Article IX.—REMOUNTED SKELETON OF PHENACODUS PRIMAÆVUS. COMPARISON WITH EUPROTOGONIA.

By Henry Fairfield Osborn.

Plate XII and Four Text Figures.

This unique skeleton was transferred to the American Museum with the remainder of the Cope Collection in 1893. It had been mounted¹ as found (Fig. 1), laterally crushed, a large portion of the vertebrae and ribs concealed so that their number could not be definitely ascertained, and in such position as to convey a false impression both of the proportions and mode of location of this remarkably primitive Ungulate.

After very careful deliberation we decided to remove the skeleton entirely from the matrix, and remount it as nearly as possible in the natural position. This removal cost many months of labor

¹ See Cope, 'Tertiary Vertebrata,' Plate LVII E.
and two months more were occupied by Mr. Hermann, Prepara-
tor, in mounting the animal as represented in Plate XII. This
mount is now a model of its kind, since it not only displays the
real characters of the animal, but every bone upon one side of
the body or the other can be removed for purposes of detailed
study. Moreover, in course of removal of the stone and plaster
matrix, the two missing cervical vertebrae were found inserted
in the tail, and the number of ribs was definitely ascertained to
be fifteen on each side, thus positively determining the dorsal
vertebral formula, a matter of very great importance. These
results alone justify the labor involved.

As photographed in Plate XII, Phenacodus primatus strikes us
as a rather slenderly built, straight-limbed animal, digitigrade
like the Tapir, five-toed, but almost exclusively supported on
three toes both upon the fore and hind feet, with the median toe
considerably enlarged, well hoofed, and extended beyond the
others; therefore functionally of the tridactyl type. Flower's
restoration, in his volume upon the Horse, is very nearly correct.
The upwardly-arched back, powerful lumbar vertebrae, the long
hind-quarters (measuring 635 mm.), the long powerful tail, when
 contrasted with the much shorter fore-quarters (measuring 460
mm.), the rather low withers and small head, are reminiscent of
Creodont ancestry.

Phenacodus was, in fact, a swift-footed, cursorial, small-brained,
microcephalic type (in distinction from Coryphodon). It was
largely propelled by its powerful hind limbs. The skeleton is,
however, straight limbed at the elbow in contrast with the early
Amblypods, such as Pantolambda and Coryphodon. In this
respect it approaches that of the Perissodactyla. The terminal
phalanges of the three median toes are broad and spreading,
while the lateral phalanges have rather the narrow compressed
type seen in Euprotogonia.

The most striking features of the skull are the small size and
separation of the basicranial foramina, the simple primitive struc-
ture of the whole region around the ear at the base of the skull
(the auditory meatus being bounded posteriorly by the mastoid),

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Osborn, Remounted Skeleton of Phenacodus primævus.
and the longitudinal grooves upon the superior intranareal surfaces of the maxillaries (also observed in Coryphodon). The proportions and characters of the skull (exclusive of the teeth) are identical with those in the ancient Amblypoda, such as Periptychus and Pantolambda.

The distinctive feature of the vertebral column is the small number of dorsal vertebrae, namely 15, exactly as in Coryphodon and Titanotherium, giving a dorso-lumbar formula of 20-21. In

Fig. 3. Skeleton of Phenacodus primorus placed in the standing position to show elevation of the withers. One-twelfth natural size.

the writer's opinion this number is characteristic of the primitive Condylarthra or Protungulata. Marsh,1 on the other hand, has assigned to the Holodactyla (Condylarthra) 23 dorso-lumbers, and to the Protungulata 30 dorso-lumbers or more. The second distinctive feature is found in the splitting of the transverse processes on the posterior dorsals for articulation with the tubercles of the ribs and for the support of the zygapophyses respectively, as shown in Fig. 2, these processes being sharply separate.

1 'Dinocerata,' pp. 171, 172.
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TABLE OF MEASUREMENTS.

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<th>Measurement</th>
<th>Phenacodus</th>
<th>Euprotogonia</th>
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<tbody>
<tr>
<td>Length, chin to perpendicular line of tail</td>
<td>4 43/4</td>
<td>1.340</td>
</tr>
<tr>
<td>Length, chin to ischiac symphysis</td>
<td></td>
<td>1.220</td>
</tr>
<tr>
<td>Length skull, condyles to symphysis of pre-maxillae</td>
<td></td>
<td>.235</td>
</tr>
<tr>
<td>Height, dorsal spines at withers</td>
<td></td>
<td>.550</td>
</tr>
<tr>
<td>Height, dorsal spines at hips</td>
<td></td>
<td>.585</td>
</tr>
<tr>
<td>Limbs, total length of hind-limb, outside measurement</td>
<td>2</td>
<td>.655</td>
</tr>
<tr>
<td>Limbs, total length of fore-limb, outside measurement</td>
<td>1</td>
<td>.460</td>
</tr>
</tbody>
</table>

Euprotogonia puercensis thus appears to be about one-half the size of Phenacodus primævus in all its measurements. As shown in Fig. 4, the lateral digits are considerably longer, reaching the ground.

![Fig. 4. Skeleton of Euprotogonia puercensis as now mounted, with missing parts restored in outline from Phenacodus. One-twelfth natural size. Same scale as P. primævus.](image)

COMPARISON WITH EUPROTOGONIA.

Euprotogonia.  [TORREJON.]

2. Fore-limb. Posterior face of ulna convex. (C.)
3. Ectepicondylar ridge prominent. (C.)
4. Magnum very small. (C.)
5. ? Os centrale. (C.)
6. Trapezoid very short. (C.)
7. Terminal phalanges laterally compressed, intermediate between hoofs and claws.

Phenacodus.  [WASATCH.]

The same, concave.
The same.
Magnum somewhat enlarged.
The same wanting.
The same somewhat enlarged.
Hoofs fully formed in P. primævus.
More compressed in P. (Trizpons-dylus) wortmani.
The same.
**COMPARISON WITH EUPROTOGONIA.—Continued.**

<table>
<thead>
<tr>
<th><strong>Euprotogonia.</strong></th>
<th><strong>Phenacodus.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>[Torrejón.]</td>
<td>[Wasatch.]</td>
</tr>
<tr>
<td>(9) Tibial spines sharp and prominent; cnemial crest very prominent and elongate. (C.)</td>
<td>The same. Cnemial crest less prominent, and shorter.</td>
</tr>
<tr>
<td>(10) No fibulo-calcaneal facet.</td>
<td>The same.</td>
</tr>
<tr>
<td>(11) Astragalocuboidal facet depressed.</td>
<td>The same.</td>
</tr>
<tr>
<td>(12) An astragalar foramen; tibial trochlea in front of foramen, i.e., sub-digitigrade. (C.)</td>
<td>No astragalar foramen. Tibial trochlea extended further back, i.e., fully digitigrade.</td>
</tr>
<tr>
<td>(13) Meso-cuneiform very short. (C.)</td>
<td>The same.</td>
</tr>
<tr>
<td>(14) Lateral digital reduction advanced: ratio of Mts.V : Mts.III : 23 mm. 37 mm., or as 2 : 3.</td>
<td>Lateral digital reduction still more advanced: ratio of Mts.V : Mts. III : 35 mm. : 73 mm., or as 1 : 2,</td>
</tr>
<tr>
<td>(15) Metatarsals and phalanges slightly curved. (C.)</td>
<td>The same nearly straight.</td>
</tr>
</tbody>
</table>

This strengthens the observation of Matthew,¹ in his recent comparison of these types, that the features in which *Phenacodus* differs from *Euprotogonia* are progressions from the Creodont type, as indicated in the above column by the letter C.

A far larger proportion of Creodont characters are, however, found in the Amblypod contemporary of *Euprotogonia*, namely, *Pantolambda*, which will be fully described by the writer in a forthcoming paper.

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