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PRELIMINARY ANALYSIS OF THE VERTEBRATE FOSSIL FAUNA OF THE BOYSEN RESERVOIR AREA

By Theodore E. White

As a part of the salvage program of the River Basin Surveys, a cooperative project between the Smithsonian Institution, the National Park Service, the Bureau of Reclamation, and the Corps of Engineers, Department of the Army, in the prospective reservoir sites in the Missouri Valley, the Boysen Reservoir area near Shoshoni, Wyo., has been prospected for vertebrate fossils for parts of two seasons. During the first period, from October 23 to November 7, 1947, I worked alone, and considerable time was lost because of early snows. The area was again worked, with the aid of John C. Donohoe, a student at Montana State College, and Ernest L. Lundelius, a student at the University of Texas, from June 4 to July 12, 1948. Although the specimens have not been credited to individuals, I wish to state that these men have proved themselves competent collectors, and we three found about equal amounts of material. Although it is planned to visit this area for as many seasons as possible before the reservoir is flooded, it seems desirable to make the information gathered to date available to other paleontologists.

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SYSTEMATIC DESCRIPTION OF FOSSIL VERTEBRATES

Class REPTILIA

Order SQUAMATA

Suborder SERPENTES

Family BOIDAE

Genus BOAVUS Marsh

BOAVUS cf. OCCIDENTALIS Marsh

About 30 associated thoracic vertebrae (loc. No. 48FR78);[1] 2 thoracic vertebrae (loc. No. 48FR80).

Although there is considerable difference in size between the two specimens, I am inclined to be extremely cautious about differentiating species of snakes on the size of the vertebrae only, since age is not readily reflected in the surface texture of the bone. Consequently, the principal importance of this material is the presence of this genus in the Lost Cabin faunal zone of the Wind River formation.

Suborder SAURIA

Family VARANIDAE

Genus SANIWA Leidy

SANIWA sp.

One dorsal and five caudal vertebrae (loc. No. 48FR65); two dorsal vertebrae of presumably a young individual (loc. No. 48FR78); one caudal vertebra (loc. No. 48FR80).

This material is too imperfect for more than generic identification and its value is only that it establishes this genus in these deposits.

Family ANGUIDAE

Genus GLYPTOSAURUS Marsh

GLYPTOSAURUS DONOHOEI, new species

FIGURE 75

Type.—U.S.N.M. No. 18316 (fig. 75), a badly damaged skull lacking the tip of the snout, both maxillae, and the right temporal region (loc. No. 48FR65).

Referred material.—U.S.N.M. No. 18317, skull and jaw fragments with scutes (loc. No. 48FR65).

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[1] For a description of localities see pp. 203–206.

Horizon and locality.—Lower Eocene, Lost Cabin, NE¼SW¼ sec. 5, T. 4 N., R. 6 E., of Wind River meridian; White Hill, south side of Cottonwood (Dry Muddy) Creek, 11 miles north-northwest (air line) of Shoshoni, Fremont County, Wyo.

Diagnosis.—A medium-sized species; interorbital breadth 33 percent less than in *G. hillsi* Gilmore; interorbital area with 5 regular alternating rows of bony scutes, supraorbital and median rows larger

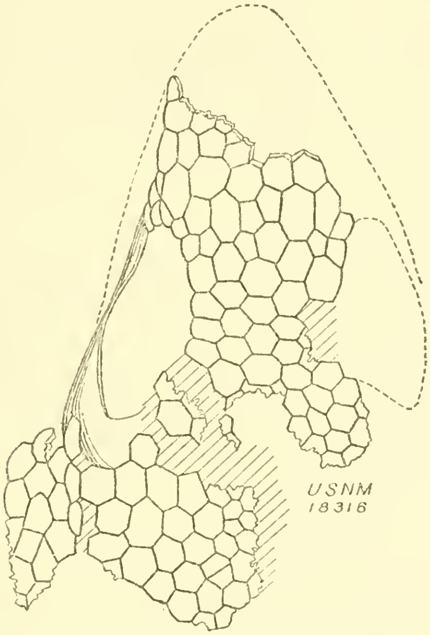

FIGURE 75.—*Glyptosaurus donohoei*, new species, type, U.S.N.M. No. 18316; squamation of dorsal surface of skull, ×1.

than second and fourth rows; scutes raised into a boss as in *rugosus* and *nodosus;* vertical diameter of orbit equal to interorbital breadth; scutes of the temporal region less regular in outline and about twice the diameter of those of the interorbital area.

Discussion.—This specimen, in conjunction with a braincase from Pipestone Springs (U.S.N.M. No. 13805), permits a few additions to Gilmore's (1928, 1938) discussions of the genus.

The various elements that make up the braincase are securely fused, as in *Peltosaurus.* The former location of some of the sutures can be made out by lines of roughened bone. The condyle is elongate-oval in outline, twice as broad as deep. The tubera basioccipitalia project ventrolaterally from the basicranial axis and are expanded anteriorly and posteriorly at their bases as though reinforced by flying buttresses. These expansions are thickened along their edges so that the tubera are triradiate from their terminations, with the median portion the heaviest. The foramen for the twelfth cranial nerve is located beside the condyle and below the paroccipital process, at the termination of the posterior wing of the tubera basioccipitalia. The ninth and tenth nerves exit through a dorsoventrally elongated foramen at the ventral side of the jugular groove a little posterior to the median portion of the tubera basioccipitalia. The fenestra ovale lies just above this foramen. The foramen for the exit of the *venus capitis lateralis* lies just above the anterior termination of the anterior wing of the tubera at the bottom of the jugular groove. The foramen for the hyoid branch of the seventh nerve lies at the top of the jugular groove slightly posterior to the foramen for the *venus capitis lateralis*. A thin, fairly deep ridge of bone extends downward from the paroccipital process of the proötic so that the jugular groove is partially enclosed laterally.

The region of the hypophyseal fontanelle is so badly damaged in both specimens that reliable data cannot be obtained. The basipterygoid processes of the basisphenoid are elongate and flattened as in most *Sauria*. They are separated from the tubera basioccipitalia by a deep notch, which extends to the main body of the basisphenoid.

The anterior edge of the proötic is damaged in both specimens, but enough of this region is preserved in U.S.N.M. No. 18316 to indicate that the ossification of the prefacial commissure very nearly or entirely encircled the facialis branch of the seventh nerve as it left the braincase.

A fragment of the maxilla in U.S.N.M. No. 18317 shows that the anterior maxillary teeth are much smaller than the posterior teeth. They increase rapidly in size to the fifth tooth, which is as large as the remainder.

The collection of *Glyptosaurus* material in the United States National Museum, which contains most of the types, was examined in connection with this material. Many of the species were founded on the characters of the frontal and interorbital regions only, and as yet some of the species are known only from the type specimens. Although the taxonomy of a genus based on such a limited portion of an animal leaves much to be desired, it is possible to make a morphological grouping of the species of this genus by means of the characters presented by this region of the skull. Only with the aid of better material can the validity of this grouping be determined. The known species are tentatively grouped as follows:

I. Interorbital region with four rows of osseus scutes with one or two odd scutes interpolated between the median rows___________G. montanus group

II. Interorbital region with five regular, alternating rows of osseus scutes. G. hillsi group

III. Interorbital region with six irregular rows of scutes; odd scutes may or may not be present between the median rows............G. giganteus group
IV. Frontal region unknown..G. sphenodon

TABLE 1.—*Stratigraphical distribution of the* Glyptosaurus montanus, G. hillsi, *and* G. giganteus *groups*

Periods	Stages	*montanus* group	*hillsi* group	*giganteus* group
Oligocene	Whitneyian			
	Orellan			*giganteus*
	Chadronian	*montanus*		*tuberculatus*
Eocene	Duchesnian			
	Uintan			
	Bridgerian		*brevidens* *princeps*	*nodosus* *sylvestris* *rugosus*
	Huerfano B		*hillsi*	
	Huerfano A		*hillsi?*	
	Wasatchian	*obtusidens*	*donohoei*	

Class MAMMALIA

Order INSECTIVORA

Family DELTATHERIDIIDAE

Genus DIDELPHODUS Cope

DIDELPHODUS VENTANUS Matthew

FIGURE 76

U.S.N.M. No. 18369 (fig. 76), a badly crushed skull with left P^2 to M^3 and both lower jaws from which all the teeth have been broken (loc. No. 48FR65); U.S.N.M. No. 18433, fragment of left mandible with M_2 (loc. No. 48FR80).

If the skull is correctly referred to this form its characters are sufficiently distinctive to warrant designation as a separate species, rather than citation as a mutation of *D. absarokae.* The distinctive characters presented by the teeth of this specimen are : P^2 two-rooted, anterior and posterior cingula well developed and with minute crenulations; P^3 submolariform and differs from P^4 only in being slightly smaller; M^1 exhibits several minute tubercles on the external cingulum between the parastyles and metastyles. Other characters of the teeth agree with Matthew's (1918, p. 583) figures of *D. absarokae.*

Although this skull is very badly broken and crushed, it adds a few details to our knowledge of the genus. Because *Ictops* is relatively well known, comparisons will be made with it, although the two forms are not closely related:

(1) The frontonasal suture lies a short distance in front of the orbit. (2) The zygoma is a little heavier than in *Ictops.* (3) Postorbital process is short but very well defined. A companion process was not observed on the fragment of the zygoma preserved. (4) The orbit appears to be as large relatively as in *Ictops.* (5) The sagittal crest is single and moderately high. (6) The parietal foramen appears to lie closer to the crest than to the squamosal. (7) Squamosoparietal

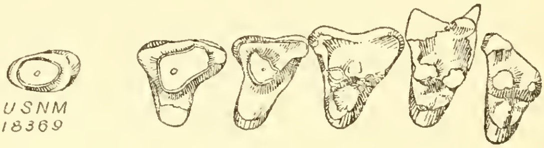

FIGURE 76.—*Didelphodus ventanus* Matthew, U.S.N.M. No. 18369; occlusal view of left P^2–M^3, ×4.

foramina were not observed. (8) The union of the mastoid portion of the petrosal and the squamosal appears to have been similar to that in *Ictops.* (9) The mastoid appears to form as much of the occiput as in *Ictops.* (10) The relationship of the glenoid to the periotic suggests that the postglenoid and posttympanic processes of the squamosal were separated by a meatal notch, although these processes were broken away. (11) The tympanic ridge of the alisphenoid is lacking, but there is a short one on the glenoid portion of the squamosal. (12) The foramina in the alisphenoid appear to have been much the same as in *Ictops*, but this region is badly crushed and difficult of interpretation. (13) The alisphenoid appears to be fused to the basisphenoid. (14) The periotic appears to be rather large judged by the dimensions of the skull that can be observed. (15) The inferior border of the massateric fossa is sharply defined by an abrupt indentation as in *Deltatheridium.*

MEASUREMENTS OF TEETH OF DIDELPHODUS VENTANUS (IN MILLIMETERS)

	Length	*Width*
P^3–M^3	13. 5	------
M^{1-3}	8. 0	------
Diastema P^{2-3}	1. 6	------
P^2	2. 1	1. 2
P^3	2. 8	3. 2
P^4	2. 6	3. 4
M^1	3. 0	3. 5
M^2	2. 4	3. 5
M^3	1. 7	3. 0

The dentition of this specimen is distinctly more advanced than that of *D. absarokae* of the Gray Bull. Unfortunately the upper dentition of this genus is unknown from the Alkalai Creek exposures. Consequently it is impossible to evaluate the stratigraphic significance of this specimen.

Family MIXODECTIDAE

Genus CYNODONTOMYS Cope

CYNODONTOMYS SCOTTIANUS COPE

U.S.N.M. No. 18436, fragment of left mandible with posterior half of P_4 and M_{1-3} (loc. No. 48FR76); U.S.N.M. No. 18434, fragment of right mandible with M_{2-3} (loc. No. 48FR80).

The limited material pertaining to this species does not permit any additions to Matthew's (1915c, pp. 470–477) discussion of the genus.

CYNODONTOMYS LUNDELIUSI, new species

FIGURE 77

Holotype.—U.S.N.M. No. 18371 (fig. 77), fragment of a right mandible with posterior half of M_1, M_2, posterior half of M_3, and the roots of P_{3-4} (loc. No. 48FR65).

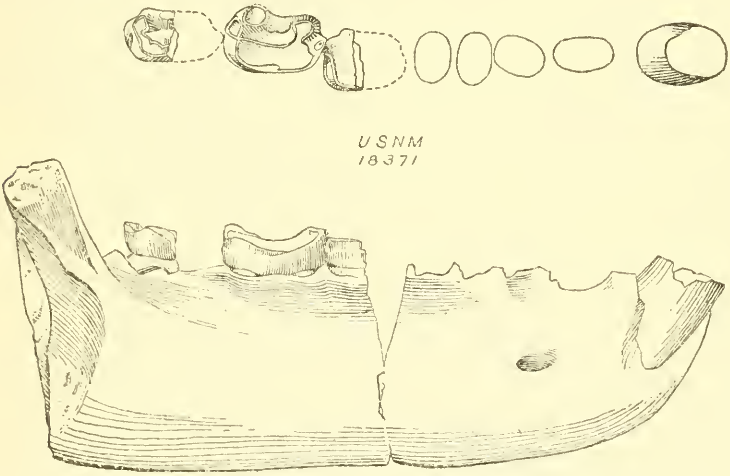

FIGURE 77.—*Cynodontomys lundeliusi*, new species, type, U.S.N.M. No. 18371; occlusal view of teeth and lateral view of right mandible, ×2.

Horizon and locality.—Lower Eocene, Lost Cabin. NW¼SW¼, sec. 5, T. 4 N., R. 6 E. of Wind River meridian, south side of Cottonwood (Dry Muddy) Creek, 11 miles (air line) north-northwest of Shoshoni, Fremont County, Wyo.

Diagnosis.—Size large, 33 percent larger than the average for *C. scottianus* (Matthew, 1915c, p. 471); M_3 relatively shorter than in that species; heel of M_3 narrower than on M_2; paraconid on M_2 distinct; external and posterior cingula as in *C. scottianus*.

Discussion.—Although the teeth in this specimen are broken and badly worn, the characters presented, especially the size, are distinct enough for the species to be easily recognized.

MEASUREMENTS OF TEETH OF CYNODONTOMYS LUNDELIUSI (IN MILLIMETERS)

	Length
P_3–M_3	30.7
P_4–M_3	22.3
M_1 (estimated)	5.0
M_2	5.5
M_3	6.5
Depth of jaw at M_1	12.8
Depth of jaw at M_3	13.7

Order TILLODONTIA

Family TILLOTHERIIDAE

Genus ESTHONYX Cope

ESTHONYX ACUTIDENS Cope

U.S.N.M. No. 18267, fragment of right mandible with I_{2-3} and P_3–M_2 (loc. No. 48FR78); U.S.N.M. No. 18470, fragments of both mandibles (loc. No. 48FR65); U.S.N.M. No. 18469, skull and jaw fragments (loc. No. 48FR80).

This material is being studied by Dr. C. L. Gazin and will be discussed in his revision of the order.

Order PRIMATES

Family ADAPIDAE

Genus NOTHARCTUS Leidy

NOTHARCTUS VENTICOLUS Osborn

U.S.N.M. No. 18437, left mandible with M_{1-3}, roots of P_{3-4}, and alveoli of P_{1-2} (loc. No. 48FR77).

This specimen does not add anything to our knowledge of the species.

Family APATEMYIDAE

Genus TEILHARDELLA Jepson

TEILHARDELLA sp.

U.S.N.M. No. 18438, right mandible with only the incisor (loc. No. 48FR80).

This specimen is provisionally referred to this genus on the characters of the mandible, which exhibit a number of differences from the genotype, but these differences cannot be properly appraised until the dentition is known. The characters exhibited by this specimen are:

P_3 procumbent; P_4 with a single large root; M_1 and M_2 with posterior root the larger; posterior root of M_3 very long and narrow; massateric fossa very deep and broad.

MEASUREMENTS OF ALVEOLI OF TEILHARDELLA sp. (IN MILLIMETERS)

	Length
P_3–M_3	7.8
M_{1-3}	5.7
M_1	1.7
M_2	1.7
M_3	2.0

Family ANAPTOMORPHIDAE

Genus LOVEINA Simpson

LOVEINA ZEPHYRI Simpson

U.S.N.M. No. 18439, portion of a left mandible with part of P_4, the base of M_1, and M_2 and M_3 (loc. No. 48FR76).

This specimen is provisionally referred to this species on the basis that M_2 and M_3 agree with those of ? *L. vespertina* (Matthew) better than with those of any other genus. It differs from that species in the proportionally shorter M_1 and M_2, in the broader trigonid, and in the presence of a minute entoconid on the heel of M_3. Since M_2 and M_3 are unknown in the genotype any attempt at comparison of the two specimens would be futile.

MEASURMENTS OF TEETH OF LOVEINA ZEPHYRI (IN MILLIMETERS)

	Length	*Width (at base)* Trigonid	*Heel*
M_{1-3}	7.4	------	------
M_1	2.3	?	1.8
M_2	2.3	2.0	2.2
M_3	2.7	1.8	1.6

Order TAENIODONTA

Family STYLINODONTIDAE

Genus STYLINODON Marsh

STYLINODON CYLINDRIFER (Cope)

U.S.N.M. No. 18440, portion of right canine (loc. No. 48FR76).

This specimen is referred to *S. cylindrifer* on the basis of the distribution of the enamel, which is in two bands, one on each side of the tooth. It is of uniform thickness and width and shows the obsolete vertical striation and the stronger transverse growth lines which Cope (1884, p. 192) describes for the type of the species. The cement, which covers the areas between the enamel bands, overlaps the enamel for a short distance on each side, but there is no evidence that the bands were covered.

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MEASUREMENTS OF CANINE OF STYLINODON CYLINDRIFER (IN MILLIMETERS)

Diameter (transverse)	10.5
Diameter (anteroposterior)	11.5
Width between enamel bands:	
Anterior	2.8
Posterior	4.8

Order RODENTIA

Family ISCHYROMYIDAE

Genus PARAMYS Leidy

PARAMYS MAJOR Loomis

U.S.N.M. No. 18442, right mandibular fragment with M_{1-2} and roots of M_3 (loc. No. 48FR76) ; U.S.N.M. No. 18441, left mandibular fragment with P_4–M_2 (loc. No. 48FR80).

This material does not permit anything to be added to Matthew's (1918, p. 614) discussion of the species.

PARAMYS MURINUS Matthew

U.S.N.M. No. 18443, right mandible with M_{1-2} and roots of P_4 (loc. No. 48FR80).

This specimen does not agree with the figures (Matthew, 1918, p. 617) of the type in that the enamel is entirely smooth and not rugose. Consequently, it is only provisionally referred to this species pending the acquisition of better material.

Order CARNIVORA

Family HYAENODONTIDAE

Genus PROLIMNOCYON Matthew

PROLIMNOCYON ANTIQUUS Matthew

U.S.N.M. No. 18444, left mandible with P_{3-4} and roots of M_{2-3} (loc. No. 48FR76) ; U.S.N.M. No. 19445, both mandibles with only roots of teeth preserved (loc. No. 48FR65).

This material does not permit anything to be added to Matthew's (1915a, p. 70) discussion of the species.

Genus SINOPA Leidy

SINOPA STRENUA (Cope)

U.S.N.M. No. 18446, mandibular fragments with M_{1-3} of both sides and associated skeletal fragments (loc. No. 48FR77).

This specimen does not permit the addition of anything to Matthew's (1915a, p. 74) discussion of the species.

Genus DIDYMICTIS Cope

DIDYMICTIS ALTIDENS Cope

U.S.N.M. No. 18447, skull with calvarium and occiput eroded away, right and left P^1–M^2 present (loc. No. 48FR75).

This specimen differs from the one figured by Matthew (1915a, p. 23) in that P^1 is 2-rooted, and there is no diastema between it and the canine. The parastyle on M^1 is better developed and the internal cingulum is continuous. M^2 has a greater transverse diameter for its length and is more advanced.

MEASUREMENTS OF TEETH OF DIDYMICTIS ALTIDENS (IN MILLIMETERS)

	Length	*Width*
P^1–M^2	58.5	-----
P^4–M^2	29.5	-----
M^1	9.0	17.0
M^2	5.0	9.0

Genus MIACIS Cope

MIACIS cf. LATIDENS Matthew

U.S.N.M. No. 18448, right maxillary fragment with M^{1-2}, roots of P^4, and associated skull fragments (loc. No. 48FR80).

This specimen is intermediate in size between the types of *M. exiguus* and *latidens* (Matthew, 1915a, p. 33–35). It agrees with the former in the extended parastyle on the upper molars and with the latter in that the paracone is much larger than the metacone. The internal cingulum is interrupted medially below the protocone. Matthew (1915a, p. 33) states that it is continuous in both species but the illustrations show it to be the same as in this specimen. Although M^1 shows considerable wear, there is a suggestion of a small hypocone, and this specimen may be prophetic of *M. parvivorus* of the Lower Bridger.

MEASUREMENT OF TEETH OF MIACIS CF. LATIDENS (IN MILLIMETERS)

	Length	*Width*
P^4–M^2	16.5	-----
P^4	7.7	-----
M^1	6.0	8.4
M^2	4.0	8.0

Genus VULPAVUS Marsh

VULPAVUS AUSTRALIS Matthew

U.S.N.M. No. 18449, left mandibular fragment with M_{1-2} (loc. No. 48FR76).

This specimen does not permit anything to be added to Matthew's (1915a, p. 39) discussion of the species.

MEASUREMENTS OF TEETH OF VULPAVUS AUSTRALIS (IN MILLIMETERS)

	Length	*Width trigonid*	*Heel*
M_{1-2}	11.7	------	------
M_1	6.9	4.5	4.0
M_2	4.8	3.9	3.3

Order CONDYLARTHRA

Family MENISCOTHERIIDAE

Genus MENISCOTHERIUM Cope

MENISCOTHERIUM TERRARUBAE Cope

U.S.N.M. No. 18451, fragment of right mandible with P_4–M_3 (loc. No. 48FR80) : U.S.M.N. No. 18450, fragment of left mandible with P_4–M_3 (loc. No. 48FR80).

The limited material of this form is uniform in size and is larger than the material from Alkalai Creek listed by Granger (1915, p. 359). On the basis of size the material agrees better with *terrarubae* than with *chamense*, but whether these should receive full specific status or be considered as varieties will not be considered here.

Although the genus was identified with certainty from one locality, it would be premature to attempt any discussion of the paleoecology of the Boysen Reservoir area on the basis of such limited data.

Family HYOPSODONTIDAE

Genus HYOPSODUS Leidy

HYOPSODUS POWELLIANUS Cope

U.S.N.M. No. 18452, right mandible with P_4–M_3 and right maxilla with P^{2-3} (loc. No. 48FR75).

This specimen is referred to *H. powellianus* on the basis of size and the position of the mental foramina, both of them lying below P_4. The teeth are so badly worn that certain identification is impossible.

MEASUREMENTS OF TEETH OF HYOPSODUS POWELLIANUS (IN MILLIMETERS)

	Length
P_4–M_3	23.5
M_{1-3}	18.5
P_4	5.0
M_1	5.5
M_2	6.0
M_3	7.0

HYOPSODUS WORTMANI Osborn

U.S.N.M. Nos. 18453, 18454, two specimens, one with upper and lower molars associated (loc. No. 48FR78); U.S.N.M. Nos. 18455–18460, six specimens, including one maxilla with M^{2-3} (loc. No. 48FR80).

There appears to be some confusion in the literature concerning the size range of the lower molars of this species. Osborn (1902, p. 185) in the original description gives the size range from 11 to 13 millimeters. Loomis (1905, p. 422) found that his material exhibited a uniform measurement of 12 mm. Matthew (1915b, p. 317), in his key to the species of the genus, gives the length of the lower molars as 10 mm. In the material from the Boysen Reservoir area, the two specimens with M_{1-3} have a molar length of 13 mm. In all the specimens the length of M_{2-3} varies between 8.0 and 9.0 mm. Van Houten (1945, p. 425) pointed out that most of the Lower Eocene genera could be revised profitably. This is certainly true of *Hyopsodus.*

Hyopsodus wortmani has never been adequately characterized in the literature, and if this material is correctly referred, the lower dentition may be characterized as follows: P_4 submolariform, anterointernal style well developed and joined to the protoconid by a distinct crest; deuteroconid well developed; anterointernal style, protoconid, and deuteroconid forming a distinct trigonid; heel well developed and trenchant, hypoconid centrally placed and prominent, entoconid small and indistinct from posterior cingulum; M_1 with metaconid distinctly twinned, crescents on protoconid well developed, hyopoconulid and entoconid distinct, anterior and posterior cingula present; M_2 similar to M_1 except that metaconid is indistinctly twinned; M_3 long and narrow, narrowing rapidly from in front posteriorly, hypoconulid as large as, or larger than, hypoconid and forming a distinct heel; entoconid small but distinct, metaconid may or may not be indistinctly twinned.

This material is not readily distinguishable from *H. paulus* Leidy, of the Lower Bridger, by size, but the teeth of the type are so badly worn that their characters cannot be properly evaluated.

Order PANTODONTA

Family CORYPHODONTIDAE

Genus CORYPHODON Duméril and Bibron

CORYPHODON sp.

Right P^{3-4} (loc. No. 48FR65).

This material is inadequate for more than generic identification.

Order PERISSODACTYLA

Family EQUIDAE

Genus HYRACOTHERIUM Owen

HYRACOTHERIUM VENTICOLUM Cope

Figure 78

U.S.N.M. No. 18368, left mandibular fragment with Dp_4 (fig. 78) (loc. No. 48FR65); U.S.N.M. No. 18462, right mandibular fragment with the heel of Dp_3 and Dp_4 (loc. No. 48FR76); U.S.N.M. No. 18461, right mandibular fragment with P_{2-4} and M_3 (loc. No. 48FR78).

Although this material is very fragmentary, it shows the character of the lower deciduous premolars, which was not treated in Granger's (1908) revision. Unfortunately, only the heel of Dp_3 is preserved.

Figure 78.—*Hyracotherium venticolum* Cope, U.S.N.M. No. 18368; lateral and occlusal views of right DP_4, $\times 1\frac{1}{2}$.

The characters that this limited material presents are as follows: Dp_3 with posteroexternal crescent well developed, cross-crest between hypoconid and entoconid well developed, hypoconulid small but distinct, external and posterior cingula present; Dp_4 with anterior and posterior external crescents well defined, metaconid distinctly twinned and higher than protoconid, cross-crest between hypoconid and entoconid well developed, entoconid higher than hypoconid, hypoconulid small but well defined, well developed anterior, external, and posterior cingula.

The deciduous teeth described here are somewhat higher crowned than the permanent teeth, and can be distinguished from the permanent dentition of *Orohippus* only with difficulty. In fact, these teeth were originally referred to that genus and it was only after Dr. C. L. Gazin and I spent some time comparing them with the material in the U. S. National Museum that their true identity was learned.

I have been told by Morris Skinner that this characteristic—the deciduous teeth of horses being more advanced than the permanent teeth—has been observed in the later Tertiary horses. In view of the growth processes involved in the formation of horse teeth (White, 1942, p. 26) it is logical to correlate the above phenomenon with the activities of the endocrine glands, which stimulate and regulate growth, during the period of postnatal development (ibid., p. 45). That the thyroid (Goldzieher, 1939, p. 83) plays an important role in influencing the morphogenic processes, particularly in the ossification of the skeleton and in the growth of the teeth, has been demonstrated by the administration of thyroid extract to hypothyroid children and by thyroidectomy of normal laboratory animals. Its action is by no means independent but is closely integrated with that of the pituitary, parathyroid, and adrenals. Nor do these glands function only in combination with each other but in combination with the other glands of the system to maintain an endocrine balance and a favorable "internal environment" or *homeostasis* (ibid., p. 11).

In order to maintain homeostasis the endocrine glands must respond to external factors. The changes in external environment that are accompanied by changes in the activity of the glands are: Altitude, temperature, climate, quantity and type of food, and accessory foodstuffs such as mineral salts and vitamins. The data on the responses to these factors are limited almost entirely to the clinical observations on man and laboratory animals. These data indicate that when less than radical changes in the external factors prove deleterious there is a strong probability that an endocrine imbalance already existed (Goldzieher, 1939, pp. 11–13).

Of equal importance to the activities of the endocrine glands are the responses of the receptor tissues to the stimuli of the hormones. These responses may be affected by a variety of factors, such as: The condition of the tissues, ennervation, chemicals, and the age and stage of development of the individual. With regard to the two last-mentioned factors, which are probaby the most fundamental, little is known except that the responses of the tissues are characteristic of the stage of development. Thus, in a young and growing individual, the response to hormones is growth and maturation, while in the adult the hormones are capable only of maintaining the orderly function of the tissues (Goldzieher, 1939, p. 6). It is a well-known fact that in animals there is a noticeable slowing down of growth soon after puberty, though the postpubertal growth period may be as long as the prepubertal. However, this may be due to the interaction of the endocrine glands.

In regard to the environment offered by this region during Lower Eocene time, Van Houten (1945, pp. 442–444) characterizes it as a humid lowland with a warm-temperate to subtropical climate supporting a luxuriant vegetation of both woodland and savannah types.

As to the soils, the parent rocks from which they were derived were igneous (extrusives and intrusives) and sedimentary (limestones, dolomites, shales, and sandstones). Weathering processes would make available phosphorus, potassium, calcium, and some sodium from the igneous rocks and calcium and magnesium from the limestones and dolomites. The result would be a very fertile soil containing an ample supply of all the minerals necessary for a luxuriant and nutritious vegetation. In view of the above considerations, it can be concluded that this region offered a very nearly optimum environment for herbivorous animals, and that factors which would seriously disturb the endocrine balance were absent.

The estrogens and androgens (sex hormones) (Goldzieher, 1939, p. 289) and the hormone of the adrenal cortex (ibid., p. 93) have an inhibitory effect on the thyrotropic hormone of the anterior lobe of the pituitary, which results in decreased activity of the thyroid. Although estrogens and androgens are present in nearly all foods (ibid., p. 743) and growing plants, and do not appear to be altered by the processes of digestion, they are not secreted in quantity by the gonads till a short period before puberty. It is believed that only a portion of these hormones taken with food find their way into the blood stream. It has been shown that these hormones are inactivated in the liver and are rapidly destroyed by oxidation in the lungs (ibid., p. 748), which greatly reduces their effectiveness when administered by mouth.

In view of the role played by the thyroid in the formation of the teeth by its effect on metabolism and growth, the low estrogen and androgen content of the blood while the deciduous teeth were being formed could result in the advanced type of teeth. That the third permanent premolar is more advanced than the fourth in some species of *Hyracotherium* (Granger, 1908) may be due to the sudden increase in the estrogen and androgen content of the blood during the interval between the formation of these two teeth. If the appearance of the physiological brake on the thyroid furnished by the secretions of the gonads and the adrenal cortex were postponed until after the determination of the form of the permanent teeth by the growth of the tooth germ, it is conceivable that the advanced type of tooth would result. In view of the antagonism between the gonads and the thyroid (Goldzieher, 1939, p. 94), such a deferment could be the result of mild hyperthyroidism.

Family BRONTOTHERIIDAE

Genus LAMBDOTHERIUM Cope

LAMBDOTHERIUM POPOAGICUM Cope

U.S.N.M. No. 18464, right P^3–M^3 (loc. No. 48FR76); U.S.N.M. 18463, right P^2–M^1 (Shoshoni Reservoir); U.S.N.M. No. 18465, loose upper teeth (loc. No. 48FR75).

This genus is generally accepted as the index fossil for the Lost Cabin faunal zone of the Wasatchian, Lower Eocene. Unfortunately, this material is too fragmentary to add anything to our knowledge of this species. Bonillas (1936) has given very good reasons for concluding that only one species existed in the Wind River Basin.

Genus EOTITANOPS Osborn

EOTITANOPS sp.

U.S.N.M. No. 18466, fragment of a right mandible with M_1–M_2 (loc. No. 48FR65); U.S.N.M. No. 19104, loose teeth including P_{3-4} and part of M_1 (loc. No. 48FR79).

This material is too fragmentary to add anything to our knowledge of the genus.

Family ISECTILOPHIDAE

Genus HEPTODON Cope

HEPTODON BROWNORUM Seton

U.S.N.M. No. 18467, badly broken right mandible with P_4–M_3 and portions of the left mandible (loc. No. 48FR65); U.S.N.M. No. 18468, right mandible with P_3–M_2 (loc. No. 48FR80); U.S.N.M. No. 18471, badly crushed skull and jaws with associated skeletal fragments (loc. No. 48FR75).

This material is referred to *Heptodon brownorum* on the basis of size, but it is too fragmentary to add anything to our knowledge of the species.

Order ARTIODACTYLA

Family DICHOBUNIDAE

Genus BUNOPHORUS Sinclair

BUNOPHORUS ETSAGICUS (Cope)

FIGURE 79

U.S.N.M. No. 18370, left mandibular fragment with P_4–M_3 and alveolae for P_{2-3} (loc. No. 48FR76).

This specimen is a younger individual than the type (Sinclair, 1914, p. 273) and shows the characters of the teeth much better. While there are some differences the material is not adequate for specific separation. Anterior mental foramen between P_1 and P_2 and the posterior below the posterior root of P_3; very short diastema between P_2 and P_3, both double rooted; P_4 with a small anterior tubercle, protoconid and deuteroconid well developed, deuteroconid nearly as high as protoconid (Cope, 1884, pl. 25e, fig. 24a, and Sinclair, 1914, fig. 7, indicate that a deuteroconid may have been present but was obliterated by wear), posterior cingulum with tubercle just lateral to median line; paraconid appears to be absent on all of the molars, a faint, discontinuous cingulum present on anterior, external, and posterior borders; hypoconulid on M_3 larger than entoconid and forming a distinct heel.

MEASUREMENTS OF MANDIBULAR FRAGMENT OF BUNOPHORUS ETSAGICUS (IN MILLIMETERS)

	Length	*Width*
P_4–M_3	31.5	------
M_{1-3}	23.3	------
P_4	7.5	4.4
M_1	7.0	6.0
M_2	7.4	6.5
M_3	9.0	7.0

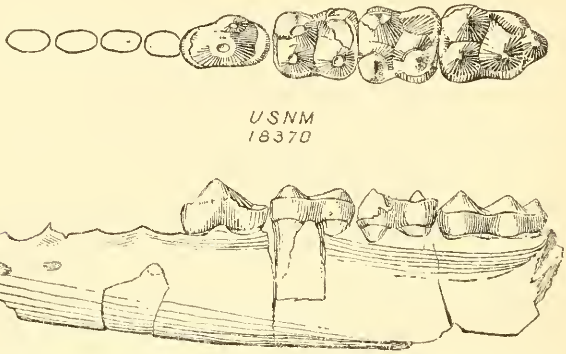

FIGURE 79.—*Bunophorus etsagicus* (Cope), U.S.N.M. No. 18370; occlusal view of teeth and lateral view of left mandible, ×1½.

Genus DIACODEXIS Cope

DIACODEXIS OLSENI Sinclair

U.S.N.M. No. 18472, left mandibular fragment with P_4–M_2 (loc. No. 48FR78).

This material does not permit anything to be added to Sinclair's (1914, p. 292) discussion of the species.

SUMMARY

Since Tertiary reptiles are yet too poorly known to be useful as horizon markers, they will be omitted from the summary. From the Boysen Reservoir area 23 species of fossil mammals have been identified; 14 of them (see Table 2) are common to the Lost Cabin faunal zone of the Lower Eocene, 2 of them to the Gray Bull, and 2 others are common to both the Gray Bull and the Lysite. Consequently, there can be little doubt that these deposits must be referred to the Lost Cabin faunal zone. However, on structural grounds these beds may be somewhat younger than the type section on Alkalai Creek.

There are about 250 feet of the Wind River formation exposed in the Boysen Reservoir area. For the most part the formation consists of drab greenish-gray gypsiferous clays with yellowish, usually fine-grained, channel sandstones forming nearly vertical cliffs. While most of the gypsum is probably secondary there are numerous areas of local concentration caused by seepage of ground water or by capillary

TABLE 2.—*Species of fossil mammals identified from the Boysen Reservoir area*

	Gray Bull	Lysite	Lost Cabin
Didelphodus ventanus			x
Cynodontomys scottianus			x
Cynodontomys lundeliusi, new species			
Esthonyx acutidens			x
Notharctus venticolus			x
Teilhardella sp			
Loveina zephyri [1]			x
Stylinodon cylindrifer			x
Paramys major [1]	x		x
Paramys murinus [1]	x		x
Prolimnocyon antiquus			x
Sinopa strenua	x	x	x
Didymictis altidens			x
Vulpavus australis	x	x	x
Miacis latidens [1]	x		x
Meniscotherium terrarubae			x
Hyopsodus powellianus		x	x
Hyopsodus wortmani			x
Hyracotherium venticolum			x
Lambdotherium popoagicum			x
Eotitanops borealis			x
Heptodon brownorum			x
Bunophorus etsagicus	x		x
Diacodexis olseni			x
Coryphodon sp			

[1] Specimens referred provisionally to this species.

action in poorly drained areas. These areas are just as hazardous to motor vehicles when dry as when wet. Local areas of banded red and greenish clays occur in several places in the Reservoir area, but are usually not more than 50 or 60 acres in extent and grade laterally into the drab-colored clays. Associated with the variegated beds there are usually one or more zones of small calcareous nodules. Nearly all the fossils collected were found in the areas of the banded clays and the best preserved ones were in the nodular zones. The few fossils that were found in the drab clays were usually so badly disintegrated by crystallization of gypsum that they were not worth collecting. Neither the field observations nor the study of the fauna give any indication of a difference in stratigraphic level between the localities. Following is a list of the localities, from which vertebrate fossils were obtained, coded according to the practice of the Smithsonian River Basin Surveys:

48FR65. NE¼SW¼ sec. 5, T. 4 N., R. 6 E., of Wind River meridian. Two prominent buttes, locally known as White Butte, or White Hill, on the south side of Cottonwood (Dry Muddy) Creek at the junction of its valley with that of the Big Horn River. The sediments consist of banded red and greenish clays with local concretionary zones, and are fossiliferous throughout the thickness of the exposure. Probably some of the material collected by J. L. Wortman in 1880. 1891.

and 1896 came from this locality, though most of his localities are rather vague, owing to the absence of cultural landmarks.

48FR75. An area of badlands centering around the corners of secs. 2, 3, 10, and 11, T. 4 N., R. 5 E., of the Wind River meridian on the south side of Cottonwood (Dry Muddy) Creek about 7 miles above the mouth. The sediments here consist of drab greenish-gray shaly clays, which are highly gypsiferous throughout. Yellowish channel sandstones play an important role in the physical features. Fossils are rare in this area and are often so badly rotted with gypsum that they are not worth collecting.

48FR76. SW¼ sec. 5, T. 39 N., R. 94 W., of the 6th principal meridian, on the east side of the Big Horn River and on the north side of Birdseye Creek. A small area of banded red and greenish clays with local concretionary zones. These banded beds grade laterally into the drab gray clays. This locality is one of the most productive in quantity and variety of fossils.

48FR77. NW¼ sec. 1 and NE¼ sec. 2, T. 4 N., R. 5 E., of the Wind River meridian, on the north side of Cottonwood (Dry Muddy) Creek about 4 miles above the mouth. A small area of banded red and greenish clays with considerable gypsum, and local nodular zones. Crossbedded channel sandstones make up a greater part of the sediments here than in any of the other localities. Fossils are rare in this locality and are usually rather badly damaged by gypsum.

48FR78. NE¼NW¼ sec. 32, T. 5 N., R. 6 E., of the Wind River meridian on the north side of Cottonwood (Dry Muddy) Creek near the mouth. A rather large area of banded red and greenish clays with considerable gypsum, and local nodular zones. The fossils were associated with the latter and were usually rather well preserved, though fragmentary. Fossils are scarce in this area and only a small fauna was obtained.

48FR79. SW¼ sec. 29, T. 5 N., R. 6 E., of Wind River meridian. On the west side of Big Horn River about 1 mile north of Cottonwood (Dry Muddy) Creek, north of a fault of unknown displacement which extends across this area about 2 miles south of the mountains. A small area of banded red, yellow, and greenish sandy clay with abundant small calcareous nodules. The only fossils obtained from this locality were broken mammal teeth and fresh-water gastropods.

48FR80. SW¼ sec. 2, T. 4 N., R. 4 E., of Wind River meridian, south side of Cottonwood (Dry Muddy) Creek about 14 miles above the mouth, west side of trail which crosses creek. A small area of banded red and greenish clays with local nodular zones. Channel sandstones are prominent in the upper portion of the exposures.

Figure 80.—Map of Boysen Reservoir area showing localities from which vertebrates were obtained.

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PROPOSED BOYSEN RESERVOIR

There appears to be less gypsum in this locality than in the others. This locality was the most productive in both quantity and variety of fossil mammals.

Table 3 shows the species obtained at each locality.

TABLE 3.—*Distribution of forms by localities*

Mammals recognized from the Boysen Reservoir area	Locality number						
	65	75	76	77	78	79	80
Didelphodus ventanus	x						x
Cynodontomys scottianus			x				x
Cynodontomys lundeliusi	x						
Esthonyx acutidens	x		x		x		x
Notharctus venticolus				x			
Teilhardella sp.							x
Loveina zephyri			x				
Stylinodon cylindrifer			x				
Paramys major			x				x
Paramys murinus							x
Prolimnocyon antiquus	x		x				
Sinopa strenua				x			
Didymictis altidens		x	x				x
Miacis latidens							x
Vulpavus australis			x				
Meniscotherium terrarubae							x
Hyopsodus powellianus		x					
Hyopsodus wortmani	x				x		x
Hyracotherium venticolum	x		x		x		
Lambdotherium popoagicum		x	x		x		
Eotitanops sp.	x		x			x	
Heptodon brownorum	x	x	x				x
Bunophorus etsagicus			x				
Diacodexis olseni					x		x
Coryphodon sp	x						

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