broken. It does not appear to be as massive as the pelvis of *Brachyostracon* figured by Brown (1912). Two sacral vertebrae are joined to the ischia by long transverse processes. The vertebrae between the ilia and the ischia are strongly arched. The extensive fusion of the vertebrae and the preservation make it impossible to determine the number of vertebrae involved in the sacrum. The number of vertebrae joined to the ilia is also indeterminate. There are eight or nine lumbar vertebrae fused to form the lumbar tube.

The pubes are small slender rods. The distal portions are not preserved so that it is impossible to determine the presence or absence of a cross bar. The reduced size of the pubes suggests that the cross bar is absent.

Six vertebrae, probably the first six caudal vertebrae, are preserved. The first has long transverse processes with rugose ends that join the pelvis and the last sacral rib. The metapophyses are broken and their development cannot be determined.

The transverse processes of the second vertebra are broken near the ends. The metapophyses extend above the prezygopophyses to the same level as the neural spine to support the caudal ring. They are not as long antero-posteriorly as the articular surfaces of the prezygopophyses and their ends are not greatly expanded.

The third through the sixth vertebrae have prominent downturned processes at the ends of the transverse processes and high massive metapophyses to support the caudal rings. The processes at the ends of the transverse processes turn more anteriorly in the posterior vertebrae. The second, fifth, and sixth vertebrae each have a foramen leading to the neural canal from the dorsal surface of the neural arch between the neural spine and the prezygopophyses.

The major difference in the caudal vertebrae between the Ingleside specimen and the specimen of *Glyptodon fredericensis* described by Melton (1964) is the presence of three rather than two caudal vertebrae with transverse processes joined to the pelvis. The centra of the vertebrae that are joined to the ischia are not solidly fused. This may have been free in *G. fredericensis.*

Five chevron bones are preserved. Four with articular facets can be articulated with the third through the sixth caudal vertebrae. The other chevron bone probably goes to the second caudal vertebra. It is flattened laterally and bifurcates at the ventral end. The third is flattened laterally and expanded posteriorly. The ventral end is not preserved. The fourth through the sixth have laterally flattened descending processes which are expanded posteriorly. The ventral ends are flattened and have heavy lateral processes that support the caudal rings.

The majority of the carapace material is in a mounted specimen in the Texas Memorial Museum at Austin, Texas. It is not known with certainty how much of this material was found articulated. The only records state that a glyptodon carapace was found. A considerable part of the posterior part of the carapace, including the posterior margin,

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[5] This may account for the difference given by Brown (1912) between the dentitions of *Brachyostracon cylindricus* and *B. mexicanus.*

FIG. 30. *Boreostracon floridanus.* Lateral view of pelvis (TMM 30967-1926). x1/5.

was articulated. On the left side of the carapace posterior to the mid-point is a shallow depression 140 mm in diameter and 50 mm deep that is the result of an injury. The scutes in this area are completely fused and no longer discernible.

On the ventral side of the carapace are very prominent scars where the carapace was attached to the pelvis and sacrum. The ilium was clearly tightly fused to the carapace. The sacrum was also fused to the carapace for a distance of about 180 mm posterior to the iliac attachment. Farther posterior and anterior to the iliac attachment, the junction between the sacrum and the carapace was ligamental.

The major part of the carapace is made up of scutes that are generally hexagonal but which may have as few as four or as many as eight sides. The outer surface of a typical scute consists of a roughly circular central area separated by a groove from eight to ten smaller marginal areas, which are separated from one another by grooves. The diameter of the central figures is usually less than half the diameter of the scute. These scutes have three or four large hair follicles on the edge of the central areas. The sculpturing in most scutes consists of irregular pitting, but scutes are present in the central part of the carapace which show the irregular radial sculpturing on the marginal areas as in *Boreostracon floridanus* from Florida. The central area is slightly concave but is not depressed to the level of the grooves. The surface of the central figure is smooth but contains numerous pits. The outer edge of the scute is frequently depressed.

The posterior marginal scutes are large, roughly square with low pointed bosses (Pl. I, A). The marginal areas are reduced to a narrow band on the anterior side of the scutes separated from the central area by a broad groove. Two or three hair follicles may be found in this groove.

The scutes of the second row are hexagonal or pentagonal with small marginal figures. The central figures are in general convex but some show small central depressions. The succeeding rows of scutes show a rapid increase in the size of the marginal areas until the typical situation for the top of the carapace is reached at the fourth row. The surface of the marginal areas of the first four or five rows of scutes is punctate; the more distant rows have poorly developed striate surfaces.

The caudal tube is incomplete. The six anterior rings are represented on the mounted specimen (Pl. I, B). As with the carapace there are no records as to the degree of articulation of the caudal tube when it was found.

All six rings have two rows of scutes. The first two rings are narrow with both rows formed by

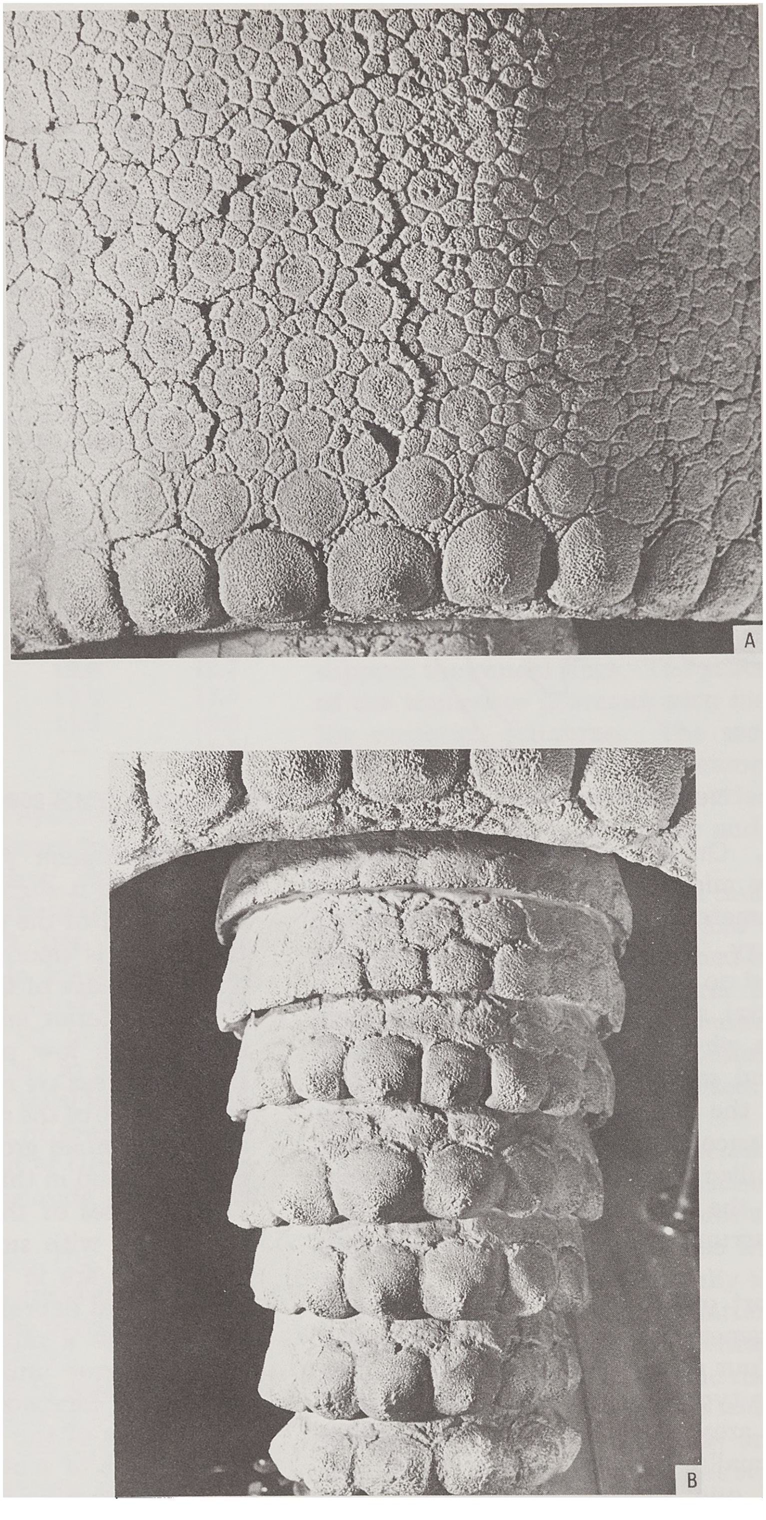

PLATE I. *Boreostracon floridanus* (TMM 977-3), x1/4.

A. Posterior margin of carapace showing transition of marginal scutes to typical scutes of the carapace.

B. Proximal rings of caudal armor.

hexagonal flat scutes with no marginal figures. In the four posterior rings the scutes of the anterior row are flat. The scutes of the posterior row are pointed on the dorsal part of the tail and flattened on the ventral side. They lack marginal areas. Melton (1964) suggested that the first two caudal rings of *Glyptodon fredericensis* lay under the ventral margin of the carapace. This was probably also the situation in the Ingleside specimen.

The glyptodont from Ingleside differs from *Brachyostracon* from Mexico in the dentition, the reduced pubes, and in the shape of the carapace. It differs from *Glyptotherium* in minor details of the teeth, the shape of the jaw, the size and sculpture of the scutes, and in having the scutes arranged in less well-defined transverse rows over the carapace. It differs from *Glyptodon fredericensis* in the depth of the depression of the central figure of the scutes, in the presence of some striated marginal figures on the scutes, and the pointed scutes along the posterior border. It differs from South American species of *Glyptodon* in having small nuchal scutes rather than larger sometimes spinose ones and in the somewhat simpler anterior lower teeth. The comparison with *Boreostracon floridanus* from Florida shows that the major difference is the lower frequency of a striated pattern on the marginal figures of the scutes. The closest resemblance is to *Boreostracon floridanus.*

Simpson (1929) considered *Glyptodon petaliferus* and *Glyptodon rivipacis* to be *nomina nuda* on the basis of an inadequate type for the first and the absence of a designated type and a diagnosis for the second. Simpson also considered it unlikely that any of the North American glyptodonts could be assigned to the genus *Glyptodon* and erected the genus *Boreostracon* for the Florida material. The writer agrees with this conclusion at least so far as the Florida and Ingleside material is concerned.

Glyptodont material referable to *Boreostracon* on the basis of either scute ornamentation, lower dentition, or both is known from several localities. Sellards (1940) has described the left side of the mandible and scutes from Bee County, Texas. Many of the scutes have striated marginal figures. The mandible and teeth show no differences from the Ingleside specimen.

Hay (1916, 1926) has reported glyptodont material from near Wolfe City in Hunt County, Texas, and from Sinton in San Patricio County, Texas. Both specimens were referred to *Glyptodon petaliferus.* Additional material in The University of Texas collections from the Sinton locality includes scutes (TMM 31141-15) with small central figures and striated marginal figures. According to Hay (1926) the known differences between the two specimens are very slight, amounting to a slight size difference and a difference in the size of a groove on the anterior end of the sixth lower tooth. No differences were observed in the femora. The differences reported by Hay (1926) for the scutes could easily be the result of comparing scutes from different areas of the carapace or of individual variation. Simpson (1929) considered the Wolfe City specimen to be specifically distinct from the Florida material on the basis of the lack of striated ornamentation on the scutes. The variation in the ornamentation in different areas of the Ingleside carapace makes it doubtful that the failure to find such ornamentation in a few scutes indicates their absence in all parts of the carapace. In addition one of the scutes of the Wolfe City specimen figured by Hay (1916) shows some striations on the marginal figures. It is doubtful that this specimen belongs in the genus *Glyptodon.* The second upper tooth differs considerably from that of the South American species of *Glyptodon* and from *Glyptodon fredericensis.* The Wolfe City specimen probably belongs to the genus *Boreostracon.*

The collection of the late A. E. Anderson, on loan to the Department of Anthropology, The University of Texas at Austin, contains glyptodont scutes from Cameron County in southernmost Texas. These scutes, which were recovered from dredging operations near the mouth of the Rio Grande, have the small depressed central figures and striated marginal figures seen in the Ingleside specimen. The precise age is unknown but is certainly late Pleistocene.

The glyptodont material from these various localities has in common the striated marginal figures on some scutes. In addition more characters in common are found between some of the samples in which there are comparable parts. They are here referred to the same taxon, *Boreostracon floridanus.*

Other more fragmentary and indeterminate glyptodont material has been reported by Hay (1924) from Jones County, Texas; by Lundelius (1967) from Shafter Lake, Andrews County, Texas; and by Ray (1965) from South Carolina.

All of the glyptodont material that can be associated even tentatively with *Boreostracon floridanus* has come from localities on the Gulf Coastal Plain of Texas or from Florida. The glyptodont material from inland localities, with the exception of the indeterminate specimens from Shafter Lake and Jones County, is older and referable to the other taxa.

Order PROBOSCIDEA

Family GOMPHOTHERIIDAE

CUVIERONIUS sp.

Material.—A right M_3 (TMM 30967-1219).

Remarks.—This specimen is the only positive indication of an anancine in the Ingleside fauna. There are four well-developed lophids on the tooth and a small lophid on the posterior end. The pretrite cusps have strong buttresses which form well-developed trefoils when worn (fig. 31). The posttrite cusps have small buttresses which produce poorly developed trefoils. The pretrite and posttrite cusps are only slightly alternating, which results in very little obliquity to the lophs.

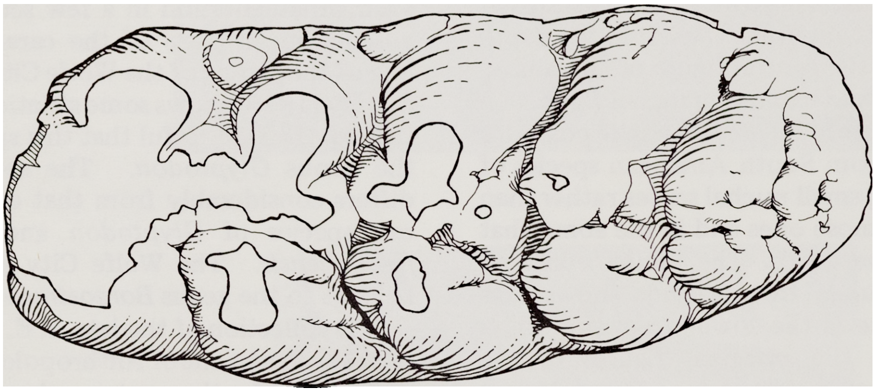

FIG. 31. *Cuvieronius* sp. Occlusal view of right M_3 (TMM 30967-1219). x1/2.

An additional conule is present on the posterior face of each pretrite cone. With deep wear these merge with the posterior buttress and become part of the trefoil. No comparable conules are present on the anterior faces of the pretrite cusps.

The labial side of the tooth has a poorly developed cingulum with conelets occupying the ends of the transverse valleys. These conelets decrease in size from front to back. The valley between the fourth and fifth lophids lacks one. There are two small conelets posterior to the fifth lophid.

The measurements of the M_3 are: length, 218 mm; width of first lophid, 84 mm; width of second lophid, 92 mm; width of third lophid, 94 mm; width of fourth lophid, 85 mm; width of fifth lophid, 68 mm.

The specific and generic identification of the late Pliocene and Pleistocene Anancinae on the basis of isolated teeth is difficult if not impossible. According to Simpson and Paula Couto (1957), who reviewed the South American mastodonts, *Cuvieronius* usually has little or no obliquity to the lophs and poor development of trefoils on the posttrite cusps. *Cuvieronius* also has a spiral enamel band on the tusks but no tusks have been found in the Ingleside collection. The lack of a tusk with an enamel band raises the possibility that the Ingleside molar might represent one of the genera of the Anancinae which are known from South America and which lack the enamel band. In general the other South American genera show more obliquity to the lophs of the molars. Therefore, the Ingleside specimen is tentatively assigned to *Cuvieronius*.

Tusks with enamel bands have been found in North America in association with molars of anancine type. One is from the Eden Formation of California (Frick, 1921); another is from the Benson fauna of Arizona (Gidley, 1926). A third, unreported in the literature, is from the Sinton, Texas, locality of Hay (1926). This fragment of an enamel band is in The University of Texas, Austin, collections (TMM 31141-30).

The Ingleside specimen seems to be one of the most recent anancines in North America. The well-dated occurrences cited by Simpson and Paula Couto (1957) are either late Pliocene or early Pleistocene. A number of specimens reported and described under the genus *Anancus* by Hay (1917, 1925, 1926) from various localities are not reliably dated.

Family MASTODONTIDAE

MAMMUT AMERICANUM (Kerr)

Elephas americanus Kerr, 1791, Anim. Kingdom, p. 116.
Mammut americanum (Kerr). Hay, 1902, U. S. Geol. Survey Bull. 179, p. 708.

Material.—Left mandibular ramus with M_{2-3} (TMM 30967-50); right mandibular ramus with M_3 (TMM 30967-352); right mandibular ramus with M_{2-3} (TMM 30967-1650); fragment of right man-

TABLE 22. *Measurements (in mm) of M^3's of* Mammut americanum *from Ingleside, Texas.*

	TMM 30967-119	TMM 30967-773	TMM 30967-985
Total length . . .	174	163	167
Width—			
First lophid . .	------	89	97
Second lophid . .	------	91	97
Third lophid . .	91	88	86
Fourth lophid . .	77	74	72

TABLE 23. *Measurements (in mm) of M_2's and M_3's of* Mammut americanum *from Ingleside, Texas.*

	Right (TMM 30967-1650)	Left (TMM 30967-50)	Right (TMM 30967-339)	Right (TMM 30967-352)	Right (TMM 30967-414)	Right (TMM 30967-904)
M_2—						
Total length .	113	98	------	------	------	------
Width 1st lophid	80	70	------	------	------	------
Width 2nd lophid	88	81	------	------	------	------
Width 3rd lophid	91	87	------	------	------	------
M_3—						
Total length .	195	185 (est.)	168	200	198	183
Width 1st lophid	90	89	85	97	93	88
Width 2nd lophid	98	104	93	97	102	96
Width 3rd lophid	100	102	90	106	101	92
Width 4th lophid	88	90	82	98	85	84

dibular ramus with M_3 (TMM 30967-339); left mandibular ramus with M_{2-3} (TMM 30967-1760); part of a palate with left M^3 (TMM 30967-119); left M_3 (TMM 30967-728); right M_3 (TMM 30967-414); right M_3 (TMM 30967-904); left M^3 (TMM 30967-591); right M^3 (TMM 30967-773); left M^3 (TMM 30967-338); left and right M^3 (probably from the same individual) (TMM 30967-985, 906).

Remarks.—The Ingleside material of this species shows no differences in size (tables 22-24) or morphology from other known specimens. Of three mandibular symphyses in the sample, one (TMM 30967-352) has alveoli in the symphyseal region, indicating the presence of small lower tusks approximately 48 mm in diameter.

TABLE 24. *Measurements (in mm) of first and second molars of* Mammut americanum *from Ingleside, Texas.*

Specimen No.	Total length	Maximum width
M^1_1—		
TMM 30967-899	84	74
TMM 30967-1611 . . .	77	65
M^2_2—		
TMM 30967-525	112	85
TMM 30967-1606 . . .	108	89
TMM 30967-470	115	93
TMM 30967-727	113	89
TMM 30967-980	111	88
TMM 30967-247	125	95
TMM 30967-159	106	82

Family ELEPHANTIDAE

MAMMUTHUS COLUMBI (Falconer)

Elephas columbi Falconer, 1857, Quart. Jour. Geol. Soc. London, vol. 12, pp. 307-360.

Paralephas columbi (Falconer). Osborn, 1942, Proboscidea, vol. 2, Amer. Mus. Nat. Hist., p. 1071.

Mammuthus columbi (Falconer). Hibbard, 1955, Univ. Michigan, Contr. Mus. Pal., vol. 12, no. 10, p. 96.

Material.—A mandible with M_3's (TMM 30967-1652); 2 M^3's (TMM 30967-1818, 165); a left mandibular ramus with M_{2-3} (TMM 30967-1787); 4 isolated M_3's (TMM 30967-227, 1172, 1201, 1729); 5 isolated upper molars, M^2's (?) (TMM 30967-1684, 2011, 1805, 213, 462); 1 isolated lower molar, M_2 (?) (TMM 30967-181); numerous isolated post-cranial elements.

Remarks.—The complete mandible (TMM 30967-1652) has a slender symphyseal rostrum approximately 80 mm in length. An examination of figures of mandibles of mammoths in Osborn (1942) indicates that this character is variable and probably has no taxonomic value.

The molar teeth lack the thick external layer of cement characteristic of *Mammuthus imperator*

TABLE 25. *Measurements (in mm) of upper molars of* Mammuthus columbi *from Ingleside, Texas.*

Specimen No.	Length	Width	No. of plates	No. of plates per 10 cm	Laminary index
TMM 30967-1684 . .	250 (est.)	121	14 (est.)	6	16.7
TMM 30967-1818 (M^3) .	-----	110	18 - 19 (est.)	6	16.7
TMM 30967-2011 . .	-----	103	18 (est.)	6 - 7	14.3 - 16.7
TMM 30967-1805 . .	-----	110	14	6.5	15.4
TMM 30967-213 . . .	216	100	16	7	14.3
TMM 30967-165 (M^3) .	-----	96	------	7.5	13.3
TMM 30967-462 . . .	-----	89	18 - 19 (est.)	7	14.3

TABLE 26. *Measurements (in mm) of lower molars of* Mammuthus columbi *from Ingleside, Texas.*

Specimen No.	Length	Width	No. of plates	No. of plates per 10 cm	Laminary index
M_2 (TMM 30967-1787)	222	93	13	6	16.7
M_3 (TMM 30967-1787)	------	------	-----	7	14.3
M_3 (TMM 30967-227)	270	98	16	5.5	18.2
M_3 (TMM 30967-1172)	272	91	15	5.5	18.2
M_3 (TMM 30967-1201)	261	95	14	5.5	18.2
M_3 (TMM 30967-1729)	233	106	14 (est.)	4.5	22.2
M_2 (?) (TMM 30967-181)	-----	80	------	7	14.3
M_3 (TMM 30967-1652)	275	94	13 - 14 (est.)	5	------

(Osborn, 1942, p. 998). The number of plates in the M^3's is 18 to 19, which is below the number in *M. jeffersoni* and close to that in *M. columbi.* The plate count per 100 mm of the M^3's ranges from 6 to 7.5 (table 25), which is above the value given by Osborn (ibid.) for *M. imperator* but within the ranges of both *M. columbi* and *M. jeffersoni.* The plate count per 100 mm of the M_3's ranges from 4.5 to 7 (table 26), which overlaps the ranges of both *M. columbi* and *M. imperator* but which is at the lower limit of the range of *M. jeffersoni.* The number of plates in the M_3's ranges from 13 to 16. This is too low for *M. jeffersoni* and *M. imperator* but is within the range given by Osborn (ibid.) for *M. columbi.* On the basis of the thin external cement and the plate counts, the Ingleside material is referred to *M. columbi.* This species was widely distributed in the southern United States and seems not to have been restricted to any particular habitat.

Order ARTIODACTYLA
Family TAYASSUIDAE
PLATYGONUS COMPRESSUS Le Conte

Platigonus compressus Le Conte, 1848, Amer. Jour. Sci., ser. 2, vol. 5, pp. 102-106.

Platygonus compressus Le Conte, 1848, Mem. Amer. Acad. Arts and Sci., vol. 3, pp. 257-274.

Platygonus compressus Le Conte. Simpson, 1949, Amer. Mus. Novitates 1408, p. 46.

Material.—A right M^3 (TMM 30967-707); left M^3 (TMM 30967-918); M_2 (TMM 30967-1646); M^1 (TMM 30967-1036); dP^3 (TMM 30967-709); premaxilla (TMM 30967-740); upper canines (TMM 30967-75, 1645); distal end of metatarsal (TMM 30967-1562).

Remarks.—These teeth compare very well in size (table 27) with those from Cherokee Cave near St. Louis, Missouri (Simpson, 1949). The anterior width of M^3 is outside the observed range of the

TABLE 27. *Measurements (in mm) of teeth of* Platygonus compressus *from Ingleside, Texas.*

Specimen No.	Length	Anterior width	Posterior width
M^3 (TMM 30967-707) . .	20.5	18.7	15.4
M_3 (TMM 30967-918) . .	------	-------	13.8
M_2 (TMM 30967-1646) .	18.3	12.6	13.9
M^1 (TMM 30967-1036) .	14.6	------	------
dP^3(TMM 30967-709) . .	12.2	12.7	10.3

St. Louis sample but it is within the calculated standard range. All other dimensions on the material fall within the observed range of the St. Louis sample. All measurements fall within the observed range of a sample of *Platygonus compressus* reported by Slaughter (1966a) from Laubach Cave in Central Texas.

Simpson showed that although several late Pleistocene samples of *Platygonus* show statistical differences, none are great enough to warrant their placement in different species. It seems likely that the Ingleside material represents another population that is assignable to *Platygonus compressus*.

Family CAMELIDAE

CAMELOPS sp.

Material.—A partial skull (TMM 30967-1599); right premaxilla (TMM 30967-76); lower incisor (TMM 30967-748); right M^2 (TMM 30967-1240A); left M^3 (TMM 30967-290); P^4 (TMM 30967-1240B); left M^2 (TMM 30967-915D); M_3 (TMM 30967-77); fragment of mandible with badly worn P_4, M_1 (TMM 30967-1122); axis (TMM 30967-479); humerus (TMM 30967-415); right and left metacarpals (TMM 30967-1594, 544); juvenile metacarpal (TMM 30967-684); left femur (TMM 30967-387); head of left femur (TMM 30967-596); metatarsal (TMM 30967-150); juvenile metatarsal (TMM 30967-1593); distal end of a metapodial (TMM 30967-726); 3 phalanges (TMM 30967-549, 346, 1552).

Remarks.—The Ingleside skull consists of a palate and braincase. The dorsal part of the rostrum is missing and the paroccipital and hamular processes are broken off (fig. 32).

The skull is, in general, similar to those of *C. hesternus* from Rancho La Brea but is slightly smaller and shows some differences in proportions (table 28).

The cranial flexion, as the skull has been repaired, is 5°. This is somewhat less than the 7° to 10° Webb (1965) reported for three specimens of *Camelops* from Rancho La Brea.

The nasal border of the premaxilla is slightly convex as in *C. kansanus* and *C. hesternus*. The nasals and the dorsal part of the maxilla are missing, and the relationships between the premaxilla, maxilla, and nasals are unknown.

The anterior border of the orbit is above M^3 and the infraorbital foramen is located over the anterior edge of M^1. The anterior palatine foramina are located opposite P^4 as in *C. hesternus*. In *C. huerfanensis* the anterior palatine foramen is located opposite M^1 (Hopkins, 1955). The posterior palatine foramina are located opposite the posterior edge of M^3 on the posterior-facing surfaces of the maxillae. The tooth rows are almost straight and diverge from one another posteriorly, in contrast to the parallel condition in *C. hesternus*.

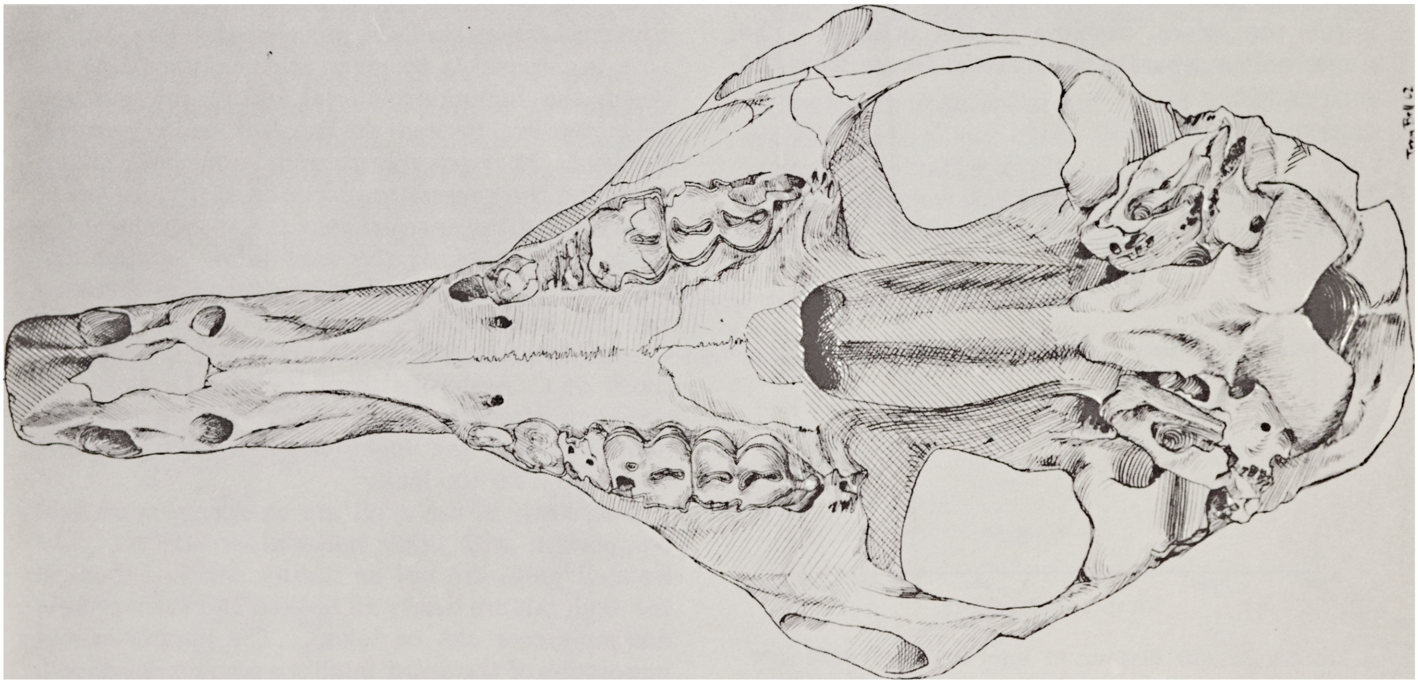

FIG. 32. *Camelops* sp. Ventral view of skull (TMM 30967-1599). x1/3.

TABLE 28. *Measurements (in mm) of skulls of various species of* Camelops *from the Pleistocene of North America.*

	Camelops sp.	*Camelops hesternus**		*Camelops huerfanensis*
	Ingleside, Texas	Rancho La Brea, California		Dallas, Texas
	(TMM 30967-1599)	(UCMP 20028)	(UCMP 20040)	(SMU 15.1)
Length from condyles to premaxilla	504	571	573	540
Distance from premaxilla to M^3	302	341	362	-----
Greatest width at posterior end of orbits	250	245	251	-----
Least width of rostrum between C and cheek teeth	53 (est.)	62.9	-----	-----
Width across outer edges of M^3	118	141.9	148	-----
Width between P^4's	49	66	56	-----

---

*Data from Webb (1965).

There is no sign of a parasphenoid pit as described by Webb (1965) for the Rancho La Brea sample.

The sagittal and lambdoidal crests are well developed but thin. The overhanging dorsal part of the occiput is occupied by a rugose depression for the insertion of the extensors of the head. This depression has the shape of a triangle with the apex directed ventrally and with lateral extensions along the lambdoidal crest. A low ridge extends along the midline of the depression.

The mastoid fossae lie lateral and ventral to the occipital depression and are separated from it by massive rounded ridges. The mastoid fossae are rounded and deep as in other specimens of *Camelops* that have been figured. They do not notch the lateral margins of the occiput. The ridges which separate the mastoid fossae from the occipital depression join ventrally to form a broad rounded ridge at the dorsal margin of the foramen magnum. On the left side the ridge separating the occipital depression and the mastoid fossa has a broad shallow groove which extends ventrally from a small foramen. This condition resembles, on a greatly reduced scale, that seen in the type of *C. huerfanensis* (Hay, 1913).

FIG. 33. Scatter diagram of total length of skull (premaxillary to occipital condyles) vs. canine to P^3 length in various specimens of *Camelops*.

The proportions of the Ingleside skull are different from those of *C. hesternus* and *C. huerfanensis* from Idaho. Scatter diagrams show that the post-canine diastema is longer in proportion to the total skull length and to the length of P^3 through M^3 in the Ingleside skull (figs. 33 and 34). The Ingleside skull and the Idaho skull are similar in the relatively narrow rostrum, and both differ from the Rancho La Brea skulls in this character (fig. 35).

It is impossible to make such comparisons between the Ingleside material and *C. sulcatus* and *C. minidokae* because of the lack of comparable material. It is possible to gain some information regarding the general proportions of the skull of *C. sulcatus* and the species from the various localities by a comparison of the mandibles. Scatter diagrams of the length of the post-canine diastema and the length of P_4 through M_3 show that the *C. sulcatus* mandible (TMM 41005-1) is similar to those of *C. hesternus* from Rancho La Brea. In addition attempts to articulate the *C. sulcatus* mandible with the Ingleside skull show that the mandible is far too large.

The teeth in the skull are so deeply worn that comparison with other material is difficult. The isolated teeth are not as deeply worn as those in the skull but are nearly all broken and few accurate measurements can be taken. The parastyles and mesostyles of the upper teeth are equally developed, as in *C. hesternus*. The remnants of the metastyles

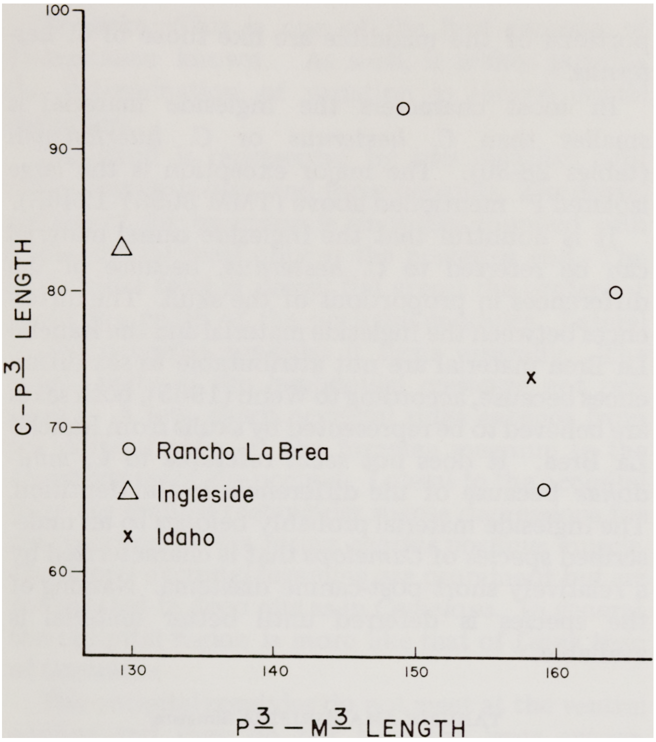

FIG. 34. Scatter diagram of P^3 through M^3 length vs. canine to P^3 length in various specimens of *Camelops*.

of the M^3's in the skull extend straight posteriorly, as in *C. hesternus*.

The isolated M_3 (TMM 30967-77) has an inconspicuous anterior stylid and no antero-external pillar (fig. 36). The inner face is not quite flat, there being a narrow, shallow, rounded groove between the first and second lobes. The posterior lobe is turned about 20° inward of the antero-posterior axis of the tooth. This tooth is smaller than any M_3 assigned to either *C. hesternus* or *C. huerfanensis*. It is within the range of size reported by Savage (1951) for *C. minidokae*.

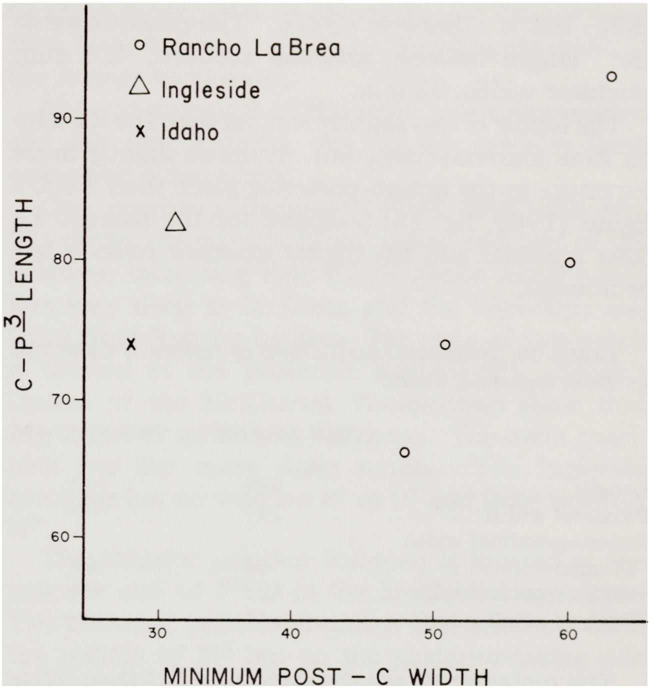

FIG. 35. Scatter diagram of minimum post-canine width vs. length from canine to P^3 in various specimens of *Camelops*.

FIG. 36. *Camelops* sp. Occlusal view of a left M_3 (TMM 30967-77). x1.

The length of an isolated P^4 (TMM 30967-1240B) exceeds that of any other *Camelops* P^4 recorded in the literature (table 29).

The humerus is slightly below the range of size of those of *C. hesternus* from Rancho La Brea (Webb,

TABLE 29. *Measurements (in mm) of dentitions of* Camelops *sp. from Ingleside, Texas.*

	TMM 30967-1599	TMM 30967-1240A	TMM 30967-1240B	TMM 30967-915D
Length from P^3 to M^3 . .	129	------	------	------
Length from P^4 to M^3 . .	113.5	------	------	------
Length from M^1 to M^3 . .	75.5	------	------	------
P^3—Length	15.8	------	------	------
Width	7.8	------	------	------
P^4—Length	20.7	------	32.8	------
Width	20.7	------	------	------
M^2—Length	29.7	38.6	------	38.8
Anterior width . . .	26.8	------	------	------
Posterior width . . .	27.4	------	------	28.4
M^3—Length	37.5	------	------	------
Anterior width . . .	25.9	------	------	------
Posterior width . . .	23.9	------	------	------

1965) but is otherwise similar. The measurements are: length between articular surfaces, 415 mm; trochlear width, 93 mm.

The femur is also slightly smaller than the Rancho La Brea material (table 30). It shows slightly more curvature in the antero-posterior plane than Webb's figure (1965, fig. 13) indicates for the Rancho La Brea material and the digital extensor fossa is less prominent.

TABLE 30. *Measurements (in mm) of femora of* Camelops *sp. from Ingleside, Texas.*

	TMM 30967-387	TMM 30967-596
Length	589	-----
Proximal width	147	------
Antero-proximal width of head	69	65
Width across condyles	139	------
Width of patellar surface	45	------

The metacarpals are shorter (table 31) than those of *C. hesternus* from Rancho La Brea (Webb, 1965) and of *Camelops* from the T-2 terrace of the Trinity River at Dallas (Slaughter et al., 1962).

TABLE 31. *Measurements (in mm) of metacarpals of* Camelops *sp. from Ingleside, Texas.*

	TMM 30967-1594	TMM 30967-544
Length	330	338
Proximal width	71	------
Distal width	95	------

In his study of the Irvingtonian fauna, Savage (1951) attempted an evaluation of the various species that have been named and noted that the species he considered valid could be placed in two size groups, the larger containing *C. kansanus, C. hesternus,* and *C. huerfanensis,* the smaller *C. minidokae* and *C. sulcatus.* The discovery of another complete left mandibular ramus with the symphysis (TMM 41005-1) from the type locality of *C. sulcatus*[6] indicates that *C. sulcatus* is not particularly small. The overall length of the mandible is 488 mm, which is larger than any mandible of *C. hesternus* from Rancho La Brea (Webb, 1965). The teeth are slightly smaller than those of the type of *C. sulcatus* (TMM 18622). In addition, the proportions of the mandible are like those of *C. hesternus.*

In most characters the Ingleside material is smaller than *C. hesternus* or *C. huerfanensis* (tables 28-30). The major exception is the large isolated P^4 mentioned above (TMM 30967-1240B).

It is doubtful that the Ingleside camel material can be referred to *C. hesternus*, because of the differences in proportions of the skull. The differences between the Ingleside material and the Rancho La Brea material are not attributable to sex differences because, according to Webb (1965), both sexes are believed to be represented by skulls from Rancho La Brea. It does not seem referable to *C. minidokae* because of the differences in the dentition. The Ingleside material probably belongs to an undescribed species of *Camelops* that is characterized by a relatively short post-canine diastema. Naming of the species is deferred until better material is available.

TANUPOLAMA MIRIFICA Simpson

Tanupolama mirifica Simpson, 1929, Bull. Amer. Mus. Nat. Hist., vol. 56, p. 593.

Material.—Braincase (TMM 30967-1778); 3 occiputs (TMM 30967-791, 515, 1026); a mandible with symphysis, canine, and cheek teeth (TMM 30967-874); mandibular symphysis with incisors (TMM 30967-1636); left mandibular ramus with P_4 through M_2 (TMM 30967-880); left mandibular ramus with M_{2-3} (TMM 30967-1651); right mandibular ramus with symphysis and M_{1-3} (TMM 30967-1806); right mandibular ramus with P_4 through M_3 (TMM 30967-445); left mandibular ramus with M_{2-3} (TMM 30967-1274); right mandibular ramus with M_{1-3} (TMM 30967-485); right and left mandibular rami with symphysis, dP_{3-4}, M_{1-2} (TMM 30967-342, 144); left mandibular ramus with symphysis, dP_4, M_{1-2} (TMM 30967-342, 916); left mandibular ramus with M_{1-2} (TMM 30967-1590); left mandibular ramus fragment with dP_4, M_1 (TMM 30967-1665); right mandibular ramus fragment with dP_4, M_1 (TMM 30967-1028); left mandibular ramus fragment with P_4, M_1 (TMM 30967-1654); left mandibular ramus fragment with dP_3 (TMM 30967-111); right maxillary fragment with M^{1-3} (TMM 30967-372); right maxillary fragment with M^{2-3} (TMM 30967-1589); numerous isolated deciduous and permanent teeth; axis (TMM 30967-251); distal ends of 7 scapulae (TMM 30967-1595, 1591, 582, 1712, 1790, 1064, 409); and other fragmentary post-cranial material.

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[6] Savage's listing of *C. sulcatus* from Austin County is erroneous and undoubtedly was a result of very confusing statements in Cope (1893, pp. 75, 83-84). The type locality of *C. sulcatus* is Rock Creek, Briscoe County, Texas. The specimen from Austin County was assigned by Cope (1893, pp. 83-84) to *Holomeniscus hesternus* and is similar in size and proportions to the Rancho La Brea material.

Remarks.—This is one of the best samples of *Tanupolama* known. As such, it makes possible the determination of variation in several dental characters.

The skull is represented by two maxillae with teeth, one braincase, and three occiputs. The dorsal surface of the braincase is smoothly rounded with a low sagittal crest only at the posterior end. The lambdoidal crest is almost flat across the center for about the width of the occipital condyles. Lateral to the occipital condyles it turns ventrally. The lateral parts of the lambdoidal crest are not preserved. A low, sharp occipital ridge extends from the dorsal border of the foramen magnum to the dorsal border of the occiput. Lateral to the occipital ridge are shallow rectangular rugose depressions for the insertion of the *rectus capitus posticus* muscle. The lateral occipital foramina are prominent but are not located in deep pits as in *Camelops.* In general, the occipital region is more like that of *Lama* than of *Camelops.*

The occipital condyles do not meet at the ventral midline and they do not have the large anteroventral lip as do those of *Camelops.* The anteroventral edges of the condyles are at the same level as the ventral surface of the basioccipital. The basioccipital is basically like that of *Lama* but has been modified to enlarge the areas of insertion of the *rectus capitus ventralis* muscle. The modification has resulted in a great widening and flattening of the basioccipital between the auditory bullae. The basicranial tuberosities are located slightly farther anteriorly than in *Lama* and are divergent posteriorly rather than parallel as in *Lama.* Stock's (1928) figure of the basioccipital does not appear to be as broad as the Ingleside specimens. Webb (1965) has suggested that the more anterior position of these tuberosities in *Camelops* and *Tanupolama* than in *Camelus* is related to the elongate skulls in the former two genera.

The anterior part of the skull is not represented and the size, spacing, etc., of the anterior teeth cannot be determined.

One maxillary fragment (TMM 30967-92) (fig. 37) shows the midline of the palate and part of the palatine, indicating that the posterior narial notch was very deep as in *Lama* and the *Camelops* material from Rancho La Brea. The apex of this notch is located at the posterior lobe of M^1. Stock's figures of the McKittrick *Tanupolama* show that this notch is variable in its shape. The older specimen has the more open notch. The Ingleside specimen has no wear on P^3 or P^4 and little wear on M^3.

The anterior palatine foramen is located at the anterior end of P^3 as in the McKittrick specimen. The posterior palatine foramen is located opposite the middle of M^3 but on the posterior-facing side of the palatine as in *Lama.*

The P^3 is represented by four specimens. It is a small tooth with a simple external crescent (fig. 38). The inner crescent is complete on three of the teeth and incomplete in the fourth, where the anterior and posterior lobes are separated by a narrow fissure. Similar variation in the structure of the P^3 has been reported by Bader (1957) for a sample of *Tanupolama mirifica* from Florida.

The P^4 is triangular with a straight outer loph and a crescentic inner loph. The two lophs are joined at each end. A small style is present at the antero-external corner of the tooth. Some specimens have small postero-internal pillars.

The upper molars show no characters which would differentiate them from the Florida sample.

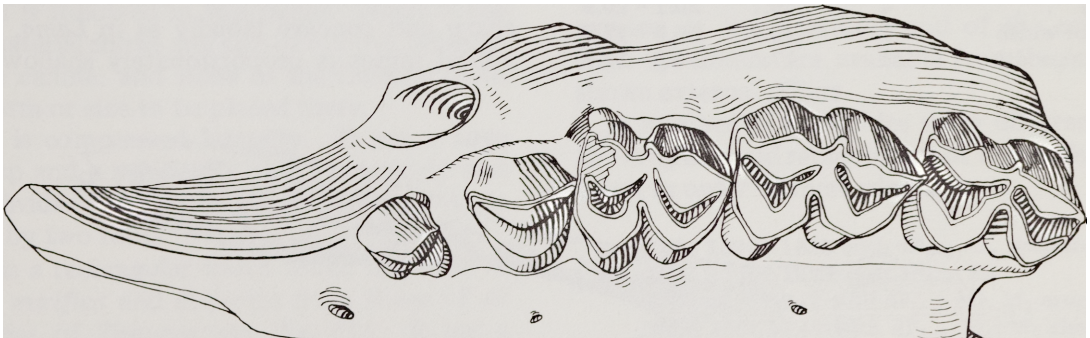

FIG. 37. *Tanupolama mirifica.* Ventral view of left maxilla (TMM 30967-92). x1.

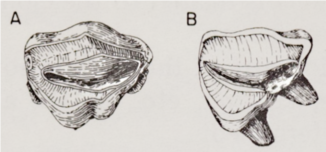

FIG. 38. *Tanupolama mirifica.* Occlusal view of P^3's showing variation of lingual wall. A, (TMM 30967-124). B, (TMM 30967-1235D). x1.

The anterior lakes of both have a small spur projecting into them from the posterior side. In some specimens the external styles appear to be better developed than in other described specimens of *Tanupolama.* A few teeth have small internal median pillars approximately one-half the height of the crown. The sizes are also similar (table 32).

The upper deciduous dentition is represented by isolated teeth only. No teeth referable to dP^2 have been found. The dP^3 (fig. 39, B) is triangular with two well-developed lobes and an incipient third lobe anteriorly. The median lobe is much smaller in proportion to the posterior one than in the *Tanupolama* material from McKittrick. In those specimens dP^3 is more molariform. It has two subequal lobes and only a rudiment of the third anterior lobe. All of the Ingleside specimens show a small spur projecting into the posterior enamel lake. One shows two spurs projecting into the posterior lake and one into the anterior lake. Stock's (1928) figures show no such spurs in the McKittrick material.

TABLE 32. *Numerical data on upper dentitions of* Tanupolama mirifica *from Ingleside, Texas.*

	No. of specimens	Mean	Observed range
P^3 —Length . .	2	13.6	13.2 - 14.0
Width . .	2	11.9	11.9 - 12.0
P^4 —Length . .	4	15.6	15.1 - 16.2
Width . .	4	15.9	14.9 - 17.0
M^1 —Length . .	1	22.1	--------
Anterior width	2	20.1	20.0 - 20.1
Posterior width	3	20.8	20.6 - 20.9
M^2 —Length . .	2	25.0	24.1 - 25.9
Anterior width	2	22.5	22.3 - 23.6
Posterior width	2	21.3	21.0 - 21.6
M^3 —Length . .	5	25.98	24.3 - 28.3
Anterior width	4	23.4	21.9 - 25.0
Posterior width	3	19.8	18.9 - 20.8
dP^3—Length . .	2	20.3	19.2 - 21.4
Anterior width	2	10.8	9.9 - 11.7
Posterior width	2	15.9	15.8 - 16.1
dP^4—Length . .	4	20.7	20.1 - 20.9
Anterior width	5	16.9	16.0 - 17.6
Posterior width	4	17.6	16.9 - 18.7

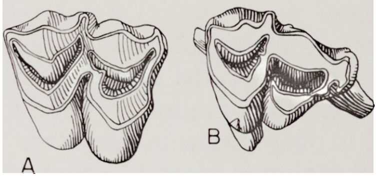

FIG. 39. *Tanupolama mirifica.* A, Occlusal view of right dP^4 (TMM 30967-1041D). B, Occlusal view of right dP^3 (TMM 30967-1514). x1.

The dP^4 is a completely molariform tooth (fig. 39, A). The parastyle and mesostyle are better developed than in most molars and differ in shape in being more open. All have a spur projecting into the posterior side of the anterior enamel lake. The internal roots are joined.

The symphysis of the mandible is completely fused by the time M_2 has erupted (fig. 40). The ventral surface of the symphysis is rounded and slightly concave in lateral view. The symphysis is long; it extends posteriorly to a point halfway between the canine and P_3. Its dorsal surface has the form of a rounded concave trough. The postcanine diastema is proportionately longer than in the McKittrick material. The diastemal crests are sharp and concave labially as in *Lama.* The horizontal ramus is proportionately shallower than in

FIG. 40. *Tanupolama mirifica.* Occlusal view of right mandibular ramus and symphysis (TMM 30967-874). x1/2.

Lama. A mental foramen opens below the lower end of the canine root. Another foramen is located under the posterior edge of P_4.

The coronoid process of the mandible is long with a recurved tip. It is not turned medially at the tip as in *Lama.* The condyle lies approximately halfway between the tip of the coronoid process and the angular process and roughly 70 mm above the alveolus of M_3. The condyle is elongate transversely and convex antero-posteriorly. The angular process lies well above M_3 and is not inflected medially. A small oval massateric fossa lies between the condyle and the angular process. It is not so elongate as in *Lama.*

The postero-ventral margin of the mandible is deeper and more strongly developed than in either *Lama* or *Tanupolama* from McKittrick. The mandibular foramen lies at the level of M_3.

There are two symphyses which show there were three procumbent incisors in each mandible. They are more procumbent and have more asymmetrical crowns than those of *Lama.* No differences can be seen from Stock's figures of the McKittrick material.

Posterior to I_3 and separated from it by a short diastema (18 mm in TMM 30967-874) is a laterally compressed, slightly recurved tooth. It is straighter and proportionately larger than the corresponding tooth in *Lama.* Stock (1928) considered this tooth to be the P_1 because of the presence in some specimens from McKittrick of a small tooth between it and I_3. This small variable tooth he took to be the canine. Webb (1965) has argued that the P_1 of Stock is the true canine and the smaller canine of Stock is a persistent dI_3. Webb's argument is based both on the morphology of the teeth and the phylogenetic history of the camelid dentition. His argument is convincing and his designation is followed in this paper. None of the Ingleside material shows any sign of a tooth between I_3 and the canine, and none of the isolated teeth have the form or size to be placed there.

The P_3 is compressed laterally. It has a large central cusp and a subsidiary cusp posteriorly that may be divided longitudinally into two. It is supported by two roots.

The P_4 is a rectangular tooth which is similar to that of *T. mirifica* and different from those of all other species of *Tanupolama* (fig. 41). It has a small antero-internal cusp, both ends of which are joined to the antero-external cusp. This forms two small enamel lakes in the anterior end of a worn tooth. The posterior part of the tooth is like that of other species of *Tanupolama.*

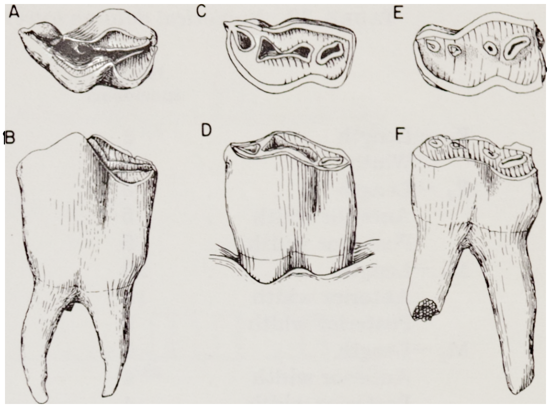

FIG. 41. *Tanupolama mirifica.* Occlusal (above) and labial (below) views of left P_4. A, B, (TMM 30967-1243). C, D, (TMM 30967-880). E, F, (TMM 30967-282) showing changes in enamel pattern with wear. x1.

The lower molars are similar to those of *T. mirifica* figured by Simpson (1929). A few have internal pillars. The sizes of the teeth (table 33) are similar to those reported by Bader (1957).

Several mandibles of *Tanupolama* with deciduous teeth are present as well as isolated deciduous teeth (fig. 42).

Two teeth (TMM 30967-1696, 1913) apparently represent dI_3. The anterior part of the crown is greatly elongated to produce an elongated bladelike tooth. No evidence of a dP_2 has been found. No alveolus for it is present in any mandible nor are there any isolated teeth which could be P_2.

The dP_3 is small and has two lobes. The posterior lobe has complete inner and outer crescents. A posterior enamel lake is formed in a worn tooth. The anterior lobe is bladelike with a small variable internal cusp.

The dP_4 has three well-developed lobes. The anterior lobe is slightly smaller than the other two, which are the same size. A small internal style is present at the posterior end of the middle lobe. Nine specimens are available from Ingleside; none shows external pillars.

A number of mandibles show different stages in the eruption and replacement of the teeth. They are listed in order of increasing age:

TMM 30967-1655 with dP_{3-4}, M_1 erupting
TMM 30967-1028 with dP_{3-4}, M_1
TMM 30967-342 with dP_{3-4}, M_1, M_2 erupting
TMM 30967-144 with dP_{3-4}, M_1, M_2 almost in place
TMM 30967-1590 with dP_{3-4} (P_3 may have pushed dP_3 out), M_{1-2}
TMM 30967-916 with dP_{3-4} (P_3 may have pushed dP_3 out), M_{1-2}, M_3 almost in place, dP_4 is well worn

TABLE 33. *Numerical data on lower dentitions of* Tanupolama mirifica *from Ingleside, Texas.*

	No. of specimens	Mean	Standard deviation	Coefficient of variation (%)	Observed range
P_3 —Length	2	11.4	------	------	11.0 - 11.7
Width	2	6.2	------	------	5.7 - 6.6
P_4 —Length	5	15.9	------	------	14.6 - 17.2
Anterior width .	5	8.3	------	------	8.3 - 9.6
Posterior width .	5	9.2	------	------	8.2 - 9.9
M_1 —Length	10	21.8±.56	1.77	8.2	18.5 - 23.8
Anterior width .	10	14.7±.25	.81	5.3	13.7 - 15.9
Posterior width .	9	15.2±.17	.53	3.5	14.8 - 15.9
M_2 —Length	6	25.0	------	------	24.3 - 26.7
Anterior width .	4	16.2	------	------	15.6 - 17.1
Posterior width .	4	15.7	------	------	15.3 - 16.3
M_3 —Length	8	32.5±.69	1.97	6.2	30.7 - 37.0
Anterior width .	8	16.5±.16	.47	2.9	15.9 - 17.2
Posterior width .	8	15.8±.21	.60	3.8	15.0 - 16.9
dP_3—Length	4	13.6	------	------	11.9 - 14.3
Anterior width .	4	4.5	------	------	4.1 - 4.7
Posterior width .	4	6.9	------	------	6.4 - 7.5
dP_4—Length	5	26.0	------	------	24.7 - 26.8
Anterior width .	5	9.3	------	------	9.0 - 9.8
Mid-width . . .	5	11.2	------	------	10.4 - 11.7
Posterior width .	5	12.3	------	------	11.5 - 12.8

The material shows that the tooth replacement pattern is similar to that of *Camelus* (Lesbre, 1903). The dP_{3-4} are lost shortly after the eruption of M_3 (in TMM 30967-916, M_3 is slightly worn and dP_4 is deeply worn). Little seems to be known concerning the age at which various teeth erupt in *Lama*. If the eruption ages of *Camelus* (Lesbre, 1903) are applied to these specimens, they fall into approximate one-year age groups from two to five years. It is possible that being a smaller animal *Tanupolama* developed faster than *Camelus* and the specimens mentioned above do not represent year classes.

A frequency distribution of the heights of the middle lobe of nineteen M_3's shows three well-defined groups (fig. 43). This again suggests that the sample of *Tanupolama* is composed of individuals falling into year classes. Unfortunately, the oldest of the juvenile mandibles has the M_3 broken so that the height of the middle lobe can only be estimated. It is doubtful that it was more than 26 mm, which would possibly place it in the highest crowned group of isolated M_3's. This would place the age of that group at 5 to 6 years. It could belong to the next younger group, in which case the highest-crowned group of isolated M_3's would be 6 to 7 years old. The oldest individual would be about 10 years old.

If the groups outlined above are year classes, this has implications for both the species and the mode of accumulation of the sample. It would indicate that *Tanupolama mirifica* was a seasonally breeding animal. It also indicates that the sample accumulated either by catastrophic mortality or by normal attrition at a limited part of the year. The field data are meager but provide no evidence for the first mode of accumulation. A seasonal accumulation could be accounted for if the pond dried up during the summer. Although the fish fauna indicates that the pond was not intermittent (Camm Swift, personal communication), there are no data

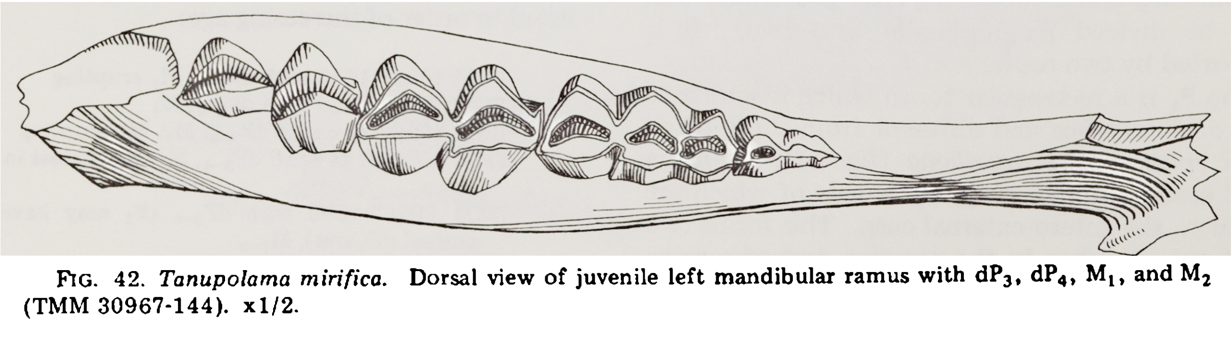

FIG. 42. *Tanupolama mirifica.* Dorsal view of juvenile left mandibular ramus with dP_3, dP_4, M_1, and M_2 (TMM 30967-144). x1/2.

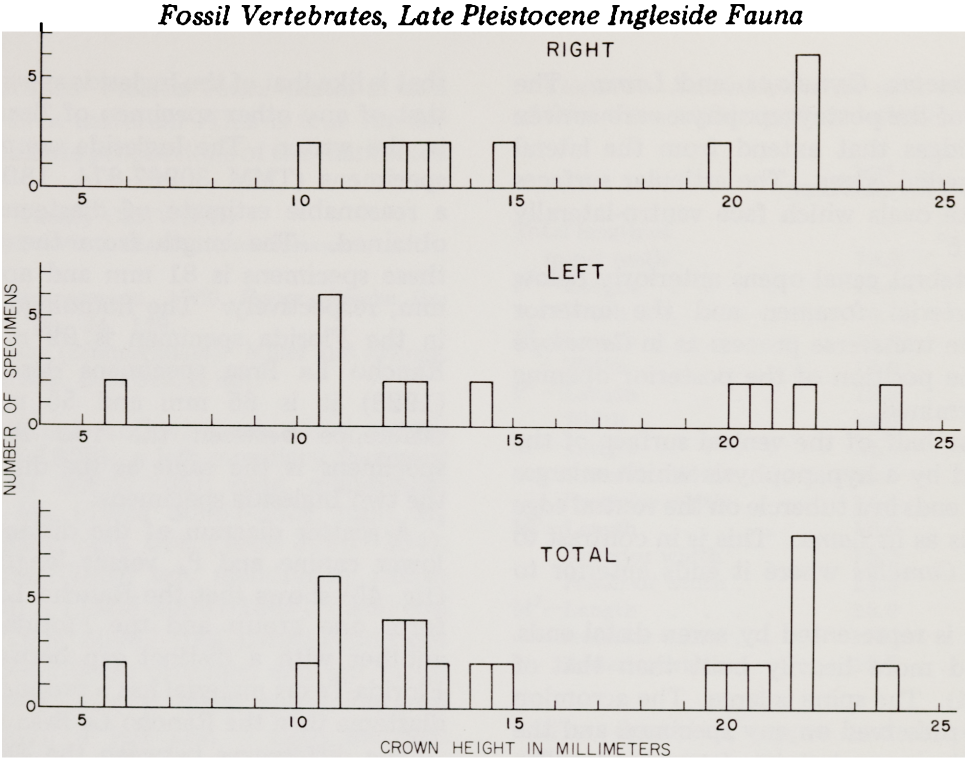

FIG. 43. Frequency histogram of crown heights of M_3's of *Tanupolama mirifica* showing the groups of distinct wear stages.

demonstrating that the *Tanupolama* sample was collected from the same stratum or strata as the fish. It is possible that the pond was a perennial one for only part of the time it was accumulating sediments.

Axis.—The axis is more slender than that of *Camelus*, *Camelops*, or *Lama*. The odontoid process is spoutlike with a medial notch as in *Camelus* and lateral notches as in *Lama* (fig. 44). The neural spine is low and rises gently posteriorly until it ends in a tubercle. This tubercle is not divided and is located at the anterior edge of the postzygopophysis. None of the other genera examined *(Camelus, Camelops, Lama)* has this tubercle located as far posteriorly.

The transverse processes consist of thin horizontal plates that end posteriorly in tubercles. They have much the same shape as those of *Camelops* and *Lama* but arise farther posteriorly than in either of these, and the tubercles project past the posterior end of the centrum.

The postzygapophyses extend posteriorly beyond the centrum for about one-half their length as in *Lama*. They are separated by a V-shaped notch in which a ridge from the tubercle of the neural spine ends. This is different from the

FIG. 44. *Tanupolama mirifica.* Left lateral view of axis (TMM 30967-251). x1/2.

situation in *Camelus*, *Camelops*, and *Lama*. The upper surfaces of the postzygapophyses are convex with arcuate ridges that extend from the lateral edges to the medial edges. The articular surfaces are flat elongate ovals which face ventro-laterally at an angle of 45°.

The intervertebral canal opens anteriorly below the vertebro-arterial foramen and the anterior extension of the transverse process as in *Camelops* and *Lama*. The position of the posterior opening cannot be determined.

The posterior half of the ventral surface of the axis is occupied by a hypapophysis which enlarges posteriorly and ends in a tubercle on the ventral edge of the epiphysis as in *Lama*. This is in contrast to *Camelops* and *Camelus* where it ends anterior to the epiphysis.

The scapula is represented by seven distal ends. It is larger and more heavily built than that of *Lama* (table 34). The spine is large. The acromion process is not preserved on any specimen and the degree of overhang cannot be determined. The glenoid cavity is round to oval with the medial border flattened in most specimens. The glenoid cavity of *Lama* is pear-shaped with the narrow end anterior. The medial border shows no sign of flattening. The coracoid border of the glenoid fossa has a deep open notch in *Tanupolama* as in *Camelops* and *Lama*. The coracoid process of *Tanupolama* is more massive and rugose than that of *Lama* but has the recurved medial process less strongly developed.

TABLE 34. *Measurements (in mm) of scapulae of* Tanupolama mirifica *from Ingleside, Texas.*

Specimen No.	Antero-posterior diameter of glenoid cavity	Transverse diameter of glenoid cavity
TMM 30967-1595 . .	65.7	49.9
TMM 30967-1591 . .	60.1	51.2
TMM 30967-582 . . .	60.0	50.0
TMM 30967-1712 . .	64.2	50.8
TMM 30967-1790 . .	58.4	47.7
TMM 30967-1064 . .	67.4	65.2
TMM 30967-409 . . .	62.6	58.1

The *Tanupolama* material from Ingleside resembles the material from Florida designated *T. mirifica* by Simpson (1929). Hibbard and Dalquest (1962) briefly reviewed the named species of *Tanupolama* and stated that *T. mirifica* can only be distinguished from *T. macrocephala* by the long diastema anterior to P_3. However, the type of *T. mirifica* has a P_4 with a complicated anterior part that is like that of the Ingleside specimens and unlike that of any other specimen of *Tanupolama* known to the writer. The Ingleside sample contains two specimens (TMM 30967-874, 1806) upon which a reasonable estimate of diastema length can be obtained. The length from the canine to P_4 in these specimens is 81 mm and approximately 90 mm, respectively. The homologous measurement in the Florida specimen is 99 mm. In the two Rancho La Brea specimens described by Stock (1928) it is 65 mm and 55 mm. Thus, the difference between the two Rancho La Brea specimens is the same as the difference between the two Ingleside specimens.

A scatter diagram of the distance between the lower canine and P_4 versus length of P_4 to M_3 (fig. 45) shows that the Rancho La Brea materials form one group and the Florida-Texas material another with a distinct gap between them. The Florida-Texas material has a proportionately longer diastema than the Rancho La Brea sample.

The differences between the Florida and Texas materials appear, on the basis of the specimens available at present, to be less than the differences

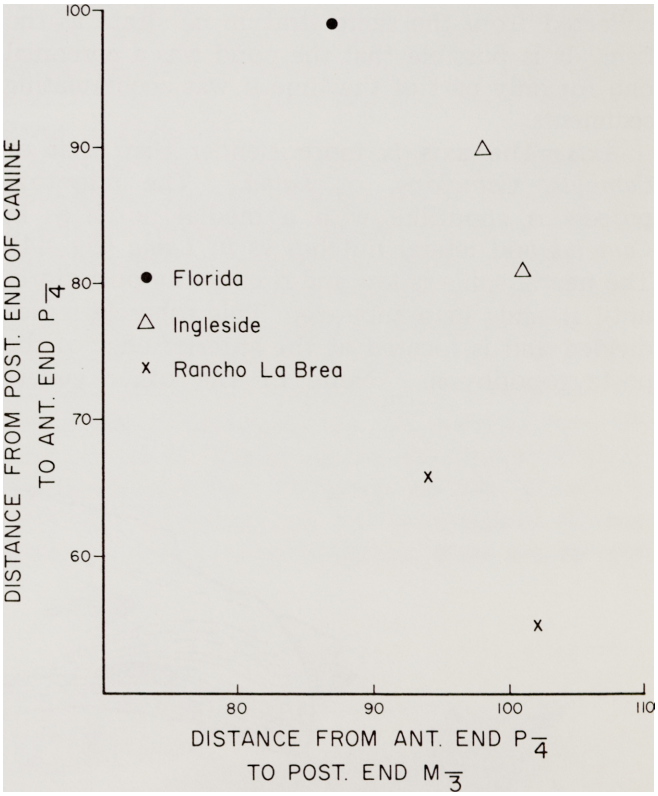

FIG. 45. Scatter diagram of distance from the lower canine to P_4 vs. length of P_4 through M_3 for various specimens of *Tanupolama*.

between the lumped Florida-Texas material and the Rancho La Brea material. This is true for the dentition as well as the proportions of the mandibles.

Family CERVIDAE

ODOCOILEUS VIRGINIANUS (Zimmermann)

Dama virginiana Zimmermann, 1780, Geographische Geschichte, vol. 2, pp. 24, 129.
Odocoileus virginianus (Zimmermann). Miller and Kellogg, 1955, U. S. Nat. Mus. Bull. 205, p. 801.

Material.—A partial skull with associated mandible (TMM 30967-1822); a left maxillary fragment with M^{1-3} (TMM 30967-305); right mandibular ramus with P_2–M_3 (TMM 30967-283); right M_3 (TMM 30967-1628); right tibia (TMM 30967-364); atlas (TMM 30967-769); left mandibular ramus fragment with M_{1-2} (TMM 30967-1869); distal end right humerus (TMM 30967-106C); distal end right radius (TMM 30967-568); proximal end left metatarsal (TMM 30967-1347); distal end metatarsal (TMM 30967-104); 4 left and 4 right astragali (TMM 30967-106D, 1490, 1520, 1542, 106E, 1490, 969, 1180); 1 left and 3 right calcanei (TMM 30967-106B, 106A, 1071, 601).

Remarks.—The partial skull (TMM 30967-1822) consists of the left side of the skull minus the premaxillaries and the braincase. Parts of both frontal bones with the antler pedicles and basal part of antlers are present. Although the skull is distorted, the antorbital fossa is small and shallow as in *O. virginianus.*

TABLE 35. *Measurements (in mm) of upper dentitions of* Odocoileus virginianus *from Ingleside, Texas.*

	Left (TMM 30967-1822)	Left (TMM 30967-305)
Total length of upper teeth . . .	78.3	-------
P^2 —Length	13.0	-------
Width	10.3	-------
P^3 —Length	10.9	-------
Width	11.9	-------
P^4 —Length	10.9	-------
Width	12.8	-------
M^1—Length	14.9	13.6
Anterior width . .	13.7	14.7
Posterior width . .	14.4	14.2
M^2—Length	16.0	15.4
Anterior width . .	15.5	15.3
Posterior width . .	14.8	14.7
M^3—Length	15.0	16.0
Anterior width . .	15.0	15.5
Posterior width . .	13.3	13.1

The dentition, upper and lower, shows few differences from a Recent sample of *O. virginianus* (tables 35 and 36). The P^2 is slightly more elongate with anterior and posterior lobes somewhat better differentiated than the majority of Recent specimens available for comparison.

A sample of fossil *Odocoileus* from North Texas has been described by Slaughter et al. (1962) and Slaughter (1966b) as having the third lobe on M_3 relatively narrower than in Recent populations and in losing the fossette on the third lobe at an

TABLE 36. *Measurements (in mm) of mandibles and lower dentitions of* Odocoileus virginianus *from Ingleside, Texas.*

	Left (TMM 30967-1822)	Left (TMM 30967-283)	Left (TMM 30967-1628)
Total length of lower teeth	80.0	-------	-------
Length from P_2 to posterior end of symphysis	36.9	-------	-------
P_2 —Length	9.3	-------	-------
Width	4.9	-------	-------
P_3 —Length	11.2	10.9	-------
Width	6.4	6.5	-------
P_4 —Length	12.6	11.0	-------
Anterior width . . .	8.2	7.0	-------
Posterior width . . .	8.2	6.9	-------
M_1—Length	13.7	11.4	-------
Anterior width . . .	9.0	9.2	-------
Posterior width . . .	10.0	9.9	-------
M_2—Length	15.7	14.3	-------
Anterior width . . .	10.6	10.2	-------
Posterior width . . .	10.9	10.3	-------
M_3—Length	19.9	19.9	18.8
Anterior width . . .	10.9	10.2	9.5
Posterior width . . .	10.1	9.2	9.2

earlier stage of wear. Two of the three Ingleside specimens resemble the Recent sample in the width of the third lobe.

The North Texas sample described by Slaughter (ibid) loses the fossette on the third lobe of M_3 at a wear stage corresponding to a chronological age of four to five years, according to the criteria given by Severinghaus (1949). The Ingleside specimen in which the fossette is absent (TMM 30967-383) was about six years old at death. This is somewhat younger than its disappearance in Recent *O. virginianus* said by Slaughter (1966b) to be eight to nine years.

Most of the antler fragments which have the burr have a rounded spongy surface immediately below it, indicating that it was shed before burial. Some have pieces of the frontal bone attached, indicating that the animal died during the fall or winter when carrying antlers. None are particularly spongy, indicating that no animals are represented that were growing new antlers at the time of death, although it is possible that the absence of developing antlers may be simply the result of the lesser chance of preservation of spongy bone. This is interpreted as evidence that the sample of *Odocoileus* accumulated during the fall and winter seasons.

Family ANTILOCAPRIDAE

BREAMERYX MINOR (Taylor)

Capromeryx minor Taylor, 1911, Univ. California Pub., Bull. Dept. Geol. Sci., vol. 6, no. 10, pp. 191-197.
Breameryx minor (Taylor). Furlong, 1946, Carnegie Inst. Washington Pub. 551, pp. 135-140.

Material.—Left M_3 (TMM 30967-1323); M^1 (TMM 30967-1524); right dP^3 (TMM 30967-1579); 2 left astragali (TMM 30967-743, 1191); distal articular surfaces of 4 metapodials (TMM 30967-1049); a second phalanx (TMM 30967-1625); an ungual phalanx (TMM 30967-1700); a dorsal vertebra (TMM 30967-1143); a lumbar vertebra (TMM 30967-1695); horn core (TMM 30967-1563).

Remarks.—In size and form these specimens resemble most closely the material from McKittrick and Rancho La Brea. The M_3 (fig. 46) is slightly larger (15.0 mm vs. 13.3 mm) than the M_3 from McKittrick (Furlong, 1930) and is slightly smaller than *B. minimus* 15.0 mm vs. 15.7 mm) (Meade, 1942). It does not have the third lobe elongated as in the latter species. Significant comparison of the dentitions of the Ingleside material and *B. mexicana* (Furlong, 1925) is impossible at the present time because the lower dentition of that species is unknown and the upper dentition of the Ingleside form is represented only by M^1 and dP^3.

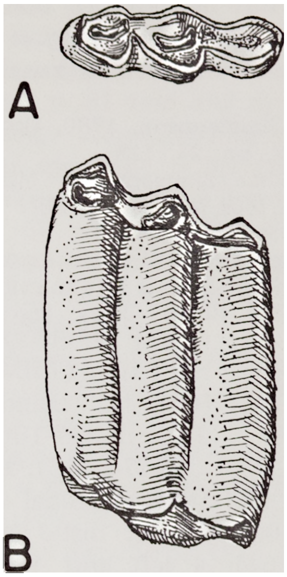

FIG. 46. *Breameryx minor.* Left M_3 (TMM 30967-1323). A, Occlusal view. B, Lateral view. x2.

The dP^3 is 11.8 mm long. It has two lobes of which the posterior is the larger both anteroposteriorly and laterally. Both lobes have complete inner selenes.

The horn core fragment consists of the lower 41 mm of a right hind prong. The front prong is broken away but obviously had a common base with the hind prong. The cross section of the hind prong is rounded, slightly elongate antero-posteriorly, and has a slight flattening on the anterior face near the base. There is a shallow narrow groove on the posterior face. The groove on the posterior face terminates ventrally above a deep, oval sulcus that is situated at the base of the horn core. The long axis of the sulcus is oriented vertically. Similar grooves and sulci are present on the hind prongs of *B. minimus*, *B. mexicana*, and *B. minor* from Rancho La Brea. The sulcus in *B. mexicana* and *B. minimus* is broader than in the Ingleside specimen or the Rancho La Brea material. The antero-posterior diameter of the hind prong at the point of divergence from the front prong is 11.0 mm. The transverse diameter at the same point is 9.9 mm.

The Ingleside material is referred to *B. minor* on the basis of the characters of M_3 and the hind prong. The differences between the various species of *Breameryx* are small and, as noted by Furlong (1946), may have been overemphasized.

Genus and Species Indeterminate

Material.—A right M^1 (TMM 30967-1035A); a right P^4 (TMM 30967-1034B); a second phalanx (TMM 30967-971).

Remarks.—These teeth are similar to those of the living *Antilocapra americana* but are somewhat larger than a specimen from West Texas. They are also larger than a series of *Stockoceras onusrosagris* given by Colbert and Chaffee (1939) and about the same size as those of *Tetrameryx*. The material is too fragmentary to allow a specific or generic identification. The length of the M^1 is 13.8 mm; length of the P^4 is 9.2 mm.

Family BOVIDAE

BISON ANTIQUUS Leidy

Bison antiquus Leidy, 1852, Proc. Acad. Nat. Sci., Philadelphia, vol. 6, p. 117.

Bison (Simobison) antiquus (Leidy). Skinner and Kaisen, 1947, Bull. Amer. Mus. Nat. Hist., vol. 89, no. 3, pp. 176-182.

Material.—Two crania with horn cores (TMM 30967-423, 1230); 3 left mandibular rami with dentitions (TMM 30967-408, 1128, 1055); 4 right mandibular rami with dentitions (TMM 30967-1133, 254, 1054, 1587); 1 juvenile left mandibular ramus with dP_3, dP_4, M_1, M_2 (TMM 30967-1039); 3 right humeri (TMM 30967-97, 329, 1781); 2 metacarpals and 1 metatarsal (TMM 30967-673, 690, 413); numerous isolated teeth and foot and toe bones.

Remarks.—The two skulls, representing a male and a female, have well-preserved horn cores that permit comparison with other material. The male skull (TMM 30967-423) (figs. 47 and 48) has only the braincase and horn cores preserved while the female skull (figs. 49 and 50) is essentially complete. In both skulls the horn cores make an angle near 90° with the midline of the skull. The horn cores of both skulls dip downward on leaving the skull to the tops of the occipital condyles then curve up, but the tips of the horn cores do not reach the level of the top of the skull. The horn

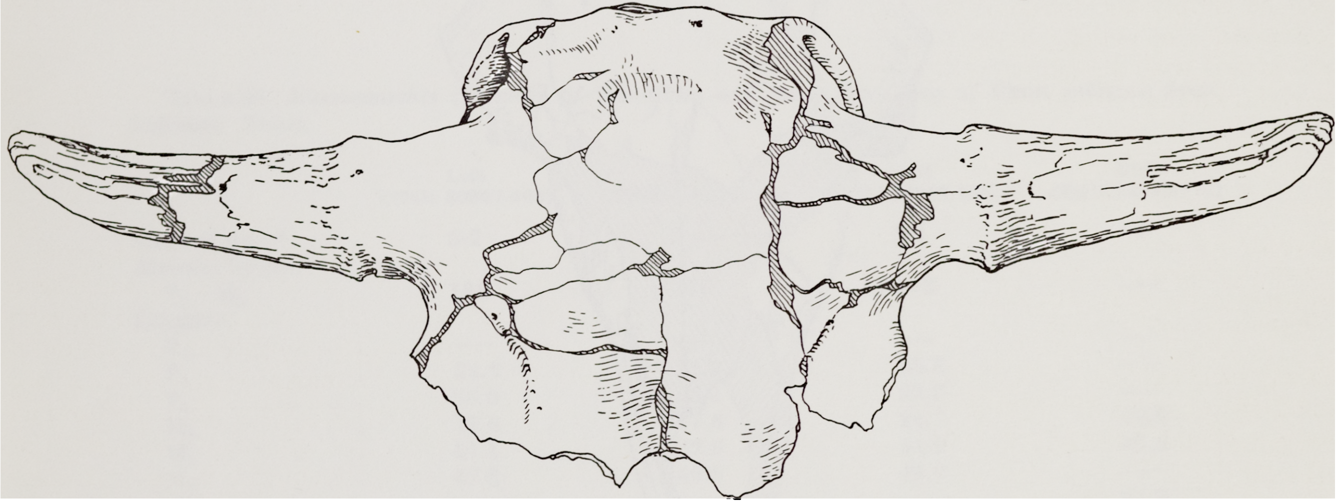

FIG. 47. *Bison antiquus.* Dorsal view of male skull (TMM 30967-423). x1/5.

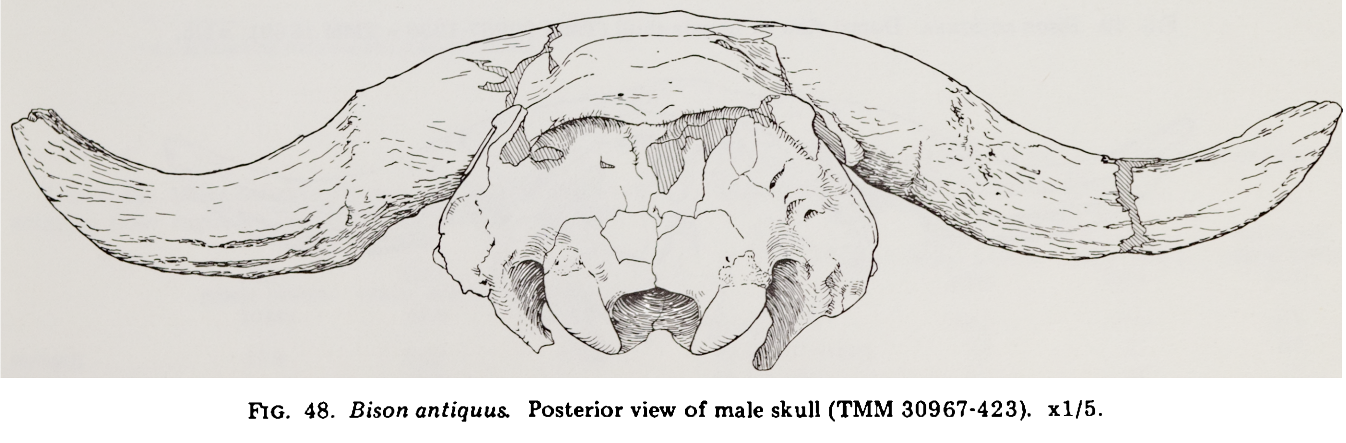

FIG. 48. *Bison antiquus.* Posterior view of male skull (TMM 30967-423). x1/5.

cores are circular in cross sections. The ends of the horn cores are blunt, particularly in the male skull, and are turned slightly posteriorly. The dorsal surface of the horn cores have grooves which are not twisted posteriorly at the tips. The frontals are arched and the cranium is broad, especially in the male skull.

The dimensions of the horn cores (table 37) fall in the range given by Skinner and Kaisen (1947) for both *B. occidentalis* and *B. antiquus.* The right angle formed by the axes of the horn cores and the skull and the absence of twisting of the grooves of the horn cores indicate that the Ingleside material should be referred to *B. antiquus.*

The dentition shows no distinctive characters (table 38). Two of the mandibular rami (TMM 30967-1128, 1133) show P_4's with posterior fossettes. In both specimens the teeth are deeply worn. None of the less deeply worn teeth show the closure of the lingual fold to form a fossette. This agrees with the statement of Skinner and Kaisen regarding this character in the extinct species of *Bison.*

The post-cranial material shows no distinctive size or morphological characters (tables 39 and 40).

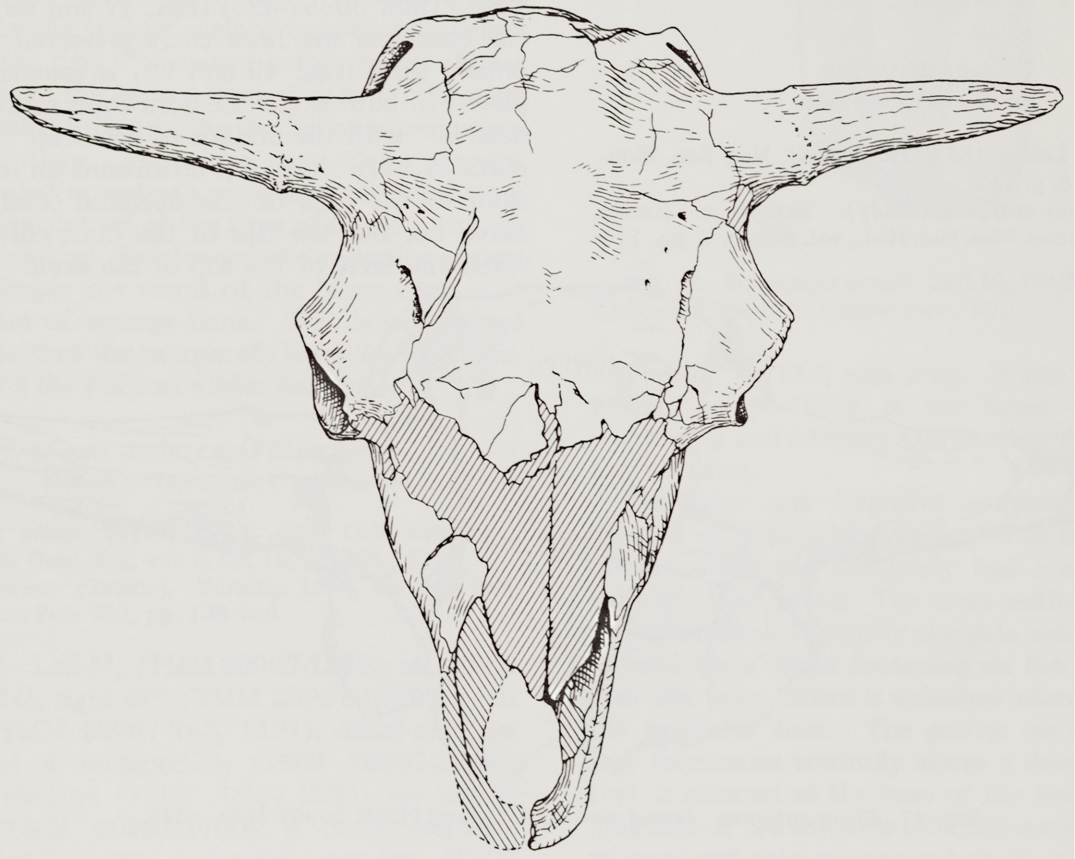

FIG. 49. *Bison antiquus.* Dorsal view of female skull (TMM 30967-1230 = TMM 1860). x1/5.

FIG. 50. *Bison antiquus.* Posterior view of female skull (TMM 30967-1230 = TMM 1860). x1/5.

TABLE 37. *Measurements (in mm) of skulls of* Bison antiquus *from Ingleside, Texas, compared with measurements of skulls of* B. antiquus *and* B. occidentalis.

	Ingleside		*B. antiquus**			*B. occidentalis**		
	(TMM 30967-423)	(TMM 1860)	min.	aver.	max.	min.	aver.	max.
*(1) Spread of horn cores, tip to tip	921	684	816	881	975	670	747	875
(2) Spread of horn cores, outside curve . . .	934	------	------	------	------	735	782	892
(3) Core length, upper curve, burr to tip . . .	275	161	220	281	344	222	279	330
(4) Core length, lower curve, burr to tip . . .	320	217	280	336	395	275	340	405
(5) Length, tip to burr, chord	253	161	197	245	280	210	243	290
(6) Vertical diameter, horn core	97	60	90	98	108	76	91	100
(7) Circumference of horn core, at base . . .	290	210	290	320	358	253	290	336
(8) Greatest width at auditory opening	312	------	------	------	------	259	275	307
(9) Width of condyles	143	135	------	------	------	124	131	147
(10) Depth from occipital crest to top of foramen magnum	110	------	------	------	------	------	------	------
(11) Depth from occipital crest to bottom of foramen magnum	151	------	------	------	------	136	158	177
(12) Transverse diameter of horn core	105	62	92	107	122	85	98	114
(13) Width between bases of horn cores	295	248	------	------	------	------	------	------
(14) Width between horn cores and orbit . . .	337	269	292	319	357	277	299	340

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*Numbers of measurements and measurements taken from Skinner and Kaisen (1947).

TABLE 38. *Measurements (in mm) of mandibles and lower dentitions of* Bison antiquus *from Ingleside, Texas.*

	Left (TMM 30967-408)	Left (TMM 30967-1128)	Left (TMM 30967-1055)	Right (TMM 30967-778)
Stage of wear*. . .	S-2	S-4 (early)	S-4	I-5
Alveolar length, $P_2 - M_3$	183	179	172	------
Length—				
P_2	------	------	------	------
P_3	21.2	21.9	20.6	------
P_4	26.0	23.1	22.0	------
M_1	29.6	27.6	26.7	36.9
M_2	37.1	32.6	31.9	45.5
M_3	47.8	49.5	49.0	------
dP_3	------	------	------	21.9
dP_4	------	------	------	39.3

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*As defined by Skinner and Kaisen (1947).

TABLE 39. *Measurements (in mm) of humeri of* Bison antiquus *from Ingleside, Texas.*

	Right (TMM 30967-1781)	Right (TMM 30967-329)	Right (TMM 30967-97)
Length . . .	353	368	370
Proximal width	------	114	------
Distal width .	106	105	114

TABLE 40. *Measurements (in mm) of metapodials of* Bison antiquus *from Ingleside, Texas.*

	Metacarpal (TMM 30967-673)	Metacarpal (TMM 30967-690)	Metatarsal (TMM 30967-413)
Length . . .	241	235	281
Proximal width	79	71	67
Mid-width . .	47	40	41
Distal width .	86	72	77

Order PERISSODACTYLA

Family TAPIRIDAE

TAPIRUS EXCELSUS Simpson

Tapirus excelsus Simpson, 1945, Bull. Amer. Mus. Nat. Hist., vol. 86, pp. 37-81.

Tapirus veroensis Sellards, 1940, Bull. Geol. Soc. Amer., vol. 51, pp. 1627-1658.

Material.—A juvenile left mandibular ramus with dP_2 and dP_3 erupted (TMM 30967-967); a juvenile right mandibular ramus which had the deciduous premolars and M_1 in use although only dP_4 and M_1 remain in the specimen (TMM 30967-917); a pair of juvenile mandibular rami with dP_{2-3} in place but ready to be replaced, dP_4 and M_1 in place, M_2 still deeply buried in the jaw (TMM 30967-1161, 1324); a pair of mandibular rami with M_3 unerupted, P_4 just erupting (TMM 30967-1422A, B); an adult left mandibular ramus with all permanent teeth in place (TMM 30967-1237); a palate with dP^4 and M^1 in place (TMM 30967-1211); a pair of mandibular rami with P_{2-3}, M_{1-2} in place, P_4 just erupting (TMM 30967-193); a left maxilla in which dP^{1-4} and M^1 were functional (specimen has dP^{3-4}, M_1 preserved) (TMM 30967-1984); a femur (TMM 30967-1393); radius (TMM 30967-1082); juvenile radius (TMM 30967-1130); acetabulae of pelvis (TMM 30967-1297, 1325); atlas (TMM 30967-1282); cervical vertebra (TMM 30967-1852); right and left juvenile femora (TMM 30967-1019, 1136); left juvenile humerus (TMM 30967-1228); right juvenile tibia (TMM 30967-1057); part of a left scapula (TMM 30967-463).

Remarks.—The dentition of the Ingleside material has the basic structure seen in *T. terrestris*, *T. veroensis*, and *T. excelsus*. The P^1 is triangular with the protocone located in the posterior half of the tooth. There is no well-defined cusp anterior to the protocone on the inner side of the tooth as is reported by Simpson (1945) for *T. terrestris*. However, a specimen of *T. terrestris* in The University of Texas, Austin, collections (TMM M-16) also lacks this cusp on the P^1. The P^1 of the Ingleside material differs greatly from that of *T. copei* in which the protocone is very large and borders a well-developed central basis. The P^1 of the Ingleside tapir has three well-defined cusps along the external side with the anterior one the highest.

The P^2 is more molariform than that of *T. veroensis* or *T. terrestris*. There is little difference in the anterior and posterior widths. It does not quite approach the condition seen in *T. copei*, in which the anterior and posterior widths are equal.

None of the upper permanent teeth have basal tubercles on the outer sides of the teeth between the paracone and metacone, although almost all show a slight swelling in this area (fig. 51). There is no well-developed basal tubercle on the inner side of the tooth between the protocone and hypocone, although as with the outer edge a swelling is present on some specimens. No well-developed external cingulum has been observed but some specimens show a swelling around the outside base of the tooth. The ectoloph crest shows a distinct notch close to the metacone in all unworn teeth. Some of the lower teeth have small tubercles on the lingual sides of the teeth between the lophids (fig. 52).

Simpson (1945) has shown that these tubercles, cingulae, etc., exhibit considerable variation in a sample of *T. veroensis* from Seminole, Florida. The Ingleside sample, though small, shows less variation in these characters than Simpson indicates for *T. veroensis*.

The teeth of the Ingleside sample are in general somewhat larger than those of the Seminole sample (table 41). The widths of all three dP_4's and the anterior widths of all three M_2's lie above the upper limits of the standard ranges of the homologous dimensions given by Simpson for the Seminole sample of *T. veroensis*. The dimensions of several other teeth (anterior width of one dP^2; posterior width of one dP^3; length, anterior width, posterior width of one dP^4; length of three P_3's; length, anterior width, posterior width of one dP_3; anterior width, posterior width of one dP_4) are larger than and fall outside the observed range of the sample of *Tapirus veroensis* from Seminole but are close to the values of the corresponding measurements of *T. excelsus*. Three P_3's have anterior widths smaller than and outside the observed range of the small sample from Seminole.

The teeth of the Ingleside sample differ very little in size from those of *T. excelsus*, although the samples are too small to permit statistical comparison. The Ingleside sample and the type of *T. excelsus* differ most from the Seminole sample of *T. veroensis* in the same tooth dimensions. Simpson (1945) noted that the most marked size differences in the dentition between the type of *T. excelsus* and the Seminole sample of *T. veroensis* are the widths of the dP_4. The same difference exists between the Ingleside sample and the Seminole sample (table 42). The Ingleside tapirs resemble the type of *T. excelsus* and another specimen from Missouri referred to *T. excelsus* by Parmalee et al. (1969) in having all the upper teeth except P^1 wider than long.

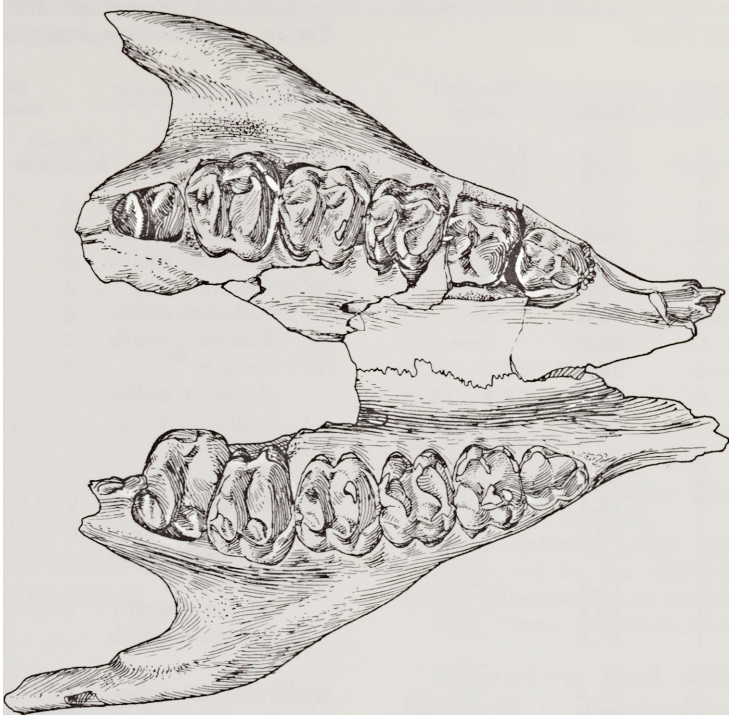

FIG. 51. *Tapirus excelsus.* Ventral view of palate (TMM 30967-1211). The left side shows dP^2, dP^3, dP^4, M^1, and M^2 in place, M^3 unerupted. The right side has the dP^2 and dP^3 removed to show the unerupted P^2 and P^3. x1/2.

The tooth ratios used by Simpson to show proportions are given in tables 43 and 44. There are few differences observable. The length/width ratio of dP_4 and the anterior-width/posterior-width ratio of one of three M_2's from Ingleside fall outside the standard ranges of those ratios of the Seminole sample of *T. veroensis.*

A comparison of the dental dimensions and ratios of the Ingleside tapirs with those of a small sample of *T. veroensis* from Hornsby Springs, Florida, reported by Bader (1957), shows only minor differences that cannot be shown to have any significance because of the small sample size. However, they are the same differences which are found between the Ingleside material and Simpson's sample of *T. veroensis* from Seminole.

The sequence of eruption and replacement of the teeth is the same as that outlined by Simpson (1945) for tapirs in general. The ages at which the teeth erupt and are replaced are not known in Recent tapirs. Simpson (ibid) mentioned one specimen of known age at death (13 months) which has dP^4_4 still functional and M^2_2 not yet in place. If *T. excelsus* followed the same schedule, then one specimen (TMM 30967-967) (fig. 53) with only dP_{2-3} in place is certainly younger than this. Another (TMM 30967-1161) with dP_{2-4} still functioning and M_2 unerupted is probably somewhat younger than 13 months. Three other ages over 13 months are represented.

The atlas is similar to that of *Tapirus excelsus* described by Simpson (1945). It differs from *Tapirus terrestris* in having transverse processes squarer on the ends and posterior corners which

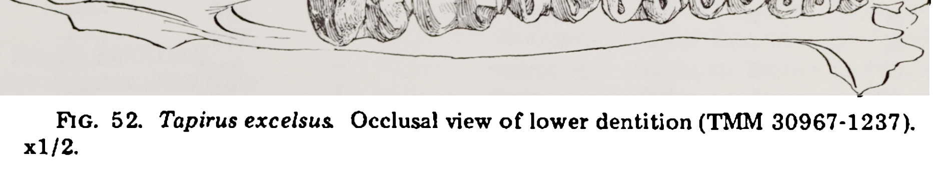

FIG. 52. *Tapirus excelsus.* Occlusal view of lower dentition (TMM 30967-1237). x1/2.

TABLE 41. *Numerical data on permanent dentitions of* Tapirus excelsus *from Ingleside, Texas.*

	No. of specimens	Mean	Observed range
P_2 —Length	5	25.2	24.2 - 26.0
Width	4	15.6	15.0 - 16.0
P_3 —Length	3	21.8	21.2 - 22.2
Anterior width . .	3	16.3	16.1 - 16.6
Posterior width . .	3	18.7	18.5 - 18.9
P_4 —Length	1	22.8	------
Anterior width . .	1	22.8	------
Posterior width . .	1	20.7	------
M_1—Length	4	23.3	22.7 - 24.2
Anterior width . .	4	19.3	18.9 - 19.9
Posterior width . .	4	18.0	17.5 - 18.8
M_2—Length	3	25.7	24.3 - 26.5
Anterior width . .	3	20.9	20.6 - 21.6
Posterior width . .	3	19.4	19.2 - 19.6
M_3—Length	1	26.7	------
Anterior width . .	1	------	------
Posterior width . .	1	17.5	------
P^1 —Length	1	19.1	------
Width	1	15.5	------
P^2 —Length	--	------	------
Anterior width . .	1	21.2	------
Posterior width . .	1	23.3	------
P^3 —Length	1	21.5	------
Anterior width . .	1	26.0	------
Posterior width . .	1	25.8	------
M^1—Length	2	23.5	21.3 - 25.6
Anterior width . .	2	27.1	26.2 - 27.9
Posterior width . .	1	29.2	------
M^2—Length	1	25.3	------
Anterior width . .	1	30.5	------
Posterior width . .	1	27.2	------

TABLE 42. *Numerical data on deciduous dentitions of* Tapirus excelsus *from Ingleside, Texas.*

	No. of specimens	Mean	Observed range
dP^1—Length	1	17.5	------
Width	1	16.9	------
dP^2—Length	1	18.9	------
Anterior width .	1	20.0	------
Posterior width .	1	20.7	------
dP^3—Length	1	19.9	------
Anterior width .	1	21.7	------
Posterior width .	1	21.2	------
dP^4—Length	2	23.3	22.2 - 24.4
Anterior width .	2	25.2	24.3 - 26.0
Posterior width .	2	22.9	22.5 - 23.4
dP_2—Length	1	27.5	------
Width	1	16.0	------
dP_3—Length	1	24.6	------
Anterior width .	1	17.0	------
Posterior width .	1	16.5	------
dP_4—Length	3	22.2	20.9 - 23.6
Anterior width .	3	18.3	18.0 - 19.1
Posterior width .	1	17.1	------

do not extend as far posteriorly beyond the posterior articular surfaces. The dorsal tubercle is well developed but is well rounded in contrast to the condition in *T. terrestris* where it is much more pointed because of the formation of a broad depression on each side of the muscle attachments. The neural canal is almost circular. The maximum width of the atlas is 141 mm.

The scapula consists of the ventral one-third of the bone with the anterior edge broken away. It resembles the scapula of *T. excelsus* in its apparent greater proportionate width, wider post-spinous fossa, and flatter medial surface than are found in the scapula of *T. terrestris.*

The adult radius is slightly shorter and heavier than that of *T. terrestris* but the difference is probably not significant. With one exception ridges and processes for muscle attachments and the articular surfaces are very much alike in the Ingleside material and *T. terrestris.* The Ingleside specimens have a very deep pit immediately above the distal articular surface for the ulna. This is lacking in the specimen of *T. terrestris* in which there is a slightly roughened triangular area in this

TABLE 43. *Numerical data on ratios of upper dentitions of* Tapirus excelsus *from Ingleside, Texas.*

	100 x maximum width / length			100 x anterior width / posterior width		
	No. of specimens	Mean	Observed range	No. of specimens	Mean	Observed range
P^1 .	1	81	-------	--	-------	-------
P^2 .	--	-------	-------	1	91	-------
P^3 .	1	120	-------	1	100	-------
M^1 .	2	116	109 - 123	1	108	-------
M^2 .	1	108	------	1	110	-------
dP^1 .	1	97	-------	--	-------	-------
dP^2 .	1	109	-------	1	97	-------
dP^3 .	1	109	-------	1	102	-------
dP^4 .	2	108.5	108 - 109	2	109	108 - 111

TABLE 44. *Numerical data on ratios of lower dentitions of* Tapirus excelsus *from Ingleside, Texas.*

	100 x maximum width / length			100 x anterior width / posterior width		
	No. of specimens	Mean	Observed range	No. of specimens	Mean	Observed range
P_2 .	4	62	58 - 66	-	------	-------
P_3 .	3	85.6	84 - 87	3	87	86 - 88
P_4 .	1	91	-------	1	97	-------
M_1 .	4	83	79 - 85	4	107	105 - 109
M_2 .	3	81.6	78 - 82	3	109.6	106 - 115
dP_3 .	1	69	------	1	103	-------
dP_4 .	1	86	-------	1	105	-------

position. This suggests the ulna had extended its articulation with the radius upward. The two bones are very close in this region in *T. terrestris.* Simpson (1945) did not mention this feature in his description of *T. excelsus.* The radius of *T. veroensis* from Florida has not been described.

FIG. 53. *Tapirus excelsus.* Occlusal view of juvenile left lower dentition with dP_2, dP_3, and part of unerupted dP_4 (BEG 30967-967). x1/2.

The femur is incomplete, making it impossible to compare relative proportions. The trochanters are no different from those of *T. terrestris.* The scar for the gastrocnemius muscle is very deep, much deeper than in *T. terrestris.* In this character the Ingleside specimen resembles *T. excelsus* but once again comparison with *T. veroensis* from Florida is impossible because the femur of the latter species is unknown.

The proximal epiphysis of the juvenile tibia is missing. It shows no differences from *T. terrestris.*

The Ingleside sample of *T. excelsus* indicates a wide geographic range for this species. The type is from Missouri. The presence of this species in southern Texas lends support to the suggestion of Simpson that a number of isolated specimens of *Tapirus* from the Midwest might belong to *T. excelsus.*

Family EQUIDAE

EQUUS COMPLICATUS Leidy

Equus complicatus Leidy, 1858, Proc. Acad. Nat. Sci. Philadelphia, p. 11.

Equus complicatus Leidy. Gidley, 1901, Bull. Amer. Mus. Nat. Hist., vol. 14, p. 109.

Equus complicatus Leidy. Hay, 1913, Proc. U. S. Nat. Mus., vol. 44, pp. 569-594.

Equus complicatus Leidy. Sellards, 1940, Bull. Geol. Soc. Amer., vol. 51, pp. 1627-1658.

Onager (Hesperohippus) complicatus (Leidy). Quinn, 1957a, Univ. Texas, Bur. Econ. Geology Rept. Inv. 33, p. 20.

Material.—A skull with worn dentition (TMM 30967-401); 4 complete right upper dentitions (TMM 30967-948, 1540, 389, 291); 3 nearly complete left upper dentitions (TMM 30967-1328, 947, 379); a mandible (TMM 30967-410); an incomplete left mandibular ramus with P_2 through M_1 (TMM 30967-870); 3 right upper molars (TMM 30967-1487, 948, 1870); 2 right M^3's (TMM 30967-3799, 389G); 2 upper premolars (TMM 30967-1640, 379A); 4 left M_3's (TMM 30967-1488, 719, 518, 934); 4 right M_3's (TMM 30967-1667, 379, 937, 933); left P_2 (TMM 30967-376); right P_3 through M_1 (TMM 30967-390A, 390B, 390D); right and left lower premolars (TMM 30967-1667); 932); 5 left and 2 right lower molars (TMM 30967-713, 390C, 1667, 1499, 1667A, 291, 1667B); 7 deciduous upper premolars (TMM 30967-223, 925, 924, 927, 1096, 713, 926); 2 left and 1 right radii (TMM 30967-853, 146, 860); 2 first phalanges of the manus and 1 first phalanx of the pes (TMM 30967-942, 1170, 1569); 3 second phalanges (TMM 30967-1570, 1478, 1018); a left and right magnum (TMM 30967-960); a right cuboid (TMM 30967-1702).

Remarks.—The dorsal surface of the skull is not preserved. The tooth rows are parallel; the incisive fissures are relatively long, narrow, and equally tapered at the ends (fig. 54). In these characters it resembles the Recent horse and differs from the asses and zebras in which the tooth rows converge anteriorly and the incisive fissures are more rounded anteriorly. The posterior ends of the incisive fissures are posterior to the canines. The major palatine foramina open opposite the middle of M^3. The posterior edges of the palatines are located opposite the anterior half of M^3.

The ventral surface of the basioccipital and basisphenoid is not as strongly keeled as in the Recent zebras but is deeper than in the Recent ass. The inferior condyloid fossa is deep relative to its width, which results in a vertical orientation of its medial wall. As a result of this the hypoglossal foramen is largely hidden by the basioccipital in ventral view. In these characters the Ingleside skull is similar to the Recent horse and zebra and different from the ass.

The alveolar region of the premaxilla is not turned downward as sharply as in the Recent horse, ass, or the zebra. The alveolar width of the premaxillaries is much narrower than in *E. pacificus.* Both the Ingleside skull (TMM 30967-401) and the skull of *E. pacificus* from Tequixquiac, Mexico (the type of *E. (Hesperohippus) mexicanus* Hibbard) have large canines and are both presumably males. This rules out the possibility that sexual dimorphism is responsible for the difference in size or width of muzzle. The palatal processes of the premaxillary are located in a depression which is shallower than in any of the Recent forms mentioned above. Their posterior ends are located 13 mm anterior to P^2. This is proportionately similar to the Recent horse and different from the zebra in which it is more anterior and the ass in which it is located at the edge of P^3. (*See* table 45 for measurements.)

TABLE 45. *Measurements (in mm) of skull of* Equus complicatus *from Ingleside, Texas.*

	TMM 30967-401
Basal length of skull	616
Length from P^2 to M^3	184
Length of palate (premaxilla-posterior edge of palate)	309
Length of pre-C diastema (alveolar measurement)	28.5
Length of post-C diastema (alveolar measurement)	55
Length of C (alveolus)	16.9
Width of C (alveolus)	12.1
Width of occipital condyle	99.7
Width at paroccipital process	125
Width at glenoid fossae	239
Width across M^3 (outside)	131
Width across anterior end of P^2 (outside)	90
Width across C (outside)	71
Minimum width of post-C diastema	60
Minimum width of pre-C diastema	68
Length of incisive fossa	110
Length of palate from posterior edge of incisive fossa	171

The upper teeth are large (table 46) and P^3 through M^3 are nearly square in cross section (fig. 55). The P^1 is absent. The protocones are elongated and flattened to varying degrees on the lingual side. There is a tendency for the flattening to increase in the posterior teeth. There is usually a groove on the lingual surface of the protocone. A small pli caballin is usually present on the premolars and less frequently on the molars. The hypoconal groove is well developed on all teeth. It is closed off in the M^3's and either forms a separate isolated lake or is joined to the posterior fossette. The parastyle and mesostyle are large and open and in many premolars are bifurcate. There is a tendency, especially strong in the molars, for the anterior part of the ectoloph to be strongly asymmetrical in its curvature between the parastyle and mesostyle. This results in the deepest part of the curve occurring very close to the mesostyle.

TABLE 46. *Measurements (in mm) of upper dentitions of* Equus complicatus *from Ingleside, Texas.*

	TMM 30967-947	TMM 30967-1328	TMM 30967-78	TMM 30967-312	TMM 30967-401
Length along ectoloph—					
P^2	40.6	42.4	41.8	42.2	40.1
P^3	32.9	31.1	33.4	31.9	29.3
P^4	30.2	29.0	31.4	------	28.5
M^1	26.8	24.1	26.2	28.0	25.1
M^2	28.4	26.7	27.4	27.8	26.9
M^3	25.3	37.5	30.8	34.5	34.1
Width normal to parastyle-mesostyle—					
P^2	26.7	28.6	25.7	28.4	24.7
P^3	28.7	31.5	29.3	31.0	28.7
P^4	26.6	33.0	28.6	------	30.6
M^1	------	28.9	27.2	28.5	28.2
M^2	25.3	29.0	26.9	27.0	26.7
M^3	20.8	26.7	23.1	24.1	23.7

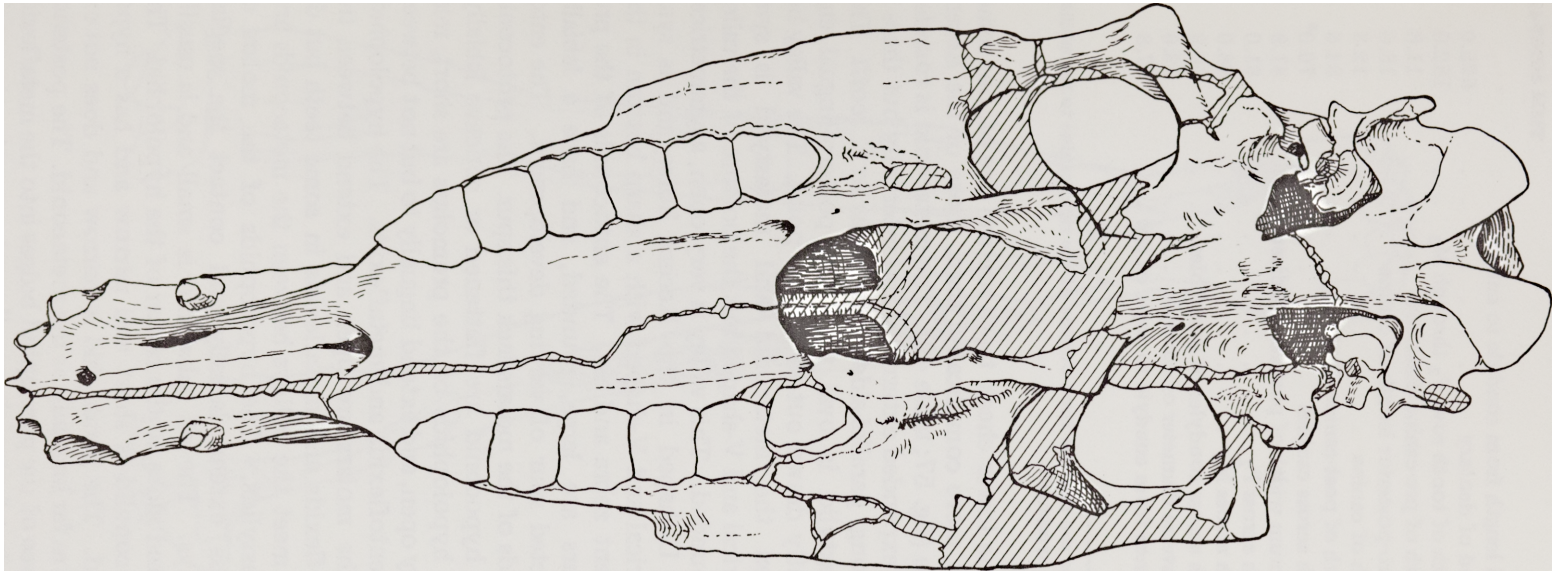

FIG. 54. *Equus complicatus.* Ventral view of skull (TMM 30967-401). x1/3.

FIG. 55. *Equus complicatus.* Occlusal view of left upper dentition (TMM 30967-379L). x1.

The fossettes have a variable number of folds on both the anterior and posterior faces. The inner fold on both faces of both fossettes is large and deep and produces a distinct lobe on the lingual side of the fossette. The number of secondary folds on the fossettes of P^3 through M^3 is shown in table 47. It can be seen that the posterior side of the anterior fossette and the anterior side of the posterior fossette possess the higher number of secondary folds. The number and size of the folds decrease in deeply worn teeth.

TABLE 47. *Number of plications on fossettes of upper cheek teeth of* Equus complicatus *from Ingleside, Texas.*

	Anterior side	Posterior side
Anterior fossette	0 - 1	2 - 5
Posterior fossette	0 - 3	0 - 2

The posterior end of the protocone is located much farther lingually than the hypocone. In this it differs from Recent *Equus caballos*, ass, and zebra in which the hypocone is located as far lingually as the posterior end of the protocone.

The post-protoconal groove is narrower in proportion to the size of the tooth than it is in *E. scotti.*

The mandible resembles that of the ass and to a lesser extent that of the zebra (fig. 56). The ventral margin of the horizontal ramus is convex and extends below a line joining the angular process and the symphysis as in the mandible of the ass. Zebra mandibles show this convexity but it usually does not extend below the level of the angular and the symphysis. The ventral margins of horse mandibles are usually straight or show slight convexity and do not extend below the level of the angular process and the symphysis.

The mandibular foramen is located at or slightly dorsal to the line extending the tooth row posteriorly. The foramen is located ventral to this line in the zebra, Recent horse, and ass. It is only slightly ventral to it in the zebra.

The diastema between the lower canine and I_3 is very short in relation to the size of the jaw (table 48). It more closely resembles the zebra and ass in this character than in the Recent horse.

The antero-posterior dimension of the ascending ramus at the level of the condyle is greater relative to the length of the tooth row than in the Recent horse, zebra, or ass.

The lower incisors are deeply worn and it is not known whether infundibulae were present, although their cross sectional shape suggests that they were.

TABLE 48. *Measurements (in mm) of mandible of* Equus complicatus *from Ingleside, Texas.*

	TMM 30967-410
Total length from condyle to anterior end of dentary	523.0
Length of tooth row, P_2 through M_3	182.0
Length of pre-canine diastema	11.8
Antero-posterior length of canine	15.0
Width of canine	12.3
Length of post-canine diastema	84.6
Width across canines	70.0[a]
Minimum width of post-canine diastema	41.9
Width across P_2	81.0
Width across M_3	98.0
Width across condyles of mandibles	20.9
Transverse diameter of condyle	63.6
Distance from condyle to angle of jaw	27.8

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[a] Twice the distance from outside of the right canine to the midline of the symphysis.

The lower cheek teeth are the size of, but somewhat more complicated than, those of the Recent horse (fig. 57; table 49). The metaconid is rounded and expanded externally and internally but there is no long, parallel-sided isthmus as in *E. scotti.* The metastylid is oval with the postero-lingual end slightly drawn out to form a point. The valley between the metaconid and metastylid is symmetrical and V-shaped but the bottom of the valley is rounded. This valley is very open, asymmetrical, and U-shaped in the Recent horse and is symmetrical and V-shaped with a sharp bottom in the Recent zebra and ass. The entoconids of the premolars are large, rounded, and have a labially directed spur of varying development. The entoconids of the molars lack this spur. The protoconid and hypoconid are flattened or concave labially. The hypolophids of the premolars are short, relatively open, and extend lingually to but not between the entoflexids and metaflexids. The hypolophids of the molars are open and extend between the entoflexids and metaflexids in some teeth but do not meet the valleys between the metaconids and metastylids. The hypolophids of the molars of zebras extend labially and contact the median valleys. The pli caballinid is small and is usually located close to the center of the hypolophid. The entoconulid is short and narrow and has a hypostylid. The paralophid is narrow and does not extend as far lingually as the metaconid. The posterior surface of the paralophid bulges into the metaflexid. This last feature is usually not present or is poorly developed in *E. scotti.* It is variable in a sample of *E. burchelli* from Kenya.

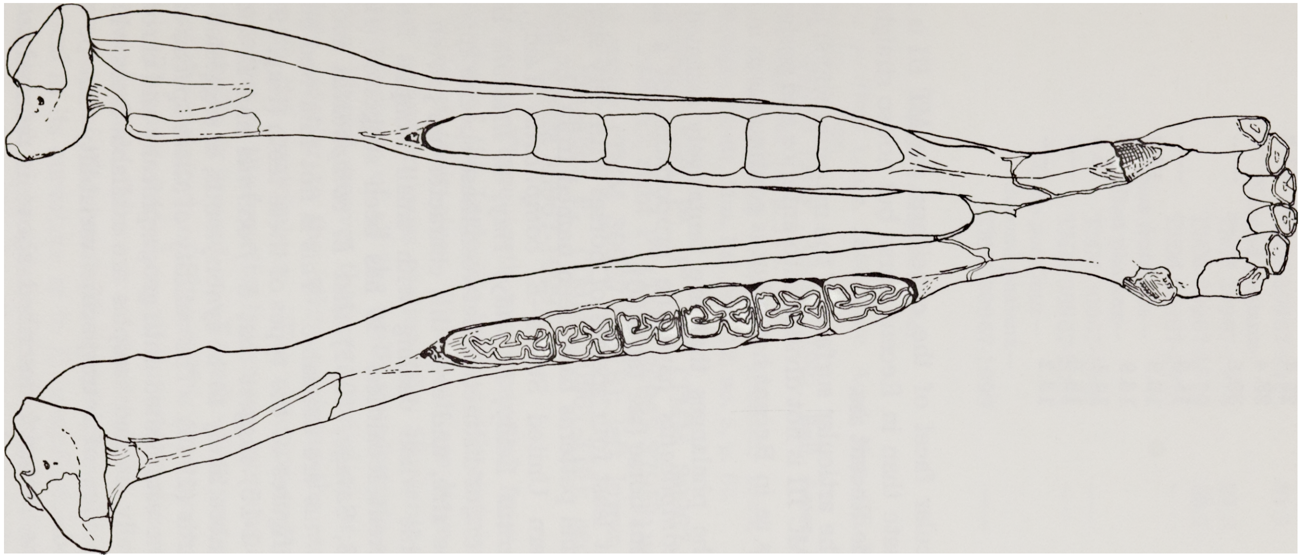

FIG. 56. *Equus complicatus.* Dorsal view of mandible (TMM 30967-410). x1/3.

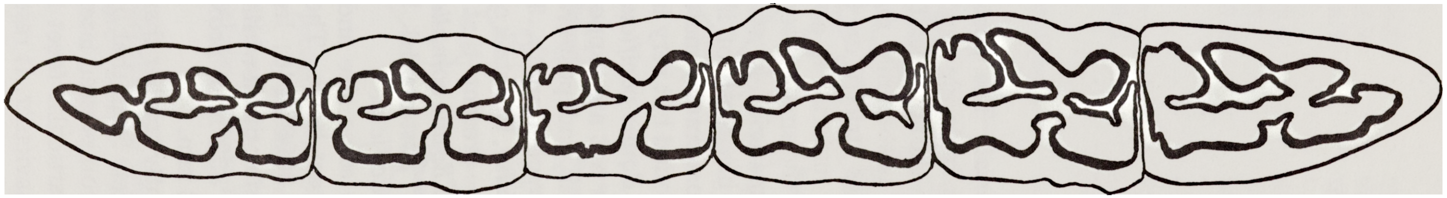

FIG. 57. *Equus complicatus.* Occlusal view of right lower dentition (TMM 30967-410). x1.

TABLE 49. *Measurements (in mm) of lower dentitions of* Equus complicatus *from Ingleside, Texas.*

	TMM 30967-410	TMM 30967-879	TMM 30967-1770	TMM 30967-390
Total length—				
P_2	35.1	38.5	34.0	------
P_3	27.6	31.9	29.7	31.0
P_4	28.4	31.2	29.8	28.2
M_1	26.0	27.1	25.4	27.2
M_2	27.5	------	28.4	------
M_3	35.8	------	39.6	------
Width—				
P_2	16.5	15.6	15.3	------
P_3	17.1	16.8	16.9	17.3
P_4	17.6	15.0	16.9	17.3
M_1	15.1	13.9	14.1	16.4
M_2	15.3	------	15.3	------
M_3	13.5	------	13.2	------

Post-cranial material.—The post-cranial material of the equids from Ingleside can be divided into three size groups. In the absence of any associations between teeth and post-cranial material the latter is assigned to species strictly on the basis of size. The smallest sized material is assigned to *Equus fraternus* which has the smallest teeth. The middle-sized post-cranial material is assigned to *Equus complicatus* which has teeth of intermediate size. The largest-sized post-cranial material which consists only of one eroded but very large second phalanx is assigned to *Equus pacificus.* These assignments are uncertain but are supported by the size distributions of teeth and post-cranial material of equids from Henderson County, Texas, where, as noted by Quinn (1957a), two sizes of teeth and post-cranial material are present that correspond to *Equus fraternus* and *Equus complicatus.* There are no large teeth or post-cranial bones that are referable to *Equus pacificus.*

The radii are the same size and proportions as those of a large Recent horse. The dimensions are as follows: TMM 30967-146; length, 346 mm; proximal width, 98 mm; distal width, 89 mm. TMM 30967-853: length, 352 mm; proximal width, 98 mm; distal width, 82 mm.

The cuboid is slightly smaller than that of a large Recent horse. It differs from that of a large Recent horse in being more compressed laterally and having a narrower anterior articular facet for the calcaneum, astragalus, and navicular. It resembles that of a Recent ass in these characters. It completely lacks the posterior articular facet for the calcaneum.

The navicular and cuneiform differ from those of the Recent horse only in very minor details. The articular facet of the cuneiform for MT III is less arcuate than in Recent horse but not so straight as in the Recent ass.

The articular surface of the magnum which joins the MC III is not divided into anterior and posterior parts as in Recent horse but is continuous as in the ass.

The phalanges that are tentatively assigned to *E. complicatus* have the proportions of a large Recent horse (*see* table 50).

At least four species of horses with very similar enamel patterns have been named from the southeastern United States—*E. complicatus* Leidy, *E. fraternus* Leidy, *E. leidyi* Hay, *E. littoralis* Hay. The major distinction between these species appears to be size, and even this character has proven unreliable when dealing with small samples from different localities. It has been suggested (Hay, 1913; Savage, 1951) that *E. complicatus* and *E. fraternus* are the same. This is not followed here. The figures of the types of these teeth (Hay, 1913, figs. 1-15) suggest that *E. fraternus* and *E. leidyi* are more likely to be synonymous, as suggested by Sellards (1940). The validity of these species cannot be established until geographically and chronologically unified samples are available from which some idea of intraspecific variability can be obtained.

The material described above is referred to *E. complicatus* because it resembles the type in morphology and size more closely than that of any other species. It differs from *E. fraternus* in being slightly larger. It differs from *E. pacificus* in the smaller size of the teeth and the narrower alveolar width of the premaxillary.

TABLE 50. *Measurements (in mm) of phalanges of equids from Ingleside, Texas.*

	Length	Proximal width (articular surface)	Distal width	Mid-width
Equus complicatus—				
First phalanx—				
TMM 30967-1170	83.0	56.3	48.8	38.5
TMM 30967-1569	84.1	54.2	46.2	39.3
TMM 30967-942	81.1	53.6	44.7	39.7
Second phalanx—				
TMM 30967-1478	37.3	45.4	45.5	43.5
TMM 30967-1570	39.1	46.8	47.1	44.6
TMM 30967-1018	------	47.8	47.2	45.2
Equus fraternus—				
First phalanx—				
TMM 30967-1569	------	46.5	------	29.9
TMM 30967-2054	------	------	39.3	31.2
Equus pacificus—				
Second phalanx—				
TMM 30967-1099	------	53.9	52.3 (est.)	52.2

EQUUS PACIFICUS Leidy

Equus pacificus Leidy, 1868, Proc. Acad. Nat. Sci. Philadelphia, p. 195.

Equus pacificus Leidy. Gidley, 1901, Bull. Amer. Mus. Nat. Hist., vol. 14, p. 116.

Equus (Hesperohippus) mexicanus Hibbard, 1955, Univ. Michigan, Contr. Mus. Pal., vol. 12, no. 5, p. 66.

Material.—Left P^3, P^4, M^1 (TMM 30967-242, 1487, 1487A); right P^4 (TMM 30967-379F); upper right molar (TMM 30967-1487B); left lower premolar, probably P_3 (TMM 30967-376); second phalanx (TMM 30967-1099).

Remarks.—These teeth are separated from the remainder of the Ingleside horse teeth mainly on the basis of their size. The teeth are large and almost square in cross section (fig. 58; table 51). The protocones of all the teeth are elongate with shallow lingual grooves that are located at or very slightly anterior to the isthmus joining the protocone to the protoselene. The anterior and posterior edges of the fossettes have many crenulations. A pli caballin is present on all teeth. The posterior end of the metaloph of P^3 and P^4 is drawn out to a point. This is rounded on all the teeth referred to *E. complicatus.* There is no tendency for the anterior part of the ectoloph to be strongly asymmetrical in its curvature as in *E. complicatus.* The parastyles and mesostyles are broad and bifurcate in the premolars. In the one molar available both the parastyle and mesostyle are broad but only the parastyle is bifurcate.

The lower premolar is much larger than those of *E. complicatus.* The metaconid is rounded as in *E. complicatus* but the metastylid is greatly

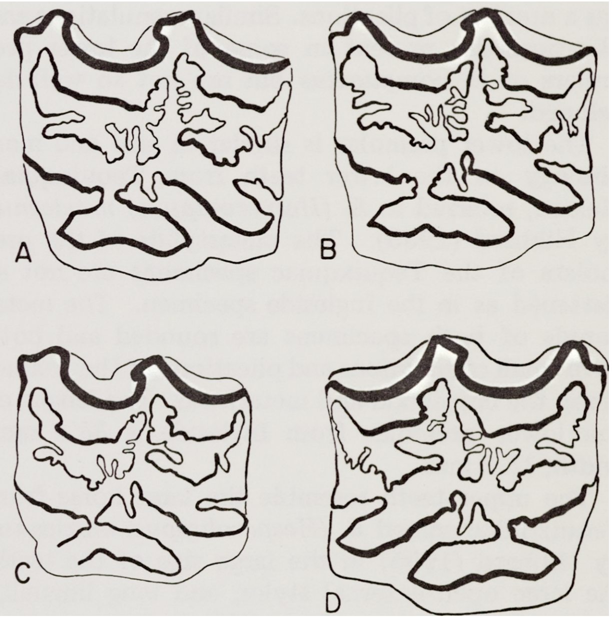

FIG. 58. *Equus pacificus.* A, Occlusal view of left P^3 (TMM 30967-242). B, Occlusal view of left P^4 (TMM 30967-1487). C, Occlusal view of left M^1 (TMM 30967-1487A). D, Occlusal view of right P^4 (TMM 30967-379F). x1.

TABLE 51. *Measurements (in mm) of upper teeth of* Equus pacificus *from Ingleside, Texas.*

	Length along ectoloph	Width normal to parastyle-mesostyle
Left P^3 (TMM 30967-242)	37.0	32.5
Left P^4 (TMM 30967-1487)	35.4	31.3
Left M^1 (TMM 30967-1487A)	30.7	28.2
Right molar (TMM 30967-1487B)	30.9	27.5

elongated and pointed with flattened lingual and posterior sides. The degree of elongation and flattening of the metastylid is much greater than in any lower premolar of *E. complicatus* from Ingleside. The metaconid-metastylid groove is very open but V-shaped. The entoconid is rounded except for the anterior edge which is flattened where it abuts on the metastylid. The protoconid and hypoconid are generally rectangular with small concavities on their labial surfaces as in the premolars of *E. complicatus.* The hypoconid is longer than the protoconid but no more so than in the lower premolars of *E. complicatus.* The hypolophid is broad and does not extend between the metaflexid and entoflexid. A pli caballinid is present and is located slightly posterior to the center of the hypolophid. The paralophid sends a broad V-shaped spur into the metaflexid. The enamel along the borders of the metaflexid and entoflexid is finely crenulated and has a number of plications. Similar crenulations and plications are present in some of the lower premolars of *E. complicatus* but are not so well developed.

The lower premolar is similar in size and morphology to the lower teeth from Tequixquiac, Mexico, referred to *E. (Hesperohippus) mexicanus* by Hibbard (1955). The metastylids of the premolars of the Tequixquiac specimens are not as flattened as in the Ingleside specimen. The metaconids of both specimens are rounded and both have small crenulations and plications of the enamel along the entoflexid and metaflexid. The length of the lower premolar from Ingleside is 35.4 mm, width, 18.8 mm.

The upper teeth resemble the large horse from Tequixquiac named *E. (Hesperohippus) mexicanus* by Hibbard (1955) in the large size of the teeth, the large open external styles, and long lingually flattened protocones. They differ in the complexity of the folding of the fossettes. The teeth of the type of *E. (Hesperohippus) mexicanus* are deeply worn, which would result in simpler folding.

The upper teeth from Ingleside also resemble those from Fossil Lake, Oregon, that were assigned to *E. pacificus* by Gidley (1901) in their dimensions and the possession of long flattened protocones. They differ from those of *E. giganteus* in being slightly smaller and in the shape and relative length of the protocone.

The only post-cranial element that can be referred to this species with any confidence is a very large, eroded second phalanx (TMM 30967-1099). It is separated in size from the other second phalanges, which are assigned to *Equus complicatus* (see table 50.

Insofar as the teeth are concerned there seem to be no significant differences between the samples from Tequixquiac, Ingleside, Fossil Lake, and the type of *E. pacificus* and they are assigned to the same species.

Savage (1951) considered *E. pacificus* to be a *nomen vanum* because the type consists only of a single upper premolar which shows no distinguishing characters. However, the combined samples from Oregon, California, Texas, and Mexico have a number of characters (large size, elongate flattened protocone, complicated crenulation on the fossettes, broad premaxillary) that taken together distinguish this taxon from most others.

EQUUS FRATERNUS Leidy

Equus fraternus Leidy, 1860, Holmes's post-Pliocene fossils of South Carolina, p. 100.

Equus fraternus Leidy. Gidley, 1901, Bull. Amer. Mus. Nat. Hist., vol. 14, p. 110; Hay, 1913, Proc. U. S. Nat. Mus., vol. 44, p. 569; Sellards, 1940, Bull. Geol. Soc. Amer., vol. 51, pp. 1627-1658; Quinn, 1957a, Univ. Texas, Bur. Econ. Geology Rept. Inv. 33, p. 20.

Equus leidyi Hay, 1913, Proc. U. S. Nat. Mus., vol. 44, p. 572.

Material.—Three right and 1 left upper molars (TMM 30967-36A, 974, 1622, 708); 1 right upper premolar (TMM 30967-1501); 1 first phalanx, pes (TMM 30967-1569); 1 distal end of a first phalanx (TMM 30967-2054); 1 left magnum (TMM 30967-1643).

Remarks.—The teeth of this species differ from those of *E. complicatus* mainly in their smaller size (fig. 59; table 52). The pattern of the upper teeth is almost as complicated as that of *E. complicatus* except when deeply worn. The protocone is elongate with the lingual surface either flat or concave. The pli caballin is small to absent, particularly in the molars. The number of plications on the fossettes is variable. The post-protoconal

TABLE 52. *Measurements (in mm) of upper teeth of* Equus fraternus *from Ingleside, Texas.*

	Length along ectoloph	Width normal to parastyle-mesostyle
Right molar (TMM 30967-1622)	23.8	24.7
Right molar (TMM 30967-36A) .	26.3	26.2
Right molar (TMM 30967-974) .	25.3	26.1
Right pre-molar (TMM 30967-1501)	25.3	26.4

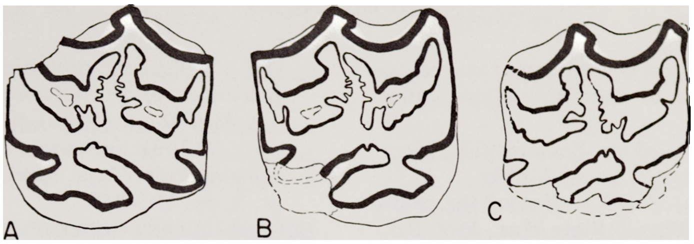

FIG. 59. *Equus fraternus.* Occlusal views. A, Left upper molar (TMM 30967-708). B, Right upper molar (TMM 30967-36A). C, Right upper molar (TMM 30967-974). x1.

groove is narrow in proportion to the size of the tooth. No lower teeth can be assigned to *E. fraternus.*

The foot bones have been assigned on the basis of size. Those which are assigned to *E. fraternus* (table 50) are smaller and more lightly built than those assigned to *E. complicatus*, and the constriction of the first phalanx is more pronounced. They resemble the phalanges of an ass more than those of a horse.

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