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PLEISTOCENE ARTIFACTS AND ASSOCIATED FOSSILS FROM BEE COUNTY, TEXAS

BY E. H. SELLARDS

With Notes on Artifacts, by T. N. Campbell, and
Notes on Terrace Deposits, by Glen L. Evans.

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ABSTRACT

This paper contains the results of a study of human remains—artifacts, workshops, camp sites, and hearths—and of the associated animals found in the Berclair terrace deposits of the Mission River drainage system of the Coastal Plain region of Texas. The artifacts are referable to Folsom, Yuma, and cultures known from central Texas, and some are not definitely placed as to cultural position. The Folsom and Yuma cultures are found near the base of the deposit; the central Texas culture occurs in the upper part but may likewise extend to the lower levels. The extinct mammals of the formation include mammoth, mastodon, horse, bison, camel, dire wolf, peccary, armadillo, glyptodon, and ground sloth. There are also some extinct turtles of which the species have not been determined.

Since deposition of the terrace, regional uplift has rejuvenated the streams which have now become intrenched in the Berclair terrace deposits. Due to this uplift the present streams have a steeper gradient than the earlier streams. On stratigraphic evidence the Berclair terrace deposits are shown to be the upstream equivalent of the Beaumont formation, probably of Lower Beaumont age. The correlation, as indicated by the vertebrate fossils, is with the Melbourne formation of Florida and almost, if not exactly, with the Tedford bone bed of San Patricio County, Texas. The paleontologic and stratigraphic evidence indicates that the formation and the included artifacts and fossils are Pleistocene.

The fact that man inhabited these valleys during the Pleistocene implies, consistent with other evidence, that he had then attained a wide distribution on the continent. The varied and specialized cultural development of the Mission River valley inhabitants suggests that this occurrence does not represent the earliest occurrence of man in North America. The time of arrival of man on the continent is yet to be determined.

INTRODUCTION

During the past two years artifacts have been found associated with extinct vertebrates at several localities in Bee and Goliad counties in the Mission River drainage basin in the Coastal Plain region of Texas. The original discovery was made at a locality on the E. H. Buckner ranch on Blanco Creek about 1⅘ miles upstream from the Beeville-Goliad road crossing.[1] Permission to excavate at this locality was

[1] This locality may be reached as follows: From Beeville follow Beeville-Goliad road, Highway 96, east 10½ miles, turn north across railroad into the E. H. Buckner ranch. Continue northwest on ranch road 1½ miles to Blanco Creek. Locality in right bank of creek. The usage right and left as applied to the creek bank in this paper is in accordance with the definition in

generously given by the owner, Mr. E. H. Buckner, of Houston, Texas. Acknowledgment for courtesies extended is made also to H. Snedal, Pryor Lucas, J. J. O'Brien, Thomas Heard, and S. P. Farish on whose properties excavations have been made.

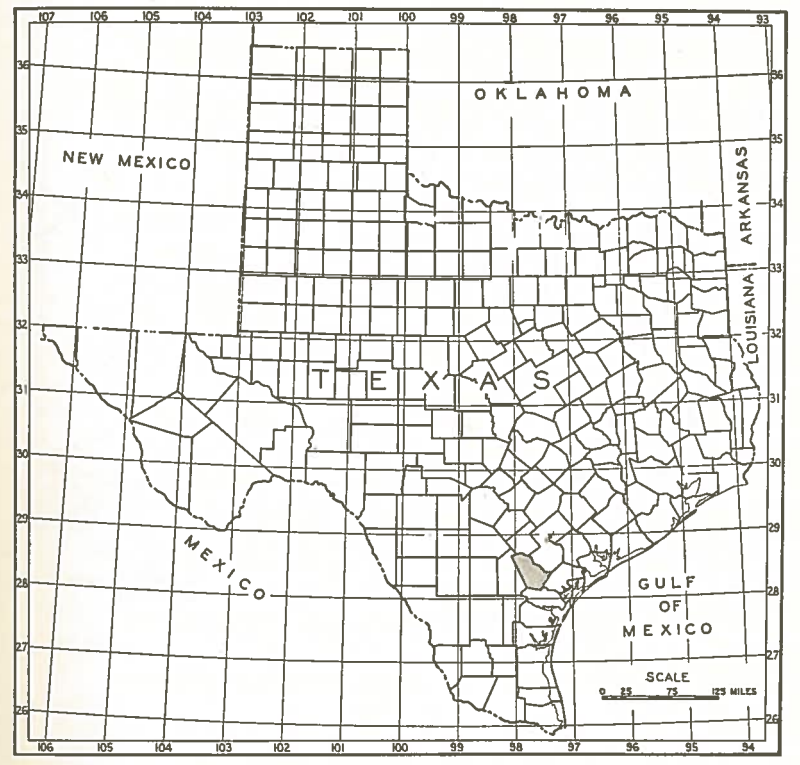


FIGURE 1.—*Index map of Texas*
Bee County indicated by shading.

Notice of the occurrence of fossils at the Buckner locality was given to the writer by Mr. and Mrs. Frank Daugherty, of Houston, Texas, in 1936. Preliminary explorations were made in February and March 1938. Extensive excavations begun in November 1938 are still in progress. In immediate charge of excavations were Glen Evans, November 1938 to May 1939; Adolph Witte, May to October 1939; and Nolan McWhirter, since October 1939. Invertebrate fossils are being identified

Webster's International Dictionary, 1926, p. 1231. "Left bank of a river, that which is on the left hand of a person whose face is turned downstream."

Assistance in the preparation of these materials was furnished by the personnel of Work Projects Administration Official Project No. 665-66-3-233.

by Horace G. Richards. W. N. McAnulty, and Joseph T. Gregory have aided the writer in identifying vertebrate fossils. W. Armstrong Price has given helpful suggestions on the geology of the Beaumont formation. The writer is greatly indebted to these gentlemen and to the Work

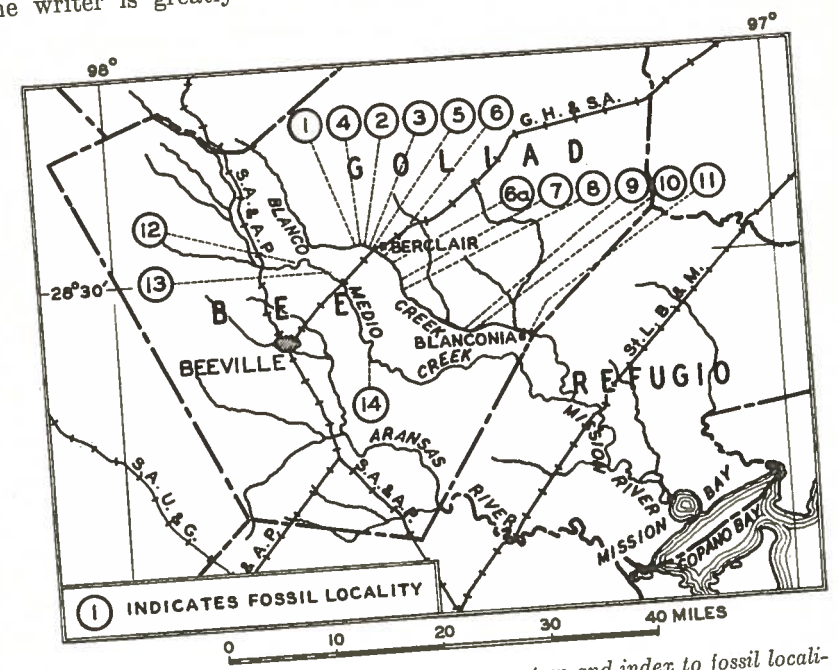


FIGURE 2.—*Map of Mission River drainage system and index to fossil localities 1 to 14*

Blanco Creek, on which are found localities 1 to 11, forms the boundary between Bee and Goliad counties; localities on left bank of stream are in Goliad County.

Projects Administration and The University of Texas by whom the explorations were made possible.

The geologic section exposed in the bed and sides of Blanco Creek at the Buckner locality, Site 1 (Fig. 2), consists of the Pliocene Goliad formation overlain unconformably by Pleistocene stream terrace deposits. Both contain vertebrate fossils. The Pliocene fossils, which are older than and not associated with the artifacts, will be described elsewhere.

Some flint flakes apparently of human handiwork had been obtained in the terrace deposits in January 1939 and, on February 8, D. L. Garner found an artifact at the base of the Pleistocene at a depth of 15 feet 10 inches. The find was immediately verified by Glen Evans, and on February 9 the writer visited the locality. The artifact at that time had been removed from the matrix, but fortunately the mould was

preserved. The artifact fitted the mould perfectly even to the details of chipping. After hardening the matrix with cementing solution, the mould was removed, thus preserving evidence that the artifact was imbedded at the base of the terrace deposit. Subsequent excavating at this and other localities resulted in the recovery of the fossils and artifacts described in this paper which are in the collections of The University of Texas.

INDEX TO SITES

Following is a list of sites from which collections have been made. It is quite certain that other sites will be developed. For a list of the Pleistocene fossils of each locality, the reader is referred to Table 1.

Site 1. Right bluff of Blanco Creek 9350 feet upstream from Beeville-Goliad public road crossing, Highway 96. Fossils and artifacts in the Pleistocene and vertebrate fossils in the Pliocene.

Site 2. Right bluff of Blanco Creek 4100 feet upstream from bridge on Beeville-Goliad road. *Parelephas columbi.*

Site 3. Right bluff of Blanco Creek about 1700 feet upstream from bridge on Beeville-Goliad road. Fossils and worked flint.

Site 4. Left bluff of Blanco Creek about 6600 feet upstream from bridge on Beeville-Goliad highway. *Paralephas columbi, Equus fraternus,* and *Bison* sp.

Site 5. Cut at east side of Beeville-Goliad road at bridge across Blanco Creek. *Parelephas columbi.*

Site 6. Right bluff of Blanco Creek 14,200 feet downstream from bridge on Beeville-Goliad road on J. J. O'Brien ranch, 600 feet upstream from confluence of Miller and Blanco creeks. Fossils and worked flint.

Site 6a. On left bank of Blanco Creek 0.5 mile downstream from Site 6 on Pryor Lucas ranch. Skull of *Equus fraternus* and other fossils.

Site 7. Left bluff of Blanco Creek about 5 miles southeast of Berclair on Pryor Lucas ranch. *Equus complicatus* and artifacts.

Site 8. Right bluff of Blanco Creek about 6 miles southeast of Berclair on Heard ranch. *Parelephas columbi* and *Equus complicatus.*

Site 9. Right bluff of Blanco Creek, 3 miles upstream from Blanconia. Worked flint.

Site 10. Right bluff of Blanco Creek, 2.25 miles upstream from Blanconia bridge on Fox ranch. *Parelephas columbi,* poorly preserved and not collected.

Site 11. Left bluff of Blanco Creek, 0.75 of a mile downstream from the Blanconia bridge. *Platygonus* sp.

Site 12. Left bluff of Boggy Creek, a tributary of Medio Creek, on the H. Snedal ranch. *Parelephas columbi, Mastodon americanus.*

Site 13. Left bluff of Medio Creek, 2.5 miles above crossing of Highway 96 on S. P. Farish ranch. Fossils and artifacts.

Site 13a. On small tributary of Medio Creek approximately 0.5 mile from Site 13. *Parelephas columbi.*

Site 14. On Medio Creek, Fox ranch, about 10 miles downstream from Site 13. *Parelephas columbi.*

FOSSILS

GENERAL STATEMENT

The formation in which the artifacts and fossils are found is a terrace of the Mission River drainage system. The town of Berclair is located near and partly on this terrace, and the terrace is here designated the Berclair terrace of the Mission River drainage system of which Blanco Creek is a part. The other principal tributary of Mission River is Medio Creek. Fossils are found in the terrace deposits to within a few feet of the top, their absence near the soil line being due probably merely to dissolving action of soil waters.

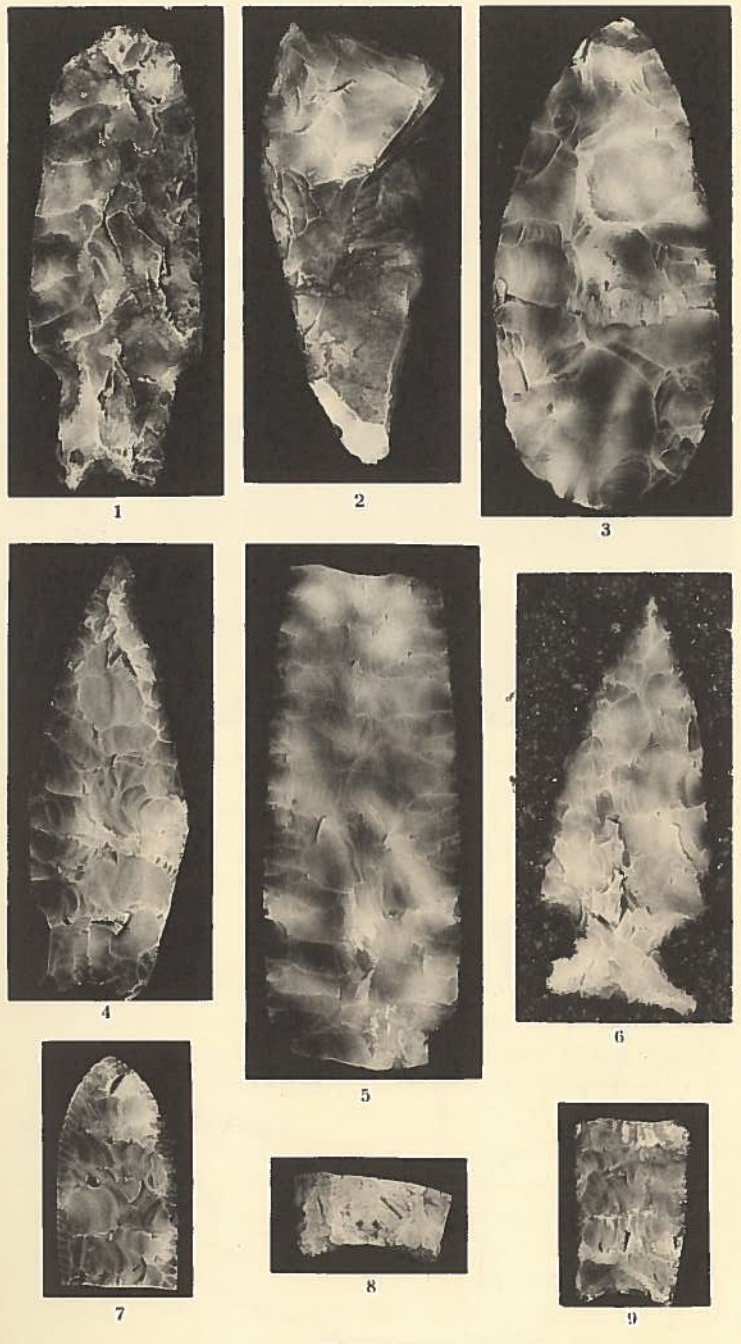
PRIMATES

The presence of man in these deposits is indicated by objects made of stone and silicified wood and by camp sites and hearths. Man-made objects have been obtained from the formation at Sites 1, 3, 6, 7, 9, and 13. These are described in the section on artifacts.

PROBOSCIDEANS

The proboscideans obtained from this formation include elephant and mastodon. The most abundant Pleistocene vertebrate fossil is the Columbian elephant, *Parelephas columbi* (Falconer). A tooth of this species, No. 30838-1, was found at Site 1 in the basal part of the formation at the same level as and near some of the artifacts. At Site 2 a tooth and scapula were obtained from the terrace deposits. At Site 3 two upper molars and a femur were found about 3 feet above the base of the deposit. The molars were still in position lying side by side. The skull, however, had disintegrated to such an extent that it could not be preserved. Two additional molars were found at this site within about 7.5 feet of the top of the terrace. With these molars were several bones including scapula, limb bones, vertebrae, and ribs. The badly disintegrated bones were not collected. The cut into the terrace deposits at the bridge across Blanco Creek, Site 5, yielded a tooth of this species. A tooth was found also in the upper part of the terrace deposit on the Snedal ranch, Site 12. One upper and two lower molars and bones of the skeleton were found at Site 6. Proboscidean bones, probably of this elephant, were found at Sites 4 and 10. The large teeth of this elephant have 19 or 20 plates; the smaller tooth found at Site 1 has about 14 plates. The plates are of medium size, counting 6, 7, or 8 per 100 mm.

A tooth from Site 6a in which the plates count 5 per 100 mm. is apparently to be referred to *Archidiskodon imperator* (Leidy).



ARTIFACTS

(1-3) Upper horizon; (4-9) Lower horizon

FIGURE 1. PIT AT SITE 1

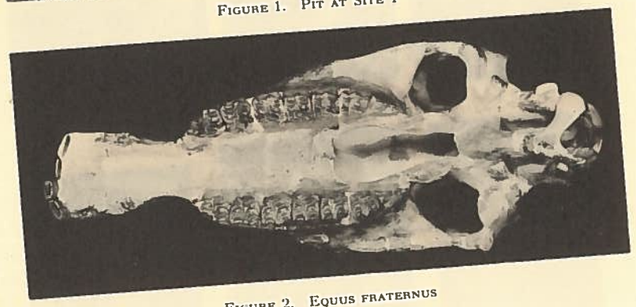


FIGURE 2. EQUUS FRATERNUS
x ⅙

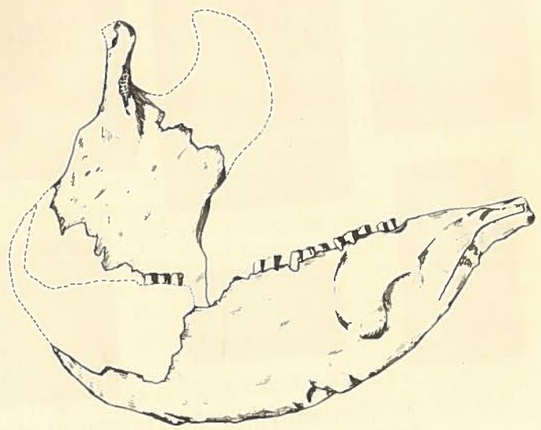


FIGURE 3. GLYPTODON PETALIFERUS
x ⅛

PLEISTOCENE FOSSILS

The American mastodon, *Mastodon americanus* (Kerr), is represented by a considerable part of a skeleton, including skull, tusks, lower jaws, vertebrae, ribs, and limb bones found at Site 12. The skull including lower jaws is exhibited at the Texas Memorial Museum, Austin. A milk molar and a cone from an adult molar found at Site 1 are referred to this species.

UNGULATES

The ungulates obtained from this formation are horse, bison, camel, deer, and peccary. Of these the horse, genus *Equus,* represented by three species, is the most abundant.

A large horse, apparently the giant Texas horse *Equus giganteus* Gidley, is represented at Site 1 by an upper right molar. In crenulations of the enamel, the tooth agrees closely with the type of the species which the writer has examined in the Cope Collection at The American Museum of Natural History in New York. The antero-posterior measurement, 41 mm., is essentially the same as that of the type. On the other hand, the transverse measurement, 30 or 35 mm., is less than that of the type. The type is a molar tooth recorded merely as from southwest Texas. However, the notes which accompany the specimen indicate that this tooth is part of an early collection made by William Taylor. From other sources (Wilson, 1890) it is known that a William Taylor lived in San Diego, Duval County, Texas, and made collections of fossils on San Diego Creek about 1888. It is believed, therefore, that the type locality of *Equus giganteus* is on San Diego Creek, Duval County, Texas, which is only about 70 miles from the Beeville locality. It is noteworthy that Taylor reports artifacts associated with the fossils collected by him near San Diego.

A horse, apparently *E. complicatus* Leidy, is represented by a right upper molar from Site 1, a broken right Pm3 from Site 3, a right upper Pm2 and a lower molar from Site 7, and several teeth from Site 8. Measurements of Pm2 are as follows: antero-posterior 40 mm., transverse 27 mm. The size of the tooth and the crenulations of the enamel agree closely with Pm2 of a skull from Henderson County referred to *E. complicatus*.

A horse smaller than *Equus complicatus* is represented at Site 1 by a left upper molar, five lower molars, and a right upper molar from Site 6, and a skull from Site 6a. Several lower molars probably of the same species have been obtained from Site 3 and parts of lower jaws from Sites 4 and 6. One upper and two lower molars were found in the stream bed. The measurements of the upper molar are: antero-posterior 26 to 27 mm., transverse 21 to 24 mm. The enamel surrounding the lakes in some teeth

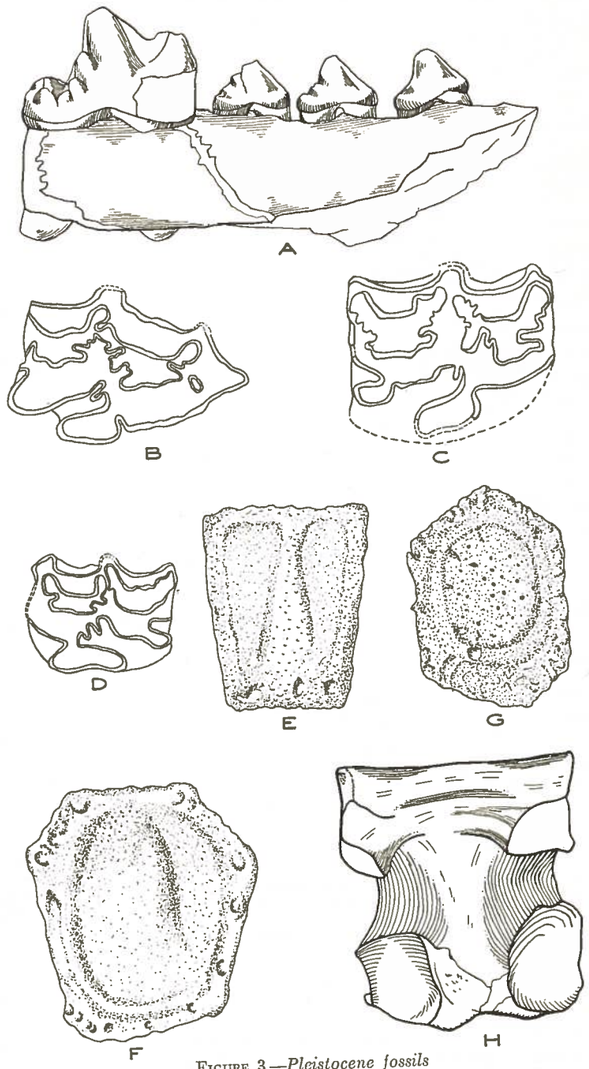


FIGURE 3.—*Pleistocene fossils*

(A) *Aenocyon ayersi*; (B) *Equus complicatus*; (C) *E. giganteus*; (D) *E. fraternus*; (E, F) *Holmesina septentrionalis*; (G) *Glyptodon* sp.; (H) ground sloth, genus indet. Natural size.

shows but few plications, being in this respect much simpler than in typical individuals of *Equus fraternus* Leidy. Notwithstanding these differences, these teeth are for the present referred to *E. fraternus*. In the skull the measurement from the front of Pm2 to the front of incisor is 142 mm. This same interval in four modern horses was found to range from 160 to 185 mm., the average being 167 mm. On the other hand, the width of the muzzle back of the incisors in the fossil skull is 82 mm., as compared to minimum 69, maximum 73, in the same four modern skulls. The incisors in the fossil, in keeping with the stoutness of the skull, are somewhat larger than those of the modern horse. The enamel folds in the teeth in this skull (Pl. 2, fig. 2) are much like those of the type of *E. fraternus*. The type specimen, which is in the American Museum of Natural History, is from Charleston, South Carolina. O. P. Hay (1913) has established a species, *Equus leidyi*, using as type several molar teeth, contained in the collections of Wagner Free Institute of Science at Philadelphia, from Peace Creek, Florida, previously referred to *E. fraternus*. The writer has compared the types of *Equus leidyi* with the type of *E. fraternus* and is doubtful if *Equus leidyi* is a valid species. The tooth compared was that selected as type of the species by Gidley (No. 9200), not the type previously selected by Cope and rejected by Gidley.

Among fossils unidentified as to species are lower molars of *Equus* found with artifacts at Site 13 and incisors, canines, and footbones at several other localities.

A bison is represented from Site 1 by a tooth and an astragalus; from Site 3 by an astragalus, ulna, and radius; and by bones from Sites 4, 6, and 6a. The length of the radius from Site 3 is 390 mm., and that of the ulna 520 mm. The size of the bones and teeth indicates one of the large extinct species, the radius and ulna being appreciably larger than the same bones of *Bison bison*.

A camel, *Camelops* sp., is represented at Site 6 by three lower jaws and a foot bone. Part of a cannon bone found at Site 1 probably represents the same species.

A peccary, *Platygonus* sp., is represented by a tusk from Site 11.

A deer, genus *Odocoileus*, is represented in the collections from Sites 1 and 6.

CARNIVORES

Carnivores are rare in this formation although several carnivore species are known to have been present during Pleistocene time. The collections from Site 1 contain a part of a carnivore tooth, but it was not until June 1940, after more than 1½ years of continuous collecting, that an identifiable carnivore was obtained. The specimen found, a

lower jaw, belongs to the large Pleistocene wolf, *Aenocyon ayersi* (Sellards), known also from the Pleistocene of Vero, Florida, and from San Patricio County, Texas. This species differs from *Aenocyon dirus*

TABLE 1.—*Vertebrate fossils from Berclair terrace deposits*

Fossils	Sites															
	1	2	3	4	5	6	6a	7	8	9	10	11	12	13	13a	14
Homo, represented by artifacts	x	..	x	..	..	x	..	x	..	x	..	..	..	x	..	..
*Parelephas columbi**	x	x	x	x	x	x	..	..	x	..	x	..	x	..	x	x
*Archidiskodom imperator?**	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..
*Mastodon americanus**	x	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..
*Equus giganteus**	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*E. complicatus**	x	..	x	..	..	x	..	x	x	..	..	..	..	..	..	..
*E. fraternus**	x	..	x	x	..	x	x	..	..	..	..	..	..	..	..	..
*Bison** sp.	x	..	x	x	..	x	x	..	..	..	..	..	..	x	..	..
*Camelops** sp.	x	..	..	..	..	x	x	..	..	..	..	..	..	..	..	..
*Platygonus** sp.	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..
Odocoileus sp.	x	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..
*Aenocyon ayersi**	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..
*Holmesina septentrionalis**	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
Dasypus sp.	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..
*Glyptodon petaliferus**	x	..	..	..	..	x	..	..	..	..	..	..	..	x	..	..
Ground sloth*, gen. indet.	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
Ondatra zibethicus	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sigmodon hispidus	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lepus sp.	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Scalopus aquaticus texanus	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bird, gen. indet.	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lizard	x	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..
Alligator	x	..	..	..	..	x	x	..	..	..	..	..	..	..	..	..
Turtles	x	..	x	..	..	x	..	x	..	..	..	..	..	x	..	..
Snake indet.	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

* Extinct species.

(Leidy), among other characters, by a more elongated muzzle and consequently more widely spaced premolars, as seen in Figure 3A.

The saber-tooth tiger also found at Vero and Ingleside has not yet been obtained from this deposit.

EDENTATES

The edentates are represented by two species of armadillo, a glyptodon, and a ground sloth.

One armadillo, *Holmesina* (*Chlamytherium*) *septentrionalis*, is represented by plates of the carapace found at Sites 1 and 3. The plates were obtained near the base of the deposits. Plates from a species of *Dasypus* have been found at Site 6. The genus *Glyptodon petaliferus* is present at Sites 1 and 13 as indicated by plates and at Site 6 by a lower jaw. A ground sloth, genus not determined, is represented by a segment from the sternum found at Site 3, depth 7 feet.

OTHER VERTEBRATES

The following additional vertebrates have been obtained from the terrace deposits: muskrat, *Ondatra* sp.; cotton rat, *Sigmodon* sp.; *Scalopus aquaticus*; *Lepus* sp.; bird, indeterminate; lizards; alligator; turtles. The turtles, although as yet undetermined, evidently include several extinct species and occur in abundance at several localities.

In Table 1 is shown the distribution of the vertebrate fossils by sites.

INVERTEBRATES

Dr. Horace G. Richards has identified the invertebrates obtained from Bee County and from deposits of approximately equal age in San Patricio County and has recognized the following land and fresh-water species:

	Bee County	San Patricio County
Bulimulus dealbatus Say	x	..
Polygyra texasianum Moric	x	x
Helicina orbiculata tropica 'Jan' Pfeiffer	x	x
Helisoma trivolvis Say	x	x
Physa conoidea Crosse and Fisher	x	..
Physa integra Haldeman (?)	..	x
Physa halei Lea	..	x
Uniomeris sp.	x	..
Sphaerium sp.	x	..
Gyraulus parvus Say	..	x

With regard to the fossils Dr. Richards (personal communication) reports:

"The list of species from the two localities is too small to permit any definite statements regarding age or climate. All the species are known to be living in Texas today. A similarity is observed between the localities in Bee and San Patricio counties in regard to their mollusk fauna and there is no reason to doubt their contemporaneity."

ARTIFACTS

GENERAL CONSIDERATIONS

The deposits which contain the artifacts and fossils are typical stream-laid sediments. As is usual in terrace deposits, the heavier and coarser

materials lie near the base of the formation and grade upward into finer materials. The deposition is irregular including lenses of coarse and fine materials and cross-bedded sands. At Site 1, the lower 4 or 5 feet contains considerable gravel with occasional sand lenses. The next 4 feet consists of sand faintly laminated, above which is chiefly silt with some fine sand and clay up to the soil level. The artifacts have been found at two levels: in the upper part of the formation, depth from surface 2 to 7.5 feet, and near the base of the formation, depth from surface 13 to 17 feet. Between these levels the deposits are barren. This may indicate merely that the conditions were unfavorable for camp sites and for the accumulation of fossils.

FREQUENCY OF OCCURRENCE OF ARTIFACTS AT SITE 1

The area excavated for artifacts and Pleistocene fossils at Site 1 is approximately 125 by 45 feet. The depth of the terrace deposits is from 15 to 17 feet. Hence the total terrace deposit removed at this site was about 3700 cubic yards, most of which was screened. About 200 relics were obtained indicating the presence of man, including artifacts, partially worked flints, rejects, chips, flakes, burnt rocks, and hearths. Most of these came from the lower or basal part of the deposit.

The ground plan (Fig. 4, B) shows that the artifacts and associated man-made objects at Site 1 were not uniformly distributed in the area excavated but tend to occur in groups either in camp sites, hearths, or at the place of chipping. Thus in the immediate vicinity of spear 68, the first artifact found, was a worked flint, No. 70, and near-by seven flint chips, apparently flaked at this locality from some larger piece not recovered. A broken rock, No. 84, but not the one yielding the flakes, was found near-by. Not far removed is a worked flint, 86-12, accompanied by two worked but incomplete flints and one flake, a spear, 86-15, an incompleted worked flint, 86-11, and three flakes. These artifacts with the worked flint, No. 82, a serrate-edged flint, 83, and flakes, 86-6, make up a group of artifacts and chips somewhat separated from others. Among the chips one finds, in some instances, as in 86-6, several that come obviously from the same core, thus indicating that the flaking was done at this place and that the chips were not stream carried. Some of the artifacts, however, occur singly and probably were stream carried to their present position. The vertical and horizontal distributions of artifacts and fossils at Site 1 are indicated in Figure 4.

GEOLOGIC POSITION OF THE SEVERAL CULTURES

Folsom, Yuma, and stemmed projectile points, scrapers, gouges, blades, and other artifacts are found in the basal part of the Berclair

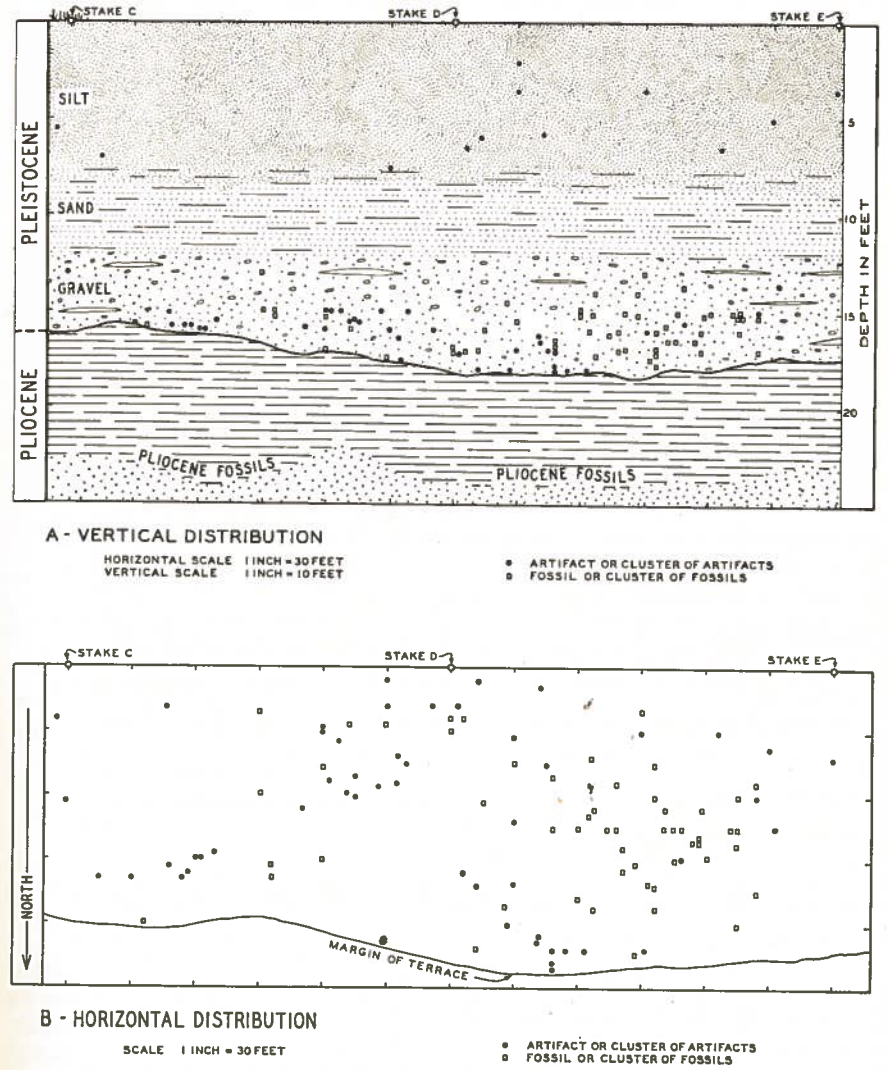


FIGURE 4.—*Vertical and horizontal distributions of artifacts and fossils at Site 1*
The first artifact found was located 42 ft. E, 33 N of stake D; depth 15.9 ft.

terrace and evidently are as old as the oldest part of this formation. There is evidence, also, of workshop activity at this level. In the upper part of the formation is found a gouge identical, according to Campbell, with the Clear Fork gouge described originally from the Abilene region. One example of this, No. 116-4, is reported from the basal part of the formation. Aside from this one occurrence the artifacts thus far

obtained from the upper part of the formation differ in some respects from those of the lower part below the sterile zone. The several cultures are sufficiently nearly contemporaneous to fall within the same geologic formation. They may represent either successive cultures or only successive habitation by different peoples or tribes. Folsom and Yuma cultures are probably not the oldest known cultures in America. Harrington (1938) and Hibben (1940) have reported artifacts stratigraphically below Folsom culture.

The artifacts of this locality have been studied by T. N. Campbell, of the Department of Anthropology of The University of Texas. His report follows. The stratigraphic position of the formation holding the artifacts is subsequently discussed. In order to determine the relation of these terrace deposits to the Pleistocene formations of the Gulf Coast, a traverse and line of levels were made downstream about 21 miles from Site 1. The report on this traverse by Glen L. Evans, who was in charge, follows the report on the artifacts.

NOTES ON ARTIFACTS

BY T. N. CAMPBELL

GENERAL STATEMENT

In this report only the more diagnostic artifacts and objects are described. All locations given for artifacts refer to the vertical and horizontal distribution charts of Figure 4.

SITE 1, UPPER HORIZON: DEPTH 2 TO 7.5 FEET

Projectile Point: Concave base, parallel-sided stem, rounded shoulders, edges of blade almost straight. Workmanship poor, with one face of the blade much better worked than the other. Distal end shows thermal fracturing, indicating damage by fire. No. 88-1; location 10 ft. E, 6 N of stake D; depth 7.5 ft. (Pl. 1, fig. 1).

Gouges or Concave-base Core Scrapers: This is the Clear Fork gouge of Ray (1929; 1934; 1938) and the concave-base core scraper of Sayles (1935). This type may be described as triangular in outline, with a straight base and edges that curve gently to a point. The base has a marked bevel. The amount of beveling varies, and within the individual specimen the beveling is usually more extensive in the central portion of the base, so that the edge of the base, when viewed from below (along the longitudinal axis), is curved; hence Sayles' term concave-base core scraper. The transverse cross section may be either plano-convex or bi-convex, depending upon whether chipping has been done on one or both sides. These gouges are made from thick flakes and seem to be retouched by the percussion technique. Three specimens occur in this series as follows: (1) Bi-convex in transverse cross section; chipped on both faces. This is the only gouge which shows notable concave-base design. (2) Plano-convex, chipped only on the convex face. Base very slightly concave. The base slants, *i.e.*, forms an acute angle with one side, an obtuse angle with the other. (3) Plano-convex; long, slender, curving. This differs from the other two specimens in that the base, though beveled, is perfectly straight (Pl. 1, fig. 2). Nos. 88-2, 3, and 4; location and depth same as No. 88-1.

Another gouge, bi-convex in transverse cross section, pointed end broken, reported to come from depth of 17 feet, is the only gouge of this kind from the lower horizon. Since there is doubt about this specimen having been found *in situ*, it is placed with the material from the upper horizon. No. 116-4.

Knife: Leaf-shaped, pointed at one end, convex base. Workmanship fair. No. 88-5; location and depth same as No. 88-1 (Pl. 1, fig. 3).

Blades: Crude, made of silicified wood. Leaf-shaped, with slightly convex base The base and one side are worked to a continuous cutting edge. The base suggests use as a gouge, the worked edge for scraping purposes. No. 88-6; location and depth same as No. 88-1.

Thick, roughly rectangular in outline. One end incompletely chipped, with some of the cortex visible; opposite end thin, suggesting use as a gouge. No. 98-1; location 30 ft. E, 10 N of E; depth 3.5 ft.

Hand Axe: Made from a small nodule fragment. Very short blade set at right angles to the thickest portion of the butt. Edge of blade broadly convex. This specimen could also have served as an adze or a scraper, but it seems to fall within the range of the well-known Texas hand-axe. No. 98-12; location 58 ft. E, 32 N of E; depth 6.5 ft.

Charred Mud-dauber Nests: Six fragments of mud-dauber nest. Fire-baked (some parts fired to pinkish color, others blackened). No. 88-7; location 10 ft. E, 6 N of D; in hearth at depth 7.5 ft. Two possible interpretations, evaluated in order of naming: (1) attached to firewood; (2) larvae baked and eaten.

SITE 1, LOWER HORIZON: DEPTH 13 TO 18 FEET

Projectile Points: Basal fragment of a Folsom point, probably the long variety. Channel flake removed from both faces. Edges and base appear to have been ground. No. 86-10; location 44.6 ft. E, 6.3 N of D; depth 15.1 ft. (Pl. 1, fig. 8).

Stemmed Yuma type (part of stem missing). Shows characteristic Yuma flaking, *i.e.*, parallel flake scars, diagonally directed across face of blade. Edges of stem seem to have been ground. No. 86-2; location 17.5 ft. E, 11.6 N of D; depth 15 ft. (Pl. 1, fig. 5).

Distal part of a small Yuma point. Very small and thin and shows the characteristic Yuma flaking. Such points are not common elsewhere but are known to occur along with the larger Yuma points. No. 86-16; location 23.3 ft. E, 22.1 N of D; depth 15.6 ft. (Pl. 1, fig. 7).

Stemless projectile point, lozenge-shaped, with concave base. Some grinding of the edges near the base. Typologically this would appear to be transitional between Folsom and the later Texas stemmed points. It resembles points shown by Ray in his Clear Fork culture. However, it is not uncommon in other central Texas cultures. No. 86-15; location 60.6 ft. E, 20.9 N of D; depth 13 ft. (Pl. 1, fig. 4).

Two stemmed projectile points, both of the same general pattern: straight base, expanding stem, sloping shoulders. This type is often referred to as side notched (broad side notches forming the stem). No. 68; location 42 ft. E, 33 N of D; depth 15.9 ft. No. 86-13; location 39.4 ft. E, 29.7 N of D; depth 16 ft. (Pl. 1, fig. 6).

Gouges: Four specimens that seem to be variations of the same type. This type is not to be confused with the Clear Fork gouge of Ray. Each of these artifacts has a slightly beveled edge at one end, such as would serve admirably for gouging purposes. All are broadly oval in outline and have been worked on both faces. No.

86-7; location 15.9 ft. E, 19.6 N of D; depth 15.5 ft. No. 116-1; location 51 ft. E, 40 N of E; depth 18 ft. No. 116-3; location 56 ft. E, 34 N of E; depth 18 ft. No. 116-5; location 44 ft. E, 44 N of E; depth 18 ft.

KNIVES OR BLADES: Oval blade, crudely chipped by percussion technique. One face is more convex than the other, with one end somewhat beveled, so that the specimen has the general appearance of a snub-nosed scraper. No. 86-3; location 15 ft. E, 17.1 N of D; depth 15.5 ft.

Small blade or knife, oval in shape, fashioned from a flake. This seems to fall within the range of leaf-shaped blades or knives with convex bases. No. 86-8; location 15.2 ft. E, 20 N of D; depth 15.3 ft.

SCRAPERS: Circular scraper, retouched around three-fourths of its circumference to give a scraping edge. The flat face has some chipping; the convex face rises to a peak. No. 82; location 44 ft. E, 31 N of D; depth 15.7 ft.

Combination blade and concave scraper (spokeshave), oval in shape. One clearly marked concave scraping edge near one point, a less well marked one near the other point and on the opposite edge. It looks as though a blade had later been made into this sort of scraper. This is not a type in any known cultural complex in Texas. No. 86-5; location 13.5 ft. E, 18.1 N of D; depth 16.3 ft.

Side scraper made from an irregularly shaped flake, with one edge rather steeply retouched. No. 116-7; location 42 ft. E, 44 N of E; depth 18 ft.

AXE OR ADZE: An unusual specimen. Notches on edges indicate hafting, either as an axe or as an adze (transversely), or possibly even as a scraper. The edge of the blade shows some evidences of usage. No. 70; location 42 ft. E, 33 N of D; depth 15.9 ft.

MUD-DAUBER NEST: Fire-baked. It is of interest that quite a number of these specimens occur at Site 1. No. 125; location 50 ft. E, 33.7 N of E; depth 17 ft.

SITES 3, 6, 7, 9, AND 13

FLAKES: A number of flakes appear, but only one seems to be the product of human flint working. Site 3. No. 104; from near base of terrace; depth 14 ft.

CORE: Core from which large flakes have been struck. Site 6. This could have served for chopping purposes, since there is one sharp edge, but this is not likely. No. 111; from near base of terrace; depth 16 ft.

PROJECTILE POINT: Basal part of small Yuma point. Site 7. Apparently the same type as No. 86-16 from Site 1. Shows characteristic Yuma flaking. No. 109; found not in place at the base of the bluff at Site 7 (Pl. 1, fig. 9). This artifact is referred to the lower horizon on the basis of its close resemblance to projectile point No. 86-16 (Pl. 1, fig. 7) which is known to come from the lower horizon.

FLAKE: Irregularly shaped flake, apparently the product of human flint working. Site 9. No clear evidence of use. No. 112; from the base of the terrace; depth 14 ft.

CONCAVE SCRAPER OR SPOKESHAVE: Small flake with concave scraping edge that shows some slight evidences of use. Site 13. No. 126-1; from near base of terrace.

FLAKES: Two flakes, one fairly large with two edges that seem to have been chipped through usage, the other small flake with no evidence of use. Site 13. Nos. 126-2 and 3; from near base of terrace.

COMMENT AND CONCLUSIONS

UPPER HORIZON: The artifacts from the upper strata at the Bee County site are considerably illuminated by comparison with the material from the recently excavated Morhiss Mound near Victoria, Texas. This stratified midden shows clear evidence of long occupation, with at least three cultures represented. The site is located on a terrace of Guadalupe River and is only about 50 miles east of the Bee County site. Mr. W. A. Duffen, Archaeologist and WPA Project Superintendent of the South Texas Unit, State-Wide Archaeological Survey, The University of Texas, was in charge of excavation at the Morhiss Mound and is now writing a report. He examined the Bee County materials and made the following significant observations:

"The Bee County artifacts from the upper horizon are clearly identifiable with the earliest material in the Morhiss midden. The projectile point, No. 88-1, occurs as a type in the Morhiss midden, where it is confined to the lower third of the midden deposits. Gouges or concave-base core scrapers of both varieties, plano-convex and bi-convex in cross section, as in Nos. 88-3, 4, and 5, occur numerously at the base of the Morhiss midden. Very few are found in the upper layers. Hand axes occur at all levels. They are rare at the bottom, however, with frequency increasing as one proceeds upward. A knife, identical in outline with the leaf-shaped specimen from Bee County, No. 88-6, was found below the midden deposits in an upper stratum of the river terrace. The foot bone of a camel was found in the terrace deposits in a stratum immediately above the knife."

Inasmuch as the Morhiss midden site was occupied over a considerable period of time by several cultural groups, the lowest material would probably represent one of the early cultures in the Coastal region of Texas. Since the Bee County upper material is identifiable with the lowest Morhiss midden material, we have here the beginnings of a good relative chronology for the Texas coast.

Considered in the light of the preceding, it would appear that the upper material from the Bee County site is early in the central Texas series. Its importance lies in its stratigraphic relationship to the Folsom and Yuma material below and also in its identity with the earliest culture represented at the Morhiss midden.

LOWER HORIZON: Examination of the artifacts from the lower horizon at the Beeville site brings out at least two significant points:

(1) Folsom and Yuma material is unmistakably present. This site in Bee County seems to be the southernmost Folsom site, and its discovery extends the distribution of Folsom sites much farther south than heretofore known. The blades and scrapers of this series, in the light of the Lindenmeier finds, might be expected to go with the Folsom and Yuma material, but the same cannot be said of the remainder of the artifacts, especially the axe (or adze) and the stemmed projectile points. The axe or adze is an unusual specimen and does not appear elsewhere as a type.

(2) It is somewhat surprising to find stemmed projectile points associated with Folsom and Yuma points. This association is of considerable

importance in connection with the dating of the other Texas cultures that are generally regarded as early. It would appear that the Folsom culture and the early cultures of central and coastal Texas overlap in time.

NOTES ON TERRACE DEPOSITS

BY GLEN L. EVANS

GENERAL CONSIDERATIONS

Blanco Creek, one of the principal tributaries of the Mission River drainage system, heads in the southern part of Karnes County, Texas, and flows southeastward forming the boundary between Bee and Goliad counties. Medio Creek heads near the Karnes-Bee County line and approximately parallels Blanco Creek through Bee County. In Refugio County the two streams unite to form Mission River which flows into Mission Bay (Fig. 2). The streams flow across a low and gently dipping coastal plain of emergence.

Two periods of stream deposition in this drainage system are represented in the main valley and in the tributary valleys. In the first period the Berclair terrace was formed in the upper or older valley. During the second period was formed a lower valley and terrace. For a part of the course the valleys are independent, but through the middle reaches of the stream they exist in a "valley-within-valley" relationship (Fig. 5). The upper valley starts near the head of the present stream and terminates in the vicinity of Blanconia in southern Bee County, some 20 miles inland from Mission Bay. The lower valley becomes intrenched within the older valley about 10 miles below the stream's head and terminates at Mission Bay.

THE OLDER VALLEY

The greater part of the older valley and its principal tributary valleys was formed in and rests on the Goliad formation, but the lower reaches of the valley extend across the outcrop belt of the Lissie. Near its head the older valley is entrenched 50 or 60 feet below the general level of the adjacent divides. Downstream intrenchment decreases progressively until at Blanconia the valley walls are no more than a few feet high. The older valley is approximately 30 miles long; the width, about 2000 feet near the head, gradually increases to more than a mile in the lower reaches. The valley walls are mature, with moderately gentle slopes, usually well covered by grass and brush. The bedrock of the valley contains channels and other minor irregularities but is otherwise quite flat. The width and flatness of the valley floor are evidence that the ancestral streams continued for a long period to widen all parts of their valleys by lateral migration of the channel after it became graded or nearly so. The principal tributaries, such as Indian Creek, Trout Creek, Miller Creek, and Maja Arroyo, have similarly developed smaller valleys.

BERCLAIR TERRACE

The older valley is filled by a well-developed ancient flood-plain or valley-fill terrace deposit, which has been named the Berclair terrace. This deposit was formed late in the first erosional cycle of the streams. The terrace extends upstream practically to the head of the streams. The deposit varies in thickness from an average of 10 or 12 feet in the upper reaches of the valley to 20 or 25 feet in the lower reaches. The terrace widens and thickens downstream and ultimately spreads widely. In so doing it loses its identity as a stream terrace and becomes a part of the Coastal Plain formation. Where the terrace materials begin to spread they thin markedly. The streams appear to have flowed into a partially filled lagoon or onto a wide salt flat which must have been at or very near sea level of that time but which is about 70 or 80 feet above the present sea level. Seaward these deposits may grade into typical Beaumont facies or may be an intercalated sand member in the Beaumont beds or may be confined in a cut-off lagoon which was never resubmerged.

The composition of the terrace ranges from light-gray to dark-gray sand, gravel, silt, and alluvial clay derived from the later Tertiary rocks of the region, particularly from the Goliad formation. Secondary calcium carbonate in the form of caliche in varying concentrations is universal. In a typical section, the cross-bedded gravels appear at the base of the deposit, poorly stratified sands in the middle, and the silts and clays at the top. The percentage of gravel and coarse sand decreases in the lower reaches of the valley. These materials are sufficiently compacted and consolidated by caliche for vertical bluffs to form on the side of the channel against which the stream impinges. The fine sediments at the top of the deposit are usually more firmly cemented than are the coarser sediments.

The terrace in general has a broad flat surface capped by a mature soil which supports a dense covering of the typical coastal varieties of brush and trees. In places, particularly in the middle and lower portions of the valley, old channel scars or traces of filled channels are present. Low ridges of sand, presumably remnants of natural levees, parallel the channels on both sides. Where meander-cut bluffs of Blanco and Medio creeks expose these filled channels they are seen to be too shallow to cut through the terrace deposit and are filled with humus-stained sand. These channel scars are not related to tributary streams and do not appear to be cut-off meanders of the present Blanco and Medio

creeks. It is believed that these shallow channels were formed by intermittent run-off after the upper valley was filled and before rejuvenation had permitted the present channel to become permanently intrenched. A similar condition exists at present, although on a more limited scale, at the extreme head of the upper valley where headward erosion of the main channel has not yet reached, and the run-off is carried in shallow

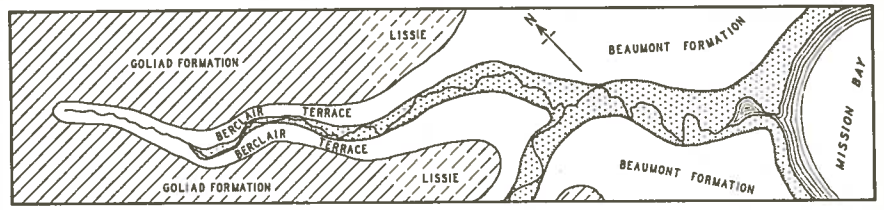


FIGURE 5.—*Diagrammatic representation of the relation of the valleys of Blanco Creek*
Showing relation of the older valley, Berclair terrace, to the Coastal Plain formations and to the later valley and low terrace of Blanco Creek.

discontinuous channels. Except in the unexcavated valley near its headwaters, the present channel cuts into the bed rock. The amount of cutting into the bed rock increases from a few feet in the upper reaches of the streams to a depth downstream of 38 or 40 feet.

Table 2 shows average width, thickness, and gradient of the Berclair terrace in reference to the present stream channel. The terrace thickens and widens progressively downstream for some distance and thins in the last four measurements where the width could not be ascertained because the deposit spreads to an unknown distance. All distances between points of measurement are along a straight line.

THE YOUNGER VALLEY

After the formation of the older valley the Coastal Plain gradually emerged. During emergence, Blanco and Medio creeks maintained their drainage to the bay across the gradually widening plain, increased their length by about 20 miles, and united to form Mission River. The drainage system became rejuvenated in a second erosional cycle, and a younger valley and flood plain or low terrace formed.

The younger valley formed first along the seaward extension of the drainage system between the termination of the older valley and the coast but has since extended by headward erosion for a considerable distance into the floor of the older valley. In these upper reaches it has cut through the old valley fill and well into the underlying Goliad and Lissie formations. In its uppermost reaches, the recent valley has a width of only 400 to 500 feet and is intrenched to a depth of about 25

feet below the surface of the old valley. This part of the valley is still being eroded. The width and depth increase downstream to 1270 feet and 38 feet respectively at Blanconia, 2100 feet and 55 feet at a point about midway between Blanconia and Refugio, and 2600 feet

TABLE 2.—*Width, thickness, and gradient of Berclair terrace*

Place measured	Width (Feet)	Thickness (Feet)	Height of base above stream bed (Feet)
1. East of Tuleta, 9½ miles below head of Blanco Creek	2000	10.5 to 12.5	2.5 to 3
2. Five miles below No. 1 and 1½ miles above highway bridge on Blanco Creek, west of Berclair, Buckner ranch	2800	18 to 21	3 to 4.5
3. At a pipeline across Blanco Creek on Lucas ranch, 5.4 miles below No. 2	3700	20.5	7
4. On Heard ranch 3.5 miles below No. 3	5250+	22.5	10
5. Blanconia bridge, north side of creek, 7 miles below No. 4	?	22.5	13
6. At first big bend in creek below mouth of Sarco Creek, 1.3 miles below No. 5	?	18.5	16.5
7. Refugio County, 2.2 miles below No. 6	?	11	25
8. Refugio County, 5 miles below Blanconia bridge	?	8 to 14	38

wide at Refugio. Below Refugio the valley widens to a mile or more, but its actual depth has not been ascertained. The floor of the lowermost reaches of the valley lies below the present sea level, as the stream channel is drowned to a distance of 4 or 5 miles above its mouth. This apparently indicates depression to present level following maximum uplift. The lower reaches of the valley, which is entrenched in the Beaumont formation, has reached maturity, and the stream is now here aggrading its channel.

LOW TERRACE

A low terrace, the present flood plain, has been formed within and coastwards from the termination of the older valley. It extends from the upper reaches of its enclosing valley to Mission Bay. Near the bay it spreads out as a low flat bordering the shore and merges with other similarly spreading flood plains. All parts of the terrace are subject to overflow during flood, and consequently it is still in the process of building by accumulating flood sediments. The deposit consists mainly of humus-stained, medium- to coarse-grained sand with minor amounts

of gravel at its base. In its lower reaches, fine sands and silts replace the coarser-grained deposits.

In the uppermost reaches of its valley, the low terrace first appears as a narrow alluvial shelf lying on the convex side of the meanders and on

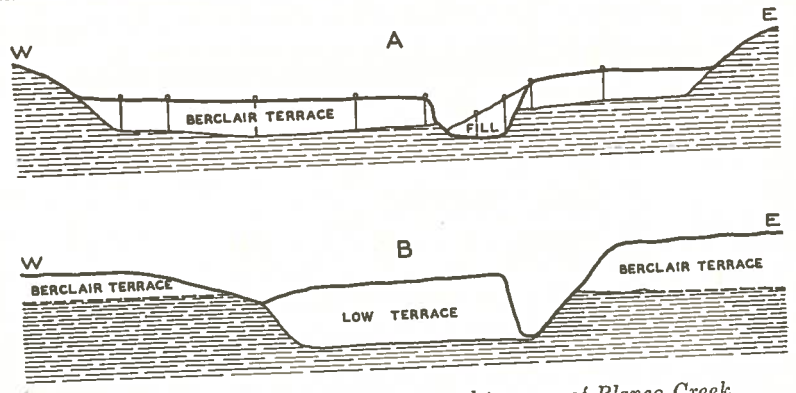


FIGURE 6.—*Cross section of valley and terraces of Blanco Creek*
(A) at Site 1; (B) at Blanconia. Scale: horizontal, 1 inch = 1000 feet; vertical, 1 inch = 80 feet.

the slipoff slopes. It widens gradually downstream. The deposit thickens from an average of 14 to 16 feet in the upper reaches to more than 30 feet in the lower reaches. Below Refugio the terrace base lies below present sea level, and the actual thickness has not been determined.

COMPARISON OF BERCLAIR TERRACE WITH LOW TERRACE

Certain marked differences distinguish the Berclair terrace from the low terrace. The low terrace is an aggrading flood plain, all parts of which are subject to overflow by Blanco and Medio creeks, while only the extreme upstream part of the Berclair terrace is subject to flooding. The low terrace is longer and thicker while the Berclair terrace is wider. The Berclair terrace extends farther inland, and the low terrace extends farther seaward. The low terrace lies everywhere at lower levels than adjacent points of the Berclair terrace. The low terrace rests against a valley wall of the Berclair terrace. In the uppermost extremities it is 8 to 10 feet vertically below the Berclair terrace. The seaward slope of the recent valley is greater than that of the older valley. Hence the two valleys become separated by increasing vertical distances at successive downstream points.

The Berclair terrace is well dissected by tributary streams projecting laterally from the intrenching recent valley. The late terrace is crossed by very few tributary streams, and nowhere do they cut completely through the deposit to the underlying bedrock.

The basal gravels of the Berclair terrace do not contain subsurface water in quantity, and no seep springs occur along its dissected margins. This is to be expected because the surface is well drained by numerous tributaries and because any surface water that finds its way into the gravels soon escapes into the numerous channels which cut through the deposit into the underlying formation. Subsurface water is present in some quantity at the base of the low terrace throughout its well-developed area. Its surface is poorly drained, and the highly porous character of its sediments permits easy entry of surface waters. Also its base lies below the level of stream dissection so that in most places its water cannot readily escape by seep springs.

The difference in the character of sediments of the two terraces is pronounced. The Berclair terrace is composed of an important percentage of gravel and coarse sand, whereas the low terrace contains an unimportant percentage of gravel and is primarily slightly compacted humus-stained sand. The Berclair terrace is a light gray to gray and contains much secondarily deposited calcium carbonate, while the more recent terrace is characteristically dark gray and contains very little calcium carbonate. The Berclair is generally well compacted and to some extent consolidated by the infiltrated caliche so that it weathers into vertical bluffs, while the late terrace is ordinarily but slightly compacted and exhibits gentle slopes on its stream-weathered margins. The Berclair has a relatively flat surface and a thick mature soil supporting dense vegetation; the recent terrace is more undulating and has a poorly developed soil with comparatively sparse vegetation. Vertebrate fossils, common in the Berclair terrace, are rare in the more recent terrace.

SUMMARY

Blanco and Medio creeks came into existence in post-Pliocene time, as indicated by their intrenchment in the Goliad formation. In forming the older valleys the streams must have been eroding actively for a considerable period to remove the enormous amount of material necessary to the formation of the relatively wide and deep valleys. After the streams reached grade and could no longer deepen their valleys they continued for some time to scour laterally by migration of their meanders. During this widening much of the Berclair terrace was deposited. As a result of this period of lateral corrasion and aggradation, the entire valley floor and the floors of the tributary valley were mantled with a considerable thickness of alluvium; these are features of an old mature valley. The waters of the ancestral creeks spread widely and deposited fine sands and silts over low flats or a partly filled lagoon near sea level, these deposits being the downstream extension of the Berclair terrace.

GEOLOGIC AGE OF THE FORMATION CONTAINING THE ARTIFACTS AND FOSSILS

AGE OF BERCLAIR TERRACE AS INDICATED BY STRATIGRAPHIC POSITION

An important fact brought out in the report by Evans is that the Berclair terrace does not extend to the present coast but apparently merges with the Beaumont formation. Dr. W. Armstrong Price (personal communication), who has made an extended study of the Beaumont, is of the opinion that the Upper Beaumont lies offshore to the east and that the exposed part of the formation in this region is Lower Beaumont. If this be true, the terrace deposits cannot be later than latest Lower Beaumont or lower Upper Beaumont. The profile of the Pleistocene stream as compared to that of the present stream, shown by Figure 7, offers important evidence of correlation of the terrace with the Beaumont formation. These profiles show that in Pleistocene time when the valley was being filled the gradient of the stream in this part of its course was less than in the present stream which has been rejuvenated. The flattening of the Pleistocene stream profile approaching what apparently was then the coastal lagoon compares closely with the flattening of the profile of the present stream approaching present sea level at Mission Bay. In Table 4 the approximate position of this terrace is shown in relation to some other formations of the Gulf Coast region.

AGE OF BERCLAIR TERRACE AS INDICATED BY FOSSILS

The fossils of the Berclair terrace include mammals, birds, reptiles, and land and fresh-water invertebrates. The birds and reptiles are as yet too imperfectly studied to be of immediate value in determining age. As is well known, the invertebrate faunas of the late Pleistocene south of the glaciated areas are closely similar to the recent faunas of the same region. This has been proven for the marine invertebrates at Vero and Melbourne, Florida, where an extensive vertebrate fauna, including extinct species of mammals, birds, and reptiles, rests upon shell marls containing relatively few extinct species. In San Patricio County, Texas, an equally extensive vertebrate fauna overlies marine shell deposits with but few extinct forms and is in immediate association with land and fresh-water invertebrates mostly of recent species. It is expected, therefore, that the invertebrate fauna will be found to be nearly the same as the modern fauna. The mammals, on the contrary, have undergone great changes chiefly in the extinction of the larger species in relatively late geologic time. In Table 3 the mammals from the Berclair terrace are compared with those obtained from two other localities—Vero, Florida, and the Tedford pit at Ingleside, Texas. The mammals listed from Vero are from the Melbourne formation which overlies the Anastasia formation consisting of marine Pleistocene

shell marl and is overlain by the Van Valkenburg beds. A closely similar fauna has been obtained from this formation at Melbourne, Florida, by Gidley and Loomis (Hay, 1927, p. 273) and at Seminole Field, Florida, by Simpson (1930). At Vero and at Melbourne as well as in Bee County

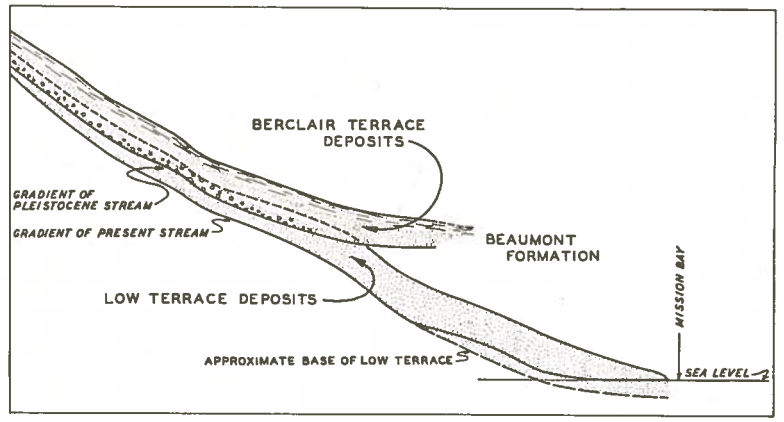


FIGURE 7.—*Profile of Blanco Creek*

Downstream from Site 1 of the Pleistocene stream that formed Berclair terrace and of the modern stream, Blanco Creek. Note difference in gradient of the Pleistocene and modern streams. Approximate scale: horizontal, 1 inch = 50,000 feet; vertical, 1 inch = 100 feet.

human relics have been found under conditions indicating that man was a part of this fauna.

Since the fauna at Ingleside, Texas, is closely similar to that of Berclair terrace it is important to determine the age of the Ingleside fauna. The Ingleside fossils are found in a filled pond several acres in extent resting on the Beaumont formation. The pond fill has a depth of from 7 to 9 feet. The section through the pond deposits is as follows: Soil, 0.5 to 1 foot; caliche, not invariably present, 1.5 to 2 feet; and yellow sand with lenses of white sand and thin clay laminae and in places nodules of bog manganese, 6 or 7 feet. Fossil bones and pond snails occur throughout the deposits below the soil level, the bones being most abundant near the base of the fill. One artifact, not in place, has been found in the caliche and sand hauled from the pit. Borings below the bottom of the pond fill show clay and sand strata with marine shells. The pond is surrounded by sand dunes. At one locality near the northeast margin of the pond where the caliche is absent two soil layers are separated by several feet of sand. In the lower soil layer in the margin of the sand dune was found a considerable part of the skeleton of an elephant. This and other considerations indicate that the dunes, which are quiescent and overgrown

TABLE 3.—*Comparison of the mammalian fauna of Berclair terrace of Mission River drainage system with that of the Melbourne formation at Vero, Florida, and of the Tedford pit, Ingleside, Texas*

Family	Berclair terrace	Vero, Florida (Melbourne formation)	Ingleside, Texas (Beaumont, Lower or Upper)
Hominidae	Artifacts	Artifacts and skeletal parts	Artifact
Elephantidae	*Parelephas columbi**	*Parelephas columbi**	*Parelephas columbi**
	*Archidiskodon imperator?**		
Mastodontidae	*Mastodon americanus**	*Mastodon americanus**	*Mastodon americanus**
Equidae	*Equus complicatus**	*Equus complicatus**	*Equus complicatus**
	*Equus fraternus**	*Equus leidyi*?†	
	*Equus giganteus**	*Equus litoralis**	
Camelidae	*Camelops** sp.	*Camelops*? sp.	*Camelops** sp.
			*Tanupolama** sp.
Bovidae	*Bison** sp.	*Bison** sp.	*Bison antiquus**
Cervidae	*Odocoileus* sp.	*Odocoileus sellardsiae**	*Odocoileus virginianus*
Tayassuidae	*Platygonus** sp.	*Tayassu lenis**	
Canidae	*Aenocyon ayersi**	*Aenocyon ayersi**	*Aenocyon ayersi**
Dasypodidae	*Holmesina septentrionalis**	*Holmesina septentrionalis**	*Holmesina septentrionalis**
	*Dasypus** sp.	*Dasypus** sp.	
Glyptodontidae	*Glyptodon petaliferus**	*Glyptodon* sp.	*Glyptodon petaliferus**
Megatheridae	Ground sloth* indet.	*Megalonyx jeffersoni**	
Mylodontidae	?	*Mylodon harlani**	*Mylodon harlani**
			Sylvilagus sp.
Leporidae	*Lepus* (*Macrotolagus*) sp.	*Sigmodon* sp.	
Muridae	*Sigmodon hispidus*	*Neofiber alleni*	
	Ondatra zibethicus		
Talpidae	*Scalopus aquaticus texanus*		

* Extinct species.
† *Equus leidyi* Hay, the writer now believes, is a synonym of *E. fraternus* Leidy.

with timber and underbrush, are the same age as the pond and accumulated previous to the disappearance of the elephant and that both the dunes and the pond deposits date from the time when this dune was at the shore line of a bay or lagoon of the Gulf and was at sea level of that time. This conclusion is further supported by the presence of worn sea shells found in the bone bed such as could have been and apparently were thrown across the sand dunes by storm waves when the pond was immediately back of the sand dunes of the coast line. W. Armstrong Price (personal communication), after studying this locality, is of the opinion that the pond deposit is of late Lower Beaumont or early Upper Beaumont age.

It is seen from Table 3 that almost all the species of mammals found in the Berclair terrace deposits are present also in the Melbourne formation at Vero and in the Tedford pit at Ingleside. Vertebrate fossils are abundant at both the Vero and Ingleside localities. The following mammalian genera and species, not found in the Berclair terrace, have been found in the Melbourne formation at Vero. Extinct species are indicated by asterisk. *Hydrochoerus robustus,** *Tapirus veroensis,** *T. haysii*?,* *Smilodon (Trucifelis) floridana,** *Vulpes palmaria,** *Lutra canadensis, Procyon lotor, Odocoileus osceola*?, *Didelphis virginiana, Cryptotis floridana, Blarina brevicauda peninsulae.* A few additional species are recorded from this formation at Melbourne and at Seminole, Florida. The following species, not found in the Berclair terrace, have been obtained from the Ingleside bone bed: *Tapirus veroensis,** *Cervus** sp., *Smilodon** sp., *Canis* sp., *Cynomys ludovicianus.*

Notwithstanding that the Berclair terrace has yielded a smaller fauna than have the other two localities, the almost complete agreement in genera and species among the fossils obtained indicates a very close if not exact correlation in age between the three localities. The gradual increase in the faunal list during the past 2 years of excavating indicates that additions may yet be made to the known fauna of the Berclair terrace.

The fauna supplemented by evidence as to stratigraphic position affords the basis for the tentative correlation given in Table 4 of some of the Pleistocene formations of the Gulf Coast region. Subsequent investigations may afford evidence for some adjustments in this proposed correlation. However, the writer is confident that in the main the correlation of Pleistocene formations as shown here is correct.

CONCLUSIONS

The artifacts found in the Berclair terrace of the Mission River drainage system include more than one cultural type. These cultures may

be in part contemporaneous, but it is more probable that some difference exists in the age of the cultures. The Folsom and Yuma cultures are probably contemporaneous. Stemmed projectile points are found at this same level in the deposits. The Clear Fork gouge is present in the

TABLE 4.—*Tentative correlations*

VERO FLORIDA	INGLESIDE TEXAS	MISSION RIVER TEXAS
VAN VALKENBURG BEDS		LOW TERRACE
MELBOURNE BONE BED	ANCIENT SAND DUNES INGLESIDE BONE BED AND LOWER BEAUMONT CLAYS INCLUDING MARINE SHELL MARL	BERCLAIR TERRACE AND LOWER BEAUMONT CLAYS
ANASTASIA MARINE SHELL MARL		

latest culture found in this terrace. As valley fill proceeds slowly it follows that the artifacts of the basal part of the formation may be appreciably older in years than are those at a higher level.

The life history of the stream includes the following periods or stages: (1) development of the stream to approximately its present inland extent accompanied by downcutting essentially to grade level; (2) meandering and lateral erosion at grade level by which the valley was enlarged to its present width accompanied by valley fill to the present thickness, or nearly so, of the Berclair terrace deposits; (3) regional uplift resulting in rejuvenation of the drainage, renewed downcutting, and extension of the stream to the present Gulf Coast; (4) formation of the younger valley best developed in the lower reaches of the stream; (5) depression forming the present drowned valley of this stream.

The artifacts, hearths, and camp sites are evidence of man's occupation of the valley during stage No. 2. To measure the lapse of time in years since man's first known habitation here is extremely difficult. It is not known how long the filled valley may have remained essentially at grade level. It is not known what length of time is involved in the regional uplift of stage No. 3. Evidence though meager suggests that uplifts proceed slowly and that the time interval is to be counted in millenniums. Lastly there is the unknown interval of time required for the stream to intrench itself during or following the uplift and to cut to grade in its lower course and by lateral meandering establish a

younger valley which in places exceeds a mile in width, this having been followed by depression of the land surface with respect to the ocean level. Bryan and Ray (1939) have suggested that the Folsom culture, one of those present in the Berclair terrace, may be 25,000 years old, Antevs (1936) places the age at 12,000 to 13,000 years, and Roberts (1940) suggests 15,000 years as the time of first appearance of man in America. In view of the recorded geologic events since man occupied these stream valleys—valley fill, regional uplift, formation of a lower terrace and coastal depression—the largest of these estimates seems doubtfully adequate, and one is inclined to think of an interval of possibly two or three times 25,000 years.

The geologic age of the formation is definitely Pleistocene. This conclusion is established on stratigraphic evidence which shows that the terrace is the upstream equivalent of the Beaumont formation and probably represents the Lower Beaumont. The Pleistocene age is further indicated by the fauna in which the mammalian species are largely extinct. The correlation of the terrace deposits is with the Melbourne bone bed of Florida and with or slightly older than the Tedford bone bed at Ingleside, Texas. The climatic conditions may not have been greatly different from those of the present. The locality affords evidence of the presence of man in America in a comparatively advanced cultural stage in the latter part of the Pleistocene period.

Man's presence in the valleys of the Mission River drainage system during Pleistocene implies his presence at the same time over a much larger area, probably, consistent with other records, throughout most if not all of North and South America. Moreover, the Folsom, Yuma, and Clear Fork are specialized cultures. So far as known they are indigenous to North America, and if this is true it is not reasonable to assume that they represent the earliest Americans. The time of first arrival of man on the continent is yet to be determined.

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