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## ADDITIONS TO THE UPPER PALEOCENE FAUNA OF THE CRAZY MOUNTAIN FIELD

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In a previous paper (Simpson, 1936) an Upper Paleocene fauna from a high level in the Fort Union group east of the Crazy Mountains in central Montana was described. During the summer of 1936, Mr. Albert C. Silberling reopened the Scarritt Quarry, from which this fauna was derived, and made a second and still larger collection there for the American Museum. The present paper records the new data derived from this addition to the collection. A specimen from a still higher level at a nearby locality is also described. This specimen was collected by Mr. Silberling personally and was presented to the Museum, while the Scarritt Quarry collection was incidental to Museum expeditions under my direction. The specimens have all been prepared by Albert C. Thomson, and the illustrations are by John C. Germann.

The common forms in the Scarritt Quarry are now all represented by large suites of jaws and teeth, and most of the specimens found by the last collecting added little or nothing to knowledge of the fauna. There are still several rare forms on which our data are very inadequate, but the chances of obtaining better specimens of these by any reasonable amount of quarrying have become small. No further work in the quarry is planned for the near future, and this paper is essentially a final report on the fauna.

### FAUNAL LIST OF THE SCARRITT QUARRY

The following list includes all the specimens now in hand, those already listed (Simpson, 1936) as well as the new material.

| | Number of Specimens | | | |
|---|---|---|---|---|
| | Jaws | | | Isolated |
| | Upper | Lower | Both | Teeth |
| MULTITUBERCULATA | | | | |
| Ptilodontidae | | | | |
| *Ectypodus hunteri* | 3 | 10 | | 44 |
| Gen. et sp. indet. | | | | 2 |

| | Number of Specimens | | | |
|---|---|---|---|---|
| | Jaws | | | Isolated |
| | Upper | Lower | Both | Teeth |
| INSECTIVORA | | | | |
| Leptictidae | | | | |
| *Leptacodon* cf. *tener* | | 6 | | |
| Pantolestidae | | | | |
| *Bessoecetor thomsoni* | 5 | 21 | 1 | 3 |
| *Palaeosinopa senior* | | | | 3 |
| Mixodectidae | | | | |
| *Elpidophorus patratus* | 1 | 4 | 1 | 6 |
| Incertae Sedis | | | | |
| *Unuchinia*[1] *asaphes* | | 1 | | |
| PRIMATES | | | | |
| Plesiadapidae | | | | |
| *Plesiadapis anceps* | | 1 | 1 | 8 |
| Carpolestidae | | | | |
| *Carpodaptes hazelae* | 3 | 6 | 1 | 1 |
| Incertae sedis | | | | |
| *Phenacolemur frugivorus* | | 3 | | |
| CONDYLARTHRA | | | | |
| Hyopsodontidae | | | | |
| *Litolestes notissimus* | 5 | 50 | 1 | 5 |
| CONDYLARTHRA or CREODONTA indet. | | | | 9 |
| PANTODONTA | | | | |
| Pantolambdidae | | | | |
| Gen. et sp. indet. | | | | 2 |
| Totals | 17 | 102 | 5 | 83 |
| Total Jaws | | 124 | | |
| Grand Total | | | 207 | |

The percentages of identified specimens of the common species are as follows:

| | |
|---|---|
| *Ectypodus hunteri* | 28% |
| *Bessoecetor thomsoni* | 14% |
| *Elpidophorus patratus* | 6% |
| *Plesiadapis anceps* | 5% |
| *Carpodaptes hazelae* | 5% |
| *Litolestes notissimus* | 29% |
| All others | 13% |

[1] The name *Apator*, previously applied to this genus, was found to be preoccupied and replaced by *Unuchinia* (Simpson, 1937).

If only the better specimens, jaws, are taken into consideration, *Litolestes notissimus* forms nearly half of the collection and altogether the three most common species, out of the thirteen or probably more present, account for nearly three-fourths of the specimens, but the quarry is mixed and apparently gives a fair sample of a whole faunule, although one of very limited facies.

Except for the last species, *Titanoides zeuxis*, all the material described below is from the Scarritt Quarry.

**Ectypodus hunteri** Simpson, 1936

The large new sample of this species includes good specimens, but has no parts not already known. The material of $P_4$ has approximately the same range as the adequate sample already reported. Two new jaws have $M_1$, the cusp formulae being 9? : 4 and 8 : 4, and there is an isolated $M^1$ measuring 3.1 by 1.4 mm. and with the cusp formula 8 : 11 : 8. The differences from *E. musculus* in these teeth are thus confirmed and may be taken as established.

Ptilodontid Indet.

An isolated ptilodontid $M_2$ measures 3.0 by 2.6 mm., by a coincidence exactly twice both linear dimensions of the type of *Ectypodus hunteri*. This doubtless belongs to the ptilodontid previously reported from an isolated $M^1$, likewise twice the size of those referred to *E. hunteri*. The material is still inadequate to define this apparently new multituberculate.

**Leptacodon** cf. **tener** Matthew and Granger, 1921

There are now six jaws in the collection that represent small insectivores allied to *Leptacodon tener*. They differ considerably among themselves in size, in the development of the metaconid on $P_4$, and in the elevation of the trigonids. Quite possibly more than one species is represented, but the fragmentary specimens do not make this sufficiently clear. The Tiffany specimens of *L. tener* are within the variation of these Scarritt Quarry specimens and further make it impossible to separate the latter from each other or from *L. tener* on any justifiable basis.

**Bessoecetor thomsoni** Simpson, 1936

This species is well represented in the new material, but no additions to the morphology are made. Two good upper jaws confirm the correctness of the composite illustration previously given. The abundant

material now in hand gives the following data on dimensions of lower teeth:

| | N | R | M | $\sigma$ | V |
|---|---|---|---|---|---|
| $LP_3$ | 8 | 1.7 – 2.0 | 1.81 ± .04 | .12 ± .03 | 6.5 ± 1.6 |
| $WP_3$ | 8 | .8 – 1.0 | .888 ± .021 | .060 ± .015 | 6.7 ± 1.7 |
| $LP_4$ | 13 | 2.1 – 2.8 | 2.49 ± .04 | .16 ± .03 | 6.3 ± 1.2 |
| $WP_4$ | 11 | 1.0 – 1.3 | 1.19 ± .03 | .100 ± .021 | 8.4 ± 1.8 |
| $LM_1$ | 12 | 2.0 – 2.5 | 2.19 ± .04 | .14 ± .03 | 6.3 ± 1.3 |
| $WM_1$ | 13 | 1.4 – 1.9 | 1.59 ± .04 | .14 ± .03 | 8.7 ± 1.7 |
| $LM_2$ | 16 | 2.0 – 2.4 | 2.19 ± .03 | .117 ± .021 | 5.3 ± .9 |
| $WM_2$ | 16 | 1.6 – 2.0 | 1.78 ± .03 | .109 ± .019 | 6.1 ± 1.1 |
| $LM_3$ | 16 | 2.3 – 2.8 | 2.56 ± .03 | .127 ± .023 | 5.0 ± .9 |
| $WM_3$ | 14 | 1.6 – 2.0 | 1.79 ± .03 | .106 ± .020 | 5.9 ± 1.1 |

**Palaeosinopa senior,** new species

TYPE.—AMERICAN Museum No. 33990, right $M_3$.

HORIZON AND LOCALITY.—Upper Paleocene, Scarritt Quarry, Crazy Mountain Field, Montana.

DIAGNOSIS.—Trigonid of $M_3$ strongly elevated; talonid small and narrow; entoconid distinct and at least as high as the hypoconid. Dimensions of type 5.2 by 3.4 mm.

The presence of a form allied or belonging to *Palaeosinopa* was recognized from a single upper molar in the first collection from this quarry. It is still represented only by isolated teeth, but these are now three in number, are definitely indentifiable, and are of considerable distributional interest. The lower molar selected as the type is intermediate in size between *P. veterrima* and *P. didelphoides* and might be within the size range of either. As would be expected, it is structurally more like the older of these Lower Eocene species, *P. veterrima*, but has a considerably higher trigonid and other minor distinctions.

American Museum No. 33991 is a right upper molar, probably $M^1$ of this species. It measures 4.7 by 6.0 mm. and differs from $M^1$ of *P. veterrima* in that the hypocone, although not greater in bulk, projects more strongly internally. American Museum No. 33828, measuring 5.0 by 8.0 mm., is likewise a right upper molar, perhaps $M^2$ of this species. Like the tooth just described, it has a small but strongly internal hypocone and otherwise closely resembles the corresponding tooth of *P. veterrima*.

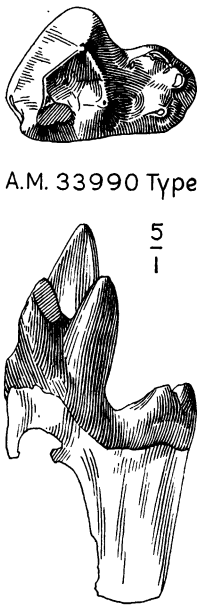


Fig. 1

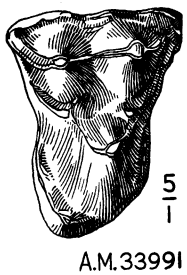


Fig. 2

Fig. 1.—*Palaeosinopa senior*, new species. Type, Amer. Mus. No. 33990, right $M_3$. Crown and internal views. Five times natural size.

Fig. 2.—*Palaeosinopa senior*, new species. Amer. Mus. No. 33991, right upper molar. Crown view. Five times natural size.

**Plesiadapis anceps** Simpson, 1936

A lower jaw, American Museum No. 33978, in the new collection has $P_3$ which closely resembles that of *P. gidleyi*, and has traces of alveoli which seem to indicate that $P_2$ was present as in *P. gidleyi* and unlike other known species of the genus. An isolated incisor, American Museum No. 33976, must belong to this species, but unlike the type it has the basal lingual cuspule as well developed as in *P. gidleyi*, so that the small size of this cuspule evidently was not a constant character of the species.

**Carpodaptes hazelae** Simpson, 1936

A new specimen of this species, American Museum No. 33980, consists of associated left upper and lower jaws with the upper ?canine, $P^2-M^3$, and $P_4-M_3$. This splendid specimen is of particular interest for revealing, for the first time, the whole upper cheek dentition in this family, one of the most peculiar known. An isolated posterior upper premolar of the closely allied genus *Carpolestes* was discovered at

Bear Creek and in the absence of other indications I at first placed it among the Multituberculata (Simpson, 1929). Jepsen (1930) later found in northern Wyoming an upper jaw of *Carpolestes* with $P^3-M^2$ and corrected my serious mistake. The last premolars remarkably resemble those of some multituberculates, but this resemblance is entirely convergent, the molars and the dentition as a whole being very different from any multituberculates and prohibiting any thought of real relationship. $P^{3-4}$ of the present species were described in the first paper on this fauna, but the more anterior upper teeth and $M^3$ have not hitherto been known in any carpolestid.

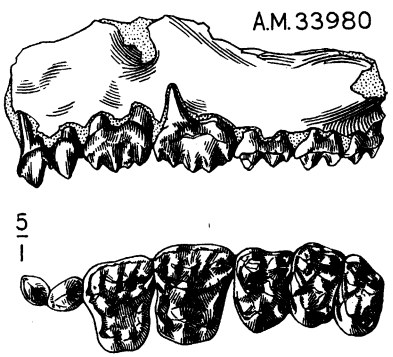


Fig. 3.—*Carpodaptes hazelae* Simpson. Amer. Mus. No. 33980, left upper jaw with C–$M^3$. External and crown views. Five times natural size.

The upper jaw as preserved probably ends anteriorly at the premaxillary suture, but this is not certain. The first two teeth are minute and are closely crowded. They might be either the canine and $P^2$ with $P^1$ missing, or $P^{1-2}$ with the canine probably but not surely missing. From the mode of reduction in analogous and probably allied forms such as *Plesiadapis*, it seems slightly more probable that $P^1$ has been lost. The first tooth has a somewhat proclivous, crested, but not markedly compressed outer cusp, preceded and followed by small cuspules of which the posterior is at a higher level (more basal on the crown). There is a strong, continuous, internal cingulum and the tooth is slightly expanded posterorinternally so as to be oval, or vaguely triangular, in plan. The following tooth, which must be $P^2$ in any case, is similar but is slightly larger, the main cusp is more symmetrical, the cuspules or styles are nearly at the same level, and the plan is less oblique.

$P^{3-4}$ are abruptly and profoundly different from the preceding teeth

in size and in structure. They are nearly unworn and beautifully preserved on this specimen and give details obscure on that previously described. $P^3$ has four large outer cusps, the second largest and the posterior three more closely related to each other than to the first. A narrow but sharp and continuous external cingulum passes around the base of the anteroexternal cusp and is continuous with the anterior cingulum. Posteriorly the external cingulum merges with the posteroexternal cusp without forming a distinct cuspule. A crest departing from the posterior end of the posteroexternal cusp forms a crescent internal to the outer cusps and ends anteriorly in a strong cusp internal to the notch between the first and second outer cusps. Posterior to this the sharp crest is irregular but has no definite cuspules. The internal lobe has a strong anterointernal cusp, preceded by a very vague and feeble cuspule and followed by a strong crest which tends to form a large but poorly distinguished posterointernal cusp.

On $P^4$, in addition to four cusps that closely resemble the external cusps on $P^3$, there are small but distinct anteroexternal and posteroexternal cuspules, both seeming to be developed from the ends of the cingulum. The intermediate crescent has its main cusps in a medial position, preceded by a small cuspule and followed by a sharp crest not developing a definite cusp. On the internal crescent, also, the main cusp is medial and it is preceded and followed by smaller but distinct, subequal cusps.

The more obvious distinctions of $P^{3-4}$ from those of *Carpolestes dubius*, as described by Jepsen (1930) are the more symmetrical plan of $P^3$, more transverse $P^4$, the presence of only four (as opposed to five) external cusps on $P^3$, and the presence of only one definite cusp, not two, on the intermediate crescent of that tooth. $P^3$ of *Carpolestes nigridens*, described by me (1929) as *Litotherium complicatum*, differs still more from that of the present specimen, being less transverse, with an anteroexternal projection more pronounced than in *Carpolestes dubius*, and also with five outer cusps.

$M^{1-2}$ have subequal paracone, metacone, and protocone, well developed subequal conules, sharp and continuous external, anterior, and posterior cingula, and small hypocones which terminate the posterior cingulum at the inner end and are also connected, less strongly, to the protocone tip by a ridge. $M^3$ is not much reduced in size but, as usual, has its posterior parts reduced relative to the anterior.

The seven lower jaws now available do not support the supposed distinction from *C. aulacodon* of greater anteroposterior compression of

$M_{1-2}$, but do confirm the other morphological distinctions and show them to be constant or nearly so, notably the more quadrate $P_4$ with five sharply distinct cuspules and less pointed apex and the more distinct third lobe of $M_3$. There is no size difference between the two species.

*Carpolestes* and *Carpodaptes* are closely allied genera, nearer each other than genera often are in paleontology, yet the several species now known still fall readily and naturally into two definable groups and it is convenient to call these genera. There are many minor distinctions constant in association as far as known, but the most obvious point of contrast is that in *Carpolestes* $P_4$ is relatively enlarged, has more apical cuspules, and its posterior cuspule has been elevated to the paraconid level of $M_1$ and has lost the definite talonid character retained in *Carpodaptes*. In this and all the other apparently distinctive characters, *Carpolestes* seems to be the more specialized genus.

In spite of the extraordinary specialization of the premolars, the facts now known about the carpolestid dentition all seem to me to point to the early primates and to no other group. The most primitive species of *Plesiadapis* have all the basic structures of the carpolestid dentition, and the aberrant specialization of the latter puts these animals on a distinct line of descent, obviously, but does not hide a resemblance so close fundamentally that I cannot conceive any other explanation for it than close relationship and community of origin.

The sample is too small to give good data on numerical variation, but the following figures give some conception of this:

| | N | R | M |
|---|---|---|---|
| $LP_4$ | 4 | 2.3 – 2.7 | 2.50 |
| $WP_4$ | 4 | 1.8 – 1.9 | 1.88 |
| $LM_1$ | 7 | 1.4 – 1.6 | 1.51 |
| $WM_1$ | 7 | 1.4 – 1.7 | 1.50 |
| $LM_2$ | 7 | 1.2 – 1.4 | 1.30 |
| $WM_2$ | 7 | 1.4 – 1.6 | 1.54 |
| $LM_3$ | 4 | 1.9 | 1.90 |
| $WM_3$ | 4 | 1.2 – 1.4 | 1.33 |

The upper teeth of American Museum No. 33980 have the following dimensions:

| ?C | | $P^2$ | | $P^3$ | | $P^4$ | | $M^1$ | | $M^2$ | | $M^3$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | W | L | W | L | W | L | W | L | W | L | W | L | W |
| 0.9 | 0.6 | 1.0 | 0.8 | 1.9 | 2.4 | 2.0 | 2.6 | 1.3 | 2.3 | 1.3 | 2.2 | 1.2 | 2.0 |

**Phenacolemur frugivorus** (Matthew and Granger, 1921)

Two new lower jaws of this species add little to knowledge of it, but it is worthy of note that this increased evidence still gives no suggestion that the Fort Union specimens differ from those of the Tiffany.

Measurements of the three Scarritt Quarry specimens are as follows:

| | $P_4$ | | $M_1$ | | $M_2$ | |
|---|---|---|---|---|---|---|
| | L | W | L | W | L | W |
| 33988 | | | 2.0 | 1.4 | 2.0 | 1.6 |
| 33987 | 1.4 | 1.1 | 1.8 | 1.5 | 2.0 | 1.7 |
| 33896 | 1.6 | 1.1 | 1.9 | 1.4 | 1.8 | 1.5 |

**Litolestes notissimus** Simpson, 1936

This common species is now represented by a remarkably large series of good specimens. American Museum No. 33940 preserves the crown of an incisor, probably $I_2$. It has a long posterolingual heel, not definitely cuspidate. The main apex is recurved and spatulate and posterolabial to it is a distinct accessory cusp. American Museum No. 33941 has the canine, which is enlarged and has a long curving root and shorter curving crown with a feeble and non-cuspidate posterolingual heel but no trace of the second cusp seen on the incisor. The upper incisors and $P_1$ are still unknown and the other parts of the dentition were described previously.

Among these specimens there are many minor morphological variations, and the whole series is worthy of minute study. At present only two interesting points will be mentioned. On $P_4$, a metaconid is always present, but it varies from a small swelling on the protoconid to a sharp, distinct cusp. The intermediate condition is most frequent and the character seems to be a continuous variate distributed normally, although it can hardly be reduced to numerical values. Another markedly variable character is the external cingula of $P_4$–$M_3$. Data on this have some subjectivity, as the variation is apparently continuous but hardly measurable as such, while probably no two observers would agree exactly as to when the cingulum can be said to be present and when absent. Yet the data are comparable when gathered by one student. I have counted the cingulum as present (or well developed) when it is distinctly visible around the external base of the trigonid, and otherwise as absent or poorly developed, and on this basis present the following data.

| Tooth | Number of Observations | Cingulum Distinct | |
|---|---|---|---|
| $P_4$ | 24 | 2 | 8 % |
| $M_1$ | 35 | 11 | 31 % |
| $M_2$ | 36 | 8 | 22 % |
| $M_3$ | 24 | 3 | 12½% |

The following data are derived only from specimens in which observations were made on both $M_1$ and $M_2$ of the same side of the same individual:

| | | |
|---|---|---|
| Well developed on both $M_1$ and $M_2$ | 6 | 20% |
| Only on $M_1$ | 3 | 10% |
| Only on $M_2$ | 1 | 3% |
| On neither | 20 | 67% |

And the following data similarly apply to associated $M_{1-3}$:

| | | |
|---|---|---|
| Well developed on all | 1 | 6% |
| On $M_{1-2}$ but not $M_3$ | 2 | 11% |
| On $M_1$ only | 3 | 17% |
| On $M_3$ only | 1 | 6% |
| On none | 11 | 61% |

From these data it follows that the cingulum is most often well developed on $M_1$ and least often on $M_3$, among the molars. It may be well developed on any one, or probably any two, of the teeth without being so on the others but nevertheless there is a significant tendency for its development on $M_2$ or $M_3$ to be associated with similar development on the more anterior molars, $M_1$ or $M_{1-2}$, respectively. These observations are not of outstanding interest as regards *Litolestes*, particularly, but the accumulation of such data is very important for an understanding of paleontological procedures and of evolution.

The following data are now available for the dimensions of the lower cheek teeth[1]:

| | N | R | M | $\sigma$ | V |
|---|---|---|---|---|---|
| $LP_2$ | 7 | 1.0 – 1.3 | 1.17 ± .05 | .13 ± .03 | 10.9 ± 2.9 |
| $WP_2$ | 6 | .6 – .8 | .68 ± .03 | .069 ± .020 | 10.1 ± 2.9 |
| $LP_3$ | 14 | 1.3 – 1.8 | 1.57 ± .04 | .14 ± .03 | 8.8 ± 1.7 |
| $WP_3$ | 13 | .9 – 1.2 | 1.031 ± .023 | .082 ± .016 | 8.0 ± 1.6 |
| $LP_4$ | 32 | 1.8 – 2.4 | 2.138 ± .025 | .141 ± .018 | 6.6 ± .8 |

[1] As elsewhere in this paper (and all others by me) standard errors are given and each constant is generally recorded to the number of places indicated by the first significant figure of one-third of the standard error. In the present case the raw data would have been better if it could have been recorded to .01 mm., which was impracticable. At least the first two decimal places of the constants, however, are probably little affected by this deficiency, although it may have influenced the high values for V in the first two variates, but these also have large standard errors.

| | N | R | M | $\sigma$ | V |
|---|---|---|---|---|---|
| $WP_4$ | 32 | 1.2 – 1.6 | 1.406 ± .018 | .100 ± .012 | 7.1 ± .9 |
| $LM_1$ | 42 | 1.8 – 2.2 | 1.960 ± .015 | .100 ± .011 | 5.1 ± .6 |
| $WM_1$ | 41 | 1.5 – 1.8 | 1.610 ± .016 | .105 ± .012 | 6.5 ± .7 |
| $LM_2$ | 39 | 1.5 – 1.9 | 1.672 ± .015 | .093 ± .011 | 5.6 ± .6 |
| $WM_2$ | 39 | 1.4 – 1.7 | 1.549 ± .014 | .087 ± .010 | 5.6 ± .6 |
| $LM_3$ | 27 | 1.5 – 1.9 | 1.681 ± .022 | .116 ± .016 | 6.9 ± .9 |
| $WM_3$ | 24 | 1.2 – 1.4 | 1.283 ± .011 | .055 ± .008 | 4.3 ± .6 |

Phenacodont or Arctocyonid, Indet.

Nine isolated teeth, upper and lower, all of about the same size and of similar character, present a difficult taxonomic problem on which it seems best not to attempt a definite commitment until the discovery of associated material reduces the present probability of falling into serious error. Two upper molars and upper and lower probable milk teeth closely resemble *Tetraclaenodon*, but not to the point of specific indentity with any specimens surely referred to that genus and not without also having much resemblance to condylarth-like arctocyonids such as *Tricentes*. Similarly an upper premolar, a broken upper molar, and three lower molars resemble *Tricentes* or similar arctocyonids, yet are not structurally referable to any previously known form and also have a more distant but still definite resemblance to the phenacodonts. There would seem to be considerable chance that these teeth belong to one species in view of their size, structure, relative abundance, and occurrence together. If so they would represent a new and peculiar genus, which is quite possible. On the other hand, they could equally well represent two or more different forms among the phenacodonts and arctocyonids. If they were considered singly, some would be referred to *Tetraclaenodon*, some to a doubtful arctocyonid, and some would be left indeterminate, but the whole series casts doubt on even a vague determination of any of them.

**Titanoides zeuxis,** new species

TYPE.—American Museum No. 35201, left lower jaw with $P_3$, trigonids of $M_{1-2}$, $M_3$, and other fragments.

HORIZON AND LOCALITY.—About 1000 feet stratigraphically above the Scarritt Quarry, "No. 3 beds" of the Fort Union Group, Section 26, Range 14 East, Township 5 North, Sweetgrass County, Montana.

DIAGNOSIS.—Much smaller than *T. primaevus* and slightly smaller than *T. gidleyi*. Lower cheek teeth more or less intermediate between these species and *Pantolambda*, with the trigonid little compressed but paraconid much lower than metaconid on $M_1$ and somewhat lower on $M_2$, trigonids moderately elevated above

talonids, $M_3$ with heel relatively large, hypoconulid and entoconid distinct and subequal, division of third lobe vaguely retained.

The specimen on which this interesting species is based was found on the surface and broken into many pieces, with few positive contacts. There seems to be no doubt that all are of one individual, since they were found together, without admixture of any certainly distinct material, the recognizable fragments without duplication, all of the left lower

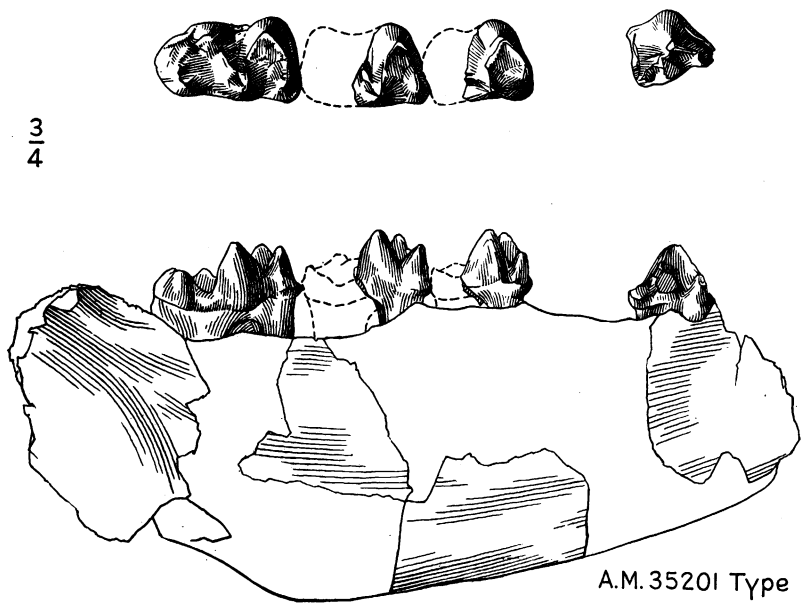


Fig. 4.—*Titanoides zeuxis*, new species. Type, Amer. Mus. No. 35201, left lower jaw with $P_3$, $M_3$, and trigonids of $M_{1-2}$. Crown and internal views. 3/4 natural size.

jaw, and all of an animal of the same size and character and one otherwise unknown. There is one nearly complete premolar in a jaw fragment that might possibly be $P_4$, but from the shape of the bone and the morphology of $P_{3-4}$ in related species it is almost surely $P_3$. A broken isolated tooth might be $P_4$ but there are difficulties in fitting it into this position and it seems best to disregard it. The trigonids of $M_1$ and $M_2$ are well preserved and there can be little question of their correct identification. $M_3$ is complete.

$P_3$ has the trigonid of nearly equal length and width. The paraconid

is very small, but is a distinct cusp. There is an inconspicuous cingular shelf below it on the internal face. The metaconid is broken but was evidently large. The talonid is very small and internal, in form like that of *Pantolambda* or *Titanoides primaevus*. There is a well developed posterior cingulum external to the talonid, proper, and also a much feebler but sharp anterior cingulum. There was probably a still weaker external cingulum, but this is uncertain as the tooth is corroded here.

The molar trigonids are wider than long, but are less compressed anteroposteriorly than is usual in *Pantolambda*. All have upstanding metaconids at least as high as the protoconid and broadly separated from the paraconids. On $M_1$ the paraconid is low and inconspicuous, on $M_3$ it approaches the metaconid in prominence, and on $M_2$ it is intermediate. On all three there is a basal swelling below the paraconid on the internal face and a strong anterior cingulum. There are no distinct metastylids, but a fold or crest in this position is well developed. The elevation of trigonids above talonids seems to be slightly greater than is usual in *Titanoides* and less than in most specimens of *Pantolambda*. The talonid of $M_3$ slightly exceeds the trigonid in length but is narrower. The talonid basin is open on the internal side and there seems to have been no marked proliferation of cuspules in this region. The entoconid and hypoconulid form a united crest, yet they have distinct apices equal in size and in height. There is a distinct emargination between hypoconid and hypoconulid and here there is a strong oblique cingulum.

On comparison of original specimens of the lower cheek teeth of *Pantolambda bathmodon*, *P. cavirictus*, *P. intermedius*, *Titanoides primaevus*, and *Barylambda faberi* and of Jepsen's figures of *Titanoides gidleyi*, all the valid species with which the present specimen is comparable, any sharp distinction between *Pantolambda* and *Titanoides* seems to disappear. As Patterson (1933) considered possible, the characters of *Titanoides* (including the form recently made type of *Barylambda;* Patterson, 1937) given by him as distinctive from *Pantolambda* in this region almost all intergrade when the whole known series is compared and there is no definite line. As tendencies rather than as hard and fast rules, the molar trigonids of *Titanoides* may be relatively lower and less compressed anteroposteriorly and the talonid of $M_3$ tends to be shorter, more rounded, with the internal cusps less individualized. In all these characters, and most others, the present specimen is about intermediate between *Pantolambda* and *Titanoides*. As between *Pantolambda* and *Barylambda* it is decidedly closer to *Pantolambda*, but on the whole it resembles *Titanoides primaevus* more than it does any recognized species

of *Pantolambda*. As *T. primaevus* is the genotype, reference to *Titanoides* thus seems preferable, but this new species practically obliterates what few diagnostic characters might still have been used to separate the genera on the basis of these teeth.

I differ from Patterson's first opinion in believing that the *Titanoides* and *Barylambda* dentitions, as a whole, are more specialized than that of *Pantolambda*. As far as the lower cheek dentition is concerned, *Pantolambda bathmodon – Titanoides zeuxis – Titanoides primaevus – Barylambda faberi* seem to me to form an ascending structural series. There probably are exceptions in details of structure, such as the compression of the trigonid in *Pantolambda*, which may be specialized but still is not a very pronounced distinction. Patterson has, however, demonstrated that this close structural relationship, which he also emphasizes, can hardly reflect direct phylogenetic connection between known species of *Pantolambda* and *Barylambda*.

There is no doubt that *Titanoides* belongs to the family Pantolambdidae, but its subfamily reference is very uncertain. Patterson (1934) divided the family into Pantolambdinae and Titanoidinae, but the division was based on skeletal characters observed in *Titanoides faberi* and not in the genotype. In removing *T. faberi* from *Titanoides* to a new genus, *Barylambda*, Patterson (1937) has necessarily deleted the subfamily Titanoidinae, since the characters assigned to that group are not in fact known in *Titanoides*, and substituted Barylambdinae. He now refers *Titanoides* (*sensu stricto*) to that subfamily, but strongly emphasizes the tentative nature of the reference. It cannot be determined until skeletal material of *Titanoides* is found. With equal emphasis on the dubiousness of any reference at present, I would very tentatively place *Titanoides* in the Pantolambdinae. The skeleton, when discovered, may very well completely negative the dental evidence, but in parts actually known now *Titanoides* seems to me somewhat closer to *Pantolambda* than to *Barylambda*.

The dimensions of the type teeth of *Titanoides zeuxis* are as follows:

| $P_3$ | | $M_1$ | $M_2$ | $M_3$ | |
|---|---|---|---|---|---|
| L | W | W[1] | W[1] | L | W |
| 14.7 | 12.6 | 13.7 | 14.0 | 25.1 | 14.2 |

[1] These are across the trigonid, the talonid being missing, but doubtless on both these teeth the trigonid width was greater and would be recorded as the tooth width even on complete teeth.

## REFERENCES


JEPSEN, G. L. 1930. 'Stratigraphy and paleontology of the Paleocene of northeastern Park County, Wyoming.' Proc. Amer. Phil. Soc., LXIX, pp. 463–528.

PATTERSON, B. 1933. 'A new species of the amblypod *Titanoides* from Western Colorado.' Amer. Jour. Sci., XXV, pp. 415–425.

1934. 'A contribution to the osteology of *Titanoides* and the relationships of the Amblypoda.' Proc. Amer. Phil. Soc., LXXIII, pp. 71–101.

1937. 'A new genus, *Barylambda*, for *Titanoides faberi*, Paleocene Amblypod.' Geol. Ser. Field Mus. Nat. Hist., VI, pp. 229–231.

SIMPSON, G. G. 1929. 'Third contribution to the Fort Union fauna at Bear Creek, Montana.' Amer. Mus. Novitates, No. 345, pp. 1–12.

1936. 'A new fauna from the Fort Union of Montana.' Amer. Mus. Novitates, No. 873, pp. 1–27.

1937. '*Unuchinia*, new name for *Apator* Simpson, not Semenow.' Journ. Paleont., XI, p. 78.