THE BORCHERS FAUNA, A NEW PLEISTOCENE INTERGLACIAL FAUNA FROM MEADE COUNTY, KANSAS

By

CLAUDE W. HIBBARD

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By CLAUDE W. HIBBARD[1]

CONTENTS

1 Vertebrate Paleontologist, State Geological Survey of Kansas, and Curator of Vertebrate Paleontology, Dyche Museum of Natural History, University of Kansas.

The deposit contains few fossils and it was only after two summers of intensive search that the remains of vertebrates were located. The exposure was worked for two weeks in the summer of 1939 and three weeks in the summer of 1940 by field parties from the University of Kansas. The fossils were taken from an impure ash presumably near the margin of the ash lens.

Geologic relations of the fossil-bearing beds.—The following section, measured by John C. Frye, geologist in the Ground-Water Division of the U.S. Geological Survey and Kansas Geological Survey, and by me, shows the nature of the deposits at the Borchers fossil locality and their geologic relations. The fossil-bearing beds are found in the middle part of the locally exposed Pleistocene strata that are classed by Smith (1940, p. 105) as belonging provisionally to the nonred facies of his Odee formation, of Pleistocene age.

Section of Quaternary and Tertiary deposits in the NW¼ sec. 21, T. 33 S., R. 28 W., Meade county, Kansas

	Thickness in feet
Quaternary system	
Recent series	
14. Top soil containing calcareous concretions	1.6
Pleistocene series	
13. Sandy silt and clay, tan to buff brown	14.6
12. Silt, clay, and some sand, gray to gray tan, calcareous nodules at top	16.0
11. Weathered ash and silt; contains vertebrate remains collectively designated as the *Borchers fauna*	4.0
10. Volcanic ash, pearl gray, thin bedded and cross bedded	4.0
9. Clay and sandy silt, tan gray and brown gray	18.3
8. Sand, coarse and well sorted at base grading upward into finer, more poorly sorted sand, rust colored; calcareous nodules at top	10.0
Tertiary system	
Ogallala formation	
7. Caliche, sandy, gray tan	6.6
6. Silt, fine sand, and some clay, tan to buff	2.6
5. Sand and silt, reddish tan, massive	7.0
4. Caliche, sandy, nodular, containing pockets and lenses of pink-tan sandy silt (*Biorbia fossilia*)	11.2
3. Sandy silt and clay, pinkish tan (*Biorbia fossilia*)	6.1
2. Sand and gravel, cross bedded, contains tightly cemented and loose zones	34.6
1. Flood plain	
	136.6

SYSTEMATIC DESCRIPTIONS

Class MAMMALIA
Order INSECTIVORA

Genus SOREX Linnaeus, 1758 (Long-tailed shrews)

Characters.—Number of teeth: incisors, 4/2; canines, 1/0; premolars, 2/1; molars, 3/3 = 32. Size very small, ears hidden in the soft fur, eyes minute, muzzle pointed. These shrews are terrestrial in habit, living generally along the edges of marshes, swamps, and streams where the ground is moist. The genus is not known to be represented by species living in Kansas at the present time.

SOREX TAYLORI Hibbard (Taylor's shrew)

Sorex taylori HIBBARD, *1938,* Kansas Acad. Sci. Trans., vol. 40, pp. 242-243, fig. 1. Type locality, Meade county, Kansas, Loc. no. 2, upper Pliocene.

Plate 1, figure 5

In the collection of fossils from the Borchers ranch are parts of five rami referable to this form. KUMVP no. 6118 is the posterior part of a right ramus bearing M_1-M_3. The anteroposterior diameter of the molar series is 3.3 mm. Specimen no. 5232 is the posterior part of a right ramus, bearing M_1-M_3; anteroposterior diameter of the molar series is 3.2 mm. Specimen no. 5233 possesses P_4-M_2. P_4 is not as large as the P_4 of the recent form, *Sorex obscurus obscurus* Merriam; it has a shorter anteroposterior diameter but a better-developed heel. The ramus is also more robust. The specimens agree well with the upper Pliocene species in that the hypoconid and entoconid of M_3 are not as well developed as in *S. obscurus obscurus,* so that the heel is smaller than in that form. The coronoid process of the specimens also differs from that of the recent species and agrees well with that of the fossil form in that there is a better-developed depression on the labial side for the attachment of the muscle.

Order CARNIVORA

Genus MUSTELA Linnaeus, 1758 (Weasels)

Characters.—Number of teeth: incisors, 3/3; canines, 1/1; premolars, 3/3; molars, 1/2 — 1 = 34 or 32. Small, long-bodied carnivores having short legs and feeding upon live prey, chiefly rodents and small birds.

CITELLUS MEADENSIS, n. sp. (Meade ground squirrel)
Plate 1, figures 2, 7

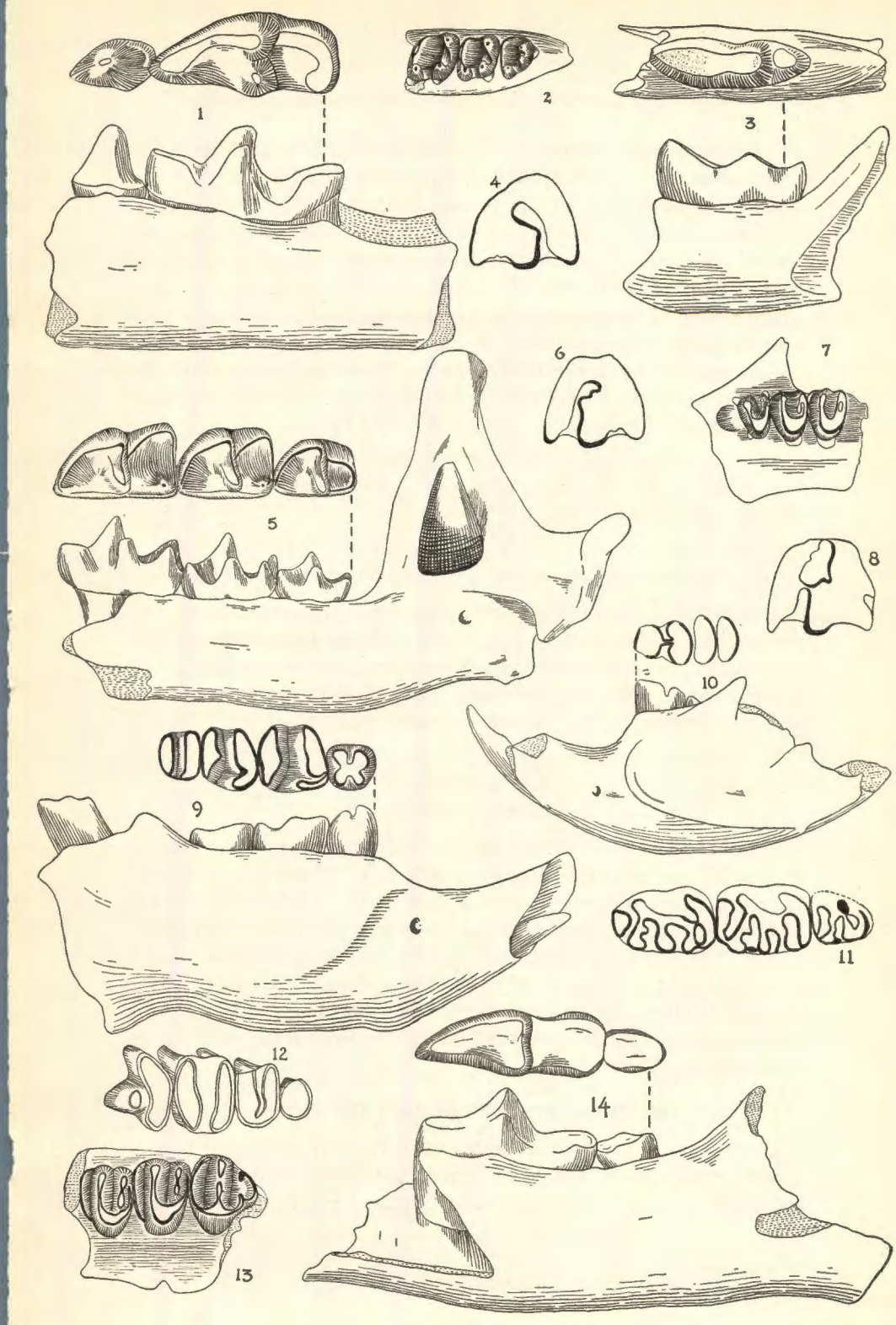
Type.—KUMVP no. 6169, anterior part of right ramus of adult, bearing P_4-M_2. Paratype, no. 6119, fragmentary left maxillary bearing P^4-M^2.

Horizon and type locality.—Pleistocene, Loc. no. 9, Meade county, Kansas, Borchers fauna.

Diagnosis.—This ground squirrel is nearly as large as *Citellus mexicanus parvidens* (Mearns). On P_4 the protoconid and paraconid (Howell, North American Fauna, no. 56, pl. 12, 1938) are well developed and are separated by a deep sulcus or groove. The hypoconid is larger than that of *Citellus tridecemlineatus arenicola* Howell. The reëntrant angle between the protoconid and hypoconid is wide, but does not extend as far across the crown of the tooth as in recent species. Between the protoconid and paraconid of M_1 and M_2 is a well-developed groove, in the center of which is a deep pit, the anterior border of which forms a prominent convexity on the anterior part of the molars. This is a greater convexity than exists in *C. mexicanus parvidens*. A similar process is found in some immature specimens of *C. tridecemlineatus* but is lost early in wear. The posterior border of the groove is partly closed by an enamel ridge that extends from the posterior border of the protoconid diagonally to the base of the paraconid. This condition is present in a vestigial stage in *C. mexicanus parvidens*, but has not been observed to be as well developed in any recent species.

Description of type.—P_4 has a transverse diameter of 1.8 mm, and an anteroposterior diameter of 1.7 mm; the anteroposterior diameter of the P_4-M_2 series is 5.85 mm; the transverse diameter of M_1 is 2.0 mm; the transverse diameter of M_2 is 2.3. The entoconid is better developed than that of recent forms.

Discussion.—*Citellus meadensis* is distinguished from *C. bensoni* Gidley, *C. tuitus* Hay, *C. cochisei* Gidley, and *C. taylori* Hay by its smaller size, and from the small *Citellus* from the upper Pliocene of Kansas by the narrower transverse diameter of its molars and by the development of the pit in the groove between the protoconid and paraconid of the molars, as well as by the pronounced ridge extending from the posterior border of the protoconid to the posterior base of the paraconid.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PEROGNATHUS PEARLETTENSIS, n. sp. (Pearlette pocket mouse)

Plate 1, figures 9, 12; Plate 2, figures 10, 14

Type.—KUMVP no. 6127, nearly complete right ramus bearing incisor and P_4-M_3. Paratypes, no. 5231, fragmentary right ramus bearing P_4-M_3; no. 5354, fragmentary left ramus bearing P_4-M_3; no. 5353, fragmentary left ramus bearing incisor and P_4 and M_2; no. 5365, fragmentary left ramus bearing incisor and P_4 and M_2; no. 5709, fragmentary right ramus bearing P_4 and M_1; nos. 6146 and 6122, nearly complete right rami bearing incisor and P_4; maxillary no. 5361, bearing P^4-M^2; and maxillary no. 5362, bearing P^4-M^3.

Horizon and type locality.—Pleistocene, Loc. no. 9, Meade county, Kansas, Borchers fauna.

Diagnosis.—This pocket mouse is nearly as large as *Perognathus apache* Merriam, but possesses a shorter and more robust diastemal region and a shorter and broader condyloid process.

Description of type.—The ramus is that of a young adult. The P_4 is just wearing into an H pattern. The anteroposterior diameter of the molar series is 3.1 mm; the depth of the ramus on the labial side below P_4 is 2.6 mm; the depth of the ramus on the labial side below M_2 is 2.25 mm. The masseteric ridge is well developed but does not extend upward as near the dorsal surface of the diastemal region as in *Perognathus flavus* Baird. The anteroposterior diameter of P_4 equals that of M_3, but the transverse diameter is not as great. M_1 is the largest tooth, M_2 is second in size, and M_3 is slightly larger than P_4.

The paratypes agree in every respect with the type. They exhibit all stages of dentitional wear. The anteroposterior diameter of the molar series of nos. 5231 and 5709 is 3.0 mm. No. 5365 is a nearly complete ramus including P_4. The anteroposterior diameter of the tooth is 0.65 mm; the anteroposterior diameter of the alveolar series, measured from the anterior root of P_4 is 3.1 mm; the depth of the ramus on the outside, measured at P_4, is 2.5 mm; the depth of the ramus measured on the outside below M_2 is 2.2 mm. The mandibular foramen is located nearer the tip of the condyloid process than it is in *Perognathus apache* Merriam. Maxillary no. 5361 is that of a young adult. The anteroposterior diameter of P^4-M^2 is 2.4 mm. No. 5362 is that of an adult and bears P^4-M^3. The labial side of M^2 and the anterior border of M^3 are slightly chipped. The anteroposterior diameter of the molar series is 3.0 mm.

developed as in *O. leucogaster arcticeps,* though larger. The mental foramen has approximately the size and position of that in *O. leucogaster arcticeps,* although the diastemal region of the jaw is not as robust. The paratypes agree with the type in characters mentioned, although they differ in anteroposterior length of crown series. The average length of the lower molar series including that of the type is 4.47 mm; extremes are 4.2 mm (an old adult) and 4.7 mm. The average depth below M_1, measured on the inside of the ramus, of 8 specimens, is 3.7 mm. In the collection there are 169 rami and maxillaries bearing one or two molars, besides numerous rami and isolated teeth referable to this form.

Onychomys fossilis is distinguished from *O. bensoni* Gidley by its larger size, and from *O. pedroensis* Gidley by the following characters, which were listed by C. L. Gazin in a letter of March 20, 1941, after he had compared the Borchers form with the Curtis ranch specimen:

> The capsular process for the reception of the base of the incisor and the groove separating the process from the rest of the ramus is better developed in *Onychomys pedroensis* than in your fossil. In *O. pedroensis* it is more like that in *O. leucogaster arcticeps,* however, of the several jaws representing the Curtis ranch form, only one has this portion preserved. Your form is distinct from *O. pedroensis* also in that the jaws of the Meade county form are not so robust, having a shallower and more slender jaw with narrower teeth. Your form is similar to *O. pedroensis* in that the last cheek tooth is less reduced and the masseteric crest extends farther forward than in the modern material.

Genus REITHRODONTOMYS Giglioli, 1874 (American harvest mice)

Characters.—Number of teeth: incisors, 1/1; canines, 0/0; premolars, 0/0; molars, 3/3 = 16. The smallest of Recent Kansas mice, lacking cheek pouches; upper incisors possess longitudinal grooves; terrestrial in habit.

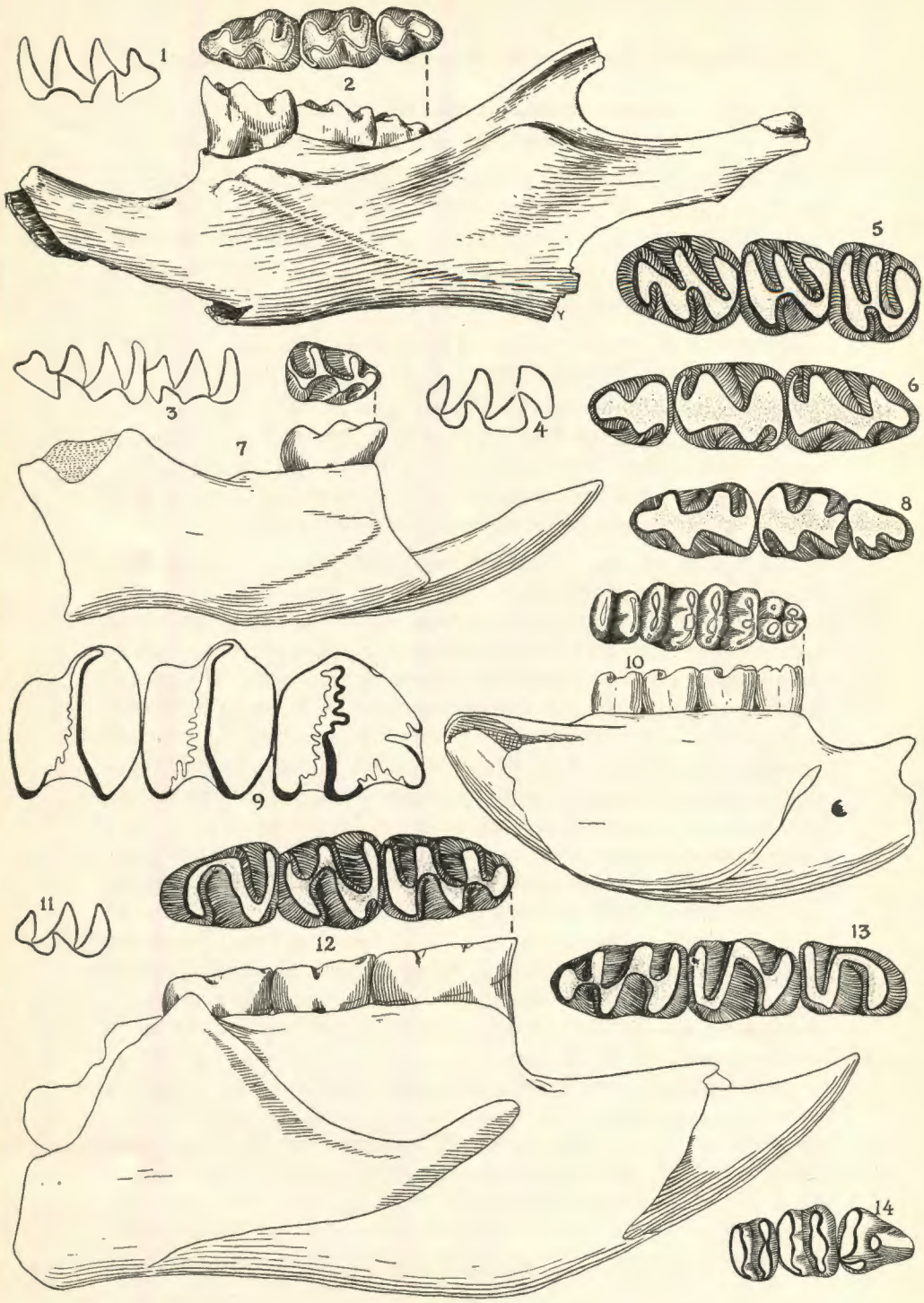
REITHRODONTOMYS PRATINCOLA, n. sp. (Meadow harvest mouse)
Plate 2, figure 7

Type.—KUMVP no. 6167, part of right ramus bearing incisor and M_1.

Horizon and type locality.—Pleistocene, Loc. no. 9, Meade county, Kansas, Borchers fauna.

Diagnosis.—This harvest mouse is smaller than *Reithrodontomys albescens griseus* (Bailey), and is distinguished by having a more acute angle between M_3 and the coronoid process.

Description of type.—M_1 has an anteroposterior diameter of 1.2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young adults to old adults. There were also collected 123 other rami and fragmentary maxillaries containing one or two molars, besides numerous isolated molars and rami without teeth.

This species is named for Dr. John Eric Hill, with whom I have spent many pleasant days collecting mammals.

Comparison.—*Sigmodon hilli* is distinguished from *Sigmodon curtisi* Gidley by its smaller size and from *Sigmodon minor* Gidley by its slightly larger size and by the fact that the reëntrant valleys of the upper molars are more oblique. Gidley (1922, p. 126) states, "the external reëntrant valleys of the molars (as shown by specimen no. 10513, USNM) are of the normal modern type." In recent forms examined the external reëntrant valleys are more curved and do not enter the crown in a straight oblique valley as in the fossil form. *S. hilli* is distinguished from *S. medius* Gidley in that the anterior internal reëntrant valley is equal in length to the opposing outer valley, a character it has in common with *S. intermedius*. It is also distinguished by the lack of any evidence of a reëntrant notch on the inner side opposite the posterior reëntrant valley of M_3. This is also a character not found in *S. intermedius*. In *S. intermedius* there occur small accessory cusps, an outgrowth of the cingulum, in the external posterior reëntrant valleys of M_1 and M_2. There is no evidence of the accessory cusps in *S. hilli*.

Genus Synaptomys Baird, 1857 (Bog lemmings)

Characters.—Number of teeth: incisors, 1/1; canines, 0/0; premolars, 0/0; molars, 3/3 = 16. A short-tailed mouse much like *Microtus*, the meadow mouse; upper incisors possess longitudinal groove; terrestrial and fossorial in habit.

Synaptomys (Mictomys) cf. vetus Wilson. (Old lemming mouse)

Synaptomys vetus Wilson, *1933*, Carnegie Inst. Wash., Publ. no. 440, pp. 124–126, figs. 2 and 3.

Plate 2, figures 1, 3, 4, 11

Material.—Fragmentary left ramus (no. 6151) bearing M_1 and M_2; ten isolated upper and lower molars from Loc. no. 9, Meade county, Kansas, Borchers fauna.

Remarks.—M_1 consists of a posterior loop, three alternating triangles, and a closed anterior loop. The first and second triangles

much larger than any observed in recent species in any stage of wear. The posterior external fold is broad and shallow and does not extend across the crown to the lingual side, but is separated from the lingual side by a deep enamel lake. The first posterior lingual enamel fold has been lost. The second and third lingual enamel folds are deeper, broader, and more complicated than in recent species of comparable age wear. The anterior lingual enamel fold is confluent with the anterior labial enamel fold, thus producing an isolated anterior cusp. The labial enamel folds of M_2 are broader than those in the recent species. The posterior labial fold has not fused with the first posterior lingual fold to produce the long outer reëntrant fold that is common in recent forms. In this respect the pattern of M_2 resembles much the condition in *Eozapus*. There are three well-developed lingual folds. The posterior fold is beginning to cut off owing to wear to form a deep enamel lake. The anterior fold is complicated, possessing a small accessory cusplet, which is developed from the cingulum and which would eventually close the reëntrant opening as the crown wore down. M_3 is as small as in the recent species of *Zapus*. Its pattern corresponds more nearly with that of the recent forms than do the patterns of M_1 and M_2. The external enamel border of the tooth is missing, so the labial reëntrant fold is destroyed. The paratype agrees with the type in size and tooth characters. The crown pattern is that of an old adult. Most of the internal reëntrant angles have been cut off to form isolated lakes.

This species is named for Dr. W. H. Burt, to whom I am indebted for unlimited help in my study of recent mammals.

Zapus burti differs from *Pliozapus solus* Wilson in that M_2 is not as broad; the dental pattern is more similar to that characteristic of the recent species of *Zapus* than of the fossil form.

Order Lagomorpha

Genus Nekrolagus Hibbard, 1939 (Extinct hare)

Characters.—Number of teeth: incisors, 2/1; canines, 0/0; premolars, 3/2; molars, 3/3 = 28. P_3 has anterior reëntrant angles, and two external reëntrant angles. The posterior external reëntrant angle extends slightly more than halfway across the crown of the tooth and is crenulated on the posterior border. Between the posterior external reëntrant angle and the enamel of the lingual

mens of *Lepus c. melanotis* (Mearns) from Kansas, with which it was compared. The only noticeable difference is the strongly crenulated reëntrant angles of P_4 and M_1, which are more numerous and better developed than in the species *L. californicus*. The anteroposterior diameter of the crown of P_3-M_1 is 9.9 mm; the depth of ramus below P_3, 14.9 mm; the distance of the mental foramen from the anterior alveolar border of P_3, 15.7 mm.

Order Artiodactyla

Genus Camelops Leidy, 1854 (Camels)

Characters.—Number of teeth: incisors, 1/3; canines, 1/1; premolars, 2/1-2; molars, 3/3. In upper molars the anteroposterior diameter is much greater than the transverse diameter. Extinct.

Camelops sp.

There have been found associated with the other fossils two camel astragali (no. 4808) seemingly of the same individual. They correspond with those of *Camelops,* although they are larger and more robust than those of *C. kansanus* Leidy of the Cragin Quarry fauna, which were taken from a younger interglacial Pleistocene deposit.

Family Antilocapridae (Pronghorns)

A digit, astragalus, and a few well-worn isolated premolars of a small antelope have been found. On the basis of the material collected it is impossible to assign them to any particular genus.

Conclusions

The Borchers fauna is the oldest known interglacial fauna of Kansas. *Sorex taylori* Hibbard, *Perognathus* sp. (the same as found at Meade county, Loc. no. 3), and *Synaptomys* cf. *vetus* Wilson are forms previously known only from the upper Pliocene. The presence of *S.* cf. *vetus* Wilson, previously known only from the upper Pliocene of Idaho, though not known from the Rexroad fauna, may be a form whose range was extended southward by the advance of the continental and the Rocky Mountain glaciers, thus arriving in the area after the Rexroad fauna had been forced southward by a changing climate.

The presence of *Onychomys* and *Sigmodon* in abundance indi-

Glossary

This brief explanation of technical terms is given for the use of readers who may not be acquainted with them.

Alveolus—Socket in the jaw where a tooth is situated.

Boreal region—The northern Boreal region includes approximately all of North and Central America in which the mean temperature of the hottest season does not exceed 64.4° F.

C.—Canine.

Canine—Teeth in upper and lower jaws that correspond to the large biting or holding teeth of dogs and cats.

Coronoid process—Portion of lower jaw behind the alveolar border and above the condyle, which extends upward and is laterally compressed, being concave on its outer surface to allow for muscle attachment.

Dental formula—Only one half of the total number of teeth is written in the formula. The number written is added and multiplied by 2. The teeth of the right or left upper jaw are written as the numerator and those of the lower jaw as the denominator. The dental formula for man is I 2/2, C 1/1, P 2/2, M 3/3 = 32. Thus, in man there are 8 teeth in each side of the upper and lower jaw when the wisdom teeth or the third molars are through.

Entoconid—Postero-internal cusp of the lower molar.

Fauna—The animal life characteristic of a region, locality, or geological horizon.

Fossorial—Said of animals that spend most of their life burrowing, or living in burrows.

Glacial age—Part of Pleistocene time when much of northern North America and mountain regions were covered with ice.

Hypoconid—Postero-external cusp of the lower molar.

I.—Incisor.

Incisor—Gnawing teeth of rodents or front teeth of any mammal.

Interglacial age—Part of Pleistocene time when glaciers had nearly or completely receded from the continent.

Labiad—Toward the lips.

M.—Molar.

Mental foramen—Opening in lower jaw or ramus situated on outer side near anterior end and through which a branch of the fifth nerve and blood vessels pass.

Metacone—The postero-external cusp of the upper molars.

Metaconid—Second antero-internal cusp lying just posterior to the paraconid, which is the first antero-internal cusp of the lower molars.

Metaloph—Posterior crest of certain molars formed by the union of cusps in the wearing down of the tooth.

Metastyle—Posterior ridge of certain upper molars formed from the cingulum.

P.—Premolar; P_1 first lower premolar; P^1 first upper premolar.

Parastyle—The anterior ridge of certain upper molars formed from the cing-

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