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THE MAMMALIAN FAUNAS OF THE PALEOCENE OF CENTRAL UTAH, WITH NOTES ON THE GEOLOGY

By C. Lewis Gazin

Further investigation of the Paleocene deposits of central Utah by the 1939 and 1940 Smithsonian Institution expeditions has added considerably to the collections representative of the upper portion of the North Horn deposits and has resulted in the discovery of a second and distinct horizon for mammals within the Paleocene series. The investigations of these years have led also to a better understanding of the geologic relations pertaining to the fossil-bearing deposits in and about Dragon Canyon and North Horn Mountain.

The area investigated lies within the region of the Manti National Forest and along the eastern part of the Wasatch Plateau. Physiographically, it belongs to the High Plateaus of Utah section of the Colorado Plateaus province, as defined by Fenneman and Johnson.

North Horn Mountain (T. 18 S., R. 6 E.), due west of the towns of Orangeville and Castledale, is an outlying remnant of the plateau to the west, being separated from it by the troughlike depression known as North or Upper Dragon. Dragon Canyon, or the Lower Dragon, lies principally in the western half of T. 19 S., R. 6 E., and together with North Dragon is primarily the result of a complex graben structure extending for a considerable distance both north and south.

The writer wishes to acknowledge the courtesy extended by Dr. Walter Granger and Dr. G. G. Simpson in permitting him to make further comparisons with Paleocene materials in the American Museum of Natural History. The drawings illustrating the specimens were made by Sydney Prentice.

HISTORY OF THE INVESTIGATION

The occurrence of fossil vertebrates in this region was first recognized in 1935 with the discovery, by Dr. J. B. Reeside, Jr., and Dr. E. M. Spieker, of the U. S. Geological Survey, of fragmentary dinosaur remains in exposures around North Horn Mountain and of incomplete mammalian remains at a locality high on Wagon Road Ridge across the Dragon depression, to the west of North Horn Mountain. These materials were all from beds that had been earlier regarded as "Wasatch" in geological investigations pertaining to coal resources of the region.

In 1937 a Smithsonian Institution expedition under the direction of C. W. Gilmore, and with the aid of Dr. Spieker, made a collection of dinosaurian remains from the Cretaceous of the region, and was also successful, through the particular efforts of George B. Pearce, a member of the party, in discovering a fruitful locality for Paleocene mammals in lower Dragon Canyon. A popular account of this expedition by C. W. Gilmore and a description of the Paleocene fossils by the writer were published in 1938.

During the summer season of 1938 a Smithsonian party under the writer's direction further investigated Paleocene and Cretaceous deposits and was successful in considerably enlarging the fauna known from the previously described Dragon Canyon locality. A popular description of the 1938 expedition and descriptions of the Paleocene collections by the writer were published in 1939.

The success of the parties in the 1937 and 1938 expeditions, and at the same time the fragmentary nature of many of the new finds discovered during these seasons, made it imperative that further work be done at these localities; hence, the 1939 and 1940 expeditions undertook more thorough investigations of both the Cretaceous and Paleocene. Accounts by the writer of the 1939 and 1940 expeditions were published in 1940 and 1941, respectively.

FAUNAL RELATIONS

Contributory to the more outstanding results of further investigation of the Paleocene in 1939 was the finding of a new fossiliferous locality in the upper portion of the North Horn series. The new locality is in a patch of exposures in the western half of section 7, T. 19 S., R. 6 E., about a mile nearly due west of the previously described Dragon Canyon locality, which is in the northwest portion of section 8. Fossils were found to occur at two levels in the new locality, the upper of which, though relatively less productive, is believed to represent the same stage as that at the old Dragon Canyon locality, the Dragon horizon, as indicated by the occurrence there of

Catopsalis utahensis, *Oxyclaenus pearcei*, *Haploconus inopinatus*, and *Ellipsodon* cf. *shepherdi*. The lower level, stratigraphically about 165 feet lower, has produced a new fauna that is more nearly equivalent to that of the Puerco but may be somewhat younger than the latter. This lower horizon, which may be known as the Wagonroad stage, is perhaps 10 or 15 feet above a level that may be arbitrarily defined as the base of the Paleocene in this region.

Lists of the forms recognized in the two faunas are given below:

DRAGON FAUNA	WAGONROAD FAUNA
MULTITUBERCULATA:	
Taeniolabididae:	
Catopsalis utahensis Gazin	*Taeniolabis* species
Ptilodontidae:	
Ptilodus ferronensis, new species	
INSECTIVORA:	
Pantolestidae:	
Aphronorus simpsoni Gazin	
Pantolestid (a), genus and species undetermined	
Pantolestid (b), genus and species undetermined	
Mixodectidae:	
Dracontolestes aphantus, new genus and species	
Mixodectid (a), genus and species undetermined	Mixodectid? (b), genus and species undetermined
TAENIODONTA:	
Stylinodontidae:	
Conoryctella dragonensis Gazin	
Stylinodont, near *Psittacotherium*	
CARNIVORA:	
Arctocyonidae:	
Protogonodon? *spiekeri* Gazin	*Protogonodon*? species
Protogonodon biatheles, new species	
Oxyclaenus pearcei, new species	*Oxyclaenus* species
Oxyclaenid	
Tricentes classus, new species	
Coniacodon? species	
Miacidae:	
Didymictis? species	
CONDYLARTHRA:	
Hyopsodontidae:	
Dracoclaenus griphus Gazin	
Oxytomodon perissum, new genus and species	
Ellipsodon shepherdi Gazin	
Ellipsodon? *sternbergi* Gazin	
Ellipsodon? species (a)	*Ellipsodon*? species (b)
Jepsenia mantiensis Gazin	
Phenacodontidae:	
	Desmatoclaenus hermaeus, new genus and species
Desmatoclaenus cf. *paracreodus*	*Desmatoclaenus paracreodus*, new species
Periptychidae:	
	Ectoconus symbolus, new species
Periptychus gilmorei Gazin	*Carsioptychus hamaxitus*, new species
Anisonchus dracus Gazin	*Anisonchus oligistus*, new species
Anisonclus onostus Gazin	
Haploconus inopinatus Gazin	*Haploconus*? *elachistus*, new species

Indicative of an earlier age than that of the Dragon level and approaching more closely that of the Puerco is the presence in the Wagonroad fauna of forms representative of the genera *Taeniolabis*, *Ectoconus*, and *Carsioptychus*. However, the separation in time of the two levels in the Dragon Canyon area is not great, as a relationship between the two stages is seen in the materials of *Protogonodon*?, *Haploconus*, and of the new form *Desmatoclaenus*. The Wagonroad is obviously more nearly comparable to the Puerco stage than it is to that of the Torrejon.

Reviewing the list of forms now known from the Dragon it would seem that the fauna was closely related to that of the Torrejon or Crazy Mountain Fort Union; however, a closer study of the individual forms in many cases shows them to be less distinctly removed from related types in the Puerco. This is noticeable in the periptychids, certain of the carnivores, and most markedly in the taeniodonts, the latter group apparently having undergone considerable change in at least two lines during lower Paleocene time. Many of the forms present, such as the multituberculates and insectivores, can be compared only with later types as ancestral stages of these are not known in the Puerco. The conclusion is that the Dragon fauna is intermediate between Puerco and Torrejon faunas in stage of development, perhaps a trifle closer to the Torrejon, whereas the Wagonroad fauna is definitely closer, if not equivalent, to that of the Puerco.

GEOLOGIC RELATIONS

Work during the summer season of 1939 included an investigation of the geologic relations existing in and around the Dragon in order to show the distribution of certain formations and to account for the otherwise anomalous position of many of the fossil localities. For this purpose a small map has been prepared (fig. 1), using an enlargement of a portion of the topographic and geologic map of E. M. Spieker as a base. The later Cretaceous and Paleocene beds previously undifferentiated are here distinguished and the distribution of these together with that of the Flagstaff limestone and later deposits is more accurately shown. Moreover, a greater refinement of the fault pattern is indicated.

Stratigraphy.—The older rocks, including the Blackhawk and Price River formation, and a limited exposure of Star Point sandstone in Ferron Canyon are all of Cretaceous age and have not been distinguished on the map. They consist principally of massive buff sandstones with interbedded clay shale, sandy clay, and coal (in the lower part), and with a certain amount of conglomeratic material in the Price River formation.

A, View northwestward of principal fossiliferous exposures of Dragon Paleocene in Dragon Canyon (loc. 2 in fig. 1 and pl. 2, *B*), NW^1_4 sec. 8, T. 19 S., R. 6 E.

B, View northward in northerly pocket of exposure seen in upper photograph. Figure in middle foreground is approximately at fossiliferous horizon. A large portion of the remains of the Dragon fauna was found in the small area shown in this view. Caprock of Flagstaff limestone is seen in right background.

A, General view northward of Wagon Road Ridge locality, near Sanpete–Emery County line and probably in sec. 36, T. 18 S., R. 5 E. The first Paleocene materials from this region, though fragmentary and undeterminable, were discovered at this locality by Drs. Reeside and Spieker in 1935. Subsequent small collections are indicative of the Dragon horizon.

B, General view northward across Ferron Canyon and up Dragon Canyon, showing the principal localities for fossil vertebrates, numbered as on the geologic map (fig. 1): (1) Cretaceous exposures at southwest portion of North Horn Mountain, which produced sauropod and ceratopsian dinosaur remains; (2) principal Dragon Canyon Paleocene locality, Dragon horizon (pl. 1); (3) Cretaceous exposures in lower part of Dragon Canyon, which produced the fossil lizard collection; (4) new Paleocene locality, with both Dragon and Wagonroad horizons (pl. 3). Original discovery locality, shown above, is indicated by arrow in left background on Wagon Road Ridge.

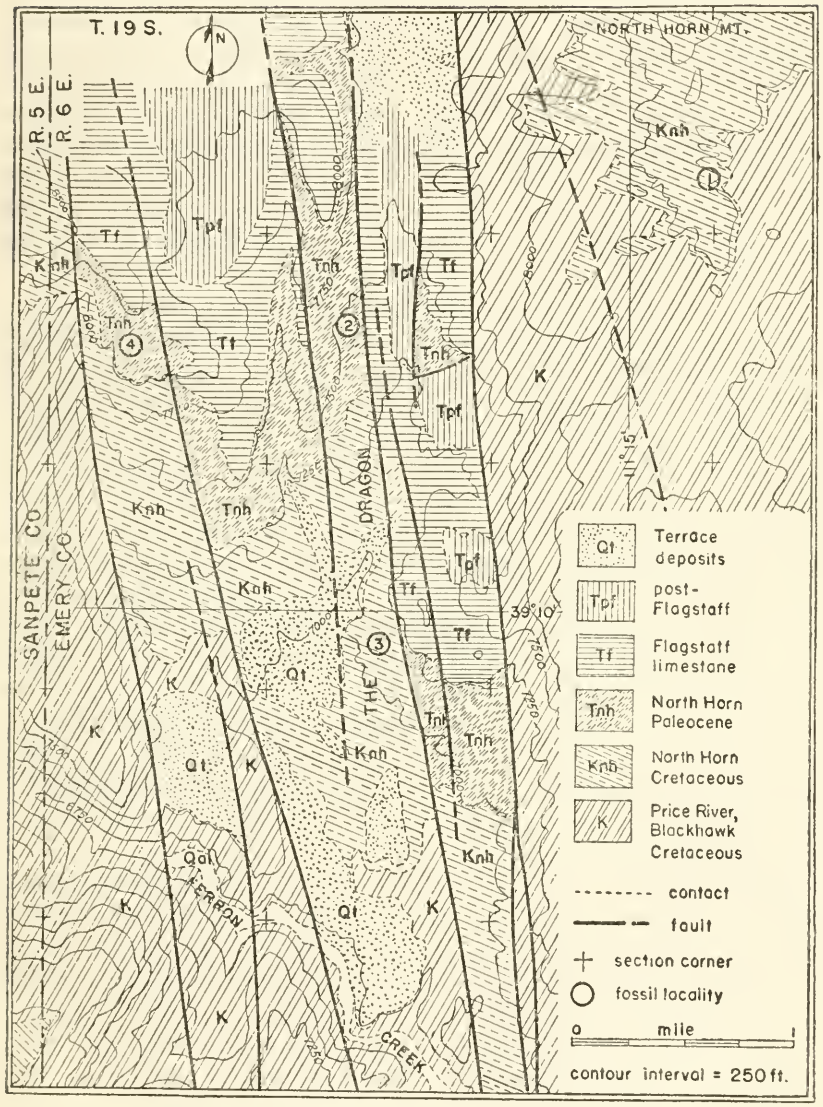


FIGURE 1.—Geologic map of the Dragon Canyon area, showing principal fossil localities.

Overlying the Price River formation, apparently in conformable relation, is the fossiliferous series of clays, sandy clays, and sandstones that have been designated by Spieker as the North Horn formation. The use of this name should in the opinion of the writer have been restricted so as to include only the Cretaceous or Paleocene beds and not both. However, since the U. S. Geological Survey has adopted the more inclusive definition for North Horn, the name Joes Valley is proposed as a member to include the Paleocene portion of the North Horn formation. The clays and sandy clays in the Cretaceous portion of the North Horn are varied in color with thick beds of gray, green, and brown shades of clay with occasional thinner zones of more reddish clay. Near the top the buff sandstones become more conspicuous, forming cliffs below the Paleocene deposits.

The Joes Valley member exposed high on the mountain slopes adjacent to Joes Valley has been more critically observed farther south on North Horn Mountain, and particularly in Dragon Canyon, where the Paleocene fossils occur. The member is defined as beginning with the highly colored clay and sandy clay, locally black carbonaceous shales, resting abruptly but without apparent disconformity on the massive sandstones capping the dinosaur-bearing North Horn beds. The variegated clays of the Paleocene series resemble those in the lower portion of the North Horn formation but are usually not so thick and appear to be more gaudily colored and with conspicuous white channel sands. The upper portion of the Joes Valley member, above both of the fossil levels, is not so markedly variegated and includes a greater quantity of buff sandstone, with thicker zones of more uniformly colored sandy clay, ending abruptly beneath the Flagstaff limestone. The thickness of the Joes Valley member was not measured, but it clearly amounts to several hundred feet. Apparently, however, it is not so thick as the lower portion of the North Horn.

The Flagstaff limestone, overlying the Joes Valley member, contains numerous fresh-water shells, but it has produced no vertebrate remains. Its age is not certainly determined, but it may be within the limits of the Paleocene. Overlying the limestone in various places in Dragon Canyon is a series of soft clays that on weathered surfaces show brick red alternating with much lighter colors. Interbedded with the clay are occasional thin beds of limestone. This material is designated on the map as post-Flagstaff. No fossils were found in these beds.

Structure.—Dragon Canyon is essentially part of a graben that extends a considerable distance north and south. The downdropped block is highly faulted and amounts simply to a zone of faulting in which the slices are all depressed below the relatively undisturbed

masses to the east and west. The principal fault along the east side of the zone has had displacement exceeding 2,000 feet in places, as indicated by the extent to which the Flagstaff limestone has been depressed. To the west across Dragon Canyon this displacement has been taken up along three principal surfaces of faulting, but with minor fractures along which displacement has been in an opposite direction.

Throughout most of the region the rocks are nearly level lying, but within the depressed zone the sediments are noticeably disturbed, particularly adjacent to the faults, where strong drag folding was observed. Certain of the slices, particularly the most easterly block, are depressed northward, and this together with the effect of drag along the bounding faults has in these cases resulted in an average northeasterly dip to the various deposits. The slice on which localities 2 and 3 are shown has been raised relative to both blocks immediately adjacent; hence the sediments are more nearly level, but with a noticeable downward drag adjacent to the westerly fault in the vicinity of locality 3. On the other hand, a very strong upward drag is apparent along the westerly margin of the two westerly slices, near locality 4.

Fossil localities.—Four localities have been indicated on the map. These show the general location of the principal occurrences of fossil vertebrates with the exception of a locality for Paleocene mammals on Wagon Road Ridge some distance to the north of the area shown on the map, and of several sites around North Horn Mountain, which cannot be shown on the map, from which dinosaur remains have been recovered.

Those that have been indicated are as follows: (1) A locality in Cretaceous rock on North Horn Mountain where the greater part of a sauropod dinosaur was discovered in 1937, near the line between sections 3 and 4, T. 19 S., R. 6 E. (2) The original Paleocene locality in Dragon Canyon from which most of the Dragon collection was obtained; NW¼ sec. 8, T. 19 S., R. 6 E. (3) A Cretaceous locality in the lower part of Dragon Canyon, which produced the unique fossil lizard collection; S½ sec. 17, T. 19 S., R. 6 E. (4) The new Paleocene locality where mammalian fossils were discovered at two distinct levels: W½ sec. 7, T. 19 S., R. 6 E.

SYSTEMATIC DESCRIPTION OF THE MATERIAL

MULTITUBERCULATA

Genus TAENIOLABIS Cope

TAENIOLABIS species

The genus *Taeniolabis* is apparently represented in the collection from the Wagonroad horizon by the posterior half of a first lower molar, U.S.N.M. No. 16172 (fig. 2, *a*). In size and appearance the specimen closely resembles this portion of M_1 in *Taeniolabis taöensis* from the Puerco of New Mexico. The form present in the Wagonroad horizon may represent this species, but in the absence of better material, showing at least something of the cusp formula, no specific reference is made.

Although our knowledge of the history or development of the Taeniolabididae is very incomplete, the presence of *Taeniolabis* and the absence of *Catopsalis* in the Wagonroad fauna are significant in indicating a relationship to the Puercan stage.

In the structure of the molars *Catopsalis* would appear to be ancestral to *Taeniolabis*, but since their known positions in time are the reverse the two must be regarded as representing separate phyla, and that having the less specialized molars surviving here longer, or reaching this region at a later date.

Genus CATOPSALIS Cope

CATOPSALIS UTAHENSIS Gazin

Catopsalis utahensis Gazin, 1939b, p. 275.

The type of *Catopsalis utahensis*, U.S.N.M. No. 15757, from the Dragon horizon, as represented at the principal Dragon Canyon locality (loc. 2 in fig. 1), consists of a single first lower molar (fig. 2, *b*). The specimen exhibits the simple type of pattern seen in *Catopsalis* from the Torrejon rather than the more specialized dental structure of the Puerco *Taeniolabis*. It differs from M_1 in specimens of *Catopsalis* known from the Torrejon of the San Juan Basin in having the cusp formula 6:4. In the type of *Catopsalis foliatus* it is 5:4, and in the type of *C. fissidens* the formula is 6:5, or better. Moreover, the tooth is relatively wider than in either of the Torrejon specimens. *Catopsalis calgariensis* from the Paskapoo was described by Russell from a second lower molar; hence no satisfactory comparison with the type of *C. utahensis* is possible.

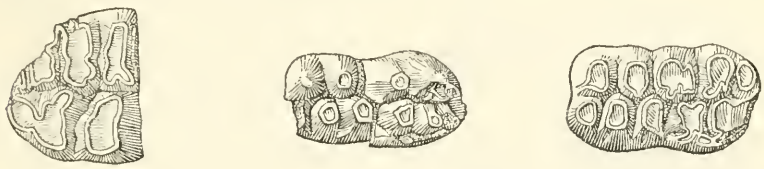
From additional material of this form collected in 1939 it is seen that the lower molars are distinctly wider than in either *C. fissidens* or *C. foliatus*. In an M_1 (fig. 2, *c*), No. 16185, from the upper or Dragon horizon at the new locality (loc. 4 in fig. 1), slightly more

View northward over newly discovered Paleocene locality in the western part of Dragon Canyon (loc. 4, fig. 1 and pl. 2, *B*), W½ sec. 7, T. 19 S., R. 6 E. Almost the entire Wagonroad collection was obtained from exposures in the foreground, limited upward approximately by the dashed line. A small collection of materials considered to be of Dragon age was obtained from exposures in the background at the level indicated by the solid line, stratigraphically about 165 feet above the Wagonroad horizon. The exposures around the distant ridge in the left background are of Cretaceous age, the Paleocene having been faulted down adjacent to these older rocks.

worn than the type, the posterointernal cusp is further divided for a part of its height so that the inner row has five cusps instead of four. Wear has obscured the posterior portion of the outer row so that it is uncertain as to whether there were five or six cusps, and the formula may be 5:5 or 6:5. The tooth is slightly larger than the type of *C. utahensis*.

The posterior portion of another M_1, No. 16211, shows a cusp division suggestive of the formula 7:5 or possibly 6:5. The latter tooth portion is about the size of the type and comes from the original Dragon Canyon locality.

An incomplete tooth portion, No. 16210, which has only four cusps preserved, is relatively large and may be the anterior portion of M_1, in which case it approaches in size small specimens of *Taeniolabis*. However, it may be the posterior portion of an M_2 of *C. utahensis*.



a *b* *c*

FIGURE 2.—*a*, *Taeniolabis* sp., lower molar portion (U.S.N.M. No. 16172), occlusal view, Wagonroad Paleocene, Utah; *b*, *Catopsalis utahensis* Gazin, M_1 (U.S.N.M. No. 15757), type specimen, occlusal view, Dragon Paleocene, Utah, *c*, *C. utahensis*, M_1 (U.S.N.M. No. 16185), occlusal view, Dragon Paleocene, Utah. All × 2.

A right lower jaw, No. 16209, in the Dragon collection has both M_1 and M_2 but unfortunately the teeth are checked and partially obscured by an ironlike matrix.

Material of *Catopsalis* is particularly rare, there being but about three known specimens outside of the material herein described, and one of these, an M_2, the type of *Catopsalis calgariensis* from the Paskapoo, has been lost, although a cast of it is in the collections of the American Museum of Natural History. The other two, the types of *C. foliatus* and *C. fissidens*, are lower dentitions from the Torrejon. The material of *C. utahensis* though more than doubling the number of specimens representing *Catopsalis* does not seem to present any significant evidence as to the ancestral stages in the development of this genus. It is interesting to note, however, that *C. utahensis*, especially as represented by No. 16185 and No. 16210, appears somewhat less distinctly removed from *Taeniolabis* than do the Torrejon forms.

The anteroposterior and transverse diameters of the type, No. 15757, are 12 (approximately) and 6.5 mm., respectively. In No. 16185 these diameters are 13 and 7.3 mm., respectively.

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Genus PTILODUS Cope

PTILODUS FERRONENSIS,[1] new species

Type.—Fragment of right ramus of mandible with P_4, U.S.N.M. No. 16176.

Horizon and locality.—Dragon Paleocene, Dragon Canyon, Emery County, Utah.

Specific characters.—Near *Ptilodus mediaevus* in size. P_4 in type longer, with crest less elevated posteriorly. About 12 serrations, as indicated by ridges on lateral surface of tooth. Notch between anterior and posterior roots not so acute and buccal wall of crown not extending down root portion so far. P^1 in referred material relatively shorter and wider and P^2 slightly wider than in *P. mediaevus*. Cusps in P^1 and P^2 less elevated and less distinct. Outer row of cusps on referred M^1 less developed posteriorly.

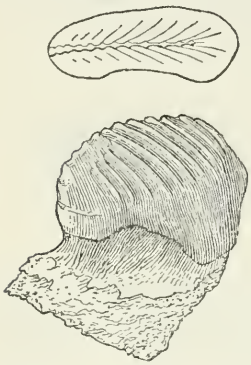


FIGURE 3.—*Ptilodus ferronensis*, new species: Jaw fragment with P_4 (U.S.N.M. No. 16176), type specimen, lateral and occlusal views, × 3, Dragon Paleocene, Utah.

Description.—Included in the material representing *Ptilodus ferronensis* are five lower jaw fragments with P_4, a maxillary fragment with P^1 and P^2, and an incomplete, isolated M^1. P_4 in No. 16176 (fig. 3), the type of *P. ferronensis*, is a little longer than in *Ptilodus mediaevus* and has the posterior portion of the crest a little less elevated. The notch between the anterior and posterior roots is not so acute, as viewed from the outer surface, and the buccal wall of the tooth does not extend so far down on the roots in the type. The notch between the roots of P_4 in No. 16225, referred to *P. ferronensis*, does not appear to be so obtuse. The number of serrations on the crown of P_4 in the type is about 12, as indicated in part by the ridges on the lateral surface of the tooth, apparently less by a similar method of counting than in certain specimens of *P. mediaevus* examined, although 12 is the median figure given by Simpson for the Torrejon form.

P^1 and P^2 in No. 16212 compare favorably in size with *Ptilodus mediaevus* (Amer. Mus. Nat. Hist. Nos. 3033 and 16533), but P^1 is relatively shorter and wider than in the Torrejon material, and P^2, though incomplete posteriorly, is a little wider than in Amer. Mus. Nat. Hist. No. 3033. The cusps of these two teeth in the Utah specimen are not so markedly separated and are less elevated than in the Torrejon material.

[1] Named from Ferron Canyon in Emery and Sanpete Counties, Utah.

An incomplete M^1 in the collection, No. 16216, shows the outer row of cusps less developed posteriorly than in Amer. Mus. Nat. Hist. No. 3033 from the Torrejon.

The length of P_4 in the type, No. 16176, of *Ptilodus ferronensis* is 9 mm. In No. 16212 P^1 is 3.3 mm. long and 2.8 wide, and P^2 is 3.5 mm. wide.

INSECTIVORA

Genus APHRONORUS Simpson

APHRONORUS SIMPSONI[2] Gazin

Aphronorus simpsoni GAZIN, 1938, p. 273.

About 19 specimens, consisting of isolated teeth or jaw fragments with one to four teeth, from the Dragon level are considered to represent *Aphronorus*. All but three of these, upper premolars, are lower jaw remains. The upper molar earlier (Gazin, 1939b, p. 275) thought to be of *Aphronorus simpsoni* is now cited herein as pantolestid (b).

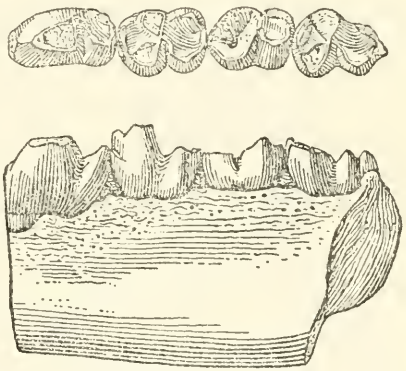


FIGURE 4.—*Aphronorus simpsoni* Gazin: Left ramus of mandible with P_4–M_3 (U. S.N.M. No. 15539), type specimen, lateral and occlusal views, × 4, Dragon Paleocene, Utah.

Aphronorus simpsoni is close in size to *A. fraudator* from the Crazy Mountain Fort Union but differs from this species in certain relative proportions, which are outside the limits given by Simpson for the middle Paleocene form. The ramus, No. 15539 (fig. 4), made the type, is slightly deeper than in the several Fort Union specimens that the writer examined, a difference more noticeable in the posterior portion. Also, the posterior molars are relatively larger, particularly M_3, which is larger than in any of the Fort Union specimens examined. However, the teeth are relatively slender. This is most noticeable in P_4, which combines the greatest length with the least width given by Simpson for *A. fraudator*. Moreover, the posterior wall or shear of the trigonid in the molars is not so distinctly transverse, but directed slightly more forward externally. In P_4 the shear is more nearly transverse though somewhat irregular as a slight ridge extends down the posterior wall of the metaconid and unites with the hypoconid crest.

[2] Named for Dr. G. G. Simpson.

TABLE 1.—*Measurements (in millimeters) of lower teeth of* Aphronorus simpsoni

Measurement	P_4	M_1	M_2	M_3
Anteroposterior diameter	3.8	3.0	3.0	3.2
Transverse diameter	2.0	2.1	2.2?	2.2

Pantolestid (a), genus and species undetermined

A maxillary portion (fig. 5), No. 16184, with M^2 and M^3, represents a pantolestid insectivore near *Bessoecetor*. The teeth are relatively wide transversely, M^2 being about one-fourth wider than in *Bessoecetor thomsoni*. Anteroposteriorly the tooth is about the same, or possibly as much as a sixth greater than in *B. thomsoni*. The hypocone is markedly lingual in position and the anteroexternal angle, though partially broken away, is seen to be much heavier than in M^2 of the Scarritt Quarry form. The anterior wall of M^2 shows a somewhat heavier cingulum and the posterior wall does not show so acute a notch adjacent to the metaconule. M^3, though poorly preserved, appears to be anteroposteriorly compressed. Both teeth are much more reduced anteroposteriorly than in *Aphronorus*, and the external styles are directed more as in *Bessoecetor*. Moreover, the teeth are much smaller than in *Palaeosinopa senior*, also recorded from the Scarritt Quarry in the Crazy Mountain field of Montana.

FIGURE 5.—Pantolestid (a), gen. and sp. undet.: Maxillary portion with M^2 and M^3 (U. S. N. M. No. 16184), occlusal view, × 4, Dragon Paleocene, Utah.

A lower jaw portion, No. 16219, with M_3 preserved may belong to this form. M_3 has the trigonid structure much as in *Bessoecetor*, or even *Aphronorus*, but the talonid is more reduced than in *B. diluculi*, somewhat as in *B. thomsoni*. However, its size is such as to suggest a relationship to the form represented by the upper molars described above, and the reduced talonid is quite in accord with the anteroposterior reduction of M^3 in No. 16184.

The anteroposterior and greatest transverse diameters of M^2, No. 16184, are 2.5 (approximately) and 4.9 mm., respectively; of M_3, No. 16219, 2.7 and 2.0 mm.

Pantolestid (b), genus and species undetermined

A single upper molar, No. 15791, provisionally referred to *Aphronorus simpsoni*, seems on further consideration to represent not *Aphronorus* but a pantolestid type closer to *Bessoecetor*. The tooth is about a third smaller than the M^2 in the form herein described as pantolestid (a), hence somewhat smaller than either of the first

two molars in *B. thomsoni* or in *B. diluculi*. However, this tooth more closely resembles *Bessoecetor* in its proportions and outline than it does the larger Dragon pantolestid (a).

DRACONTOLESTES,[3] new genus

Type.—*Dracontolestes aphantus*, new species.

Generic characters.—Lingual cusps of lower molars slightly more elevated than outer. Trigonid moderately elevated. Paraconid crest extends to a markedly lingual point. Talonid basin closed lingually. Crest extending forward from hypoconid joins trigonid at a distinctly lateral point. No external cingulum on M_2 and M_3.

DRACONTOLESTES APHANTUS,[4] new species

Type.—Left ramus of mandible, U.S.N.M. No. 16180, with M_3 and part of M_2.

Horizon and locality.—Dragon Paleocene, Dragon Canyon, Emery County, Utah.

Specific characters.—Much smaller than known species of *Eudaemonema* and *Elpidophorus*. Teeth about the size of those in *Aphronorus simpsoni*.

Description.—The lower jaw with M_3 and part of M_2, No. 16180 (fig. 6), represents a species in the Dragon level which is clearly mixodectid, but cannot be certainly referred to any of the known genera. The form is much smaller than species of *Eudaemonema* and *Elpidophorus*, being distinctly smaller than *Elpidophorus minor* from the Crazy Mountain Fort Union.

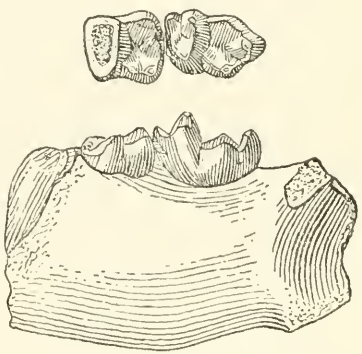


FIGURE 6.—*Dracontolestes aphantus*, new genus and species: Left ramus of mandible with M_2–M_3 (U.S.N.M. No. 16180), type specimen, lateral and occlusal views, ×4, Dragon Paleocene, Utah.

The inner cusps are only slightly more elevated than the outer, such as observed in some material of *Eudaemonema cuspidata*, not so accentuated in this respect as in *Elpidophorus*. The trigonid portion is elevated with respect to the talonid but the cusps in general, though sharp, are not so elevated as in *Eudaemonema cuspidata*. The crest carrying the paraconid extends lingually even more than in *Elpidophorus patratus* somewhat as in *Elpidophorus minor*, not extending forward or so median in position as characteristic of *Eudaemonema*. Moreover, the talonid basin is closed lingually by

[3] δράκων, dragon + λῃστής, thief.

[4] ἄφαντος, obscure.

the crest extending forward from the entoconid to the metaconid, and the crest forward from the hypoconid joins the posterior wall of the trigonid at a point distinctly more external than in either of the above genera. The talonid basin is well excavated and in M_3 is not so restricted by the flexure of the outer wall anterior to the hypoconid as in *Elpidophorus patratus*. The hypoconulid in M_2, though weak, is placed almost as close to the entoconid as in the Crazy Mountain forms. It may be further noted that the two molars do not show evidence of an external cingulum such as exists in *Elpidophorus* material.

The anteroposterior diameter of M_3 in No. 16180 is 3.5 mm. The transverse diameters of M_2 and M_3 are 2.3 and 2.0 mm., respectively.

This new form is possibly closest to the *Elpidophorus* line but differs most notably in the less accentuated elevation of the inner cusps and in the more widely basined talonids. The differences from *Eudaemonema* that are significant, though not striking, in determining the relationship of this form lie principally in the position of the paraconid and in the distinctly closed talonid basins. The lateral position of the crest joining the hypoconid with the trigonid wall is distinctive with respect to both.

Specimen No. 15719, which includes an incomplete lower molar, earlier described (Gazin, 1939b, p. 276) as belonging possibly to a primate, closely resembles M_2 in the above described type, so that in the absence of additional material demonstrating more certainly the presence of a primate in the fauna this specimen is referred to *Dracontolestes aphantus*.

Mixodectid (a), genus and species undetermined

A jaw fragment, No. 16220, with a single molar is seen to represent a second mixodectid type of insectivore in the Dragon fauna. The tooth is almost as large as in *Eudaemonema cuspidata* and apparently a little larger than in *Elpidophorus minor*. The protoconid and metaconid are broken, and although the inner of the two may possibly have been the larger, in the talonid the entoconid is not higher than the hypoconid, suggesting *Eudaemonema* rather than *Elpidophorus*, and the talonid basin opens internally with almost, but not quite, as broad an opening as in specimens of *Eudaemonema*. The tooth also lacks the distinct external cingulum seen in material of *Elpidophorus*. However, the paraconid is markedly internal in position, and not so low or projecting so forward as in *Eudaemonema cuspidata*. The paraconid is placed somewhat as appears to be the case in M_2 of *Elpidophorus minor*. The tooth, though a little shorter, is relatively wider than in *Eudaemonema cuspidata*, suggesting *Elpidophorus* in this respect, but is slightly lower crowned than in either. It may be further noted that the hypoconulid, rising

from a slight posterior cingulum, does not appear to be placed quite so far internally, and the outer walls of the protoconid and hypoconid are not so nearly vertical as in *Eudaemonema* and *Elpidophorus*, but seem to be more sloping, causing at least the talonid basin to appear slightly narrower with respect to the width of the tooth.

The anteroposterior and transverse diameters of the lower molar, No. 16220, are 3.4 and 2.9 mm., respectively.

Mixodectid ? (b), genus and species undetermined

A maxillary portion, No. 16200, with an upper molar, possibly M^2 (fig. 7), and part of the next succeeding tooth may represent a small mixodectid in the Wagonroad fauna. The molar shows a well-developed shelflike cingulum external to the paracone and metacone and acute external styles. The hypocone is markedly lingual in position and a cingulum is continuous around the inner portion of the protocone, not including the hypocone but apparently terminating posteriorly and upward between the protocone and hypocone. A posterior cingulum extends laterally from the hypocone. The lingual position of the hypocone suggests a relationship to *Eudaemonema*, inasmuch as in *Elpidophorus* the hypocone is not placed so far inward. The cingular shelf on the outer side of the tooth seems more prominent than in either of the Crazy Mountain forms.

FIGURE 7.—Mixodectid? (b): Maxillary portion with one upper molar and part of another (U.S.N.M. No. 16200), occlusal view, × 4, Wagonroad Paleocene, Utah.

The occurrence of this small form in the Wagonroad fauna is of interest, being unlike anything in the Puerco and if found to represent a mixodectid it is the earliest known.

The tooth measures about 3.3 and 5.4 mm., anteroposteriorly and transversely.

TAENIODONTA

Genus CONORYCTELLA[5] Gazin

CONORYCTELLA DRAGONENSIS[6] Gazin

Conoryctella dragonensis GAZIN, 1939b, p. 276.

A conoryctid type of taeniodont is recognized in the Dragon collections by a maxillary portion with three teeth, P^4 to M^2, and a lower jaw fragment with a single molar obtained in 1938, and two additional lower molars found in 1939.

The upper teeth, No. 15704, made the type of *Conoryctella dragonensis* (fig. 8), are seen, as previously described, to be a little smaller

[5] *Conoryctes* + *ella*, a small conoryctid.
[6] Named for Dragon Canyon.

than in *Conoryctes comma* but distinctly larger than in *Onychodectes tisonensis*. The Dragon form is about intermediate between these two species in degree of hypsodonty. P^4 is not so nearly molariform as in *C. comma* and has the lingual portion more compressed anteroposteriorly. The protocone and deuterocone are prominent conical cusps, and the tritocone, though damaged, is seen to be but weakly developed as compared to the other two cusps. The lingual portion of this tooth does not appear crescentic; nevertheless, a low crest or cingulum extends along the posterior portion between the deuterocone and tritocone.

The paracone and metacone in the first two molars, as far as preserved, are seen to be conical and low and are separated from the outer margin of the teeth by a heavy cingulum. The mesostyle, though present, is not so strongly developed as in *C. comma*. It is absent in *O. tisonensis*. The anteroexternal and posteroexternal angles of the teeth are more rounded than in *O. tisonensis* and do not exhibit styles at these points as in the Puerco form.

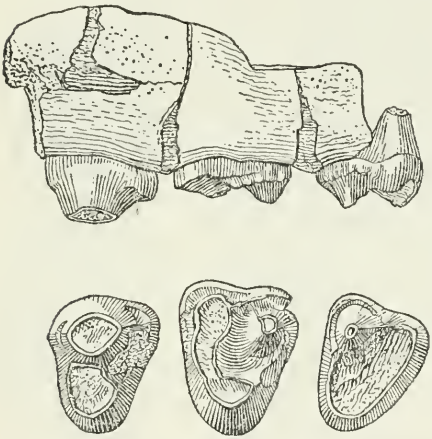


FIGURE 8.—*Conoryctella dragonensis* Gazin: Maxillary portion with P^4–M^2 (U.S.N.M. No. 15704), type specimen, lateral and occlusal views, × 2, Dragon Paleocene, Utah.

The anteroposterior diameters of the upper teeth, P^4 to M^2, are approximately 7.5, 8.2, and 7.4 mm., respectively. Any transverse measurements would be highly arbitrary.

The lower jaw fragment, No. 15722, with a molar tooth, apparently M_1, may represent *Conoryctella dragonensis*, although it is from an individual somewhat smaller than the type. The tooth is about intermediate between *O. tisonensis* and *C. comma* in hypsodonty but apparently a little nearer *O. tisonensis* in size. The trigonid of the tooth possesses a moderately developed paraconid situated much as in M_1 of *O. tisonensis*. The heel or talonid, though partially obscured by matrix, is relatively broad, appears to be deeply basined and to have a somewhat cuspidate crest, approaching the condition seen in *C. comma*.

The two lower molars, No. 16173, added to the collection in 1939, exhibit an arrangement of the cusps around the margin of the talonid very much as in *Onychodectes*, without the greater number of accessory cuspules seen in *Conoryctes*. The teeth are relatively a little

wider and the heel more basined than in *Onychodectes* and as with other material known of the form the two teeth are intermediate between *O. tisonensis* and *C. comma* in size and hypsodonty.

The Dragon lower teeth do not exhibit the basal accessory cuspule anteroexternal to the hypocone characterizing *Onychodectes rarus*.

Stylinodont, near Psittacotherium

A single incisor tooth, No. 16204, apparently lower, seems most certainly to belong to a stylinodont type of taeniodont. The tooth is moderately worn but shows evidence of a conical labial portion and a marked lingual shelf, and exhibits a heavy, transversely flattened root. The tooth is about intermediate in size between corresponding teeth in the types of the Puerco and Torrejon species, *Wortmania otariidens* and *Psittacotherium multifragum*. The lingual shelf seems more extended than in *Wortmania* but is not so prominent or so broadened as in *Psittacotherium*, and the enamel does not extend down the labial wall of the tooth for so great a distance as in the latter genus.

The occurrence of a stylinodont in the Dragon fauna was to be expected since this family is represented in both the Puerco and Torrejon stages; in fact the line appears to be continuous through the Paleocene, and into Eocene time where it is represented by the genera *Ectoganus* and *Stylinodon*.

CARNIVORA

Genus PROTOGONODON Scott

PROTOGONODON? SPIEKERI[7] Gazin

Protogonodon? spiekeri Gazin, 1938, p. 274.

The species *Protogonodon? spiekeri* was described from a right lower jaw portion with M_1, M_2, and part of M_3 in the Dragon collection obtained in 1937. Subsequent material includes a lower jaw portion with M_2 and isolated portions of lower molars. Upper jaw material, including an M^3 and a maxillary portion with part of M^3 and the root portion of M^2, was referred to this species, but the recognition of a second species, *Protogonodon biatheles*, from lower-jaw material obtained from the Dragon horizon in 1939 makes doubtful the reference of these upper teeth to *P.? spiekeri*, in the absence of any association between upper and lower teeth.

The lower molars of *Protogonodon? spiekeri*, as represented by the type, No. 15538 (fig. 9), correspond closely in size to those of *P.*

[7] Named for Dr. Edmund M. Spieker.

pentacus from the Puerco but exhibit more rugose enamel. The paraconid, which is preserved in only the first two molars, is more lingual in position and not so distinct from the metaconid. The cusps around the talonid, however, though low, are somewhat more distinct from those adjacent than in *P. pentacus*, with less development of a crest and basin. The trigonid portions of the teeth are somewhat more elevated with respect to the talonids than is usual in *P. pentacus*.

In the reduction and position of the paraconid and in the rugosity of the enamel the Dragon form makes a definite approach toward the condition seen in the Torrejon specimens referred to *Claenodon corrugatus* (*C. ferox*). The paraconid in M_2, and perhaps M_1, of *P.? spiekeri* is better developed and more distinctly separated from the metaconid than in *C. corrugatus* although it is placed nearly as far

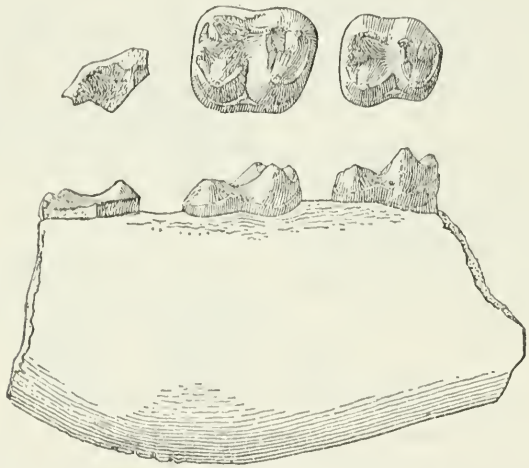


FIGURE 9.—*Protogonodon? spiekeri* Gazin: Right ramus of mandible with M_1, M_2, and part of M_3 (U.S.N.M. No. 15538), type specimen, lateral and occlusal views, × 1½, Dragon Paleocene, Utah.

lingually as in the Torrejon material. The union or ridge between the protoconid and metaconid is simple and not double as frequently seen in the more coarsely rugose teeth of *Claenodon corrugatus*. On the talonid the hypoconulid is more distinct from the entoconid, whereas in *C. corrugatus* these two form a more conspicuous ridge, which usually continues with the cingulum around the hypoconid. The cusps in general are lower and more distinct than in *Claenodon*, with a less distinctly basined talonid, with fewer accessory cuspules, and a finer quality of rugosity.

M_3 in the type, though incomplete, is much less elongate than in *C. corrugatus*, as indicated by the spacing of the metaconid, entoconid, and hypoconulid.

The maxillary fragment, No. 15541, tentatively referred to *Protogonodon? spiekeri*, shows no important characters other than a relatively great difference in size between M^2 and M^3. The isolated M^3 is complete and shows a slight development of a mesostyle, not nearly so prominent, however, as in *Deuterogonodon montanus*, and the slight hypocone is not nearly so lingual in position.

In most respects, especially in the character of the trigonid of the lower molars, *P.? spiekeri* stands in a relation nearly intermediate between *Protogonodon* and *Claenodon*, with perhaps a slightly greater resemblance to *Protogonodon*. It is distinct from *Deuterogonodon montanus*, as represented by the paratype, in the lowness of the cusps, the far less developed crest and basin of the talonid, and in the relatively greater importance of the entoconid.

The anteroposterior diameters of the first and second lower molars are 10 and 11 mm., respectively. The transverse diameters are 8 and 9.3 mm.

PROTOGONODON BIATHELES, new species

Type.—Portions of both rami of the mandible with M_1 and M_2, U.S.N.M. No. 16181.

Horizon and locality.—Dragon Paleocene, Dragon Canyon, Emery County, Utah.

Specific characters.—M_1 and M_2 slightly larger than *Protogonodon? spiekeri*. Paraconid median in position. Talonid relatively wide. Teeth slightly rugose.

Description.—Fragments of both rami of the mandible, No. 16181 (fig. 10), with M_1 and M_2, found in a mass of barite crystals together with well-worn upper teeth of *Desmatoclaenus paracreodus* in the Dragon horizon, appear to represent a species of *Protogonodon* distinct from *P.? spiekeri*. The molars are only slightly larger than those in *P.? spiekeri*, but in contrast with this form the paraconid is much more median in position, even in comparison with *Protogonodon pentacus*. The trigonid portion is relatively narrow, and the talonid, especially of M_2, is markedly wider and more basined than in either *P.? spiekeri* or *P. pentacus*. This specialization is directly opposite to that seen in *Protogonodon kimbetovius* where the talonid is relatively narrow. The enamel of the teeth is very slightly rugose, much less so in the talonid basin in comparison with *P.? spiekeri*, although the teeth appear to be about as unworn as in the type of the latter.

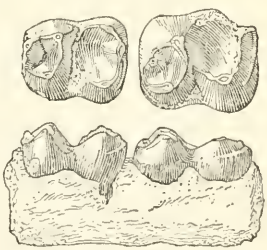


FIGURE 10.—*Protogonodon biatheles*, new species: Left ramus of mandible with M_1 and M_2 (U.S.N.M. No. 16181), type specimen, lateral and occlusal views, × 1½, Dragon Paleocene, Utah.

Considerable doubt attaches to the assignment of any upper teeth to this species. Those tentatively assigned to *P.? spiekeri* may belong to *P. biatheles;* however, the reduced size of M_3 suggested in the type of *P.? spiekeri* indicates allocation of the preserved third upper molars to that species.

PROTOGONODON? species

A maxillary portion, No. 16193 (fig. 11), including M^3 and a much damaged M^2, in the Wagonroad collection strongly resembles material in the Dragon collections referred to *Protogonodon? spiekeri.* M^3 is rounded and the cingulum, which appears to extend entirely around the tooth, is rugose, whereas the central basin is smooth. Arising from the cingulum is a hypocone about as in the Dragon M^3 but between the paracone and metacone and separate from the cingulum a much-worn accessory cuspule or mesostyle is developed to an extent approaching that in *Deuterogonodon montanus.* In M^3, No. 15733, referred to *P.? spiekeri* from the Dragon horizon, there is a slight cuspule in this position.

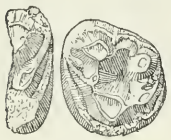


FIGURE 11.—*Protogonodon?* sp.: Left maxillary portion with M^3 and part of M^2 (U.S.N.M. No. 16193), occlusal view, × 1½, Wagonroad Paleocene, Utah.

The anteroposterior and transverse diameters of M^3, No. 16193, are about 9.5 and 10.5 mm., respectively.

Other incomplete portions of teeth in the collections from the Wagonroad horizon probably represent the same form as No. 16193, or a closely related type. All show evidence of a moderately heavy cingulum but none of the upper tooth fragments exhibit a mesostyle as in No. 16193.

A single last lower molar, No. 16344, in the small collection from the original Wagon Road Ridge locality (the equivalence of which to either the Wagonroad or Dragon horizons is uncertain) may represent a species of *Protogonodon.* The elevation of the trigonid suggests *Eoconodon* but differs from that form in having the paraconid so nearly median in position.

Genus OXYCLAENUS Cope

OXYCLAENUS PEARCEI,[8] new species

Type.—Portions of right and left rami of the mandible with M_2 and M_3, U.S.N.M. No. 16186.

Horizon and locality.—Dragon Paleocene, Dragon Canyon, Emery County, Utah.

[8] Named for Franklin Pearce, in recognition of his field assistance.

Specific characters.—Size near *Oxyclaenus simplex.* Talonid of M_2 relatively wide. Paraconid directed forward and more distinct from protoconid and metaconid. M_3 unreduced.

Description.—Several lower jaw fragments from the Dragon horizon represent a species of *Oxyclaenus* near *O. simplex.* M_2 in the type specimen, No. 16186 (fig. 12), from the upper or Dragon level at the new locality in the western part of the canyon is about the same size as the single lower molar belonging with the type of *O. simplex*, being smaller and not so high crowned as in *Oxyclaenus cuspidatus.* It differs from *O. simplex* principally in having a wider talonid portion and a narrower trigonid, somewhat as in *Loxolophus* but with the talonid basin more open internally; however, the teeth are relatively slender and exhibit a well-defined external cingulum as in *Oxyclaenus.* The paraconid is directed more forward than in *Oxyclaenus* and separated from both the protoconid and metaconid by a more distinct notch.

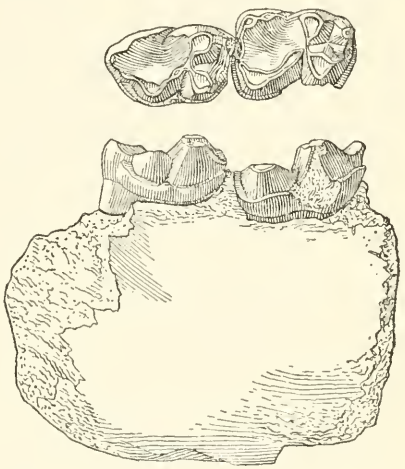


FIGURE 12.—*Oxyclaenus pearcei*, new species: Right ramus of mandible with M_2–M_3 (U.S.N.M. No. 16186), type specimen, lateral and occlusal views; × 3, Dragon Paleocene, Utah.

M_3 in the type exhibits a trigonid portion much as in M_2, but the tooth is fully as large as M_2, not showing the reduction seen in Puerco specimens referred to *O. simplex* (Amer. Mus. Nat. Hist. No. 16347) and *O. cuspidatus* (Amer. Mus. Nat. Hist. No. 16346).

An upper molar fragment, No. 15736, which includes only the inner portion may represent this form, and is characterized by a prominent lingually placed hypocone and an equivalent protostyle symmetrically placed.

The anteroposterior diameters of M_2 and M_3 in No. 16186 are 5.7 and 6.0 mm., respectively. The transverse diameters are 4.1 and 3.5 mm.

OXYCLAENUS species

A single upper molar, No. 16217, in the material from the Wagon-road level, is seen to correspond closely to M^1 in the type of *Oxyclaenus simplex* and may possibly represent *O. pearcei*, the species described from the Dragon horizon. The tooth differs from M^1 of *O. simplex* only in being slightly narrower transversely and in hav-

ing cusps, which appear to be somewhat more acute, although this tooth in the type of *O. simplex* is rather well worn. The tooth, No. 16217, measures 4.8 mm. anteroposteriorly across the styles and 5.2 mm. transversely.

Oxyclaenid?

An isolated upper molar, possibly M^2, No. 15546, in the 1937 collection from the Dragon level, may be from an oxyclaenid type of carnivore. The tooth is too large to belong to *Oxyclaenus pearcei* and differs somewhat from the *Oxyclaenus* type of tooth. Although exhibiting a parastyle, the external angles are not so acute as in either *Oxyclaenus* or *Chriacus*. The hypocone is more lingual than in *Oxyclaenus* and a slight protostyle is present at the lingual extremity of the anterior cingulum. The hypocone, however, is not developed as in *Chriacus*, the cusps in general are more nearly conical, and the cingulum does not extend entirely across the lingual wall of the protocone. Moreover, the protoconule and metaconule are more distinctly separated from the outer cusps than in any of the oxyclaenid material examined.

Some resemblance is seen between this tooth and M^2 in the condylarth *Dracoclaenus griphus*, with which it corresponds closely in size, but there is no mesostyle, the hypocone is more lingual in position, there is a slight protostyle, and, as in comparison with the oxyclaenids, the protoconule and metaconule are too widely separated from the paracone and metacone, respectively.

The anteroposterior diameter of the tooth is about 6.2 mm. and the transverse diameter 7.6 mm.

Genus TRICENTES Cope

TRICENTES ELASSUS,[9] new species

Type.—Upper molar, M^1, U.S.N.M. No. 16178.

Horizon and locality.—Dragon Paleocene, Dragon Canyon, Emery County, Utah.

Specific characters.—A little smaller than *Tricentes subtrigonus*. Cusps and outer angles of upper molars somewhat more acute. Cingulum does not extend around lingual wall of protocone on M^1.

Description.—At least three isolated upper molars and a lower molar in the Dragon collection are recognized as belonging to *Tricentes*. The upper molars are a little smaller than in material referred to *Tricentes crassicolidens* and about a fifth smaller than in the type of *Tricentes subtrigonus;* however, certain specimens from the Torrejon are nearly as small as the Dragon form. The outer angles of the upper molars are somewhat more acute, and the cusps in general

[9] ἐλάσσων, small, in allusion to its size.

have a weaker, less inflated appearance. The posterior portion of the external cingulum of M^1, Nos. 16178 (fig. 13) and 15783, rises forward on the protocone much as in the Torrejon material of *Tricentes*, but the inner cingulum does not extend around the protocone as is common, though not invariable, in *Tricentes subtrigonus*. In M^2, No. 16179 (fig. 13), the cingulum appears to be continuous around the protocone. The enamel is weakly rugose on both M^1 and M^2, but there is no indication of a mesostyle on the cingulum or between the paracone and metacone on these teeth.

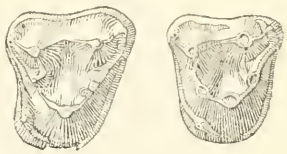


FIGURE 13.—*Tricentes elassus*, new species: M^1 (U.S.N.M. No. 16178), type specimen (on right), and M^2 (U.S.N.M. No. 16179), occlusal views, × 3, Dragon Paleocene, Utah.

A maxillary portion with M^3 and an incomplete M^2, No. 16206, may represent *Tricentes elassus*. The teeth are a little smaller than in *T. subtrigonus* but otherwise show no importance differences. The enamel is somewhat more smooth than in the type but the teeth are well worn. The inner portion of M^2 shows a slightly heavier cingulum around the protocone than in the isolated M^2 described above.

The lower molar, No. 16215, in the collection shows no important differences from material of *Tricentes subtrigonus* except that the paraconid is perhaps a little more lingual in position.

The anteroposterior and transverse diameters of the type, M^1, are 5.1 and 5.6 mm., respectively.

Genus GONIACODON Cope

GONIACODON? species

An upper molar, U.S.N.M. No. 16207, closely resembles M^1 in *Goniacodon levisanus*, equaling in size this tooth in individuals having somewhat smaller teeth than the average in the known material. The only apparent distinction lies in the extension of the cingulum on the anterior wall of the tooth to a more lingual point than in *Goniacodon levisanus*. The anteroexternal and posteroexternal styles are broken off so that the direction or extent of these angles cannot be determined. The tooth is not greatly different from M^2 in *Claenodon procyonoides*, but the resemblance between the Utah specimen and M^1 in *G. levisanus* is more striking.

An isolated upper premolar, No. 16208, resembles P^4 in *Goniacodon levisanus* so closely that it may well belong to the same form as that represented by the molar. The principal cusp is broken down, but the deuteroconid portion is preserved and corresponds closely to that in *G. levisanus*, except in being a little more restricted anteroposteriorly. The outer portion of the tooth is somewhat distorted,

but it appears as if this portion may not have extended so far anteroposteriorly as in *G. levisanus*.

The anteroposterior diameter of the upper molar, No. 16207, cannot be measured, but the transverse diameter is about 9 mm.

Genus DIDYMICTIS Cope

DIDYMICTIS? species

A fourth lower premolar, U.S.N.M. No. 15763, apparently represents the genus *Didymictis*. The tooth is only slightly smaller than in *Didymictis haydenianus* from the Torrejon but does not have the first cuspule posterior to the large cusp so distinctly set off from this primary cusp. The cuspules of the talonid are more nearly in the median line of the tooth than was observed in *D. haydenianus*. The tooth is distinctly larger than in *D. microlestes* from the Crazy Mountain locality in the Fort Union of Montana.

An isolated fourth upper premolar may possibly belong to *Didymictis* but is too small to belong to the form represented by the lower tooth. Moreover, the deuterocone portion does not extend forward so markedly as in the Torrejon material of *Didymictis*, a condition suggestive of *Ictidopappus*, but the posterior cusp, though prominent, is not developed into so nearly a shearing blade as in either *Didymictis* or *Ictidopappus*.

A fragment of the trigonid portion of a lower molar collected during the 1939 season may represent *Didymictis*, but it adds little or nothing to our information regarding the form occurring in the Dragon.

CONDYLARTHRA

Genus DRACOCLAENUS[10] Gazin

DRACOCLAENUS GRIPHUS[11] Gazin

Dracoclaenus griphus Gazin, 1939b, p. 281.

The material in the Dragon collection representing *Dracoclaenus griphus* most closely resembles that of the Torrejon form *Protoselene opisthacus* but differs from it in several respects. A relatively large number of specimens, though fragmentary, are referred to this form and four of these are figured (fig. 14).

P^4 (fig. 14, *d*) in specimen No. 15705 is larger and more inflated than in *P. opisthacus*, although there is much variation in P^4 of material referred to *P. opisthacus*, such as between Amer. Mus. Nat. Hist. Nos. 16614 and 3285. In size of P^4 *D. griphus* approaches *Mioclaenus turgidus*, but with less reduction of the cingulum and no

[10] δρακων dragon+*claenus*.
[11] *Griphus*, an enigma.

"metaconule" such as usually is present in *M. turgidus*. The tritocone of P^4 in *Dracoclaenus griphus* is almost indistinct from the primary cusp, whereas this tooth in *P. opisthacus* (Amer. Mus. Nat. Hist. No. 16614) exhibits a division of the main outer cusp into a promi-

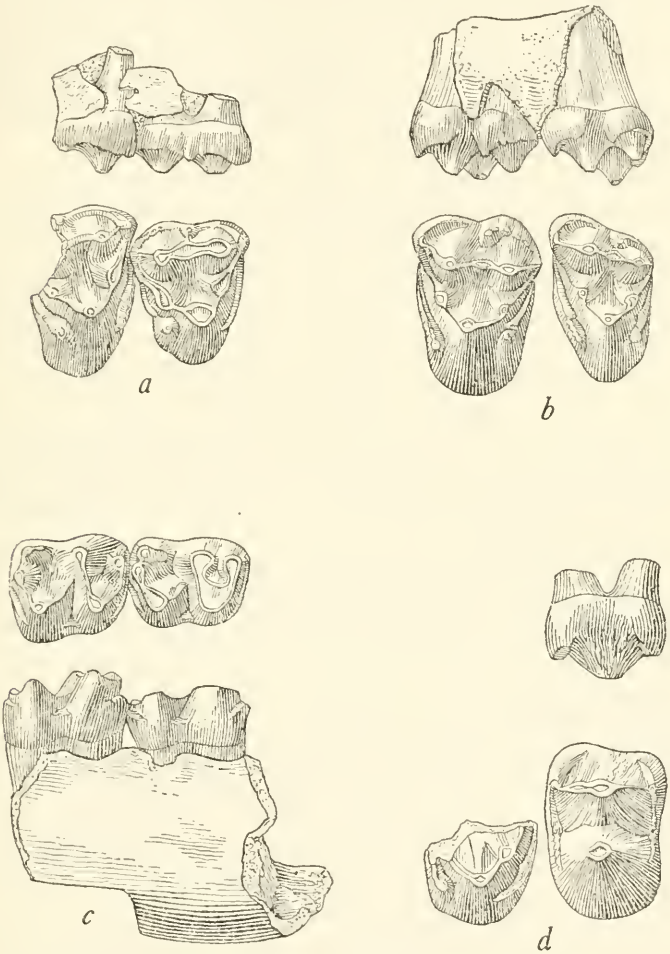


FIGURE 14.—*Dracoclaenus griphus* Gazin: *a*, M^1 and M^2 (U.S.N.M. No. 15789), type specimen, lateral and occlusal views; *b*, M^2 and M^3 (U.S.N.M. No. 16182), lateral and occlusal views; *c*, right ramus of mandible with M_1 and M_2 (U.S.N.M. No. 15773), lateral and occlusal views; *d*, P^4 and part of M^1 (U.S.N.M. No. 15705), lateral and occlusal views. × 3. Dragon Paleocene, Utah.

nent protocone and a lesser tritocone placed close together. The anteroexternal and posteroexternal styles are more prominent on P^4 of the Dragon form, and a slightly better developed cingulum, though discontinuous, is indicated on the outer surface.

The upper molars (type, fig. 14, *a*), M^1 and M^2, in No. 15789 resemble closely those in *Protoselene opisthacus*, but the difference in size between these teeth is more noticeable than in the Torrejon form, with M^2 distinctly larger than in *P. opisthacus*. The external cingulum is more prominent and more markedly crescentic about both the paracone and metacone. The mesostyle is well developed as in certain specimens of *P. opisthacus* but more conical and distinctly separated from the crest which extends between the paracone and metacone. In *P. opisthacus* the mesostyle extends outward as a spur or projection from this crest.

Additional material obtained in 1939 includes several more isolated teeth, but in particular two maxillary portions: No. 16203 with M^1 and M^2 and No. 16182 with M^2 and M^3 (fig. 14, *b*). The newly acquired upper teeth show *Dracoclaenus griphus* to run somewhat larger than *P. opisthacus*. The two forms are most nearly alike in M^1, but the posterior upper molars show less resemblance. To the greater size of M^2 is further added a much better development of the parastyle than in *P. opisthacus*. M^3, not hitherto known, is seen to be more like M^2 than in *P. opisthacus*. This tooth is relatively larger than in the Torrejon form and, although approaching a triangular outline, shows a more distinct hypocone and much better developed protoconule and metaconule.

A somewhat distinctive upper dentition from the Wagon Road Ridge locality, including P^4–M^2, No. 15703, resembles the type in most characters of the molars but has a weaker hypocone on both molars and a very weak metaconule on M^2. The anteroexternal angle of M^2 extends forward even somewhat more, suggestive of the oxyclaenids, but has the mesostyle, particularly in M^1, as in No. 15789. The external cingulum is not so crescentic around the outer cusps, the outer wall being more nearly straight. P^4 is similar but a little smaller than in Nos. 15705 and 15780. This specimen, No. 15703, may represent a distinct species of *Dracoclaenus* or may possibly be an oxyclaenid, close in size to *Oxyclaenus simplex;* however, P^4 and M^1 more closely resemble the *Dracoclaenus* material.

The lower jaw portion, No. 15773 (fig. 14, *c*), considered by comparison to represent *Dracoclaenus griphus*, also resembles material of *Protoselene*. It corresponds closely in size to *P. opisthacus* but has the paraconid on M_1 and M_2 more internal in position, and in M_2 it is not placed so low and is less reduced than in *P. opisthacus*. The talonid basin is apparently not so deep and is narrower between the hypoconid and entoconid. A slight accessory cusp is present on the anterior crest of the entoconid nearly as prominent as in *P. opisthacus*.

An M_3, No. 15752, in the collection, possibly belonging to this form, does not so closely resemble *P. opisthacus*. The paraconid, though low, is placed more internal than is usual in the Torrejon form. Moreover, the entoconid is not so simple as usual in *P. opisthacus*, exhibiting three small cusps in this position, and the hypoconulid is more distinctly separated from the hypoconid.

TABLE 2.—*Measurements (in millimeters) of upper and lower teeth of* Dracoclaenus griphus

Measurement	U.S.N.M. No.—						
	15705	15789 (type)		16182		15773	
	P^4	M^1	M^2	M^2	M^3	M_1	M_2
Anteroposterior diameter	5.7	5.4	.....	5.8	4.6	5.3	5.3
Transverse diameter	7.9	6.4	7.5	8.3	7.5	4	4.4

OXYTOMODON[12] new genus

Type.—*Oxytomodon perissum*, new species.

Generic characters.—Lower teeth slender with cusps high and distinct. Paraconid on M_2 and M_3 lingual in position and close to metaconid. Cingula absent or weakly developed and no crest from paraconid to lingual surface as in *Oxyacodon*. Hypoconulid less developed. M_3 unreduced.

OXYTOMODON PERISSUM,[13] new species

Type.—Left M_2 and M_3, U.S.N.M. No. 16183.

Horizon and locality.—Dragon Paleocene, Dragon Canyon, Emery County, Utah.

Specific characters.—Near *Oxyacodon priscilla* in size.

Description.—A jaw fragment, No. 16183 (fig. 15), with M_2 and M_3 and three additional specimens, which include only M_3, represent in the Dragon fauna a hyopsodont condylarth near *Oxyacodon*. *Oxytomodon perissum* is near *Oxyacodon priscilla* in size, but the paraconid on the lower molars is lingual in position, close to the metaconid, and does not exhibit a

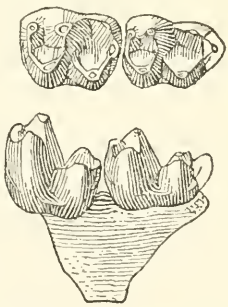


FIGURE 15.—*Oxytomodon perissum*, new genus and species: Fragment of left ramus of mandible with M_2 and M_3 (U.S.N.M. No. 16183), type specimen, lateral and occlusal views, × 4, Dragon Paleocene, Utah.

[12] ὀξύτόμος, sharp + ὀδους, tooth.

[13] περισσός, unnecessary or superfluous, in allusion to the considerable variety of small condylarths.

crest extending from the paraconid down to a weak inner cingulum around the metaconid as in *Oxyacodon*. The form resembles *Oxyacodon* and differs from *Ellipsodon* in having relatively high, distinct cusps, and M_3 is unreduced in size. However, the hypoconulid is not so well developed as in the lower molars of *Oxyacodon*, and in M_3 it is more reduced and less distinctly separated from the entoconid. The teeth are slenderer than in *O. priscilla* and show no marked cingula on either the lingual or buccal surfaces, except for one of the third molars, No. 15542, which has a slight cingulum on the outer surface.

Litomylus dissentaneus from the Crazy Mountain Fort Union exhibits characters close to those seen in *Oxytomodon perissum*, particularly in the sharpness of the cusps, but the paraconid in the lower molars of *L. dissentaneus* is much reduced and median in position.

The anteroposterior and transverse diameters of M_2 in No. 16183 are 3.5 and 2.7 mm., respectively. The transverse diameter of M_3 is 2.4 mm.

Genus ELLIPSODON Scott

ELLIPSODON SHEPHERDI[14] Gazin

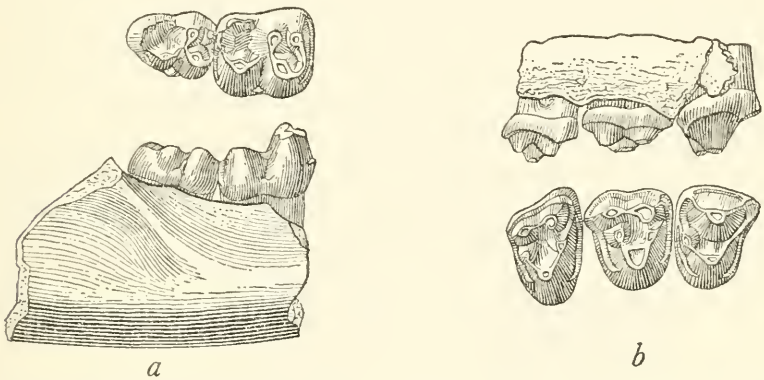
Ellipsodon shepherdi GAZIN, 1939b, p. 283.

Ellipsodon shepherdi is comparatively well represented in the Dragon fauna. The collection now includes about 55 specimens comprised of isolated teeth and lower jaw and maxillary portions having one or more teeth.

This species, as indicated by the type lower jaw (fig. 16, *a*), is slightly smaller than *Ellipsodon lemuroides*, and the molars, M_2 and M_3, are relatively narrower. M_3 is reduced to about the same extent as in *E. lemuroides*, more reduced than in the smaller forms, *E. aequidens*, *E. acolytus*, and *E. aquilonius*, but less reduced than in the Puerco species, *E. priscus*, and possibly somewhat less reduced than in the genotype, *E. inaequidens*. The paraconid of the last two lower molars is more distinct in the Dragon form than in any of the previously known species of *Ellipsodon*, much better developed and more lingually placed than in *E. aequidens*, but only slightly more prominent than in *E. aquilonius*. The talonids of M_2 and M_3 are more distinctly basined than in Torrejon material referred to *E. inaequidens*, but less distinctly basined than in *E. aquilonius* from Montana; also, the talonid on M_3 is better developed than in the Puerco form *E. priscus*. Moreover, the talonid of M_2 in *E. shepherdi* does not exhibit so prominent a hypoconulid as in *E. aequidens*, but shows a more distinct entoconid than in *E. inaequidens*.

[14] Named for Harold Shepherd, in recognition of his field assistance.

Additional lower jaw material of *E. shepherdi* collected in 1939 includes two specimens, No. 16289 and No. 16303, in which P_4 is preserved in association with the molars, rendering more certain the reference of several isolated lower premolars to this species. P_4 is seen to be comparable in size to that in *E. lemuroides* but showing a distinct metaconid, a slight paraconid, and two cusps at the posterior margin of the talonid. These are variably developed in the premolars referred to *E. shepherdi*, but more distinct that in *E. lemuroides* and other species from the San Juan Basin. The metaconid is better developed than in specimens of the smaller *E. aquilonius* but not to the extent seen in *Litaletes disjunctus*, nor is the



a *b*

FIGURE 16.—*Ellipsodon shepherdi* Gazin: *a*, Portion of right ramus of mandible with M_2–M_3 (U.S.N.M. No. 15721), type specimen, lateral and occlusal views; *b*, right maxillary portion with P^4–M^2 (U.S.N.M. No. 15790), lateral and occlusal views. × 3. Dragon Paleocene, Utah.

paraconid of P_4 so well defined as in *Litaletes*. The moderately enlarged P_4 and the brachydont condition of the teeth, combined with the reduced size of M_3, indicate a closer relationship to certain of the species regarded as *Ellipsodon* than to *Litaletes disjunctus*.

The upper teeth, P^4 to M^2 in the maxilla, No. 15790 (fig. 16, *b*), referred to *Ellipsodon shepherdi* are relatively smaller than in the type lower jaw and approach somewhat closer to *E. acolytus* than to *E. lemuroides* in size; however, this difference within the Dragon material may not be greater than can be accounted for by individual variation.

P^4 shows a cusp in the position that would be occupied by the metaconule in the molars. This is absent in the somewhat smaller P^4 of the Puerco form, *E. priscus*, but was observed in certain specimens of the later material. P^4 is noticeably larger than in *E. aequidens*, and M^1 and M^2 are relatively longer.

An M_3, if properly referred, indicates this tooth to be more reduced than in *E. lemuroides* and much more reduced than in *E. acolytus*, *E. aequidens*, and *E. aquilonius*.

The upper cheek teeth do not closely resemble those in the genotype, *E. inaequidens*. The upper teeth in the latter exhibit smooth crests running to the protocone and weak or undeveloped cingula.

TABLE 3.—*Measurements (in millimeters) of upper teeth (U.S.N.M. No. 15790) and lower teeth (U.S.N.M. No. 15721) of* Ellipsodon shepherdi

Measurement	P^4	M^1	M^2	M_2	M_3
Anteroposterior diameter	3.7	3.9	3.6	4.4	3.8
Transverse diameter	4.5	4.9	[1] 5.8	4	2.9

[1] Greatest transverse diameter.

ELLIPSODON? STERNBERGI[15] Gazin

Ellipsodon? sternbergi GAZIN, 1939b, p. 284.

A species nearly intermediate in size between *Ellipsodon lemuroides* and *Mioclaenus turgidus* is represented by several fragmentary specimens from the Dragon horizon, including a jaw portion, No. 15755, with M_3 and a part of M_2, which was made the type of *Ellipsodon sternbergi* (fig. 17). M_2 is much larger and broader than in other species of *Ellipsodon;* however, it apparently shows no crenulation of the crest around the posterointernal margin of the talonid as seen in many, though not all, of the lower dentitions of *M. turgidus*. M_3 is a little larger than in *Ellipsodon shepherdi* and somewhat more rounded, being nearly oval in shape. The paraconid is lacking on M_3, with only a low crest extending across the front of the tooth, connecting the protoconid and metaconid. Though reduced, the paraconid is present in all specimens of *Mioclaenus turgidus* in which M_3 was observed.

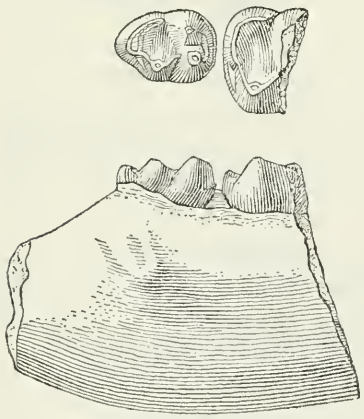


FIGURE 17.—*Ellipsodon sternbergi* Gazin: Portion of right ramus of mandible with M_3 and part of M_2 (U.S.N.M. No. 15755), type specimen, lateral and occlusal views, × 3, Dragon Paleocene, Utah.

Among the specimens referred to *E. sternbergi* is a jaw portion, No. 16339, having both M_1 and M_2 preserved. M_1 is but little larger

[15] Named for George F. Sternberg, in recognition of his field assistance.

than the corresponding tooth in *E. shepherdi* and closely resembles it in form. M_2 is considerably larger than *E. shepherdi* and is further characterized by having the talonid basin more restricted anteroposteriorly than was noted in other species. The paraconid is present on M_2, though not markedly developed. This cusp seems even less developed on M_2 in another referred specimen, No. 15769, in which only this tooth is preserved.

A few upper teeth may be referred questionably to this species, but these closely resemble upper teeth in *E. shepherdi* except for a somewhat greater transverse diameter and a more prominent protocone. The protocone, however, is not so broad as in M^2 of *Jepsenia mantiensis*. The reduced extent of the talonid basin of M_2 in *E. sternbergi* is opposed to the enlargement of the protocone in M^2 of *J. mantiensis*, although both of these teeth are large relative to other teeth in the series.

There is no certainty that this form represents the genus *Ellipsodon*, particularly since the premolars are not known. It is possible that a small species of *Mioclaenus* is represented. Moreover, the distinctions between *E. sternbergi* and *Jepsenia mantiensis* are not entirely satisfactory, being based for the most part on inference.

The transverse diameter of the second lower molar in the type is about 5 mm. The anteroposterior and transverse diameters of the third lower molar are 4.4 and 3.3 mm., respectively.

ELLIPSODON? species (a)

A lower jaw, U.S.N.M. No. 15781, from the Dragon horizon is unusual in that the two teeth preserved, M_1 and M_2, have rather blunt cusps, a flattened talonid, and a relatively undepressed area between the three cusps of the moderately elevated trigonid. It resembles somewhat specimens from the Torrejon that have been referred to *Ellipsodon inaequidens* but with the paraconid more distinctly set off, although this cusp is subdued as are the other cusps of the teeth. This may represent an unusual condition in *E. shepherdi* but probably represents a distinct form whose affinities are uncertain.

ELLIPSODON? species (b)

A small hyopsodont is represented in the Wagonroad horizon by a portion of an upper molar, a second lower molar, and two third lower molars. The upper molar portion, No. 16282, is larger than in *Ellipsodon shepherdi* and has a relatively more expanded protocone portion, somewhat as in *Jepsenia mantiensis* but with no evidence of a hypocone or protostyle although the tooth is noticeably worn. M_2, No. 16284, is almost identical in size with this tooth in the type of *E. shepherdi* but differs from it somewhat in that the tri-

gonid portion appears slightly less inflated anteroposteriorly, permitting a somewhat longer talonid basin, suggestive of *Litaletes disjunctus* but with less acute cusps. M_2 also resembles that in Dragon material referred to *Jepsenia mantiensis* but is distinctly narrower and with somewhat better defined cusps on the crest of the talonid. The third molars, Nos. 16283 and 16285, which may also belong to the same type of condylarth, are reduced in size with respect to the second molar described above but not to the extent shown in *E. shepherdi*. The talonid basin is more excavated than in *E. shepherdi* and the hypoconulid is better defined, approaching the condition seen in *Litaletes*, quite opposed to the reduction seen in *Ellipsodon priscus*. M_3 is appreciably smaller and lower crowned than in *Litaletes disjunctus*, and the entoconid is not distinct as it is in the Crazy Mountain form.

The Wagonroad form, if all the above material can be regarded as representing the same type, appears to be a hyopsodont close to or within the genus *Ellipsodon*, but clearly distinct from the Dragon *E. shepherdi* and the nearly contemporaneous *E. priscus* from the Puerco.

The second lower molar, No. 16284, has an anteroposterior diameter of 4.6 mm. and a transverse diameter of 3.9 mm. M_3, No. 16285, is 4.2 and 3.0 mm., respectively.

Genus JEPSENIA[16] Gazin

JEPSENIA MANTIENSIS[17] Gazin

Jepsenia mantiensis Gazin, 1939b, p. 285.

Jepsenia mantiensis, from the Dragon horizon, makes the closest approach to *Litaletes disjunctus* of the various hyopsodont condylarths with which comparisons have been made. The upper molar series designated as the type, No. 15747 (fig. 18), is only slightly more robust than in the Montana form. M^1 has about the relative proportions of that in *L. disjunctus* and shows a distinct hypocone about as in that form. However, the lingual portion of M^2 is more expanded anteroposteriorly, and the hypocone on this tooth is weaker and represented only by the abrupt termination lingually of the posterior cingulum. Also, the midportion of the posterior cingulum on both M^1 and M^2 is not deflected upward toward the root portion of the teeth so much as in *L. disjunctus*. The cusps in the upper molars have a more nearly conical appearance, especially the protoconule and metaconule. Moreover, the protoconule and metaconule are distinctly better developed. A parastyle and mesostyle are present, more noticeable in M^2, although the cingulum is not so extended

[16] Named for Dr. Glenn L. Jepsen.
[17] Named for the Manti National Forest.

at the anteroexternal portion of the molars. M^3 is relatively smaller than in *L. disjunctus* and the metacone, though distinct, is not so well developed, and the cingulum is less prominent and is discontinuous around the lingual and buccal surfaces of the tooth.

An M^2 with material numbered 15544 shows more acute anteroexternal and posteroexternal styles, no mesostyle, a lower protocone than in *L. disjunctus*, protoconule and metaconule relatively weak as in *L. disjunctus*, but the hypocone is much more lingual in position and is nearly matched by a protostyle on the anterolingual portion of the tooth, with the cingulum almost but not quite continuous around the inner margin of the protocone. M^1 in this material, though lacking a mesostyle, corresponds closely to that in the type of *Jepsenia mantiensis*. It is possible that the two molars, which were found close together, belong to the same individual and may represent a type distinct from the foregoing.

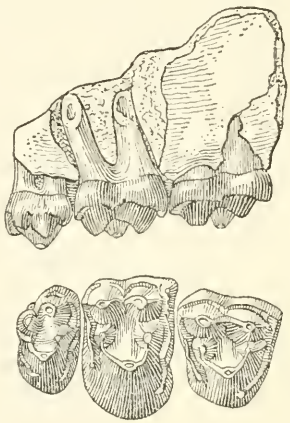


FIGURE 18.—*Jepsenia mantiensis* Gazin: Right maxillary portion with M^1-M^3 (U.S.N.M. No. 15747), type specimen, lateral and occlusal views, ×3, Dragon Paleocene, Utah.

Several isolated jaw fragments with single molars, one with M_2 and part of M_1, and several with portions or all of M_2 and M_3, are presumed to represent *Jepsenia mantiensis*. The lower teeth in general show a distinct paraconid in a lingual position and a basined talonid with a strong hypoconid, a moderate entoconid, and a weak hypoconulid which is the dorsal termination of a slight posterior cingulum rising from the posteroexternal portion of the tooth. The trigonid portion is not greatly different from that in *L. disjunctus*, but with less acute cusps. The entoconid on the heel of M_1 and of M_2 is less developed, and the small cuspule anterior to the entoconid is less evident than in *Litaletes*. M_3 is about the size of that in *Ellipsodon? sternbergi* but is narrower and shows a distinct paraconid, not, however, so distinct as in *E. shepherdi*. M_2 in *E.? sternbergi* is distinctly wider than in the material referred to *Jepsenia mantiensis* but the talonid basin is relatively smaller.

TABLE 4.—*Measurements (in millimeters) of upper teeth of* Jepsenia mantiensis

Measurement	M^1	M^2	M^3
Anteroposterior diameter	4.5	4.4	3
Transverse diameter	5.4	6.4	[1] 4.6

[1] Greatest transverse diameter.

DESMATOCLAENUS,[18] new genus

Perhaps one of the most interesting discoveries made by the 1939 expedition is the finding in both the Dragon and Wagonroad levels of a new *Tetraclaenodon*-like form which nearly bridges the gap between *Tetraclaenodon* and forms of *Protogonodon*. *Desmatoclaenus* is so nearly intermediate that its assignment to the condylarths rather than to the creodonts is entirely arbitrary.

Type.—*Desmatoclaenus hermaeus*, new species.

Generic characters.—P^3 with prominent deuterocone and no indication of tritocone. P^4 intermediate between *Protogonodon* and *Tetraclaenodon*. Anteroexternal portion of M^2 projects outward more than in *Protogonodon*. External cingulum discontinuous across paracone in M^1 and M^2, and there is no mesostyle between the outer cusps of these teeth. Hypocone, protoconule, and metaconule less developed than in *Tetraclaenodon*. Hypocone not so lingual in position as in *Protogonodon*. M^3 relatively small with prominent cingulum about protocone and without evidence of a hypocone. P_4 nearly as in *Tertaclaenodon* but relatively small. Lower molars with lingually placed paraconid much better defined than in *Tetraclaenodon*, and talonid basin not so broad as in *Protogonodon*. M_3 with cuspidate entoconid-hypoconulid crest.

DESMATOCLAENUS HERMAEUS [19] new species

Type.—Greater portion of upper and lower dentition, U.S.N.M. No. 16202.

Horizon and locality.—Wagonroad Paleocene. Dragon Canyon, Emery County, Utah.

Specific characters.—Size near *Protogonodon protogonioides*, slightly smaller than *Tetraclaenodon puercensis*.

Description.—The specimen comprising the best material is an assortment of 14 more or less complete upper and lower teeth, clearly from one individual, No. 16202 (fig. 19), found in the Wagonroad horizon. The inclusion in the material of upper and lower premolars was extremely fortunate in that the approach to *Tetraclaenodon* is more distinctly shown.

P^3, though incomplete anteriorly, is much like that in *Tetraclaenodon*, with the principal cusp somewhat flattened transversely and exhibiting a sloping posterior crest but with no indication of a tritocone—the principal cusp is higher and more conical in *Protogonodon*. The deuterocone, a distinct cuspule almost as well developed as in *Tertaclaenodon*, is placed somewhat farther forward than in this form, about in the position occupied by a suggestion of a

[18] δέσμα, a chain or link + *claenus*.

[19] ἕρμαιον, a lucky find.

deuterocone in P^3 of *Protogonodon*. The posterointernal cingulum is better developed than in *Protogonodon*, but not so shelflike as in *Tetraclaenodon*.

P^4 is somewhat more worn but shows the principal cusp to be slightly less conical than in *Protogonodon* with a more distinct posterior crest. The presence or absence of a tritocone cannot be determined because of wear, but if present it was not developed to the extent seen in *Tetraclaenodon*. The deuterocone portion is restricted anteroposteriorly more than in *Tetraclaenodon*, approaching *Protogonodon*, but a cingulum not seen in *Protogonodon* is developed along the anterior and posterior walls of this cusp, separate from the shelf or crest joining the deuterocone to the outer extremities of the tooth. The cingulum and shelf are not developed to the extent seen in *Tetraclaenodon*, nor is there certain evidence of a protoconule or metaconule on the crest; however, wear may have obliterated an incipient development of these. The parastyle, as in *Tetraclaenodon*, is directed more externally than in *Protogonodon*.

FIGURE 19.—*Desmatoclaenus hermaeus*, new genus and species: Left upper dentition, including P^3, P^4, M^2, M^3, and right lower dentition, including P_3–M_1, M_2, and part of M_2 U.S.N.M. No. 16202), type specimen, occlusal views, × 2, Wagonroad Paleocene, Utah.

M^1 is not preserved in the material of this individual but is included in a maxilla of another and larger specimen, which presumably represents a distinct species and is described elsewhere.

M^2 is rather well worn but was evidently low cusped and had a weak hypocone as compared with this tooth in *Protogonodon* and in contrast to the marked development of the cusp in *Tetraclaenodon*. However, this cusp is located directly posterior to the protocone as in *Tetraclaenodon*, occupying a position in the flexure between the protocone and metaconule, and not so lingual in position as noted in *Protogonodon*. The protoconule and metaconule appear to be less developed relative to the primary cusps than in *Tetraclaenodon*, in which the six principal cusps approach equality. In *Protogonodon* the protocone is more prominent and somewhat over-

shadows the protoconule and metaconule. The anterior portion of the tooth is relatively wide and projects outward somewhat as in *Tetraclaenodon* and shows a prominent parastyle. The external cingulum is much weaker than in *Protogonodon* and is peculiar in being discontinuous across the postero-external portion of the paracone; however, there is no mesostyle such as observed in *Tetraclaenodon* and the cingulum is perhaps a little better developed postero-external to the metacone than in *Tetraclaenodon.*

M^3 is relatively small as in *Tetraclaenodon*, more reduced than in *Protogonodon*, but the cingulum is continuous around the inner wall of the protocone as in the latter and there appears to be little or no evidence of a distinct hypocone.

The lower teeth of the type are from both rami and between them include a representation of the series from P_3 to M_3. Although rather well worn, many characters can be ascertained showing, as with the upper dentition, the structural position that this form holds between *Protogonodon* and *Tetraclaenodon.*

P_3, though incomplete posteriorly, is seen to be small and narrow, comparable in this respect to *Protogonodon*, but with a more gently sloping posterior crest.

P_4, though slender and relatively small, shows a marked resemblance to *Tetraclaenodon.* The parastylid is high, prominent, and deflected inward from the anterior crest of the protoconid about as in *Tetraclaenodon.* The tooth is well worn, but from the outline of the occluding surface there is little doubt that a pronounced metaconid was present. The heel structure is nearly as in *Tetraclaenodon* but with less anteroposterior extent and a less distinct entoconid.

M_1 is too worn to show any important characters but as in the succeeding tooth shows the talonid to be less widely basined than in *Protogonodon.*

In M_2 the trigonid portion exhibits a more prominent paraconid than in *Tetraclaenodon*, which is perhaps not so close to the metaconid, but as in the latter it is distinctly lingual in position and is joined by an arcuate crest to the anterior slope of the protoconid, forming a somewhat more distinct but anteroposteriorly restricted trigonid basin than in *Protogonodon pentacus.*

M_3 is relatively small as in *Tetraclaenodon* but with a much better developed paraconid. The trigonid is anteroposteriorly shortened and the paraconid more lingual in position than in *Protogonodon.* The talonid basin is relatively simple, with the entoconid and hypoconulid not actually distinct but forming a slightly cuspate crest.

Remarks.—The intermediate position of *Desmatoclaenus* between *Protogonodon* and *Tetraclaenodon* suggests that *Tetraclaenodon* may

have arisen from *Protogonodon* through *Desmatoclaenus*. This may well be the case but the larger known forms such as *P. pentacus* or even *P. stenognathus* are probably not in the line. It is conceivable that a small form such as *P. protogonioides*, whose teeth are closer to *Desmatoclaenus* than are those of *P. pentacus* (especially P^3), may have given rise to *Desmatoclaenus*, assuming a somewhat earlier stage for the Puerco of the San Juan Basin.

TABLE 5.—*Measurements (in millimeters) of upper and lower teeth of* Desmatoclaenus hermaeus *(U. S. N. M. No. 16202)*

Measurement	P^4	M^2	M^3	P_3	P_4	M_1	M_2	M_3
Anteroposterior diameter	------	7.6	5.8	------	7.1	7.8	------	8.5
Transverse diameter	7.8	11.0	[1]8.2	4.1	4.8	6.5	7.7	5.8

[1] Greatest transverse diameter.

DESMATOCLAENUS PARACREODUS,[20] new species

Type.—Right maxillary portion, U.S.N.M. No. 16201, with M^1–M^3.

Horizon and locality.—Wagonroad Paleocene, Dragon Canyon, Emery County, Utah.

Specific characters.—Larger than *Desmatoclaenus hermaeus*. Lingual portion of upper molars more inflated. M^3 relatively larger. Hypocone better developed.

Description.—A second and somewhat larger species is indicated by material apparently from both the Wagonroad and Dragon horizons. The specimen selected as the type, No. 16201 (fig. 20, *a*), was obtained from the Wagonroad level and includes M^1 to M^3. The teeth are much like those in *Desmatoclaenus hermaeus* in most characters of the molars, but the lingual portions of these teeth have a more inflated appearance and M^3 is relatively larger. Although slightly damaged at the posterointernal angle, M^3 shows better evidence for a hypocone than in *D. hermaeus*. The upper molars make an approach toward the conditions seen in *Protogonodon stenognathus*, but the differences, as in *D. hermaeus*, are in the direction of *Tetraclaenodon*.

A maxillary portion, No. 16177 (fig. 20, *b*), with M^2 and M^3 from the Dragon horizon corresponds closely to the type of *D. paracreodus*, but the teeth being less worn show characters not seen in the type. The external cingulum is weaker than in *Protogonodon*, and, as in the types of *D. hermaeus* and *D. paracreodus*, the cingulum is interrupted along the posteroexternal portion of the paracone in M^2, and the anteroexternal portion of both teeth projects outward promi-

[20] παρα, near + κρέας, flesh + ὀδούς, tooth, in allusion to its resemblance to the carnivore *Protogonodon*.

nently. This portion of M^2 is slightly damaged, but the anterior cingulum becomes well developed laterally, suggesting a conspicuous parastyle as in *Tetraclaenodon*. The cusps are all low and conical in M^2 and the lingual portion, as in the type, is somewhat inflated anteroposteriorly, with no cingulum around the inner portion. The hypocone is weak and situated posterior to the protocone. In the early stage of wear represented by this specimen the protocone is seen to be divided, with a slight cuspule immediately adjacent and posterior to the principal cusp. This may have been the case in M^2 of the type of *D. hermaeus*, as indicated by the outline of the worn surface of occlusion.

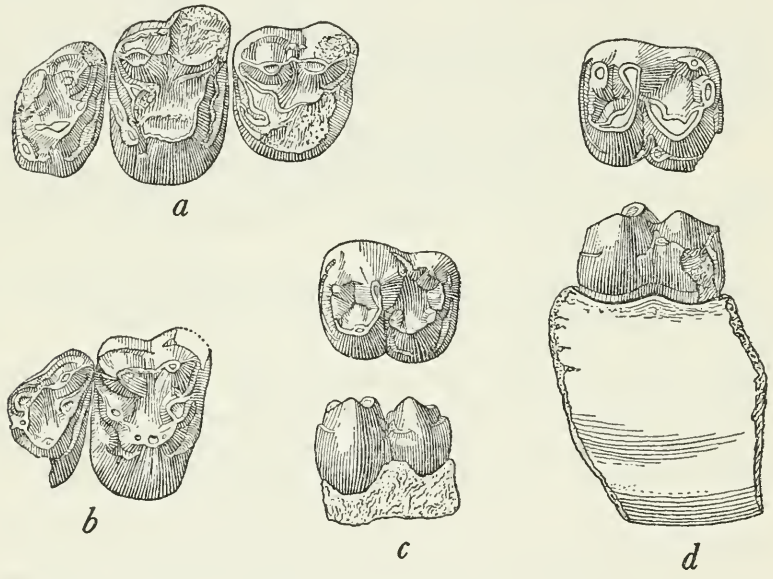


FIGURE 20.—*Desmatoclaenus paracreodus*, new species: *a*, M^1–M^3 (U.S.N.M. No. 16201) type specimen, occlusal view; *b*, M^2–M^3 (U.S.N.M. No. 16177), occlusal view; *c*, lower molar (U.S.N.M. No. 16196), lateral and occlusal views; *d*, lower molar (U.S.N.M. No. 16194), lateral and occlusal views. ×2. *a*, *c*, *d*, Wagonroad Paleocene, Utah; *b*, Dragon Paleocene, Utah.

M^3 of the Dragon specimen is somewhat distorted, but the cingulum is better developed than in M^2. The outer cusps are perhaps more compressed anteroposteriorly and the protocone seems relatively prominent. On both molars the enamel is relatively smooth, except for a noticeable rugosity around the lingual wall of the protocone near its peak.

Several isolated lower molars, including No. 16194 (fig. 20, *d*) and No. 16196 (fig. 20, *c*), from the Wagonroad level are referred to this species, being comparable to those of *D. hermaeus* in structure

but are appreciably larger, even than in *Tetraclaenodon*, being about the size of those in *Protogonodon stenognathus*. The trigonids of these teeth show the paraconids to be entirely lingual in position, as in *Tetraclaenodon*, but better developed and perhaps not so close to the metaconid. The paraconid is more lingual and not so far forward as in *Protogonodon* material, and the crest from the paraconid to the anterior wall of the protoconid is higher, closing the trigonid basin anteriorly. Moreover, the talonid portion of the lower molars is relatively narrower than in *Protogonodon pentacus* with the basin restricted transversely, being more nearly comparable to the form of the talonid in the first two lower molars of *Tetraclaenodon*. A relatively narrow talonid was noted in the lower molars of the large *Protogonodon kimbetovius*.

A jaw portion with M_2, No. 16218, and an isolated portion of a lower molar in the collections from the Dragon level are considered to belong to *D. paracreodus*. These closely resemble the lower teeth from the Wagonroad level referred to *D. paracreodus*.

TABLE 6.—*Measurements (in millimeters) of upper teeth of* Desmatoclaenus paracreodus *(U. S. N. M. No. 16201)*

Measurement	M^1	M^2	M^3
Anteroposterior diameter	8.4	8.1	6.2
Transverse diameter	10.5	12	[1] 9.9

[1] Greatest transverse diameter.

Genus ECTOCONUS Cope

ECTOCONUS SYMBOLUS,[21] new species

Type.—Right maxillary portion, U.S.N.M. No. 16189, with M^1, M^2, and part of P^4.

Horizon and locality.—Wagonroad Paleocene, Dragon Canyon, Emery County, Utah.

Specific characters.—Molars smaller than in *Ectoconus ditrigonus*. Premolars relatively larger. No "protoconule" on P^4. Protostyle on upper molars weak. Parastyle on M^2 weak. Parastylid absent or weakly developed on lower molars.

Description.—Several specimens from the Wagonroad horizon, including maxillae and jaws with two teeth each, are found to represent a new species of *Ectoconus*. The molar teeth are seen to be distinctly smaller than in *E. ditrigonus*, hence much smaller than in *E. majusculus*. The premolars, however, are relatively larger and the anterior lower premolars, as indicated in referred specimens, are actually larger than in *E. ditrigonus*.

[21] σύμβολον, clue, in allusion to its importance in determining the age of the Wagonroad horizon.

The upper molars, No. 16189 (fig. 21, *b*), of which only M^1 and M^2 are known, closely resemble those in *E. ditrigonus* in structural details, but with perhaps a somewhat weaker protostyle. The posteroexternal portion of M^1 shows the cuspate condition characterizing upper molars in *Ectoconus*. The mesostyle, metastyle, and the large cusp external to the metacone are developed to about the same extent as in *E. ditrigonus;* however, the parastyle on M^2 appears weaker than in *E. ditrigonus*. P^4, No. 16188 (fig. 21, *c*), is of about the same width, or perhaps slightly wider transversely than M^1, and differs from that

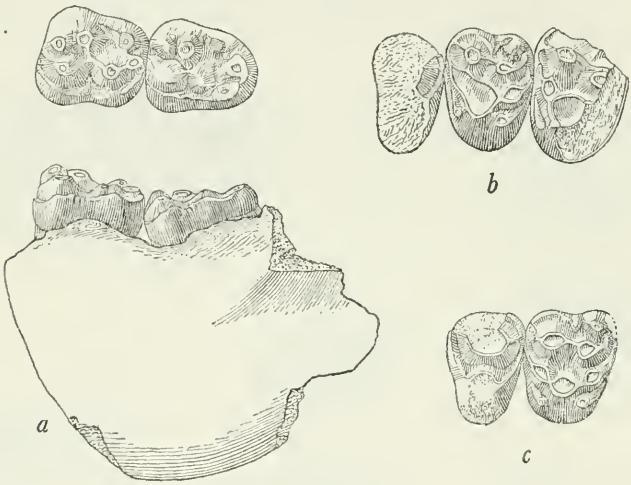


FIGURE 21.—*Ectoconus symbolus*, new species: *a*, Portion of left ramus of mandible with M_2–M_3 (U.S.N.M. No. 16190), lateral and occlusal views; *b*, M^1 and portions of P^4 and M^2 (U.S.N.M. No. 16189), type specimen, occlusal view; *c*, P^4–M^1 (U.S.N.M. No. 16188), occlusal view. × 1½. Wagonroad Paleocene, Utah.

in *E. ditrigonus* in the absence of an accessory cusp anteroexternal to the deuterocone, in about the position occupied by the protoconule in the molars.

The lower jaw material consists of three specimens which together give a representation of the dentition from P_2 to M_3, except for M_1. The premolars are relatively large, particularly P_2, No. 16213, but become relatively narrower posteriorly than in *E. ditrigonus*. The molars, No. 16190 (fig. 21, *a*), are smaller and relatively narrower than in *E. ditrigonus*, and there is but the slightest suggestion of a second paraconid or parastylid; however, the presence of this cuspule is not invariable in *E. ditrigonus*. M_2 and M_3 in *Ectoconus symbolus* are otherwise similar to those in *E. ditrigonus* in having low blunt cusps and a heavy external cingulum.

TABLE 7.—*Measurements (in millimeters) of upper and lower teeth of* Ectoconus symbolus

Measurement	U.S.N.M. No.—					
	16188		16189 (type)		16190	
	P^4	M^1	M^1	M^2	M_2	M_3
Anteroposterior diameter	6.8	8.4	8.1	[1] 8.7	9.6	10.6
Transverse diameter	[1] 10	10.0	10.5	[1] 12.5	8.8	8.2

[1] Approximate.

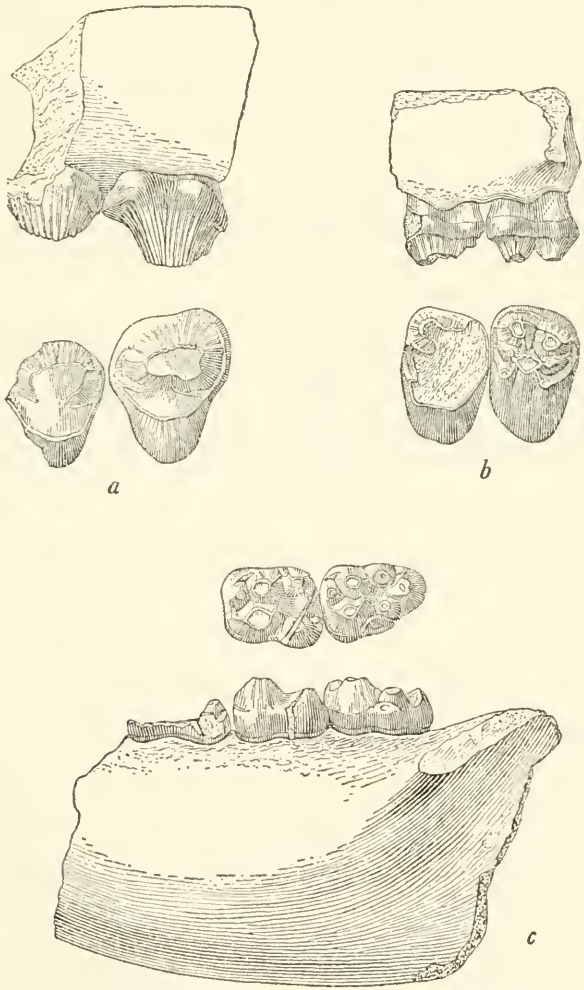


FIGURE 22—*Carsioptychus hamaxitus*, new species: *a*, Maxillary portion with two premolars (U.S.N.M. No. 16198), lateral and occlusal views; *b*, left maxillary portion with M^1 and M^2 (U.S.N.M. No. 16197), type specimen, lateral and occlusal views; *c*, portion of left ramus of mandible with M_2 and M_3 (U.S.N.M. No. 16195), lateral and occlusal views $\times 1\frac{1}{2}$. Wagonroad Paleocene, Utah.

Genus CARSIOPTYCHUS Simpson

CARSIOPTYCHUS HAMAXITUS,[22] new species

Type.—Left maxillary portion, U.S.N.M. No. 16197, with M^1 and M^2.

Horizon and locality.—Wagonroad Paleocene, Dragon Canyon, Emery County, Utah.

Specific characters.—Teeth smaller than in *Carsioptychus coarctatus*. Premolars slightly smaller with respect to molars than in *C. coarctatus* and upper teeth relatively a little narrower transversely than in the Puerco form. Lower premolars with slightly better developed anterior stylid.

Description.—Several specimens, including upper and lower teeth, from the Wagonroad level represent a small species of *Carsioptychus*. Though the teeth are small as compared to those in *Carsioptychus coarctatus*, the form is slightly more progressive toward *Periptychus* than is the Puerco species, but not so advanced as *Periptychus gilmorei* from the Dragon. The premolars are relatively smaller than in *C. coarctatus* and the upper molars, No. 16197 (fig. 22, *b*), and premolars, No. 16198 (fig. 22, *a*), are relatively narrower transversely. Moreover, the lower premolars show a slightly more advanced stage in the development of an anterior stylid. The lower molars (fig. 22, *c*) appear to be developed much as in *C. coarctatus*, and as in that species show no evidence of the seventh cuspule, near the center of the tooth, characterizing *Periptychus carinidens*, but seen only on M_3 of *P. gilmorei*.

TABLE 8.—*Measurements (in millimeters) of upper and lower teeth of* Carsioptychus hamaxitus

Measurement	U.S.N.M. No.—					
	16198		16197 (type)		16195	
	P^3?	P^4?	M^1	M^2	M_1	M_3
Anterior diameter	------	10.8	[1] 7.8	8.2	8.0	9.5
Transverse diameter [2]	11.8	13.5	11.4	11.8	[1] 7.8	7.2

[1] Approximate.

[2] The transverse diameter of the upper teeth is taken from the external cingulum to the base of the ename lingually and at right angles to the direction of the tooth row.

[22] αμαξιτος, carriage road or wagon road, from the name of the horizon in which it was found and the name of the ridge, at the lower end of which the locality occurs.

Genus PERIPTYCHUS Cope

PERIPTYCHUS GILMOREI[23] Gazin

Periptychus gilmorei Gazin, 1938, p. 275.

The large periptychid, *P. gilmorei*, in the Dragon fauna is rather well represented in the collection, the best specimen being the type, No. 15537, and including portions of right and left maxillae with 14 teeth in all (fig. 23). Specimen No. 16228, obtained in 1939, includes portions of both maxillae with P^4–M^3 and a portion of the left ramus of the mandible with P_4–M_3, the lower teeth being partially embedded in barite. The lower dentition is best represented in specimen No. 15689 (fig. 24), which includes portions of right and left rami, exhibiting M_2–M_3 and P_4–M_2, respectively.

FIGURE 23.—*Periptychus gilmorei* Gazin: Right upper dentition including P^2–M^3 (U.S.N.M. No. 15537), type specimen, lateral and occlusal views, × 1½, Dragon Paleocene, Utah.

Periptychus gilmorei is intermediate between *Carsioptychus coarctatus* from the Puerco and *Periptychus carinidens* from the Torrejon in almost all characters of the upper dentition. The teeth are relatively wide transversely as compared with their length, and the premolars are only slightly larger than the molars. The premolars show the inner crescent developed almost as much as in *Periptychus carinidens*, but the deuterocone portion is more constricted anteroposteriorly, although not so much as in *Carsioptychus coarctatus*. Moreover, P^2 is much more like that in *Periptychus* than the simple condition observed in several specimens of *Carsioptychus*.

The molar teeth show a distinct resemblance to those in *Carsioptychus*, and in addition to their being relatively wide transversely they show a more distinct external cingulum than in *Periptychus*.

[23] Named for C. W. Gilmore, whose party discovered the first Dragon Canyon locality.

The hypocone and protostyle have a somewhat more lingual position, and the lingual walls of the molars (and premolars as well) appear to be more gently sloping than in *Periptychus*. The cusps and cuspules are somewhat less widely spaced than in *P. carinidens*, particularly the protoconule and metaconule, which are located very close to the protocone.

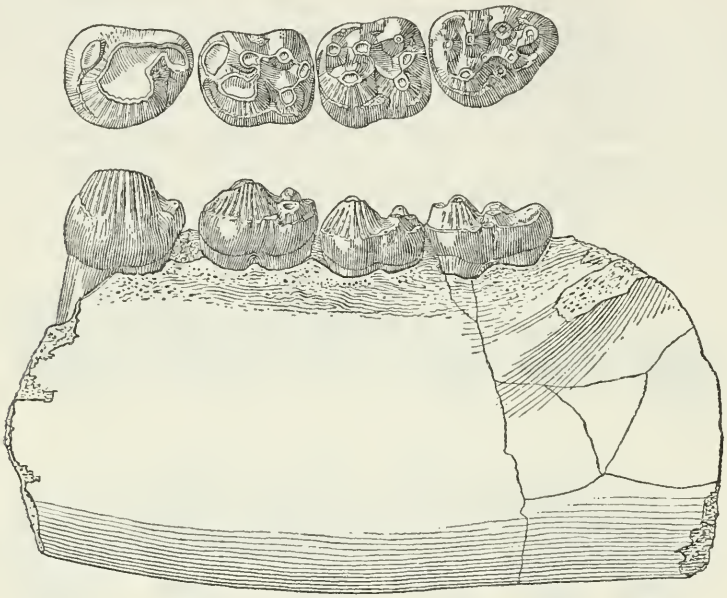


FIGURE 24.—*Periptychus gilmorei* Gazin: Left ramus of mandible, P_4–M_3 (U.S.N.M. No. 15689) (M_3 and posterior portion of jaw fragment restored from right ramus), lateral and occlusal views, × 1½, Dragon Paleocene, Utah.

An additional feature seen in the type of *Periptychus gilmorei*, but probably of no importance, as it was not observed in No. 16226, is the very slight development of a "protostyle" and "hypocone" on P^4. This was not observed in any of the Puerco or Torrejon material. Also, the third molar, on the right side only, is peculiar in that the lingual wall exhibits a cuspule median to the protocone, between the protostyle and hypocone.

The lower teeth of *Periptychus gilmorei*, as represented by specimen No. 15689, are also nearly intermediate in most respects between *Carsioptychus coarctatus* and *Periptychus carinidens*. The protoconid of P_4 is not directed posteriorly so markedly as in *C. coarctatus*, and a small anterointernal cusp is present, this being prominent in *P. carinidens* but usually absent in *C. coarctatus*. On the posterointernal portion of the tooth there is a small cusp; the talonid, however, is not developed so much as in *P. carinidens*. The extent to which a meta-

conid has become distinct from the protoconid cannot be exactly determined, owing to wear, but it is clearly not separated to the extent seen in *P. carinidens*.

The lower molars are wider than in the *Carsioptychus* material at hand but not so wide as is common in Torrejon material of *Periptychus*. These teeth show a slight cingulum around the external side, which was not observed in material of the other forms. The small seventh cusp located about in the center of the crown of the lower molars of *Periptychus carinidens* is not present in the first two molars of *P. gilmorei* but is weakly developed in M_3. This cusp is not known in *Carsioptychus*.

TABLE 9.—*Measurements (in millimeters) of upper teeth (U.S.N.M. No. 15537, type) and lower teeth (U.S.N.M. No. 15689) of* Periptychus gilmorei

Measurement	P^2	P^3	P^4	M^1	M^2	M^3	P_4	M_1	M_2	M_3
Anteroposterior diameter	11.6	11.7	10.5	9.2	9.5	8.8	11	10.3	10	11.5
Transverse diameter [1]	12.7	14.6	14.0	14.2	14.1	11.1	9.6	8.7	9.7	9

[1] The transverse diameter of the upper teeth is taken from the external cingulum to the base of the enamel lingually and at right angles to the direction of tooth row.

Genus ANISONCHUS Cope

ANISONCHUS DRACUS [24] Gazin

Anisonchus dracus GAZIN, 1939b, p. 278.

The larger of the two species of *Anisonchus* is represented in the Dragon collection by three maxillary portions with one to four teeth apiece and five lower jaw fragments with one or two molars each. The type, No. 15745, is a maxillary fragment with P^4 to M^3 preserved (fig. 25).

The upper teeth in No. 15745 are clearly of an *Anisonchus* type and are intermediate in observed characters between *A. gillianus* and *A. sectorius* of the Puerco and Torrejon, respectively; comparable in this respect to *Periptychus gilmorei* in its relationship to the two developmental stages occurring in the San Juan Basin, noticeably in the relation of the length to the width of the tooth crowns.

The Dragon form approaches *A. sectorius* in size but retains relatively wider teeth transversely, and longitudinally a little shorter, and the cusp pattern is not so restricted transversely. The upper teeth appear also to have a longer, more gradually sloping lingual wall, with a somewhat more lingually placed hypocone column. The

[24] *δράκων*, dragon, from Dragon Canyon.

lingual portion of P^4 seems more constricted anteroposteriorly and apparently has a less conspicuously developed lingual crescent.

A. gillianus has teeth relatively wide transversely, the length of the tooth row shorter, and the hypocone is placed more lingually with respect to the metacone, and to a certain extent with respect to the protocone, than in *A. sectorius*.

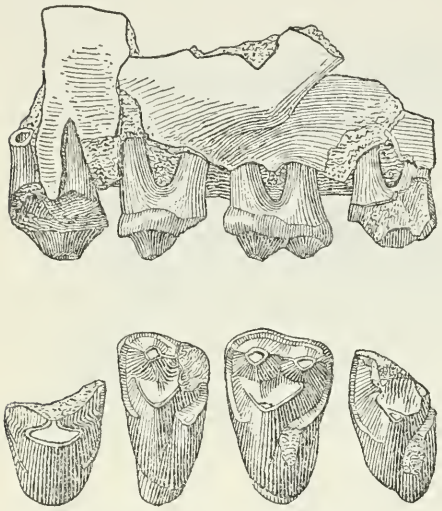


FIGURE 25.—*Anisonchus dracus* Gazin: Left maxillary portion with P^4–M^3 (U.S.N.M. No. 15745), type specimen, lateral and occlusal views, × 3. Dragon Paleocene, Utah.

The lower jaw fragments exhibit teeth comparable in size to those in *A. sectorius* and show no significant differences from them, nor are differences evident in the preserved material which would serve to clearly distinguish the Dragon form from *A. gillianus*. However, the crest connecting the hypoconid to the trigonid appears distinctly lower than that connecting the entoconid to the metaconid. This condition was noted in an M_1 of *A. gillianus* but not in other specimens of either this species or *A. sectorius*. Moreover, the hypoconulid does not project backward in the molars referred to *Anisonchus dracus* quite so far as in M_2 of *A. sectorius*, a condition approximated in M_2 of *A. gillianus*, though possibly of doubtful significance.

TABLE 10.—*Measurements (in millimeters) of upper teeth (U.S.N.M. No. 15745, type) and lower teeth (U.S.N.M. No. 16249) of* Anisonchus dracus

Measurement	P^4	M^1	M^2	M^3	M_1	M_2
Anteroposterior diameter	5?	4.4?	4.8	4?	5.2	5.2
Transverse diameter	----	6.6?	7.8	----	3.6	3.9

ANISONCHUS ONOSTUS[25] Gazin

Anisonchus onostus GAZIN, 1939b, p. 280.

The smaller of the two species of *Anisonchus* in the Dragon fauna is represented by the type, No. 15788 (fig. 26), which is a lower jaw portion with M_1 and M_2, and to the species is tentatively referred an upper premolar and a lower jaw fragment with the teeth P_4, M_1, and part of M_2 much worn.

[25] *Onostus*, despicable, in allusion to its size.

Anisonchus onostus is distinctly smaller than *A. dracus*, being very near the Puerco form, *A. gillianus*, in size but with the cusps on the talonid of both M_1 and M_2 slightly more widely spaced, though having the cut characterizing the anisonchines. This spacing of the cusps gives the teeth a wider appearance, whereas actually they are a trifle narrower than those in several specimens of *A. gillianus* with which comparisons were made. The teeth also appear somewhat lower crowned than those of *A. gillianus* exhibiting about the same wear.

The anteroposterior diameters of the first and second lower molars are 4.3 and 4.1 mm., respectively. The transverse diameters are 2.9 and 3.2 mm.

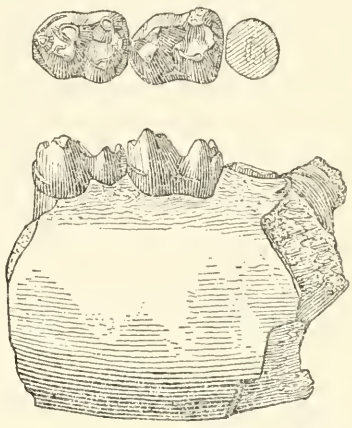


FIGURE 26.—*Anisonchus onostus* Gazin: Portion of left ramus of mandible with M_1–M_2 (U.S.N.M. No. 15788), type specimen, lateral and occlusal views, × 3, Dragon Paleocene, Utah.

ANISONCHUS OLIGISTUS,[26] new species

Type.—Left maxillary portion with M^1 and M^2 associated portion of left ramus of mandible with M_1 and M_2, U.S.N.M. No. 16192.

Horizon and locality.—Wagonroad Paleocene, Dragon Canyon, Emery County, Utah.

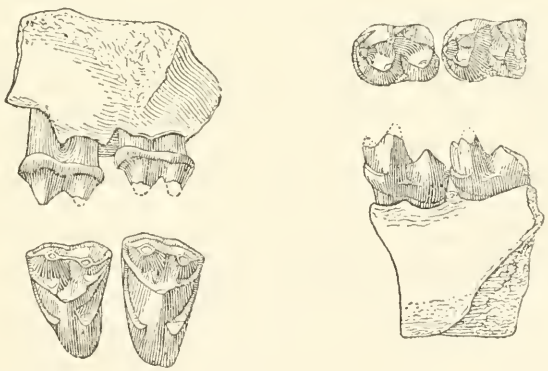


FIGURE 27.—*Anisonchus oligistus*, new species: Left maxillary portion with M^1–M^2; portion of left ramus of mandible with M_1–M_2 (U.S.N.M. No. 16192), type specimen, lateral and occlusal views, × 3, Wagonroad Paleocene, Utah.

Specific characters.—Upper and lower molars smaller than in *Anisonchus gillianus* and relatively narrower transversely. Upper

[26] ὀλίγιστος, least, in allusion to size of teeth.

molars more nearly triangular in occlusal view. Talonid basin of lower molars slightly less constricted anteriorly.

Description.—Anisonchus is represented in the Wagonroad collection by a maxillary portion and a lower jaw fragment found together and both having the first two molars preserved, U.S.N.M. No. 16192 (fig. 27), which has been made the type of *Anisonchus oligistus*. Six other specimens are referred to this species. These include two maxillary fragments, with M^2–M^3 and P^4–M^2 somewhat damaged, two lower jaw fragments each with the greater portions of two molars, and two isolated premolars.

Anisonchus oligistus is apparently the smallest species known of this genus, having both upper and lower molar teeth a little smaller and relatively narrower transversely than in material of *A. gillianus* from the Puerco. The lower teeth are also smaller and more slender than in the type of *Anisonchus onostus* from the Dragon level.

The upper molars appear for the most part very much like those in other species of *Anisonchus*, but are somewhat more nearly triangular in outline, as viewed from below, with the lingual portion a little more constricted anteroposteriorly and the hypocone column distinctly lingual, though not so markedly lingual as in *Haploconus*. The anterior cingulum extends to a markedly lingual point but does not exhibit a distinct protostyle.

The lower molars in addition to their slenderness show relatively high trigonids, and the cusps appear to be more acute than in *A. gillianus*. Moreover, the paraconid may be slightly more external in position. The talonid appears deeply basined in the type, and the crest extending forward from the hypoconid joins the posterior wall of the trigonid at a position which appears to be slightly more external. This is not so obvious in the type, but noticeable in the two referred lower jaws. As a result the talonid basin in the referred specimens appears somewhat less constricted anteriorly.

TABLE 11.—*Measurements (in millimeters) of upper and lower teeth of* Anisonchus oligistus *(U.S.N.M. No. 16192)*

Measurement	M^1	M^2	M_1	M_2
Anteroposterior diameter	3.9	3.7	3.8	
Transverse diameter	5.1	6.0	2.8	2.9

[1] The transverse diameter of the upper teeth is taken from the external cingulum to the base of the enamel lingually and at right angles to the direction of the tooth row.

Genus HAPLOCONUS Cope

HAPLOCONUS INOPINATUS[27] Gazin

Haploconus inopinatus GAZIN, 1939b, p. 280.

A second genus of anisonchine periptychids is represented in the Dragon fauna by several fragmentary specimens, including a maxillary portion with M^1 and most of M^2, No. 15760, which has been made the type of *Haploconus inopinatus* (fig. 28). The form apparently represents *Haploconus* as indicated by the prominent lingual position of the hypocone. It is close in size to the Torrejon material referred to *Haploconus angustus* but with the teeth relatively wider transversely and with M^2 much wider than M^1. A difference in width between M^1 and M^2 was noted in certain specimens of *Haploconus* referred to *H. angustus*, but apparently the difference is not so marked as in *H. inopinatus*.

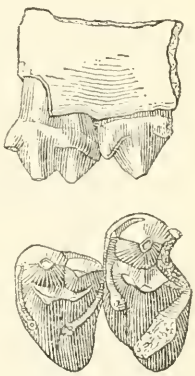


FIGURE 28.—*Haploconus inopinatus* Gazin: Left maxillary portion with M^1 and the greater part of M^2 (U.S.N.M. No. 15760), type specimen, lateral and occlusal views, × 3, Dragon Paleocene, Utah.

The two upper molars in the type show a slight development of a metaconule, but most noticeable is the distinct protostyle that characterizes teeth in *Haploconus corniculatus*. *H. inopinatus* is much smaller than the type of *H. corniculatus*, and in the latter the upper molars appear to be relatively as well as actually much longer anteroposteriorly than in the Dragon form.

The anteroposterior diameter of the first upper molar in the type is 4.3 mm. The greatest transverse diameters of the first and second upper molars are 6.1 and 7.1 mm., respectively.

A second maxillary portion, No. 16256, is referred to *H. inopinatus;* however, the two molars it exhibits are not well preserved and add little to our knowledge of this form. An isolated upper premolar, apparently P^4, No. 16254, may well belong to *Haploconus*, closely resembling this tooth in *H. angustus*, but a little smaller and with the lingual portion, though broad, somewhat less inflated anteroposteriorly.

A lower jaw portion, U.S.N.M. No. 15744, with M_1 and M_2 poorly preserved, and partially obscured by ironlike matrix, appears to represent *Haploconus* in the absence of a paraconid and in the bladelike form of the protoconid on M_1. It corresponds closely in size to the type of *Haploconus angustus*, but with M_1 narrower, particularly the anterior portion, and M_2 possibly wider than in the Torrejon form.

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[27] *Inopinatus*, unexpected.

A second lower jaw portion, No. 16255, collected in 1939, has P_4 and the greater portion of $M_1$and M_2 preserved. P_4 is a little shorter than in most specimens of *H. angustus*, though relatively as wide and appears inflated as characteristic of this genus. The two molar portions show no important distinguishing characters. These two teeth have the cingulum rather prominent external to the protoconid, but distinctly weak on P_4. In No. 15744 the cingulum is not evident. However, in *H. angustus* the development of the cingulum appears to be highly variable, and when present is apt to be most noticeable on the anterior portion of the tooth and about the hypocone.

In 1940 several isolated teeth were found near one another at a level about 30 or 40 feet higher than that of the Dragon fauna at the old Dragon Canyon locality. These include P^4, a right and left P_4, portions of two anterior lower molars, and the greater part of M_3. The talonid portions of the various lower molars are to be compared with those of *Haploconus* rather than any other known form. One of the molars, however, has most of the trigonid preserved, and this exhibits a small paraconid. It is also significant that the two lower premolars have a moderately developed paraconid and are anteroposteriorly elongate and slender, approaching the form seen in *Anisonchus*, quite unlike the premolar exhibited in No. 16255 referred to *H. inopinatus*. The form represented by these teeth is clearly distinct from that represented by No. 16255, but I hesitate to describe it as distinct because, first, there is no certainty as to which of the types of lower teeth should be referred to *H. inopinatus*, and secondly, there is no real assurance that the isolated teeth discussed above are from one animal, although it seems probable that they are.

HAPLOCONUS? ELACHISTUS,[28] new species

Type.—Left maxillary portion with M^2 and part of M^1, and lower jaw fragments, U.S.N.M. No. 16191.

Horizon and locality.—Wagonroad Paleocene, Dragon Canyon, Emery County, Utah.

Specific characters.—Size near that of *Conacodon cophater*, smaller than either *Haploconus angustus* or *Haploconus inopinatus*. Teeth relatively a little shorter anteroposteriorly than in *H. inopinatus*. Difference between transverse diameters of M^2 and M^1 relatively not so great. Protostyle weak. Lower molars and P_4 with slight paraconid.

Description.—Representing *Haploconus? elachistus* are several isolated teeth and a few jaw and maxillary portions with one or two teeth. No. 16191, a maxillary portion with M^2 and part of M^1, and

[28] ἐλάχιστος, smallest or least, in allusion to size.

some lower jaw fragments with incomplete teeth and found associated, is made the type (fig. 29). The teeth are close in size to those of the nearly contemporaneous *Conacodon cophater* but more closely resemble those of species of *Haploconus*. The form is distinctly smaller than either *Haploconus angustus* from the Torrejon or *Haploconus inopinatus* from the Dragon horizon.

M^1 and M^2 resemble these teeth in *H. inopinatus*, but in addition to their smaller size do not show so marked a difference between their transverse diameters as in *H. inopinatus*; moreover, the upper molars are relatively a little shorter anteroposteriorly. The protocone is distinctly lingual in position, approaching, but not reaching, the condition seen in *Conacodon cophater*. There is a slight protostyle at the lingual termination of the anterior cingulum, not so well developed as in *H. inopinatus*, nor does the anterior cingulum extend so far lingually as in *C. cophater*. In the latter form the anterior cingulum quite joins the protocone lingually in M^2 and M^3. *H.? elachistus* also differs noticeably from *C. cophater* in the weakness of the external cingulum. As in later forms of *Haploconus*, the external cingulum in *H.? elachistus* does not extend across the paracone.

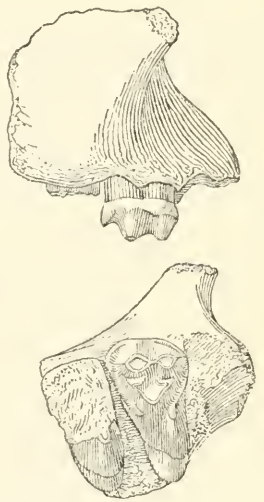

FIGURE 29.—*Haploconus? elachistus*, new species: Portion of left maxilla with M^2 and part of M^1 (U.S.N.M. No. 16191), type specimen, lateral and occlusal views, × 3, Wagonroad Paleocene, Utah.

The anteroposterior diameter of M^2 in the type is 3.6 mm. The transverse diameter from the external cingulum to the base of the enamel lingually and at right angles to the direction of the tooth row is about 6.1 mm.

The lower teeth are much like those in *Haploconus angustus*, except for their smaller proportions. However, the various lower molars referred to *H.? elachistus* exhibit a slight, medianly placed paraconid. This is also true of P_4 in No. 16548, although P_3 in the same specimen, though not entire, shows no evidence of a paraconid. It is interesting to note that slight paraconids were observed on the lower molars of a Torrejon specimen, U.S.N.M. No. 5886, referred to *Haploconus corniculatus*, as well as on one of the Dragon specimens. The paraconids of the lower molars of *H.? elachistus*, however, are not developed as seen in M^1 of *Conacodon cophater*, nor is the talonid portion so compressed anteroposteriorly, and the entoconid, though very well defined, is not placed so far lingually.

The presence of a form apparently representing *Haploconus* in beds nearly as old as Puerco is interesting in extending downward the known range of *Haploconus* and tending to a rather limited extent to break down certain of the characters separating *Haploconus* and *Conacodon*. *Conacodon* possesses specialized dental structures which apparently did not give rise to those seen in *Haploconus*, but this earlier form of *Haploconus*, as represented in the Wagonroad fauna, shows a less marked separation from the Puerco *Conacodon* than do the Torrejon species.

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