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# PALEONTOLOGY AND GEOLOGY OF THE BADWATER CREEK AREA, CENTRAL WYOMING. PART 19. PERISSODACTYLA

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## ABSTRACT

Eight species of perissodactyls, representing six families, are found in the Badwater faunas. All of these except a titanothere are absent from the locality 20 assemblage, suggesting both temporal and ecological differences between that and the other Badwater assemblages.

## INTRODUCTION

Certain late Eocene perissodactyls have been reviewed by Radinsky (1963, 1964, 1967). Even so, material in the Badwater collection adds significantly to our knowledge of the late Eocene helaletid *Dilophodon*, and raises questions about our understanding of late Eocene titanotheres and horses. Thorough review of both these groups is now badly needed.

The species of perissodactyls and their distribution in the Badwater localities are given in Table 1. I believe it is significant that no perissodactyl other than a titanothere is found at locality 20. The faunule from locality 20 has been considered on other evidence (Black, 1978: 231) to be younger than that from the other Badwater localities but slightly older than the LaPoint and Pearson Ranch faunas. The absence of *Dilophodon* and *Epitriplopus* at locality 20 may reflect the younger age of that assemblage, while the absence of *Epihippus*, *Colodon*, and *Amynodon* is due either to depositional or to paleoecological factors.

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Table 1.—*Perissodactyls in the Badwater Fauna.*

| Locality | Taxa |
|---|---|
| | Family Equidae |
| 6 | *Epihippus gracilis* |
| 5, 5A, 6, 7, Wood Dry Creek | *Epihippus parvus* |
| | Family Brontotheriidae |
| 3, 20 | ? *Telmatherium* cf. *T. cultridens* |
| | Family Eomoropidae |
| Dry Creek | *Grangeria*? *anarsius* |
| | Family Helaletidae |
| 5, 5A, 6, 7 | *Dilophodon leotanus* |
| 5, 5A, 6, 7, Rodent | *Colodon woodi* |
| | Family Hyracondontidae |
| 5, 6 | *Epitriplopus uintensis* |
| | Family Amynodontidae |
| 3, 5, 6 | *Amynodon* sp. |

The questions of faunal correlation and paleoecology will be dealt with in detail in the final paper of the Badwater series.

All measurements given are in millimeters. Abbreviations used are as follows: CM, Carnegie Museum of Natural History; KUMNH, Museum of Natural History, University of Kansas; PU, Princeton University Museum; USNM, Smithsonian Institution; L, length; W, width; N, number; SD, standard deviation; CV, coefficient of variation.

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## SYSTEMATIC REVIEW

### Order Perissodactyla
### Family Equidae Gray, 1821
### Genus *Epihippus* Marsh, 1878
### *Epihippus gracilis* (Marsh), 1871

*Referred specimens.*—USNM 21092, $RP^2$-$P^4$; 21094, lower molar; CM 16861, isolated upper molar; 14423, 14426 isolated lower cheek teeth.

*Locality.*—All CM specimens from locality 6 (Black and Dawson, 1966).

*Discussion.*—*Epihippus gracilis* is a rare form at Badwater. Only five specimens are known, all but one of which are isolated teeth. However, the larger size of these few specimens clearly sets them off from specimens of *Epihippus parvus*, a species which is more com-

monly found at Badwater. Measurements for dentition of *E. gracilis* (length followed by width) are as follows: 16861 LM, 9.5, 11.8; 14423 $RP_4$, 7.8, 6.0; 14426 RM, 9.2, 6.5.

### *Epihippus parvus* Granger, 1908

*Referred specimens.*—USNM 21091, $RP^2$-$P^3$; 21093, isolated lower molariform tooth; CM 14424, 14427–14429, 14459–14461, 14464–14466, 14526–14529, 14531–14533, 14581, 14582, 14842, 15267–15275, 16069, 16808, 16815, 16862–16864, 18189, 18190, 18259, 18260, 19740, 19741, 19753, 21992, 21993, 28863, 28881, 28882, 29016–29018, all isolated molariform teeth.

*Localities.*—5, 5A, 6, 7, Wood, Dry Creek.

*Discussion.*—This smaller species of *Epihippus* is much more common at Badwater than is *E. gracilis* and it is found at most localities. As all the material is isolated teeth little can be said except that the Badwater specimens of *E. parvus* compare favorably in size and morphology with specimens of this species from the Uinta C Myton Member of the Uinta Formation in northeastern Utah.

## Family Brontotheriidae Marsh, 1873
## Genus *Telmatherium* Marsh, 1872
## ? *Telmatherium* cf. *T. cultridens*
(Figs. 1–2)

*Referred specimens.*—CM 21211, partial left mandible with $P_3$-$M_3$; 25381, femur, tibia, proximal end of scapula, partial innominates.

*Locality.*—20.

*Discussion.*—In the absence of diagnostic skull material it is difficult to arrive at a reliable generic determination of this form. On the basis of size and overall dental morphology the jaw is quite similar to the type of *Telmatherium cultridens* (PU 10027), a partial skull and mandible with complete dentition from Henry's Fork Divide, Bridger Basin, Wyoming (Osborn, 1929:168). The Badwater mandible is smaller than that of species of *Telmatherium* known from the late Eocene and it is also smaller than any of the other late Eocene titanotheres of the genera *Diplacodon, Eotitanotherium, Dolichorhinus, Metarhinus, Sthenodectes,* and *Manteoceras*. The dentition is bunodont with the crests rounded, not elevated and sharp as in the known late Eocene species.

Wood et al. (1936) cited the presence of *Telmatherium* cf. *cultridens* at Badwater locality 3 but this reference was made on the basis of half a lower molar (Gazin, 1956). Until all late Eocene titanotheres are reviewed, a review which is badly needed, assignment of this Badwater specimen must remain questionable.

On the basis of its dental morphology this specimen appears to represent persistence into the late Eocene of a more generalized, middle Eocene species. Measurements are given in Table 2.

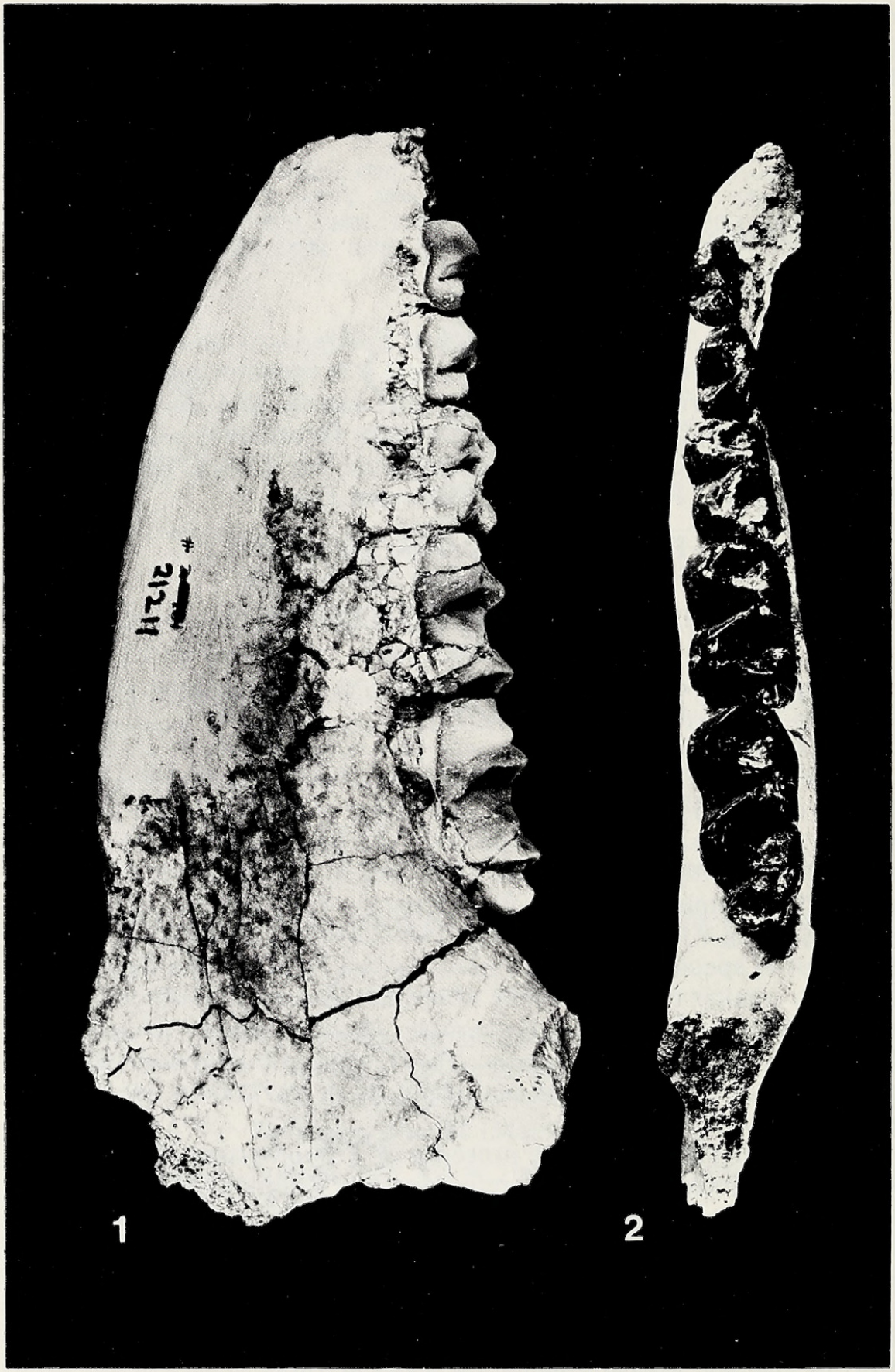
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Table 2.—*Measurements of* ?Telmatherium *cf.* T. cultridens *(CM 21211 $LP_3$-$M_3$).*

| Teeth | L | W |
|---|---|---|
| $P_3$ | 20.3 | 12.2 |
| $P_4$ | 22.5 | 14.5 |
| $M_1$ | 28.0 | 20.0 |
| $M_2$ | 38.0 | 25.5 |
| $M_3$ | 50.7 | 25.0 |

## Family Eomoropidae Matthew, 1929
## Genus *Grangeria* Zdansky, 1930
## *Grangeria? anarsius* (Gazin, 1956)

*Eomoropus anarsius* Gazin, 1956:12.

*Locality.*—Dry Creek locality, SE ¼, S.9, T.39N., R.92W., Fremont County, Wyoming.

*Discussion.*—No additional material of this chalicothere has been found since Gazin's original description of the only known specimen, USNM 21097, a partial skull with left $C^1$, $P^3$, and $M^{1-3}$ and a left mandible with $P_3$-$M_3$. Radinsky (1964:16) transferred the species from *Eomoropus* to *Grangeria*.

*Grangeria? anarsius* is not yet known to occur in the main suite of Badwater localities along Badwater Creek in Natrona County. The single known specimen comes from the Dry Fork locality several miles to the west in Fremont County.

## Family Helaletidae Osborn, 1892
## Genus *Dilophodon* Scott, 1883
## *Dilophodon leotanus* (Peterson), 1931
## (Figs. 3–5)

*Heteraletes leotanus* Peterson, 1931:68.

*Referred specimens.*—USNM 21098 both maxillae with $P^3$-$M^3$; 20207 right mandible with $P_2$-$M_3$; about a dozen isolated cheek teeth in the USNM collections; KUMNH 17188, 17207–17209, isolated molars; CM 28837, partial $RP^1$-$M^3$; 14462, 18241, $P^1$; 14425, 15998, $P^2$; 14580, 19757, $P^3$; 14578, 16893, $P^4$; 14475, partial $RM^2$-$M^3$; 16060, $LP^4$-$M^3$; 14583, 14837, 18239, 19756, 25329, $M^1$; 14577, $M^2$; 14535, 15277, 15588, 18240, 21995, $M^3$; 23652, left mandible with $dP_2$-$dP_4$-$M_1$-$M_2$, right mandible with $dP_3$-$dP_4$-$M_1$-$M_2$; 19772, $LP_3$-$P_4$; 14457, 14591, $P_3$; 28892, $P_4$; 14454, 14478, 14579, $M_1$; 18186, $M_3$.

*Localities.*—5, 5A, 6 and 7.

←

Fig. 1.—?*Telmatherium* cf. *T. cultridens*, CM 21211, lateral view left mandible, ×½.

Fig. 2.—?*Telmatherium* cf. *T. cultridens*, CM 21211, occlusal view $LP_3$-$M_3$, ×½.

Table 3.—*Measurements of teeth of* Dilophodon leotanus.

| Catalog nos. | Teeth | L | W |
|---|---|---|---|
| CM 14457 | $P_3$ | 5.3 | 4.7 |
| CM 14591 | $P_3$ | 5.2 | 4.6 |
| CM 19772 | $P_3$ | 6.1 | 4.4 |
| CM 19772 | $P_4$ | 6.5 | 5.1 |
| CM 28892 | $P_4$ | 6.0 | 5.5 |
| CM 23652 | $M_1$ | 8.2 | 6.0 |
| CM 23652 | $M_1$ | 8.1 | 6.0 |
| CM 14579 | $M_1$ | 8.3 | 5.9 |
| CM 14454 | $M_1$ | 8.5 | 6.4 |
| CM 14478 | $M_1$ | 8.5 | 6.3 |
| CM 23652 | $M_2$ | 9.2 | 6.5 |
| CM 23652 | $M_2$ | 9.1 | 6.4 |
| CM 18186 | $M_3$ | 10.1 | 6.8 |
| CM 14462 | $P^1$ | 4.6 | 4.6 |
| CM 18241 | $P^1$ | 4.5 | 4.0 |
| CM 14425 | $P^2$ | 5.2 | 6.1 |
| CM 15998 | $P^2$ | 5.2 | 6.2 |
| CM 19757 | $P^3$ | 5.7 | 8.6 |
| CM 14580 | $P^3$ | 5.9 | 8.9 |
| CM 14578 | $P^4$ | 6.3 | 8.7 |
| CM 16893 | $P^4$ | 6.1 | 9.0 |
| CM 16060 | $P^4$ | 5.9 | 8.8 |
| CM 25329 | $M^1$ | 7.5 | 8.5 |
| CM 18239 | $M^1$ | 7.6 | 9.5 |
| CM 19756 | $M^1$ | 6.6 | 8.2 |
| CM 14582 | $M^1$ | 7.7 | 8.8 |
| CM 16060 | $M^1$ | 7.1 | 8.8 |
| CM 14577 | $M^2$ | 8.3 | 9.2 |
| CM 16060 | $M^2$ | 8.2 | 9.5 |
| CM 18240 | $M^3$ | 9.0 | 10.5 |
| CM 15588 | $M^3$ | 8.8 | 10.3 |
| CM 21995 | $M^3$ | 9.5 | 10.3 |
| CM 16060 | $M^3$ | 8.6 | 10.1 |

*Discussion.*—Radinsky (1963:53–56) has provided a thorough description of the *Dilophodon* dentition and has compared the dental morphology of *D. leotanus* with that of *D. minusculus*. He characterized *D. leotanus* as being slightly smaller than *D. minusculus* with a small hypocone on $P^3$-$P^4$ and with shortened lower premolar trigonids.

→

Fig. 3.—*Dilophodon leotanus*, CM 16060, $LP^4$-$M^3$, ×1.

Figs. 4–5.—*Dilophodon leotanus*, CM 23652, occlusal and medial view, left mandible, $dP_3$-$M_2$, ×1.


3
4
5


6
7

The larger sample of *D. leotanus* from Badwater confirms that $P_3$-$P_4$ are shorter than $P_3$-$P_4$ of *D. minusculus* and that they have anteroposteriorly compressed trigonids. There is no hypocone on $P^3$. One $P^3$ shows a short metaloph (CM 19757), whereas another (CM 14580) has no metaloph at all. The three $P^4$s in the sample show the same metaloph variation from no metaloph (CM 16060) to a complete metaloph (CM 16893). A small hypocone is discernable on one $P^4$ (CM 14578) but no hypocone is present on the other $P^4$s.

The upper and lower molars are closer in size to those of *D. minusculus* than are the premolars (Table 3). The differences in the anterior dentition and in the symphysis would seem to warrant specific separation of *D. minusculus* and *D. leotanus* as suggested by Gazin (1956) and Radinsky (1963).

## Genus *Colodon* Marsh, 1890
## *Colodon woodi* (Gazin), 1956

*Desmatotherium woodi* Gazin, 1956:17.

*Holotype.*—USNM 20200, $RP^3$-$M^3$.

*Referred specimens.*—USNM 20201, $P^4$-$M^1$; 20202, $RP^1$-$P^4$, $M^2$-$M^3$; CM 28873, $RP^3$; 14534, partial $RM^1$; 14463, partial $LM^2$; 15279, $LM^2$; 15593, $RM^2$; 15594, $RM^1$; 15595, $LM^3$; 21994, $LM_1$.

*Localities.*—5, 5A, 6, 7, and Rodent.

*Discussion.*—The additional Carnegie Museum specimens add little to what was already known of this species (Radinsky, 1963:62) except to support that *Colodon woodi* (Table 4) is smaller than *Colodon kayi*.

The single lower molar is relatively narrower than similar teeth of *Colodon kayi*. The paralophid is weak and there is no metalophid.

## Family Hyracodontidae Cope, 1879
## Genus *Epitriplopus* Wood, 1927
## *Epitriplopus uintensis* (Peterson, 1919)
## (Figs. 6–7)

*Referred specimens.*—CM 14430, right lower molar; 14530, left lower molar; 16052, left $M^3$; 17501, left lower molar; USNM, 21099, left lower molar.

*Localities.*—CM 14530, locality 5, all other Carnegie specimens from locality 6.

*Discussion.*—Gazin (1956:23) recorded the presence of a hyracodontid at Badwater on the basis of one complete and two fragmentary lower molars. He assigned the material to *Epitriplopus* stating that he could not be certain whether the form represented *Epitriplopus*, *Triplopus*, or *Prothyracodon*.

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Figs. 6–7.—*Epitriplopus uintensis*, (6) CM 14430, RM, ×2. (7) CM 16052, $LM^3$, ×2.

Table 4.—*Measurements of teeth of* Colodon woodi.

| Catalog nos. | Teeth | L | W |
|---|---|---|---|
| CM 28873 | $RP^3$ | 8.7 | 11.4 |
| CM 15594 | $RM^1$ | 11.1 | 14.5 |
| CM 15279 | $LM^2$ | 12.4 | 14.4 |
| CM 15593 | $RM^2$ | 12.9 | 15.8 |
| CM 15595 | $LM^3$ | 14.3 | 16.2 |
| CM 21994 | $LM_1$ | 11.4 | 8.5 |

*Prothyracodon* is a synonym of *Triplopus* while Peterson's *Prothyracodon uintensis* (Peterson, 1919) was made the type of *Epitriplopus* by Wood (1927). Among other diagnostic characters the cheek teeth of *Epitriplopus* are higher crowned than those of *Triplopus* and there is no trace of a metacone on $M^3$ in *Epitriplopus*, whereas the metacone is distinct in *Triplopus* (Radinsky, 1967:27).

The Badwater material includes an $M^3$ with no metacone and the posterior extension of the ectoloph extremely reduced and displaced far lingually. In this character the tooth is intermediate between that of the most reduced $M^3$ of *Triplopus*, seen in *T. rhinocerinus* (Radinsky, 1967:Plate 1) and the $M^3$ of *Epitroplopus uintensis* where no posterior ectoloph extension is seen. This reduction together with the height of crown of the worn lower molar (CM 14430) and of the $M^3$ lead me to assign the Badwater hyracodont to *Epitriplopus uintensis*. Measurements are given in Table 5.

## Family Amynodontidae Scott and Osborn, 1883
## Genus *Amynodon* Marsh, 1877
## *Amynodon* sp.

*Material.*—CM 15447, fragment of left maxilla with partial $M^2$ and base of $M^3$.
*Locality.*—3.

*Discussion.*—Wood, Seton, and Hares (1936) recorded the presence of *Amynodon advenus* from Badwater, Wyoming, in a series of interbedded tuffaceous silts and pond limestones. This was later recorded as locality 3 by Tourtelot (1957). The original Badwater collection made by Wood, Seton, and Hares has not been seen by us and our material is too fragmentary for specific allocation.

Table 5.—*Measurements of teeth of* Epitriplopus uintensis.

| Catalog nos. | Teeth | L | W |
|---|---|---|---|
| CM 16052 | $M^3$ | 16.5 | 18.9 |
| CM 14430 | $M_1$ or $_2$ | 18.0 | 11.1 |
| CM 17501 | $M_1$ or $_2$ | 16.0 | 11.1 |

In addition to the fragmentary maxilla, there are in the Carnegie Museum collections fragments of molar enamel from localities 5 and 6 which probably are those of an amynodont.

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