

Article XXI.—NEW CANIDÆ FROM THE MIOCENE
OF COLORADO.

By W. D. MATTHEW.

Cynarctus, new genus.

Family *Canidæ*, Subfamily *Amphicyoninæ*.

Dentition $\overline{3.1.4.3}$. Carnassials reduced and molars enlarged, talonids bicuspid in the type species, and two accessory cusps on the trigonids. Jaw long and slender as in the dogs, premolars cynoid.

Cynarctus saxatilis, n. sp.

Size of the Coyote. *Jaw* somewhat more slender anteriorly, inferior border more convex, angular process longer, curving more upward and inward. Coronoid process more triangular, the tip narrow,

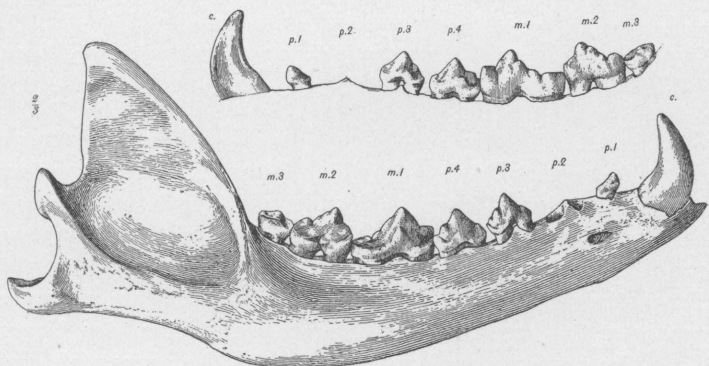


Fig. 1. *Cynarctus saxatilis*. Lower jaw, outer side, $\times \frac{2}{3}$, and inside view of teeth. Type, No. 9453. Loup Fork (Pawnee Creek Beds), Colorado.

the anterior border with slight uniform backward curvation, while in the coyote it is straight until near the tip and then curves suddenly backward. Masseteric fossa deeper and wider, its inferior border much more marked.

Teeth. Incisors not preserved. Canine and premolars little worn, molars much worn. Premolars somewhat smaller than in *C. latrans*, carnassial nearly one-fourth smaller, molars over one-fourth larger.

The trigonid of the *carnassial* is low, and reduced in size, and two

accessory cusps are added to it, one external to the protoconid, one behind the metaconid. The protoconid is central in position, greatly reduced in proportionate size compared with *Canis* or even with *Amphicyon*, and the shearing edges of pr^d and pa^d are reduced and little used. The accessory cusps and heel are nearly as high as the pa^d . The heel consists of a larger external and smaller internal cusp, both greatly worn, but apparently low and rounded. The external cingulum is strong and crenulate.

The second molar has the same composition as the first, except that the paraconid is small and connate with the protoconid, which is of the same size as the well-separated metaconid. The external cingulum is very broad in the anterior half of the tooth and bears one well-defined cusp external to the protoconid. The heel is nearly as long as the trigonid.

The third molar is obovate with shallow basin heel, and larger trigonid too much worn for distinction of cusps. The cusps of the heel are mostly obsolete, the surface wrinkled.

The premolars are shorter than in *C. latrans*, all except the first bearing the posterior accessory cusp, characteristic of the dogs, but absent in the bears. The first premolar is single rooted, spaced equally between the canine and second premolar. (In the dogs it approaches the other premolars, in the bears usually the canine.)

Canine slightly more slender than in *C. latrans*, more curved at base, less curved toward tip.

The deep masseteric fossa, long angular process, and strong metaconid suggest *Daphænus*, which, however, has the normal canine proportion of carnassial and molar teeth, and, like all the more ancient genera, has the shear more oblique to the tooth-line than in the later Canidæ.

From the more ancient genus *Cephalogale* it differs in the presence of the accessory premolar cusps, slender jaw, larger molars, the posterior molars less unlike to the carnassial, and in the presence on the carnassial of two accessory cusps. All the modern microdont Canidæ except *Otocyon* have a more typical proportion of carnassial and tubercular teeth, and lack the accessory carnassial cusps. Their premolars are narrower. *Cynarctus* is near to *Haplocyon* Schlosser, founded on the jaw-fragment with pms 2 to 4 from St. Gérand-le-Puy, described by the late Prof. Filhol under the name of *Amphicyon crucians*. But the premolars are more cynoid, not so high, and the posterior accessory cusp is present on p_3 . The

horizon of the two is different, and I hardly think that they are really allied, although the distinctions on known parts may appear rather slight.

From *Pseudarctos* it differs in the presence of the two accessory cusps on the trigonid of the carnassial, in the larger premolars with well-marked deuterocoid, the slender jaw and small third molar.

From *Amphicyon* the genus differs in the bicuspid heels of the molars, greater reduction of pr^4 , and presence of accessory external and internal cusps, long slender jaw, and cynoid premolars.

From *Ursavus* it differs in the less reduction of the premolars, presence of accessory cusps on p_2 , p_3 , and p_4 , and the much more cynoid character of molars 2 and 3. In *Ursavus*, judging from Dr. Schlosser's figures and description, the cusps on m_2 are nearly obsolete, and the surface flat and wrinkled, while m_3 is a round, peg-like tooth with flat, wrinkled crown. The jaw of *Ursavus* is deep and short like that of the bears, and the coronoid directed nearly upward as in the Ursidæ.

The foregoing description is based on a nearly perfect pair of lower jaws found in the Loup Fork (Pawnee Creek beds) of Cedar Creek, Colorado, by Mr. Brown of the American Museum Expedition of 1901. A single lower carnassial in the Cope Collection from the Colorado Loup Fork probably represents the same species. No upper teeth are known, and the position of the genus is therefore uncertain. Judging from the characters of the lower teeth it would seem probable that it must be placed with the Canidæ, and cannot be considered as near to *Ursavus*, which is unmistakably a bear. As far as can be determined from the lower jaw characters, it seems to be partly intermediate between *Ursavus* and *Canis*, with some primitive characters retained, no doubt, from its Oligocene ancestors. If this be borne out by the characters of the upper teeth, *Cynarctus* will help to bridge the most serious gap in the series of extinct genera connecting the Ursidæ and Canidæ. *Amphicyon*, as Dr. Schlosser has shown, does not fulfil the requirements for a direct ancestor of the

bears, but must be considered as a side branch paralleling them. *Cynarctus* would seem somewhat more but by no means exactly in the line of descent. The slender jaw excludes it from direct relationship.

In a previous paper the writer has discussed an alternate hypothesis of the origin of the Ursidæ which derives them from the Creodont family Arctocyoniidæ, instead of from the Canidæ. It was then stated that the apparent chain of extinct types connecting the Canidæ and Ursidæ formed a most serious objection to considering any other hypothesis as possible, but it was pointed out that there was a wide gap in the series between such genera as *Amphicyon* and *Dinocyon*—unmistakable dogs although bear-like—and *Hyænarctus* and *Ursavus*, unmistakable bears, although with the primitive carnivore formula lost by the modern bears. Dr. Schlosser has shown that *Amphicyon* is a side branch of the Canidæ and *Hyænarctus* of the Ursidæ and that the wide gap between the primitive Oligocene dogs, such as *Cephalogale* and the earliest true Ursidæ cannot be filled by any genera hitherto known. The genus here described reduces this gap, as its close resemblance to *Ursavus* in the composition of the teeth seems hardly explicable except on the ground of a near relationship; while in most characters it is as unquestionably a dog as *Ursavus* is a bear. It does not seem, however, to point especially to *Cephalogale* as an ancestor. Its relationship to the direct line of descent is uncertain.

Nevertheless this additional evidence in favor of the derivation of the bears from early Canidæ seems to render untenable any other hypothesis. The Arctocyoniidæ must then be considered as a case of parallelism not confined to the general characters of teeth and feet, but extending to the detailed structure of both, the rather exceptional cusp composition of carnassial and molar teeth, the relative proportions of the digits, even certain details in the character of the carpals and tarsals being common to both, besides the more general characters of large quadrate, flattened molars, reduced premolars, slender canines, plantigrade, large-clawed feet.

?? *Ursavus* sp.

Another small Amphicyonoid of about the same size as *C. saxatilis* is indicated by No. 9454, a lower carnassial, and a few fragments from Pawnee Buttes. The tooth is composed of very low trigonid of three cusps, paraconid nearly as large as protoconid, me^d well developed, more internal than posterior, long basin heel completely enclosed by a well-marked ridge, which begins at the metaconid and swings around the margin nearly to the protoconid, the heel-cusps being scarcely seen. Trigonid is proportioned much as in *Ursavus*, but no accessory cusps, and heel without well-marked cusps. Trigonid and especially the protoconid lower than in *Amphicyon*, and marked basin heel.

? *Cyon* or *Icticyon* sp.

A palate and a ramus of the lower jaw, both young individuals showing the milk dentition, are referred here. The permanent sectorials are formed within the jaw, but not extruded. The character of the milk dentition proves that the specimens belong to the Canidæ, but to the division of the family with most highly secant teeth. This is confirmed by the metaconid; in the superior one the deuterocone is minute, and there is no anteroexternal cusp. I am unable to make comparisons with the milk dentition of either *Cyon* or *Icticyon*; the permanent upper carnassials differ from the figures of *Icticyon* and from specimens of *Cyon alpinus* in the greater reduction of the anterointernal cusp and presence of two strong ridges on the anterior slope of the protocone, diverging from the point, one running to the anteroexternal corner of the base, the other to the base of the anterior internal cusp.

The permanent incisors are trifid, the lateral cusps being stronger than in any Canid that I have seen, equal almost to the median cusp. The external temporary incisor has but one strong lateral cusp, the external one minute; a posterior cusp is also present. The temporary canine is short and small with prominent posterior ridge. The permanent first premolar is one-rooted, with anterior and posterior cusps and

small posterior cingular cusp. The second temporary premolar is smaller, more compressed, two-rooted, with rudimentary posterior cusp. The third is the carnassial, and is three-rooted, composed of large protocone and strong posterior blade, with a minute anterointernal basal cusp situate between the anterior and internal roots. The fourth milk premolar is molariform, with no protoconule, strong hypocone (in reality probably a metaconule), besides the three main cusps. The second lower milk premolar is two-rooted, set obliquely in the jaw, and has a small posterior cusp. The fourth (carnassial) has the trigonid of shearing protoconid and paraconid blades, small metaconid, and three-cusped basin heel. Compared with the corresponding teeth in the Coyote these teeth differ in larger size, greater robustness, more sectorial character in the carnassials, proportionately smaller and narrower heel on dp_4 , dp_4 of less transverse and greater longitudinal width, the inner cusps less marginal, reducing the size of the basin enclosed by them. The anterointernal cusp on dp_3 is smaller and situated much more anteriorly; the anteroexternal cingular cusp is hardly noticeable. The jaw is very much shorter and deeper, the premaxilla is carried much farther back between maxilla and nasal. The cusp composition is the same in both.

No Canid has been described with which this can well be identified. It is of the size of *Ælurodon*, but differs in absence of anteroexternal cusp on p^4 (and other characters). It is much more modernized than any of the John Day dogs, and the size is too great for *C. brachypus* Cope, *temerarius* or *vafer* Leidy, *anceps* Scott, all of which, moreover, seem more typically cynoid.

In a previous article Dr. Wortman and the writer attempted to trace a line of descent from the Eocene *Uintacyon* and *Prodaphænus* through the Oligocene *Daphænus* and *Temnocyon* to the modern *Cyon*. It seems not unlikely that the Canid here described may nearly represent the Upper Miocene stage of evolution of this race. *Iticyon* seems also to be more or less nearly connected with it—and if this hypothesis of descent be correct, this group parallels the Camels in their

present and past distribution, originating in North America, spreading to South America and Asia, and becoming extinct in their old home while still surviving in the two widely separated districts to which they had wandered.

In this as in other cases the writer desires to guard against expressing any belief that the evolutionary series worked out in various lines represent the actual species through which descent has occurred. They represent indeed the history of the evolution of certain parts; they may in some cases be not far from the direct line of descent. But it appears probable that each 'stage' represents in most cases a migration rather than a mutation of species. Believing that the principal causes of the evolutionary changes among the Tertiary mammalia lay in the secular world-wide alteration in climatic and geographic conditions, it seems improbable that in any given locality a change in the fauna occurred directly without a change in the area over which the species flourished. It seems much more likely that most of the changes in fauna in a locality were due to successive waves of migration, setting out from the region in which the new climatic conditions first appeared. This would involve in general a succession of waves of migration spreading from the north into America on one hand, Europe, southern Asia, and Africa on the other, differentiating to some extent as the separation increased, and driving the older faunas southward before them. Hence the Tertiary aspect of so large a part of the South American and African faunas, and hence the primitive aspect of forest faunas in general, the new conditions of cold and arid climate which culminated in the Glacial Epoch involving the spread of open plains, and diminution of the forest areas.

***Amphicyon americanus* Wortman.**

Amphicyon americanus WORTMAN, Amer. Journ. Sci., Vol. XI, 201, Sep. Jan. 25, March, 1901.

This species is of moderate size in the genus and of rather primitive character, in some respects approaching the species of the European Oligocene (*A. lemanensis*, etc.). Dr. Wortman gives the following measurements:

Length of superior molar series, including canine...	134 mm.
Anteroposterior diameter of canine at base.....	24
Length of true molar series.....	46
Transverse diameter of first superior molar.....	27
Anteroposterior diameter of superior sectorial.....	27
Width of palate at first molar, including crowns...	98

Amphicyon sinapius, n. sp.

? *Canis*, sp. incerta, COPE, Rep. Vert. Pal. Col. U. S. G. S. Terrs. Ann. Rep. 1873 (1874), 519.

A larger American species of *Amphicyon* is represented by a number of fragmentary specimens from the Colorado Loup Fork.

- Am. Mus. No. 9358. Jaw fragment with broken carnassial and complete first tubercular molar. Type.
- " 9357. Carnassial tooth, unworn. Co-type.
- " ?9356. Twenty-three vertebrae, ribs, humerus, and ulna.
- " ?9355. Astragalus, parts of tibia, humerus, radius, and several metapodials, of uncertain association.
- " ?8248. (Cope Coll.). Astragalus, and anterior part of a lower jaw, without teeth.

Our material unfortunately does not enable us to determine the dental formula, but the characters of the teeth agree best

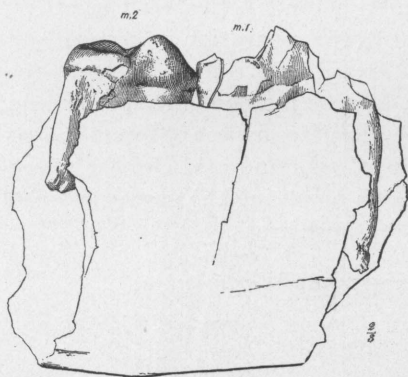


Fig. 2. *Amphicyon sinapius*. Part of lower jaw, inner side, x 3. Type, No. 9358. Loup Fork (Pawnee Creek Beds), Colorado.

with those of *Amphicyon*, and are more primitive than those of *Dinocyon*. It is much larger than *A. lemanensis*, but resembles rather nearly the figures of that genus given by Dr. Schlosser. It somewhat exceeds *A. major* and *A. giganteus* in size, the heel of m_1 is broader, m^2 is much larger and broader comparing it with de

Blainville's figures, and on both molars the entoconid is represented only by a broad cingular ridge. Both in size

and characters the second lower molar is very like that figured by Dr. Schlosser in 'Palæontographica' and referred

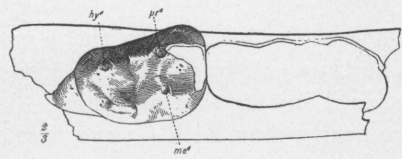


Fig. 3. *Amphicyon sinapius*. Crown view of m_1 in jaw, $\times \frac{3}{4}$. Type, No. 9358.

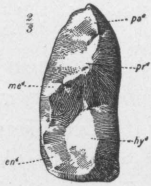


Fig. 4. *Amphicyon sinapius*. Lower carnassial $\times \frac{3}{4}$. No. 9357. Loup Fork (Pawnee Creek Beds), Colorado.

doubtfully to *A. major*. Without more complete material the position of this species cannot certainly be determined.

? *Dinocyon* (*Borophagus*) *mæandrinus* (*Hatcher*).

Ælurodon mæandrinus HATCHER, Amer. Nat. 1893, 240.

The type consists of part of a lower jaw, with the second and third premolars greatly worn, and roots of fourth premolar and sectorial. It differs from other *Ælurodon*s, according to Mr. Hatcher's description and figure, in the much greater size, extremely short jaw, and reduced premolars, large posterior root to the sectorial. All these characters point to the *Amphicyoninæ* rather than to the true dogs; the second molar, whose proportionate size would make the position of the species certain, is unfortunately not indicated in the type.

To this species may be referred provisionally Am. Mus. No. 10583, a fragmentary lower jaw with roots of the teeth, associated with parts of tibia, etc., found by Mr. Gidley of the American Museum Expedition of 1899 in the Loup Fork formation of Donley Co., Texas.

Measurements.

	Type.	10583
Post-canine diastema.....	19	14
Premolar dentition.....	60	62
Carnassial, length.....	47	47
Second molar.....	—	24
Carnassial, width ant. root.....	—	15
“ “ post. “	—	20
Depth of jaw behind p_4	55	69

? **Dinocyon** (**Borophagus**) **diversidens** (*Cope*).

Borophagus diversidens COPE, Amer. Nat., 1892, 1028; Vert. Pal. Llano Estac. (4th Ann. Rep. Geol. Surv. Tex., 1892), 54, pl. xiii, fig. 4.

Blanco horizon (Upper Pliocene). Referred to the Hyænidæ by Professor Cope. The type is a fragment of a lower jaw, with two premolars preserved and the root of a third. It agrees with *Amphicyon* more nearly than with *Hyæna* in the form of the individual teeth, as well as in their proportion one to another; the second premolar is smaller, apparently, than in the Loup Fork species.

? **Dinocyon** (? **Borophagus**) **gidleyi** *Matthew*.

Dinocyon (? *Borophagus*) *gidleyi* MATTHEW, Bull. Am. Mus. Nat. Hist., Vol. XVI, 1902, 129-136.

? **Amphicyon** **ursinus** *Cope*.

Canis ursinus COPE, Proc. Phila. Acad. Nat. Sci. 1875, 275; Rep. Wheeler Survey, Vol. IV, pl. ii, p. 304, pl. lxix, fig. 1.

The reduction of the premolars, proportionately large tubercular teeth, deep, massive jaw with comparatively straight inferior margin, large heel on the lower sectorial, etc., place this species with the *Amphicyons*. Professor Cope remarks on the probability that *C. ursinus* is very close to *C. haydeni*. Leidy's species is, however, much more like the wolf in proportion of sectorial to tubercular teeth, and the heel of the sectorial is comparatively small, as in *C. lupus* or in the *Ælurodons*.

A. ursinus is about the size of *A. americanus*, and is perhaps synonymous with it.