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EOCENE FOSSIL MAMMALIA FROM THE SAND WASH BASIN, NORTHWESTERN MOFFAT COUNTY, COLORADO

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Introduction

A small, biostratigraphically significant assemblage of fossil vertebrates has been accumulated over the past 50 years from the Sand Wash Basin of northwestern Moffat County, Colorado. The Sand Wash deposits that yielded these fossils appear to be an outlier of the much better known Washakie Formation of the Washakie Basin to the north, and there are numerous faunal similarities as well. The mammals provide evidence suggesting that faunas representing both Bridgerian and Uintan land-mammal ages may be recognized in the Sand Wash beds.

The previously published record of Sand Wash Eocene vertebrates is incomplete. This paper documents the entire mammalian fauna known to us, updates and consolidates taxa that have been previously published, and examines the biostratigraphic position of the Sand Wash fauna.

History of Study

Fossil vertebrates from the Sand Wash Basin were first collected by Carnegie Museum of Natural History parties directed by Earl Douglass and including J. Leroy Kay in 1922, 1923, and 1924. These collec-

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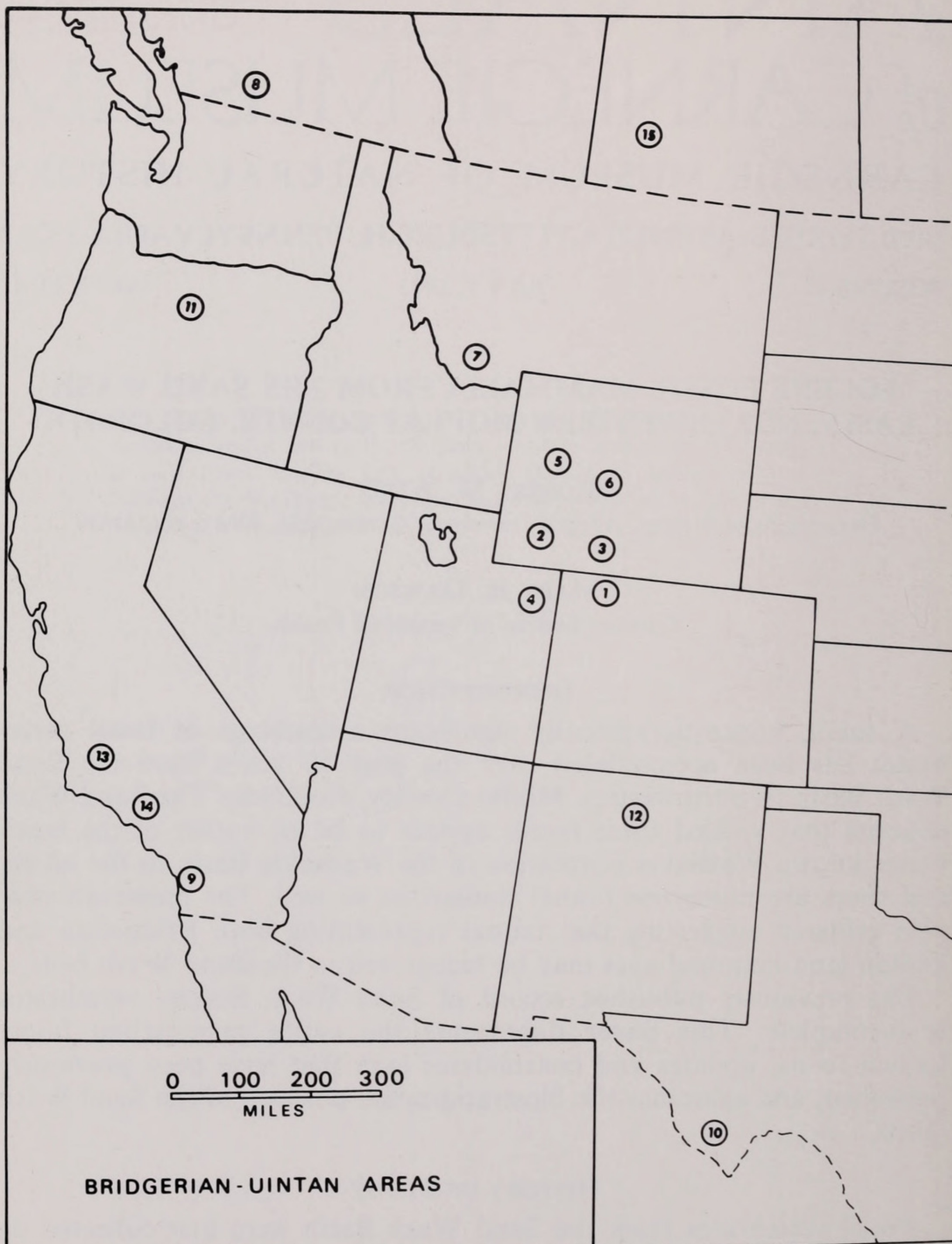

Fig. 1 Distribution of Bridgerian and Uintan mammalian fossil-producing areas in western North America. Areas indicated as follows: 1. Sand Wash Basin; 2. Green River Basin; 3. Washakie Basin; 4. Uinta Basin; 5. Togwotee Pass; 6. Wind River Basin; 7. Southwestern Montana; 8. Princeton; 9. San Diego; 10. Big Bend; 11. Clarno; 12. Galisteo; 13. Sespe; 14. Poway; 15. Swift Current Creek.

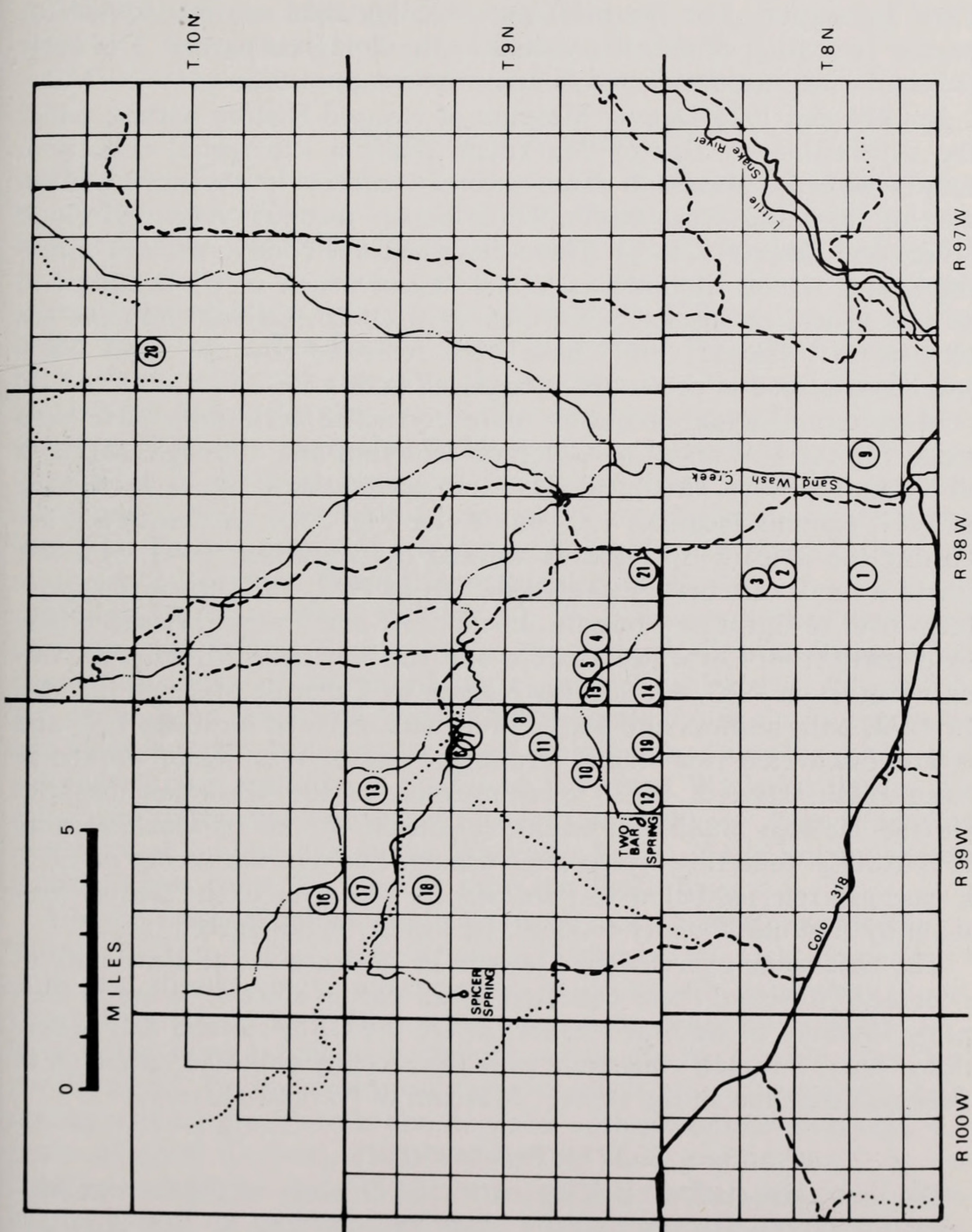

Fig. 2. Outline map of part of the Sand Wash Basin, western Moffat County, Colorado. Heavy solid lines=paved highways; heavy dashed lines=graded roads; heavy dotted lines =trails; light solid lines=flowing streams; light interrupted lines=intermittent streams; numbers=fossil vertebrate localities.

tions were incidental to studies of the nearby later Tertiary Brown's Park Formation. For the most part, locality data are inadequate for precise relocation of the sites visited by the Douglass parties. This early collection was not mentioned in any previous publication.

In 1924 and 1925 Denver Museum of Natural History parties, under the supervision of Harvey Markman, made a substantial collection, mostly of large mammals from several localities in the northwestern part of the Sand Wash Basin. Three papers resulted: Abel and Cook (1925) and Cook (1926a,b). These described one condylarth, one uintathere, and several titanotheres, almost all of which were considered to be new genera or species. Since then, *Hyopsodus* (Gazin, 1968) and the uintatheres (Wheeler, 1961) have been reviewed and the Sand Wash specimens placed in previously recognized taxa.

More recently, taxonomically more diversified collections have been made for the University of Colorado Museum and Carnegie Museum of Natural History. One of us (Dawson) spent several weeks in the area in 1961, opening localities 1, 2, and 3 (see Fig. 2 for locations), and revisiting the Spicer's Spring area worked by Markman. P. O. McGrew found a small vertebrate locality (loc. 20) in 1962, and turned the specimens over to Carnegie Museum. Localities 1 and 3 were revisited briefly by a party from Carnegie Museum and the American Museum of Natural History in 1963, and locality 3 again by Carnegie Museum in 1964. In 1972, both authors and M. C. McKenna revisited localities 1, 2, and 3, and discovered two others, localities 4 and 5. West again worked in Sand Wash Basin in 1973, revisiting most of the Markman localities (10-19). He also found four additional sites (6-9), one of which, locality 9, is readily collectible by screen-washing. Early in the spring of 1973, a specimen referred below to *Parahyus* sp. was given to the Denver Museum by a Moffat County resident. Its locality is designated loc. 21.

The specimens collected by Dawson in 1961 are in the University of Colorado Museum; those collected by all parties since 1961 are in Carnegie Museum of Natural History, as are the Douglass and Kay collections. The Markman collection, plus the recently collected specimen of *Parahyus,* remains in the Denver Museum of Natural History.

ACKNOWLEDGEMENTS

We thank the staff of the Department of Geology of the Denver Museum of Natural History (Messrs. Jack Murphy and K. Don Lindsey) and the University of Colorado Museum (Drs. Peter Robinson and Judith Van Couvering) for access to specimens in their respective charges. Drs. Edward J. McKay and Richard Mauger contributed unpublished data on the geology of the Sand Wash Basin. John Sutton and Helen McGinnis prepared the photographs. This research was supported by NSF grant GB20263A1 to West, and NSF grant G14254 to Dawson.

The following museum abbreviations are used below:
DMNH - Denver Museum of Natural History
UCM - University of Colorado Museum, Boulder
CM - Carnegie Museum of Natural History, Pittsburgh

GEOLOGICAL SETTING

The Sand Wash Basin is an isolated area of about 600 square miles of middle-to-late Eocene lacustrine and fluvial rocks in northwestern Moffat County, Colorado (Fig. 1). The most recent mapping, by Edward J. McKay of the U. S. Geological Survey, shows well the southern fault contact with middle Tertiary rocks (Brown's Park Fm.) and the eastern onlap onto the earlier Eocene Green River and Wasatch Formations. McKay's maps do not extend to the northern and western sides of the Sand Wash Basin. For these areas reference must be made to Sears and Bradley (1924) and Sears (1924). Maps of Sears and Bradley show conformability of the later beds over the Green River formation in those directions as well. The nearest presumably correlative rocks are in the Washakie Basin, north of the Wyoming line, about 15 miles north of the north end of the Sand Wash Basin (Roehler, 1973).

McKay (letter to West, October 30, 1972) follows earlier work and uses the term Bridger Formation for the Sand Wash post-Green River Formation rocks. However, he agrees with Roehler that, "the 'Bridger' of the Sand Wash and Washakie Basins are lithologically and faunally alike, and key beds can be traced from one basin to the other; and although faunas are alike in the Green River and Washakie Basins, the lithologies differ. For this reason, Roehler suggests the name Washakie for rocks of Bridger age in the Washakie Basin. If the Survey adopts Roehler's new name, I'll use it in the Sand Wash Basin."

All the fossil mammal localities are in rocks mapped by McKay as "upper Bridger." This designation is, however, of local importance only, and should not be construed to be necessarily equivalent to the Green River Basin Twin Buttes Member of the Bridger Formation. We have noted some lithologic variations across the basin within the "upper Bridger." To the northwest there is much more channelling, producing striking green sandstone deposits, with prominent overbank deposits adjacent to them. These are rich in bone, and appear to be the lithologies exploited by the Markman parties whose localities all were in that part of the exposure area (Fig. 2). To the southeast the sediment seems considerably finer, shows relatively less channelling, and floodplain and lacustrine environments are predominant.

Markman (in Cook, 1926b:12) believed that all his specimens were recovered from no more than 200 feet of vertical section. He did not, however, report any materials from the southern and eastern part of the basin, where additional localities were found more recently. These are up to a few hundred feet lower, topographically, than some of the Markman localities, and are down strike from them. Unfortunately, ground cover and faulting make positive correlations across the basin difficult. It may be that the southeastern localities are significantly lower in the section than the northwestern ones.

Occurrence of Fossils

Fossil bone is not abundant in the Sand Wash Basin, but is present in most places. Turtles are the most frequently encountered vertebrates, and several kinds, both terrestrial and aquatic, are present. In the northwestern part of the basin only a few scraps of smaller mammals have been encountered, while larger perissodactyls and uintatheres predominate. Farther southeast, large mammals continue to be a significant part of the assemblage, but remains of small organisms, fish, amphibians and reptiles, as well as mammals, occur more frequently. Fossil wood is common throughout Sand Wash Basin.

The 21 vertebrate fossil localities in the Sand Wash Basin are indicated approximately in Fig. 2. The precise locality data are on file in the Department of Geology, Milwaukee Public Museum, and the Section of Vertebrate Fossils, Carnegie Museum of Natural History.

Faunal List

Marsupicarnivora
- Didelphidae
  - *Peratherium marsupium*

Insectivora
- Pantolestidae
  - *Pantolestes natans*

Carnivora
- Miacidae
  - *Viverravus minutus*
  - *Viverravus* sp.
  - *Uintacyon vorax*

Primates
- Adapidae
  - *Notharctus robustior*
- Omomyidae
  - *Washakius* sp.

Rodentia
- Ischyromyidae
  - *Leptotomus bridgerensis*
  - Ischyromyid sp.

Sciuravidae
- *Tillomys* sp. cf. *T. senex*

Condylarthra
- Hyopsodontidae
  - *Hyopsodus despiciens*

Perissodactyla
  Equidae
    Orohippus sylvaticus
  Helaletidae
    Hyrachyus modestus
    Hyrachyus small species
    Isectolophus sp. cf. *I. latidens*
  Brontotheriidae[1]
    Tanyorhinus blairi
    Tanyorhinus bridgeri
    Tanyorhinus harundivorax
    Tanyorhinus sp.
    Telmatherium accola
    Telmatherium advocata
    Manteoceras foris
    Manteoceras pratensis
    Metarhinus sp.
Dinocerata
  Uintatheriidae
    Eobasileus cornutus
Artiodactyla
  Dichobunidae
    Homacodon sp. cf. *H. vagans*
    Parahyus sp.

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[1]See following discussion of these particular assignments.

SYSTEMATIC PALEONTOLOGY

Class Mammalia
Subclass Metatheria
Order Marsupicarnivora
Family Didelphidae
Peratherium marsupium (Troxell, 1923)

Two molar teeth (CM 23193, locality 1, and CM 23194, locality 9) are assigned to this species. CM 23193, M^2, has a well developed stylar cusp C, but is so worn that the degree of development of the other stylar cusps cannot readily be seen. The presence of cusp C prevents assignment to *Peratherium knighti* (McGrew, 1959:147-148). In its size (length 2.3 mm, width 2.3 mm) as well as the size of the lower molar, CM 23194 (length 2.0 mm, anterior width 0.7 mm, posterior width 0.6 mm), there is a good fit with *Peratherium marsupium* from the Green River Basin (West, 1973:80).

Peratherium marsupium occurs through Bridgerian time. The phylogenies of Eocene didelphids are so poorly understood that this species is of little biostratigraphic significance.

Subclass Eutheria
Order Insectivora
Family Pantolestidae
Pantolestes natans Matthew, 1909

This is the single representative of Insectivora in the Sand Wash collection. The size of both UCM 21475 (locality 2) and CM 23189 (locality 1) places this form among the middle-to-large *Pantolestes* of Matthew (1909). Comparison with a suite of *Pantolestes* molars from the Green River Basin shows that the Sand Wash specimens are larger than the average from the Bridger Formation. The most reasonable assignment for these specimens is in *P. natans,* a late Bridgerian species. The genus is also known from post-Bridgerian rock in Uintan deposits of the Uinta Basin.

Order Carnivora

Family Miacidae

Viverravus minutus Wortman, 1901

An isolated highly sectorial P_4 (CM 14915, locality 3) is referred here. It is a slender tooth (6.4 mm long, 3.0 mm wide) with a pronounced posterior hypoconid. The genus is known definitely only from the Bridgerian, and this species is reported from throughout the Bridgerian.

Viverravus sp.

An isolated M^2 (CM 23199, locality 20) is tentatively placed in this genus. It is a simple tooth with no hypocone and only the paraconule visible. It is most similar morphologically to *V. minutus,* the tiniest of the later Bridgerian miacids, but this single tooth does not permit secure species identification.

Uintacyon vorax Leidy, 1872

Fig. 3

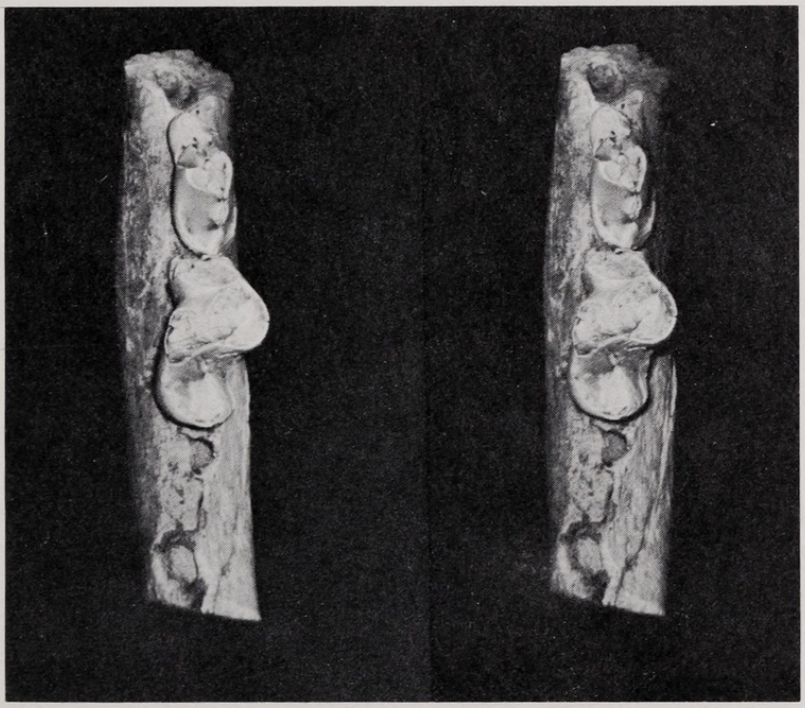
This species is represented by a dentary fragment (CM 23191, locality 4) with P_4-M_1 and roots of all post-canine teeth. There is a short diastema between C and P_1 and between P_1 and P_2. P_2 and P_3 are sub-equal in size and double-rooted. P_4 is sectorial, with a well developed hypoconid. M_1 has a high paraconid and a well developed enclosed talonid basin. M_2 is double-rooted, while the much smaller M_3 has only a single root. There are two mental foramina, one beneath the anterior root of P_2 and the other beneath the anterior root of P_3. The symphysis is long and stout. *Uintacyon vorax* is a Bridgerian species, but the genus is also known from Uintan rocks at Myton Pocket, Uinta Basin, Utah.

Order Primates

Family Adapidae

Notharctus robustior (Leidy, 1872)

One specimen (UCM 33360) with M^1 and M^2 is definitely *N. robustior,* and a second (UCM 33394), a lower molar trigonid, is tentatively



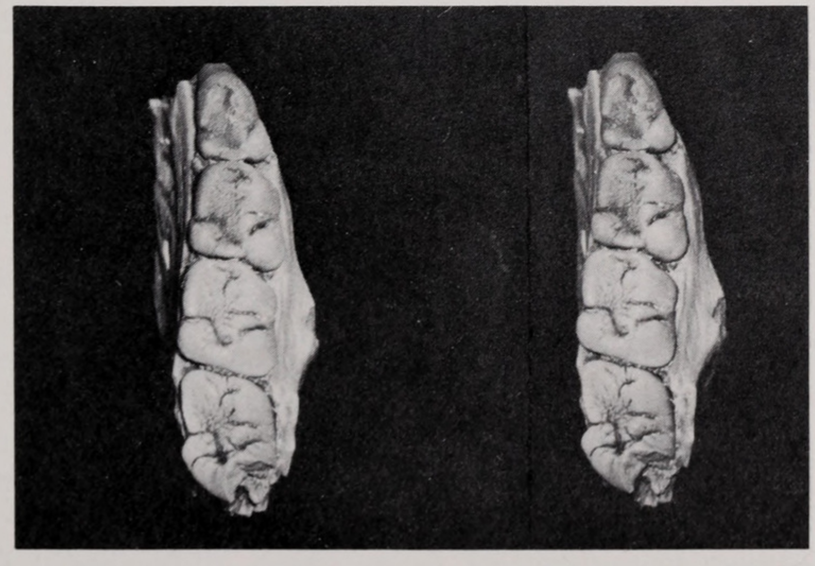


Fig. 3. (top) *Uintacyon vorax,* part of CM 23191, right jaw with P_4-M_1 (stereophotographs).
Fig. 4. (bottom) *Leptotomus bridgerensis,* CM 14907, right jaw with dP_4, M_{1-3} (stereophotographs). Line equals 1 cm.

placed here. Both were found at locality 3. Both the size and topography of these teeth conform to those of *N. robustior* (Robinson, 1957). *Notharctus* is well known from the late Wasatchian through Bridgerian, and has recently been reported in an early Uintan fauna in the Washakie Basin (Turnbull, 1972).

Family Omoyidae
Washakius sp.

A single lower first molar (CM 23200, locality 20) is assigned to *Washakius*. It is similar in size to Bridgerian *W. insignis*, but enough of the enamel is spalled off to render insecure a precise species identification. *Washakius* is a common Bridgerian genus, and has also been reported from a Uintan locality (Poway) in southern California.

Order Rodentia

Most of the rodent specimens from these Sand Wash localities and all that are relatively completely represented by upper and lower jaws with teeth are referable to *Leptotomus bridgerensis*. A few other fragmentary remains may represent two other ischyromyid taxa, and one tooth represents the Sciuravidae. The lack of diversity of the rodent fauna from the Sand Wash Basin is striking in contrast to the situation in the Green River Basin, from which more varied ischyromyids and sciuravids as well as cylindrodontids are known. Whether this difference reflects more complete collecting in the Green River Basin or has some paleoecologic basis is uncertain at present.

Family Ischyromyidae
Leptotomus bridgerensis Wood, 1962
Fig. 4

SPECIMENS: CM Nos. 14905-14907, 16098; UCM Nos. 33351-33353, 33361, 33380, 33386, 33390, 33917. All locality 3.

One of the most characteristic features of *Leptotomus*, the shape of the lower incisor [convex and narrow anteriorly, widest about two thirds of the distance from the anterior face (Wood, 1962:64)] typifies the lower jaws referred here. Upper and lower cheek teeth, though not greatly different from those of *Paramys*, are morphologically similar to previously known specimens of *Leptotomus bridgerensis*. In size this sample overlaps Wood's sample (1962:90-91) in about half of their measurements but ranges larger in the remainder. In spite of this difference, the overlap and morphological resemblance support reference to *Leptotomus bridgerensis*, already known from the Green River and Washakie Basins.

One lower jaw, CM 14907, has dP_4, previously unknown in this species. It is a slender tooth, relatively elongate in the trigonid, and has an anterior cingulum curving anteriorly and linguad from the protoconid. This specimen also exhibits the wrinkled enamel characteristic of early stages of wear.

The lower jaws referred here are variable in development of the masseteric fossa, which is distinct in all specimens but more heavily ridged in jaws of the older individuals.

It is interesting to note that *Leptotomus bridgerensis,* the species most adequately represented in the Sand Wash fauna, is the only ischyromyid reported (Wood, 1962) from Bridgerian deposits in the Washakie Basin, suggesting that environments sampled in these two basins may be similar.

Ischyromyid spp.

Two specimens, an isolated incisor (UCM 33369, locality 3) and a jaw fragment with incisor (UCM 33918, locality 3), represent two additional rodent taxa, probably ischyromyid. One has a relatively wide incisor and the other, a larger form, has an incisor that is widest posteriorly. The specimens, which are not referable to *Leptotomus,* are not adequate for positive generic identification.

Family Sciuravidae
Tillomys sp. cf. *T. senex* Marsh, 1872

One lower molar tooth, probably M_2 (CM 23197, locality 20), is close in size and morphology to the Bridgerian species *Tillomys senex.* It is to be hoped that additional small mammalian remains might be recovered from this locality, which was found and collected by P. O. McGrew.

Order Condylarthra
Family Hyopsodontidae
Hyopsodus despiciens Matthew, 1909

Hyopsodus markmani Abel and Cook, 1925:34
Hyopsodus despiciens Gazin, 1968:15

SPECIMENS: UCM Nos. 33307-33349, 33354, 33356, 33357-33359, 33372, 33378; CM Nos. 14887-14903, 14908, 16097, 16100-16101, 23190, locality 3; CM Nos. 23185-23186, locality 2.

Abel and Cook (1925) described a new species, *H. markmani,* from the Sand Wash Basin, DMNH 486 as the holotype. However, Gazin (1968:28-29) pointed out that DMNH 486, instead of being M^1 - M^2, as described originally, is actually dP^4 - M^1, and that it represents the already known late Bridgerian species *H. despiciens,* as do the other eight specimens collected by Markman. We concur with the synonomy. *Hyopsodus despiciens* is by far the most common species in the collections from the southern and eastern Sand Wash localities.

TABLE 1.
DISTRIBUTION OF SAND WASH FAUNA BY LOCALITY[1]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Peratherium marsupium	1[2]								1												
Pantolestes natans	1	1																			
Viverravus minutus			1																		
Viverravus sp.																				1	
Uintacyon vorax				1																	
Notharctus robustior			2																		
Washakius sp.																				1	
Leptotomus bridgerensis			12																		
Ischyromyid sp.			2																		
Tillomys sp. cf. *T. senex*																				1	
Hyopsodus despiciens		2	72									X[3]									
Orohippus sylvaticus			6	1																1	
Hyrachyus modestus			2																		
Hyrachyus small sp.	1		1																		
Isectolophus sp. cf. *I. latidens*																		?			
Tanyorhinus blairi												X									
Tanyorhinus bridgeri											X	X						X			
Tanyorhinus harundivorax										X											
Tanyorhinus sp.											X	X						X			

[1]Localities numbered as in Fig. 2.
[2]Number of determined specimens from each locality in CM and UCM 1961 and post-1961 collections.
[3]Presence at a locality in older collections.

TABLE 1 (cont'd).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Telmatherium accola												X									
Telmatherium advocata												X									
Manteoceras foris												X									
Manteoceras pratensis												X									
Manteoceras sp.											X	X	X								
Metarhinus sp.									1												
Undet. titanotheres	X	X	X			X	X	X		X		X	X	X	X	X		X	X		
Eobasileus cornutus											X		X								
Undet. uintatheres											X		X				X				
Homacodon sp. cf. *H. vagans*			2																		
Parahyus sp.																					1

TABLE 2.
TEMPORAL DISTRIBUTION OF SAND WASH EOCENE MAMMALIAN GENERA

	Bridger A-B	Bridger C-D	Washakie A (lower)	Washakie B (upper)	Wagonhound	Myton
Peratherium	X	X		X		
Pantolestes	X	X			X	X
Viverravus	X	X				
Uintacyon		X				X
Notharctus	X	X	X	X		
Washakius	X	X				
Leptotomus		X	X	X	X	X
Tillomys		X				
Hyopsodus	X	X	X	X	X	
Orohippus	X	X	X			
Hyrachyus	X	X	X	X	X	
Isectolophus		X			X	X
Tanyorhinus				X	X	
Telmatherium			X		X	
Manteoceras			X	X	X	
Metarhinus			X	X	X	
Eobasileus			X	X	X	
Homacodon		X	X			
Parahyus[1]						

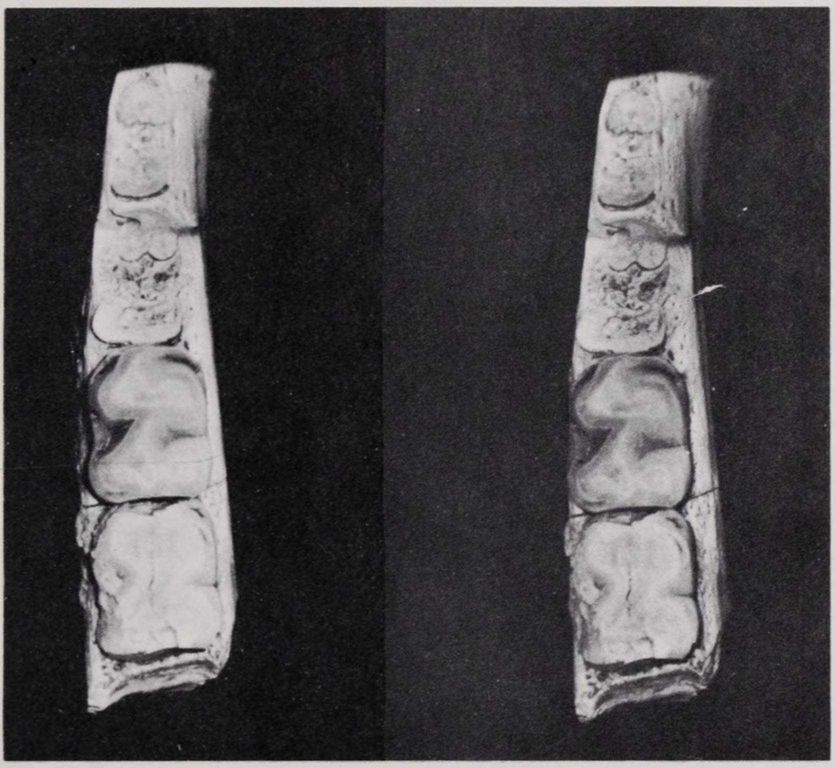
[1]Locality of type of *P. vagus* uncertain, possibly Uintan of Washakie Basin (McKenna, 1972:93); referred specimen from Bridgerian-Uintan Tepee Trail Formation (Lewis, 1973; McKenna, 1972).

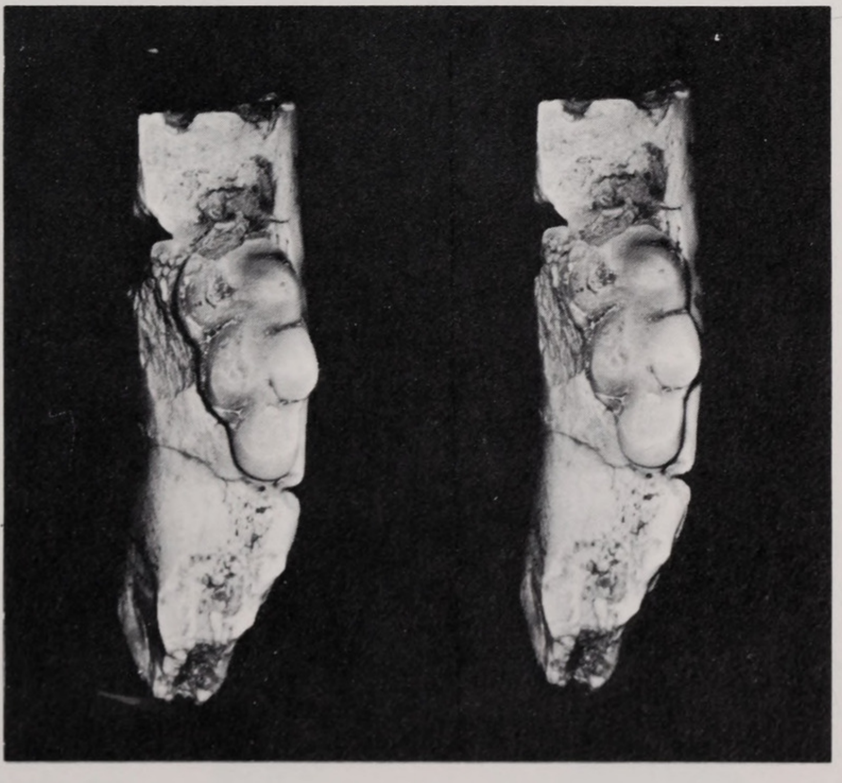
Order Perissodactyla
Suborder Equoidea
Family Equidae
Orohippus sylvaticus Leidy, 1870
Figs. 5, 6, 7

SPECIMENS: UCM 24303, 33363, 33366, 33381, 33386, 33389, locality 3; CM 23188, locality 4; CM 23198, locality 20.

These specimens are placed in *O. sylvaticus* rather than *O. agilis,* which is approximately the same size, because of the broad heel on M_3 and the subequal anterior and posterior widths of P_4 on which the anterior end is markedly narrower in *O. agilis* (Kitts, 1957). *O. sylvaticus* is later Bridgerian in age, and *Orohippus* is succeeded in the Uintan by the more advanced *Epihippus,* characterized by greater molarization of the premolars.

Suborder Tapiroidea
Family Helaletidae
Subfamily Hyrachyinae
Hyrachyus modestus Leidy, 1870





Figs. 5, 6. *Orohippus sylvaticus,* UCM 24301, left jaw with P_4-M_1, M_3 (stereophotographs). Fig. 5, P_4-M_1. Fig. 6, M_3. Line equals 1 cm.

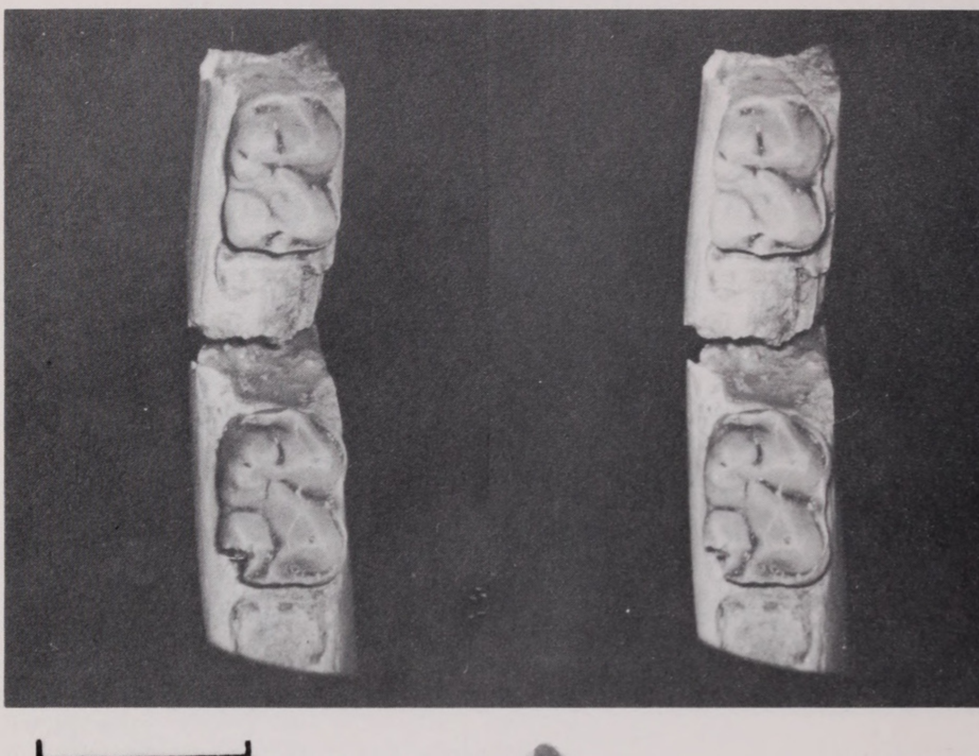


Fig. 7. (top) *Orohippus sylvaticus*, UCM 24302, right jaw with P_4, M_2 (stereophotographs). Line equals 1 cm.

Fig. 8. (bottom) *Hyrachyus*, small sp., CM 14904, jaws with right and left dP_{3-4}, M_1. Line equals 1 cm.

One badly broken dentary fragment, UCM 33382 (locality 3), appears to represent this species. Its size is appropriate (Radinsky, 1967) but it is too fragmentary for further comments. UCM 33388 (locality 3), a broken upper molar, probably also may be assigned to *H. modestus.*

Hyrachyus small species
Fig. 8

Two well-preserved dentaries (UCM 33355, locality 1, and CM 14904, locality 3) may document a new species of *Hyrachyus.* CM 14904 has dP_3, dP_4, and M_1 in both rami. The permanent incisors and canine are in early stages of eruption, and thus do not provide reliable measurements.

These materials represent an animal too small to be placed realistically in either recognized species of *Hyrachyus* (Radinsky, 1967), and do not belong to any other known helaletid (*Isectolophus, Dilophodon,* for example). A new species of *Hyrachyus* may be represented, but definite determination should await more complete, mature specimens.

Isectolophus cf. *I. latidens* Osborn, Scott, and Speir, 1878

CM 11381 is a nearly complete skull of a very young tapiroid, having dP^{2-4} and unworn M^1 preserved. It is currently under study by W. D. Turnbull. Although precise locality information is lacking for the specimen, greenish sandstone matrix adhering to the skull suggests that it came from the northwestern group of localities near Spicer Spring. Immaturity make identification of the skull difficult, but in size of M^1 (length, 11.5 mm; width, 12.2 mm) the specimen is closer to the range of the Bridgerian species *I. latidens* than to that of the Uintan *I. annectens* (Radinsky, 1963:22-25).

Subclass Brontotherioidea
Family Brontotheriidae

Cook (1962b) recognized considerable diversity among the Sand Wash titanotheres. Unfortunately his paper was published while Osborn's 1929 monograph on the titanotheres was in press, so the Sand Wash taxa were not worked into Osborn's grand synthesis. Cook did not make adequate comparative studies of the Sand Wash specimens, so many of his species characterizations are inadequate. A thorough revision of titanotheres is greatly needed, with attention to individual and sexual variation of these animals. It would be premature and would only add to nomenclatorial confusion to do more in this study than suggest possible synonomies.

Tanyorhinus blairi Cook, 1926
Tanyorhinus bridgeri Cook, 1926
Tanyorhinus harundivorax Cook, 1926
Tanyorhinus sp.

The genus *Tanyorhinus* and these three species were described as new by Cook. His generic comparison was with *Dolichorhinus,* the well-known early Uintan narrow-skulled genus. Our review of Cook's material and comparison of it with specimens of *Dolichorhinus* in the Carnegie Museum collections suggest that Cook's generic characteristics may be attributed to individual variation, sexual dimorphism, wear stages of the teeth, and post-mortem crushing. Therefore, we believe that *Tanyorhinus* may realistically be included within *Dolichorhinus.*

The three species of *Tanyorhinus* proposed by Cook seem to be biologically unnecessary. *T. blairi* and *T. bridgeri* appear to be sexual dimorphs, with *T. blairi* probably the male. The holotype of *T. blairi* differs from that of *T. bridgeri* in being a bit larger and more robust. *T. harundivorax* is represented by a single dentary fragment, less worn than specimens of Cook's other two species. It is difficult to maintain this as specifically separate. It appears to us to be simply a younger individual of the species represented by the much more complete material of *T. blairi* and *T. bridgeri.*

Telmatherium accola Cook, 1926
Telmatherium advocata Cook, 1926

Telmatherium is a well-established genus from the Wagonhound. We concur with Cook's generic assignment, even though he himself was not positive of it (1926b:16). We question the biological necessity for two species, again for the reason of sexual dimorphism. The holotype of *T. advocata* seems more robust than the holotype of *T. accola.* Our preference is to recognize a single Sand Wash species of *Telmatherium.*

Manteoceras foris Cook, 1926
Manteoceras pratensis Cook, 1926
Manteoceras sp.
Fig. 9

This genus is known from both Bridgerian and early Uintan times, as it is frequently found in the Green River, Washakie, and Uinta Basins. Several specimens in the Carnegie Museum collection are more complete than those available to Cook, and permit more careful study. CM 11380 and CM 11382 share attributes of both Bridgerian *M. manteoceras* and Uintan *M. uintensis.*

The holotype (DMNH 487) of *M. foris* is a dentary with deciduous teeth. Cook differentiated it from *M. pratensis* by the shape and simplicity of the premolars, which apparently were not recognized as deciduous. It is now preferable to regard the Sand Wash specimens of *Manteoceras* as individuals of a single species. Until a larger sample is available, it is not possible to determine whether *M. manteoceras* or *M. uintensis* is the more appropriate species designation for this material.

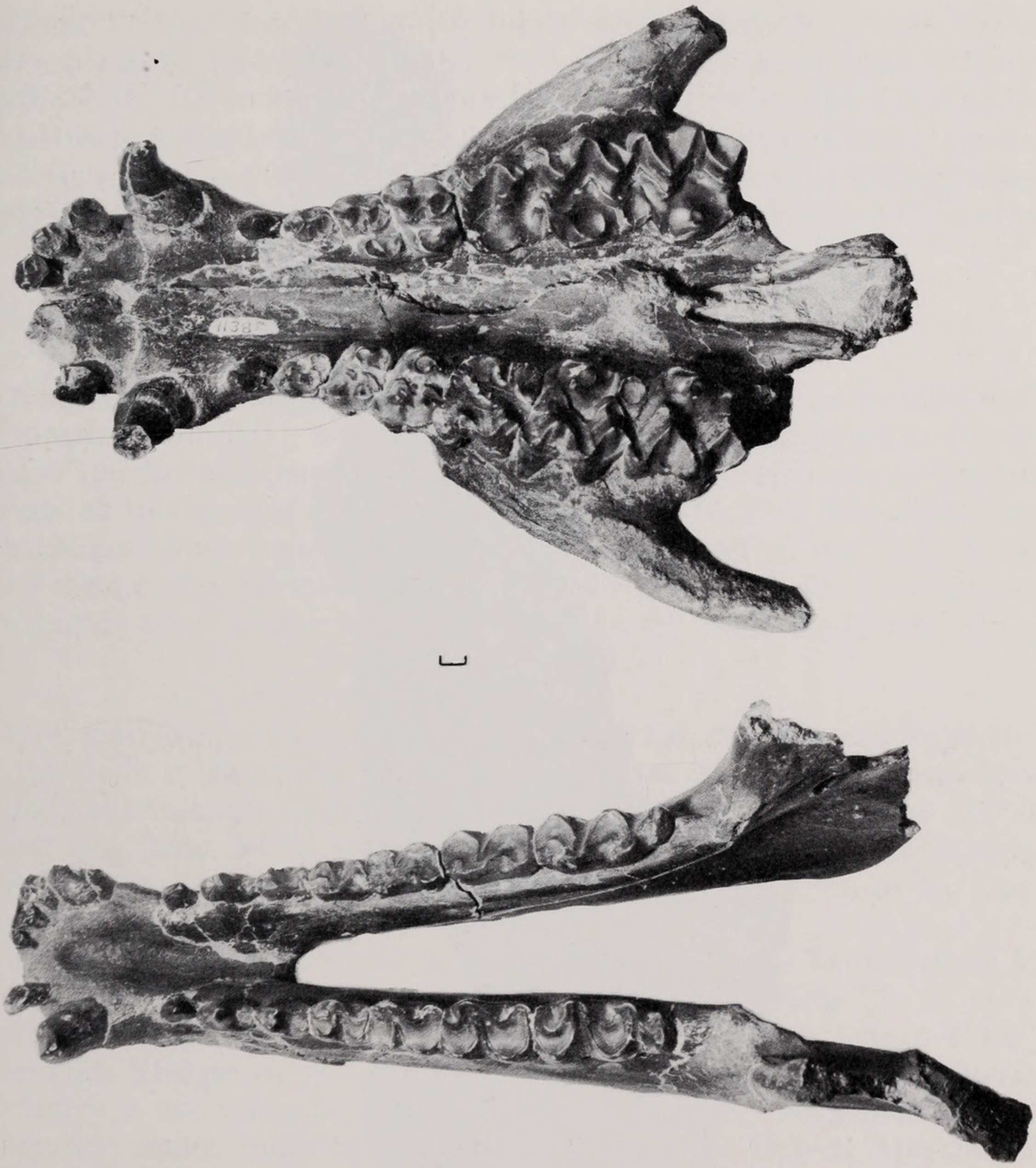


Fig. 9. *Manteoceras pratensis,* CM 11382, partial skull and lower jaw. Line equals 1 cm.

Metarhinus sp.

Fig. 10

A single maxillary fragment with P^1 to M^1 (CM 26287, locality 9) belongs to *Metarhinus,* a titanothere genus not in Cook's collection. The specific assignment remains uncertain for lack of complete molar teeth. This genus, like other titanotheres discussed above, appears in both Bridgerian and early Uintan faunas, and is further evidence for the critical biostratigraphic position of the Sand Wash fauna.

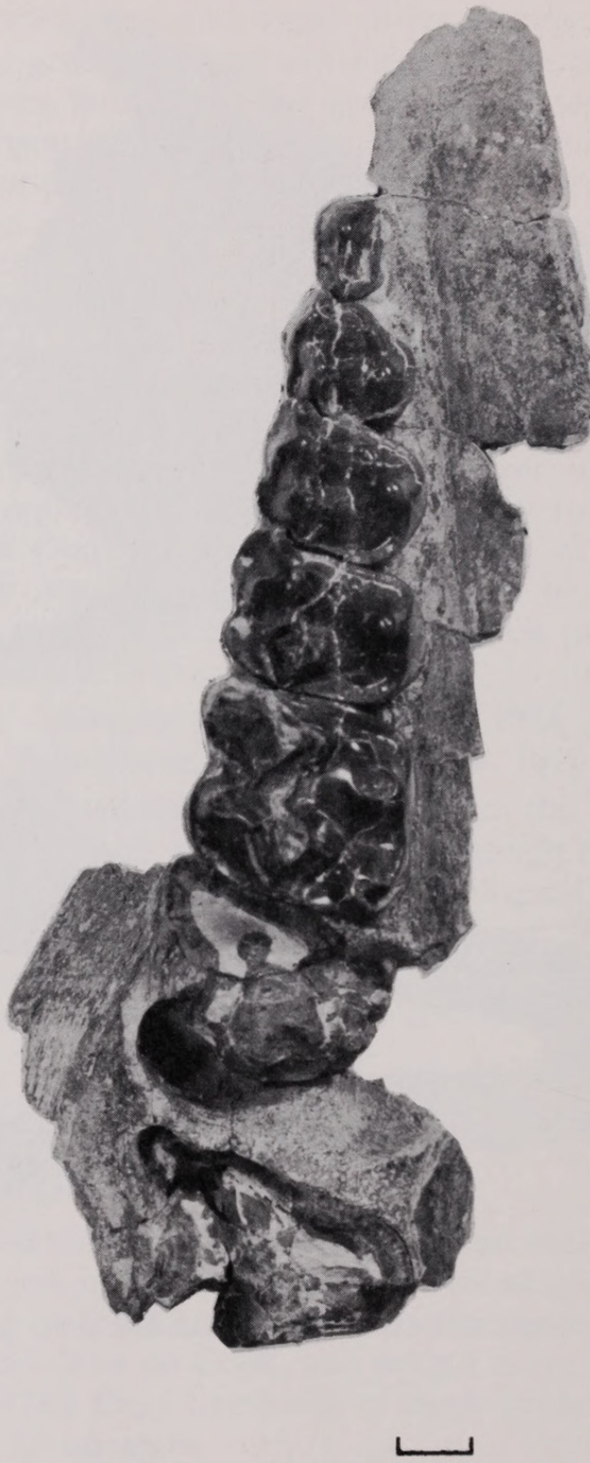


Fig. 10. *Metarhinus* sp., CM 26287, right maxilla with P^1-M^1. Line equals 1 cm.

Order Dinocerata
Family Uintatheriidae
Eobasileus cornutus Cope, 1872

Uintacolotherium blayneyi Cook, 1926a:7
Eobasileus cornutus Wheeler, 1961:53

Cook (1926a) described a presumed new uintathere, *Uintacolotherium blayneyi,* based on DMNH 495 and other specimens. Wheeler (1961:52-55, 61) reviewed the uintatheres and synonymized Cook's material with *Eobasileus cornutus.* This suggests an early Uintan age for at least some Sand Wash mammals. *Eobasileus* is readily differentiated from *Uintatherium* by its size and the relative development of the horns.

Order Artiodactyla
Family Dichobunidae
Homacodon sp. cf. *H. vagans* Marsh, 1872

A right dentary fragment (UCM 33392) with M_2 and an isolated lower molar (CM 14963), both from locality 3, may be compared to *Homacodon vagans.* Size and morphology are readily comparable to the materials of this species described by Sinclair (1914:286). The prominent separation of the hypoconulid from the main part of the talonid and the fusion of the paraconid and metaconid that characterize *H. vagans* are readily seen in these specimens. The species is late Bridgerian.

Parahyus sp.

One specimen, consisting of a well-preserved dentary and fragments of the skull, is tentatively referred to *Parahyus*, the enigmatic bunodont artiodactyl recently discussed by Lewis (1973) and McKenna (1972). Thus far, Sand Wash locality 21 has produced only this specimen, which was collected by a Moffat County resident and given to the Denver Museum of Natural History.

The Sand Wash *Parahyus* is smaller than *P. vagus* as described by both Sinclair (1914) and Lewis (1973). Of those artiodactyls of more certain geographic and geologic provenance, the specimen most closely resembles Bridgerian *Helohyus* from the Green River Basin, although it clearly is not referable to any known species of that genus. As it is at present under study by K. Don Lindsey of the Denver Museum of Natural History, we simply indicate its occurrence in the Sand Wash assemblage as *Parahyus* sp.

DISCUSSION

Of primary interest is the age of the faunal assemblage outlined above. As indicated by Table 2, the elements of the Sand Wash fauna occur in both Bridgerian and Uintan rocks. The large mammals, especially the perissodactyls and uintatheres, suggest a Uintan Age, while the smaller mammals are far more suggestive of late Bridgerian time. As mentioned earlier, most of the large mammals were collected in the northwestern part of the basin (*Hyopsodus* is the only small mammal from that region), while the smaller mammals were collected farther south and east.

Several explanations for this distribution may be suggested. First, inadequacy of collecting may explain the absence of small mammals accompanying the titanotheres and uintatheres in the northwestern part of the basin. This is unlikely, as a number of competent field paleontologists have carefully examined the Markman localities near Two Bar and Spicer's Springs with identical lack of success in recovering small vertebrates. The nature of the sample does then seem to reflect adequately the preserved fauna.

Second, there may be a significant stratigraphic distance between the large mammal ("Uintan") localities and the small mammal ("Bridgerian") localities. This would then suggest two discrete time-stratigraphic units in the Sand Wash Basin Eocene, something that is difficult to demonstrate geologically. If the northwestern part of the basin is indeed substantially younger than the southern part, the range of *Hyopsodus despiciens* must then be extended into the later Eocene.

Third, perhaps the most realistic interpretation of Sand Wash mammals involves the readily observable facies differences across the basin, and the association of the mammals with different paleoenvironments. The particular situations of the fossil assemblages suggest that the "Uintan" and "Bridgerian" assemblages represent two rather different ecosystems that were in existance at approximately the same time. What geologic evidence there is more strongly supports this position than that of a large stratigraphic differential across the basin.

If this alternative is valid, the particular biostratigraphic position of the Sand Wash mammals brings into question the adequacy of the conventional terms "Bridgerian" and "Uintan" as descriptive devices. This fauna would fall on the Bridgerian-Uintan boundary as traditionally understood, and thus is adequately defined by neither term.

Finally, the last two suggestions can be considered simultaneously. Perhaps there is a time difference accompanied by ecologic variation. This would readily accommodate the distributional discrepancies.

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