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PLIOCENE SAW ROCK CANYON FAUNA  
IN KANSAS

BY  
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*(Continued on inside back cover)*

## PLIOCENE SAW ROCK CANYON FAUNA IN KANSAS

By CLAUDE W. HIBBARD

### CONTENTS

Introduction .....	91
Rexroad formation .....	92
Saw Rock Canyon section .....	93
Cimarron River section .....	94
Wolf Canyon section .....	94
Discussion of outcrop areas .....	95
Saw Rock Canyon fauna .....	97
Mollusca .....	97
Vertebrata .....	98
<i>Osteoborus progressus</i> Hibbard .....	98
<i>Perognathus mclaughlini</i> , sp. nov. ....	98
<i>Dipoides wilsoni</i> , sp. nov. ....	100
<i>Baiomys rexroadi</i> Hibbard .....	103
<i>Cosomys primus</i> Wilson .....	103
Discussion .....	104
Literature cited .....	105

### INTRODUCTION

A RICH fossil-bearing locality discovered in Saw Rock Canyon, Seward County, Kansas, in June 1943, by Thad G. McLaughlin and Hibbard, yielded Pliocene vertebrates, from two adjacent lithologic units. An upper 12-foot layer of sandy silt has yielded remains of mastodon and land turtles, and an underlying sandy silt and clay bed about 10 feet thick remains of a beaver and "bone-eating" dog. The name *XI member* (new name) is proposed for this lower sandy silt and clay unit. The invertebrate and vertebrate fauna which it contains is known as the Saw Rock Canyon local fauna. The purpose

of this paper is to describe the Saw Rock Canyon fauna and to discuss the stratigraphic position of the XI member.

The occurrence of vertebrate fossils at this locality was briefly described by the author in 1944. The fossils were interpreted to be of Middle Pliocene age and the strata were referred to the Ogallala. Subsequent visits have furnished additional vertebrate material for study and have given more precise data on its stratigraphic occurrence. The mastodon and the land turtle described in 1944, as *Pliomastodon adamsi* and *Testudo riggsi*, respectively, are now known to belong to the Rexroad fauna, *sensu stricto*, and to come from an upper fossiliferous unit which is recognized to be of Blancan, Upper Pliocene age.

The presence of the beaver (*Dipoides*), obtained in the early collection, had caused the whole assemblage to be considered of Middle Pliocene age. *Dipoides* has been regarded in the past as a Hemphillian form. *Osteoborus progressus*, the bone-eating dog, is recognized in its evolutionary development to be intermediate between *O. cynoides* (Martin) of Hemphillian age and *Borophagus diversidens* Cope of Blancan age. The strata of the lower fossiliferous unit are intermediate in age between those from which the Hemphill fauna and the Blanco fauna were recovered, that is, near the boundary line of Middle and Upper Pliocene time.

The co-operation of Robert W. Wilson, curator of Paleontology in the University of Kansas Museum of Natural History, who granted permission to use the specimens in the museum as a basis for this publication, is gratefully acknowledged.

#### REXROAD FORMATION

The Rexroad formation was named by H. T. U. Smith (1940, p. 95) from exposures along the tributaries of Crooked Creek on the Rexroad Ranch, in sec. 22, T. 33 S., R. 29 W., Meade County, Kansas. For a further discussion of these beds in this region see McLaughlin (1946, pp. 33, 133) and Byrne and McLaughlin (1948, pp. 31, 34, 73).

At the beginning of deposition of the Rexroad formation, the topography of the Seward County area was very irregular. This

irregularity accounts for differences in the thickness of the Rexroad formation from place to place and for variations in the lithologic character of its basal beds. Some of the relief on the pre-Rexroad surface was due to faulting (sink-hole development) which affected the Laverne formation but not the Rexroad (Byrne and McLaughlin, 1948, p. 73). The topographically highest parts of the Laverne were exposed almost until the end of the Rexroad deposition, when the braided streams began to fill the valleys which occupied the surface depressions and spread a thin veneer of sand over the flood plain in the interstream areas where outliers of the Laverne still remained. The Laverne formation on these uplifted blocks of the interstream areas is characteristically capped with a thin deposit of Rexroad sand.

A series of measured sections and a discussion of the sections that outcrop in the general region of Saw Rock Canyon follows.

*Saw Rock Canyon Section*

Type section of XI member of the Rexroad formation.

McLaughlin and Hibbard, 1943. Near the center of the west line in sec. 36, T. 34 S., R. 31 W., Seward County, Kansas.

	<i>Thickness feet</i>
Meade formation	
7. Meade Gravels member. Sand and gravel, cemented with calcium carbonate. A few pebbles are as much as 1 inch in diameter. Forms prominent bench. ....	2.7
Disconformity	
Rexroad formation	
6. Silt, fine sand, red, containing lenses of fine gravel and coarse sand .....	12.0
5. Caliche, silicious, very hard, white. Forms prominent ledge....	2.7
4. Silt, reddish buff, containing fine sand (holotype of <i>Pliomas-todon adamsi</i> taken at top of bed, and the remains of <i>Testudo riggsi</i> near the base of bed) .....	10.5
Disconformity	
3. XI member. Clay, greenish gray to blue gray, some silt and fine sand near base, containing abundant remains of invertebrates, pond and river turtles and beaver ( <i>Saw Rock Canyon fauna</i> ) .....	5.6
2. Caliche, containing yellow-green to rusty-brown chert nodules..	1.4

1. Sand, fine to coarse, cross-bedded, poorly consolidated, yellow to rusty brown ..... 17.3
- Unconformity (angular)
- Laverne formation

*Cimarron River Section*

Sec. 20, T. 34 S., R. 30 W., Meade County, Kansas.

	<i>Thickness</i>
	<i>feet</i>
Crooked Creek formation	
7. Pearlette Ash member. Volcanic ash .....	4.0
6. Silt, sandy, reddish (invertebrates) varies from 1 to 3 feet....	3.0
5. Zone of pebbles .....	0.4
Unconformity	
Meade formation	
4. Missler member. Silt, sandy, reddish with stringers of caliche..	12.0
3. Meade Gravels member. Sand and gravel (basal 3 to 5 feet consolidated) .....	15.0
Unconformity	
Rexroad formation	
2. Clay, blue gray to brown (varies from 2 to 12 feet).....	10.0
1. Silt, reddish, sandy ( <i>Testudo riggsi</i> ) .....	10.0
(Base not exposed)	

*Wolf Canyon Section*

Modified from Byrne and McLaughlin, 1948, p. 74. In secs. 7 and 18, T. 35 S., R. 30 W., Meade County, Kansas.

	<i>Thickness</i>
	<i>feet</i>
Topsoil on caliche rubble	
Meade formation	
16. Silt, fine, sandy, grading upward into massive caliche at top, (from 2 to 8 feet thick).....	26.0
15. Silt, sandy, calcareous, ash gray at base, grading upward into gray tan to light tan; weathers to a resistant bench.....	7.5
14. Meade Gravels member. Sands and gravels, coarse; locally cemented with calcium carbonate .....	11.0
Disconformity	
Rexroad formation	
13. Silt, sandy, reddish to pinkish, zones of caliche (approximately middle of bed, a blue-gray zone 4 inches to 2 feet thick containing invertebrates) .....	40.0
12. Silt, fine, sandy, reddish, with lenses of clay at top of bed, massive caliche (weathers to hard resistant bench, 1 foot to 4 inches) .....	4.75

11. Silt, fine, sandy, reddish, streaked with caliche, grading upward into a gray clay .....	16.5
10. Sand, fine to coarse, containing lenses of blue-gray clay, bed grades upward into red sandy silt.....	3.0
9. Sand and gravel, fine to medium, light gray; cross-bedded, cemented with calcium carbonate, forming prominent ledges, eroded into long longitudinal stringers .....	14.0
8. Sand and gravel, fine to coarse, gray, unconsolidated.....	10.0
7. Clay, blue green, with zones of fine sandy silt, containing remains of large camel (Bed 12 of Byrne and McLaughlin, 1948, p. 75) .....	13.0
6. Sand, fine to medium, yellowish .....	5.5
5. Shale, sandy or weathered caliche, 4 inches to 1 foot .....	1.0
4. Clay, gray .....	1.75
3. Clay, blocky, red .....	.25
2. Shale, sandy, mottled gray and interbedded with lenses of blue-gray clay .....	8.75
1. Sand, fine to coarse, gray to tan, with lenses of green sandy silt (from which were taken a rabbit femur and pelvis, apparently <i>Nekrolagus</i> ) .....	2.25
Unconformity (angular)	
Laverne formation (inclined beds)	

### Discussion of Outcrop Areas

In the Saw Rock Canyon section beds 4, 5, and 6, are correlated with the upper part of the Rexroad formation exposed in Wolf Canyon and also in Keefe Canyon, Meade County. The reddish sandy silt of bed 4, exposed on the north side of the Cimarron River (sec. 20, T. 34 S., R. 30 W.) northeast of Saw Rock Canyon, yielded the remains of three specimens of *Testudo riggsi*. The beds of the Rexroad formation at this exposure have been traced from Keefe Canyon in sec. 3, T. 35 S., R. 30 W., and sec. 34, T. 34 S., R. 30 W., to this exposure (Hibbard and Riggs, in press).

West of the measured section near the head of Saw Rock Canyon in SE.¼ SE.¼ sec. 35, T. 34 S., R. 31 W., above the Meade Gravels in the overlying beds, is an outcrop of volcanic ash which further duplicates the geological section exposed in sec. 20, T. 34 S., R. 30 W.

In the Saw Rock Canyon section beds 1, 2, and 3 appear to be local in origin. At the time of the faulting and collapse of the

Laverne formation numerous depressions were developed. These depressions received immediately eroded materials from the disturbed Laverne beds. It appears that isolated depressions were developed in the area as well as the dissection of much of the area by streams after the faulting. Whether all the deformation of the Laverne deposits took place at the same time or whether it was a series of events that occurred over a rather long period of time is not known. The faulting of the Laverne beds in the area of Saw Rock Canyon preceded considerably the deposition of the deposits containing the Rexroad fauna. This is evident by the fossil remains which were trapped in the sediments laid down in the Saw Rock Canyon depression. The first sediments washed into the depressions were sands from the tilted beds. The peculiar rusty-brown chert nodules occurring in bed 2, are reworked from one of the uppermost beds of the Laverne in that area. The chert nodules were later found in place at the top of the Laverne exposures in sec. 4, T. 35 S., R. 30 W., and sec. 32, T. 34 S., R. 30 W., on the north side of the Cimarron River in southwestern Meade County. There is a chance that beds 1 and 2 of the measured section in Saw Rock Canyon are almost in normal relationship to the underlying Laverne but have been slightly distorted and slumped due to the faulting. Since the stream producing Saw Rock Canyon has not entirely dissected the basin, but has exposed only an edge of it, the total thickness of sediments laid down in the depression is unknown.

The type locality of the XI member of the Rexroad formation is near the center of the west line of sec. 36, T. 34 S., R. 31 W., Seward County, Kansas. The beds receive their name from the XI Ranch on which the exposures occur. Bed 3 is typical of the XI member.

The member consists of beds overlying the Laverne formation and underlying typical Rexroad beds. Beds 1, 2, and 3 are lithologically distinct from deposits previously known in the Rexroad formation. The fauna taken from bed 3 is also distinct from other faunas known from the High Plains region. Beds 1, 2, and 3 are included in the Rexroad formation because they appear to form a unit. Bed 3 shows a closer relationship both faunally and genetically to the overlying Rexroad beds rather than to the Laverne or Ogallala

formation of this region. Beds 1 and 2 are provisionally assigned to this member, since they may prove to be slightly distorted upper beds of the Laverne formation. The only other deposits observed in the area that may be comparable in part to these beds are beds 1 to 7 inclusive in Wolf Canyon, Meade County, in sec. 7, T. 35 S., R. 30 W.

The best exposure of the Rexroad formation is in Wolf Canyon in secs. 7 and 18, T. 35 S., R. 30 W., Meade County, Kansas. It was at the head of this canyon on July 21, 1947, that McLaughlin and Hibbard located an invertebrate horizon in the Rexroad formation varying from fifteen to twenty feet below the Meade Gravels of the Meade formation. This invertebrate zone was traced for more than a mile along the walls of the main canyon and its tributaries. Matrix was removed for the recovery of fossils.

In the Wolf Canyon section, beds 1 to 7 inclusive appear to have been derived locally from eroded Laverne beds at the time of tilting. Only fragmentary fossil remains are known but they are distinct from remains of vertebrates known from the Laverne deposits just southeast in Beaver County, Oklahoma. These beds are considered equivalent, in part, to beds 1 to 3 inclusive, as observed and studied in Saw Rock Canyon, sec. 36, T. 34 S., R. 31 W., Seward County, Kansas, only two and one-half miles westward on the south side of the Cimarron River.

#### SAW ROCK CANYON FAUNA

This local fauna was first named by Hibbard (1944) and occurs in the XI member of the Rexroad formation near the head of Saw Rock Canyon near the center of the west section line of sec. 36, T. 34 S., R. 31 W. The fauna is known by the following forms taken from bed 3 of the measured section at this locality.

#### *Mollusca*

Invertebrates are numerous in the upper part of bed 3. A large number of these were collected by McLaughlin and Hibbard in 1943, and by Hibbard and his party in 1944. They are being studied at the present time by A. B. Leonard. Franzen and Leonard (1947) reported on the fossil Pupillidae taken from this deposit.

*Vertebrata*

A systematic description is given of the mammalian fauna only, though the occurrence of the other vertebrates is noted.

The remains of fish, amphibians, and pond and river turtles are common in bed 3. Bird remains are rare.

Class MAMMALIA

Order CARNIVORA

Family Canidae

*Osteoborus progressus* Hibbard

*Osteoborus progressus* Hibbard, 1944, *Univ. Kan. Sci. Bull.*, Vol. 30, Pt. 1, No. 10, p. 107.

The remains of this bone-eating dog are known only from the type specimen which was taken from a local bog deposit at the base of bed 3.

Order RODENTIA

Family Heteromyidae

*Perognathus mclaughlini*, sp. nov.

(Figs. 1, 2H)

*Holotype*.—No. 24340, University of Michigan Museum of Paleontology, part of a right ramus bearing  $P_4$  and  $M_3$ . Collected July 28, 1947, by Dick Rinker, C. C. Carpenter, and Claude W. Hibbard. Paratypes; No. 24341 U.M., part of a left ramus bearing  $P_4$  taken July 28, and specimen No. 7740 K.U. (Fig. 2H), part of a left maxillary bearing  $P^4-M^2$ , recovered by Morton Green from matrix removed by McLaughlin and Hibbard, June, 1943.

*Horizon and type locality*.—Lower Upper Pliocene, XI member of the Rexroad formation, Saw Rock Canyon, sec. 36, T. 34 S., R. 31 W., Seward County, Kansas, University of Kansas, locality 6.

*Description of holotype*.—A pocket mouse similar in size to *Perognathus gidleyi* Hibbard from the Rexroad fauna of Meade County, Kansas. The alveolar length of the tooth series ( $P_4-M_3$ ) is 3.55

mm. The transverse width of  $P_4$  is 0.75 mm., and the anteroposterior diameter of  $P_4$  is 0.8 mm. *Perognathus mclaughlini* is distinguished from *P. gidleyi* by the characters of  $P_4$ . The  $P_4$  of *P. mclaughlini* has a very shallow external re-entrant angle which does not separate the anterior loph from the posterior loph. In fact, the outer cusp of the anterior loph joins the outer cusp of the posterior loph. The internal re-entrant angle of  $P_4$  is well developed and separates the anterior loph and posterior loph on the lingual side of the tooth. The posterior loph does not possess as great an anteroposterior width as

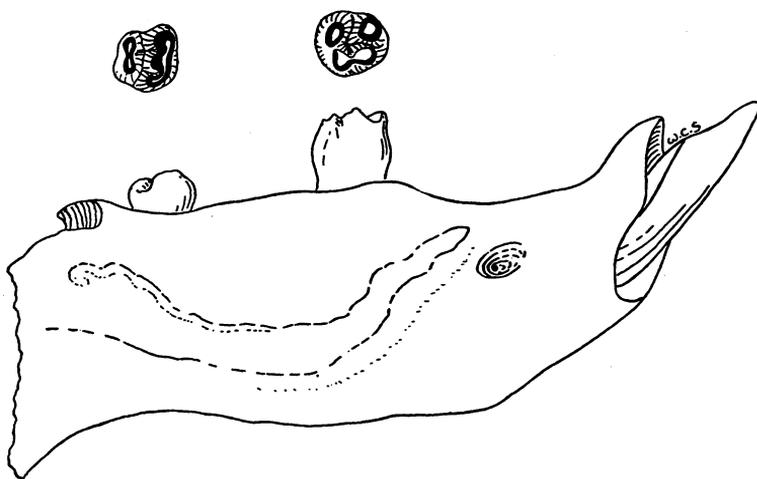


FIG. 1. Ramus of *Perognathus mclaughlini*, n. sp., holotype, U.M.M.P. No. 24340. Lateral and occlusal views.  $\times 10$ . Drawing by W. C. Sherman.

that loph possesses in *Perognathus gidleyi*. The  $P_4$  and  $M_3$  of the holotype are approximately the same size.  $M_1$ , as shown by the alveolus, is the largest tooth in the series.

The  $P_4$  of the paratype, No. 24341, possesses the same characters as those of the type. The left maxillary, No. 7740 K.U., is that of a young mouse. The anterior and posterior lochs of  $M^2$  are not separated by a broad valley as in  $M^1$ . The internal cusp of the anterior loph joins the internal cusp of the posterior loph in  $M^2$ .  $M^3$  is missing.

*Perognathus mclaughlini* is distinguished from *Perognathus dunklei* Hibbard from the Edson Quarry fauna, Middle Pliocene, and *Perognathus pearlettensis* Hibbard from the Borchers fauna, apparently Yarmouth in age, by its larger size.

This species is named for Thad G. McLaughlin, of the U. S. Geological Survey, who has devoted a number of years to studying the late Tertiary deposits of western Kansas.

### ***Dipoides wilsoni*, sp. nov.**

(Fig. 2A, B, F)

*Holotype*.—Specimen No. 6783, Kansas University Museum of Natural History, consisting of RP<sup>4</sup>-M<sup>3</sup>, LP<sup>4</sup>-M<sup>2</sup>, and the two upper incisors. It was taken June, 1943, by McLaughlin and Hibbard. Paratypes; a right tibia, No. 6891 K.U., and two right astragali, No. 6892 K.U. In the University of Michigan Museum of Paleontology is a left ramus, specimen No. 24338, bearing DP<sub>4</sub>, M<sub>1</sub>, and M<sub>2</sub>, and a RM<sup>3</sup> of an immature beaver, taken in the summer of 1947.

*Horizon and type locality*.—Lower Upper Pliocene, XI member of the Rexroad formation, Saw Rock Canyon, sec. 36, T. 34 S., R. 31 W., Seward County, Kansas.

*Description of holotype*.—The upper teeth are those of a medium-sized individual. The teeth are hypsodont, with the base of the teeth completely open. Each tooth possesses a mesostria and a hypostria. They are open at the base, extend the full depth of the mesoflexus and hypoflexus, and they are filled with cement (for terminology of teeth, see Stirton, 1935). Parastria, metastria, paraflexus, and metaflexus exist only on the teeth of immature animals and are lost early in wear, giving the tooth a compressed S-pattern. *Dipoides wilsoni* is smaller than *D. stirtoni* Wilson, and further distinguished from it by the absence of the paraflexid on P<sub>4</sub> and M<sub>3</sub> in adult specimens. *D. wilsoni* is approximately the size of *Dipoides williamsi* Stirton though smaller and distinguished from it by the more compressed teeth with external inflections of the enamel extending more nearly across the crown of the tooth toward the enamel of the opposite side. *D. wilsoni* is more closely related to *Dipoides williamsi* than to *D. stirtoni*.

Measurements in millimeters of holotype, No. 6783 K.U. (RP<sup>4</sup>-M<sup>3</sup>):

Length of occlusal surface of tooth row, P <sup>4</sup> -M <sup>3</sup> .....	17.6
Length of P <sup>4</sup> .....	11.0
Length of anteroposterior occlusal surface of P <sup>4</sup> .....	4.8
Greatest width of occlusal surface of P <sup>4</sup> .....	4.6
Length of M <sup>1</sup> .....	10.5
Length of anteroposterior occlusal surface of M <sup>1</sup> .....	4.85
Greatest width of occlusal surface of M <sup>1</sup> .....	4.4
Length of M <sup>2</sup> .....	9.1
Length of anteroposterior occlusal surface of M <sup>2</sup> .....	5.0
Greatest width of occlusal surface of M <sup>2</sup> .....	4.15
Length of M <sup>3</sup> .....	8.8
Length of anteroposterior occlusal surface of M <sup>3</sup> .....	4.9
Greatest width of occlusal surface of M <sup>3</sup> .....	3.9
Width of incisor .....	4.4

*Paratypes*.—The tibia of specimen No. 6891 K.U. has an over-all length of 85.0 mm. The proximal end of the fibula is missing. The larger of the two astragali, specimen No. 6892 K.U., has an over-all length of 14.7 mm., with a greatest width of 12.1 mm. In the University of Kansas collection there are twenty-two isolated molars and premolars of adult beavers, all of which possess a compressed S-pattern. The largest of these teeth is a fourth premolar with a length of 16.2 mm.; the anteroposterior occlusal length is 5.3 mm., and the greatest width of occlusal surface is 3.9 mm. The largest molar has a length of 13.5 mm., with an anteroposterior occlusal length of 5.1 mm., and an occlusal width of 5.0 mm. In no tooth is the base closed or constricted. There are fragments of four lower incisors. The greatest width of the two largest incisors is the same, being 5.1 mm. There is one upper incisor which has a width of 5.2 mm. The incisors, as pointed out by Wilson (1934), are not flattened as in *Castor*. Both lower and upper incisors are decidedly rounded.

Specimen No. 24338, University of Michigan, is that of an immature individual (Fig. 2B, 2F). DP<sub>4</sub> is two-rooted and possesses an S-pattern. M<sub>1</sub> and M<sub>2</sub> each possess a paraflexid which extends across the tooth nearly as far as the mesoflexid. The parastrid extends down on the side of the teeth less than 1 mm. With slight wear the paraflexids will become isolated enamel islands

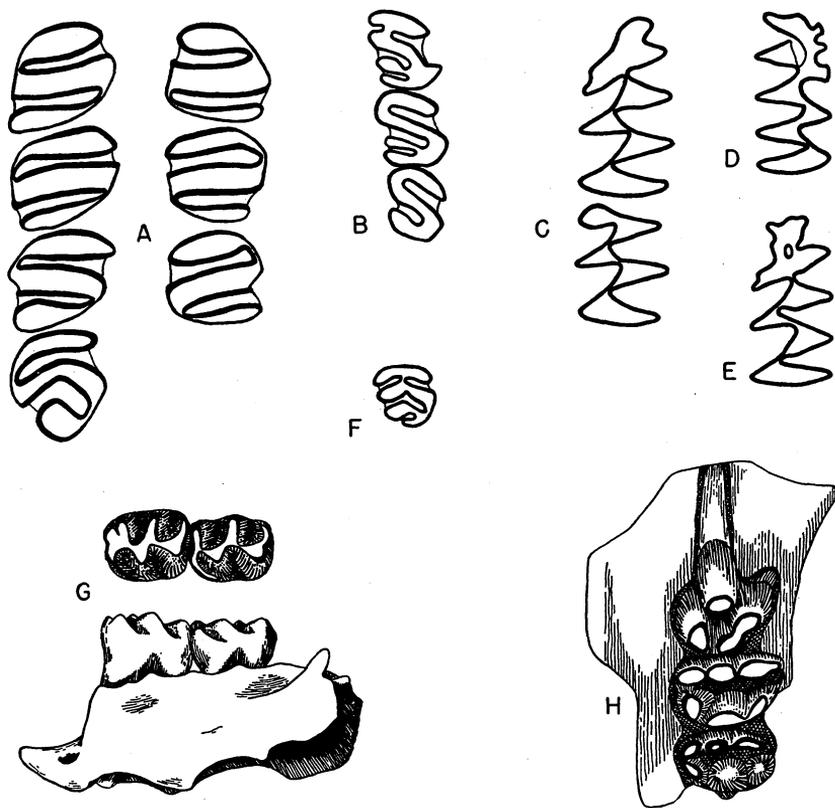


Figure 2

- (A) *Dipoides wilsoni*, sp. nov., holotype, K.U. No. 6783, RP<sup>1</sup>-M<sup>3</sup> and LP<sup>1</sup>-M<sup>2</sup>. Occlusal view.  $\times 3$ . Drawing by Betty Brooks.
- (B) *Dipoides wilsoni*, sp. nov., paratype, U.M.M.P. No. 24338, LDP<sub>4</sub>, M<sub>1</sub> and M<sub>2</sub>. Occlusal view.  $\times 3$ . Drawing by Betty Brooks.
- (C) *Cosomys primus* Wilson, U.M.M.P. No. 24344, LM<sub>1</sub>-M<sub>2</sub>. Occlusal view.  $\times 8$ . Drawing by Betty Brooks.
- (D) *Cosomys primus* Wilson, U.M.M.P. No. 24344, RM<sub>1</sub>. Occlusal view.  $\times 8$
- (E) *Cosomys primus* Wilson, U.M.M.P. No. 24344 LM<sub>1</sub>. Occlusal view.  $\times 8$
- (F) *Dipoides wilsoni*, sp. nov., paratype, U.M.M.P. No. 24338, RM<sub>2</sub>, Occlusal view.  $\times 3$ . Drawing by Betty Brooks.
- (G) *Baiomys rexroadi* Hibbard, K.U. No. 6898, left ramus, M<sub>1</sub>-M<sub>2</sub>. Labial and occlusal views.  $\times 10$ . Drawing by Frances Watson Horseman.
- (H) *Perognathus mclaughlini*, sp. nov., paratype, K.U. No. 7740. Left maxillary, P<sup>1</sup>-M<sup>2</sup>. Occlusal view.  $\times 10$ . Drawing by Frances Watson Horseman.

and quickly disappear, giving the tooth the normal S-pattern.  $M_2$  however, has a very small metaflexid which would have disappeared with further wear. The mesoflexids and hypoflexids of  $M_1$  and  $M_2$  are deep, and wider toward the expanded open base of the teeth. They are filled with cement. The anteroposterior occlusal surface of  $DP_4-M_2$  is 10.2 mm. The width of the incisor is 2.2 mm., contrasted with a width of 5.1 mm. in the adult individuals. The right  $M^3$  of the immature beaver shows the same development of the S-pattern as is shown in the lower molars. The metaflexus will soon disappear with wear, being followed in disappearance by the para-flexus which is better developed. The hypoflexus will extend completely across the crown of the tooth.

This species is named for Robert W. Wilson, who has devoted much time to the study of fossil rodents.

#### Family Cricetidae

##### *Baiomys rexroadi* Hibbard

(Fig. 2G)

*Baiomys rexroadi* Hibbard, 1941. *Amer. Midl. Nat.*, Vol. 26, No. 2, p. 351.

There was recovered a fragmentary left ramus, No. 6898 K.U., bearing  $M_1-M_2$  of a small rodent, indistinguishable in size and characters of the teeth from the holotype of *Baiomys rexroadi* taken at locality 2, Meade County, Kansas, Rexroad fauna.

##### *Cosomys primus* Wilson

(Fig. 2C, D, E)

*Cosomys primus* Wilson, 1932. *Journ. Mammal.*, Vol. 13, No. 2, p. 150.

In the summer of 1947 there was recovered, with the immature jaw of *Dipoides*, the fragmentary part of a left ramus, No. 24344 U.M., bearing  $M_1-M_2$ , and a few isolated molars of a vole indistinguishable from *Cosomys primus* Wilson. More complete material may show that the specimens are distinct from *C. primus*. The ramus is that of an adult animal. The teeth are without cement and well-rooted even in the immature specimen (see below). The

anteroposterior diameter of  $M_1$ - $M_2$  at the occlusal surface is 5.1 mm. The anteroposterior diameter of  $M_1$  is 3.0 mm., with an occlusal width of 1.6 mm. The anteroposterior diameter of the occlusal surface of  $M_2$  is 2.0 mm. Among the isolated molars recovered there are three isolated lower first molars. The anteroposterior diameters of the occlusal surfaces of these teeth are respectively, 3.0 mm.; 2.8 mm.; and 2.8 mm. The width of the occlusal surfaces are 1.6 mm.; 1.6 mm.; and 1.4 mm., respectively. One of the isolated first molars is that of an adult animal. Another is that of a younger individual possessing an enamel islet opposite the fourth inner re-entrant angle (Fig. 2E). The third, a  $RM_1$ , is that of an immature specimen with an occlusal width of 1.4 mm. (Fig. 2D). This tooth clearly shows the development of the enamel islet discussed by Wilson (1932 and 1933). The islet is developed from the deeply infolded and posteriorly deflected fourth internal re-entrant angle (Fig. 2D). The infolding of the enamel nearly isolates the third internal triangle. In  $M_1$  of the older individuals the enamel of the second external re-entrant angle and the enamel of the third internal re-entrant angle meet, thus closing off the third alternating triangle from the anterior loop. The enamel of the teeth is constant in thickness except in the formation of the islet. There is no differentiation of thick and thin enamel tracts in the development of the re-entrant angles.

These specimens are distinguished from *Ogmodontomys poaphagus* Hibbard of the Rexroad fauna of this region by their smaller size, the closed third alternating triangle of  $M_1$ , the presence of the deeply infolding fourth internal re-entrant angle, and by the presence of the enamel islet opposite the fourth inner re-entrant angle in the early stage of wear of  $M_1$ .

#### DISCUSSION

From a study of the vertebrates it is evident that the forms are younger than the Edson Quarry fauna (Hemphillian) from Sherman County, Kansas, and older than the Rexroad fauna (Blancan) from Meade County, Kansas. A closer relationship is shown between the Rexroad fauna and the Saw Rock fauna than between the Saw Rock

and the Edson Quarry fauna, as indicated by the rodents. For this reason the fauna could be assigned either to the upper part of the Middle Pliocene or to the lower part of the Upper Pliocene.

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