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A Contribution to the Vertebrate Paleontology of Texas.

By *E. D. Cope.*

(Read before the American Philosophical Society, February 5, 1892.)

I. FAYETTE FORMATION.

In the First Annual Report of the Geological Survey of Texas (p. 47), Mr. R. A. F. Penrose, Jr., describes this formation as it occurs in South and East Texas. He places it at the summit of the Tertiary series and below the "Posttertiary;" that is, at the summit of the Neocene, just prior to the advent of the Plistocene. This location is justified by the only vertebrate fossils—definitely traceable to these beds, which have been sent me for identification by Dr. E. T. Dumble, State Geologist of Texas. One of these consists of a well-preserved left ramus with symphysis and nearly complete dentition of the mandible of the large lama, *Holomeniscus hesternus* Leidy. This species is characteristic of the Equus beds of Oregon, California and Mexico, and indicates satisfactorily the age of the formation in which it occurs. It confirms fully the position assigned to the Fayette beds by Mr. Penrose. The only other identifiable fossil from this formation is several teeth of the *Equus major* Dekay. This species is most abundant in the Eastern States, where the Equus beds have not been certainly identified; but it occurs also in the Equus bed of Nueces county, Texas, with other characteristic species of that epoch. The specimens of the two species named came from Wharton county. This is the first exact determination of the age of the Fayette formation from paleontological data, and is therefore of much interest, as it enables us to correlate a definite horizon of the East with the Equus bed of the Pacific region. The determination of King and myself that the Equus bed is upper Pliocene is confirmed; since besides Penrose, Chamberlin assures us that the Fayette formation (Appomattox or Orange sand) is pre-glacial.

II. UPPER CENOZOIC OF THE STAKED PLAINS.

In some remains of vertebrata, obtained by Mr. W. T. Cummins, from Crosby county, Texas, and sent me for determination by Dr. E. T. Dumble, State Geologist, three genera may be identified, and several others are indicated. The three genera are Equus, Mastodon and Testudo. They are enclosed in a white siliceous friable chalk, which Mr. Louis Woolman finds on examination to be highly diatomaceous. Prof. C. Henry Kain had identified the following species: *Compylodiscus bicostatus* W. Smith; *Epithemia gibba* Ehr.; *E. zebra* Ehr.; *E. gibberula* var. *producta* Ehr.; *Navicula major* Ehr.; *N. viridis* Ehr.; *N. rostrata* Ehr.; *N. elliptica* var. *minutissima* Green; *Gomphonem clavatum* Ehr.; *Cymbella cistula*, Hemp.; *Fragillaria virescens* Ruffs var. The formation has been named the Blanco Canyon bed by Mr. Cummins (First Annual Report of the Geol. Survey

of Texas, 1890, p. 190) without exact determination of its position in the Cenozoics.

The Mastodon is of the *M. angustilens* type, as indicated by the teeth, but there are not enough fragments preserved to render it clear whether they pertain to this species or to some allied one. The Equus is allied to the *E. occidentalis* of Leidy, but the enamel plates are more simple than in that species, being the most simple known in the genus. I regard it as an undescribed species, and describe it below under the name of *Equus simplicidens*. A second species of horse is indicated, but an exact determination cannot be made without additional material. The tortoise is a terrestrial form. A water bird of which a tarcometatarsus is contained in the collection, is kindly determined for me by Dr. Shufeldt as allied to the rails.

EQUUS SIMPLICIDENS sp. nov.

This species is represented by one nearly entire superior molar of an adult, and one of a young animal, with characteristic fragments of two other superior molars, and several fragments of inferior molars. The size of the teeth is about that of the *E. occidentalis* and *E. caballus*. The internal column is of moderate anteroposterior extent, its posterior border marking the anterior third of the posterior lake. Its long diameter is considerably less than half that of the crown. A peculiarity found in two of the superior molars, but not in two others, is that the median dentinal connection between the external and median crescents is interrupted by the continuity of the enamel plates bordering the lakes from the one

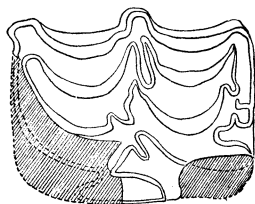


FIG. 1. *Equus simplicidens* Cope; crown of true molar of left side; natural size.

to the other. This arrangement is frequently seen in the large pm. 3, in the species of Equus, but does not occur in the other premolars and molars. It is a reversion to the condition seen in Anchitherium. A principal character of the species is seen in the extreme simplicity of the enamel borders of the lakes. They are without inflection, except the usual loop on the posterior inner border of the anterior lake, and this is simple and widely open at the base. At the point of junction of the median crescents (meta- and paraconules), the usual loop of the internal enamel border is seen. The external median rib is narrowed and not flattened; the anterior rib is more flattened, especially at the present grinding face.

The species with which it is necessary to compare this species is the *Equus occidentalis* of Leidy. The enamel plates bordering the lakes in that species are always more complex, although they are simpler in it than in the other extinct species of North America. Even in the simplest forms (*e. g.*, that figured by Leidy in Vol. i, Report U. S. Geol. Surv. Tens., 1873, Pl. xxxiii, Figs. 1, 2) the lakes have anterior and posterior

emarginations on the inner border, which are wanting in the present species.*

The species is probably the oldest member of the genus *Equus* known from North American beds. It is the only species which was contemporary with a *Mastodon* with the *M. angustidens* type of molars. The simplicity of the enamel foldings is appropriate to this primitive period, as it approximates to the condition seen in many of the three-toed horses and the supposed one-toed *Hippidium spectans* Cope.† The size of the molars is about that of the modern horse, *E. caballus* L.

Observations.—The contemporaneity of this species of *Equus* with the *Mastodon* with molars of the *M. angustidens* type has considerable significance. The latter is characteristic of the Loup Fork horizon in North America, in which the genus *Equus* does not occur. The *Equus* beds, so named from the abundance of individuals of four species of *Equus* which they contain, have never produced a specimen of *Mastodon* allied to *M. angustidens* in North America.‡ The fact that the *Equus* of the Staked Plains is different from those of the *Equus* beds, adds to the indication furnished by the *Mastodon* that these beds do not belong to the *Equus* horizon; but the presence of the genus *Equus* is equally conclusive that they do not pertain to the Loup Fork. It is probable that the age of the beds is intermediate. They thus offer an interesting field for further research.

CRECCOIDES OSBORNII, Shufeldt, gen. et sp. nov.

Char. gen.—Only a fragment of a left tarso-metatarsus represents this new genus and species of bird. It evidently belonged to some wader of about the proportions of a medium-sized heron, or to a form rather larger than the Floridan crane-like rail *Aramus*.

The specimen consists of about the superior moiety of the tarso-metatarsus, and, in so far as it goes, appears to be perfect, with the exception of slight marginal abrasions of the summit of the bone and the almost complete fracturing off of the hypotarsal process. Superiorly, the intercondyloid prominence or tubercle is rounded and not especially conspicuous; the inner condyloid depression is more extensive than the outer one, and occupies a higher plane. In front the shaft is longitudinally excavated only above, the excavation gradually but soon disappearing as we pass down towards the distal extremity; and at the midpart of its

* The horse found in Florida by Mr. Wilcox, which Dr. Leidy identified as his *Equus fraternus* (Transac. Wagner Free Inst. Science, Philadelphia, 1889, p. 16), must be referred to a genus distinct from *Equus*, on account of the absence of cups of the incisors, by the loss of the internal wall. This is seen in both unworn and worn specimens. In some cases an internal cingulum remains to indicate its position. It appears to be a case of degeneracy. I have named the genus *Tomolabis*.

† *American Naturalist*, 1887, p. 1072.

‡ It is probable that the *Dibelodon shepardii* Leidy, which has molars of this type, occurs in the *Equus* beds of the valley of Mexico. Cfr. Cope, Proceed. Amer. Philos. Soc., 1884, May.

continuity it is subcylindrical upon section. A short distance below the head of the bone are seen the usual anteroposterior perforating foramina, here three in number, two being lateral and below, with a mid one just above them. Immediately below these is a single, somewhat prominent tubercle for the insertion of the tendon of the *tibialis anticus* muscle. It occupies nearly a median position upon the shaft. So far as can be ascertained from the imperfect hypotarsial process it would appear that it possessed originally a large, single, inner groove for tendons, with a plate-like projection to its outer side.

Char. specif.—Proximally, the tarso-metatarsus is considerably excavated to the inner side of the hypotarsus at a point just below the summit. The outer muscular line is single and commences at the middle point of the margin of the outer condylar depression, passing from thence down the back of the shaft. The inner muscular line bifurcates proximally, then passes more obliquely backwards than the outer line, to finally pass parallel with the latter also down the back of the shaft.

Measurements.

	MM.
Greatest transverse width of proximal end	15
Greatest anteroposterior diameter of prox. end, not including hypotarsus	11
Distance from apex of intercondyloid tubercle to the tubercle for tib. ant. muscle	10
Vertical depth of hypotarsus	10
Transverse diameter of shaft near its middle	6

Remarks.—This fragment has been compared with the corresponding part of the skeleton in a great many kinds of birds. It was found to differ entirely from all larine, gallinaceous and raptorial types, while on the other hand it seemed to combine the characters of several various species of existing waders and allied groups. The writer compared it with numerous species of the genera *Guara*, *Plegadis*, *Aramus*, *Rallus*, *Crex*, *Porzana*, *Ajaja*, *Tantalus*, *Botaurus*, *Ardea*, *Nycticorax*, *Grus* and the *Gallinules*, *Storks*, etc.

For a skeleton of *Crex pratensis* I am indebted to Mr. F. E. Beddard, prosector of the Zoölogical Society of London, and for the loan of other material to the United States National Museum, as well as to Mr. F. A. Lucas, of that institution, for placing the same at my disposal. In the specimen under consideration, the Ralline characters appear to predominate, while more remotely we may see Ibis in its general form and outline. Apart from the question of size it, however, distinctly differs from the tarso-metatarsus in such a form as *Aramus giganteus* in that the shaft was more cylindrical as it approached its midportion, and, as has been said above, did not show the anterolongitudinal excavation in that part. Moreover, in *Aramus* the hypotarsus exhibits *two* grooves for the passage of tendons, and the tubercle for the insertion of the *tibialis anticus* muscle

is double. Essentially, it agrees with Aramus in the *general form* of its hypotarsus and in the direction of its lateral muscular ridges. In other particulars it exhibited both some minor differences and agreements with the corresponding bone in the skeletons of *Crex* and *Rallus*. Upon the whole the specimen would appear to have belonged to some large rail-like wader, now extinct.

The name of the genus I create to contain this form is composed of the two Greek words, $\kappa\rho\acute{\alpha}\xi$, a crane, and $\epsilon\iota\delta\omicron\varsigma$, resemblance. Its specific name is given it in honor of Prof. Henry F. Osborn, of Columbia College, New York, in recognition of his excellent work in paleontology for a number of years past.

The specimen was collected by Mr. W. T. Cummins, and is at present in the possession of Prof. E. D. Cope, to whom the writer is indebted for the honor of having been permitted to describe it.—*R. W. Shufeldt.*

TESTUDO TURGIDA sp. nov.

This species is represented by the greater part of a chelonite of about the size of the *Xerobates agassizii* of Arizona. It is remarkable for the remarkable depth of the dermal sutures and sculpture lines, and for the swollen character of the interspaces which separate both. The general shape is a short, wide oval, with steep to vertical margins.

The plastron is widely emarginate posteriorly, and the anal-femoral dermal sutures form a deep notch in the border. The anal scuta are oblique rhomboids, with equal and nearly parallel sides. The median longitudinal dermal suture is deep and wide, cutting half through the thickness of the plastron. It sends off a branch on each side bounding the gular plates in front. The part of the plastron enclosed in the latter forms two flattened cones appressed together, whose vertical diameter exceeds the transverse, and whose subconic apices are separated by a deep notch. The interclavicular bone is very large and is wide diamond-shaped, the anterior angle being larger than the posterior. The transverse humeropectoral suture is very deep, and is similar to the median longitudinal. The borders of the anterior lobe are strongly convex, with a chord only twice as long as the lateral border of the gular plates.

The nuchal bone has a strongly concave-emarginate border. On the posterior vertebral bones is a seat-like concavity, which is surrounded by a ridge which forms the greater part of a circle. The costal bones are unequally divided by the costal dermal sutures, which are very deep. Each costal scutum is divided into two areas, one of which is marked with ribs parallel to the vertebral axis at one extremity and a seat-shaped plane with a bordering ridge at the other, which is in some of the costals smaller and more swollen. The other half or part of the costal scutal area is swollen in the longitudinal direction, but not for its entire length. The marginal bones are massive and have a subacute border between the bridge and the median points. They are much deeper than long, and are deeply divided by the sutures which separate the dermal marginals. These

grooves cut the margin into deep notches at some points and into shallower ones at others. The areas between these sutures are all swollen in the same way as the alternate parts of the costal plates.

Measurements.

	MM.
Length of plastron anterior to posterior angle of interclavicle.....	80
Width of plastron anterior to posterior angle of interclavicle..	112
Length of interclavicle.....	40
Width of interclavicle.....	58
Thickness of interclavicle.....	11
Length of free lateral margin of gular plate.....	29
Width of base of both gular plates.....	45
Length of xiphiplastral bone.....	32
Width of xiphiplastral bone on anterior suture.....	53
Width of emargination of posterior lobe of plastron.....	50
Diameters of free marginal near bridge	{ anteroposterior 20 { vertical 34 { transverse below.... 25
Diameters of marginal of bridge.....	{ anteroposterior 29 { vertical 44 { transverse below.... 21
Diameters of penultimate vertebral bones	{ anteroposterior.. 17 { transverse..... 30

The American tortoise, which has produced gular areas somewhat like those of this species, is the *Testudo cultratus* Cope of the White River Neocene of Colorado. That species is, however, totally different in the dermal sutures of the usual character, flat marginals, etc., and the gular processes are not conic, but trihedral in form.

The specimen above described comes from Espuella near Dockum, from the same horizon as that of Crosby county, or the Blanco Canyon bed of Cummins.

III. ON A MESOZOIC PYCNODONT.

MICRODUS DUMBELII sp. nov.

This species is represented by a splenial bone of the left side, which supports four and a half rows of teeth. The external two rows include small teeth with crowns, which are either round or slightly transversely oval. The teeth of the third row are larger and the crowns are all transversely oval. The teeth of the fourth row are of unequal sizes, commencing anteriorly of about the same size as those of the third row. The third tooth from the front, as preserved, is much larger, but it is exceeded by the fourth; while the fifth is half as large again as the fourth. The sixth and last is a little smaller than the fifth. The teeth of the fifth row are as

small as those of the first and second rows, and extend posteriorly to the anterior part of the fourth of the fourth row, and not beyond. The crowns of the teeth are perfectly smooth and without keel or depression.

	MM.
Length of tooth series	17
Six teeth of external row.....	10
Six teeth of third row.....	11.5
Six teeth of fourth row.....	16.5
Diameters of fifth of fourth row	{ anteroposterior..... 3
	{ transverse..... 7

The horizon of this species is not exactly known, but it is probably Lower Cretaceous. It gives me much pleasure to dedicate it to Dr. E. T. Dumble, Director of the Geological Survey of Texas.

IV. TRIASSIC OR BOKUM BEDS.

The fossils from these beds present a general similarity to those obtained elsewhere in the Trias. Fragments of large Stegocephali are abundant, and Crocodilians of the Parasuchian group are still more so. Teeth like those of the Eastern Clepsysaurus and Zatomus also occur. The number of identifiable species is small, and the best preserved of these is a new representative of the genus *Episcoposaurus* Cope, already described from the Triassic bed of New Mexico.*

EPISCOPOSAURUS HAPLOCERUS sp. nov.

I refer to this species the following pieces which were found together by Mr. W. T. Cummins. A dorsal and probably two caudal vertebræ; a scapula of the right side; a few fragments of ribs, and about thirty dermal bones. The generic characters and those of higher value may be first described.

The single dorsal vertebra is from the posterior part of the series. Its articular surfaces are shallowly concave. The neural arch is not entirely coössified, part of the sutural surface being visible in the fracture, from which the neuropophysis has been broken. There is a rib-facet at each end. The smaller, which is longer than deep, is continuous at an open angle with the tubercular articulation of the short diapophysis. The other is longer than deep, lenticular in outline, and terminates acutely above. The scapula is massive, and the inferior extremity is thinned below and turned obliquely inwards. No proscapula. The coracoid facet is not large, and is separated by an angle from the glenoid cavity. The ribs are flat, not very wide, and have one subacute edge. The head of one is attached to the dorsal vertebra, above described. The capitular and articular surfaces are subequal and are separated by an angle. The dermal bones are thick and are united by suture, so as to form transverse bands across the body; but are not united in the anteroposterior direction. Some

*Proceedings Amer. Philos. Soc., 1887, p. 213.

of them have median tuberosities, which are developed in others into horn-like spines. These form rows on the opposite sides of the middle line, as they are unilaterally symmetrical.

Char. specif.—The dorsal vertebra above referred to has the centrum slightly wider than deep. Its inferior surface is contracted on each side, and is slightly concave on the middle line. The surface is smooth. The diapophysis is robust, subtriangular in section, and it does not project freely beyond the centrum. The centrum of a caudal vertebra with chevron facets, is deeper than wide, and has robust diapophyses, which spring principally from the centrum. The outline of the articular face is a hexagon elongate vertically. This is partly due to the broad truncation of the inferior face. Concavity of centrum slight.

Measurements of Vertebrae and Ribs.

	MM.
Diameters of dorsal	{ anteroposterior..... 66
	{ vertical..... 64
	{ transverse..... 75
Diameters of caudal	{ anteroposterior..... 52
	{ vertical..... 59
	{ transverse..... 51
Vertical diameter of head of rib attached to dorsal, above mentioned.....	46
Transverse diameter of capitulum of do.....	26
Transverse diameter of shaft of another rib.....	40
Thickness of shaft of another rib.....	15

The section of the scapula is everywhere lenticular. It is robust, rather short, without much constriction at the base, and but a moderate expansion above. A distinct clavicular facet is not preserved. The incurvature of the inferior surface is most abrupt anteriorly, the angle there amounting almost to a tuberosity.

Measurements of Scapula.

	MM.
Length on external face from superior border to line of superior edge of glenoid cavity.....	141
Diameters at narrowest part	{ anteroposterior..... 60
	{ transverse..... 32
Diameters glenoid cavity....	{ vertical..... 52
	{ transverse..... 40

The *dermal bones* are subquadrate in form, and have sutures on two opposite sides and thin edges on the other opposite sides. The inferior surface is more or less concave from one sutural border to the other. They are all coarsely pitted, but the pits are reduced in size towards the edges in some of the plates. In many of the plates there is a prominent obtusely conic tuberosity placed unsymmetrically near the centre or edge of the

plate. This tuberosity is in some of the plates developed into a prominent spine or horn, which has an anteroposteriorly oval section. The surfaces of the tuberosities are punctate. These horns are placed on the sides, and probably not far from the median line, since they form with the adjacent tuber-bearing plates a strong angle, such as would be necessary to enclose the neural spines of the vertebral column. It is also not certain whether these spines were on the dorsal, cervical or caudal regions, or whether they were on all of them. The plates adjacent to those bearing spines are the most robust. The spines are gently curved, probably backwards.

Measurements of Dermal Plates.

	MM.
Diameters of plate without knob	anteroposterior..... 90
	transverse..... 78
	vertical at suture..... 18
Diameters of plate with knob....	anteroposterior.....100
	transverse..... 70
	vertical at suture..... 37
Diameters of plate with spine....	anteroposterior.....115
	transverse (chord)..... 65
	vertical at suture..... 35
Elevation of spine of plate last, measured from base (apex restored).....	190
Diameters of spine at base.....	anteroposterior..... 95
	transverse..... 65
Diameters of spine 45 mm. below apex	anteroposterior..... 30
	transverse..... 20
Diameter of pits on flat bone.....	5
Diameter of pits on knobbed bone.....	9

In *comparison* with the only species of the genus known thus far, the *E. horridus*, from the Triassic bed of New Mexico, the present species has the tuberosities and horns of a different shape. In that species the former are compressed and keel-like, and the horns are also compressed, having an edge in front and a triangular section. The individual which served as the basis of the description of the *E. horridus* is also of rather smaller size than the present one.