Article XI. — A SKULL OF DINOCYON FROM THE MIOCENE OF TEXAS.

By W. D. MATTHEW.

Among the valuable specimens brought back by Mr. J. W. Gidley from his collecting trip for the American Museum last summer, were the skull and part of the skeleton of an enormous carnivore which on extraction from its matrix proves to be a Canid of the Amphicyonine group. It appears to be a very aberrant species of *Dinocyon*, a genus hitherto known by teeth and fragments of the jaw of *D. thenardi* described by

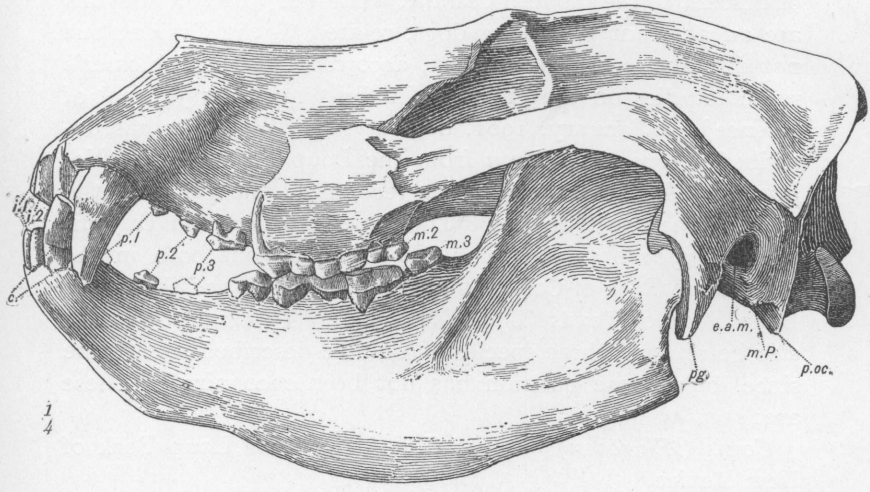

Fig. 1. Side View of Skull × ¼.

Jourdan in 1862[1] from the Upper Miocene beds of Grive St.-Alban.

This specimen is more complete than any Amphicyonine hitherto described, not only in this country, but in Europe, where Amphicyons have long been known. The skull and

[1] Comptes Rendus de l'Institut, LIII; Bull. des Sociétés savantes (1862). Another species, *Amphicyon göriachensis* Toula, is referred to this genus by Prof. Deperet. Dr. Schlosser prefers to place it with *Hemicyon*, probably identical with *H. sansaniensis* Lartet. It would seem to be an intermediate form, like *Dinocyon* in the carnassial, like *Hemicyon* in the tuberculars.

jaws are complete although crushed, and the first eight vertebræ are in place. The succeeding nine vertebræ and parts of the hind limb were found close by. All were enveloped in hard flinty concretion, which has been removed from one side only of the specimen. The horizon is the Loup Fork terrane, which, in the part of Texas in which this specimen was found, contains a fauna approximately Upper Miocene in age so far as comparisons have been instituted.

It is only within the past two years that true Amphicyons have been recognized in this country, the species referred to that genus by Leidy and Cope being, as Prof. Scott has shown,[1] much more primitive, and nearly or quite in the line of descent of the modern Canidæ, while the true Amphicyons are an aberrant branch of dogs, related to the Ursidæ, but not directly ancestral to them, according to Dr. Schlosser's recent studies on the group.[2] In the 'American Journal of Science' for January, 1901, however, Dr. Wortman has described a true *Amphicyon* from the Loup Fork beds of Nebraska. Mr. Earl Douglas has recognized the genus in the same terrane in Montana. The American Museum Expeditions of 1901 obtained remains of Amphicyons both in the older Loup Fork of Colorado (Middle Miocene) and the newer Loup Fork of Texas (Upper Miocene). To this group may also be referred three species of Canidæ described some time since, but whose position has not been recognized. These are:

Canis (*Ælurodon*) *ursinus* Cope,[3] from the Loup Fork of New Mexico.

Borophagus diversidens Cope,[4] from the Blanco of Texas.

Ælurodon mæandrinus Hatcher,[5] from the Loup Fork of Kansas.

The specimen here described represents a species distinct from any of those above mentioned, and is named in honor

[1] Notes on the Canidæ of the White River Oligocene, Trans. Amer. Phil. Soc., Vol. XIX, 1898, p. 326 *et seq.*

[2] Ueber die Bären und bärenähnlichen Formen des europäischen Tertiärs. Palæontographica, Bd. XLVI, 1899, p. 95 *et seq.*

[3] Proc. Acad. Nat. Sci. Phila., 1875, p. 256; Rep. Wheeler Survey, 1877, p. 304, pl. lxix, fig. 1.

[4] American Naturalist, 1892, p. 1028; Rep. Tex. Geol. Sur., 1892, p. 52, pl. xiii, fig. 4.

[5] American Naturalist, 1894, p. 239 and fig.

of Mr. J. W. Gidley, the discoverer of many of the choicest specimens of fossil mammals in the collections of the American Museum and of Princeton University.

Dinocyon (? Borophagus) gidleyi, sp. nov.

Generic and Subfamily Characters. — Dentition, $\frac{3.1.4.2}{2.1.?\,4.3}$. Premolars much reduced, without posterior accessory cusps, one or two of the inferior series perhaps absent. Carnassials small and low with reduced shear, tubercular teeth very large with low cusps. Jaw very deep and massive, facial part of skull elongated, sagittal and occipital crests high, brain-case small. Bullæ inflated, but smaller than in typical Canidæ, mastoid process small, paroccipital process moderately long, coössified with the bulla. (In the bears the mastoid process is much enlarged, the paroccipital reduced, and the tympanic bulla not inflated.)

Subgeneric Characters.—Teeth like those of *Amphicyon* in form, especially such species as *A. americanus* Wortman. Upper molars much wider transversely, and the first more trigonal in outline than in *Dinocyon thenardi.*

Specific Characters.—Size somewhat greater than in *D. thenardi* or *D.* ("*Aelurodon*") *mæandrinus*, premolars more reduced and premolar region of the jaw longer than in the latter species or in *Borophagus diversidens.*

It is difficult to place this fine species in any of the described genera. In form and character the carnassials and molars (Fig. 2) are like those of *Amphicyon.* But the third upper molar, a well developed tooth in *Amphicyon*, is absent from either side of the Texas skull, as it is in *Dinocyon* and *Hemicyon*, and probably in *Pseudamphicyon.*[1] The size is near that of *D. thenardi*, with which the proportions of the lower teeth, so far as they can be seen, agree fairly well. But the first and to some extent the second upper molars, are trigonal and much extended transversely, while in *Dinocyon*, and still more in *Hemicyon*,

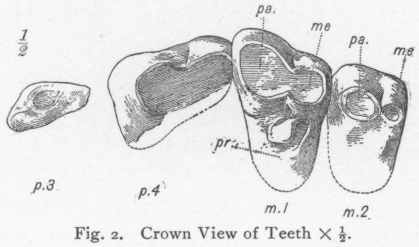

Fig. 2. Crown View of Teeth × ½.

[1] Schlosser, *l. c.*

these teeth approach the round quadrate shape characteristic of *Hyænarctos*. *D. gidleyi* may be considered as an aberrant member of the genus *Dinocyon*, but its relationship to the type species is perhaps rather formal than real.[1]

The skull (Fig. 1) is the most complete one yet described of an Amphicyonine dog. Professor Filhol[2] has described and figured a skull of *A. lemanensis*, but it was by no means complete. The Texas skull, although crushed, is quite complete, and the parts of the skeleton preserved enable us to determine the proportions and general character of this great carnivore.

The size of the skull equals or exceeds that of any living carnivore of which I can find record. It is longer, wider, and deeper than the largest *Ursus maritimus* skull in our collection, and its measurements slightly exceed those given for the Kadiak bear in length and depth (including the jaw). The crushing of the skull prevents any exact comparison in width; but the Kadiak skull is probably much wider than was that of *D. gidleyi*.

The most striking characters of the skull are the size and depth of the jaw, and the heavy zygomatic arches. The nasal openings are large and cavernous, as in the polar bear, unlike the smaller and more slender muzzle of the lesser bears and of the dogs. The inferior postorbital process is hardly as prominent as in the wolf, much less than in any of the bears. The tympanic bullæ are inflated, although of proportionately smaller size than in the wolf. The teeth are larger in proportion to the size of the skull than in the bears, especially the molars, which exceed those of *U. maritimus* in length and are more than twice as wide. The cranium bears a high crest, as in *Amphicyon*, giving attachment for the powerful jaw-muscles; and the brain is decidedly smaller than in the modern Ursidæ. Compared with *Amphicyon*

[1] Should further study of the American Amphicyons render it advisable to remove *D. gidleyi* and the probably nearly allied *D. mæandrinus* to a different genus, Cope's name *Borophagus* may perhaps be used. But as the type of *Borophagus* is from the Blanco beds it would be desirable to know more than we do at present about the Blanco Amphicyons before making any such change. All that can be said at present is that there were two or more species of the group in this horizon, of unknown dental formula.

[2] Arch. Mus. Lyons, III, 1883, pl. i, figs. 3–5.

lemanensis of the Upper Oligocene, the premolars are more reduced, the muzzle larger, the sagittal crest not so high, and the brain-case fully as large in proportion (although, as the skull is so much larger, one would expect to see a proportionately smaller brain-case). The arches are heavier and the jaw much deeper. In the outline sketch of the skull (Fig. 3) the crushing of the specimen has been corrected, as nearly as could be estimated.

The cervical vertebræ are of the size of those of the polar bear, but differ rather widely from both bears and modern

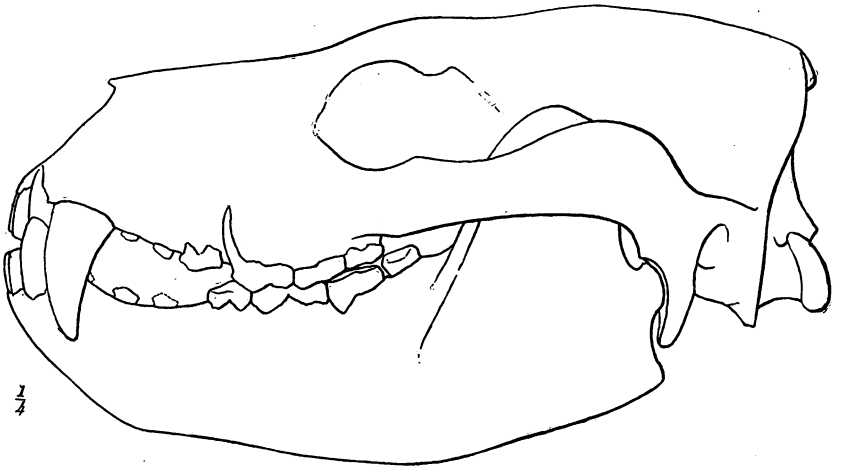

Fig. 3. Outlines of skull restored × ¼.

Canidæ, suggesting some of the more primitive Canidæ, such as *Daphænus*. The *atlas* is not very perfectly preserved, and does not show any very significant characters. The *axis* is not unlike that of the bears, the spine ending posteriorly in a short heavy process directed equally upward and backward. The anterior prolongation of the spine as a thin high lamina, carried far forward in the dogs and still further in the cats, is much reduced, as it is in the Ursidæ. The hæmal surface of the centrum bears a strong median ridge. The remaining *cervicals* bear spines of much greater height than in *Canis* or *Ursus*, and of quite different form; they are flat, slender at

the base, and carry a nearly uniform width to the tip, where they are slightly enlarged. This form of spine in the cervicals, resembling the usual form of a dorsal spine, is seen to a less extent in *Daphœnus*, but not in any of the large modern carnivora, among which the bears offer the nearest approach. The zygapophyses are considerably smaller than in *U. maritimus;* the transverse processes are as long, but quite slender,—their inferior lamellæ quite well developed on the one or two vertebræ in which they have not been broken off.

Fig. 4. Femur × ½.

The centra of probably the first nine *dorsals* are preserved, of which the first was found in position. They are somewhat narrower and a little longer than in *U. maritimus;* the first three are strongly keeled, the others are round inferiorly, as in the bear. No part of the arches or spines is preserved.

The *femur* (Fig. 4) is smaller than that of *U. maritimus*, and resembles much more that of the wolf in its characters. The ball faces more laterally than in the bears, and is well to one side of the axis of the shaft; the shaft is somewhat curved, less so than in *Canis*, much more than in *Ursus;* the condyles project more posteriorly, the trochlea is narrow and deep, as in the wolf, not broad and shallow as in the bear. The lesser trochanter appears to be less prominent than in either *Canis* or *Ursus;* the greater trochanter projects to a level with the top of the ball, and is considerably more prominent than in *Ursus*.

The upper end of the tibia is preserved, but considerably crushed. It appears to have the high cnemial crest and narrow proximal facets of the dog, not the lower crest and broad facets of the bear.

Nothing is preserved of the feet, an unfortunate defect, for

the best generic distinction between *Dinocyon* and *Hemicyon* lies in the foot characters, the former genus being plantigrade with short metapodials like the bears, the latter digitigrade with long metapodials like the dogs.[1] If indeed the closer resemblance to the Canidæ which we find in the femur and tibia of *D. gidleyi* is equally marked in the distal parts of the limbs, then our species is not related to *Dinocyon*, but must be placed in a distinct genus allied to *Hemicyon*.

Measurements.	D. gidleyi.	D. thenardi.	A. lemanensis.	U. maritimus.	D. mæandrinus Type spm.	D. mæandrinus Texas spm.
Length of skull, incisors to occipital crest	450		323	397		
Length of upper dentition (i^2–m^2 in *Dinocyon* and *Ursus*)	204		144	147		
Length of upper p^4–m^2	79		52	64		
" " " p^4 longit.	34		17	16		
" " " m^1 "	26	33	15	19		
" " " m^2 "	21	29	13	27		
Width " " m^2 transverse....est.	32	33	18	15		
" " " m^1 " ....est.	40	34	19	13		
" " " p^4 "	22		12	8		
Length of jaw	363			252		
Depth " " beneath p_4	82			50	55	69
" " " " m_2	103			50		
Post-canine diastema (c_1–p_4 exclusive)						
Length p_4–m_3	101			76		
" m_1	40	45		25	47	47
" m_2	31	32		21		24
" m_3	17	19		17		
Width of skull (as crushed)	270		180	197		
Length of seven cervical vertebræ	347			330		
Width of centra of same, average	44			46		
Length of ten dorsal vertebræ	398			345		
Average width of centra	39			40		
Length of femur	391			438		
Least diameter of shaft	32			34		
Diameter of distal end	87			98		
" " ball	46			56		

Although more specialized than *Amphicyon*, *D. gidleyi* is apparently not nearer to the bears; the characters of the

[1] Filhol, Mammifères fossiles de Sansan, p. 151.

femur are considerably less bear-like than in *A. major*, judging from Filhol's description and figures;[1] the vertebræ are bear-like in many respects, but quite peculiar in the length and form of the spines. The skull and teeth suggest an independent specialization, parallelling that of the bears in a few characters, but in most respects peculiar. A further discussion of its relationship is reserved for a later paper.

The animal must have been of peculiar appearance, not greatly resembling either bears or dogs. The enormous head was carried very low (if this is the correct interpretation of the high cervical spines), more so than in the bears, much more than in the wolves; the muzzle was long and heavy; the contour of the head was straight, and continuous with the neck; the ears of moderate size, jaw very long and deep, wide gaping, cheeks rather wide. The neck was as massive as in *U. maritimus*, the trunk longer and slimmer, the legs shorter, sharply flexed at the knees, the thigh not as free from the trunk as in Ursidæ, but much more like the condition seen in the Canidæ.

[1] Mammifères fossiles de St. Gerand le Puy.