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PALEOCENE MAMMALIAN FAUNAS OF THE BISON BASIN IN SOUTH-CENTRAL WYOMING

(With 16 Plates)

By

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INTRODUCTION

One of the more interesting developments relative to the investigation of early Tertiary mammals in the Rocky Mountain region during the past several years was the discovery in 1952 by Dr. R. W. Brown, Harold Masursky, and H. R. Christner of the U. S. Geological Survey of the occurrence of Paleocene mammal remains in the Bison basin of Wyoming. The Bison basin is in the Sweetwater drainage to the north of the Red Desert, and its south rim forms part of the Continental Divide, separating inland drainage of the Continental Divide basin from that of the Missouri River system. The gray and buff to reddish silty clays and sandstones of the Paleocene are here exposed at intervals along the escarpment bounding the basin. There are four principal fossil localities—two in the exposures below the south rim of the basin, one in the southwestern part, and one at the western extremity. These have been determined as lying within sections 28 and 29 of T. 27 N., R. 95 W., in Fremont County, but very near the southern boundary.

Slight differences in age would appear to be indicated by the faunas represented at the different localities, but most if not all may be included within the early or lower part of Tiffanian upper Paleocene. Similarities to the Torrejonian fauna of the Montana Fort Union are noted, but these are in part attributed to a possible similarity in rather general environmental conditions. A resemblance is evident in the variety of carnivores and condylarths, modified by certain genera which are regarded as indicative of Tiffanian time.

ACKNOWLEDGMENTS

In addition to the Geological Survey personnel above mentioned as having discovered the occurrence of Paleocene mammals in the Bison basin, acknowledgment is due George N. Pipiringos, James MacLachlan, Dr. J. R. Hough, and Robert DeMar for having given field aid in 1953. Dr. Paul O. McGrew aided in turning over, for the purposes of this study, collections obtained for the University of Wyoming in 1953. Particular mention may be made of interest shown in this work by Dr. Roland W. Brown in having first called my attention to the occurrence, and in his marked contribution to the field collecting in both 1952 and 1953, as well as being an original discoverer.

Acknowledgment is made of aid no less important from Drs. George G. Simpson, Edwin H. Colbert, Bobb Schaeffer, and Mrs. Rachel H. Nichols in permitting me to examine and make comparisons with various Paleocene collections in the American Museum and from Dr. Glenn L. Jepsen in making available type and other materials in the extensive Polecat Bench Paleocene collections at Princeton University.

The drawings depicting the specimens shown in plates 1 to 11 were made by Lawrence B. Isham; those of *Caenolambda pattersoni* in plates 12 to 14 by William D. Crockett.

HISTORY OF INVESTIGATION

Following discovery of the fossil materials by the U. S. Geological Survey party in July 1952[1] and their reference to me for study and report, the results of a preliminary examination were presented before the Cambridge meeting of the Society of Vertebrate Paleontology in November. During the later part of 1952 and early in 1953, Wallace G. Bell, a graduate student at the University of Wyoming, engaged in a thesis study of the geology of a rather general area including the Bison basin, and Paul McGrew made collections at certain of the fossiliferous sites. Agreement was early reached whereby the University of Wyoming party would join with the Smithsonian Institution–U. S. Geological Survey expedition in the search of these exposures in the summer of 1953, and that I would be permitted to study and describe the collections as a whole.

In June 1953 a party from Washington consisting of Dr. Roland W. Brown, Franklin Pearce, and myself was accompanied in the field by Messrs. Pipiringos and MacLachlan. We were joined at the fossil

[1] A very cursory examination of these beds was made by the writer in 1951, accompanied by C. L. Jenks, Jr., of the Shell Oil Co., but on the north side of the basin where exposures are evidently quite barren of fossils.

locality by Dr. Hough and Mr. DeMar of the U. S. Geological Survey and by Dr. McGrew and his party of students from the University. The combined efforts of the group were largely concentrated in a search of the vicinity of the small saddle or discovery locality below the south rim of the basin, and a site found by Mr. Bell in the southwestern part of the basin. Later, a third fossiliferous site was encountered by Dr. Brown, Mr. Pearce, and myself at the western extremity of the basin, and Pearce located a fourth along a ledge on the south escarpment between the saddle and Bell's *Titanoides* locality.

All sites were revisited by Pearce and me with continued success in 1954 but with diminishing returns, as it appears that the original richness of the sites was due largely to a residual concentration of materials, and the interval between successive field seasons is evidently too short for erosion to afford profitable collecting. Moreover, there seemed to be no one place where the concentration of bone might be regarded as great enough to warrant quarrying operations.

OCCURRENCE AND PRESERVATION OF MATERIAL

The four principal fossil occurrences (see pls. 15 and 16) are referred to in the following discussion as the saddle or discovery locality, the ledge locality, Bell's or the *Titanoides* locality, and the west-end locality. The small badland saddle where Brown and others of the Geological Survey first encountered bone is located about midway north and south in the eastern half of sec. 28, T. 27 N., R. 95 W., according to information from Bell's mapping furnished me by McGrew. The richest concentration of the smaller forms was in the saddle, determined by means of a hand level to be about 58 feet below the rim or top of the escarpment immediately to the south. The beds here have a dip of approximately 9° southward. Fossils were found scattered for about a couple of hundred feet in either direction from the saddle and stratigraphically near the same level, although a couple of specimens of *Plesiadapis jepseni* in the University of Wyoming collections came from possibly 50 feet higher. The material rather generally consists of incomplete jaws and maxillae and a good number of isolated teeth. A single skull, that of the new pantodont *Caenolambda pattersoni,* was encountered in a nodule a little distance away but at about the stratigraphic level of the saddle.

Approximately a quarter of a mile or more to the west, apparently in the western half of section 28, a northwest-facing exposure exhibits a prominent ledge about 25 or 30 feet below the rim. A fair concentration of jaw and maxillary portions and isolated teeth was found for a hundred feet or less along the ledge and in the soft clay for a few feet immediately above. The ledge locality would seem almost certainly to be stratigraphically much higher than the saddle. The locality is nearer the rim, hence topographically higher, and the dip of the beds may be a little more southwesterly than at the saddle so that the ledge would appear to be stratigraphically higher than any portion of the escarpment above the saddle. A considerable extent, however, of the exposures between the two localities is obscured by talus and vegetation, and so the relationship could not be determined precisely.

The locality that I am informed Mr. Bell discovered, and from which the University of Wyoming secured upper teeth of *Titanoides primaevus,* is still farther west, about midway north and south in the eastern half of adjacent section 29. The general locality is in the southwestern part of the basin and just west of the most westerly of the wagon trails crossing the south rim of the basin. Fossils, though comparatively few, were found ranging from very near the top of the escarpment to 30 or 40 feet stratigraphically lower. The beds here appear to have a greater southerly dip than at the saddle or ledge localities, and the stratigraphic position relative to the more easterly localities is not readily evident from field relations, as much of the escarpment between this locality and the ledge is obscured. The faunas discussed in the following part of this paper would suggest that it is still higher.

The most westerly locality is an east-facing gravel-capped exposure at the west end of the basin, evidently about midway east and west across section 29, close to the northern line. Fossils were discovered here in a very restricted zone around a low hill set out from near the base of the exposure and at about its most southeasterly extent. Jaws and isolated teeth were encountered over an area of only a few hundred square feet on the slopes extending out from the base of this hill. The west-end exposure is well isolated by grass and sagebrush slopes from the *Titanoides* locality to the south, but there seems no doubt from the dip at the latter locality that the west-end site must be considerably lower stratigraphically, unless the intervening rock is complicated by changes in dip or faulting. The relative position of the horizon represented with respect to that at the ledge or saddle is uncertain, but there is some evidence from the fossils that it may not be far removed in time from that represented at the ledge.

THE BISON BASIN FAUNAS

The following tabulation pertains to the four principal localities in the Bison basin from which collections were obtained. The figures

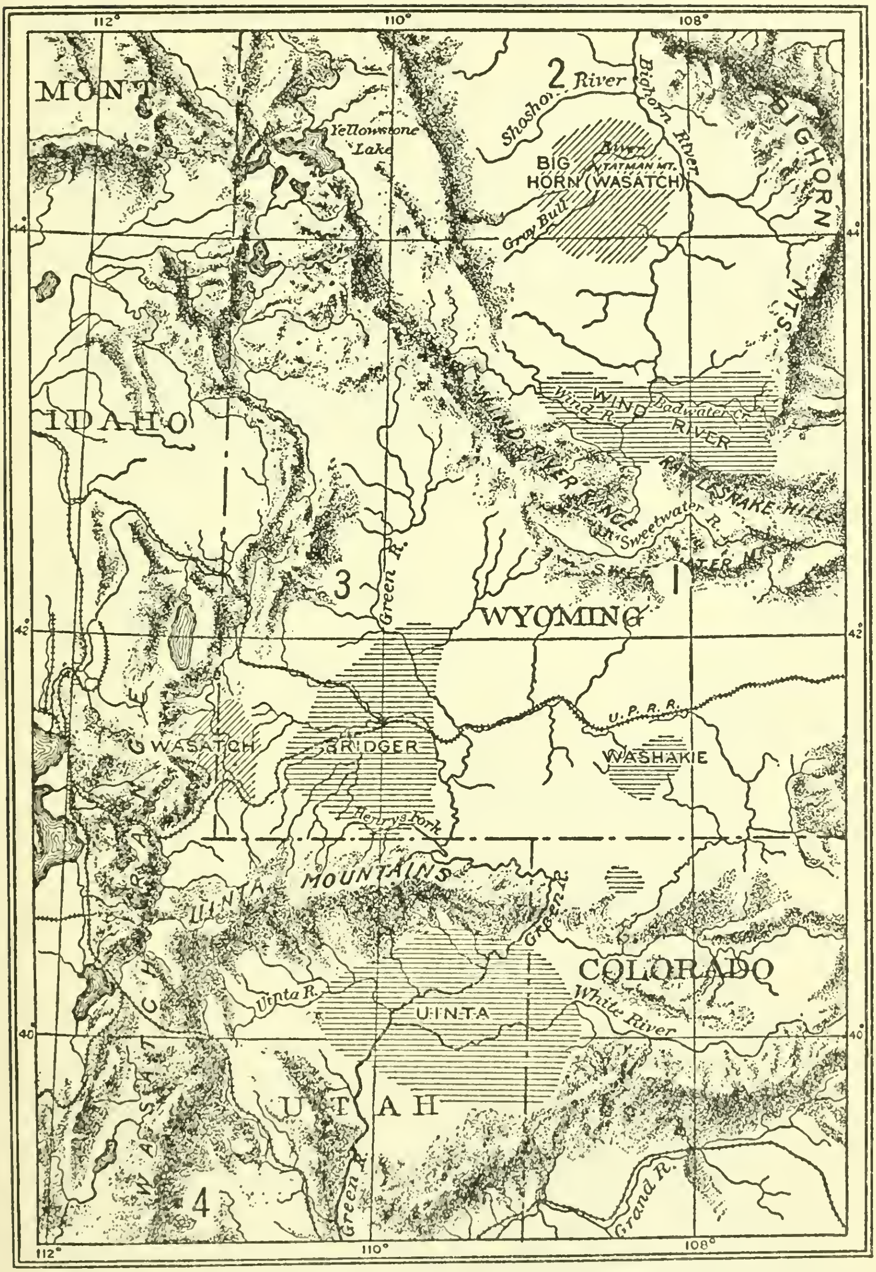

Fig. 1.—Map of western Wyoming and portions of adjacent States showing Eocene sedimentary basins, with nearby Paleocene fossil localities numbered as follows: 1, Bison basin Tiffanian; 2, Polecat Bench Puercan to Clarkforkian; 3, Buckman Hollow Clarkforkian (Almy); 4, Wagonroad ridge and Dragon Canyon, Puercan and Dragonian (North Horn). Map reproduced from Osborn, U. S. Geol. Surv. Monogr. 55, figs. 9, 49, 1929.

used refer to the number of specimens encountered, giving an indication of the extent of the material upon which identifications are based, as well as some, though generally meager, information on the relative abundance of the various forms within and between the faunas. In certain instances species names are repeated but on a less certain or comparative basis where differences of a minor sort, possibly variant or subspecific in value, are noted between related materials from two different localities.

From the tabulated data it is seen that the known collections total about 236 generally determinable specimens. Of these 53 are in the collections of the University of Wyoming, with occurrence divided between the vicinity of the saddle and the *Titanoides* locality. The larger collections are in the U. S. National Museum and represent all four sites.

	Saddle loc.	Ledge loc.	West-end loc.	*Titanoides* loc.
REPTILIA:				
Sauria:				
Anguid, undet.	6	..	..	1
MAMMALIA:				
Multituberculata:				
Cf. *Ptilodus montanus* Douglass	1	..	..	..
Cf. *Ectypodus musculus* Matthew and Granger	1	..	..	..
Cf. *Ectypodus hazeni* Jepsen	1	..	..	..
Cf. *Anconodon russelli* (Simpson)	1	..	..	..
Marsupialia:				
Peradectes elegans Matthew and Granger	1	..	..	..
Peradectes pauli, new species	2	..	..	..
Insectivora:				
Diacodon pearcei, new species	1	..	..	..
Bisonalveus browni, new genus and species	4	..	..	..
Primates:				
Pronothodectes, cf. *matthewi* Gidley	4	..	..	..
Pronothodectes simpsoni, new species	..	9	..	..
Pronothodectes, cf. *simpsoni*, new species	8	..	..	..
Plesiadapis, cf. *fodinatus* Jepsen	..	1	2	3
Plesiadapis jepseni, new species	11*	7	2	..
Plesiadapis, cf. *jepseni*, new species	..	..	..	2
Carnivora:				
Tricentes fremontensis, new species	11	2	..	..
Chriacus, near *C. pelvidens* (Cope)	3	..	1	..
Chriacus, sp. (small)	1	..	..	..
Thryptacodon, cf. *australis* Simpson	..	..	1	1
Thryptacodon demari, new species	..	6	1	..
Thryptacodon, cf. *demari*, new species	2	..	1	1
Thryptacodon belli, new species	11	..	1	..

	Saddle loc.	Ledge loc.	West-end loc.	*Titanoides* loc.
MAMMALIA—continued				
Carnivora—continued				
Claenodon, cf. *procyonoides* (Matthew)	3	..	..	..
Claenodon, cf. *montanensis* (Gidley)	5	..	..	..
Claenodon, cf. *ferox* (Cope)	5	..	3	1
Claenodon acrogenius, new species	6	1	..	..
Dissacus, sp.	..	2	..	..
Didymictis, near *D. tenuis* Simpson	1	..	..	..
Condylarthra:				
Promioclaenus pipiringosi, new species	1	..	..	..
Cf. *Promioclaenus pipiringosi*, new species	..	2	..	..
Promioclaenus? sp.	1	..	..	..
Litomylus scaphicus, new species	2	1	..	..
Litomylus scaphiscus, new species	1	2	..	..
Haplaletes pelicatus, new species	4	..	..	..
Haplaletes serior, new species	..	..	..	1
Protoselene? *novissimus*, new species	2	..	..	..
Litolestes lacunatus, new species	..	..	1	3
Cf. *Litolestes lacunatus*, new species	1	..	..	..
Gidleyina wyomingensis, new species	..	10	9	..
Gidleyina, cf. *wyomingensis*, new species	5	..	..	3
Phenacodus? *bisonensis*, new species	28	2	..	..
Phenacodus? sp. (large)	..	1	1	2
Pantodonta:				
Titanoides primaevus Gidley	..	..	..	1
Caenolambda pattersoni, new genus and species	1	..	..	..
Cf. *Caenolambda pattersoni*, new genus and species	1	1	..	..
Pantodont, undet. (tooth frags.)	2	5	3	1

* Two of these are from the vicinity of the saddle locality but approximately 50 feet higher.

ENVIRONMENT AND RELATIONSHIPS BETWEEN THE BISON BASIN FAUNAS

Although differences are noted between the faunas represented at the four principal localities, all four faunas appear to be Tiffanian, and for the most part, if not all, a comparatively early part of this time interval. Whether these differences are essentially a matter of chance collecting, of facies or environmental differences with time as a minor factor, or of change resulting in part from evolution of certain persisting kinds, but complicated by migration involving the introduction and disappearance or local extinction of others, is not entirely clear. Each, though, is likely to have contributed to the picture.

Chance collecting is unquestionably an important factor where the number of specimens of each form is small, but it cannot be predicted with any assurance that further collecting would increase the faunal resemblance between sites or further emphasize dissimilarities. Undoubtedly certain missing forms would appear, increasing the number of genera and species common to two or more localities, but better representation of populations of each would likely point out persistent differences.

A stratigraphic difference seems evident between at least three of the four sites so that differences due to environment or facies would not be unexpected, whereas this would be unlikely were the same horizon represented at each in so restricted a geographic area. Chance collecting may be appealed to as distorting the picture with respect to environmental differences, particularly where the numbers of specimens are small; nevertheless, with the same collecting personnel involved at each of the sites, attention may be directed to certain contrasting features observed. The saddle locality for example shows evidence of a fauna containing a wealth of smaller mammalian forms. Scant numbers of specimens show a variety of multituberculates, marsupials, and insectivores not represented at the other localities. Still better materials include representation of primates, creodonts, and condylarths, with equivalent or closely related forms known at the other levels. Almost all the genera here peculiar to the saddle locality, with the exception of *Bisonalveus* and *Protoselene*?, are elsewhere known in later faunas, so that one may postulate in addition to time an environmental difference possibly only of local significance which, were it not for the persistence of the primates, would suggest a more open or less sylvan environment for the later levels. The saddle genera missing from the higher levels I suspect are forest-dwelling types. On the other hand, all but two, *Dissacus* and *Titanoides,* of the genera known in the four faunas as a whole are represented in the saddle collections, indicative of a cosmopolitan assemblage of a type perhaps better known only from the Crazy Mountain Fort Union and evidently also from the Polecat Bench. In all probability the Torrejon fauna is of a more open terrain, although points of resemblance are seen in the Carnivora. Nevertheless, the condylarths in particular and many of the other forms from the Bison basin seem more closely allied to faunas of the Crazy Mountain Fort Union as well as to those of the Polecat Bench series. No doubt much of this resemblance is regional in significance and perhaps generally characteristic of the extensive Fort Union, which the Wyoming as well as the Montana sites have been regarded as representing. These in turn are geographically remote with a rather distinctive difference in latitude from the Nacimiento deposits in the San Juan basin of New Mexico.

There would seem to be little doubt that some differences observed between the Bison basin faunas may be attributed to time. That there is a time difference seems evident from the stratigraphic relations, and the localities in the foregoing tabulation are arranged from left to right in ascending order as far as I can determine, except that the relative position of the west end with respect to the ledge locality is entirely uncertain. The more marked differences between the various localities, such as in the genera represented, would, between what appear to be closely related faunas, have less significance as a time factor than the differences observed between the most closely related types. Change resulting from the evolution of certain forms, or the superseding of primitive by more advanced though related types, may be noted in at least three of the orders.

Among the primates *Pronothodectes* is represented in both the saddle and ledge localities, but evidently not higher, and the more primitive *Pronothodectes matthewi* has been found only at the saddle level. *Plesiadapis* is recognized at all localities, and the smaller of these, *P. jepseni,* is best or more typically represented at the saddle and ledge, whereas large *P.* cf. *fodinatus* has not been found in the saddle and most of the material is from the presumably highest or *Titanoides* locality.

Among the Carnivora, *Tricentes* was encountered frequently at the saddle, scantly at the ledge and not higher. Particularly striking with regard to the change in Carnivora is the development of *Thryptacodon.* The small *T. belli* found in the saddle is replaced at the ledge by distinctly larger *T. demari,* almost certainly through development in situ. Material of *Thryptacodon,* which appears structurally a little different than the foregoing and resembling more closely *T. australis,* is found only at the west-end and *Titanoides* localities, although associated there with scant materials that appear to indicate one or both of the other species. These latter, however, may possibly represent variation within a population of a single species in which the mean is rapidly changing. On the other hand, *T. australis* may have appeared from elsewhere during the later time here represented. The impressive display in range of size for *Claenodon* is seen only at the saddle, and only the typically large form compared to *Claenodon ferox* and possibly a single specimen of *Claenodon acrogenius* occur at higher levels. It is possible that *Tricentes* and the smaller forms of *Claenodon* may have become extinct during the interval included by the Bison basin faunas.

Most of the small condylarths are found only in the saddle or ledge faunas, and there appears in these no comment-worthy differences between the two faunas; however, a single specimen of *Haplaletes* encountered at the *Titanoides* locality is of a surprisingly larger form than the *Haplaletes* represented at the saddle. On the other hand, a single specimen from the saddle referred tentatively to *Litolestes lacunatus* is scarcely different than the typical material from the *Titanoides* locality. Among the larger condylarths the form described as *Gidleyina wyomingensis* from the ledge and west-end localities may be a little more progressive than indicated by material referred to it from the saddle. Abundant *Phenacodus? bisonensis* is almost restricted to the saddle level although two specimens came from the ledge. This seems replaced by a considerably larger, at the same time much more rare, species from the ledge and higher. The span of time represented by the Bison basin faunas may have witnessed the extinction of such forms as *Promioclaenus* (which includes much that had been grouped before under *Ellipsodon*), *Protoselene*, and *Litomylus*.

It is not known to what extent the times of *Caenolambda* and *Titanoides* may have overlapped. Typical materials of each were found as single specimens at the saddle and *Titanoides* localities respectively. Undetermined pantodont tooth fragments were collected at all localities.

AGE AND CORRELATION OF THE FAUNAS

In consideration of the age or ages represented by the Bison basin faunas we may deal first with that represented at the saddle locality, rather clearly the oldest of the four levels. In regarding this as Tiffanian somewhat greater emphasis is given to the appearance of forms known to characterize later horizons than to the presence or survival of older genera. For example, *Plesiadapis, Thryptacodon, Litolestes, Gidleyina,* and *Phenacodus* may be regarded as Tiffanian in first appearance, whereas *Pronothodectes, Tricentes, Claenodon, Promioclaenus, Litomylus, Haplaletes,* and *Protoselene* have been rather generally thought to be Torrejonian. Species represented of certain of the latter genera are not clearly separable from those of the Torrejonian levels in the Nacimiento and Fort Union and might be regarded as long lived, but others in this group such as *Pronothodectes simpsoni, Claenodon acrogenius, Litomylus scaphicus,* and *Haplaletes pelicatus* are distinctly advanced.

The interpretation that there is an admixture of materials of rather different horizons at the saddle locality, though not impossible, may be discarded as a serious possibility inasmuch as nearly all the genera of both aspects are found together at the ledge locality where collecting was limited to a narrow zone above a ledge and very near the top of the escarpment. Moreover, among the Tiffanian genera represented at the saddle an early stage of development seems clearly indicated in *Plesiadapis jepseni, Thryptacodon belli,* and the material referred to *Gidleyina wyomingensis,* as well as in the close approach that *Phenacodus? bisonensis* makes to *Tetraclaenodon.*

With due regard to the presence of forms of older aspect in the fauna an age assignment of early or lower Tiffanian rather than later Torrejonian seems indicated. This is further supported by the resemblance or similarity that persists between the Bison basin faunas, although above the saddle and particularly above the ledge locality the Torrejonian aspects appear to be lost. Direct comparison of the saddle fauna with that of the Melville is difficult because of the sparsity of Carnivora and condylarths so well represented in the Bison basin; nevertheless the saddle level may not be much older than the Melville, generally regarded as lower Tiffanian.

The fauna from the *Titanoides* locality is rather limited, but evidence is seen for a somewhat more typical Tiffanian stage. The presence of *Titanoides primaevus* suggests a definite relationship only with a horizon in the type Fort Union in western North Dakota, although somewhat smaller forms from the Melville and Silver Coulee have been referred to this genus, as well as *"Sparactolambda" looki* from the DeBeque beds. A large species of *Plesiadapis* regarded as closest to *P. fodinatus* from the Silver Coulee level of the Polecat Bench series suggests an equivalent horizon in Tiffanian time, but the Bison basin form in at least one individual retains a second lower premolar not seen in any of the typical *P. fodinatus* material. Material close to *Plesiadapis jepseni* also occurs at the *Titanoides* locality, suggesting a closer tie with the older levels in the Bison basin. The *Thryptacodon* here is evidently to be compared closely with that from the Tiffany beds in Colorado. The presence of *Claenodon* cf. *ferox* is not significant in view of the still later occurrence of this genus in beds of Clarkforkian age elsewhere. *Haplaletes serior* would possibly suggest a comparatively early horizon, but this species is so much larger than that from the Lebo, or even than the form described from the saddle locality in the Bison basin, that its significance seems lost. *Litolestes* is a Tiffanian genus here represented by a species which appears to differ only in being of larger size than that from the Melville and much larger than the Silver Coulee genotype. *Gidleyina* and the material of the comparatively large form of *Phenacodus?* at the *Titanoides* locality suggest little other than Tiffanian.

From the foregoing it would seem that the *Titanoides* locality fauna, in the absence of forms of Torrejonian aspect, might be regarded as somewhat higher in the Tiffanian than Melville but, from consideration of the primates only, possibly not so late as Silver Coulee.

Except for their intermediate positions, no particular additional evidence is forthcoming from the ledge and west-end locality faunas, other than that the ledge would seem almost certainly closer to the saddle than to the *Titanoides* locality in age.

SYSTEMATIC DESCRIPTION OF VERTEBRATE REMAINS

REPTILIA

Sauria

ANGUIDAE

The only nonmammalian specimens encountered during the collecting were four fragmentary dentaries, two portions of maxillae, and a premaxilla of a lizard. These were examined by Dr. David H. Dunkle and recognized as belonging to a small anguid type. The genus represented could not be determined from the material at hand, but *Peltosaurus* has been recognized in horizons as early as Lance and Fort Union. Nevertheless *Glyptosaurus* and *Xestops* also include diminutive species and these genera are known in the Eocene. All but one of the specimens came from the saddle locality. A single fragmentary dentary was found at the *Titanoides* locality.

MAMMALIA

Multituberculata

PTILODONTIDAE

Although the multituberculates appear to be comparatively rare, to judge by the frequency with which their remains are encountered, nevertheless they must have been highly diversified, because each of the four fragmentary specimens known evidently represents a different form. The materials in each case are too incomplete to indicate with certainty the genus represented but, of the forms tentatively identified, two suggest Torrejonian and two Tiffanian, although three of the specimens came from the small saddle locality discovered by Dr. R. W. Brown. The fourth specimen, that compared with the Tiffanian *Ectypodus musculus,* came from a short distance away but regarded as the same stratigraphic horizon as the saddle.

Cf. PTILODUS MONTANUS Douglass, 1908

Plate 1, figure 1

A relatively large ptilodont multituberculate is represented by a single incomplete left P_4, U.S.N.M. No. 20877. There is no certainty that the form represented is *Ptilodus,* as no other portions of the dentition were found and the anterior margin of the tooth was broken away. In size and outline, as well as in the spacing of the serrations, of which there were at least 13, the tooth rather closely resembles P_4 in *Ptilodus montanus.* The preserved portion measures 8.1 mm., but estimated from complete specimens of *P. montanus* this tooth in its entirety would have been about 8.8 or 8.9 mm. long and within the upper limit of measurements for *P. montanus.*

Cf. ECTYPODUS MUSCULUS Matthew and Granger, 1921

Plate 1, figure 3

A small jaw fragment with M_1 and the alveoli for M_2, U. of Wyo. No. 1105, would appear to represent *Ectypodus musculus.* The size of the included molar, 2.5 by 1.25 mm., is near that given by Granger and Simpson (1929, p. 655) for *E. musculus,* although the Wyoming specimen would appear to be about a quarter of a millimeter broader. The cusp formula, 9: 5 or 6, is comparable to the 8:6 cited by Jepsen (1940, p. 307) as well as by Matthew and Granger, particularly as one of the outer cusps in No. 1105 is scarcely distinct. This tooth may well belong to the form represented by the P_4, U.S.N.M. No. 20878, compared below with *Ectypodus hazeni* but is appreciably shorter than the 3.2 mm. cited by Jepsen for the length of M_1 in *E. hazeni,* although the cusp formula for this tooth is the same as that for *E. musculus.*

Cf. ECTYPODUS HAZENI Jepsen, 1940

Plate 1, figure 2

An isolated though complete P_4, U.S.N.M. No. 20878, compares very closely to this tooth in the Silver Coulee *Ectypodus hazeni.* It resembles this form in the size (5 mm. long) and outline of the tooth but has only 11, or possibly 12, serrations rather than the 13 listed by Jepsen (1940, p. 307). No. 20878 also resembles P_4 in *Mimetodon churchilli,* which is indicated as having 12 serrations, but the tooth has perhaps a somewhat more convex profile, with the straight posterior section a relatively shorter part of the entire profile. The anterior margin of the tooth is deeply notched and pocketed, suggesting the presence of P_3, but the absence of other associated material precludes certain generic identification.

Cf. ANCONODON RUSSELLI (Simpson), 1935

Plate 1, figure 4

Anconodon russelli may be represented by a fragment of the right mandibular ramus showing the root portion of the incisor and P_4, U. of Wyo. No. 1065. The preserved premolar is close in size to that referred above to *Ectypodus hazeni,* but its profile is slightly more convex dorsally and has a long straight front edge more as in *Anconodon.* P_4 is 5.2 mm. in length, which is about midway in the range of 4.9 to 5.4 mm. given by Jepsen (1940, p. 291) for *Anconodon russelli.* The number of serrations is not certainly determined but would appear to be about 13 or 14. Fourteen serrations are noted for several of the Gidley Quarry specimens from the Crazy Mountain Fort Union, but 15 or 16 prevail in the Rock Bench material according to Jepsen.

Marsupialia

DIDELPHIDAE

PERADECTES ELEGANS Matthew and Granger, 1921

Plate 2, figure 6

A rather well preserved right mandibular ramus with the posterior three molars, U. of Wyo. No. 1104, corresponds so closely in direct comparison with the type of *Peradectes elegans* from the Tiffany of Colorado that there seems no doubt that the species are the same. Lower molars are, of course, amazingly conservative in didelphids, but the near identity in various measurements of the teeth in the Bison basin jaw and the type leave no alternative but recognition of this species in the upper Paleocene of Wyoming. Measurements of the teeth have been incorporated below with those of the following species believed to be distinct.

PERADECTES PAULI,[2] new species

Plate 2, figures 4, 5

Type.—Portion of left mandibular ramus with last two molars, U.S.N.M. No. 20879.

Horizon and locality.—Bison basin Tiffanian, saddle locality, below south rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Appreciably smaller teeth than *Peradectes elegans* and lower molars with outer cusps slightly less elevated and talonids relatively more abbreviated.

[2] Named for Paul O. McGrew.

Discussion.—In addition to being of smaller size than *Peradectes elegans*, it was noted that lower molars of *P. pauli* show a protoconid which, though higher than the paraconid and metaconid, is not so much elevated with respect to these cusps. Also, the hypoconid is a comparatively lower cusp. Moreover, the talonid basin is relatively both a little narrower and shorter than in *P. elegans* and the entoconid and hypoconulid a little less widely separated.

With the distinctions between species of didelphid marsupials generally including little more than size so far as characters of lower molars are concerned and with very limited information on the variability of observed structural differences in these earlier forms, conclusions as to generic identity based on lower molars are not entirely satisfactory. As to whether the cited differences preclude reference of *P. pauli* to *Peradectes* there is no certainty. Although the somewhat lower protoconid might suggest *Peratherium*, this is not supported by the more abbreviated talonids, and the entoconid is not nearly so prominent. Furthermore, *Peratherium* has not been certainly recognized in pre-Eocene deposits. In the absence of any representation of the upper dentition, about which on a generic level evidence of a somewhat more satisfactory nature has been developed (Simpson, 1935a), the species is assigned to *Peradectes*.

MEASUREMENTS IN MILLIMETERS OF LOWER TEETH IN SPECIES OF *Peradectes*

	Peradectes elegans		*Peradectes pauli*, n. sp.	
	A.M.N.H. No. 17376 (type)	U. of Wyo. No. 1104	U.S.N.M. No. 20879 (type)	U.S.N.M. No. 20880
M_1, anteroposterior diameter	1.75	...	...	1.6
transverse diameter of trigonid	0.9	...	...	0.7
transverse diameter of talonid	0.95	...	...	0.75
M_2, anteroposterior diameter	1.75	1.7	...	...
transverse diameter of trigonid	1.0	1.0	...	0.8
transverse diameter of talonid	1.0	1.0	...	...
M_3, anteroposterior diameter	1.75	1.7	1.55	...
transverse diameter of trigonid	1.05	1.05	0.95	...
transverse diameter of talonid	1.05	1.0	0.8	...
M_4, anteroposterior diameter	1.75	1.65	1.6	...
transverse diameter of trigonid	0.95	0.95	0.85	...
transverse diameter of talonid	0.8	0.7	0.6	...

Insectivora

LEPTICTIDAE

Simpson (1937b) presented a logical arrangement of the earlier leptictids which went far toward clarifying the complexity and diversity of these forms. Nevertheless, a review of the various materials in connection with the study of the leptictid form represented in the Bison basin Paleocene has indicated the need for certain further modification.

Attention (Gazin, 1952) was called to the rather distinctive characters observed in the type of *Diacodon alticuspis,* and I am now convinced that Cope's *Ictops bicuspis* should not have been referred to *Diacodon* and that Matthew's earlier disposition of this species under the name *Palaeictops* should be revived. As well as *Palaeictops bicuspis* (Cope), this genus apparently should include *Palaeictops tauricinerei* (Jepsen) and *Palaeictops pineyensis* (Gazin) from among the lower Eocene forms, and possibly also *Palaeictops minutus* (Jepsen) from the Silver Coulee (Tiffanian) Paleocene.

The genus *Prodiacodon* was named by Matthew as a subgenus replacing *Palaeolestes* (preoccupied) for the species *P. puercensis* of the Torrejon horizon. This form, though generically distinct, is, I believe, more closely allied to *Palaeictops bicuspis* than to typical *Diacodon* or *D. alticuspis.* In 1935 Simpson (see 1937b) described *Prodiacodon concordiarcensis* from the upper Lebo (Torrejonian) and expressed some doubt as to the correctness of referring it to that genus. In view of the somewhat later but closely related form encountered in the Bison basin fauna, and of the particular characteristics, rather generally overlooked, of *Diacodon alticuspis,* I am placing both the Lebo and Bison basin forms in *Diacodon.* These then become *Diacodon concordiarcensis* (Simpson) and *Diacodon pearcei,* new species.

DIACODON PEARCEI,[3] new species

Plate 1, figure 6

Type.—Left ramus of mandible with P_3-M_1, U.S.N.M. No. 20970.

Horizon and locality.—Bison basin Tiffanian, small saddle below south rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—*Diacodon pearcei* closely resembles *Diacodon concordiarcensis* (Simpson) from the Crazy Mountain Fort Union (upper Lebo) in the structure of the teeth, but is distinctly larger, about intermediate between *D. concordiarcensis* and *D. alticuspis.* P_4 is seen to be about 14 percent longer and 27 percent wider than in *D. concordiarcensis* and about 20 percent shorter and 22 percent narrower than *D. alticuspis.* The paraconid of this tooth is higher than in the Lebo species.

[3] Named for Franklin L. Pearce.

Discussion.—The closeness of the resemblance between *D. concordiarcensis* and *D. pearcei* convinces me that whatever disposition is made of one, so far as the genus is concerned, the other must likewise be assigned. These two are characterized by comparatively high trigonids and abbreviated molar talonids, associated with a progressive P_4, with a likewise abbreviated though basined talonid. The combination of characters seems most closely approximated in the San Jose and Knight material of *Diacodon alticuspis*. In *Palaeictops* P_4 is comparable in progressiveness, but the talonid in this tooth and in the lower molars is broad and long, comprising a greater proportion of the tooth crown. The molar trigonids, though also high in certain species, are relatively shorter anteroposteriorly. *Prodiacodon* is likewise characterized by comparatively large talonids. A small cuspule about halfway down the posterior slope of P_2 and P_3 in *Prodiacodon puercensis* and much better developed in species of *Palaeictops* is not seen on the P_2 of *D. concordiarcensis* or the P_3 of *D. pearcei*. On the other hand, an anterior cuspule, well developed and high on these teeth in the latter two species, is absent or weak and low in *Prodiacodon* and *Palaeictops*.

Among the other early leptictids, *Leptacodon* has a less progressive P_4 than *Diacodon*, with a strong but low paraconid and in particular a comparatively weak and more posterior metaconid. Moreover, the molar trigonids appear lower and the talonids comparatively larger than in *Diacodon*. *Myrmecoboides* has a large P_4 with paraconid forward as in *Diacodon* and *Palaeictops*, though lower; however, the greatly elongated talonids exhibited in the molars and P_4 immediately distinguish this genus. The abbreviation of the talonid on P_4 and the lower molars of *Xenacodon* is suggestive of *Diacodon*, but P_4 would appear to be distinctly less progressive in that the paraconid is small and the talonid not basined.

MEASUREMENTS IN MILLIMETERS OF LOWER TEETH IN TYPE SPECIMEN OF *Diacodon pearcei*, U.S.N.M. NO. 20970

P_3, anteroposterior diameter : greatest transverse diameter	1.8 : 1.0
P_4, anteroposterior diameter : transverse diameter of trigonid	2.4 : 1.4
M_1, anteroposterior diameter : transverse diameter of trigonid	2.2 : 1.6

PANTOLESTIDAE

BISONALVEUS,[4] new genus

Type.—*Bisonalveus browni*, new species.

Generic characters.—Resembling *Aphronorus*, but P_4 much smaller

[4] *Bison* + *alveus*, basin—for Bison basin.

and exhibiting a slightly more noticeable paraconid and a better developed and more posterolingual entoconid. Paraconids of lower molars higher and more lingual, but hypoconulid of M_1 and M_2 indistinct and less prominently projecting on M_3. Entoconid on M_1 and M_2 more forward in position. Small cuspule on crest anterolingual to hypoconid on M_3.

Discussion.—The structure of P_4 and the general form of the molars suggest an alliance of this form with *Aphronorus* and hence with the pantolestids, although the weakness of the hypoconulid would seem to negate such a relationship. The molars, though exhibiting comparatively acute cusps, might by themselves have been regarded as condylarth.

P_4 of *Bisonalveus* has a slightly better developed paraconid at the anterolingual margin of tooth, and a more pronounced and posterolingually located entoconid so that this portion of the talonid crest is not so depressed or so nearly oblique. The metaconid is only a little lower than the protoconid and slightly posterior to it. The shape of these two cusps is rather like that in *Aphronorus*.

The lower molars show elevated trigonids, somewhat less so than in *Aphronorus,* but the paraconid is almost as high as the metaconid. The paraconid, moreover, is more lingual in position than it is in *Aphronorus*. The talonids of the molars are basined much as in *Aphronorus,* but the arcuate posterior crest of the first two shows little or no evidence of a hypoconulid. It may be noted that the hypoconulid on molars of *Aphronorus* is relatively weak in comparison with middle Eocene *Pantolestes* but is nevertheless clearly defined. In *Bisonalveus,* furthermore, the entoconid has a more forward position on the crest of the talonid in M_1 and M_2 than in *Aphronorus*. In M_3 the entoconid and hypoconulid are closer together. Anterior to the hypoconid on M_3 (only) there is a distinct cuspule, much as seen in some leptictid molars.

Bisonalveus lower molars differ from those of *Bessoecetor* in much the same way as they do from those of *Aphronorus*. The fourth lower premolar, however, is entirely different from that of *Bessoecetor* and has more nearly the form of that in *Aphronorus*.

BISONALVEUS BROWNI,[5] new species

Plate 1, figure 5

Type.—Left ramus of mandible with P_4-M_3, U.S.N.M. No. 20928.

Horizon and locality.—Bison basin Tiffanian, saddle locality, south

[5] Named for Dr. Roland W. Brown.

rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—In size of teeth *Bisonalveus browni* is distinctly smaller than *Aphronorus fraudator* Simpson. The length of the lower molar series is about 13 percent shorter, whereas P_4 is about 45 percent less in length, and 36 percent narrower. Specific characters are not otherwise distinguished from those of the genus.

In addition to the type there are in the collections of National Museum a fragmentary left mandibular ramus with M_3 (No. 20929) and an isolated P_4 (No. 20930). A jaw fragment with a much worn P_4 and M_1 in the University of Wyoming collections (No. 1067) may also represent this species.

MEASUREMENTS IN MILLIMETERS OF LOWER TEETH IN TYPE SPECIMEN OF *Bisonalveus browni*, U.S.N.M. NO. 20928

Length of lower cheek tooth series, P_4-M_3, incl.	9.5
Length of lower molar series, M_1-M_3, incl.	7.5
P_4, anteroposterior diameter : greatest transverse diameter	2.2 : 1.5
M_1 anteroposterior diameter : transverse diameter of trigonid	2.5 : 1.7
M_2 anteroposterior diameter : transverse diameter of trigonid	2.6 : 2.0
M_3 anteroposterior diameter : transverse diameter of trigonid	2.6 : 1.5

Primates

PLESIADAPIDAE

In numbers of jaws and, to a lesser extent, maxillae, the plesiadapids are surprisingly well represented. Not less than four species, presumably divided between two genera, are recognized. Not all, however, are found associated at any one locality. The most primitive, *Pronothodectes* cf. *matthewi,* and presumably the most progressive, *Plesiadapis* cf. *fodinatus,* are not found together, but both are associated with the forms or variants of the forms that might be referred to as intermediate in development, *Pronothodectes simpsoni* and *Plesiadapis jepseni. Pronothodectes* is generally regarded as a forerunner of *Plesiadapis,* which it undoubtedly is, but their occurrence together here is unquestionable in two restricted localities. *Pronothodectes* cf. *matthewi* and a small variant of *Pronothodectes simpsoni* are found associated with *Plesiadapis jepseni* at the saddle locality and typical *Pronothodectes simpsoni* is associated with *Plesiadapis jepseni* and *Plesiadapis* cf. *fodinatus* (a single specimen of a small individual) at the stratigraphically much restricted ledge locality. At the more westerly and probably higher localities *Plesiadapis* cf. *fodinatus* is found with scant material referred, perhaps questionably, to *Plesiadapis jepseni.*

PRONOTHODECTES, cf. MATTHEWI Gidley, 1923

Plate 2, figures 1, 2

A decidedly small plesiadapid is represented in the collections by four lower jaw portions and a maxillary fragment. One of the jaws, U.S.N.M. No. 20758, includes P_4-M_2 and part of M_3, and a second specimen, U. of Wyo. No. 1062, exhibits P_3-M_1. The maxillary portion, U. of Wyo. No. 1099, with two molars, is very tentatively referred but would seem to belong with this material rather than the larger *Pronothodectes simpsoni.*

There is little doubt that the genus represented is *Pronothodectes* rather than *Plesiadapis,* as the dental formula includes all the lower premolars. The species represented is very close to the small *Pronothodectes matthewi,* which Gidley (1923) described from the Montana Fort Union. The lower premolars and molar trigonid cusps, though sloping, are less so than in *Plesiadapis* material of the *P. anceps* type, and the trigonids are moderately compressed anteroposteriorly as in *Pronothodectes matthewi.* Only a slightly greater transverse width to the teeth was noted in the Bison basin material.

All the specimens of this form were obtained from the saddle locality at the south rim of the Bison basin, associated with *Pronothodectes* cf. *simpsoni* and *Plesiadapis jepseni,* but not the advanced *Plesiadapis* cf. *fodinatus.*

MEASUREMENTS IN MILLIMETERS OF TEETH REFERRED TO *Pronothodectes matthewi* GIDLEY

	U. of Wyo. No. 1099
M^1, anteroposterior diameter	2.5
M^2, anteroposterior diameter	2.5

	U.S.N.M. No. 20758	U. of Wyo. No. 1062
P_3, anteroposterior diameter : transverse diameter		1.8 : 1.5
P_4, anteroposterior diameter : transverse diameter	2.1 : 1.7	2.2 : 1.8
M_1, anteroposterior diameter : transverse diameter of talonid	2.4 : 2.0	2.5 : 2.1
M_2, anteroposterior diameter : transverse diameter of talonid	2.5 : 2.3	......
M_3, anteroposterior diameter	3.2[a]	......

[a] Approximate.

PRONOTHODECTES SIMPSONI,[6] new species

Plate 3

Type.—Right ramus of mandible with P_4-M_3, U.S.N.M. No. 20754.

Horizon and locality.—Bison basin Tiffanian, ledge locality at south

[6] Named for Dr. G. G. Simpson in appreciation of his work on the early primates.

rim of Bison basin, W½ sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Size nearly intermediate between *Pronothodectes matthewi* and *Plesiadapis gidleyi,* closer to the latter. P_1 pressed close to incisor, posterior lower premolars and molar trigonids of more inflated appearance than in *P. matthewi.*

Discussion.—The more typical materials of this species are from the ledge locality about a quarter of a mile west of the saddle locality and include about nine jaws besides the type in the collections of the U. S. National Museum. About four specimens in each of the National Museum and University of Wyoming collections from the saddle locality would seem to represent a variant somewhat smaller in size, although evidently closer to this species than to *Pronothodectes matthewi.* None of the material of this species was found at the more westerly and possibly higher horizons in the basin.

Like the material referred to *Pronothodectes matthewi,* that of this species would appear by definition to be *Pronothodectes* rather than *Plesiadapis,* because in all specimens where the dental formula can be determined all the lower premolars were represented, P_1 and P_2 being, of course, single-rooted teeth as in *P. matthewi. P. simpsoni,* as noted in the diagnosis, is characterized by much larger teeth, about 18 to 31 percent larger in length of lower molar series in materials from the ledge locality, and possibly as low as 12 to about 24 percent larger than *P. matthewi* in the materials referred to *P. simpsoni* from the saddle locality.

Pronothodectes simpsoni differs from *P. matthewi,* in addition to its greater size, by exhibiting teeth of a more *Plesiadapis*-like appearance. This is noticeable in the more typical materials from the ledge locality in the comparatively inflated appearance of the cusps. Perhaps it is more noticeable in the trigonid, which is distinctly less anteroposteriorly compressed in M_2 and M_3. The variant from the saddle locality overlaps in size range that represented at the ledge locality and is less obviously different from *P. matthewi* in size and appearance of the cusps, but would seem to be closer to *P. simpsoni.* A lower jaw (U. of Wyo. No. 1057, pl. 3, fig. 2) of *P.* cf. *simpsoni* with P_4 to M_3 from the saddle locality exhibits a disproportionately long M_3 (buccally incomplete), but other specimens with M_3 from the saddle show this tooth to be normally proportioned. M_1 and M_2 in No. 1057 are scarcely distinguished from these two teeth in the smaller specimens of *P. simpsoni* from the ledge (i.e., U.S.N.M. No. 20770, pl. 3, fig. 3).

MEASUREMENTS IN MILLIMETERS OF LOWER TEETH IN SPECIMENS OF *Pronothodectes simpsoni*

	U.S.N.M. No. 20754 (type)	U.S.N.M. No. 20770	U. of Wyo. No. 1057 *
Length of lower molar series	9.8	8.9	9.4
P_4, anteroposterior diameter : transverse diameter	2.5 : 1.9	......	2.2 : 2.0
M_1, anteroposterior diameter : greatest transverse diameter	2.8 : 2.4	2.6 : 2.3	2.5 : 2.1
M_2, anteroposterior diameter : greatest transverse diameter	3.1 : 2.8	2.9 : 2.5	2.7 : 2.5
M_3, anteroposterior diameter : greatest transverse diameter	4.3 : 2.5	3.6 : 2.2	4.4 : ..

* Small variant but with large M_3

PLESIADAPIS, cf. FODINATUS Jepsen, 1930

Plate 2, figure 3

Three specimens in the collections of the National Museum and three in those of the University of Wyoming are believed to represent the comparatively large plesiadapid that Jepsen (1940) described from the Silver Coulee horizon in the Polecat Bench series of northwestern Wyoming. Represented among these are P_4 to M_3, and only one (U. of Wyo. No. 1085) of the specimens is a maxilla, exhibiting M_2 and M_3. The specimens, with one exception, are from the more westerly localities and probably higher stratigraphically than the saddle locality and possibly higher than the ledge. One jaw with teeth a trifle smaller than in the others came from the ledge but is believed to be closer to *Plesiadapis fodinatus* than it is to the new form, *P. jepseni.*

The teeth in the Bison basin materials referred to *P. fodinatus* correspond so closely to those of the Silver Coulee form that there would seem to be no serious doubt as to the correctness of the assignment. The resemblance is very close in all proportions of the molar teeth, and like *P. fodinatus* the teeth do not show such markedly sloping labial walls as in correspondingly large *Plesiadapis rex* and related *P. anceps.* It was noted, however, that in one of the jaws, which has preserved the alveoli of the anterior cheek teeth, a small P_2 had been present, although there was no evidence of a P_1. P_2 is not present in the type or other observed materials of *P. fodinatus* from the Princeton Quarry but is present in *P. gidleyi* and almost always present, though not invariably so, in the material described below as the new species, *Plesiadapis jepseni.* Its presence in the Bison basin jaw compared with *P. fodinatus* may not be significant. There is, moreover, a suggestion in this particular jaw of somewhat smaller premolars and a shorter diastema behind the incisor than in typical *P. fodinatus.* The length of the diastema, though, is uncertain as the bone is incomplete.

MEASUREMENTS IN MILLIMETERS OF TEETH IN SPECIMENS OF *Plesiadapis,* CF. *fodinatus* JEPSEN

	U. of Wyo. No. 1085
M^2, anteroposterior diameter : greatest transverse diameter....	3.8 : 5.9
M^3, greatest transverse diameter..............................	5.5

	U. of Wyo. No. 1082	U.S.N.M. No. 20783	U.S.N.M. No. 20784
P_4, anteroposterior diameter : greatest transverse diameter	2.6 : 2.2	......	......
M_1, anteroposterior diameter : greatest transverse diameter	3.6 : 2.9	3.2 : 2.9	......
M_2, anteroposterior diameter : greatest transverse diameter	......	3.6 : 3.4	3.9 : 3.6
M_3, anteroposterior diameter : greatest transverse diameter	......	......	5.5 : 3.5

PLESIADAPIS JEPSENI,[7] new species

Plate 4

Type.—Left ramus of mandible with P_4-M_3, U.S.N.M. No. 20760.

Horizon and locality.—Bison basin Tiffanian, ledge locality at south rim of Bison basin, W½ sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Close in size to *Plesiadapis gidleyi* and *Plesiadapis anceps.* P_2 almost always present and hypoconulid portion of talonid of M_3 broad as in *P. gidleyi.* Lower teeth relatively broad with outer walls decidedly sloping as in *P. anceps* and *P. rex.* Conule weak to scarcely discernible on lingual slope of primary cusp of P^3 but prominent on P^4. Mesostyle absent or very weak on upper molars, M^3 slightly more expanded posterointernally than in *P. anceps.*

Discussion.—*Plesiadapis jepseni* is one of the better represented forms in the Bison basin collection, exceeded in number of specimens only by *Phenacodus? bisonensis* and *Gidleyina wyomingensis.* About 23 specimens, mostly lower jaws, are for the most part divided between the saddle and ledge localities below the south rim of the basin. Two, however, came from the locality at the west end of the basin and two from near the *Titanoides primaevus* locality in the southwestern part of the basin. Three mandibular portions and one maxilla are in the collections of the University of Wyoming.

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[7] Named for Dr. Glenn L. Jepsen in appreciation of his work on the Plesiadapidae.

A small part of this collection, that secured by Dr. Roland Brown and others, was originally cataloged and described by me in a preliminary unpublished manuscript, as well as in a report to the U. S. Geological Survey, as representing *Plesiadapis anceps,* which it most nearly resembles in the general structure of the lower molars. The resemblance is noticeable in the relative breadth of the teeth and strongly sloping outer walls, a feature also noted in the larger *Plesiadapis rex.* The protoconid in particular has a long posterolateral slope quite unlike *P. gidleyi* and *P. fodinatus* or the later *P. dubius* and *P. rubeyi.* This slope is characteristic of the posterolateral wall of the primary cusp in premolars as well as in the molars of *P. jepseni* and *P. anceps. Plesiadapis jepseni* is unlike *P. anceps* and more nearly resembles *P. gidleyi* in the expansion of the posterior portions of the third upper and lower molars. The posterolingual portion of M^3, though somewhat more expanded than in *P. anceps,* is possibly not so distinctive in this respect as *P. gidleyi;* however, the third lobe or hypoconulid portion of M_3 is generally as much expanded as in *P. gidleyi.* Moreover, in about eight of the lower jaws in which the presence or absence of P_2 can be determined, it is certainly missing in only one. This tooth is apparently not present in *P. anceps,* typical *P. fodinatus,* and later plesiadapids.

MEASUREMENTS IN MILLIMETERS OF TEETH IN SPECIMENS OF *Plesiadapis jepseni*

	U.S.N.M. No. 20781	U.S.N.M. No. 20780
Length of cheek tooth series, P^3-M^3	12.4	......
Length of upper molar series, M^1-M^3	8.5	......
P^3, anteroposterior diameter : greatest transverse diameter	2.0 : 2.3	2.1 : 2.5
P^4, anteroposterior diameter : greatest transverse diameter	2.2 : 3.1	2.3 : 3.1
M^1, anteroposterior diameter : greatest transverse diameter	2.9 : 4.1	2.8 : 4.0
M^2, anteroposterior diameter : greatest transverse diameter	3.0 : 4.7	3.0 : 4.6
M^3, anteroposterior diameter : greatest transverse diameter	2.9 : 3.9	......

	U.S.N.M. No. 20760 (type)	U.S.N.M. No. 20586
Length of cheek tooth series, P_4-M_3	12.6	......
Length of lower molar series, M_1-M_3	10.4	......
P_3, anteroposterior diameter : greatest transverse diameter	......	2.4 : 1.9
P_4, anteroposterior diameter : greatest transverse diameter	2.4 : 2.8	2.5 : 2.4

M_1, anteroposterior diameter : greatest transverse diameter	3.0 : 3.0	3.2 : 3.0
M_2, anteroposterior diameter : greatest transverse diameter	3.3 : 3.2	3.3 : 3.2
M_3, anteroposterior diameter : greatest transverse diameter	4.4 : 2.9	......

Carnivora

ARCTOCYONIDAE

Creodonts are well represented in the collections, comprising a diversity of forms not hitherto recorded in the Tiffanian. Most of the forms are of arctocyonid types, and among these are species of *Tricentes* and *Claenodon*, suggesting affinities with the earlier Torrejonian faunas, together with *Thryptacodon* better known in later horizons. *Chriacus*, having a comparatively great range in geologic time, is represented by a species rather similar but possibly a little more progressive than that of the Torrejon. So far as *Claenodon* is concerned, although the species are difficult to distinguish from those of the Torrejon, undescribed material of the genus has been obtained from Paleocene deposits as late as Clarkforkian, and the presumably descendant *Anacodon* is, of course, found in the lower Eocene.

Oxyclaeninae

TRICENTES FREMONTENSIS,[8] new species

Plate 5, figure 4

Type.—Left ramus of mandible with M_1-M_3, U.S.N.M. No. 20582.

Horizon and locality.—Bison basin Tiffanian, saddle locality at south rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Teeth close in size to those of *Tricentes subtrigonus* but anterior portion of lower dentition reduced, with trigonid of M_1 narrow and premolars smaller.

Discussion.—The above new specific name is proposed with some hesitancy, as the Torrejon species, *Tricentes subtrigonus*, shows an astonishing amount of variation in characters of the lower teeth. Variation in size, relative proportion of teeth, and cusp development makes any attempt at detailed comparison nearly futile. Marked variability was also noted in the material of *Tricentes fremontensis*. Nevertheless, P_3 and P_4, as observed in U.S.N.M. No. 20584, are smaller than in any of the specimens of *T. subtrigonus* I have examined, and in

[8] Named for Fremont County, Wyo.

the dozen or more other specimens of *T. fremontensis* at hand the relative narrowness of the anterior molars, particularly the trigonid of M_1, may be distinctive. The type, U.S.N.M. No. 20582, is a comparatively large individual with teeth relatively wider than nearly all others from this locality. Their width, however, in proportion to their length (more evident in M_1), though matched in certain individuals of *T. subtrigonus,* is rather less than the average in the Torrejon materials observed. Other specimens of *T. fremontensis* appear to be outside the range of *T. subtrigonus* in this respect. Moreover, the paraconid on M_2 and M_3 is placed low on the trigonid of lower molars in *T. fremontensis* and is weaker than generally seen in *T. subtrigonus.* In none of the posterior lower molars of the Bison basin form is this cusp so conspicuously developed as it is in so much of the Torrejon material. It should be noted, however, that the difference is one in average for the material at hand, as teeth of *T. subtrigonus* can be found in which there is scarcely a trace of the paraconid on M_3.

MEASUREMENTS IN MILLIMETERS OF TEETH IN SPECIMENS OF
Tricentes fremontensis

	U.S.N.M. No. 20584
P_3, anteroposterior diameter : transverse diameter	4.0 : 2.4
P_4, anteroposterior diameter : transverse diameter	4.5 : 2.9

	U.S.N.M. No. 20582 (type)
M_1, anteroposterior diameter : transverse diameter of trigonid	6.2 : 3.8
M_1, transverse diameter of talonid	4.5
M_2, anteroposterior diameter : greatest transverse diameter	6.4 : 4.9
M_3, anteroposterior diameter : greatest transverse diameter	6.6 : 4.3

CHRIACUS, near C. PELVIDENS (Cope), 1881

Plate 5, figures 1, 2

About four fragmentary jaws of a species of *Chriacus* are included in the collections of the National Museum. Unfortunately, only one of these (U.S.N.M. No. 20983) has as many as two complete teeth. The form represented is undoubtedly close to *Chriacus pelvidens* of the Torrejon, with the anteroposterior diameter of the lower teeth about the same as in that species. Their width, however, in two of these is a little greater than in any of the *C. pelvidens* material at hand. Moreover, the metaconid on P_4, in one of the two specimens that retains this tooth, is distinctly better developed, as it is in small *Spanoxyodon latrunculus.* Although a distinct species of *Chriacus,* or even possibly *Spanoxyodon,* may well be represented here, the evidence is not conclusive and no satisfactory diagnosis can be made.

P_4 in U.S.N.M. No. 20983 measures 6.1 mm. long by 3.7 mm. wide. M_1 in this specimen is 7.3 by 5.4 mm.

An isolated upper molar, probably M^2 (U.S.N.M. No. 21003), would also appear to represent a species of *Chriacus* about the size of *C. pelvidens.* The outer styles of this tooth are not noticeably developed, but lingually the cingulum carries a prominent hypocone and a likewise prominent though less developed protostyle at the anterolingual margin of the tooth. This tooth measures 6.3 mm. long by 8.8. mm. wide transversely.

CHRIACUS, sp.

Plate 5, figure 3

A single upper molar from the saddle locality, U.S.N.M. No. 21019, presumably M^2, is much smaller, approximately 25 percent less in general proportions than the M^2 discussed in the foregoing section. In size it would appear to be more nearly comparable to *Chriacus truncatus,* approximately that of *Thryptacodon belli.* The rectangular appearance of this tooth and the prominence of the anterointernal cusp or protostyle would seem to remove it from consideration as a form of *Thryptacodon.* The tooth measures 5.2 mm. long by 6.3 mm. wide transversely.

THRYPTACODON, cf. AUSTRALIS Simpson, 1935

Plate 6, figure 5

A fragmentary left mandibular ramus, including P_4, M_1, and M_3, in the collection obtained by the University of Wyoming (No. 1076) from the *Titanoides* locality, in details of the teeth closely approximates that of the species of *Thryptacodon* named by Simpson (1935c) from the Tiffany beds of Colorado. The teeth are a trifle larger than in the type as may be seen from the dimension Simpson has given, but the rudimentary condition of the metaconid on P_4 and the prominently isolated hypoconulid on M_3 suggest possibly a closer relationship to *Thryptacodon australis* than to *T. demari* described as new in the following section.

The trigonid of M_3 in U. Wyo. No. 1076 seems rather broadly basined and the paraconid distinctly weak. Moreover, the hypoconulid, in addition to being prominent, is rather distinctly set off from the entoconid, and there is a low crest between the entoconid and hypoconid. The hypoconulid portion of M_3 is believed to be highly variable in *Thryptacodon,* but *T. australis* material observed shows this cusp rather better defined than in much of the Wasatchian

T. antiquus material exhibiting M_3. A slightly more posteriorward position for the hypoconulid is indicated also for M_1, somewhat reminiscent of *Chriacus,* though not nearly so distinctive in this respect and, of course, the teeth in general are not nearly so high cusped.

MEASUREMENTS IN MILLIMETERS OF TEETH IN SPECIMEN REFERRED TO *Thryptacodon australis* SIMPSON, U. OF WYO. NO. 1076

P_4, anteroposterior diameter : greatest transverse diameter	5.1 : 2.9
M_1, anteroposterior diameter : greatest transverse diameter	6.7 : 4.6
M_3, anteroposterior diameter : greatest transverse diameter	7.1 : 5.3

THRYPTACODON DEMARI,[9] new species

Plate 6, figures 2, 3

Type.—Right ramus of mandible with P_4-M_3, U.S.N.M. No. 20985.

Horizon and locality.—Bison basin Tiffanian, ledge locality at south rim of Bison basin, W½ sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Size a little smaller than *Thryptacodon australis.* P_2 isolated by longer diastemata. Metaconid of P_4 much better developed. Proportions of M_1 about as in *T. australis* but posterior molars comparatively short and broad. Hypoconulid of M_3 variable but may be much reduced.

Discussion.—About 11 specimens in the National Museum collections and one or two in the collection made by the University of Wyoming are recognized as pertaining to the new species *Thryptacodon demari.* The lower molar series of this form is only a little shorter than in *Thryptacodon australis* Simpson from the Tiffany beds of Colorado, and on the basis of size alone would probably not be distinct from that species. In many respects *T. demari* shows points of resemblance to the distinctly more robust appearing *T. antiquus.* The lower premolars, though slender, are well spaced anteriorly, more as in *T. antiquus.* P_4, however, has a better developed metaconid than in either of these. M_1 is about the same size as in more nearly contemporary *T. australis,* but M_2 and M_3 are shorter and relatively broader. In M_3 the shortness may be effected largely by the more reduced hypoconulid in some specimens which, somewhat as illustrated by Matthew for the type of *T. antiquus,* may be more closely joined to the entoconid, and the talonid basin opened posteriorly between the hypoconid and entoconid. In the Bison basin specimen thought to represent *T. australis,* and as evident in Simpson's illustra-

[9] Named for Robert DeMar, who aided materially in the collecting of 1953.

tion of the type, the talonid basin of M_3 is confined posteriorly by a low crest between the hypoconid and entoconid and the hypoconulid is sharply separated from the entoconid. It should be noted, however, that an approach to this condition is made in certain specimens of *T. demari,* hence possibly not of diagnostic significance.

Differences from *T. antiquus,* in addition to the development of the metaconid on P_4, include a little less difference in width between M_2 and the trigonid of M_3, with M_3 relatively much shorter. Moreover, teeth of *Thryptacodon demari* show a cingulum, usually discontinuous, external to the hypoconid, but it appears not to be developed external to the protocone to the extent seen in *T. antiquus.* Also, it is not nearly so expanded posterior to the hypoconid on M_3.

A fragmentary maxilla, U.S.N.M. No. 20984, referred to this species, has M^1 and M^2 preserved, and a second maxilla, U.S.N.M. No. 20992, has only M^2. Also, there is an isolated M^1 in the University of Wyoming collection which may represent this species. M^1 exhibits an anteriorly projecting and weakly cusped parastyle. The cingulum is evenly continuous around the anterior and lingual portions of the tooth and the hypocone is a simple conical cusp rising from the cingulum posterointernal to the the protocone. There is no protostyle and there are no particularly distinct accessory cuspules adjacent to the hypocone as observed in the Eocene materials. M^2 lacks the distinctive parastyle, and in No. 20984 (but not in No. 20992) there is a very rudimentary protostyle anterolingual to the protocone where the cingulum is somewhat more sharply deflected around the margin of the tooth than in M^1. As in M^1, however, there are no clearly distinguishable accessory cuspules adjacent to the hypocone.

The right M^2 described by Simpson (1928) as *Thryptacodon pseudarctos* in the Bear Creek Paleocene fauna of southern Montana is larger and apparently has a more robust protocone than in No. 20984 considered to be *Thryptacodon demari.* The type, *T. pseudarctos,* measures 6.9 by 8.6 mm. Measurements of teeth in *T. demari* are included with those of *T. belli.*

THRYPTACODON BELLI,[10] new species

Plate 6, figures 1, 4

Type.—Right ramus of mandible including M_1-M_3, U. of Wyo. No. 1045.

[10] Named for Wallace G. Bell, engaged in the geologic mapping of the Bison basin area.

Horizon and locality.—Bison basin Tiffanian, saddle locality at south rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Length of lower molar series is about 13 percent less than in the type of *Thryptacodon demari* and lower jaw much shallower. Upper and lower molars similar to those in *T. demari,* except that M_3 is relatively much narrower.

Discussion.—In addition to the type there are two other specimens representing this species in the University of Wyoming collection and about nine in the collections of the National Museum. No difficulty was encountered in distinguishing these materials from that representing *Thryptacodon demari* and upon completing the segregation of the species it was found that all the material except one specimen of *T. belli* was derived from the saddle locality at the south rim, whereas all but two of the specimens of *T. demari* were from the localities farther to the west, and apparently a little higher stratigraphically.

MEASUREMENTS IN MILLIMETERS OF TEETH IN TWO NEW SPECIES OF *Thryptacodon*

	T. demari U.S.N.M. No. 20984	*T. belli* U.S.N.M. No. 20986
M^1, anteroposterior diameter buccally : transverse diameter	5.7 : 6.2	......
M^2, anteroposterior diameter buccally : transverse diameter	6.5[a] : 8.0	5.2 : 7.1
	U.S.N.M. No. 20985 (type)	U. of Wyo. No. 1045 (type)
P_4, anteroposterior diameter : transverse diameter	5.2 : 2.7	......
M_1, anteroposterior diameter : transverse diameter	6.7 : 4.3	5.6 : 3.8
M_2, anteroposterior diameter : transverse diameter	6.2 : 5.3	5.4 : 4.7
M_3, anteroposterior diameter : transverse diameter	6.2 : 4.8	5.3 : 4.0

[a] Approximate.

Arctocyoninae

The approximately 30 specimens of claenodonts in the Bison basin collections nearly run the gamut in size of teeth from a little smaller than in *Claenodon procyonoides* to possibly a little larger than in the largest *Claenodon ferox,* as represented in the Torrejon collections. No one, I believe, would seriously contend that a single species is represented, nor does it seem possible to arrange them logically, with the material at hand, into less than about four species. Possibly a larger collection would show a different distribution as to species and would probably represent not more than three. Simpson (1936) has shown, for example, that the amount of material now known from the Torrejon in New Mexico has resolved the complex there into only two determinable species, the larger of which exhibits a surprising range in size. A complex similar to that in the Bison basin picture is seen in the fewer though distinctly better materials encountered in the Fort Union of the Crazy Mountain field in Montana. Simpson was there faced with the necessity of recognizing five species, but undoubtedly this arrangement would also be somewhat simplified if an adequate sample could be obtained.

Except for the largest form in the Bison basin fauna, there seem to be no characters but size by which the various species may be recognized. Using Simpson's histogram (1937b, fig. 35) for the length of M_2 in the Torrejon materials in the American Museum, I have, in figure 2, added to the number individuals in each size group according to information derived from Torrejon collections in the National Museum, and included a similar histogram for the Bison basin teeth. In the latter, columns are extended by dashed lines in instances where in the absence of M_2 the size of an adjacent molar is indicative of one group or another. Specific assignments made, mostly tentative, are also shown. I rather supect that with further material a single intermediate group will eventually be indicated where comparison is now made with *C. montanensis* and *C. ferox,* although the pattern shown in the Torrejon materials would suggest great variation in a large species. Nevertheless, the differences between the new species, *C. acrogenius,* and that referred to *C. ferox* are rather marked and would appear to include more than size of teeth alone.

CLAENODON, cf. PROCYONOIDES (Matthew), 1937

Plate 7, figure 5

A decidedly small species of *Claenodon* is represented at the saddle locality by a lower jaw, U.S.N.M. No. 20630, including the molars M_1-M_3, a jaw portion retaining only P_2 and P_3, U.S.N.M. No. 21007, and an isolated M_3. The proportions of the teeth in No. 20630 are very close to those in the type of *Claenodon procyonoides* from the New Mexico Torrejon. The isolated molar represents an individual slightly smaller. I was unable to find any characters of significance in these specimens by which the Bison basin form could be determined as distinct from the earlier *C. procyonoides.*

MEASUREMENTS IN MILLIMETERS OF LOWER TEETH IN SPECIMENS OF *Claenodon,* CF. *procyonoides* (MATTHEW), U.S.N.M. NO. 20630

Length of lower molar series, M_1-M_3	24.0
M_1, anteroposterior diameter : greatest transverse diameter	7.7:6.1
M_2, anteroposterior diameter : greatest transverse diameter	8.0:6.7
M_3, anteroposterior diameter : greatest transverse diameter	8.7:5.6

CLAENODON, cf. MONTANENSIS (Gidley), 1919

Plate 7, figure 4

A range in size of teeth indicated by about five claenodont specimens in the Bison basin suite includes the proportions of the type of *Claenodon montanensis* from the Torrejon stage of the Montana Fort Union. All these tentatively referred materials, as well as those of the smaller form discussed above, were derived from the vicinity of the saddle locality below the south rim of the Bison basin. There would appear to be no characters of significance in the rather fragmentary materials of this intermediate species which would serve to distinguish it from that of the earlier *C. montanensis.* Moreover, I suspect that additional material may render difficult its clear separation from that represented by the materials referred to *C. procyonoides.*

MEASUREMENTS IN MILLIMETERS OF TEETH IN SPECIMEN OF *Claenodon*, CF. *montanensis* (GIDLEY), U.S.N.M. NO. 20574

M_2, anteroposterior diameter : greatest transverse diameter..........	9.5[a]: 7.5
M_3, anteroposterior diameter : greatest transverse diameter..........	9.8: 6.3

[a] Approximate.

CLAENODON, cf. FEROX (Cope), 1883

Plate 7, figures 2, 3

A somewhat larger series, including at least nine specimens, is most nearly comparable to the materials of *Claenodon ferox* that in the New Mexico collections were earlier distinguished as *Claenodon corrugatus,* or the lower portion of the size range for *C. ferox.* As well as jaw portions, there are in this group three fragmentary maxillae, each with two molars, and an isolated P^3. In the portion of the histogram representing this material the three individuals indicated by dashed lines have M_3 preserved rather than M_2, and proportions of the latter are estimated by comparison with teeth in a better preserved individual of this group, U.S.N.M. No. 20633.

Whether or not the form represented by this group of specimens is the same as that tentatively referred to *C. montanensis,* there seems no certain evidence; nevertheless, the extremes in size when combined are strikingly far apart, and any attempt to group them together without rather conclusive evidence would seem an incompatible arrangement. Moreover, it should be particularly noted that although the actual size range of the individuals in such a lumped arrangement might be no more than in the *C. ferox* material of the Torrejon, the percentage of difference in the series is very much greater. For this

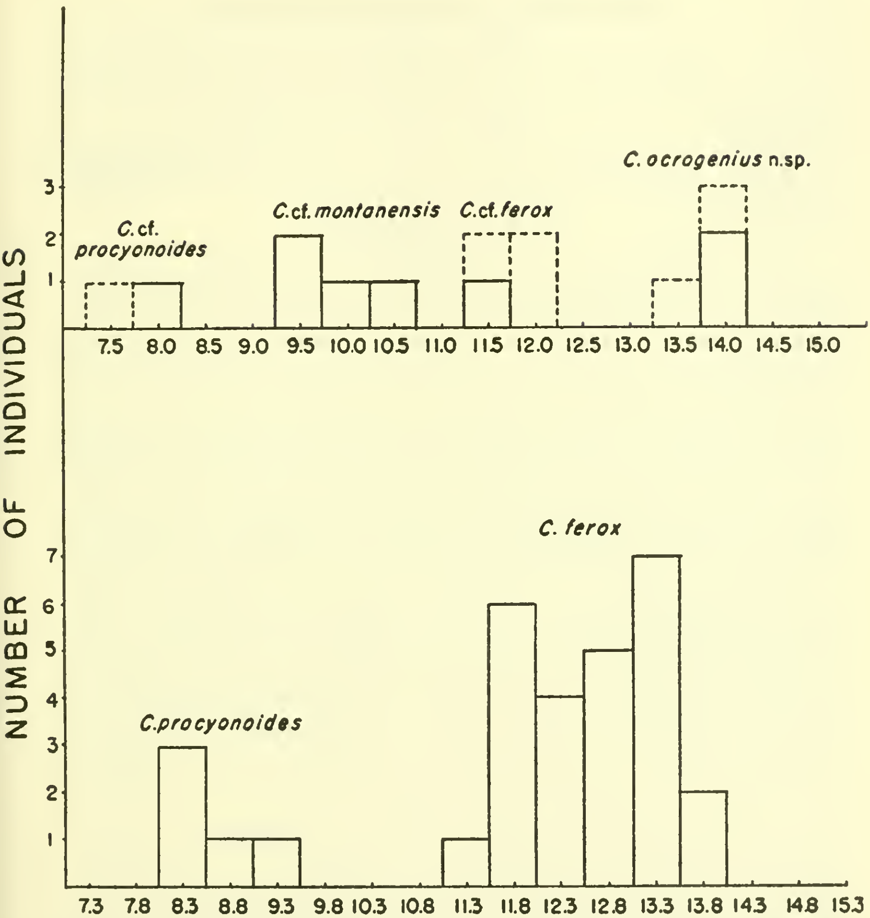

Fig. 2.—Histogram of length of M_2 of *Claenodon* from Bison basin Paleocene, above, and Torrejon (modified from Simpson, 1937) of New Mexico, below.

reason a histogram using a linearly arranged grouping of sizes is misleading unless this characteristic is understood.

MEASUREMENTS IN MILLIMETERS OF TEETH IN SPECIMENS OF *Claenodon*, CF. *ferox* (COPE)

	U.S.N.M. No. 20797
M^2, anteroposterior diameter : transverse diameter*	10.7 : 15.9
M^3, anteroposterior diameter : transverse diameter	8.2 : 11.1

	U.S.N.M. No. 20633
M_2, anteroposterior diameter : transverse diameter	11.4 : 10.4
M_3, anteroposterior diameter : transverse diameter	12.7 : 9.1

* Transverse diameter taken lingually to base of enamel.

CLAENODON ACROGENIUS,[11] new species

Plate 7, figures 1, 6

Type.—Right ramus of mandible with P_1, M_1, and M_3, U.S.N.M. No. 20634.

Horizon and locality.—Bison basin Tiffanian, saddle locality at south rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Size comparable to the very largest individuals of *Claenodon ferox*. Jaw very deep, particularly beneath position of anterior premolars. Canine large and anterior premolars separated by a marked diastema. P_2 possibly absent or reduced to single rooted tooth.

Discussion.—*Claenodon acrogenius* is represented by approximately seven specimens in the collections of the National Museum and possibly by a molar talonid in the University of Wyoming collection. Among the referred specimens are the posterior portions of three other lower jaws with one molar each, two maxillary fragments exhibiting M^1, one of which also includes most of P^4, and an isolated P_4.

Although the size of the teeth in this material is within, or nearly within, the upper limits of the size range for *Claenodon ferox* as recognized in the Torrejon materials, the depth of the jaw, as shown in the type specimen, appears to be exceedingly great, particularly toward the forward extremity. Moreover, the type specimen has a large saberlike canine, as indicated by the root portion, and a diastema of very considerable length anterior to P_3. P_1 is close to the canine and P_2 is missing. A short distance posterior to P_1 there is a depression that may have been an alveolus for a root of P_2. It is uncertain, of course, but this tooth may have been lost during the life of the animal and the alveoli nearly obliterated. In any case, the length of the diastema between P_1 and P_3 is very much greater than would be required for a P_2.

The two molars preserved in this jaw are much worn and do not include M_2. These teeth are a little smaller than those in the other more fragmentary deep-jawed specimens and are interpreted as representing the smaller size group of *C. acrogenius* as shown in the histogram.

MEASUREMENTS IN MILLIMETERS OF TYPE OF *Claenodon acrogenius*, U.S.N.M. NO. 20634

Length of cheek tooth series, posterior margin of alveolus of canine to posterior margin of M_3	87.[a]
Diastema between P_1 and P_3	15.0

[11] From Greek, *akrogeneios* = with prominent chin.

Depth of jaw beneath diastema between P_1 and P_3	31.0
P_1, anteroposterior diameter : transverse diameter	3.5[a] : 2.2
P_3, anteroposterior diameter at alveoli	11.0
P_4, anteroposterior diameter at alveoli	13.5
M_1, anteroposterior diameter : transverse diameter	12.2 : 9.7
M_3, anteroposterior diameter : transverse diameter	15.0[e] : 9.9

[a] Approximate.
[e] Estimated.

MESONYCHIDAE

DISSACUS, sp.

Mesonychid creodont material is exceedingly scarce in the Bison basin collections, as only two incomplete teeth have been encountered. One of these is the outer portion of an upper cheek tooth, not identified as to position, but showing the high conical paracone, somewhat lower metacone, and a prominent parastyle characteristic principally of P_4-M_2 in *Dissacus*. In size it is a trifle larger than M_2 in *D. navajovius* as illustrated by Matthew (1937, figs. 16, 17). The other specimen consists of about the posterior two-thirds of a lower cheek tooth. The anterior and medial portions of the protoconid, including the position of a possible metaconid, are missing. The shearing talonid is slightly longer than in the Torrejon *D. navajovius* tooth material in the National Museum collections. The material, however, is not adequate for specific diagnosis, although there would seem to be no doubt as to the genus represented.

MIACIDAE

DIDYMICTIS, near D. TENUIS Simpson, 1935

A lower jaw fragment with M_2 and the talonid of M_1 in the University of Wyoming collection (No. 1063) would appear to be the only determinable miacid material so far encountered in the Bison basin collecting. The specimen is from the vicinity of the saddle locality below the south rim of the basin. The species is clearly a minute form of *Didymictis* and the talonid of M_1 has proportions almost the same as in the type of *Didymictis tenuis* from the Gidley quarry in the Crazy Mountain Fort Union. M_2 is not preserved in the *D. tenuis* material, but the root portions shown in the type indicate a tooth slightly longer than that of the Bison basin specimen. However, this difference alone would not warrant recognition of a separate species. Nevertheless, it is probable, in view of the difference in age of the horizons represented, that the species are not the same. M_2 in No. 1063 measures 2.6 mm. long by 1.4 mm. wide. The talonid of M_1 is about 1.5 mm. wide.

CONDYLARTHRA

HYOPSODONTIDAE

PROMIOCLAENUS PIPIRINGOSI,[12] new species

Plate 11, figures 1, 2

Type.—Right ramus of mandible with M_1 and M_2, U.S.N.M. No. 20571.

Horizon and locality.—Bison basin Tiffanian, saddle locality at south rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Close in size of molar teeth to *Promioclaenus lemuroides* (Matthew), but lower premolars noticeably smaller. Premolars simple and but slightly inflated. P_2 and P_3 without parastylid and without talonid cusps or crest. P_4 with only a vestige of a parastylid, no metaconid, but exhibiting two small cusps at posterior margin of a very short talonid. Molars relatively narrow transversely without entoconid, and hypoconulid on talonid rim of M_1 and M_2 well defined.

Discussion.—In addition to the type, a fragmentary jaw with P_2-P_4 (U.S.N.M. No. 21021) and a maxilla with M^2-M^3 (U.S.N.M. No. 21022) are believed to represent *Promioclaenus pipiringosi.* The lower molars exhibited in the type are only slightly shorter anteroposteriorly than in the Torrejon *Promioclaenus lemuroides* material at hand, but distinctly narrower relatively. Though worn, the cusps on the marginal crest of the talonid appear comparatively well defined, rather more as in teeth of the distinctly smaller *Promioclaenus aquilonius* of the Montana Fort Union. The lower premolars, if No. 21021 is correctly referred, are small and not so inflated as in *P. lemuroides,* though less slender than in *P. aquilonius.* Moreover, the anterior premolars are without parastylid or any talonid cusps. P_4, however, shows a slight parastylid and a pair of cusps on the talonid; nevertheless, there is no evidence of a metaconid so generally observed on this tooth in *P. aquilonius.* The two upper molars in the tentatively referred maxillary fragment are much worn and exhibit few characters of significance. The individual represented is a little smaller than the type. The external cingulum is prominent between the paracone and metacone and divided about midway.

Use of the generic designation *Promioclaenus* Trouessart, rather than *Ellipsodon,* for these forms, is in conformity with Dr. R. W. Wilson's findings (1952) with respect to the genotype *Ellipsodon inaequidens.* Trouessart proposed *Promioclaenus* for the two species

[12] Named for George N. Pipiringos, of the U. S. Geological Survey.

P. acolytus and *P. lemuroides.* Presumably *P. acolytus* (Cope), the first of the two listed by Trouessart, is to be regarded as the genotype.

MEASUREMENTS IN MILLIMETERS OF TEETH IN SPECIMENS OF *Promioclaenus pipiringosi*

	U.S.N.M. No. 21021
P_2, anteroposterior diameter : greatest transverse diameter	2.7 : 1.6
P_3, anteroposterior diameter : greatest transverse diameter	3.3 : 2.1
P_4, anteroposterior diameter : greatest transverse diameter	3.8 : 2.8
	U.S.N.M. No. 20571 (type)
M_1, anteroposterior diameter : greatest transverse diameter	4.1 : 3.4
M_2, anteroposterior diameter : greatest transverse diameter	4.4 : 3.7

PROMIOCLAENUS? sp.

A very large species of *Promioclaenus* may be represented by a fragmentary right mandibular ramus (U.S.N.M. No. 21020), having preserved only the posterior portion of M_2 and part of the trigonid as well as the roots of M_3. The form is close in size to *Litaletes disjunctus* Simpson of the Montana Fort Union. M_3 would appear to be fully as large as in *L. disjunctus,* a relative size quite unlike typical *Ellipsodon.* There is a distinct possibility that this is *Litaletes* rather than *Promioclaenus;* however, the cusps included in the preserved portion of M_2, though somewhat worn, suggest a lower crowned tooth as in *Promioclaenus,* distinctly less inflated than in *Mioclaenus.*

LITOMYLUS SCAPHICUS,[13] new species

Plate 8, figures 2, 4

Type.—Right ramus of mandible with M_2 and M_3, U.S.N.M. No. 21014.

Horizon and locality.—Bison basin Tiffanian, saddle locality at south rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Lower molars larger and relatively wider than in *Litomylus dissentaneus.* Cusps relatively lower and more inflated, with paraconid more reduced.

Discussion.—There would seem no doubt but that the genus *Litomylus,* originally described by Simpson on the basis of the species *L. dissentaneus* in the Torrejonian of the Montana Fort Union, is represented by two distinct species in the Bison basin Tiffanian. *Litomylus*

[13] *Skaphikos,* from Greek *skaphos* = anything hollowed out as a basin, in allusion to the Bison basin.

scaphicus, the larger, is represented at the saddle locality by the type specimen, and at the ledge locality, about one-quarter mile to the west, by a second jaw portion, U.S.N.M. No. 21015, almost identical to it.

An upper molar, U.S.N.M. No. 21013, possibly M^1, from the saddle locality is structurally very much like the first or second upper molars in *L. dissentaneus,* except that the protoconule and metaconule are less well defined.

Measurements of the teeth of this form are included with those of the following species.

LITOMYLUS SCAPHISCUS,[14] new species

Plate 8, figure 5

Type.—Right ramus of mandible with P_3, M_1 and M_2, U.S.N.M. No. 21010.

Horizon and locality.—Bison basin Tiffanian, ledge locality at south rim of Bison basin, W½ sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Size of teeth close to those in *Litomylus dissentaneus,* distinctly less than in *L. scaphicus,* P_3 with parastylid and posterior cusps much better developed than in *L. dissentaneous.* Paraconid on molars more reduced. Talonid basin a little less deeply pocketed.

Discussion.—A second jaw fragment with M_1 and part of M_2, U.S.N.M. No. 21011, is also from the ledge locality and a single lower molar of this small species was encountered at the saddle but no material was obtained from the west end of the basin.

Litomylus scaphiscus resembles the larger *L. scaphicus* in the more reduced paraconids of the lower molars but is strikingly close in size of both premolars and molars to *L. dissentaneus.* It differs from *L. dissentaneus* essentially in the better development of the cusps of P_3, the weaker paraconids of the molars (particularly M_1), and the less deeply basined molar talonids. Moreover, the depth of the pocket is greatest nearer the lingual margin than in *L. dissentaneus.*

MEASUREMENTS IN MILLIMETERS OF TEETH IN TYPE SPECIMENS OF TWO NEW SPECIES OF *Litomylus*

	L. scaphicus U.S.N.M. No. 21014 (type)	*L. scaphiscus* U.S.N.M. No. 21010 (type)
P_3, anteroposterior diameter : greatest transverse diameter	......	3.7 : 1 :65
P_4, anteroposterior diameter : greatest transverse diameter	......	3.8* : —

[14] *Skaphiskos,* from Greek *skaphos* (diminutive form) = hollowed out as a basin, in allusion to the Bison basin.

M_1, anteroposterior diameter : greatest transverse diameter	......	3.2 : 2.2
M_2, anteroposterior diameter : greatest transverse diameter	3.6 : 3.1	3.3 : 2.5
M_3, anteroposterior diameter : greatest transverse diameter	3.8 : 2.6	......

[e] Estimated.

HAPLALETES PELICATUS,[15] new species

Plate 9, figure 1

Type.—Left ramus of mandible with P_3-M_3, U.S.N.M. No. 21008.

Horizon and locality.—Bison basin Tiffanian, saddle locality at south rim of Bison basin, sec. 28, T. 27 N., R., 95 W., Fremont County, Wyo.

Specific characters.—Length of lower molar series about one-fifth greater than that of *Haplaletes disceptatrix.* Premolars more inflated. Metaconid of P_4 weaker. Paraconid weak on M_1, vestigial or absent on M_2 and M_3. External cingulum weak and discontinuous or absent on lower molars.

Discussion.—The type of *Haplaletes pelicatus* is an excellent lower jaw with the cheek-tooth series in a nearly unworn state. Among the referred materials are three lower-jaw fragments each with one molar, all from the same locality as the type. Two of the latter are in the collections of the University of Wyoming.

The teeth in U.S.N.M. No. 21008 bear a striking resemblance to those in the type of *H. disceptatrix* from the earlier or Torrejonian equivalent of the Fort Union, particularly in the form and slope of the molar cusps. The premolars, however, are a little more inflated and as a consequence the metaconid of P_4 is not so prominent. *Haplaletes* is rather distinctive among condylarths, and the posterior molars, particularly M_3, look surprisingly like these teeth in *Thryptacodon.* The first molars, however, bear little resemblance.

Comparison of *Haplaletes pelicatus* with *Haplaletes diminutivus* Dorr (1952) is not feasible inasmuch as the latter is represented by a partial upper dentition; nevertheless the very small size of the Dell Creek form leaves no doubt as to their distinctness.

Measurements of teeth in *H. pelicatus* are included with those of the following species.

HAPLALETES SERIOR,[16] new species

Plate 9, figure 2

Type.—Left ramus of mandible with M_2 and M_3, U. of Wyo. No. 1078.

[15] From Greek, *pelike* = basin, in allusion to the Bison basin.

[16] *Serior* = later, with reference to its stratigraphic position.

Horizon and locality.—Bison basin Tiffanian, *Titanoides* locality, southwestern portion of basin, sec. 29, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Lower molar teeth about 15 percent longer and nearly 22 percent wider transversely than in *Haplaletes pelicatus.* Paraconid on M_2 and M_3 vestigial. Talonid basin shallow. Hypoconulid of M_3 broader and less protruding posteriorly. No external cingulum.

Discussion.—The type of *Haplaletes serior* is the only known specimen and comes from near where the *Titanoides* upper teeth were discovered, about a mile west of the saddle locality, and apparently a little higher stratigraphically.

Haplaletes serior is a larger form than *H. pelicatus* with relatively wider molars. The form appears, from the limited material, to represent the same genus as *H. pelicatus* but would seem more distinct from *H. disceptatrix.* However, the difference from the latter is for the most part a rather marked disparity in size.

MEASUREMENTS IN MILLIMETERS OF TEETH IN TYPE SPECIMENS OF TWO NEW SPECIES OF *Haplaletes*

	H. pelicatus U.S.N.M. No. 21008 (type)	*H. serior* U. of Wyo. No. 1078 (type)
P_3, anteroposterior diameter : greatest transverse diameter	2.6[a] : 1.6[a]	......
P_4, anteroposterior diameter : greatest transverse diameter	3.3 : 2.0	......
M_1, anteroposterior diameter : greatest transverse diameter	3.0 : 2.3	......
M_2, anteroposterior diameter : greatest transverse diameter	3.2 : 2.8	3.7 : 3.4
M_3, anteroposterior diameter : greatest transverse diameter	3.3 : 2.6	3.7 : 3.1

[a] Approximate.

PROTOSELENE? NOVISSIMUS,[17] new species

Plate 8, figures 1, 3

Type.—Left ramus of mandible with M_2 and M_3, U.S.N.M. No. 20572.

Horizon and locality.—Bison basin Tiffanian, saddle locality at south rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

[17] *Novissimus* = youngest or latest, with reference to the stratigraphic horizons for *Protoselene.*

Specific characters.—Lower molars a little smaller and relatively more slender than in *Protoselene opisthacus.* Paraconid on M_2 and M_3 slightly lingual to midposition and distinctly isolated from both protoconid and metaconid. Talonid crest, particularly the crista obliqua, lower, and basin a little shallower.

Discussion.—A single M_1 (U.S.N.M. No. 21023) is known in addition to the type and was found at the same locality.

Protoselene? novissimus may not represent this genus but is much closer to it than to any other known condylarth. It has elongate molars approximating the selenodonty exhibited in *P. opisthacus,* but the crests are lower and consequently the basins a little more shallow appearing. The paraconid is located in about the same position, but on the posterior molars is more definitely isolated from the adjacent cusps. The extent to which this cusp is joined by a crest to the protoconid, however, is variable in the Torrejon form. M_2 in the type specimen measures 5.4 mm. long by 3.8 mm. wide. M_3 is 5.5 by 3.2 mm.

The isolated M_1 can be nearly matched in material of *P. opisthacus* but in each case the trigonid and talonid basins are a little shallower and the crista obliqua between the hypoconid and trigonid is a little more depressed. M_1 measures 5.6 mm. long by 3.6 mm. wide.

LITOLESTES LACUNATUS,[18] new species

Plate 11, figures 3, 4

Type.—Left ramus of mandible with P_4 and M_1, U.S.N.M. No. 21016.

Horizon and locality.—Bison basin Tiffanian, *Titanoides* locality, southwestern portion of Bison basin, sec. 29, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Approximately a third larger than *Litolestes notissimus* in size of lower molars and well outside the range given by Simpson (1937a). Lower premolars relatively larger. P_4 with small anterolingual parastylid, metaconid weak and close to primary cusp, and two small talonid cuspules very close together. Paraconid weak or absent on M_2 and M_3. Metaconid and protoconid about equal on M_1 and M_2, and metaconid higher on M_3. Entoconid comparatively high on all three molars.

Discussion.—The form herein described as *Litolestes lacunatus* is the smallest of the condylarths recognized in the Bison basin collections, yet it is distinctly larger than either of the previously described

[18] *Lacunatus* = hollowed out, with reference to the Bison basin.

species of this Tiffanian genus. The genotype *Litolestes ignotus* Jepsen is from the Silver Coulee horizon in the Polecat Bench series and *L. notissimus* from the Melville portion of the Crazy Mountain Fort Union. *Litolestes lacunatus* is represented in the Bison basin collections by two additional specimens from the same locality as the type: a lower jaw fragment with M_1 and M_2 (U. of Wyo. No. 1083) and a jaw fragment with M_3 and part of M_2 (U. of Wyo. No. 1079). A lower jaw portion with P_3, P_4, and a much worn M_1 (U. of Wyo. No. 1059) from the saddle locality may represent this species, but P_4 is lower and wider and lacks any evidence of a metaconid; moreover, the details of M_1 are rather obscured by wear. A jaw fragment with only P_4 (U.S.N.M. No. 21017) corresponds very closely to the type but came from the locality at the extreme west end of the basin.

A maxilla (U.S.N.M. No. 20931) from the west-end locality exhibiting P^3-M^2 has rather well worn molars; nevertheless there seems no doubt that it represents *Litolestes lacunatus.* P^3 and P^4 are nearly similar to those teeth in *L. notissimus,* but the parastyle, a very small cusp on P^3 in *L. notissimus,* is absent on this tooth in *L. lacunatus,* however, that on P_4 is more robust in *L. lacunatus.* The parastyle and perhaps the metastyle on the molars are not so outstanding buccally as in *L. notissimus.* Moreover, the talon portions of the molars appear to be a little broader anteroposteriorly in the Bison basin specimen.

MEASUREMENTS IN MILLIMETERS OF TEETH IN SPECIMENS OF *Litolestes lacunatus*

	U.S.N.M. No. 21016 (type)
P_4, anteroposterior diameter : greatest transverse diameter	3.2 : 1.9
M_1, anteroposterior diameter : greatest transverse diameter	2.7 : 2.0

	U. of Wyo. No. 1079
M_2, transverse diameter of talonid	2.2
M_3, anteroposterior diameter : greatest transverse diameter	2.2 : 1.6

PHENACODONTIDAE

GIDLEYINA WYOMINGENSIS, new species

Plate 9, figures 3, 4

Type.—Right ramus of mandible with P_3-M_1, U.S.N.M. No. 20790.

Horizon and locality.—Bison basin Tiffanian, locality at west end of Bison basin, N½ sec. 29, T. 27 N., R. 95 W., Fremont County, Wyo.

Specific characters.—Size of P_4 and molars close to that in *Gidleyina silberlingi.* P_3 much smaller and with simple posterior median crest and single talonid cusp. Paraconid of lower molars variable but generally low and weak. Trigonid not so prominently basined as in *Gidleyina superior.* Upper molars with prominent styles, and crests of protocone distinctive.

Discussion.—*Gidleyina wyomingensis* is better represented in the more westerly and stratigraphically somewhat higher levels than at the saddle locality. The type is from the locality at the west end of the basin, as are about eight other specimens, although most of these are isolated upper and lower teeth. The material from the ledge locality seems entirely similar to that from the west-end locality, and among the 10 specimens from the ledge is the upper dentition (U.S.N.M. No. 20795) figured in plate 9 and about three jaws with two or more molars. About five specimens from the saddle locality, including portions of upper and lower dentitions, might well represent a slightly smaller variant, though probably not specifically distinct from that represented in the material from the more westerly collecing sites.

Doubt may be logically entertained as to the advisability of recognizing *Gidleyina* as distinct from *Ectocion.* Comparison of the Tiffanian materials with the genotype of *Ectocion, E. osbornianum,* from the lower Eocene would seem to justify separate recognition but, as may be expected, the Clarkforkian materials, particularly those from the Almy, in no way simplify this arrangement. As noted by Simpson, the upper premolars in *Gidleyina* are less progressive and the upper molars show better development of crests from the protocone to the protoconule and metaconule. No upper premolars appear to be included in the Bison basin collections but the molars exhibit the protocone crests as mentioned above, and in comparison with *G. montanensis* have perhaps somewhat better developed external styles. P_4 in both the Montana and Wyoming *Gidleyina* material would appear distinctive when compared with Eocene material of *Ectocion,* principally in that the trigonid is elongate in comparison with the talonid length, whereas in *E. osbornianum* this relationship is rather generally reversed with the trigonid often short and broad and the talonid usually, though not invariably, better developed. Moreover, in some individuals of *E. osbornianum* the talonid of P_4 looks quite molariform, with a surprisingly well developed entoconid.

With regard to the forms of *Gidleyina* known from the Melville unit of the Montana Fort Union, I strongly suspect that *Gidleyina silberlingi* is a synonym of *G. montanensis.* Simpson (1937b) called attention to this possibility at the time he published Gidley's descriptions. There is some difference in the stratigraphic levels attributed to the two, but not as much difference as between either of them and *Gidleyina superior.* Nevertheless, to judge by the variation in molar structure noted for both *Gidleyina* and *Ectocion, G. superior* may be no more than a variant of *G. montanensis.* The possibility also remains that *G. wyomingensis* is likewise not distinct, but possible synonomy here awaits demonstration that the lower premolars exhibited in the type of *G. silberlingi* are atypical.

A form which Simpson (1935c) described as *Phenacodus gidleyi* in the Tiffany fauna has teeth only a trifle larger than in *G. wyomingensis,* but the trigonid portions of the lower teeth in the type of *P. gidleyi* represent a little greater proportion of the tooth length than in *G. wyomingensis.* I am unable to determine whether *P. gidleyi* represents *Phenacodus* or *Gidleyina.*

MEASUREMENTS IN MILLIMETERS OF TEETH IN SPECIMENS OF *Gidleyina wyomingensis*

	U.S.N.M. No. 20795
Length of upper molar series, M^1-M^3	20.1
M^1, anteroposterior diameter : greatest transverse diameter	7.4 : 9.6[a]
M^2, anteroposterior diameter : greatest transverse diameter	7.2 : 10.4
M^3, anteroposterior diameter : greatest transverse diameter	5.7 : 8.4

	U.S.N.M. No. 20790 (type)	U.S.N.M. No. 20793
P_3, anteroposterior diameter : greatest transverse diameter	5.8 : 3.5	......
P_4, anteroposterior diameter : greatest transverse diameter	6.8 : 4.7	......
M_1, anteroposterior diameter : greatest transverse diameter	6.5 : 5.2	6.6 : 5.2
M_2, anteroposterior diameter : greatest transverse diameter	......	6.8 : 5.6
M_3, transverse diameter of trigonid	......	4.8

[a] Approximate.

PHENACODUS? BISONENSIS,[19] new species

Plate 10, figures 1-3

Type.—Right maxilla with P^4-M^2, U.S.N.M. No. 20564, and probably a left maxilla with M^1 and M^2 believed to be from the same individual.

Horizon and locality.—Bison basin Tiffanian, vicinity of saddle locality at south rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont County, Wyo.

[19] Named for the Bison basin.

Specific characters.—Size very close to that of *Phenacodus almiensis,* about intermediate between that of *Phenacodus? grangeri* and *Phenacodus? matthewi* of the Tiffany beds. P^3 and P^4 with tritocone distinct, but much less progressive than in *P. almiensis.* Mesostyle prominent on M^1 but variable on M^2. Lower premolars comparatively simple and unprogressive. P^4 trigonid with paraconid low and forward, and talonid weakly basined, with entoconid generally distinct though small.

Discussion.—Approximately 30 specimens of this form are at hand and nearly all are from the vicinity of the saddle locality. Two specimens, however, were secured from the ledge locality statigraphically a little higher.

Uncertainty exists as to whether the species represented by this material should be referred to *Phenacodus* or to *Tetraclaenodon.* Its allocation to *Phenacodus* is entirely arbitrary and scarcely more than an impression. As noted by Granger (1915), there are actually no clear-cut characters by which the genera may be separated. Although there are differences between them in degree of development for a number of characters, they are in the nature of average differences, lacking in the consistency generally expected at the generic level. Granger attempted a definition based on the development of the mesostyle, but certain upper molars of *Tetraclaenodon puercensis* show a rather surprising prominence in this style. The shift of the metaconule posteriorward would seem evident for *Phenacodus primaevus* but not diagnostic for such Paleocene forms as *Phenacodus almiensis* or *Phenacodus? grangeri.* I note a decreasing prominence of the protoconule and metaconule with respect to the primary cusps in rising above the Torrejon level, to the extent that in some Wasatchian material of *Phenacodus* the metaconule is entirely missing on M^2 and M^3. Nevertheless, this is variable in populations of the better known species of *Phenacodus* as well as in *Tetraclaenodon puercensis,* and, like the increasing significance of the tritocone of the upper premolars, is a difference in degree not readily defined.

The lower teeth do not appear to present characters of significance on a generic level. Certainly the development or reduction of the paraconid is too highly variable. The talonid of P_4 would seem to become more molariform in time and the entoconid better developed but this cusp is occasionally prominent in material of *Tetraclaenodon puercensis,* and a decidedly primitive appearing P_4 structure has been observed in material representing certain of the smaller species of *Phenacodus* in the Eocene.

Phenacodus? bisonensis would appear to be *Tetraclaenodon* in the subordinate appearance of the tritocone on P^3 and P^4 and its proximity to the primary cusp, and in this respect is certainly distinct on a specific level from the Clarkforkian materials, such as *Phenacodus almiensis.* Nevertheless, these teeth show deuterocone portions more suggestive of *Phenacodus,* and P^3 has a rather conspicuously developed postero-internal talon basin not observed in U. S. National Museum Torrejon materials. *P.? bisonensis,* moreover, resembles *P. almiensis* in the slightly more crested appearance of the upper molar cusps and in the lesser significance of the conules in comparison with *Tetraclaenodon puercensis.* The mesostyle of the upper molars is distinct and moderately prominent in all referred materials; however, in the type specimen, although prominent on M^1, it is very weak on M^2.

MEASUREMENTS IN MILLIMETERS OF TEETH IN SPECIMENS OF *Phenacodus? bisonensis*

	U.S.N.M. No. 20566	U.S.N.M. No. 20564 (type)
P^3, anteroposterior diameter : transverse diameter	7.8 : 6.5	......
P^4, anteroposterior diameter : transverse diameter	7.2 : 8.0	8.3 : 9.2
M^1, anteroposterior diameter : greatest transverse diameter	......	9.4 : 11.0
M^2, anteroposterior diameter : greatest transverse diameter	......	9.4 : 12.8

	U.S.N.M. No. 20567	U.S.N.M. No. 20569
Length of lower molar series	......	28.7
P_3, anteroposterior diameter : greatest transverse diameter	7.7 : 4.6	......
P_4, anteroposterior diameter : greatest transverse diameter	8.8 : 5.7	......
M_1, anteroposterior diameter : greatest transverse diameter	8.9 : 7.6	8.2 : 7.3
M_2, anteroposterior diameter : greatest transverse diameter	9.5[a] : 7.4	9.6 : 8.2
M_3, anteroposterior diameter : greatest transverse diameter	......	10.5 : 7.2

[a] Approximate.

PHENACODUS? sp. (large)

Plate 10, figures 4, 5

A fragmentary right mandibular ramus with M_3, U.S.N.M. No. 21025, an isolated P^3, M^3, and an incomplete lower molar (the latter two in the collections of the University of Wyoming) are of a species much larger than *Phenacodus? bisonensis.* The range of size represented in materials of *P.? bisonensis* is surprisingly limited, certainly in comparison with such forms as *T. puercensis* and *P. primaevus,* so that the teeth here indicated as of a distinct species stand out conspicuously in the collections. The form represented may be *Phenacodus*? *grangeri* which Simpson (1935c) described from the Colorado Tiffany, but the measurements where equivalent materials are present noticeably exceed those of the more southern animal. M_3 which measures 13.6 by 9.2 mm., for example, is 19 percent longer and 12 percent wider. This difference in a form such as *Phenacodus* might not be important. The significance would, of course, depend on the position of these two examples with regard to their respective but unknown means.

The third lower molar apparently reveals no information as to whether references should be made to *Phenacodus* or *Tetraclaenodon.* P^3, however, as in *P.*? *bisonensis* has a well-developed posterointernal basin and the tritocone is apparently better defined than usual in *Tetraclaenodon puercensis.* The isolated M^3 has a distinct but small mesostyle and the hypocone is particularly small.

PANTODONTA

CORYPHODONTIDAE

TITANOIDES PRIMAEVUS Gidley, 1917

Plate 11, figure 5

The finding in North Dakota by a party under the direction of Dr. Glenn L. Jepsen of portions of the skull including the upper dentition belonging beyond doubt to the type of *Titanoides primaevus* was unusually good fortune, so that no uncertainty now exists as to the characteristics of the superior dentition of this upper Paleocene pantodont. Patterson early (1933) described new materials from the Plateau Valley beds of Colorado as representing *Titanoides,* but upon later discovery of at least three pantodont forms from these beds, with distinguishing features in the upper dentition, was forced to regard all as distinct from *Titanoides* and the species at first referred to *Titanoides* was given the new generic name *Barylambda.* It now develops, with the finding of *Titanoides* upper teeth, that while *Barylambda* and *Haplolambda* are clearly distinct, *Sparactolambda* [20] is the form which I believe must now be regarded as the synonym of *Titanoides.*

In the University of Wyoming material from the Bison basin there

[20] Jepsen's discovery has likewise permitted us to determine correctly the identity of an excellent pantodont skull collected by Dr. T. E. White in McKenzie County, N. Dak., and, like the type of *T. primaevus,* from the general area of the type Fort Union. This skull, originally and with apparent correctness, determined by White as representing *Sparactolambda,* is now seen to belong beyond doubt to *Titanoides primaevus.*

is a right maxilla (U. of Wyo. No. 1093) with three little-worn upper molars. The resemblance of these teeth to those in the type of *Titanoides primaevus* is striking so that no doubt exists as to the identity. The teeth in No. 1093 are slightly smaller in all dimensions, except M^3, and are nearly similar in form. Observable differences include a better developed metacone on the molars, and M^3 shows, in addition to a slightly larger size, the parastyle directed somewhat more laterally in No. 1093, not so forward as in the type. Very slight differences noted are a less developed protoconule on M^2 and metaconule on M^3.

MEASUREMENTS IN MILLIMETERS OF UPPER MOLARS IN SPECIMEN OF *Titanoides primaevus* GIDLEY, U. OF WYO. NO. 1093

Length of upper molar series, M^1-M^3	66.8
M_1, anteroposterior diameter : transverse diameter *	20.8 : 23.3
M_2, anteroposterior diameter : transverse diameter *	25.3 : 27.9
M_3, anteroposterior diameter : greatest transverse diameter	20.4 : 34.0

* Anteroposterior diameters of M_1 and M_2 taken across outer styles and transverse diameters perpendicular to line between outer styles. Anteroposterior diameter of M_3 taken perpendicular to anterior face.

CAENOLAMBDA,[21] new genus

Type.—*Caenolambda pattersoni,* new species.

Generic characters.—Skull with elongate cranium, strong, arched sagittal crest, broad frontals, narrow nasals and heavy canines resembling the *Titanoides* group. Upper cheek teeth, though comparatively small, are anteroposteriorly shortened and transversely broad as in the *Barylambda-Haplolambda* group, but with molars M^1 to M^3 about equaling one another in size.

Discussion.—*Caenolambda* presents a rather unusual combination of characters and does not closely resemble any of the previously described genera. Nevertheless, in a general way, the skull is apparently more like *Titanoides* than *Barylambda* or *Haplolambda.* This is noticed in the relatively elongate cranium and strong, arched sagittal crest. It resembles the cast of the paratype of *"Sparactolambda" looki* in narrowness of the nasals, although the nasal cavity is apparently not so large. As in the latter and the type of *Titanoides primaevus* the canine is very well developed. The upper cheek teeth, however, are decidedly different. The teeth are distinctly shortened anteroposteriorly, particularly the lingual portions, and very broad transversely. The external styles at the anterior and posterior angles of the teeth do not project laterally to such an extent and the primary external cusps are somewhat closer to the labial margin of the tooth, so that

[21] From Greek *kainos,* recent or new, + *lambda,* the Greek letter—named in analogy with *Pantolambda, Barylambda, Archaeolambda,* and others.

the characteristic "V" and "W" shapes to the outer cusps are not so transversely extended as in *Titanoides,* or the more extreme condition seen in *Archaeolambda.* The relatively great width is composed largely of the talon, and in the molars, as clearly shown in M^2, there is a strong ledgelike cingulum about the lingual and posterior margin. On *Titanoides* molars the lingual cingulum is weak, although better developed along the posterior margin of the premolars than in *Caenolambda.* The molars of *Caenolambda* would appear to be about equal to one another in size as in *Pantolambda,* not showing the marked increase from M^1 to M^3 seen in *Titanoides,* or the reduction of M^3 noted in *Barylambda* and *Haplolambda.*

The skull of *Barylambda* is large and relatively broader than that of *Caenolambda.* The nasal cavity is larger and the nasal bones much wider. The frontals are broad in both forms, but *Barylambda* does not exhibit a sagittal crest so heavy and prominently arched as in *Caenolambda.* The teeth of *Barylambda* are transversely broad in comparison to their anteroposterior dimension, as in *Caenolambda,* but the talon of molars, particularly M^1 and M^2, is not nearly so slender; moreover, the cingulum is weak or absent lingually rather than shelf-like. M^3, as noted above, is much reduced in *Barylambda.*

The comparisons between *Haplolambda* and *Caenolambda* are rather similar to those between *Barylambda* and *Caenolambda,* although the species *Haplolambda quinni* and *Caenolambda pattersoni* are more nearly comparable in size. The cranial portion of *Haplolambda* is shorter and the sagittal crest not so arched as in *Caenolambda,* but the nasals are wider and the nasal cavity larger although the frontals are not so broad. The cheek teeth resemble those of *Caenolambda* in their relative width and the distinctly labial position of the primary external cusps, but again as in *Barylambda* the molar talons are not so slender, the cingulum is lingually weak, and M^3 is reduced. In *Haplolambda,* moreover, M^1 would appear to be larger than M^2, quite the reverse of *Titanoides.* The comparatively small canine in *Haplolambda* would appear to be a striking difference from both *Caenolambda* and *Titanoides,* but the size of this tooth is so often a matter of dimorphism that one hesitates to stress the character. Nevertheless, if there is any dimorphism in this respect within species of *Coryphodon,* it is certainly much less evident.

CAENOLAMBDA PATTERSONI,[22] new species

Plates 12-14

Type.—Skull, lacking zygomatic arches and mandible, U.S.N.M. 21036.

[22] Named for Bryan Patterson in appreciation of his work on the pantodonts.

Horizon and locality.—Bison basin Tiffanian, vicinity of saddle locality at south rim of Bison basin, sec. 28, T. 27 N., R. 95 W., Fremont, Wyo.

Specific characters.—Length of skull greater than that of *Haplolambda quinni* but less than *Titanoides primaevus*. Much smaller than *Barylambda faberi*. Cheek teeth comparatively small. Other characters not distinguished from those discussed above as characterizing the genus.

Discussion.—Except for a few isolated teeth or tooth fragments which may represent this species, there are no determinable materials other than the type. Moreover, the more fragmentary specimens cannot be allocated as between this form and *Titanoides primaevus,* the latter having been certainly encountered only at the *Titanoides* locality, at a level believed to be higher stratigraphically than the saddle.

The skull designated the type of *Caenolambda pattersoni* is advanced in maturity so that the teeth are rather well worn, with the characters of M^1 almost obliterated. Moreover, the sutures are nearly all obscured so that little is revealed of the surface extent of the separate elements of the skull. This situation was further complicated by the fact that the skull was discovered in a dense limestone nodule and during its preparation much difficulty was experienced determining the actual boundary between bone and matrix. As a result much in the way of important detail cannot be discerned.

MEASUREMENTS* IN MILLIMETERS OF SKULL, U.S.N.M. NO. 21036, TYPE SPECIMEN OF *Caenolambda pattersoni*

Length of skull from the anterior margin of premaxillae to posterior margin of occipital condyles	320.
Length from anterior margin of canine alveolus to posterior margin of occipital condyles	300.
Distance from posterior margin of palate at posterior narial aperture to posterior margin of occipital condyles	170.
Width across postorbital processes	110.
Width across nasals about midway of length	24.
Length of upper dentition, C (at alveolus) to M^3, incl.	135.
Length of upper cheek tooth series, P^2 to M^3, incl.	92.
Length of upper molar series, M^1 to M^3	52.
C, anteroposterior diameter (at alveolus) : greatest transverse diameter	26.0 : 16.0
P^2, anteroposterior diameter : transverse diameter	13.0 : 19.0
P^3, anteroposterior diameter : transverse diameter	13.0 : 23.0
P^4, anteroposterior diameter : transverse diameter	13.5 : 23.5
M^1, anteroposterior diameter : transverse diameter	18.5 : 27.0
M^2, anteroposterior diameter : transverse diameter	19.0 : 30.0
M^3, anteroposterior diameter : transverse diameter	16.0 : —

* Measurements are nearly all approximate owing to fracturing and distortion of skull, and teeth are much worn and nearly all slightly damaged at styles. Tooth measurements include styles and are taken parallel to and at right angles to direction of tooth row.

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EXPLANATION OF PLATES

Plate 1

MULTITUBERCULATES AND INSECTIVORES FROM THE BISON BASIN PALEOCENE

Fig. 1. Cf. *Ptilodus montanus* Douglass: Left P_4 (U.S.N.M. No. 20877), lateral view. Four times natural size.

Fig. 2. Cf. *Ectypodus hazeni* Jepsen: Left P_4 (U.S.N.M. No. 20878), lateral view. Four times natural size.

Fig. 3. Cf. *Ectypodus musculus* Matthew and Granger: Left ramus of mandible with M_1 (U. of Wyo. No. 1105), occlusal view. Four times natural size.

Fig. 4. Cf. *Anconodon russelli* (Simpson): Right ramus of mandible with P_4 (U. of Wyo. No. 1065), lateral view. Four times natural size.

Fig. 5. *Bisonalveus browni,* new genus and species: Left ramus of mandible (U.S.N.M. No. 20928), type specimen, lingual and occlusal views. Four times natural size.

Fig. 6. *Diacondon pearcei,* new species: Left ramus of mandible (U.S.N.M. No. 20970), type specimen, lingual and occlusal views. Four times natural size.

Plate 2

PRIMATES AND MARSUPIALS FROM THE BISON BASIN PALEOCENE

Figs. 1, 2. *Pronothodectes,* cf. *matthewi* Gidley: 1, Left ramus of mandible (U.S.N.M. No. 20758), lateral and occlusal views; 2, right ramus of mandible (U. of Wyo. No. 1062), lateral and occlusal views. Three times natural size.

Fig. 3. *Plesiadapis,* cf. *fodinatus* Jepsen: Left ramus of mandible (U.S.N.M. No. 20784), lateral and occlusal views. Three times natural size.

Figs. 4, 5. *Peradectes pauli,* new species: 4, Left ramus of mandible (U.S.N.M. No. 20879), type specimen, lingual and occlusal views; 5, left ramus of mandible (U.S.N.M. No. 20880), lingual and occlusal views. Four times natural size.

Fig. 6. *Peradectes elegans* Matthew and Granger: Right ramus of mandible (U. of Wyo. No. 1104), lingual and occlusal views. Four times natural size.

Plate 3

PRONOTHODECTES FROM THE BISON BASIN PALEOCENE

Figs. 1, 3. *Pronothodectes simpsoni,* new species: 1, Right ramus of mandible (U.S.N.M. No. 20754), type specimen, lateral and occlusal views; 3, right ramus of mandible (U.S.N.M. No. 20770), lateral and occlusal views. Three times natural size.

Fig. 2. *Pronothodectes,* cf. *simpsoni,* new species: Left ramus of mandible (U. of Wyo. No. 1057), lateral and occlusal views. Three times natural size.

PLATE 4

PLESIADAPIS FROM THE BISON BASIN PALEOCENE

Figs. 1-3. *Plesiadapis jepseni,* new species: 1, Left ramus of mandible (U.S.N.M. No. 20586), lateral and occlusal views; 2, left maxilla (U.S.N.M. No. 20781), occlusal view; 3, left ramus of mandible (U.S.N.M. No. 20760), type specimen, lateral and occlusal views. Three times natural size.

PLATE 5

TRICENTES AND CHRIACUS FROM THE BISON BASIN PALEOCENE

Figs. 1, 2. *Chriacus,* near *C. pelvidens* (Cope): 1, Right ramus of mandible (U.S.N.M. No. 20983), lateral and occlusal views; 2, left M^2? (U.S.N.M. No. 21003), occlusal view. Two and one-half times natural size.

Fig. 3. *Chriacus,* sp: Left M^2? (U.S.N.M. No. 21019), occlusal view. Two and one-half times natural size.

Fig. 4. *Tricentes fremontensis,* new species: Left ramus of mandible (U.S.N.M. No. 20582), type specimen, lateral and occlusal views. Two and one-half times natural size.

PLATE 6

THRYPTACODON FROM THE BISON BASIN PALEOCENE

Fig. 1. *Thryptacodon belli,* new species: Right ramus of mandible (U. of Wyo. No. 1045), type specimen, lateral and occlusal views. Twice natural size.

Fig. 2. *Thryptacodon,* cf. *demari,* new species: Left maxilla (U.S.N.M. No. 20984), occlusal view. Twice natural size.

Fig. 3. *Thryptacodon demari,* new species: Right ramus of mandible (U.S.N.M. No. 20985), type specimen, lateral and occlusal views. Twice natural size.

Fig. 4. *Thryptacodon,* cf. *belli,* new species: Left maxilla (U.S.N.M. No. 20986), occlusal view. Twice natural size.

Fig. 5. *Thryptacodon,* cf. *australis* Simpson: Left ramus of mandible (U. of Wyo. No. 1076), occlusal and lateral views. Twice natural size.

PLATE 7

CLAENODON FROM THE BISON BASIN PALEOCENE

Figs. 1, 6. *Claenodon acrogenius,* new species: 1, Left ramus of mandible (U.S.N.M. No. 20575), occlusal view, natural size; 6, right ramus of mandible (U.S.N.M. No. 20634), type specimen, lateral view, one-half natural size.

Figs. 2, 3. *Claenodon,* cf. *ferox* (Cope): 2, Left ramus of mandible (U.S.N.M. No. 20633), occlusal view; 3, right maxilla (U.S.N.M. No. 20797), occlusal view. Natural size.

Fig. 4. *Claenodon,* cf. *montanensis* (Gidley): Left ramus of mandible (U.S.N.M. No. 20574), occlusal view. Natural size.

Fig. 5. *Claenodon,* cf. *procyonoides* (Matthew): Right ramus of mandible (U.S.N.M. No. 20630), lateral and occlusal views. Twice natural size.

Plate 8

LITOMYLUS AND PROTOSELENE? FROM THE BISON BASIN PALEOCENE

Figs. 1, 3. *Protoselene? novissimus,* new species: 1, Left ramus of mandible (U.S.N.M. No. 20572), type specimen, lateral and occlusal views; 3, right ramus of mandible (U.S.N.M. No. 21023), lateral and occlusal views. Four times natural size.

Fig. 2. *Litomylus,* cf. *scaphicus,* new species: Right M^1 or M^2 (U.S.N.M. No. 21013), occlusal view. Four times natural size.

Fig. 4. *Litomylus scaphicus,* new species: Right ramus of mandible (U.S.N.M. No. 21014), type specimen, lateral and occlusal views. Four times natural size.

Fig. 5. *Litomylus scaphiscus,* new species: Right ramus of mandible (U.S.N.M. No. 21010), type specimen, lateral and occlusal views. Four times natural size.

Plate 9

HAPLALETES AND GIDLEYINA FROM THE BISON BASIN PALEOCENE

Fig. 1. *Haplaletes pelicatus,* new species: Left ramus of mandible (U.S.N.M. No. 21008), type specimen, lateral and occlusal views. Four times natural size.

Fig. 2. *Haplaletes serior,* new species: Left ramus of mandible (U. of Wyo. No. 1078), type specimen, lateral and occlusal views. Four times natural size.

Figs. 3, 4. *Gidleyina wyomingensis,* new species: 3, Right ramus of mandible (U.S.N.M. No. 20790), type specimen, lateral and occlusal views; 4, right maxilla (U.S.N.M. No. 20795), occlusal view. Twice natural size.

Plate 10

PHENACODUS? FROM THE BISON BASIN PALEOCENE

Figs. 1-3. *Phenacodus? bisonensis,* new species: 1, Right ramus of mandible (U.S.N.M. No. 20567), lateral and occlusal views, 1½ times natural size; 2, right maxilla (U.S.N.M. No. 20564), type specimen, occlusal view, 1½ times natural size; 3, right maxilla (U.S.N.M. No. 20566), occlusal view, twice natural size.

Figs. 4, 5. *Phenacodus*? sp. (large): 4, Right ramus of mandible (U.S.N.M. No. 21025), occlusal view, 1½ times natural size; 5, right P^3 (U.S.N.M. No. 21038), occlusal view, twice natural size.

Plate 11

CONDYLARTHS AND TITANOIDES FROM THE BISON BASIN PALEOCENE

Figs. 1, 2. *Promioclaenus pipiringosi,* new species: 1, Right ramus of mandible (U.S.N.M. No. 20571), type specimen, lateral and occlusal views; 2, right ramus of mandible (U.S.N.M. No. 21021), lateral and occlusal views. Four times natural size.

Figs. 3, 4. *Litolestes lacunatus,* new species: 3, Left ramus of mandible (U.S.N.M. No. 21016), type specimen, lateral and occlusal views; 4, left ramus of mandible (U. of Wyo. No. 1079), lateral and occlusal views. Four times natural size.

Fig. 5. *Titanoides primaevus* Gidley: Right upper molars (U. of Wyo. No. 1093), occlusal view. Natural size.

Plate 12

CAENOLAMBDA FROM THE BISON BASIN PALEOCENE

Caenolambda pattersoni, new genus and species: Skull (U.S.N.M. No. 21036), type specimen, dorsal view. One-half natural size.

Plate 13

CAENOLAMBDA FROM THE BISON BASIN PALEOCENE

Caenolambda pattersoni, new genus and species: Skull (U.S.N.M. No. 21036), type specimen, lateral view. One-half natural size.

Plate 14

CAENOLAMBDA FROM THE BISON BASIN PALEOCENE

Caenolambda pattersoni, new genus and species: Skull (U.S.N.M. No. 21036), type specimen, ventral view. One-half natural size.

Plate 15

SOUTH RIM OF BISON BASIN SHOWING FOSSIL LOCALITIES

View westward along escarpment forming south rim of Bison basin. Fossil localities indicated are as follows: a, saddle locality; b, ledge locality; c, *Titanoides* locality; and d, west-end locality.

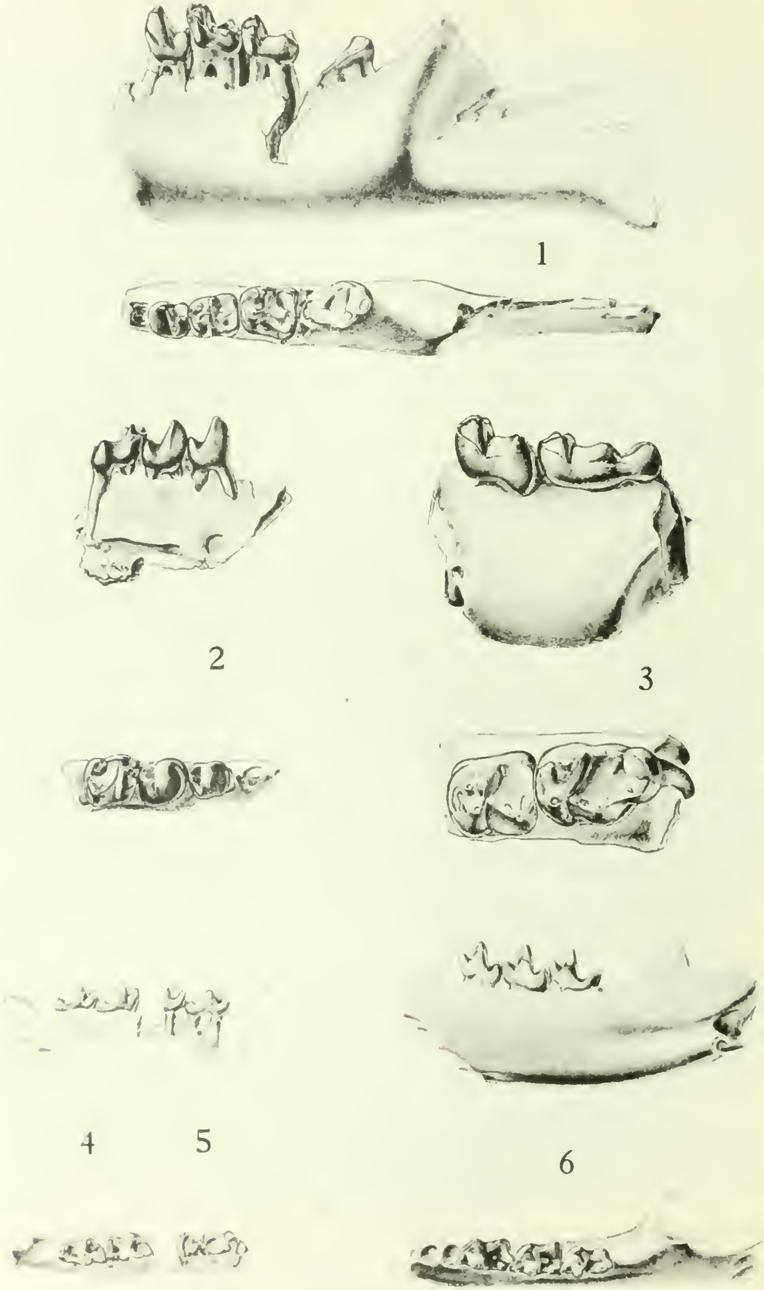
Plate 16

TWO FOSSIL LOCALITIES IN THE BISON BASIN

Above, view eastward of ledge locality (b). Below, view southwestward of west-end locality (d).

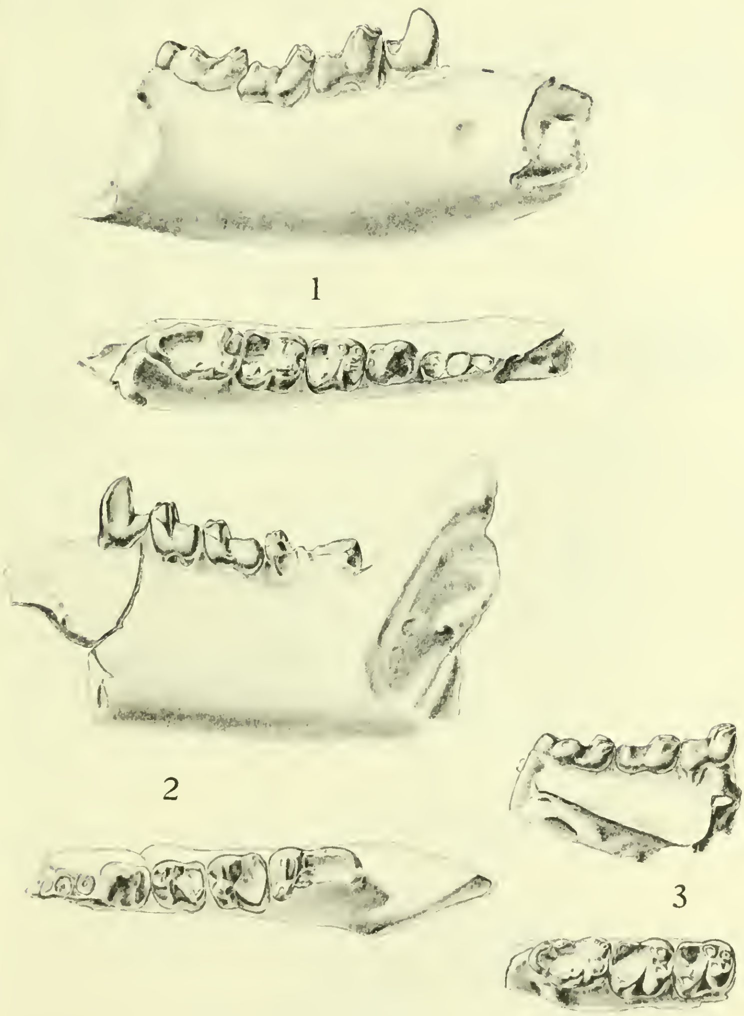
MULTITUBERCULATES AND INSECTIVORES FROM THE BISON BASIN PALEOCENE

(SEE EXPLANATION AT END OF TEXT.)



Primates and Marsupials from the Bison Basin Paleocene

(See explanation at end of text.)



PRONOTHODECTES FROM THE BISON BASIN PALEOCENE

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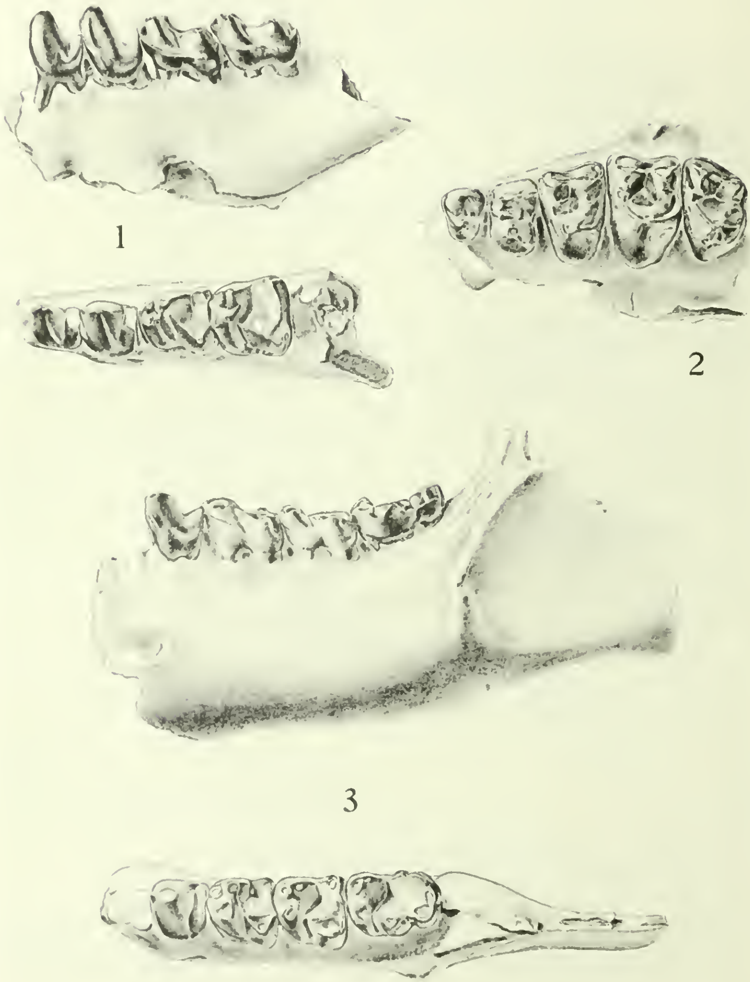
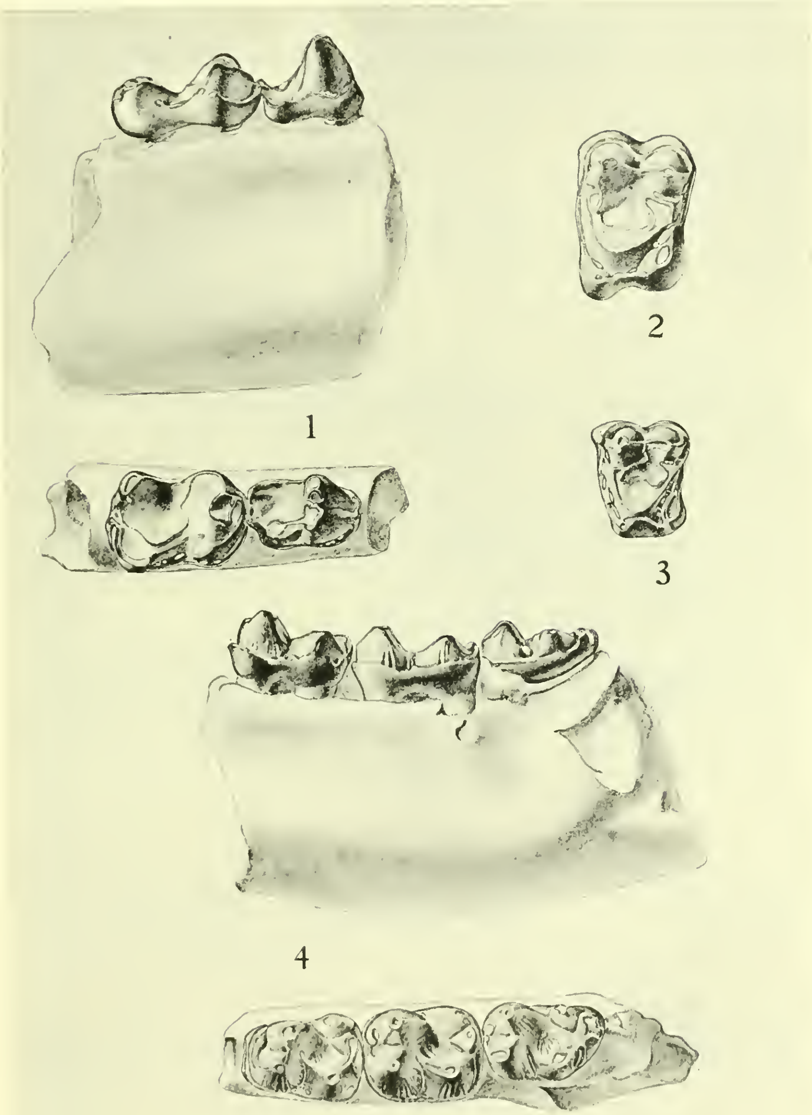


PLESIADAPIS FROM THE BISON BASIN PALEOCENE

(SEE EXPLANATION AT END OF TEXT.)



TRICENTES AND CHRIACUS FROM THE BISON BASIN PALEOCENE

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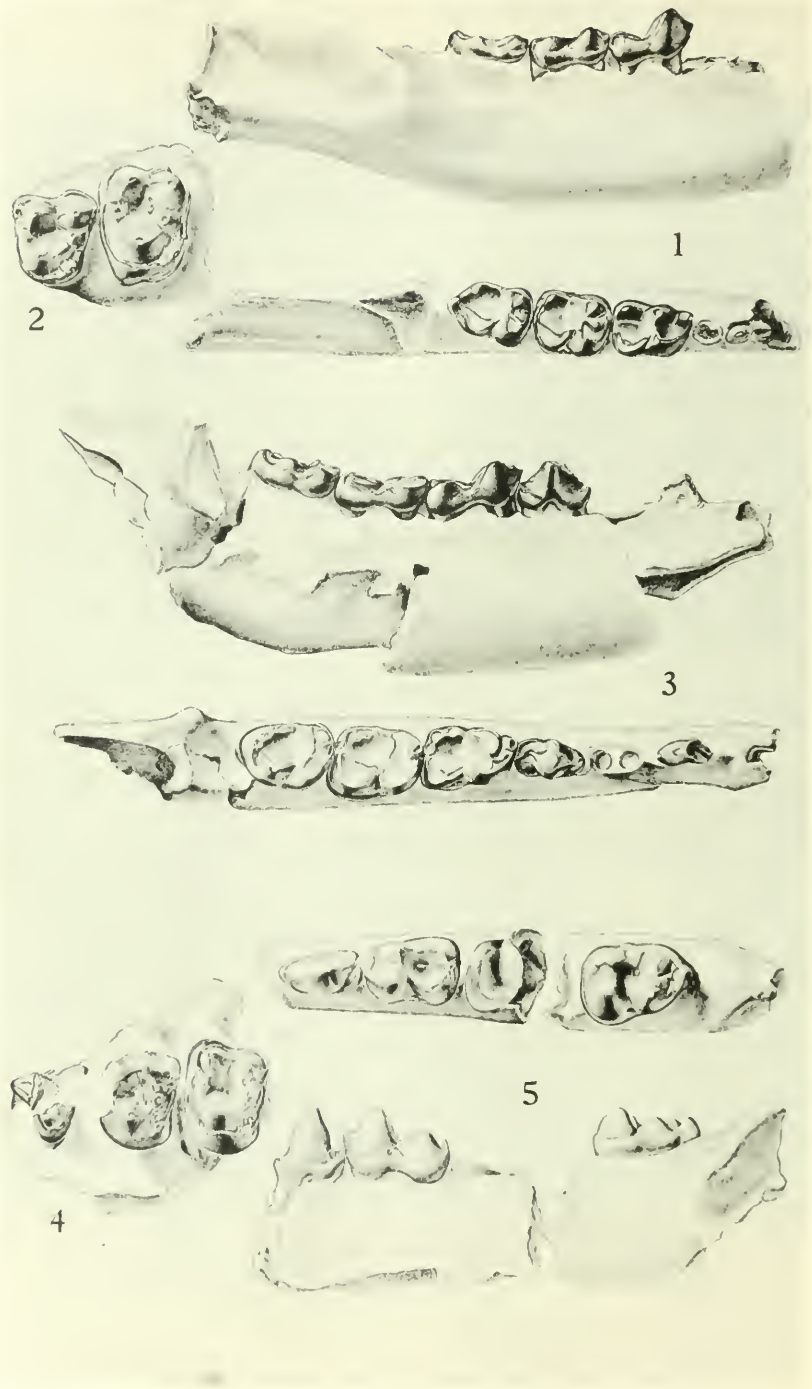
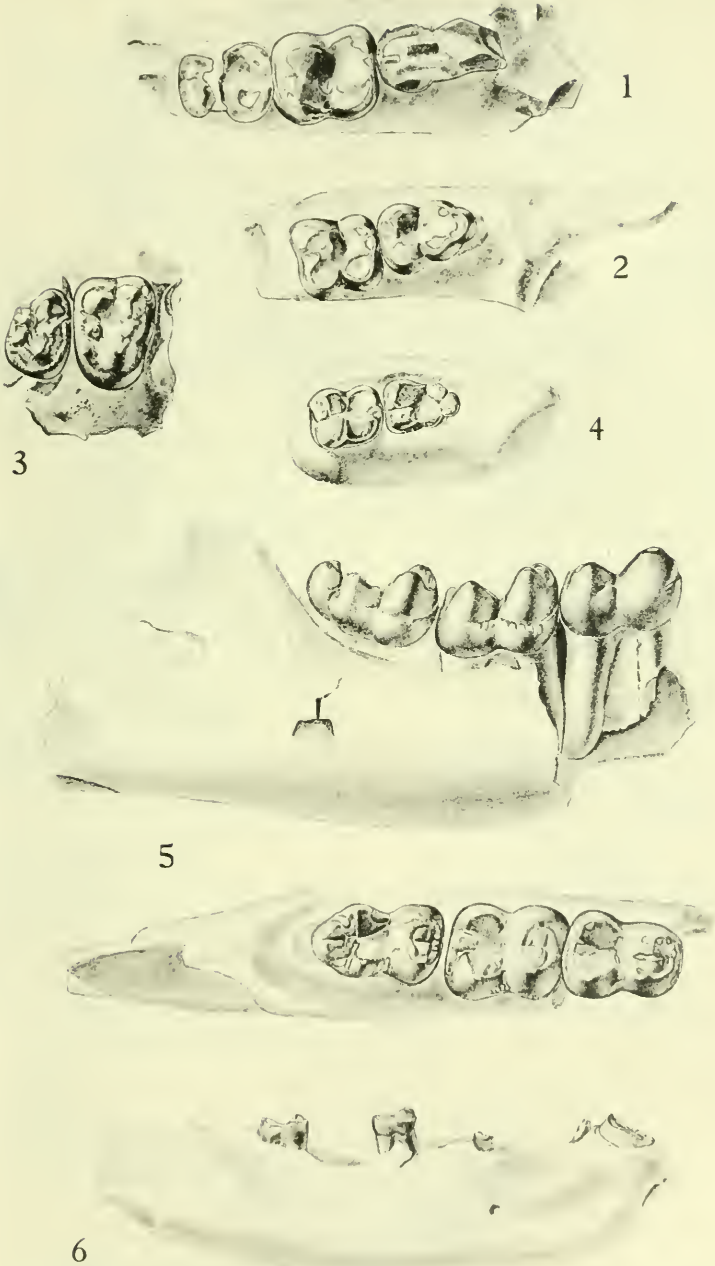


Thryptacodon from the Bison Basin Paleocene

(See explanation at end of text.)



CLAENODON FROM THE BISON BASIN PALEOCENE

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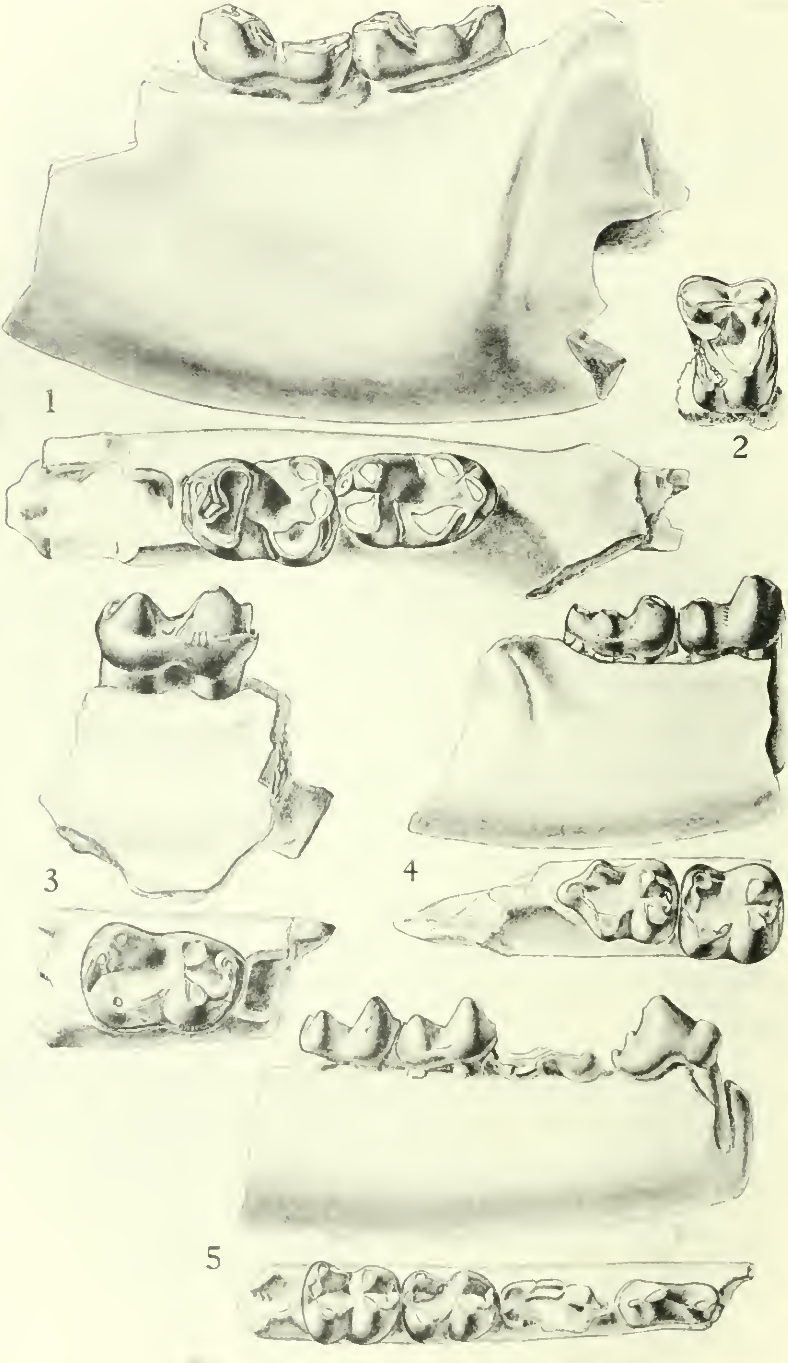

LITOMYLUS AND PROTOSELENE? FROM THE BISON BASIN PALEOCENE

(SEE EXPLANATION AT END OF TEXT.)

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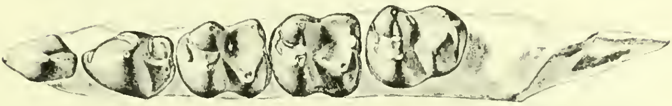

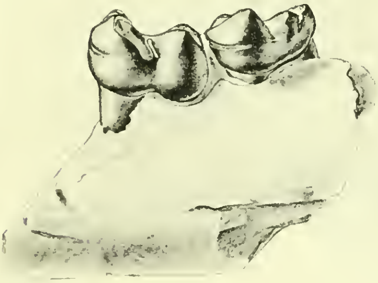

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HAPLALETES AND GIDLEYINA FROM THE BISON BASIN PALEOCENE

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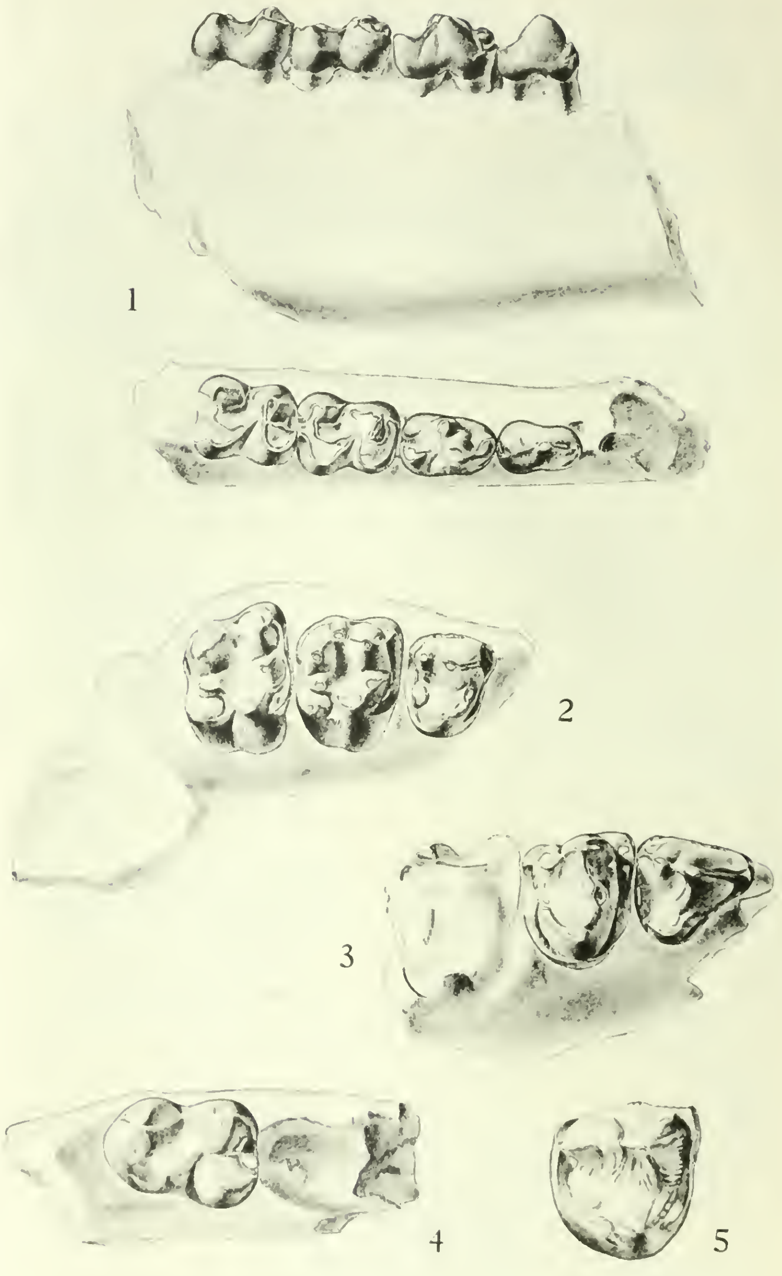

PHENACODUS? FROM THE BISON BASIN PALEOCENE

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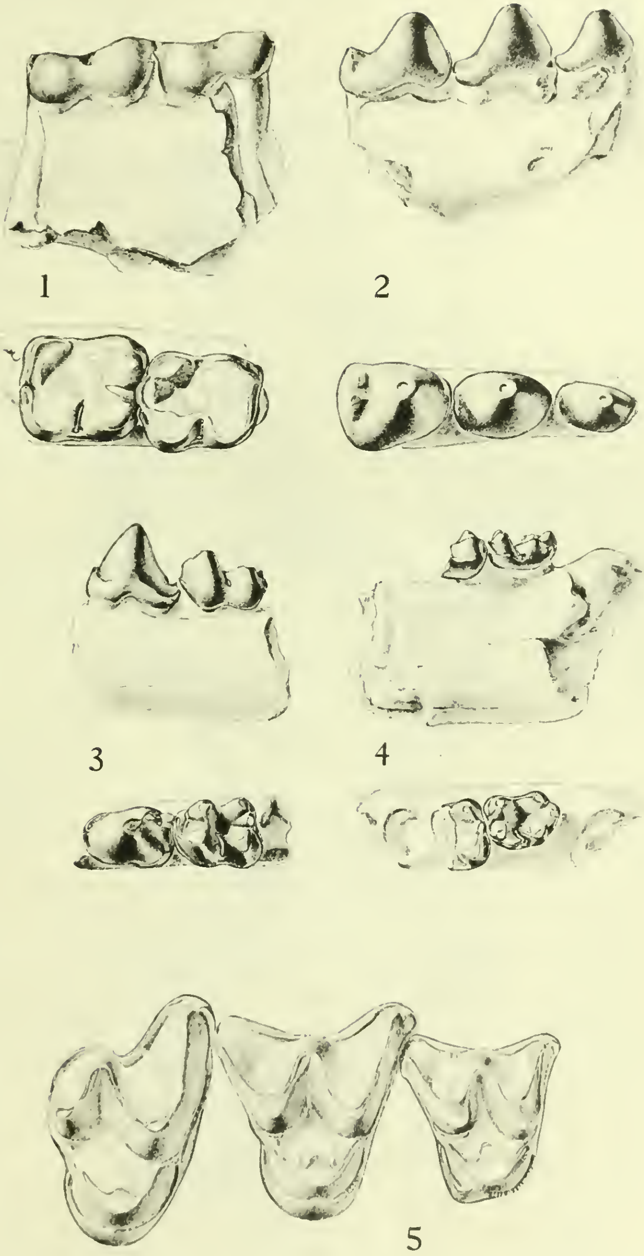

CONDYLARTHS AND TITANOIDES FROM THE BISON BASIN PALEOCENE

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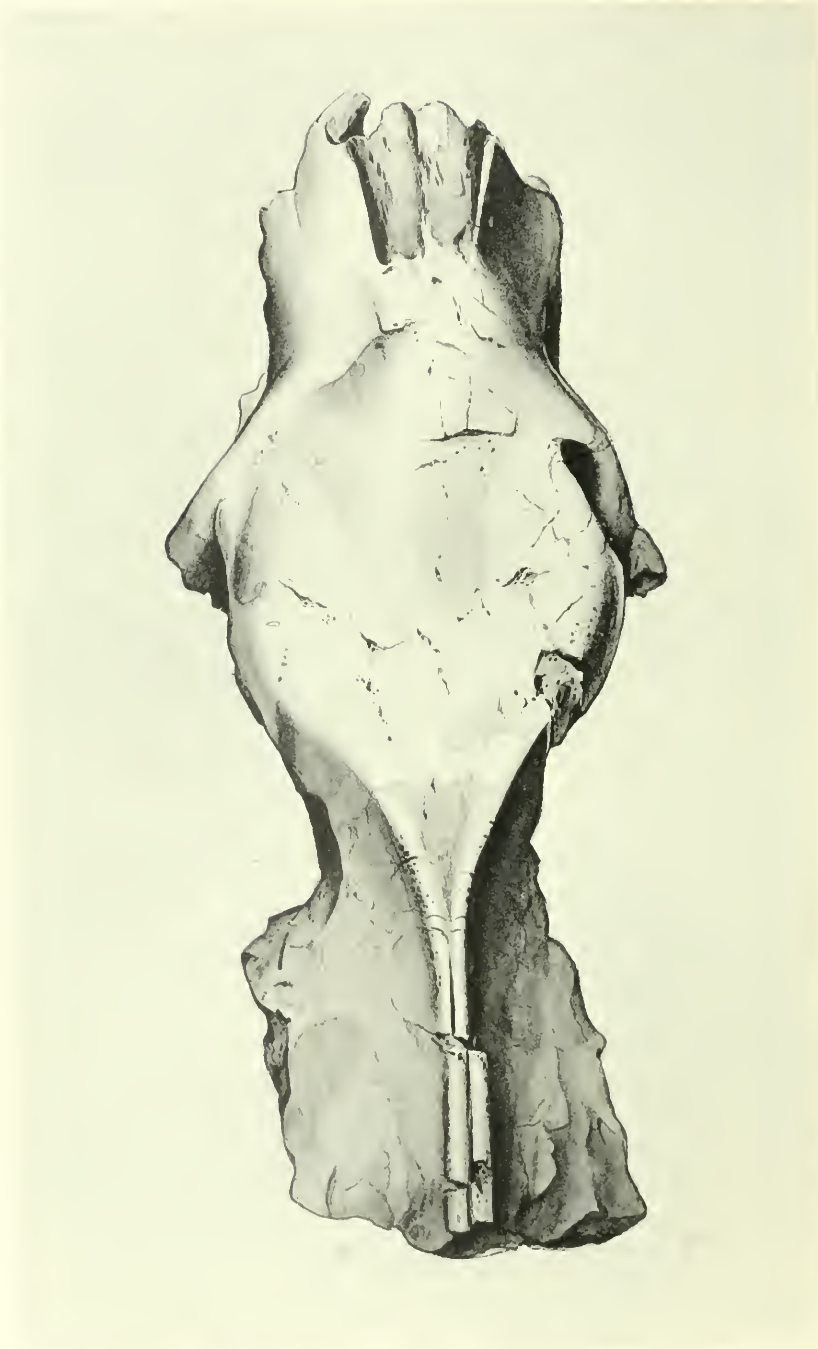
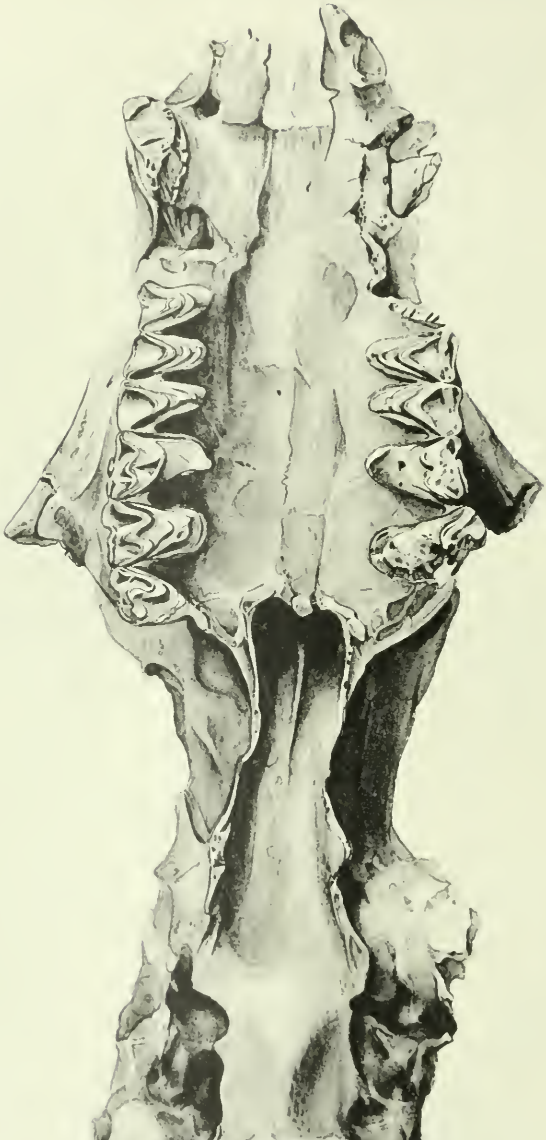


CAENOLAMBDA FROM THE BISON BASIN PALEOCENE

(SEE EXPLANATION AT END OF TEXT.)

Caenolambda from the Bison Basin Paleocene

(See explanation at end of text.)



CAENOLAMBDA FROM THE BISON BASIN PALEOCENE

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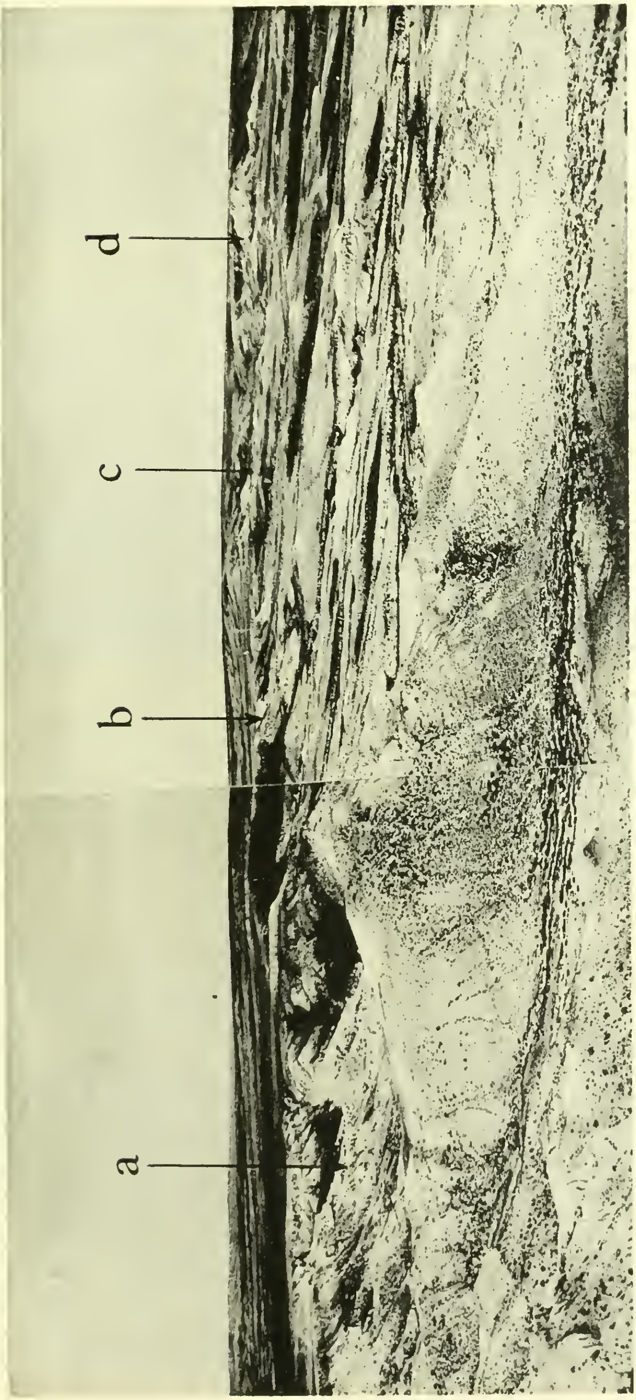

SOUTH RIM OF BISON BASIN SHOWING FOSSIL LOCALITIES

(SEE EXPLANATION AT END OF TEXT.)

TWO FOSSIL LOCALITIES IN THE BISON BASIN

(SEE EXPLANATION AT END OF TEXT.)