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INTRODUCTION

ACKNOWLEDGMENTS

THROUGH THE ENCOURAGEMENT of the late Dr. James D. Bump, Director of the Museum of Geology of the South Dakota School of Mines and Technology, the present study of the Wounded Knee faunas was begun by the writer in 1953. The purpose of the project was two-fold. First, it was hoped that the local boundary between the Oligocene and the Miocene could be established on the basis of stratigraphic collecting above the top of the Leptauchenia nodular layer in the Brule formation. Second, it was hoped that this collecting would expand our knowledge of the "Rosebud" faunas that were described by William D. Matthew in 1907.

I am especially and deeply indebted to Dr. Bump for his continued assistance and enthusiasm throughout the progress of this work. I also wish to acknowledge the assistance given me in the field by Dr. Mary R. Dawson, Mr. Burton Fedt, Dr. Morton Green, and Mr. Philo Macdonald. Permission to collect in the Pine Ridge Indian Reservation was given to us through the courtesy of the Oglalla Sioux Tribal Council. Mr. and Mrs. Joseph Horncloud of Pine Ridge assisted in many ways. Mr. and Mrs. Will Spindler of Day School Number Seven at Wounded Knee allowed us to use their facilities and assisted in public relations with the local residents.

Dr. Allen F. Agnew, Director of the South Dakota Geological Survey, aided in the stratigraphic work in the area. Mr. J. C. Harksen, assisted by Mr. D. G. Geiser, working jointly for Agnew and the writer, mapped three geological quadrangles as part of this project. Copies of these quadrangle maps, which accompany this publication (map 2), were supplied by the South Dakota Geological Survey.

The American Museum of Natural History provided work space and access to its collections during the year that I spent working on this report. Dr. Edwin H. Colbert, Mrs. Rachel H. Nichols, and Dr. Bobb Schaeffer of the American Museum of Natural History and Dr. George Gaylord Simpson, then of the American Museum of Natural History and now of the Museum of Comparative Zoölogy at Harvard College, were of immeasurable assistance during this period. Dr. Max K. Hecht, also of the American Museum of Natural History, assisted in the identification of the reptile material. The late Mr. Charles H. Falkenbach of the Frick Laboratories aided in the identification of the oreodonts in the collection. Dr. Craig Black and Dr. A. E. Wood were consulted on the rodents. The collections in the Museum of Paleontology at the University of California, in the Chicago Natural History Museum, in the Museum of Comparative Zoölogy at Harvard College, and in the Yale Peabody Museum at Yale University were made available to me for comparison. The figures were drawn by Mrs. Florence D. Wood, and the typing of the manuscript and editorial assistance were supplied by my wife, Eileen D. Macdonald.

The final study of the faunas and the publication of this report were made possible through National Science Foundation Grants, Numbers G-6582 and GN-68, both administered by the American Museum of Natural History.

ABBREVIATIONS

The names of institutions in the collections of which the specimens used in this study belong are abbreviated as follows:

A.C.M., Amherst College Museum, Amherst, Massachusetts

A.M.N.H., the American Museum of Natural History

F:A.M., Frick Laboratory at the American Museum of Natural History

F.M.N.H., Field Museum of Natural History, Chicago. Although now the Chicago Natural History Museum, the specimens that were collected in the Wounded Knee area carry Field Museum numbers

M.C.Z., Museum of Comparative Zoölogy at Harvard College, Cambridge, Massachusetts
N.S.M., Nebraska State Museum, Lincoln
P.U., Princeton University, Princeton, New Jersey
S.D.S.M., Museum of Geology at the South Dakota School of Mines and Technology, Rapid City
U.C.M.P., University of California Museum of Paleontology, Berkeley
Y.P.M., Peabody Museum, Yale University, New Haven, Connecticut

The same initials are used to indicate the localities that have been designated by the field parties of the respective institutions or assigned by the present author; in such references the abbreviation "No." does not occur.

HISTORY OF EXPLORATION OF THE WOUNDED KNEE AREA

The Tertiary deposits in South Dakota that lie south of the White River and north of the Pine Ridge escarpment have been in a geologists' and paleontologists' backwater since work began in this area more than a hundred years ago. The abundant rewards that resulted from collecting in the White River Badlands caused the fossil hunters to ignore the less rewarding formations to the south. Below the border, in Nebraska, Agate Springs and Sioux County have attracted the attentions of paleontologists westward, to the virtual exclusion of the region between Chadron and Gordon, Nebraska.

In 1906, William D. Matthew, Albert Thomson, and William K. Gregory, of the American Museum of Natural History, spent a summer season collecting a mammalian fauna from the Miocene beds that are exposed along the Wounded Knee and Porcupine Creek drainages in Shannon County, South Dakota, a portion of the Pine Ridge Indian Reservation. The primary areas of interest were the Wounded Knee Creek drainage between Wounded Knee post office and Manderson and the Porcupine Creek drainage between Porcupine Butte and a point about 10 miles northwest of the Porcupine post office. The purpose of this expedition was to find a fauna that was post-Oligocene in age but older than the Miocene faunas from Nebraska and the John Day region of Oregon.

The history of this expedition is excellently summarized in Thomson's report (MS) to the Director of the American Museum of Natural History. As a point of historic interest, the pertinent portions of this report are quoted below:

Report of the Expedition of 1906 to the Miocene on Pine Ridge Indian Reservation, S. D., by Albert Thomson

This expedition was sent out by Professor Henry F. Osborn to explore the Miocene along the southern tributaries of the White River on the Pine Ridge Indian Reservation.

Little was known of the fauna of this region as no systematic collecting had ever been done here aside from that which had been done by Mr. J. W. Gidley of this Museum in 1902–03 on the Rosebud Reservation.

The writer left New York June 4th, reaching Rapid City, South Dakota, June 9th, where a team, harness, tent, and provisions were purchased. On June 14th Dr. W. D. Matthew of the American Museum of Natural History joined the party, and June 16th we left Rapid City en route to Mr. Thomson's ranch on Springs Creek, S. D., where a part of an outfit used in 1904 had been stored. Here we spent nearly two days in getting our outfit into shape for traveling, also employing a Mr. Halisey as cook and teamster. Now being fully equipped for our purpose we proceeded to our field of operation, which was only a distance of about sixty miles to the southeast.

We traveled for one day through the famous Big Badlands of South Dakota, extending from the Cheyenne River on the north to White River to the south. Entering the Pine Ridge Reservation on the divide between Cheyenne and White Rivers, we crossed the White River and followed up Wounded Knee Creek for a distance of about twenty miles where we made our first camp in the Miocene beds.

Here our season's work began. Dr. Matthew and myself spent four days collecting with good results, finding in all eleven numbered specimens which from our field determinations are: *Merycochoerus*, *Rhinoceros*, *Archaeohippus*, *Steneofiber*, *Ticholeptis*, and *Leptauchenia*. Later I will quote geological observations from notes made by Dr. Matthew.

Having examined all exposures along Wounded Knee Creek, we moved camp to Porcupine Creek near Porcupine post office, where we remained until the close of the season. With a light team and wagon which [we] had in our outfit enabled us to work this country from our camp for a radius of twenty miles. For convenience in working these beds they had been divided and called the Upper and Lower Rosebud Beds. During the early part of the season good luck seemed to be with us as we

came across nearly all the rich pockets in both the upper and lower beds.

The fauna of the Upper beds is as follows: *Merychyus*, *Merycochoerus*, *Rhinoceros*, *Camel*, *Peccary*, *Amphicyon*, and Rodents. Of these *Merychyus* was the most common, fragments could be seen everywhere, but, strange to say, a good skull and jaws were hard to find though we were fortunate enough to discover one. Skeletal material was all more or less fragmentary.

The fauna of the Lower beds is similar to that of the Upper beds and runs as follows: *Merycochoerus*, Oreodonts, Camel, Rhinoceros, Elothere, Rodents, and Carnivora. *Merycochoerus* is the most common in these beds. We collected in all about 33 *Merycochoerus* skulls. Many have parts of skeletons associated, and one complete articulated skeleton of *Merycochoerus*. One large block containing many *Mesoreodon* skulls which will make a very good specimen for exhibition.

On July 26th Dr. Matthew returned to New York, which was a great loss to our party. Mr. W. K. Gregory of the American Museum of Natural History joined the party August 1st and remained until the close of the season. Mr. Gregory proved to be a valuable assistant and a very agreeable companion.

Professor Osborn visited our camp early in August. After three days stay Professor Osborn and myself took a delightful trip through the Big Badlands.

Taking everything into consideration, the small party and the disagreeable weather toward the end of the season, the expedition met with very good success. Mr. Gregory and I took a day's trip to the northeast for the purpose of looking up a locality for next season. Along American Horse Creek and Medicine Root Creek we saw some very promising looking exposures, and from information gathered from residents there are good Miocene exposures as far east as Eagles Nest Butte. . . .

For next season's work in this region I would suggest (1) a very strong party, (2) saddle horses in connection with our light driving outfit, because exposures of the Upper beds are all more or less scattered and for the best results this region must be worked systematically, that is to say, every little exposure should be prospected. . . .

Little can be said of the geology of these beds yet, as only a small territory has been examined. In order to come to any definite conclusion as to their formation they should be carefully examined from our camp on Porcupine Creek west and southwest as far as Agate Spring Quarry and east and northeast as far as they extend. The beds seem to be very irregular and inconstant, with numerous stream channels. The levels cannot be easily traced for any great distance except for certain beds of volcanic ash and volcanic tuff, which may prove to be widespread and constant and have been provisionally used to separate horizons in the formations. Beginning the Upper Rosebud beds at a volcanic ash layer near the top of Porcupine Butte and running down to about the level of Porcupine post office. Here is a rather hard and nearly white, calcareous shaly limestone, which we called about the top of the Lower Rosebud section. The Lower Rosebud beds beginning at this calcareous layer and running down to a white bed at the top of the *Leptauchenia* clays, making the total thickness of the Rosebud beds about feet [*sic*].

About ten miles northwest of Porcupine post office on Porcupine Creek the *Leptauchenia* clays are shown and correspond in character to those capping Sheep Mountain and other prominent points in the Big Badlands. At this point we also discovered a contact between the Lower Rosebud and *Leptauchenia* clays and collected fossils from both beds.

I think when this year's collection from this region has been worked out that we will find we have a larger and probably different fauna from that of Peterson's Agate Spring Quarry in the Lower Nebraska beds, which are, I think, considerably higher than the Rosebud beds.

Mr. Dawson of Porcupine reported finding an elephant tusk in the lower Rosebud. We carefully examined the fragments of the so-called tusk and found them to be a rib probably of a rhinoceros. We also examined the prospect where this specimen was found and uncovered two more large ribs and several vertebrae of the same animal. Elephant remains have been found in this region but only fragmentary, and in gravel pits from the Pleistocene . . .

SUMMARY OF EXPENSES

Traveling expenses from New York to Rapid City, S. D. and return	$ 137.45
Team and harness, tent, canvas, and hardware	373.00
Provisions, feed, lumber, wood alcohol and hire of saddle horse	210.34
Cook and teamster at $30. per month	99.00
Total	$ 819.79
Credit for sale of two horses	50.00
	769.79
Salary of W. D. Matthew 2 months	200.00
Salary of Albert Thomson 4 months	360.00
	$1,329.79

Respectfully submitted,
Albert Thomson

In 1907, work was continued about 10 to 15 miles east of Porcupine Creek in the Kyle area, in the American Horse Creek drainage, and in the vicinity of Eagle's Nest Butte. The material collected by this expedition was considered as part of the 1906 fauna.

While collecting and studying the stratigraphy of the Wounded Knee area, Matthew and Thomson (MS) made two basic assumptions: 1. The base of the Miocene is marked by the heavy white ash layer that is prominently exposed in the White River Badlands in South Dakota. (This ash is well developed on the top of Sheep Mountain Table to the north of the White River and may also be seen in the face of the northward-facing escarpment south of the White River near the mouth of Porcupine Creek.) 2. The Miocene beds in this area, above the white ash, were equivalent to the exposures of pink silt along the Little White River and its tributaries near Rosebud Agency in Todd County, South Dakota, about 90 miles to the east.

Gidley (1904) had named the pink silts in Todd County the "Rosebud beds" in a three-part paper in which he and Matthew described a suite of specimens collected in the Rosebud Agency area in 1903.

The original Rosebud Fauna as listed by Gidley (1904, p. 246) included:

"cf. *Cynodesmus*
Steneofiber pansus Cope
Meniscomys sp.
?Eporeodon
Merycochoerus vel *Promerycochoerus*
Merychyus cf. *elegans*"

Various later reviews of this material indicate that the identifiable specimens represent:

Promylagaulus cf. *riggsi*
Capatanka brachyceps (Matthew)
Merychyus arenarum Cope

While collecting on Wounded Knee Creek, south of Manderson, Matthew and Thomson (MS) referred all their specimens to the "Rosebud beds," and state in their field notes:

The beds on Wounded Knee above Manderson do not show any break in sedimentation but are apparently continuous, changing gradually from a sandy clay full of small round concretions (Leptauchenia beds) to a soft clayey sand full of irregular concretions in some layers, others soft layers, and in upper part harder limey layers.

In Leptauchenia beds occurred numerous *Leptauchenia* and an oreodont about the size of *Eporeodon*, and fragments of *Leptomeryx*, horse and carnivore and *Steneofiber*. The base of [the] Rosebud beds was determined by fauna only, as no break occurs, but *Leptauchenia* fauna disappears and *Ticholeptus* is found. Higher up occurred the *Merycochoerus* skulls, which are probably (some of them at least) *Promerycochoerus*. Upper levels of Rosebud beds are very barren. *Cosoryx* occurs, etc. Contact between Rosebud and Loup Fork not well shown on this creek.

Upon moving their activities to the Porcupine Creek drainage, Matthew and Thomson divided the fauna into two units. The part that came from above the level of their camp near Porcupine post office was called the "Upper Rosebud" fauna, and the material from below the level of their camp was designated as the "Lower Rosebud" fauna. This division is described as follows in their field notes:

'Upper Rosebud' includes beds from top or near top of Porcupine Butte down to creek bottom at camp ½ mile above p.o.

'Lower Rosebud' includes beds from creek bottom at camp down to Leptauchenia beds which show at creek level ab't 8 miles below postoffice, at top of Leptauchenia Beds is a strong white layer which in Thomson's opinion is identical with that at top of Sheep Mountain.

The above description is accompanied by a sketch of a geologic section of the region which also indicates the levels from which some of the material was collected. This section accurately presents the over-all topographic expression of the formations along Porcupine Creek. Unfortunately, the levels indicated for many of the specimens are not acceptable, as they are geographically impossible.

The only publication on the area, other than brief notices of new species or revisions of known material, was a paper by Matthew (1907) in which he reported on the fauna collected for the American Museum of Natural History in 1906 and referred the post-Oligocene deposits in the area to the Upper and Lower Rosebud beds. In this report he wrote (pp. 169–171):

In 1902 and 1903 the American Museum parties collecting in the Loup Fork of South Dakota, south of White River, made a brief reconnaissance of the beds laying between the Loup Fork and White River formations, and found a few fossils sufficient to indicate their age as Lower Miocene, and the local term of Rosebud beds was proposed by Matthew and Gidley for this intermediate formation. In 1906, when the work in this region was resumed, Prof. Osborn authorized a thorough search of these rather barren and unpromising beds, in view of the probable importance and interest of whatever fossils might be found in them. The results of the first season's work have fully justified Osborn's decision, the fauna being almost entirely new, and supplying two intermediate stages of evolution between the Oligocene and later Miocene. Although probably nearly equivalent in age to the Agate Springs fauna [Harrison formation] it presents a very different facies, as far as comparisons have been made. Only a small part of the collection has yet been studied and compared in the museum; for the remainder the determinations are those made by the writer in the field, and are merely approximate and in no case specific. The results already attained, however, seem of sufficient interest to warrant their publication, especially desirable in connection with Prof. Osborn's forthcoming correlation of the mammal faunae of the American Tertiary and Quarternary.

The western part of the formation attains a thickness estimated at 500 feet on Porcupine Creek, a southern tributary of White River. The base is taken at a heavy white stratum which appears to be identical with the stratum capping the White River formation on Sheep Mountain in the Big Badlands. This stratum can be seen extending interruptedly across the river to Sheep Mountain about twenty miles distant, capping several intervening buttes and projecting points of the underlying formation. The Rosebud beds at the bottom approximate the rather hard clays of the upper Leptauchenia beds, but become progressively softer and sandier towards the top, and are capped at Porcupine Butte . . . by a layer of hard quartzitic sandstone. Several white flinty calcareous layers occur in the beds, one of which, about half-way up [slightly above the base of the Harrison formation], was used to divide them into Upper and Lower. The stratification is very variable and inconstant, lenses and beds of soft fine grained sandstone and harder and softer clayey layers alternating with frequent channels filled by sandstones and mud-conglomerates, all very irregular and of limited extent. The hard calcareous layers are more constant. A bed of volcanic ash [lower Ash Hollow] lies near the top of the formation and there may be a considerable percentage of volcanic material in some of the layers further down. These volcanic ash beds should in theory be of pretty wide extent, and may be of considerable use in the correlation of the scattered exposures on the heads of different creeks—a very difficult matter without their aid.

These beds form the upper part of the series of bluffs south of the White River on the Pine Ridge and Rosebud Reservations and are exposed in the upper part of the various tributary creeks. The name Arickaree . . . has been applied by Darton to these and various more or less similar formations overlying the White River in the Central Great Plains. In northeastern Colorado the Arickaree beds are known from their fauna to be middle or late Miocene; in the bluffs south of White River in South Dakota they are Lower Miocene—possibly in part Oligocene; for the most part their age is unknown. Hence the term Arickaree, if Darton's connotation of it be accepted, must be used in a broad way—somewhat as Loup Fork has been used by most writers—to signify deposits of similar lithologic character and stratigraphic position, but of quite different age in different parts of the Plains.

Between 1906 and 1953, some additional material was collected from this area by various museums, more species were described from the two "faunas," and the original collection was subjected to minor revisions as various groups of mammals were reviewed by later authors.

In 1953, the Museum of Geology of the South Dakota School of Mines and Technology began an extensive program of collecting in the Wounded Knee area. By this time it had become apparent that the "Rosebud faunas" were actually a complex of specimens from several different formations, and that the lumping together of this material into two "faunas" was an oversimplification.

In reviewing the Miocene of western Nebraska, Schultz (1938) recognized this fact when he suggested that the term "Arickaree Group" be confined to the Gering, Monroe Creek, and Harrison formations and further stated: "The term 'Rosebud' is a generalized, indefinite name for deposits in the vicinity of the Rosebud Agency in South Dakota. It appears to include deposits of more varied age than the Arickaree. The 'Rosebud' was divided into upper and lower and the use extended by Dr. W. D. Matthew."

In order to return the term "Rosebud" to its original usage, Macdonald (1957a) proposed that the term "Wounded Knee fauna (s)" be applied to the assemblages from the Porcupine Creek and Wounded Knee Creek drainages.

In the type area, the Rosebud formation is exposed above the Brule and below the Valentine formations. These beds, when traced westward, are found in scattered outcrops along most of the southern border of South Dakota. In the Porcupine Creek and Wounded Knee Creek area, the Rosebud formation overlies the Harrison formation and is the most widely exposed lithic unit in the southern part of the area. In recent years, these beds have been referred to the Marsland formation on the basis of the fossil fauna. Although partially equivalent in age, these beds are quite distinct, lithologically, from the Marsland or "Upper Harrison" of western Nebraska.

As collecting progressed, it became obvious that Matthew and Thomson were mistaken in their designation of some stratigraphic levels during the 1906 field season. The outcrops at Manderson and below (downstream as well as stratigraphically) are not Leptauchenia beds but are actually well up into the Miocene section. The cliff-forming sands and silts that form a conspicuous part of the topography at Manderson are part of the Monroe Creek formation. The beds just below the cliffs are also of Miocene age, being in part equivalent to the Gering formation of Nebraska, and are herein referred to the Sharps formation. Actually, the basal Miocene white ash, which Nichnish and Macdonald (1962) named as the Rockyford member of the Sharps formation, disappears underground about 12 miles north of Manderson near the abandoned Wakan Store. On the Porcupine Creek side of the divide, the Rockyford member disappears on a tributary to Porcupine Creek on the Groom Ranch, about 5 miles north of the point indicated in the 1906 field notes.

The "strong white layer which in Thomson's opinion is identical with the top of Sheep Mountain" (Matthew and Thomson, MS) is actually near the top of the Sharps formation. This area is shown in Osborn's monograph on the Equidae (1918, fig. 7). This error is very understandable, as this outcrop is in the zone of strong mineralization just below the base of the Monroe Creek formation. A large number of peculiar, cigar-shaped concretions in this mineralized zone are similar to those found in the ash on Sheep Mountain Table. Thus, the combination of the heavy, white, cemented zone and the distinctive concretions easily leads to a mistake in formational identification.

As the result of the discovery of these discrepancies, a project that was begun as an effort to re-collect and expand the original "Rosebud" faunas became a search for a new fauna that would close the gap between the fauna known from the latest Oligocene and the fauna from the "Lower Rosebud." The result of this collecting is described herein as the Wounded Knee-Sharps fauna.

It is now apparent that the section exposed on Porcupine Creek includes the Chadron formation, the Brule formation, a previously unnamed formation for which the name Sharps has been proposed, the Monroe Creek formation, the Rosebud formation, and the Ash Hollow formation which caps Porcupine Butte. The last-named was referred to by Matthew (1907, p. 170) as "a layer of hard quartzitic sandstone."

The 1906 collection came from the middle part of these beds. The "Lower Rosebud" came from the section that includes the top of the Sharps formation through the lower part of the Harrison formation. The "Upper Rosebud" came from the lower part of the Harrison formation through the Rosebud formation. It is doubtful if any of the 1906 collection came from above the Rosebud formation. However, it is quite certain that some of the material collected in 1907, and referred to the Upper Rosebud formation from the American Horse Creek, Kyle, and Eagle's Nest Butte region, is post-Rosebud in age and may even be as young as Ash Hollow.

The new materials described herein were collected primarily from the Sharps formation. An examination of the Nebraska section in the Scotts Bluff and Redington Gap area suggests that the Sharps formation is, in part, lithologically equivalent to the beds that Darton (1898) mapped as the upper part

of the Brule formation. However, it is not lithologically equivalent to the Gering formation in that area. Further, a comparison of the available material indicates that the fauna of the upper portion of the Brule formation in that area and the Gering formation of Darton is, in part, contemporaneous with the Wounded Knee-Sharps fauna.

GEOLOGY OF THE WOUNDED KNEE AREA

The Wounded Knee faunas were collected along the drainages of Wounded Knee and Porcupine creeks. These creeks and their tributaries have cut two essentially parallel valleys, about 6 miles apart, through an outlier of the high plains that extends north from Pine Ridge to the south side of White River. The collecting area covers slightly more than four townships. Between the Wounded Knee collecting area and the Pine Ridge escarpment is a wide plain which is traversed by U. S. Highway 18. Certain portions of this plain are covered with deposits of the Ogallala group (Green, 1956). Wounded Knee Creek and Porcupine Creek have their origins on this plain in a sand dune area at the eastern terminus of Pine Ridge. Flowing generally northwest, these streams have cut through the Miocene and Oligocene deposits between Pine Ridge and White River, so that the Chadron formation is exposed at their mouths on White River. East of the mouth of Porcupine Creek, White River and its tributaries have developed an escarpment some 350 feet high which forms the southern boundary of the White River Badlands and exposes the entire Brule section and 253 feet of the Sharps formation. It is on this escarpment, in the SW. $\frac{1}{4}$ of the SW. $\frac{1}{4}$ of sect. 25, T. 41 N., R. 43 W., that part of the type section of the Sharps formation is exposed.

The Sharps formation is of early Miocene age. It overlies the Brule formation in this area and underlies the Monroe Creek formation. The basal Rockyford member of the Sharps formation is composed of a prominent volcanic ash bed which ranges up to 55 feet in thickness in the White River Badlands and is 38.5 feet thick in the type section of the Sharps formation. This member was described by Nicknish and Macdonald (1962) as the Rockyford member of the Sharps formation. The remainder of the Sharps formation attains a thickness of 346.5 feet in the Wounded Knee area. A detailed discussion of the Sharps formation is given in the South Dakota Geological Survey map of the areal geology of the Sharps Corner, Malone, and Manderson quadrangles which accompany this report (map 2).

Between the mouth of Porcupine Creek and that of Wounded Knee Creek, the escarpment is not so prominent. The combined attack of the two streams and their tributaries has reduced the topography, and much of the area is covered by Quaternary dune sands. A thick section of channel deposits has replaced the top of the typical Brule beds and the Sharps silts and clays. Some of the lower portions of these channels are Protoceras channels, although they do not exhibit the characteristic (if channel deposits may be characterized) green hue that is seen in most exposures of Protoceras channels. In this area, channels of Miocene age are found to have cut 40 feet below the level of the Rockyford ash. Possibly these channel deposits are equivalent in age to the Gering of Darton, but insufficient fossil material is available for a definite age determination to be made.

One of the minor channels in this area, which is exposed between the Brule and the Quaternary sands, has produced an interesting microfauna which is listed in the locality data of this report as the Godsell Ranch Channel faunule. South of the channel area, the Sharps formation and the underlying Brule formation are heavily cemented. This cementation and its attending light color and cliff-forming characteristics have misled earlier investigators into believing that all this section was part of the Brule formation. This zone of cementation extends south for a distance of about 5 miles, where it becomes less prominent and is exposed only in patches for another 4 miles in a southeasterly direction. This zone of cementation is not seen on the east side of Porcupine Creek except for small local tongues and an area covering slightly more than 1 square mile just south of St.

John's Church (S.D.S.M. V5354). This large exposure is shown in Osborn (1918, fig. 7). It was this exposure that led Matthew and Thomson to believe that they had reached the level of the top of the Brule formation at that point.

The top of the cemented area between Chimney Butte and the Tibbets Ranch road is covered with the remnants of Quaternary sand dunes. Because of the headward cutting of tributary streams in this area, many of these dunes have assumed a pyramidal shape which presents a ragged skyline when viewed from the east or west. To the west of Wounded Knee Creek, the escarpment is entirely gone as the result of the combined work of Wounded Knee Creek, Grass Creek, and their tributaries.

Southward along the two streams a continuous succession of younger formations is exposed. Overlying the Sharps formation is the prominent cliff-forming Monroe Creek formation. This unit appears as a series of cliffs about 3 miles south of Sharps Corners on the east side of Porcupine Creek and about ½ mile south of the Gooseneck Road on the Wounded Knee-Porcupine Creek divide. North of these most northern exposures of the Monroe Creek formation, the Sharps formation forms the highest topographic features, with the exception of those areas that have perched remnants of sand dunes. West of Wounded Knee Creek the area has been more heavily eroded, so that the Monroe Creek formation does not appear north of a point about 2 miles south of the junction of the Gooseneck Road and the Manderson-Rockyford Road. Overlying the Monroe Creek formation is the Harrison formation which contains the heavily cemented layers that marked the division between Matthew's Upper and Lower Rosebud faunas. Southward, as the stream valleys become narrower, the Rosebud formation is exposed over most of the highlands. The top of Porcupine Butte, which is the highest topographic feature in the area, is capped with sands and tuffs that are a remnant of the formerly widespread Ash Hollow formation.

The geologic succession in the Wounded Knee area is diagrammatically shown in figure 1.

<table>
<tr><th>Horizon</th><th>Group</th><th>Formation</th><th>Thickness</th><th>Matthew (1907)</th></tr>
<tr><td>Lower Pliocene</td><td>Ogallala</td><td>Ash Hollow</td><td></td><td></td></tr>
<tr><td>Middle Miocene</td><td></td><td>Rosebud</td><td>220'</td><td rowspan="2">Upper Rosebud</td></tr>
<tr><td rowspan="3">Lower Miocene</td><td rowspan="3">Arikaree</td><td>Harrison</td><td>128'</td></tr>
<tr><td>Monroe Creek</td><td>90'</td><td rowspan="2">Lower Rosebud</td></tr>
<tr><td>Sharps</td><td>385'</td><td rowspan="2">Leptauchenia Beds</td></tr>
<tr><td>Middle & Upper Oligocene</td><td rowspan="2">White River</td><td>"Leptauchenia Beds"
Brule
"Oreodon Beds"</td><td></td></tr>
<tr><td>Lower Oligocene</td><td>Chadron</td><td></td><td></td></tr>
</table>

FIG. 1. Geologic units in the Wounded Knee area.

FAUNAL LIST AND STRATIGRAPHIC DISTRIBUTION OF THE WOUNDED KNEE FAUNAS

The division of the Wounded Knee fossil vertebrates into four faunas is an arbitrary separation by recognized lithologic units. Only through such a separation can these faunal complexes become useful in regional correlation.

TABLE 1

LIST OF THE WOUNDED KNEE FAUNAS AND THEIR STRATIGRAPHIC DISTRIBUTION

	Sharps Formation	Monroe Creek Formation	Harrison Formation	Rosebud Formation
Reptilia				
Squamata				
Iguanidae, indet.	x[a]	—	—	—
?Peltosaurus sp.	x	—	—	—
Anguidae, indet.	x	—	—	—
Amphisbaenidae, indet.	x	—	—	—
Mammalia				
Marsupialia				
Peratherium spindleri	x	—	—	—
Insectivora				
Ocajila makpiyahe	x	—	—	—
Domnina greeni	x	—	—	—
Domninoides evelynae	x	—	—	—
Proscalops sp.	—	x	—	—
Talpidae, indet.	x	—	—	—
Arctoryctes terrenus	x	—	—	x
Primates				
Ekgmowechashala philotau	x	—	—	—
Lagomorpha				
Palaeolagus hypsodus	x	—	—	—
Palaeolagus philoi	x	—	—	—
Megalagus primitivus	x	—	—	—
?Palaeolaginae, indet.	x	—	—	—
Archaeolagus primigenius	—	—	—	x
Archaeolagus macrocephalus	—	—	—	x
Rodentia				
Prosciurus dawsonae	x	—	—	—
?Prosciurus dawsonae	x	—	—	—
Allomys harkseni	—	x	—	—
Meniscomys hippodus	x	—	—	—
Meniscomys sp.	—	x	—	—
Promylagaulus riggsi	—	—	—	?
Promylagaulus cf. *riggsi*	—	x	—	—
Mylagaulodon cf. *angulatus*	—	—	—	x
Pleurolicus leptophrys	x	—	—	x
Pleurolicus dakotensis	—	x	?	—
Pleurolicus clasoni	x	—	—	—
Gregorymus formosus	—	—	x	x
Gregorymus curtus	—	—	x	?
Grangerimus oregonensis	—	—	—	x
Grangerimus dakotensis	x	—	—	—
Heliscomys sp.	x	—	—	—
Proheteromys fedti	x	—	—	—

TABLE 1—(*Continued*)

	Sharps Formation	Monroe Creek Formation	Harrison Formation	Rosebud Formation
Proheteromys gremmelsi	x	—	—	—
Proheteromys bumpi	x	—	—	—
Proheteromys matthewi	—	—	—	x
Hitonkala andersontau	x	—	—	—
Florentiamys agnewi	x	—	—	—
Tamias sp.	x	—	—	—
Palaeocastor nebrascensis	x	—	—	—
Palaeocastor simplicidens	—	?———	——?	—
Capatanka cankpeopi	x	—	—	—
Capatanka brachyceps	—	?———	——?	—
Capacikala gradatus	x	—	—	—
?Capacikala sciuroides	—	—	x	—
Eumys blacki	x	—	—	—
Eumys woodi	x	—	—	—
Scottimus sp.	x	—	—	—
Carnivora				
Hesperocyon leptodus	x	—	—	—
Hesperocyon gregorii	—	—	x	—
Nothocyon roii	x	—	—	—
Nothocyon geismarianus	x	x	—	—
Nothocyon lemur	x	—	—	—
Nothocyon near *latidens*	—	?———	——?	—
Tomarctus thomsoni	—	—	—	x
Cynodesmus cooki	x	—	—	—
Cynodesmus vulpinus	—	—	x	—
Cynodesmus minor	—	—	—	x
Neocynodesmus delicatus	—	?———	——?	—
Mesocyon robustus	x	—	x	—
Sunkahetanka geringensis	x	—	—	—
Sunkahetanka pahinsintewakpa	x	—	—	—
Enhydrocyon crassidens	x	?———	——x	—
Mammacyon obtusidens	—	?———	——?	—
Palaeogale dorothiae	x	—	—	—
Promartes lepidus	—	—	—	x
Promartes gemmarosae	—	?———	——?	—
Megalictis ferox	—	—	—	x
Nimravus sectator	—	?———	——?	—
Ekgmoiteptecela olsontau	x	—	—	—
Perissodactyla				
Miohippus equinanus	—	?———	——x	—
Miohippus near *equinanus*	x	—	—	—
Miohippus cf. *gemmarosae*	—	—	x	—
Miohippus equiceps	x	—	—	—
Parahippus pristinus	—	?———	——x	—
Parahippus coloradensis praecurrens	—	—	—	x
Parahippus texanus	—	—	—	x
Hyracodon apertus	x	—	—	—
Hyracodon sp.	x	—	—	—
Diceratherium gregorii	x	—	—	x
Diceratherium cf. *gregorii*	x	—	—	—
Diceratherium armatum	x	—	—	—

TABLE 1—(*Continued*)

	Sharps Formation	Monroe Creek Formation	Harrison Formation	Rosebud Formation
Artiodactyla				
Leptochoerus sp.	x	—	—	—
Agriochoerus sp.	x	—	—	—
Mesoreodon megalodon cf. *sweeti*	x	—	—	—
Phenacocoelus stouti	—	—	—	x
Promerycochoerus carrikeri	—	—	x	—
Promerycochoerus barbouri	—	—	x	—
Promerycochoerus minor pygmyus	—	—	x	x
Promerycochoerus montanus pinensis	—	?———	x	—
Desmatochoerus curvidens gregorii	—	—	x	—
Desmatochoerus hatcheri geringensis	x	—	—	—
Desmatochoerus wyomingensis	x	—	—	—
Merycochoerus matthewi	—	—	—	x
Merychyus minimus	—	—	—	x
Cyclopidius schucherti	x	—	—	—
Cyclopidius simus	x	—	—	—
Desmathyus pinensis	—	—	x	—
Arretotherium leptodus	—	—	x	—
Arretotherium sp.	x	—	—	—
Oxydactylus cf. *wyomingensis*	x	—	—	—
Oxydactylus exilis	—	—	—	x
Oxydactylus lacota	—	—	—	x
?Oxydactylus sp.	x	—	—	—
Nanotragulus cf. *loomisi*	x	—	—	—
Nanotragulus ordinatus	—	?———	x	—
Nanotragulus intermedius	x	—	—	—
Leptomeryx sp.	x	—	—	—
Blastomeryx primus	—	—	—	x
Blastomeryx advena	—	—	—	x
Blastomeryx sp.	—	—	—	x

[a] x, Those elements that can be definitely placed; ?———x or x———?, those that are known to occur in one formation and may have been found in the adjacent formation; ?———?, those for which the data are unsatisfactory.

MIOCENE FOSSIL LOCALITIES IN THE WOUNDED KNEE AREA

The following pages contain a list of the fossil localities from which the Wounded Knee faunas were collected. After each locality description, a summary of the material collected from that site is given. The locality given is the type locality for those species that are marked with an asterisk (*).

The American Museum of Natural History localities were gleaned from the 1906 field notes of Matthew and Thomson (MS); in the following list these are designated as "Field notes, 1906." Arbitrary locality numbers have been assigned by me for ease of reference. The localities are numbered in the order of description in the Matthew and Thomson field notes, without regard to geographic or stratigraphic position. The horizons are shown as originally named, with parenthetical additions made wherever possible.

Stratigraphic comments are based on either the oreodont monographs of Schultz and Falkenbach, or the "1906 field notes in hand" survey that I performed in the summer of 1959 (identified as "J.R.M."). Some specimens in the American Museum that are indeterminate, have not been prepared, or are in the process of being studied by others (i.e., the oreodonts) either have been omitted from the list or are listed in quotation marks.

Most of the localities are shown on map 1.

A.M.N.H. "ROSEBUD" 1

"Wounded Knee Cr'k, 5 m. above [south of] Manderson . . . Rosebud beds": Field notes, 1906. (Harrison formation: Schultz and Falkenbach, 1949, p. 183. Probably Harrison formation, possibly Monroe Creek formation: J.R.M.)

Enhydrocyon crassidens Matthew
**Miohippus equinanus* Osborn
Promerycochoerus montanus pinensis Schultz and Falkenbach
Desmatochoerus curvidens gregorii (Loomis)

A.M.N.H. "ROSEBUD" 2

"Wounded Knee Cr'k, 4 m. above [south of] Manderson . . . Rosebud beds": Field notes, 1906. (Harrison formation: Schultz and Falkenbach, 1949, pp. 102, 129–130. Probably Harrison formation, possibly Monroe Creek formation: J.R.M.)

Diceratherium sp.
Promerycochoerus montanus pinensis Schultz and Falkenbach
Promerycochoerus carrikeri Peterson

A.M.N.H. "ROSEBUD" 3

"Wounded Knee Cr'k, 3 m. above [south of] Manderson . . . Rosebud beds . . . base of Rosebud beds": Field notes, 1906. (Harrison formation: Schultz and Falkenbach, 1949, p. 130. Harrison formation: J.R.M.)

Promerycochoerus montanus pinensis Schultz and Falkenbach

A.M.N.H. "ROSEBUD" 4

"Wounded Knee Cr'k, 2 m. above [south of] Manderson . . . transition beds bet. Rosebud & Leptauch. . . . upper Leptauchenia beds": Field notes, 1906. (Monroe Creek formation or Sharps formation: J.R.M.)

"Leptauchenia"

A.M.N.H. "ROSEBUD" 5

"E. of Porcupine Butte, 'Bird head' of Porcupine Creek . . . upper Rosebud beds": Field notes, 1906. (Lower Marsland formation: Schultz and Falkenbach, 1947, pp. 221–222. Rosebud formation: J.R.M.)

Gregorymus formosus (Matthew)
Cynodesmus minor Matthew
**Promartes lepidus* (Matthew)
Megalictis ferox Matthew
Diceratherium sp.
Merychyus minimus Peterson
**Oxydactylus exilis* Mathew
**Oxydactylus lacota* Matthew
Problastomeryx primus (Matthew)

A.M.N.H. "ROSEBUD" 6

"Porcupine Butte . . . uppermost Rosebud beds": Field notes, 1906. (Rosebud formation or Ash Hollow formation: J.R.M.)

"Entoptychus," exchanged to Calcutta Museum, 1912

A.M.N.H. "ROSEBUD" 7

"Porcupine Cr'k 4 miles below [Porcupine] postoffice . . . lower Rosebud beds": Field notes, 1906. (Harrison formation: Schultz and Falkenbach, 1954, p. 184. By inference from the description of A.M.N.H. "Rosebud" 8, this is in the Harrison formation which outcrops at this point at the top of the bluffs between $\frac{1}{2}$ and 1 mile east of Porcupine Creek: J.R.M.)

Gregorymus curtus (Matthew)
**Capatanka brachyceps* (Matthew)
**Cynodesmus vulpinus* (Matthew)
**Mesocyon robustus* Matthew
Miohippus equinanus Osborn
Miohippus gemmarosae Osborn
**Parahippus pristinus* Osborn
Diceratherium sp.
**Promerycochoerus montanus pinensis* Schultz and Falkenbach
Promerycochoerus barbouri Schultz and Falkenbach
Promerycochoerus carrikeri Peterson
Desmatochoerus curvidens gregorii (Loomis)

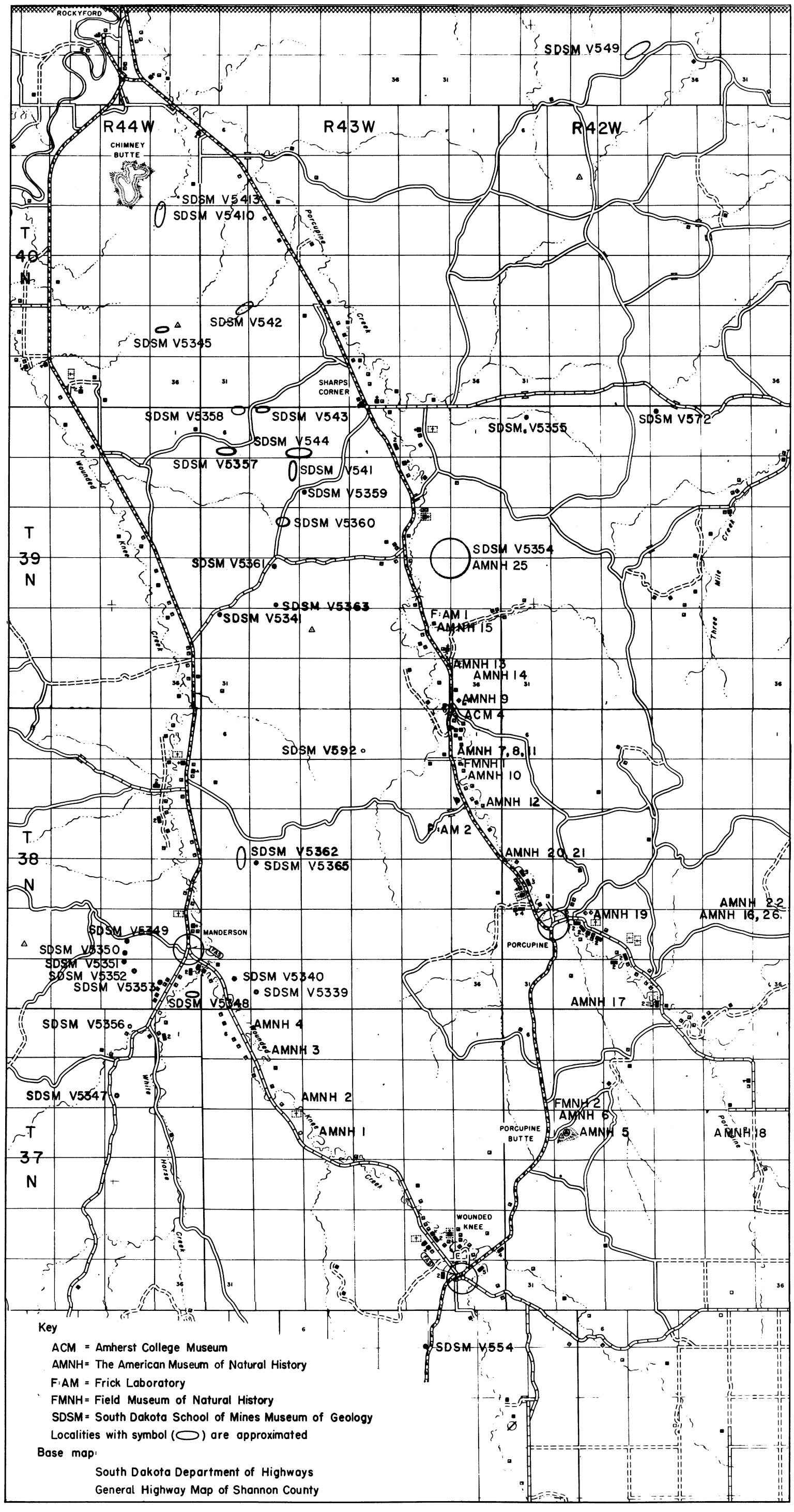
A.M.N.H. "ROSEBUD" 8

Described in 1906 field notes (Matthew and Thomson, MS) as the same area as A.M.N.H. "Rosebud" 7, but qualified as "lower level" and "lowest Rosebud." (Harrison formation: Schultz and Falkenbach, 1949, p. 130. Monroe Creek formation: J.R.M.)

**Palaeocastor simplicidens* (Matthew)
Nothocyon cf. *geismarianus*
**Nimravus sectator* Matthew
"Leptauchenia"
Promerycochoerus montanus pinensis Schultz and Falkenbach

A.M.N.H. "ROSEBUD" 9

"Porcupine Cr'k 5 m. below [Porcupine]



MAP 1. Vertebrate fossil localities in the Wounded Knee area, Shannon County, South Dakota.

postoffice . . . lower Rosebud": Field notes, 1906. (Monroe Creek formation in bluffs, Sharps formation in creek bottom: J.R.M.)

"Leptauchenia"

A.M.N.H. "ROSEBUD" 10

"Porcupine Cr'k 3½ m. below [Porcupine] p.o. . . . lower Rosebud": Field notes, 1906. (Monroe Creek formation: J.R.M.)

Castoridae, indet.
?Nothocyon sp.
Miohippus gemmarosae Osborn

A.M.N.H. "ROSEBUD" 11

"Porcupine Cr'k 4 m. below [Porcupine] p.o. . . . lower Rosebud": Field notes, 1906. (Monroe Creek formation: J.R.M.)

?Eporeodon sp.

A.M.N.H. "ROSEBUD" 12

"Porcupine Cr'k 3 m. below [Porcupine] p.o. . . . lower Rosebud": Field notes, 1906. (Harrison formation: Schultz and Falkenbach, 1949, p. 130. The geologic section in Matthew's field notes indicates that this locality is in the Monroe Creek formation. As outcrops in the area are present in both formations, it must be presumed that the field notes are correct: J.R.M.)

**Capatanka brachyceps* (Matthew)
**Enhydrocyon crassidens* Matthew
"Leptauchenia"
Promerycochoerus montanus pinensis Schultz and Falkenbach

A.M.N.H. "ROSEBUD" 13

"E. of Porcupine Cr'k 6 m. below [Porcupine] p.o. . . . lower Rosebud": Field notes, 1906. (Monroe Creek formation: J.R.M.)

"Entelodon"

A.M.N.H. "ROSEBUD" 14

"Divide E. of Porcupine Cr'k, 6 m. below [Porcupine] p.o. . . . lower Rosebud": Field notes, 1906. (Shown in Monroe Creek formation in geologic section in field notes. The reference to the "divide" suggests Harrison formation rather than Monroe Creek formation. Harrison formation: J.R.M.)

**Nanotragulus ordinatus* (Matthew)

A.M.N.H. "ROSEBUD" 15

"Divide E. of Porcupine Cr'k 7 m. below [Porcupine] p.o. . . . lower Rosebud": Field notes, 1906. (Harrison formation: Schultz and Falkenbach, 1949, p. 128; 1955, p. 183. Harrison formation: J.R.M.)

**?Capacikala sciuroides* (Matthew)
Enhydrocyon crassidens Matthew
Promerycochoerus montanus pinensis Schultz and Falkenbach
Promerycochoerus barbouri Schultz and Falkenbach
Promerycochoerus carrikeri Peterson
**Desmatochoerus curvidens gregorii* (Loomis)

A.M.N.H. "ROSEBUD" 16

"3 miles East of Porcupine p.o. . . . upper Rosebud": Field notes, 1906. (Harrison formation unless specimens came from highest exposures on hills: J.R.M.)

Gregorymus curtus (Matthew)
**Parahippus coloradensis praecurrens* Osborn
**Desmathyus pinensis* Matthew
"Merychyus"
Camelidae, indet.
Pseudoblastomeryx advena (Matthew)

A.M.N.H. "ROSEBUD" 17

"W. of Porcupine Cr'k about 3 m. N.E. of Porc[upine] Butte . . . upper Rosebud": Field notes, 1906. (Lower Marsland formation: Schultz and Falkenbach, 1947, p. 222. Early Hemingfordian: Dawson, 1958, p. 44. Probably Rosebud formation, although some specimens may have come from the Harrison formation: J.R.M.)

**Archaeolagus macrocephalus* (Matthew)
Tomarctus thomsoni (Matthew)
Promartes lepidus (Matthew)
Parahippus coloradensis praecurrens Osborn
Parahippus texanus Leidy
Desmathyus pinensis Matthew
Phenacocoelus stouti Schultz and Falkenbach
Merychyus minimus Peterson

A.M.N.H. "ROSEBUD" 18

"3 m. E. of Porcupine Butte . . . upper Rosebud": Field notes, 1906. (Marsland formation: Schultz and Falkenbach, 1940, p. 289. Rosebud formation: J.R.M.)

Pleurolicus leptophrys Cope
**Proheteromys matthewi* Wood
**Parahippus coloradensis praecurrens* Osborn
Parahippus sp.
**Merycochoerus matthewi* Loomis
Pseudoblastomeryx sp.

A.M.N.H. "ROSEBUD" 19

"1 m. E. of Porcupine P.O. . . . lower Rosebud": Field notes, 1906. (Harrison formation: J.R.M.)

**Hesperocyon gregorii* (Matthew)

A.M.N.H. "ROSEBUD" 20

"2 m. N.W. of Porcupine p.o. E. of Porcupine Cr'k . . . lower Rosebud": Field notes, 1906. (Harrison formation: Schultz and Falkenbach, 1949, p. 124. Harrison formation, although there are some small exposures of the Monroe Creek formation in the area: J.R.M.)

**Gregorymus formosus* (Matthew)
**Promerycochoerus minor pygmyus* Loomis

A.M.N.H. "ROSEBUD" 21

"E of Porcupine Cr'k. 2 m. N.W. of Porc[upine] P.O. . . . lower Rosebud": Field notes, 1906. (Harrison formation: Schultz and Falkenbach, 1949, p. 126. Harrison formation: J.R.M.)

Capatanka brachyceps (Matthew)
**Diceratherium gregorii* Peterson
**Arretotherium leptodus* (Matthew)
Promerycochoerus minor pygmyus Loomis

A.M.N.H. "ROSEBUD" 22

"4 m. E. of Porcupine P.O. . . . E. of Porc[upine] Cr'k . . . upper Rosebud": Field notes, 1906. (Lower Marsland formation: Schultz and Falkenbach, 1947, p. 222. Rosebud formation: J.R.M.)

**Megalictis ferox* Matthew
**Cynodesmus minor* Matthew
Camelidae, indet.

A.M.N.H. "ROSEBUD" 23

"About 6 m. E. of Porcupine p.o. E. of Porc[upine] Cr'k. . . . upper Rosebud": Field notes, 1906. (Harrison formation: Schultz and Falkenbach, 1949, p. 126. Probably Rosebud formation, possibly Harrison formation: J.R.M.)

**Gregorymus curtus* (Matthew)
Promerycochoerus minor pygmyus Loomis

A.M.N.H. "ROSEBUD" 24

"8 m. E. of Porcupine P.O. . . . N. of Porc[upine] Cr'k . . . upper Rosebud": Field notes, 1906. (Probably Rosebud formation: J.R.M.)

**Tomarctus thomsoni* (Matthew)
?Merycochoerus sp.

A.M.N.H. "ROSEBUD" 25

"10 m. N.W. of Porcupine P.O. . . . Leptauchenia Beds": Field notes, 1906. (Sharps formation: J.R.M.)

"Leptauchenia"
"Oreodon"

A.M.N.H. "ROSEBUD" 26

Three miles east of Porcupine post office. Upper Rosebud. (Lower Marsland formation: Schultz and Falkenbach, 1947, p. 222. Rosebud formation: J.R.M. This locality is not shown in the 1906 field book, but the above information was taken from the catalogue card.)

Merychyus minimus Peterson

The following specimens were collected by the 1906 expedition without specimen field numbers. The localities are given in such broad terms that levels can be determined only by faunal content, based on the assumption that all the material listed from one "locality" was actually collected from the same level. Under each locality number, the first statement is not a direct quotation but represents the present writer's interpretation of the 1906 field notes (Matthew and Thomson, MS) and the locality cards.

A.M.N.H. "ROSEBUD" 27

East of Porcupine Creek, upper Rosebud. (Lower Marsland formation: Schultz and Falkenbach, 1947, p. 222. Early Hemingfordian: Dawson, 1958, p. 42. Probably Rosebud formation: J.R.M.)

**Archaeolagus primigenius* (Matthew)
Promartes lepidus (Matthew)
Merychyus minimus Peterson

A.M.N.H. "ROSEBUD" 28

West of Porcupine Creek, upper Rosebud. (Lower Marsland formation: Schultz and Falkenbach, 1947, p. 222. Probably Rosebud formation: J.R.M.)

**Arctoryctes terrenus* Matthew
Merychyus minimus Peterson

A.M.N.H. "ROSEBUD" 29

Porcupine Creek, upper Rosebud. (Lower Marsland formation: Schultz and Falken-

bach, 1947, p. 222. Probably Rosebud formation: J.R.M.)

Gregorymus formosus (Matthew)
Grangerimus cf. *oregonensis*
Promartes sp.
Merychyus minimus Peterson
**Pseudoblastomeryx advena* (Matthew)

A.M.N.H. "ROSEBUD" 30

Northwest of Porcupine post office, lower Rosebud. (Monroe Creek formation or Harrison formation: J.R.M.)

Heteromyidae, indet.
Miohippus equinanus Osborn

A.M.N.H. "ROSEBUD" 31

Porcupine Creek, lower Rosebud. (Monroe Creek formation or Harrison formation: J.R.M.)

Castoridae, indet.
**Pleurolicus dakotensis* Wood
Miohippus equinanus Osborn
Nanotragulus ordinatus (Matthew)

A.M.N.H. "ROSEBUD" 32

East of Porcupine Creek, lower Rosebud. (Harrison formation or Monroe Creek formation: J.R.M.)

Nothocyon near *latidens*
Parahippus pristinus Osborn

Parties from the Amherst College Museum collected in the localities that are listed below in 1931 and 1934. These localities have been arbitrarily numbered by the writer for identification purposes.

A.C.M. "ROSEBUD" 1

"Porcupine Creek, six miles west of Post Office in Lower Rosebud beds of South Dakota": Loomis (1932, p. 317). (Six miles west of Porcupine post office places one high in the Harrison formation above the Monroe Creek formation cliffs overlooking Manderson. I believe that the locality should be recorded as 6 miles northwest of the Porcupine post office, which would place it in either the Monroe Creek formation or the Harrison formation: J.R.M.)

**Promartes gemmarosae* (Loomis)

A.C.M. "ROSEBUD" 2

" . . . in the lower Miocene Rosebud formation on Porcupine Creek, South Dakota, just above the concretionary layer, or about 100 feet above the base of the beds": Loomis (1936, p. 44). (Monroe Creek formation or Harrison formation: J.R.M.)

**Mammacyon obtusidens* Loomis

A.C.M. "ROSEBUD" 3

" . . . from Porcupine Creek, So. Dakota, in the Lower Rosebud beds": Loomis (1932, p. 325). (Monroe Creek formation or Harrison formation: J.R.M.)

**Neocynodesmus delicatus* (Loomis)

A.C.M. "ROSEBUD" 4

"From Porcupine Creek, 5 mi. N.N.W. of Porcupine Post Office": Schultz and Falkenbach (1949, p. 130). (Harrison formation: Schultz and Falkenbach, 1949, p. 128. Harrison formation: J.R.M.)

Promerycochoerus montanus pinensis Schultz and Falkenbach

A.C.M. "ROSEBUD" 5

"Porcupine Creek, South Dakota": Loomis (1933, p. 723). (From Miocene deposits equal to the Harrison formation: Schultz and Falkenbach, 1947, p. 253. Probably Harrison formation: J.R.M.)

?Oreodontoides curtus (Loomis)

The following localities are those of the Frick Laboratory as reported by Schultz and Falkenbach, 1949 and 1954. The assignment of locality numbers was made by the present writer for purposes of identification.

F:A.M. "ROSEBUD" 1

"1½ mi. S. of the large exposures at the mouth of Porcupine Creek Canyon, were found in a pink clay with small nodules that underlies the high exposures": Schultz and Falkenbach (1954, p. 189). (Gering formation: Schultz and Flakenbach, 1954, p. 180. Sharps formation: J.R.M.)

Desmatochoerus hatcheri geringensis Schultz and Falkenbach
Desmatochoerus wyomingensis Schultz and Falkenbach

F:A.M. "ROSEBUD" 2

"2 mi. N.N.W. of Porcupine Post Office, W. side of Porcupine Creek": Schultz and Falken-

bach (1949, p. 130). (Harrison formation: Schultz and Falkenbach, 1949, p. 128. Harrison formation: J.R.M.)

Promerycochoerus montanus pinensis Schultz and Falkenbach

The following localities are those of the Field Museum of Natural History (now the Chicago Natural History Museum) which have appeared in published reports. Arbitrary numbers have been assigned to these localities by the present writer for the convenience of later reference.

F.M.N.H. "ROSEBUD" 1

"Lower Rosebud beds, lower Miocene. Four miles northeast of Porcupine, South Dakota": McGrew (1941a, p. 55). (Monroe Creek formation or Harrison formation: J.R.M.)

**Heliscomys woodi* McGrew

F.M.N.H. "ROSEBUD" 2

"Four miles south of Porcupine, South Dakota; top of lower Rosebud beds": McGrew (1941b, p. 6). (If the locality data are correct, the specimen is certainly from the Rosebud formation: J.R.M.)

**Promylagaulus riggsi* McGrew

F.M.N.H. "ROSEBUD" 3

"In the upper Rosebud beds of South Dakota, near Porcupine Butte": McGrew (1941b, p. 9). (Rosebud formation: J.R.M.)

Mylagaulodon cf. *angulatus*

Following are the vertebrate localities of the Museum of Geology of the South Dakota School of Mines and Technology; all are in Shannon County, South Dakota. They are listed in numerical order without regard to their relative stratigraphic levels. The first two digits of the locality number indicate the year in which the locality was first worked.

S.D.S.M. V5339

Two hundred yards southeast of the quarter-section post on the boundary of sect. 31 and sect. 32, T. 38 N., R. 43 W., in nodular zone at base of cliffs at top of Sharps formation.

Palaeocastor nebrascensis (Leidy)

S.D.S.M. V5340

East of the Wooden Ranch house, in the NE. $\frac{1}{4}$ sect. 31, T. 38 N., R. 43 W., at top of Sharps formation just below the cliffs of the Monroe Creek formation.

Arctoryctes terrenus Matthew
Palaeocastor nebrascensis (Leidy)

S.D.S.M. V5341

On the southeast side of the Gooseneck Road in the NE. $\frac{1}{4}$ of the NW. $\frac{1}{4}$ of sect. 30, T. 39 N., R. 43 W., in nodules near the middle of the Sharps formation.

Palaeolagus philoi Dawson
Palaeocastor nebrascensis (Leidy)
Nanotragulus intermedius Schlaikjer

S.D.S.M. V5345

At base of hills about 2 miles east of the abandoned Wakan Store in the W. $\frac{1}{2}$ of sect. 25, T. 40 N., R. 44 W., in the lower one-quarter of the Sharps formation.

Palaeocastor nebrascensis (Leidy)

S.D.S.M. V5347

On the southeast side of the Manderson-Pine Ridge road, 3.6 miles southwest of Manderson in the SW. $\frac{1}{4}$ of sect. 11, T. 37 N., R. 44 W., near the top of the Sharps formation.

Megalagus primitivus (Schlaikjer)
Pleurolicus leptophrys Cope
Miohippus equiceps (Cope)
Nanotragulus intermedius Schlaikjer

S.D.S.M. V5348

At the top of the Sharps formation in the SE. $\frac{1}{2}$ of the SE. $\frac{1}{4}$ of sect. 36, T. 38 N., R. 44 W.

Cyclopidius schucherti Thorpe
Oxydactylus cf. *wyomingensis*

S.D.S.M. V5349

Twenty-five feet from the south side of road in the pass in the NW. $\frac{1}{4}$ of the SE. $\frac{1}{4}$ of sect. 26, T. 38 N., R. 44 W., in the very top of the Sharps formation.

Palaeocastor nebrascensis (Leidy)

S.D.S.M. V5350

At the top of the Sharps formation in the

SE. ¼ of the SW. ¼ of sect. 26, T. 38 N., R. 44 W.

Palaeolagus hypsodus Schlaikjer
Pleurolicus clasoni, new species
Palaeocastor nebrascensis (Leidy)
Capacikala gradatus (Cope)
Nothocyon roii, new species
Miohippus near *equinanus*
Miohippus equiceps (Cope)
Diceratherium armatum Marsh

S.D.S.M. V5351

Near the top of the Sharps formation in the NE. ¼ of the NW. ¼ of sect. 35, T. 38 N., R. 44 W.

?Prosciurus dawsonae, new species
Palaeocastor nebrascensis (Leidy)
Capacikala gradatus (Cope)
Nothocyon geismarianus (Cope)
Miohippus equiceps (Cope)

S.D.S.M. V5352

Near the top of the Sharps formation in the NW. ¼ of the NE. ¼ of sect. 35, T. 38 N., R. 44 W.

Palaeocastor nebrascensis (Leidy)

S.D.S.M. V5353

Two hundred yards northwest of the Manderson-Pine Ridge road, 0.9 mile southwest of Manderson in the NW. ¼ of the SW. ¼ of sect. 36, T. 38 N., R. 44 W., in the middle of the Sharps formation.

Palaeolagus philoi Dawson
Palaeocastor nebrascensis (Leidy)
Hesperocyon leptodus (Schlaikjer)
Leptomeryx sp.
Nanotragulus intermedius Schlaikjer

S.D.S.M. V5354

In the badlands centering around the common corner of sects. 13, 14, 23, and 24, T. 39 N., R. 42 W., near the top of the Sharps formation. This is the area shown in Osborn (1918, fig. 7).

**Peratherium spindleri*, new species
**Domninoides evelynae*, new species
Arctoryctes terrenus Matthew
Palaeolagus hypsodus Schlaikjer
Palaeolagus philoi Dawson
Megalagus primitivus (Schlaikjer)
Prosciurus dawsonae, new species
Meniscomys hippodus Cope
**Proheteromys fedti*, new species
**Hitonkala andersontau*, new species
Palaeocastor nebrascensis (Leidy)
**Capatanka cankpeopi*, new species
Capacikala gradatus (Cope)
**Nothocyon roii*, new species
Mesocyon robustus Matthew
Sunkahetanka geringensis (Barbour and Schultz)
Miohippus near *equinanus*
Diceratherium gregorii Peterson
Leptochoerus sp.
Cyclopidius schucherti Thorpe
Arretotherium sp.
Nanotragulus intermedius Schlaikjer
Nanotragulus cf. *loomisi*

S.D.S.M. V5355

On the south side of the Sharps Corners-Kyle road in the NE. ¼ of the NW. ¼ of sect. 6, T. 39 N., R. 42 W., near the middle of the Sharps formation.

Capatanka cankpeopi, new species
Capacikala gradatus (Cope)

S.D.S.M. V5356

On the north side of the Manderson-Pine Ridge road, 1.9 miles southwest of Manderson in the SE. ¼ of the NW. ¼ of sect. 2, T. 37 N., R. 44 W., in the middle of the Sharps formation.

Capacikala gradatus (Cope)

S.D.S.M. V5357

On the south side of the Tibbets Ranch road in the SE. ¼ of sect. 6, T. 39 N., R. 43 W., in the middle of the Sharps formation.

Palaeolagus philoi Dawson
Grangerimus dakotensis, new species
Palaeocastor nebrascensis (Leidy)
**Palaeogale dorothiae*, new species
Nanotragulus intermedius Schlaikjer

S.D.S.M. V5358

On the west side of the Tibbets Ranch road in the SE. ¼ of sect. 31, T. 40 N., R. 43 W., and the NE. ¼ of sect. 6, T. 39 N., R. 43 W., near the middle of the Sharps formation.

Ekgmowechashala philotau, new species
Palaeolagus hypsodus Schlaikjer
**Palaeolagus philoi* Dawson
Megalagus primitivus (Schlaikjer)
Palaeocastor nebrascensis (Leidy)
Capacikala gradatus (Cope)
Nothocyon roii, new species
Mesocyon robustus Matthew

Sunkahetanka geringensis (Barbour and Schultz)
Miohippus equiceps (Cope)
Diceratherium cf. *gregorii*
Mesoreodon megalodon cf. *sweeti*
Nanotragulus intermedius Schlaikjer

S.D.S.M. 5359

In gully on south side of Sharps Cutoff road in the SW. ¼ of sect. 9, T. 39 N., R. 43 W., near the middle of the Sharps formation.

Arctoryctes terrenus Matthew
Palaeolagus philoi Dawson
Proheteromys bumpi, new species
Palaeocastor nebrascensis (Leidy)
Capatanka cankpeopi, new species
Capacikala gradatus (Cope)
Hesperocyon leptodus (Schlaikjer)
Nothocyon lemur (Cope)
**Cynodesmus cooki*, new species
Mesocyon robustus Matthew
Miohippus equiceps (Cope)
Leptomeryx sp.
Nanotragulus intermedius Schalaikjer

S.D.S.M. V5360

In the gullies on both sides of the Sharps Cutoff road in the N. ½ of sect. 17, T. 39 N., R. 43 W., in the middle of the Sharps formation.

Peratherium spindleri, new species
**Ocajila makpiyahe*, new species
Arctoryctes terrenus Matthew
Palaeolagus hypsodus Schlaikjer
Palaeolagus philoi Dawson
?Palaeolaginae
Prosciurus dawsonae, new species
**Florentiamys agnewi*, new species
Palaeocastor nebrascensis (Leidy)
Capatanka cankpeopi, new species
Capacikala gradatus (Cope)
Nothocyon roii, new species
Sunkahetanka geringensis (Barbour and Schultz)
Enhydrocyon crassidens Matthew
Miohippus near *equinanus*
Miohippus equiceps (Cope)
Diceratherium cf. *gregorii*
Leptomeryx sp.
Nanotragulus intermedius Schlaikjer

S.D.S.M. V5361

On the south side of the Gooseneck road near the junction with the Sharps Cutoff road in the NE. ¼ of the NW. ¼ of sect. 20, T. 39 N., R. 43 W., near the top of the Sharps formation.

Ekgmowechashala philotau, new species
Palaeolagus philoi Dawson
Megalagus primitivus (Schlaikjer)
Palaeocastor nebrascensis (Leidy)
Capacikala gradatus (Cope)
Nothocyon geismarianus (Cope)
**Sunkahetanka pahinsintewakpa*, new species
Cyclopidius simus Cope
Nanotragulus intermedius Schlaikjer

S.D.S.M. V5362

Near the Needle in the SE. ¼ of sect. 18 and NE. ¼ of sect. 19, T. 38 N., R. 43 W., at the very top of the Sharps formation.

Arctoryctes terrenus Matthew
Palaeolagus philoi Dawson
**Proheteromys gremmelsi*, new species
Palaeocastor nebrascensis (Leidy)
Capatanka cankpeopi, new species
Capacikala gradatus (Cope)
Enhydrocyon crassidens Matthew
Miohippus equiceps (Cope)
Oxydactylus cf. *wyomingensis*
?Oxydactylus sp.
Nanotragulus intermedius Schlaikjer
Nanotragulus cf. *loomisi*

S.D.S.M. V5363

About 50 feet north of the quarter-section marker at the base of the cliffs, 0.75 mile south of the junction of the Gooseneck road and the Sharps Cutoff road in the SW. ¼ of the SE. ¼ of sect. 20, T. 39 N., R. 43 W., at the top of the Sharps formation.

?Oxydactylus sp.

S.D.S.M. V5365

East of the Needle in the NW. ¼ of the NW. ¼ of sect. 20, T. 38 N., R. 43 W., near the top of the Sharps formation.

Palaeocastor nebrascensis (Leidy)

S.D.S.M. V541

In the middle of the Sharps formation in the NW. ¼ of sect. 8, T. 39 N., R. 43 W.

Domninoides evelynae, new species
**Ekgmowechashala philotau*, new species
Palaeolagus philoi Dawson
**Prosciurus dawsonae*, new species
**Grangerimus dakotensis*, new species
**Proheteromys bumpi*, new species
Palaeocastor nebrascensis (Leidy)
Capacikala gradatus (Cope)
Eumys woodi, new species
Hesperocyon leptodus (Schlaikjer)

Nothocyon geismarianus (Cope)
Mesocyon robustus Matthew
Sunkahetanka geringensis (Barbour and Schultz)
Miohippus equiceps (Cope)
Cyclopidius schucherti Thorpe
Cyclopidius simus Cope
Oxydactylus cf. *wyomingensis*
Nanotragulus intermedius Schlaikjer

S.D.S.M. V542

Along the course of unnamed canyon on the Groom Ranch in the N. ½ of sect. 30, T. 40 N., R. 43 W., in the lower part of the Sharps formation.

Palaeolagus hypsodus Schlaikjer
Palaeolagus philoi Dawson
Palaeocastor nebrascensis (Leidy)
Capatanka cankpeopi, new species
**Eumys woodi*, new species
Mesocyon robustus Matthew
Diceratherium gregroii Peterson
Agriochoerus sp.

S.D.S.M. V543

On the south and east sides of the Tibbets Ranch road in the S. ½ of the SW. ¼ of sect. 32, T. 40 N., R. 43 W. and the NW. ¼ of sect. 5, T. 39 N., R. 43 W., near the middle of the Sharps formation.

Palaeocastor nebrascensis (Leidy)
Capacikala gradatus (Cope)
Diceratherium gregorii Peterson
Diceratherium armatum Marsh

S.D.S.M. V544

Along bottom of canyon extending through the N. ½ of sects. 7 and 8, T. 39 N., R. 43 W., near the middle of the Sharps formation.

Palaeolagus hypsodus Schlaikjer
Palaeocastor nebrascensis (Leidy)
Arretotherium sp.

S.D.S.M. V545

On the border of the Grass Creek badlands in sect. 23, T. 39 N., R. 45 W., at the base of the Sharps formation.

Hyracodon apertus Sinclair

S.D.S.M. V549

At the edge of the White River bluffs in the NW. ¼ of sect. 35 and the S. ½ of sect. 26, T. 41 N., R. 43 W., in the Rockyford member of the Sharps formation.

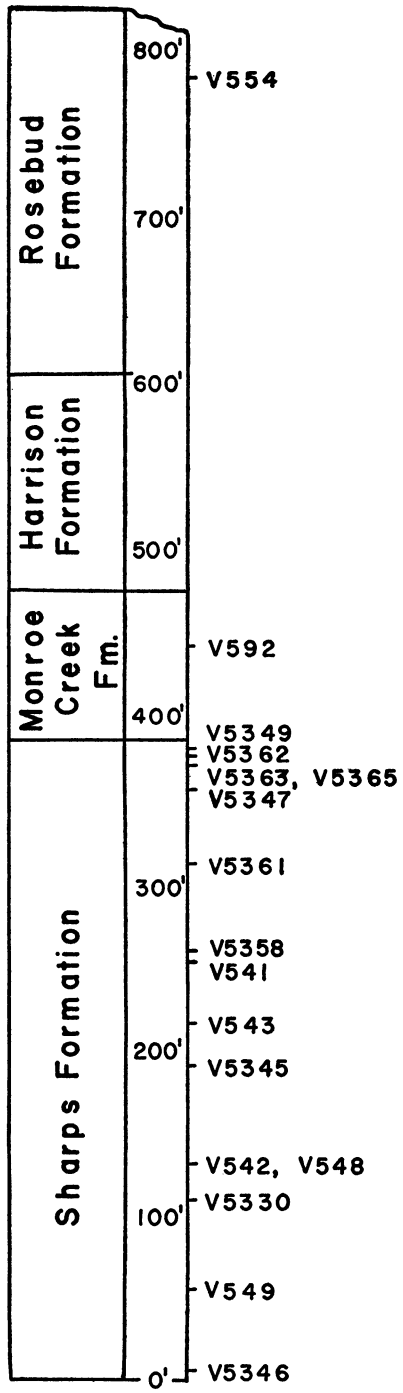


FIG. 2. Stratigraphic levels of selected fossil localities, in the Wounded Knee area, of the South Dakota School of Mines and Technology.

Palaeolagus hypsodus Schlaikjer
**Ekgmoiteptecela olsontau*, new species

Hyracodon sp.
Nanotragulus intermedius Schlaikjer

S.D.S.M. V5410

In heavy Miocene channel deposits at the Godsell Ranch in the S. ½ of sects. 11 and 12, the E. ½ of sect. 14, and the W. ½ of sect. 13, T. 40 N., R. 44 W.

Palaeocastor nebrascensis (Leidy)
Capacikala gradatus (Cope)
**Eumys blacki*, new species
Hesperocyon leptodus (Schlaikjer)
Cynodesmus cooki, new species
Nothocyon lemur (Cope)
Oxydactylus cf. *wyomingensis*
Leptomeryx sp.
Nanotragulus intermedius Schlaikjer

S.D.S.M. V5413

(Godsell Ranch Channel Faunule)

In a small, fossiliferous, stream-channel deposit lying between the Brule formation and the Quaternary alluvium on the Godsell Ranch. The fauna indicates that this channel is referable to the Sharps formation. On the east side of the canyon in the NW. ¼ of the SE. ¼ of sect. 12, T. 40 N., R. 44 W.

Iguanidae, indet.
?*Peltosaurus* sp.
Anguidae, indet.
Amphisbaenidae, indet.
Peratherium spindleri, new species
**Domnina greeni*, new species
Talpidae, indet.
Heliscomys sp.
Proheteromys bumpi, new species
Hitonkala andersontau, new species
Tamias sp.
Scottimus sp.

S.D.S.M. V554

Near the top of the Rosebud formation on the west side of the Wounded Knee-Highway 18 road in the SE. ¼ of the SE. ¼ of sect. 4 and NE. ¼ of the NE. ¼ of sect. 9, T. 36 N., R. 43 W.

Tomarctus thomsoni (Matthew)

S.D.S.M. V572

In the Sharps formation on the south side of the Sharps Corner-Kyle road in the NW. ¼ of the NW. ¼ of sect. 3, T. 39 N., R. 42 W.

Cyclopidius schucherti Thorpe
?*Oxydactylus* sp.

S.D.S.M. V592

In anthills near the middle of the Monroe Creek formation in the SW. ¼ of sect. 3, T. 38 N., R. 43 W.

Proscalops sp.
**Allomys harkseni*, new species
Meniscomys sp.
Promylagaulus cf. *riggsi*
Pleurolicus dakotensis Wood

CORRELATION OF THE WOUNDED KNEE FAUNAS

Because the Wounded Knee faunas occur in an apparently continuous sequence of deposits, a fairly complete picture of the early Miocene faunal sequence can be expected. At the present time, the Wounded Knee-Sharps fauna is the largest assemblage known, with four reptiles and 62 mammals recorded. Twenty-one mammals are recorded from the Wounded Knee-Rosebud fauna; 19 mammals, from the Wounded Knee-Harrison fauna; and six mammals, from the Wounded Knee-Monroe Creek fauna. In addition, there are several forms for which there is no accurate stratigraphic control, so they may have been collected from the Monroe Creek formation, the Harrison formation, or the Rosebud formation.

Of the mammals occurring in the Wounded Knee-Sharps fauna, seven species are also found in the "Lower Harrison fauna" from Goshen Hole, Wyoming; seven species are found in the John Day fauna of Oregon; and four have been recorded from the Gering formation of Nebraska and Wyoming.

The Wounded Knee-Monroe Creek fauna has so far produced only six mammalian species. Of these, one (*Nothocyon geismarianus*) is known from the John Day of Oregon, and another (*Promylagaulus* cf. *riggsi*) is known from the Rosebud-Rosebud fauna.

The Wounded Knee-Harrison fauna has one species (*Pleurolicus leptophrys*) that is also known from the Wounded Knee-Sharps fauna and from the John Day fauna. Four other species (three oreodonts and a rhinoceros) are found in the Harrison formation of Nebraska and Wyoming.

One of the 21 species of mammals of the Wounded Knee-Rosebud fauna (*Grangerimus oregonensis*) is also found in the John Day

TABLE 2

GEOGRAPHIC AND STRATIGRAPHIC DISTRIBUTION OF CERTAIN WOUNDED KNEE FAUNAL ELEMENTS

	South Dakota, Rosebud-Rosebud Fauna	Wyoming (Goshen Hole), "Lower Harrison" Formation	Oregon, John Day Fauna	Nebraska and Wyoming, Gering Formation	Nebraska and Wyoming, Harrison Formation	Nebraska and Wyoming, Marsland Formation
Wounded Knee-Rosebud fauna						
Archaeolagus primigenius	—	—	—	—	—	x
Archaeolagus macrocephalus	—	—	—	—	—	x
Grangerimus oregonensis	—	—	x	—	—	—
Promartes lepidus	—	—	—	—	—	x
Megalictis ferox	—	—	—	—	—	x
Merycochoerus matthewi	—	—	—	—	—	x
Merycochoerus minimus	—	—	—	—	—	x
Wounded Knee-Harrison fauna						
Pleurolicus leptophrys	—	—	x	—	—	—
Promerycochoerus carrikeri	—	—	—	—	x	—
Promerycochoerus barbouri	—	—	—	—	x	—
Promerycochoerus pygmyus	—	—	—	—	x	—
Desmatochoerus gregorii	—	—	—	—	x	—
Wounded Knee-Monroe Creek fauna						
Promylagaulus cf. *riggsi*	x	—	—	—	—	—
Nothocyon geismarianus	—	—	x	—	—	—
Wounded Knee-Sharps fauna						
Palaeolagus hypsodus	—	x	—	—	—	—
Palaeolagus philoi	—	x	—	—	—	—
Megalagus primitivus	—	x	—	—	—	—
Meniscomys hippodus	—	—	x	—	—	—
Pleurolicus leptophrys	—	—	x	—	—	—
Capatanka gradatus	—	—	x	—	—	—
Hesperocyon leptodus	—	x	—	—	—	—
Nothocyon geismarianus	—	—	x	—	—	—
Nothocyon lemur	—	—	x	—	—	—
Mesocyon robustus	—	x	—	—	—	—
Sunkahetanka geringensis	—	—	—	x	—	—
Diceratherium armatum	—	—	x	—	—	—
Miohippus equiceps	—	x	—	—	—	—
Desmatochoerus geringensis	—	—	—	x	—	—
Desmatochoerus wyomingensis	—	—	—	x	—	—
Mesoreodon megalodon cf. *sweeti*	—	—	—	x	—	—
Cyclopidius simus	—	x	—	—	—	—
Nanotragulus intermedius	—	x	—	—	—	—

fauna, and six species (two lagomorphs, two carnivores, and two oreodonts) are known from the Marsland formation of Wyoming and Nebraska.

The lack of significant depositional breaks within this stratigraphic sequence from the top of the Brule formation through the Rosebud formation suggests that future collecting in the Wounded Knee area should produce a fairly complete phylogenetic series within many of the mammalian groups of the early Miocene in the Great Plains. With further work in the upper part of the Brule formation in the extensive badlands south of White River and east of Porcupine Creek and in the badlands of the Grass Creek drainage, ancestral species should be found for many of the forms that appear in the Sharps formation.

The Wounded Knee area may well have the potential of becoming an early Miocene standard of correlation in the western United States.

SYSTEMATIC PALEONTOLOGY

REPTILIA LINNAEUS, 1758

SQUAMATA OPPEL, 1811

The lizards are represented in the Wounded Knee-Sharps fauna by a small collection of jaw fragments from the Godsell Ranch Channel locality (S.D.S.M. V5413). The fragmentary nature of this material makes identification below the family level virtually impossible.

IGUANIDAE GRAY, 1827

IGUANIDAE, GENUS INDETERMINATE

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 5829, 11 jaw fragments, from S.D.S.M. V5413.

ANGUIDAE COPE, 1864

PELTOSAURUS COPE, 1873

Peltosaurus COPE, 1873a, p. 5.

?Peltosaurus, species indeterminate

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 5578, jaw fragment, from S.D.S.M. V5413.

ANGUIDAE, GENUS INDETERMINATE

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 5896, 30 jaw fragments, from S.D.S.M. V5413.

AMPHISBAENIDAE GRAY, 1825

AMPHISBAENIDAE, GENUS INDETERMINATE

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 5897, two jaw fragments, from S.D.S.M. V5413.

MAMMALIA LINNAEUS, 1758

MARSUPIALIA ILLIGER, 1811

DIDELPHIDAE GRAY, 1821

PERATHERIUM AYMARD, 1850

Peratherium AYMARD, 1850, p. 81.

Peratherium spindleri,[1] new species

Figure 3

TYPE: S.D.S.M. No. 54343, fragment of right mandible, with M_{1-4} and the roots of P_{3-4}.

TYPE LOCALITY: S.D.S.M. V5354.

[1] For Mr. and Mrs. Will Spindler of Wounded Knee, South Dakota.

HORIZON: Sharps formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna: S.D.S.M. No. 5694, fragment of left mandible, with M_4, from S.D.S.M. V5360; S.D.S.M. No. 5835, 54 isolated cheek teeth, from S.D.S.M. V5413.

DIAGNOSIS: Of medium size; strongly developed anterior and posterior cingula; labial cingulum continuous.

DESCRIPTION: P_3 and P_4 not crowded, as adjoining roots are separated by short space. M_1 having trigonid somewhat elongated; metaconid opposite protoconid; talonid slightly wider than trigonid; entoconid with apex slightly anterior to apex of hypoconid, connected to base of metaconid by thin, high crest; hypoconulid posterior to base of entoconid; cingulum beginning below and slightly labial to apex of paraconid, descending steeply to base of tooth just anterior to base of protoconid, continuing posteriad to anterior base of protoconid, reduced but still visible as it extends posteriad across labial face of base, expanding to prominent shelf as it rises across posterior face to join base of hypoconulid. M_2 similar to M_1; trigonid not laterally compressed; labial portion of cingulum more prominent. M_3 similar to M_2; labial portion of cingulum slightly less prominent. M_4 having trigonid slightly compressed anteroposteriorly; cingulum terminating at base of protoconid, with small segment crossing base of valley between protoconid and hypoconid; talonid tapering posteriorly; hypoconid, hypoconulid, and entoconid subequal, forming small, raised triangle at posterior end of talonid; entoconid not connected to base of metaconid.

DISCUSSION: The possibility cannot be entirely ruled out that this specimen is conspecific with *P. youngi* McGrew (1937), which is based on an isolated M^3 from the early Miocene of the Harrison formation in Nebraska. The only suggestion that such is not the case is the presence of isolated upper cheek teeth of *Peratherium* from the Godsell Ranch Channel faunule (S.D.S.M. V5413) which are not referable to *P. youngi*. By the same token, this species is not referable to *Nanodelphys* McGrew (1939) from the Brule formation of

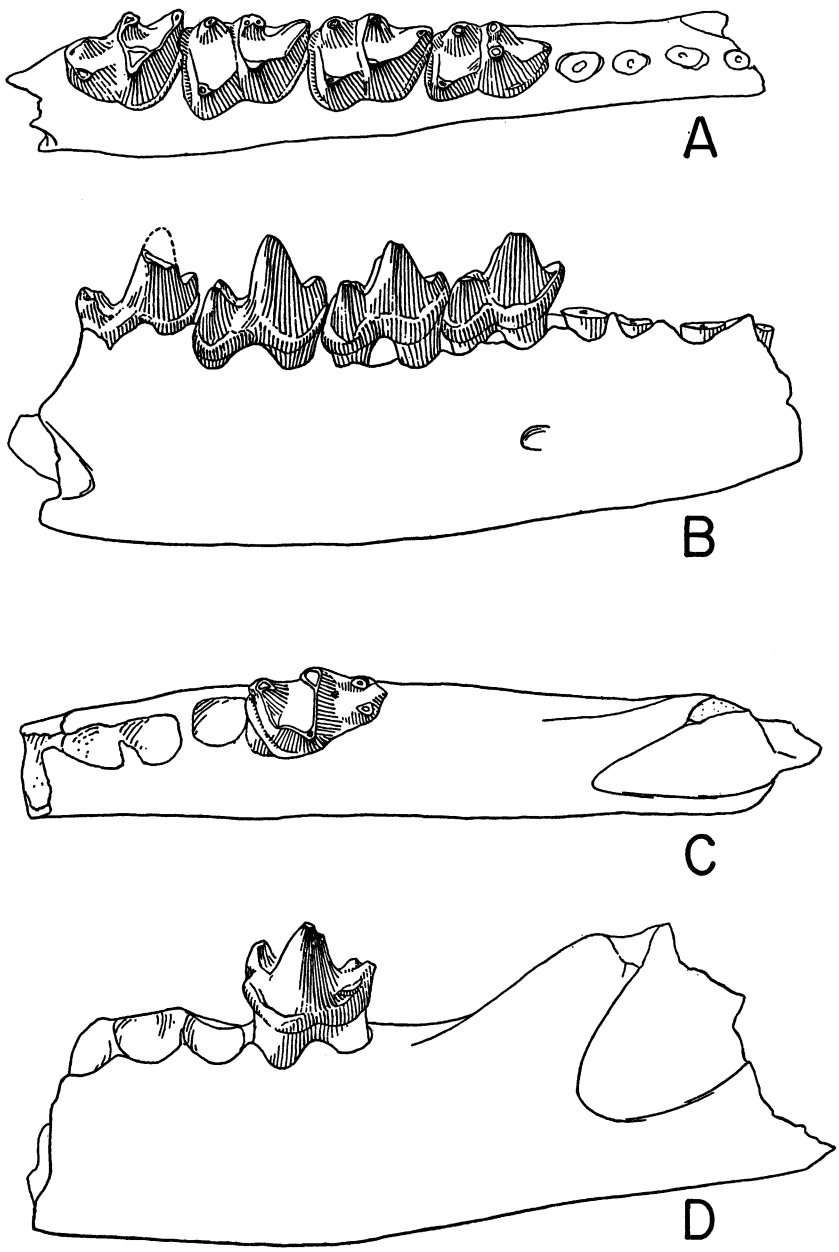


FIG. 3. *Peratherium spindleri*, new species. A. Type, S.D.S.M. No. 54343, right ramus, with M_{1-4}, crown view. B. Same specimen, labial view. C. Referred specimen, S.D.S.M. No. 5694, left ramus, with M_4, crown view. D. Same specimen, labial view. All approximately ×10.

western Nebraska, which is also based on upper cheek teeth.

A comparison with the types of the species that Cope described from the Oligocene of northeastern Colorado indicates that this form is quite distinct. *Peratherium fugax* (Cope, 1873a) is larger, with a relatively narrower cingulum and a greater separation between P_3 and P_4. *Peratherium tricuspis* (Cope, 1873b) is larger; also, in it the cingulum is relatively larger, the protoconid is a more prominent cusp, the talonid is longer, and the

TABLE 3

MEASUREMENT (IN MILLIMETERS) OF THE LOWER TEETH OF *Peratherium spindleri*, NEW SPECIES

	S.D.S.M. No. 54346, Type	S.D.S.M. No. 5694
M_1		
Length	1.42	—
Width	1.07	—
M_2		
Length	1.65	—
Width	1.17	—
M_3		
Length	1.70	—
Width	1.18	—
M_4		
Length	1.62	1.80
Width	1.07	1.04

hypoconid projects more posteriorly. The trigonids of M_{3-4} of *P. alternans* (Cope, 1873b) are quite different, as the protoconid is behind the metaconid, and the paraconid is in a more median position; the talonids are basined, and the entoconulid of M_4 projects as a slender shaft to the rear. *Peratherium hunti* (Cope, 1873b) is smaller, its hypoconid is more rounded posteriorly, and its entoconid is farther posterior. *Peratherium gracile* (Cope, 1873b) is too fragmentary for a valid comparison. *Peratherium marginale* (Cope, 1873b) has a foreshortened trigonid, the protoconid posterior to the metaconid, and the hypoconid and entoconid conical. *Peratherium scalare* (Cope, 1873b) has no posterior labial cingulum and is larger.

Scott (*in* Scott and Jepsen, 1941) recognized only two of these species as valid: *P. fugax* and *P. hunti*. In the latter species, he included as synonyms *P. stevensonii* (Cope, 1873b), *P. gracile* (Cope, 1873b), and *Didelphis pygmaea* Scott (1884). Galbreath (1953) followed Scott in recognizing these same two species but did not indicate the synonymy of the other described species.

A comparison of the types, on which Cope based this superabundance of species, suggests that more than two species were present during the span of Oligocene time in northeastern Colorado. This supposition can be supported only by a complete review of all the available material and a complete reëvaluation of variability within this genus.

In addition to *Peratherium*, another genus, *Nanodelphys* McGrew (1937) based on *N. minutus*, is known from the Brule formation. The type of this species is a maxillary fragment with M^{2-3} which was supplemented by another fragment with M^{1-4}. While this species cannot be compared directly with *P. spindleri*, it should be noted that the isolated upper molars from the Godsell Ranch Channel faunule are not referable to *Nanodelphys*.

Other species of *Peratherium* have been described from elsewhere in North America. Matthew (1903) proposed *P. titanelex* from the early Oligocene Pipestone Springs locality in Montana. This species is smaller than the Sharps form, its premolars are more crowded, and it has a much smaller posterior cingulum. *Peratherium valens* (Russell, 1934) from the Cypress Hills area of Saskatchewan is essentially a *nomen vanum* and cannot be compared with the material at hand. *Peratherium merriami* Stock and Furlong (1922) from the John Day is much larger, and in it the entoconid is near the center of the lingual side of the talonid, the talonid of the M_4 is laterally compressed, and the labial cingulum does not extend posteriorly.

On the basis of the above evaluation, *P. spindleri* appears to represent a distinct form. The addition of more complete material with associated upper and lower dentitions will greatly clarify the relationships of these prominent members of the Oligocene and early Miocene mammalian microfauna of the Great Plains.

INSECTIVORA BOWDICH, 1821

ERINACEIDAE BONAPARTE, 1838

OCAJILA,[1] NEW GENUS

GENOTYPIC SPECIES: *Ocajila makpiyahe*, new species.

GEOLOGIC RANGE: Early Miocene.

DIAGNOSIS: Trigonid compressed anteroposteriorly; anteroposterior diameter of trigonid subequal to that of talonid; paraconid reduced to ridge.

[1] *Ocaji*, all-kinds, and *-la*, a diminutive suffix, in Sioux; "all-kinds" is a Sioux convention for "strange" or "odd." Thus *Ocajila*, little oddment. Pronounced Oh-shâh-jgee-lah; "jg" denotes soft "g" as in rouge.

Ocajila makpiyahe,[1] new species

Figure 4

TYPE: S.D.S.M. No. 56105, fragment of left mandible, with slightly worn M_{2-3}.

TYPE LOCALITY: S.D.S.M. V5360.

HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: As for the genus.

DESCRIPTION: Trigonid of M_2 compressed anteroposteriorly; paraconid is blade extending from anterior apex of triangular protoconid to anterolingual base of conical metaconid, blade having light apex on midline that may represent remnant of paraconid; protoconid triangular, slightly worn, connected to metaconid by posterior transverse ridge, ridge deeply notched at midline; metaconid conical nearly opposite protoconid; talonid subequal to trigonid, hypoconid triangular, anterior ridge connected to base of trigonid below apex of protoconid, posterior transverse blade terminating at small hypoconulid on midline of posterior border; hypoconulid very small, projecting slightly beyond general plane of posterior wall; entoconid triangular, as high as metaconid, connected labially to hypoconulid and anteriorly to base of entoconid; talonid deeply basined; cingulum arising anteriorly below apex on midline of paraconid ridge, extending labially and downward to anterior labial corner of tooth below protoconid, continuing posteriad on labial wall, becoming indistinct as it turns corner of hypoconid, and becoming prominent on posterior wall as it rises to midline under hypoconulid, faintly developed along lingual wall from anterior base of entoconid to lingual termination of paraconid blade. M_3 having trigonid like that of M_2, paraconid blade with less obvious apex; talonid subequal in length to trigonid, but narrower than trigonid; no indication of hypoconulid; entoconid only slightly taller than hypoconid; cingulum like that of M_2 but posterolingual termination below labial posterior corner of entoconid.

MEASUREMENTS OF TYPE: Length of M_2, 1.78 mm.; width of M_2, 1.45 mm.; length of M_3, 1.42 mm.; width of M_3, 1.14 mm.

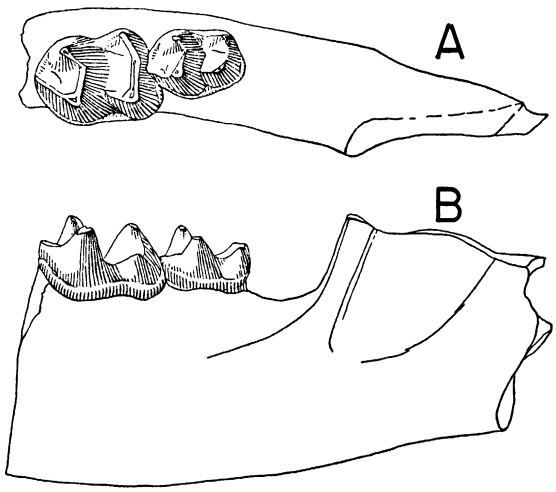


FIG. 4. *Ocajila makpiyahe*, new species. Type, S.D.S.M. No. 56105, left ramus, with M_{2-3}. A. Crown view. B. Labial view. Both slightly less than $\times 10$.

DISCUSSION: With nine previously described genera of erinaceids from the North American Tertiary, these small mammals are becoming an important if not conspicuous part of the New World fossil fauna.

Among the known genera, the genus *Ankylodon* Patterson and McGrew (1937) most closely resembles *Ocajila*. Both genera have the anteroposterior shortening of the trigonid, with the attending reduction of the paraconid to a ridge running transversely across the anterior edge of the molars. There are, however, outstanding differences that indicate that *Ocajila* is not a descendant of *Ankylodon*, but rather a member of another phylum within the highly diversified North American hedgehogs. The Wounded Knee genus differs basically from *Ankylodon* in the lower trigonid, in the absence of a deep groove between the talonid and trigonid, and in the less conspicuous hypoconulid. As M_3 is unknown in *Ankylodon*, the stage of reduction cannot be determined.

The reduction of M_3 is a variable feature among the North American erinaceids. In *Metacodon* and *Meterix* it is but little smaller than M_2; in *Metechinus nevadensis* Matthew (1929), it is missing entirely, as presumably is also the case in *M. marslandensis* Meade

[1] *Makpiya*, cloud, and *he*, horn, in Sioux, meaning "horncloud." Pronounced Mach-pée-yah Hay. "Mach-" is pronounced as in German. For Mr. and Mrs. Joseph Horncloud of Pine Ridge, South Dakota.

(1941). Other genera are known only from upper dentitions or are sufficiently different to be far removed from *Ocajila*. *Entomolestes* Matthew (1909b) from the Bridger Eocene shows many similarities to this genus, but the time gap between the two genera makes extrapolation a dangerous and unprofitable procedure.

SORICIDAE GRAY, 1821

DOMNINA COPE, 1873

Domnina COPE, 1873a, p. 1.

Domnina greeni,[1] new species

Figure 5

TYPE: S.D.S.M. No. 5895, fragment of left mandible, with M_1 and part of M_2.

TYPE LOCALITY: S.D.S.M. V5413, Godsell Ranch Channel faunule.

HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: Labial cingulum on anterior labial face of trigonid only; entostylid and anterior crest of entoconid lower and laterally compressed.

DESCRIPTION: M_1 with trigonid similar to that of other species; talonid with entoconid lower and compressed laterally, with posterior shelf; labial cingulum extending from anterior face of base of paraconid ventrally along base of tooth to point midway between paraconid and protoconid; posterior cingulum hidden by M_2 except for small portion at posterior base of hypoconid. M_2 having trigonid and anterior moiety of talonid; similar but slightly smaller than M_1; short segment of labial cingulum developed at base of valley between protoconid and hypoconid.

MEASUREMENTS OF TYPE: Length of M_1, 2.30 mm.; width of M_1, 1.35 mm.

DISCUSSION: While it must be admitted that the above specimen is not an ideal type for a species, I believe that, owing to its temporal position and separation from the early Oligocene *D. thomsoni* Simpson (1941) and the middle Oligocene *D. gradata* Cope (1873a), it is distinct from these species. *Domnina compressa* Galbreath (1953) from the middle Oligocene Cedar Creek member of the White River formation in northeastern Colorado is quite different in several characteristics, particularly in the loss of the entostylid with its anterior spur that blocks the talonid lingual valley.

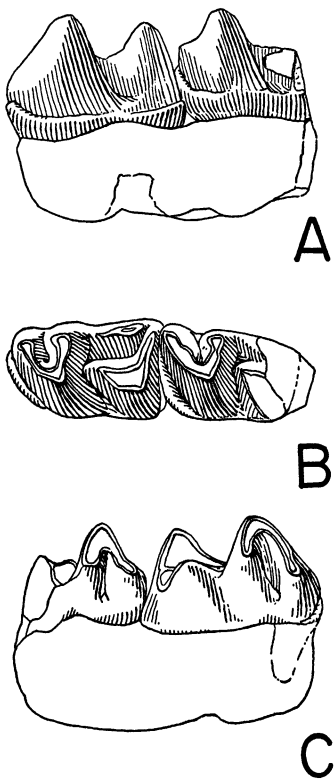


FIG. 5. *Domnina greeni*, new species. Type, S.D.S.M. No. 5895, left ramus, with M_{2-3}. A. Labial view. B. Crown view. C. Lingual view. All approximately ×10.

Domina greeni is a simple continuation of the line composed of *D. thomsoni* and *D. gradata*. It was probably derived from the latter species or its direct descendants, without a great deal of modification in the tooth structure. On the other hand, *D. compressa* represents a completely separate branch which perhaps should be designated as a separate genus or at least should receive subgeneric status.

TALPIDAE GRAY, 1825

DOMNINOIDES GREEN, 1956

Domninoides GREEN, 1956, p. 152.

Domninoides evelynae,[2] new species

Figure 6

TYPE: S.D.S.M. No. 53381, fragment of

[1] For Dr. Morton Green of the South Dakota School of Mines and Technology, Rapid City, South Dakota.

[2] For Mrs. L. F. Macdonald, St. Helena, California.

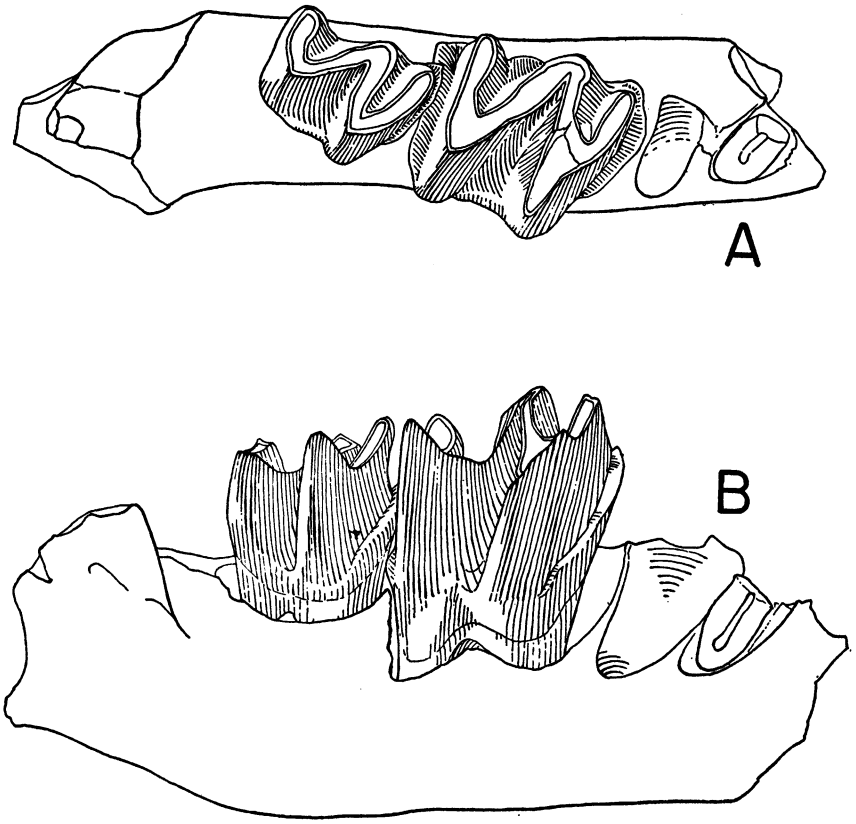


FIG. 6. *Domninoides evelynae*, new species. Type, S.D.S.M. No. 53381, right ramus, with M_{2-3}. A. Crown view. B. Labial view. Both approximately×10.

right mandible, with M_{2-3} and the alveoli for M_1.

TYPE LOCALITY: S.D.S.M. V5354.

HORIZON: Sharps formation, early Miocene.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 54322, fragment of right mandible, with worn M_{1-2}, from S.D.S.M. V541.

DIAGNOSIS: Anterior cinguli slightly developed; valley of talonid of M_2 partially blocked by expanded cingular segment.

DESCRIPTION: M_1 two-rooted, with anterior root smaller than posterior. M_2 having subequal trigonid and talonid; paraconid, protoconid, and metaconid connected by strong, high ridge forming acute triangle; hypoconid connected to metaconid and entoconid by equally strong ridges; cingulum arising below base of open trigonid valley, extending anteriorly around base of paraconid, across two-thirds of anterior face of tooth, poorly developed on labial side opposite opening of valley between trigonid and talonid, on posterior face forming a flat shelf extending from opposite entoconid across three-quarters of face; a small segment extending from anterolingual base on entoconid to posterolingual base on metaconid, this segment higher posteriorly than anteriorly so that talonid valley opens lingually only at anterior side. M_3 similar to M_2 except talonid slightly lower, and posterior lingual section of cingulum not developed.

MEASUREMENTS OF TYPE: Length of M_2, 2.79 mm.; width of M_2, 2.13 mm.; length of M_3, 2.16 mm.; width of M_3, 1.65 mm.

DISCUSSION: This species may well be ancestral to *D. riparensis* Green (1956) from the early Pliocene Wolf Creek fauna of a few miles to the south. The expansion of the anterior and labial cingulum and the reduction of the lingual cingulum indicate the derivation of the later species from *D. evelynae*.

Although Green referred this genus to the Soricidae, there seems to be little doubt that it is a talpid.

The situation concerning *Proscalops secundus* Matthew (1909b) should be reviewed here. The taxonomic position of *P. secundus* was succinctly stated by Galbreath (1953, p. 49): "*Proscalops secundus* has never been adequately described. So far as I can ascertain, the type designation and specific name must be cited as figures 3 and 4 of plate 51, and the accompanying legends on page 559 of 'The Carnivora and Insectivora of the Bridger Basin Middle Eocene' (Matthew, W.D., 1909[b], Am. Mus. Nat. Hist., Mem., vol. 9, pt. 6). Compared with *P. miocaenus* the major distinguishing features of the type specimen (A.M.N.H. No. 13768) are: Skull longer (28 mm.) and wider; M^3 relatively longer (anteroposterior length 1.8 mm., and transverse width 2.14 mm.), paracones, metacones, and protocones of P^4–M^3 broader and more shelf-like; and styles more elongate and sharper antero-posteriorly."

The locality given by Thomson for the type specimen is the same as that of the paratype (A.M.N.H. No. 13809) of *Miohippus gemmarosae* Osborn (1918). An investigation of this area (6 miles south of Eagle's Nest Butte, Bennett County or Washabaugh County, South Dakota) indicates that the specimen may have come from the upper portion of the Monroe Creek or the lower portion of the Harrison. We can be confident that the type did not come from the Pliocene deposits in this area, as they are strikingly different in character and would not be confused with the "Rosebud." We can assume that *P. secundus* is intermediate in age between the two species of *Domninoides*.

PROSCALOPS Matthew, 1901

Proscalops Matthew, 1901, p. 370.

Proscalops, species indeterminate

Referred Specimen: From the Wounded Knee-Monroe Creek fauna, S.D.S.M. No. 5899, isolated M^2, from S.D.S.M. V592.

TALPIDAE, genus indeterminate

Referred Specimen: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 5898, fragments of two upper molars, from S.D.S.M. V5413.

INSECTIVORA, genus incertae sedis

ARCTORYCTES Matthew, 1907

Arctoryctes Matthew, 1907, p. 172.

Arctoryctes terrenus Matthew, 1907

Arctoryctes terrenus Matthew, 1907, p. 172.

Type: A.M.N.H. No. 12864, left humerus.

Type Locality: West of Porcupine Creek, South Dakota.

Horizon: Probably Rosebud formation, middle Miocene.

Reffered Specimens: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. Locality Numbers	S.D.S.M. Specimen Numbers
V5340	53435, fragment of left humerus
V5354	54342, fragment of left humerus
V5354	55112, fragment of right humerus
V5359	54250, left humerus
V5359	54274, fragment of right humerus
V5360	5693, fragment of right humerus
V5360	56104, fragment of right humerus
V5360	5970, right humerus
V5362	54311, right humerus
V5362	5579, fragment of right humerus
V5362	5659, fragment of left humerus
V5362	5697, fragment of left humerus
V5362	5962, right humerus

Discussion: In a recent series of excellent papers, Reed (1954, 1956) and Reed and Downs (1958) have described and discussed the known material referable to *Arctoryctes* and the more primitive genus *Cryptoryctes* from the Oligocene. The material at hand is all referable to *Arctoryctes* and, although the completeness of the specimens varies a great deal, the entire suite can be regarded as representing *A. terrenus* Matthew (1907). Unfortunately the exact locality and horizon of the type specimen were not recorded. A field number was not assigned to this specimen, and the locality data on the specimen file card leave a great deal to be desired. We can assume that the specimen was found anywhere between Porcupine Creek and the top of the divide east of Wounded Knee Creek. The reference to "Upper Rosebud" probably precludes the possibility that the type came from beds below the Harrison.

While the material at hand gives us no additional information about the origins or

affinities of this enigmatic mammal, it does greatly increase the known stratigraphic range of the species.

As we all realize, a solution of the *Arctoryctes* mystery awaits the discovery of associated skeletal material. It should be noted that the following genera of insectivores were found at the same localities as the humeri listed above: at S.D.S.M. V5360, *Ocajila*; and at S.D.S.M. V5354, *Domninoides*.

The hedgehogs do not seem to be likely candidates for association with *Arctoryctes*. *Domninoides* is known only from lower dentitions; consequently this talpid is a possible entry. *Proscalops* can still be considered as a possibility, although Galbreath (1953, p. 49) suggests that this possibility is weakened by the association of a typical talpid humerus with *Proscalops* in the Oligocene of northeastern Colorado.

Reed is currently studying the Wounded Knee-Sharps humeri, listed herein, for inclusion in a forthcoming paper.

PRIMATES Linnaeus, 1758

OMOMYIDAE Gazin, 1958

EKGMOWECHASHALA,[1] new genus

Genotypic Species: *Ekgmowechashala philotau*, new species.

Geologic Range: Early Miocene.

Diagnosis: P_4 semi-molariform. M_{1-2} with paraconid entirely missing, large metastylid, talonid widely basined, well-developed hypoconid and entoconid, enamel on talonid basin very rugose.

Ekgmowechashala philotau,[2] new species

Figures 7, 8

Type: S.D.S.M. No. 5550, fragment of left mandible, with P_3–M_2 and partial alveoli for P_2 and M_3.

Paratype: S.D.S.M. No. 5551, fragment of right mandible, with heavily worn P_4–M_2.

Type Locality: S.D.S.M. V541.

[1] *Ekgmo*, cat, and *wechasha*, man, and *-la*, diminutive suffix, in Sioux: meaning, literally, "little cat man." "Cat man" is a Sioux convention for monkey. As the monkey was unknown to the Sioux until recent years, the name was coined as a brief description signifying "cat-like animal that walks like a man." Pronounced Iǵg-uh-moo Wee-cháh-shah-lah.

[2] For Mr. Philo G. Macdonald for his noteworthy assistance in the field; *-tau* is the Sioux possessive suffix.

Horizon: Sharps formation, early Miocene.

Referred Specimens: From the Wounded Knee-Sharps fauna: S.D.S.M. No. 53413, fragment of right ramus, with worn P_4–M_2 and roots of P_3, from S.D.S.M. V5358; S.D.S.M. No. 55111, fragment of right ramus, with unworn M_{1-2}, from S.D.S.M. V5361.

Diagnosis: As for the genus.

Description: P_3 double-rooted, with larger posterior root; apex of large principal cusp above anterior root; small, medial, posterior, accessory cusp; cingulum extending from below apex of cusp on labial side around posterior end of tooth and forward to a point just labial to midline of anterior face of principal cusp, at this point rising into crest that extends to apex of principal cusp; accessory cusp apparently not developed from cingulum. P_4 semi-molariform; cingulum running from midline of anterior end around labial side to posterolabial corner; major cusp is anterolabial cusp, with its apex on midline, separated from anterolingual cusp by deep sulcus that curves downward and lingually to form isolated section of cingulum on anterolingual corner; anterolingual cusp oriented diagonally, anterolingual side bulbous, posterolabial side sloping downward on a plane surface into sulcus that separates anterior cusps from posterior cusp; short segment of cingulum. opposite posterolingual corner of this cusp; labial medial cusp smaller, conical, and arising from posterolabial corner of principal cusp; posterior cusp or talonid cusp situated with its apex nearly at posterior edge of tooth and slightly labial to midline, labially separated from anterior cusps by shallow, V-shaped valley and lingually by widened basin, enamel of anterior face of this cusp crenulated, as is floor of adjacent valley; lingual side of talonid walled by extension of anterolingual cusp, this wall having three incipient cusps that step down posteriorly, last of these in posterolingual corner of tooth and separated from center one by faintly defined, narrow valley. M_1 without paraconid; protoconid large, with small anterior spur that may represent paralophid, and well-developed spur with two incipient cusps directed posterolingually from posterolabial corner; metaconid opposite protoconid, separated from protoconid by deep, V-shaped valley, com-

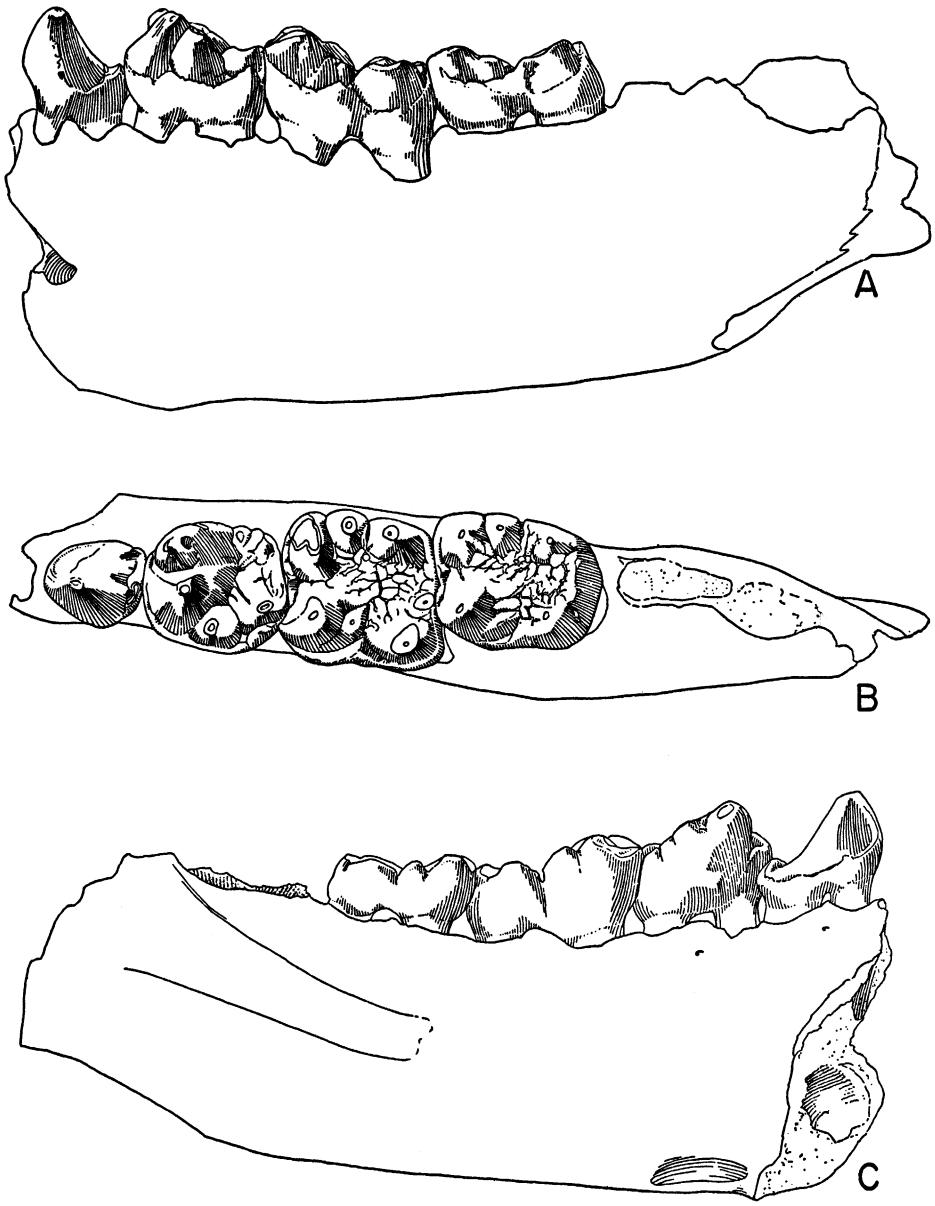


FIG. 7. *Ekgmowechashala philotau*, new species. Type, S.D.S.M. No. 5550, right ramus, with P_3–M_2. A. Lingual view. B. Crown view. C. Labial view. All approximately ×6.

pressed anteroposteriorly; small metastylid posterior to metaconid; basin posterior to protoconid and metaconid invaded by prominent "alluvial fan" extending posterolingually from protoconid; hypoconid large, with small attached hypoconulid; entoconid smaller than hypoconulid; cingulum interrupted, extending across anterior face from lingual side of metaconid to spur on protoconid, from anterolabial corner of protoconid along labial side and across posterior end of posterolingual corner of entoconid; enamel heavily crenulated in talonid basin and on anterolabial side of entoconid. M_2 similar to M_1; protoconal spur reduced; and cingulum reduced. M_3 with single elongated alveolus only, probably reduced.

DISCUSSION: The presence of a primate in

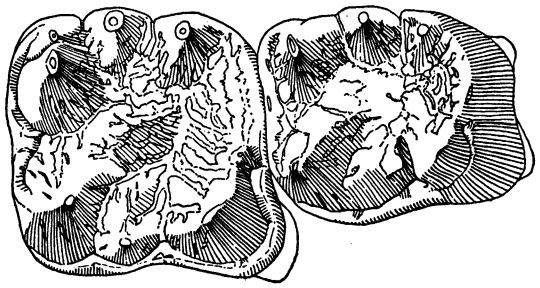


FIG. 8. *Ekgmowechashala philotau*, new species. Referred specimen, S.D.S.M. No. 55111, right M_{1-2}, crown view. ×10.

the early Miocene of North America is unexpected but not impossible. Small mammals with restricted populations are easily missed in fossil collecting, particularly in an area that has had relatively little exploration and even less emphasis on the collecting of mamalian microfauna.

Although *Ekgmowechashala* shares certain characteristics with the Necrolemuridae of the Old World, more likely it belongs to the Omomyidae and may well be a descendant of any of several late Eocene genera. This genus shares certain characteristics with *Washakius* Leidy (1873), *Dyseolemur* Stock (1934), *Stockia* Gazin (1958), and *Ourayia* Gazin (1958) from the Uintan, and *Chumashius* Stock (1938) from the Duchesnean. In each of these, the molars are somewhat similar, and they all share a tendency toward the molarization of P_4.

In *Washakius* we find the beginning of the development of a metastylid, the shifting of the paraconid to a median position, and a rugose development of the enamel on the floor of the talonid basin. *Dyseolemur* has the paraconid displaced to a position close to the protoconid and a well-developed metastylid. *Stockia* has almost completely lost the paraconid on M_2 and has developed a very large hypoconid. *Ourayia* has completely lost the paraconid on M_2, although it is still strongly developed on M_1. There are no metastylids on these molars, but the hypoconid is strongly developed, and the talonid basins show the beginnings of rugose and crenulated enamel floors. *Chumashius* resembles *Ekgmowechashala* only in the loss of the paraconid.

While none of the above genera can be indicated as an ancestor to *Ekgmowechashala*, each illustrates trends in the development of the Omomyidae that may have culminated in *Ekgmowechashala*. The lack of known Oligocene intermediaries does not preclude the possibility that this Miocene form developed from one of these Eocene genera or from a still unknown Eocene progenitor. We must also consider the possibility of a late Oligocene or early Miocene immigrant from Eurasia or South America.

TABLE 4

MEASUREMENTS (IN MILLIMETERS) OF THE LOWER TEETH OF *Ekgmowechashala philotau*, NEW SPECIES

	S.D.S.M. No. 5550, Type	S.D.S.M. No. 5551, Paratype	S.D.S.M. No. 55111
P_3			
Length	2.4	—	—
Width	1.8	—	—
P_4			
Length	3.3	3.0	—
Width	2.8	2.7	—
M_1			
Length	3.6	3.5	4.2
Width	3.3	3.3	3.5
M_2			
Length	3.4	3.3	3.9
Width	2.8	2.8	2.8

LAGOMORPHA BRANT, 1855

LEPORIDAE GRAY, 1821

PALAEOLAGUS LEIDY, 1856

Palaeolagus LEIDY, 1856a, p. 89.

Palaeolagus hypsodus Schlaikjer, 1935

Palaeolagus hypsodus SCHLAIKJER, 1935, p. 126. DAWSON, 1958, pp. 23–28.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5350	5545, mandible
V5354	54244, 5530, 5539, mandibles
V5354	53386, 5531, maxilla
V5358	53424, maxillary
V5360	5543, 56102, mandibles
V5360	5540, maxillary
V542	54321, maxillary
V544	54265, partial skull
V549	54314, 54315, mandibles

DISCUSSION: Dawson (1958, pp. 23–28) has discussed the morphology and the relationships of this species. As the material listed above was included in her study of this form, it is not necessary to add anything further here.

Like *Megalagus primitivus*, this species is found in beds of equivalent age in both Wyoming and Nebraska.

Palaeolagus philoi Dawson, 1958

Palaeolagus philoi DAWSON, 1958, pp. 29–32, figs. 11–14.

TYPE: S.D.S.M. No. 53389, partial right maxillary, with P^3–M^2, broken P^2, and alveolus for M^3.

TYPE LOCALITY: S.D.S.M. V5358.

HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: "Size near that in *Palaeolagus intermedius*. Differs from *P. intermedius* in having more hyposodont upper cheek-teeth and a proportionately shorter palatine component on the palate" (Dawson, 1958, p. 29).

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. Locality Numbers	S.D.S.M. Specimen Numbers
V5341	5535, mandible
V5353	53383, mandible
V5354	53388, 54123, 5529, mandibles
V5357	53384, mandible
V5358	54283, 54284, mandibles
V5359	54276, 54277, mandibles
V5360	53428, 5541, 5544, mandibles
V5361	5537, mandible
V5362	54313, mandible
V541	54325, maxillary; 5526, 5527, 5528, 5538, mandibles
V542	54259, mandible

DISCUSSION: This species is the common leporid of the Sharps formation in the Wounded Knee area. Specimens have been collected from 12 of the 31 localities in the Sharps formation. Dawson (1958, pp. 29–32) has discussed the morphology and affinities of this species. The specimen that Schlaikjer (1935, p. 129) referred to *Archaeolagus ennisianus* (Cope) from the Goshen Hole area of Wyoming is conspecific with *P. philoi*.

MEGALAGUS WALKER, 1931

Megalagus WALKER, 1931, p. 234.

Megalagus primitivus (Schlaikjer), 1935

Hypolagus primitivus SCHLAIKJER, 1935, p.127.
Megalagus cf. *primitivus* DAWSON, 1948, pp. 17–18, fig. 7.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. Locality Numbers	S.D.S.M. Specimen Numbers
V5347	5536, mandible
V5354	53387, 56114, mandibles
V5358	54282, mandible
V5361	54264, mandible

DISCUSSION: Dawson (1958, pp. 17–18) has referred the above specimens to *M.* cf. *primitivus*. As lower dentitions are unknown from the type locality, Dawson hesitated to make a positive statement as to the identity of the Sharps material. However, in the light of her excellent summation of the matter, there seems to be little reason for not assuming that the material is conspecific with the Goshen Hole species.

Megalagus primitivus can be considered a horizon marker for the very early Miocene in the Great Plains, as it is now known from the "lower Harrison" of eastern Wyoming, the Gering of western Nebraska, and the Sharps of southwestern South Dakota.

?PALAEOLAGINAE DICE, 1929

Palaeolaginae? DAWSON, 1958, pp. 37–38, fig. 18.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 5542, fragment of left mandible, with P_{3-4}; from S.D.S.M. V5360.

DISCUSSION: Dawson (1958, pp. 37–38) described this fragment and referred it to the Palaeolaginae with a question mark. As she pointed out in her discussion, this specimen may be an aberrant specimen of *Palaeolagus philoi*, or it may represent a form that is convergent with, although not ancestral to, the later Leporinae. I agree with Dawson that, until additional material is available, this specimen should remain in this category without a generic or specific assignment.

ARCHAEOLAGUS Dice, 1917

Archaeolagus Dice, 1917, p. 180.

Archaeolagus primigenius (Matthew), 1907

Lepus primigenius Matthew, 1907, p. 216.
Archaeolagus primigenius (Matthew) Matthew, 1924, p. 87. Dawson, 1958, p. 42.

Type: A.M.N.H. No. 12911, partial right ramus, with P_3–M_1.
Type Locality: A.M.N.H. "Rosebud" 27.
Horizon: Rosebud formation, middle Miocene.

Archaeolagus macrocephalus (Matthew), 1907

Lepus macrocephalus Matthew, 1907, p. 214.
Archaeolagus macrocephalus (Matthew) Matthew, 1924, p. 87. Dawson, 1958, p. 44.

Type: A.M.N.H. No. 12910, partial left ramus, with P_3–M_3 and parts of two hind feet.
Type Locality: A.M.N.H. "Rosebud" 17.
Horizon: Rosebud formation, middle Miocene.

RODENTIA Bowdich, 1821

ISCHYROMYIDAE Alston, 1876

PROSCIURUS Matthew, 1903

Prosciurus Matthew, 1903, p. 213.

Prosciurus dawsonae,[1] new species

Figure 9

Type: S.D.S.M. No. 56112, left ramus, with unworn P_4–M_3.
Type Locality: S.D.S.M. V541.
Horizon: Sharps formation, early Miocene.

Referred Specimens: From the Wounded Knee-Sharps fauna: S.D.S.M. No. 53382, right ramus, with unworn M_{1-3}, from S.D.S.M. V5354; S.D.S.M. No. 56103, fragment of right ramus, with worn P_4, from S.D.S.M. V5360.

Diagnosis: Hypolophid greatly reduced on all cheek teeth, connected to hypoconulid; posterior arm of protoconid (metalophid II) greatly reduced.

Description: P_4 having protoconid and metaconid widely separated, connecting metalophulids deeply notched; mesoconid connected to protoconid by ectolophid, ectolophid pinched between mesoconid and hypoconid; hypoconid connected to hypoconulid by low posterolophid; entoconid isolated; metastylid appressed to metaconid; hypolophid missing. M_1 similar to P_4; plan somewhat more rhomboidal than that of P_4. M_3 plan nearly triangular, with metaconid, proconid, and hypoconid forming apexes; metaconid and protoconid widely separated, connected by high metalophulid I, metalophulid II greatly reduced; posterolophid expanding anterolingually from hypoconid; entoconid and hypoconulid forming posterior moiety of lingual border; three metastylids.

TABLE 5

Measurements (in Millimeters) of the Lower Teeth of *Prosciurus dawsonae*, New Species

	S.D.S.M. No. 56112, Type	S.D.S.M. No. 53382	S.D.S.M. No. 56103
P_4			
Length	2.7	—	2.4
Width	2.3	—	2.1
M_1			
Length	2.3	2.4	—
Width	2.1	1.9	—
M_2			
Length	2.5	2.5	—
Width	2.3	2.3	—
M_3			
Length	3.5	3.3	—
Width	2.4	2.2	—

Discussion: This survivor from the Oligocene is yet another indication of the continuity of deposition that spans the late Oligocene-early Miocene boundary in this region of the Great Plains. Wood (1937, p. 169) reports a maxillary from the upper portion of the Brule formation that is tentatively referred to *P.* cf. *relictus*. Although the material described above has become differentiated from the typical *P. relictus* of the middle Oligocene, there is no valid reason for not assigning this species to *Prosciurus*. Additional material from the Upper Brule formation may indicate a trend toward the tooth pattern shown in the Wounded Knee material.

The possibility that this species is an immigrant from the Old World must not be completely overlooked. Possibly this species is a derivative of *Plesiospermophilus* Filhol (1883)

[1] For Dr. Mary R. Dawson for her assistance during two field seasons.

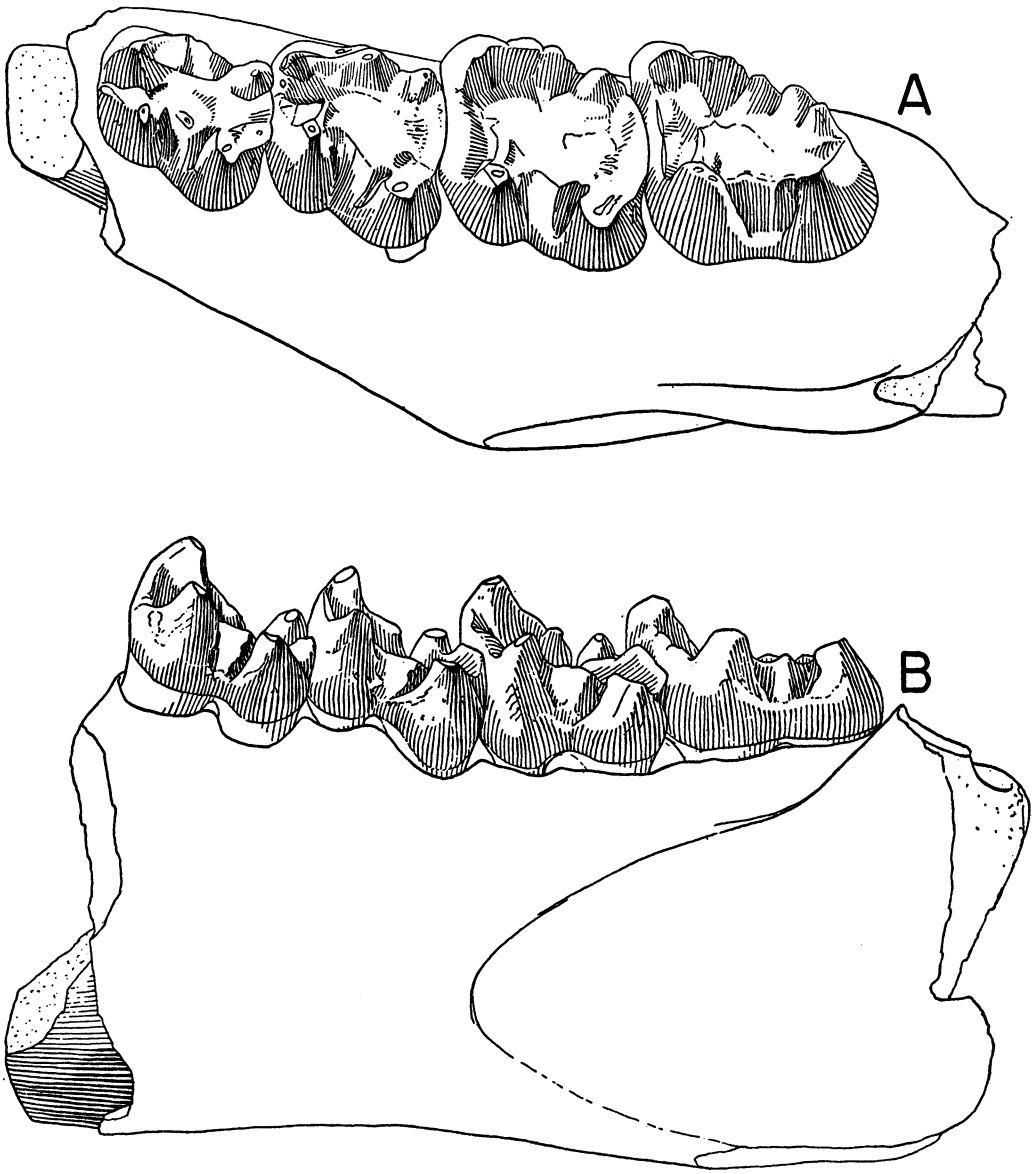


FIG. 9. *Prosciurus dawsonae*, new species. Type, S.D.S.M. No. 56112, left ramus, with P_4–M_3. A. Crown view. B. Labial view. Both approximately ×10.

from the Stampian of Europe, rather than being an advanced *Prosciurus*. Actually, the major resemblance between *Prosciurus dawsonae* and *Plesiospermophilus* is the loss of hypolophulid I which is greatly reduced in the European form. In contrast, P_4 in the present form is shorter, the anteroconid is notched as in *Prosciurus*, and the protoconid and metaconid are subequal; M_1 has a subequal protoconid and metaconid which are conical. It seems far more reasonable to assign this form to a minor modification of the more typical *Prosciurus* than to consider it an import from the Old World.

?Prosciurus dawsonae

Figure 10

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 5598, max-

illary fragment, with M^{1-3} and the alveoli for P^{3-4}, from S.D.S.M. V5351.

DESCRIPTION: M^1 having a broad anterior cingulum; paracone connected to protocone by protoloph; protoloph with small protoconule; metacone connected to metaconule by metaloph; metaloph not connected to protocone; posterior cingulum extending from metacone to protocone, with faint suggestion of hypocone near protocone; parastyle well developed; mesostyle prominent, narrow anteroposteriorly, extending well beyond labial margin of paracone and metacone; very small metastyle. M^2 similar to M^1; no indication of metastyle. M^3 widely expanded in region of metacone; metacone, metaloph, and metaconule removed by wear, leaving a wide flat surface sloping toward base of mesostyle.

MEASUREMENTS OF S.D.S.M. No. 5598: Length of M^1, 2.2 mm.; width of M^1, 2.9 mm.; length of M^2, 2.3 mm.; width of M^2, 3.0 mm.; length of M^3, 2.5 mm.; width of M^3, 2.5 mm.

DISCUSSION: This specimen is referred to *P. dawsonae* more in a spirit of the conservation of names than in a full conviction that it belongs to a species that is now known only from lower dentitions. While the general pattern of the upper molars strongly resembles that of typical *Prosciurus*, the strong development of the mesostyles on the molars is reminiscent of the Aplodontoidea. This superficial resemblance is overshadowed by the simplicity of the crown pattern and the lack of crown height. This specimen is extremely provocative; without associated lower dentitions, it is impossible to make a definite determination of its specific affinities.

On the basis of the fact that *P. dawsonae* lower jaws are known from other localities a short distance away and from essentially the same stratigraphic level, this specimen must be at least congeneric, if not conspecific, with that form.

APLODONTIDAE TROUESSART, 1897

ALLOMYS MARSH, 1877

Allomys MARSH, 1877, p. 253.

Allomys harkseni,[1] new species

Figure 11

TYPE: S.D.S.M. No. 59155, isolated M^1 or M^2.

PARATYPE: S.D.S.M. No. 59156, partial M^1 or M^2.

TYPE LOCALITY: S.D.S.M. V592.

HORIZON: Monroe Creek formation, early Miocene.

DIAGNOSIS: Larger than *Allomys cavatus* (Cope, 1881b), crown more rectangular in outline, stylar cusps more prominent, and anteroloph with anterolingual cusp well developed.

DESCRIPTION: Ectoloph strongly developed, with prominent parastyle, elongated narrow mesostyle, and small metastyle. Paracone and metacone subequal in size, separated from stylar cusps by broad and deep concave

[1] For Mr. J. C. Harksen, formerly of the South Dakota Geological Survey, in appreciation of his work on the stratigraphy of the Wounded Knee area.

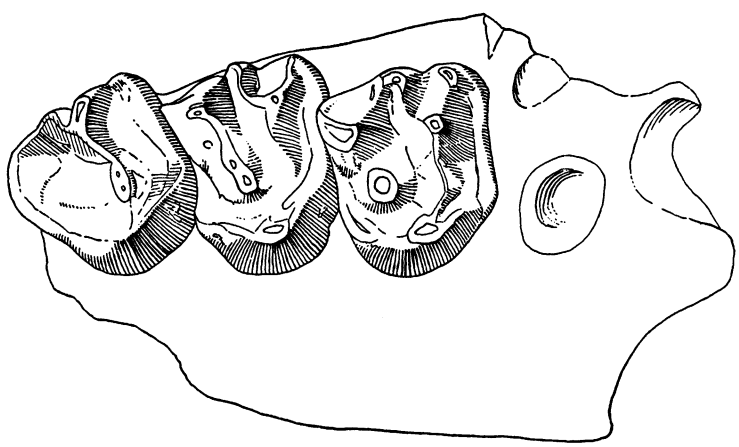


FIG. 10. *?Prosciurus dawsonae*, S.D.S.M. No. 5598, fragment of right maxillary, with M^{1-3}, crown view. Approximately ×10.

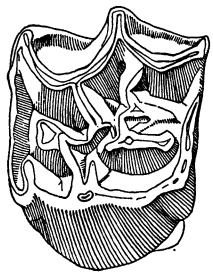


FIG. 11. *Allomys harkseni*, new species. Type, S.D.S.M. No. 59155, isolated M^1 or M^2, crown view. ×10.

valleys; concave face of metacone having suggestion of a flattened rib. Anteroloph thin and high, separated from protoconule by deep valley, at anterolingual corner of tooth expanding lingually into small cusp that resembles hypocone; between this cusp and connection with protocone a small spur extending anterolabially into "antero-internal basin" (McGrew, 1941b, p. 13); beyond this spur cingulum connected to anterior edge of protocone. Posteroloph parallel to anteroloph, at posterolingual corner expanding into small but prominent hypocone, then continuing, to connect with posterior edge of protocone. Protocone equal in height to paracone and metacone; small labial spur extending into median valley. Protoloph connected to protocone just anterior to spur; joining small protoconule at its posterolingual corner where it forms right angle and extends posterolabially for short distance where it again forms a right angle and connects to posterolingual corner of paracone. Protoconule an elongated cusp that extends anterolabially from junction with protoloph into "antero-external basin"; not joining anteroloph to separate two anterior basins. Metaconule a large elongated cusp that extends from base of posteroloph anterior to center of transverse valley; at anterior end separated from labial spur of protocone; this anterior extension and protoconal spur probably representing incipient connection between these cusps which, if developed, would form complete metaloph. Metaloph extending labially from anterolabial corner of metaconule and expanding posteriad into narrow, anteroposterior cusp that is about half of size of metaconule; continuing labially, joining anterolingual corner of metacone. Anteroposterior diameter, 2.7 mm.; transverse diameter, 3.5 mm.

DISCUSSION: The occurrence of *Allomys* in the Great Plains area presents an interesting addition to our knowledge of this aplodontid. Previously, the reported distribution, as summarized by Shotwell (1958), had been confined to the Pacific border states, with occasional strays into western Montana. The presence of a distinct species in the early Miocene of western South Dakota indicates an unsuspected distribution into the Great Plains area.

MENISCOMYS COPE, 1879

Meniscomys COPE, 1879b, p. 67.

Meniscomys hippodus Cope, 1879

Meniscomys hippodus COPE, 1879b, p. 67.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 56113, left ramus, with well-worn P_4–M_3, from S.D.S.M. V5354.

DESCRIPTION AND DISCUSSION: This specimen suggests moderate hypsodonty, as P_4 still shows evidences of the fossettes and reëntrants in spite of the advanced stage of wear. The teeth are strongly rooted. P_4 has an anterior reëntrant open to within 0.3 mm. of the base of the enamel; the single lingual reëntrant is slightly posterior to the labial reëntrant; the single remaining fossette on the labial side of the posterior moiety probably opened into the labial reëntrant at an earlier stage of wear. M_1 is worn to a featureless plane, although the mesostylid is still strongly developed. M_2 is heavily worn; the reëntrant posterior to the mesostylid still contains a shallow lake; the base of this oval lake is in line with the reëntrant near the midline; there is an indication of another fossette lingual to the midline near the anterior margin. M_3 has a reduced mesostyle; the anterior and posterior oval fossettes are diagonally oriented, and the medial oval fossette is transversely oriented and slightly anterior to the labial and lingual reëntrants. The ramus has a single mental foramen located anterior to P_4; the ascending ramus arises opposite the posterior root of M_2.

MEASUREMENTS OF S.D.S.M. NO. 56113: Length of P_4, 2.6 mm.; width of P_4, 1.7 mm.; length of M_1, 1.4 mm.; width of M_1, 1.6 mm.;

length of M_2, 1.8 mm.; width of M_2, 1.7 mm.; length of M_3, 1.9 mm.; width of M_3, 1.4 mm.

A comparison of this specimen with the type indicates that P_4 is somewhat shorter anteroposteriorly. P_4 and M_{2-3} have single reëntrants on the lingual wall, which are probably the result of the current stage of wear and not a condition found in younger dentitions. The lower cheek-tooth row is shorter than that of the type. The posterior edge of the mesostylids on P_4–M_2 is at right angles to the lingual wall.

It could be argued that these differences between the Wounded Knee specimen and the material from the John Day should be accorded specific distinction. Such differences as do exist may be wholly the result of the stage of wear found in the Wounded Knee jaw, or they may fall within the normal variation between populations of the same species.

Meniscomys, species indeterminate

REFERRED SPECIMEN: From the Wounded Knee-Monroe Creek fauna, S.D.S.M. No. 59157, isolated partial P_4, from S.D.S.M. V592.

DISCUSSION: This isolated tooth is essentially unworn, but it is badly broken so that it is specifically indeterminate. It is mentioned here simply to record the presence of this genus in the Monroe Creek formation of this area.

MYLAGAULIDAE COPE, 1881

PROMYLAGAULUS MCGREW, 1941

Promylagaulus MCGREW, 1941, p. 5.

Promylagaulus riggsi McGrew, 1941

Promylagaulus riggsi MCGREW, 1941b, pp. 5–9, figs. 1–2.

TYPE: F.M.N.H. No. P26256, facial region of cranium.

TYPE LOCALITY: F.M.N.H. "Rosebud" 2.

HORIZON: Probably Rosebud formation, middle Miocene.

Promylagaulus cf. riggsi

REFERRED SPECIMENS: From the Wounded Knee-Monroe Creek fauna, S.D.S.M. No. 59158, isolated M_1, from S.D.S.M. V592.

DESCRIPTION AND DISCUSSION: This isolated left M_1 is slightly smaller than the M_1 of a jaw in the collections of the American Museum of Natural History (A.M.N.H. No. 10824) from the Rosebud formation near the Little White River below Lake Creek. Matthew (*in* Gidley, 1904, p. 263) referred that specimen to *Meniscomys*, species indeterminate, and McGrew (1941b, p. 9, fig. 3) re-referred it to *Promylagaulus* cf. *riggsi*.

The Wounded Knee specimen is not so worn as that from the White River area and shows three additional lakes that have probably been obliterated by wear on the American Museum specimen. These lakes are in the anterolabial corner, the posterolabial corner, and the posterolingual corner. This tooth is 2.0 mm. in length and 1.5 mm. in breadth.

MYLAGAULODON SINCLAIR, 1903

Mylagaulodon SINCLAIR, 1903, p. 143.

Mylagaulodon cf. angulatus

Mylagaulodon angulatus SINCLAIR, 1903, pp. 143–144, fig. 1.

Mylagaulodon cf. *angulatus* Sinclair MCGREW, 1941b, pp. 9–10, fig. 4.

REFERRED SPECIMEN: From the Wounded Knee-Rosebud fauna, F.M.N.H. No. P26266, isolated P^4, from F.M.N.H. "Rosebud" 3.

GEOMYIDAE GILL, 1872

PLEUROLICUS COPE, 1879

Pleurolicus COPE, 1879b, p. 66.

Pleurolicus leptophrys Cope, 1881

Pleurolicus leptophrys COPE, 1881b, p. 381. WOOD, 1936a, pp. 7–8.

REFERRED SPECIMENS: From the Wounded Knee fauna: S.D.S.M. No. 53380, right ramus, with I–M_3, Sharps formation, from S.D.S.M. V5347; A.M.N.H. No. 12896, left ramus, with I–M_3, Rosebud formation, from A.M.N.H. "Rosebud" 18.

DISCUSSION: The specimen from the Sharps formation falls within the expected range of variation of this species. The dentition is slightly worn. The anterior loph of P_4 is two-cusped; as there is no suggestion of an anteroconid, the two cusps are distinctly separated. Both lophs of M_1 are strongly united by wear; the protostylid is strongly developed. M_2 is similar to M_1, with a slightly weaker protostylid. M_3 is less worn, so that the cusps are distinct. The protostylid has a small anterolingual spur that suggests the beginning of an anterior cingulum. The anterior end of the

TABLE 6

MEASUREMENTS (IN MILLIMETERS) OF THE LOWER TEETH OF *Pleurolicus leptophrys*

	S.D.S.M. No. 53380	A.M.N.H. No. 12896
P_4		
Length	1.52	1.52
Width	1.57	1.72
M_1		
Length	1.65	—
Width	2.11	—
M_2		
Length	1.52	1.50
Width	2.08	1.78
M_3		
Length	1.23	1.18
Width	1.68	1.52

masseteric crest is below the anterior root of the P_4.

Wood (1936a, pp. 7–8) referred two specimens from the American Museum of Natural History 1906 and 1907 Rosebud collections to this species. One of these, a left ramus (A.M.N.H. No. 12896), is from the Wounded Knee area.

Because these specimens appear to be conspecific with *P. leptophrys* from the John Day fauna, care must be taken in the use of this form for precise correlation. In the Wounded Knee area, we have a demonstrated geologic range from near the top of the Sharps formation (early Miocene) into an unknown level in the Rosebud formation (middle Miocene).

Pleurolicus dakotensis Wood, 1936

Pleurolicus dakotensis WOOD, 1936a, pp. 8–9, fig. 9.

TYPE: A.M.N.H. No. 12893, left ramus.

TYPE LOCALITY: A.M.N.H. "Rosebud" 31.

HORIZON: Monroe Creek formation or Harrison formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Monroe Creek fauna, S.D.S.M. No. 59159, 14 isolated cheek teeth, from S.D.S.M. V592.

DISCUSSION: These 14 isolated teeth, which were collected from an anthill by J. C. Harksen, include an unworn P_4 that closely matches the type specimen.

Pleurolicus clasoni,[1] new species

Figure 12

TYPE: S.D.S.M. No. 54388, fragment of right ramus, with incisor and lightly worn P_4–M_1.

TYPE LOCALITY: S.D.S.M. V5350.

HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: Anterior loph of P_4 three-cusped, with small anteroconid; posterior loph with very small hypostylid; masseteric crest terminating posterior to mental foramen.

DESCRIPTION: Incisor laterally compressed, enamel brown. P_4 roughly circular; anterior loph with large lingual cusp; small anteroconid at anterolabial corner, and protoconid posterolabial to anteroconid; anterior loph separated from posterior loph by transverse valley that widens and deepens lingually; metaconid and hypoconid subequal; hypostyle small, base connected to hypoconid. M_1 is nearly square; metaconid elongated transversely, connected to protoconid anteriorly at early stage of wear; protoconid circular; protostylid elongated anteroposteriorly, separated from protoconid by long, lateral valley; hypolophid separated from metalophid by wide, deep, transverse valley that is narrowed labially by protostylid; small hypostylid closely connected to hypoconid; at this wear stage, entoconid an extension of hypoconid; entoconid and hypoconid indicated by slight

TABLE 7

MEASUREMENTS (IN MILLIMETERS) OF THE LOWER TEETH OF *Pleurolicus clasoni*, NEW SPECIES, AND *Pleurolicus copei*

	P. clasoni, S.D.S.M. No. 54288, Type	*P. copei*, A.M.N.H. No. 7182, Paratype
P_4		
Length	2.00	—
Width	1.74	—
M_1		
Length	1.91	1.78
Width	2.03	2.31

[1] For Mr. Jack Clason of Hot Springs, South Dakota, who helped in the field whenever he was needed.

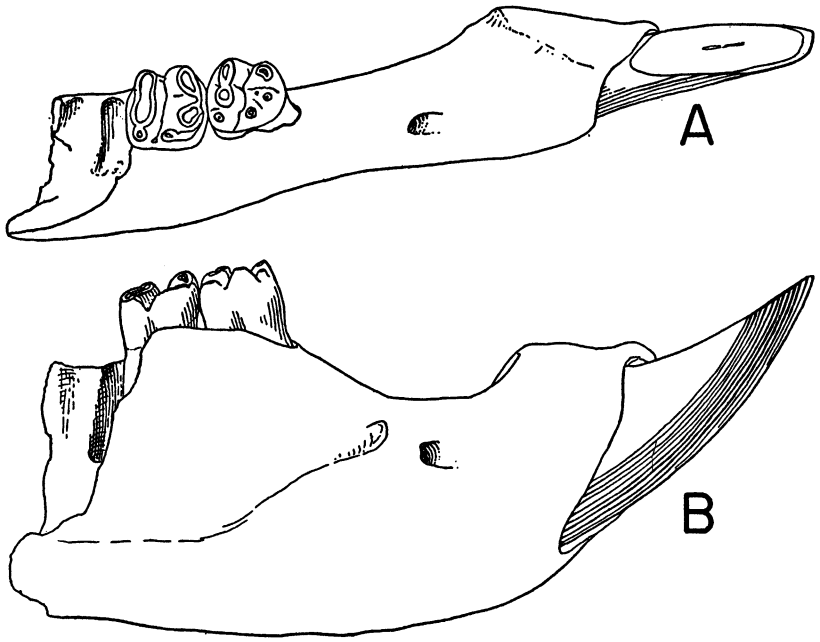


FIG. 12. *Pleurolicus clasoni*, new species. Type, S.D.S.M. No. 54388, right ramus, with C–M_1. A. Crown view. B. Labial view. Both approximately×5.

widening of hypolophid. Masseteric ridge extending nearly half of distance between P_4 and mental foramen. Mental foramen high on ramus and just anterior to masseteric ridge.

DISCUSSION: Although close to *Pleurolicus copei* Wood (1936a) from the John Day of Oregon, this species differs in several important details. A comparison with the type of *P. copei* cannot be made, as the latter is the anterior portion of a cranium (A.M.N.H. No. 7175); however, the paratypes (A.M.N.H. Nos. 7181 and 7182) are partial lower dentitions. P_4 of *P. clasoni* has a more widely opened transverse valley and a more restricted notch at the labial end of the transverse valley than that of the John Day species. The details of the cusps of P_4 cannot be compared, as P_4 of A.M.N.H. No. 7181 is heavily worn. *Pleurolicus clasoni* has a nearly square M_1, with an elongated protostylid, in contrast to the transversely elongated M_1 with a short, thick protostylid seen in the paratypes of *P. copei*.

GREGORYMUS WOOD, 1936

Gregorymus WOOD, 1936a, p. 9.

Gregorymus formosus (Matthew), 1907

Entoptychus formosus MATTHEW, 1907, pp. 212–213, figs. 24–26.

Gregorymus formosus (Matthew) WOOD, 1936a, p. 9, fig. 10.

TYPE: A.M.N.H. No. 12887, cranium, with dentition.

TYPE LOCALITY: A.M.N.H. "Rosebud" 20.

HORIZON: Harrison formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee faunas: A.M.N.H. No. 12888, skull, Harrison formation, from A.M.N.H. "Rosebud" 20; A.M.N.H. No. 12909, jaw fragment, Rosebud formation, from A.M.N.H. "Rosebud" 29.

Gregorymus curtus (Matthew), 1907

Entoptychus curtus MATTHEW, 1907, pp. 213–214.

Gregorymus curtus (Matthew) WOOD, 1936a, pp. 9–11, figs. 11–13.

TYPE: A.M.N.H. No. 12890, partial cranium.

TYPE LOCALITY: A.M.N.H. "Rosebud" 21.

HORIZON: Harrison formation or Rosebud formation, early or middle Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Harrison fauna: A.M.N.H. No. 12891, cranium with P^4–M^3, from A.M.N.H. "Rosebud" 7; A.M.N.H. Nos. 12895, jaw with P_4–M_3, and 12981, jaw fragment with dP_4–M_1, from A.M.N.H. "Rosebud" 16.

GRANGERIMUS Wood, 1936

Grangerimus WOOD, 1936a, p. 13.

Grangerimus oregonensis Wood, 1936

Grangerimus oregonensis WOOD, 1936a, p. 13.

REFERRED SPECIMEN: From the Wounded Knee-Rosebud fauna, A.M.N.H. No. 12982, partial cranium, from A.M.N.H. "Rosebud" 29.

DISCUSSION: The complete, slightly worn cheek-tooth series of this cranium closely matches the type from the John Day beds of Oregon. The endostyle of P^4 is closely appressed to the single anterior cusp, although they do not seem to fuse until a late stage of wear. This close association is also seen in the heavily worn P^4 of the type (A.M.N.H. No. 7044), although it is not apparent in Wood's figure (1936a, fig. 17).

Grangerimus dakotensis, new species

Figure 13

TYPE: S.D.S.M. No. 54248, partial cranium, with P^4–M^3.

TYPE LOCALITY: S.D.S.M. V541.

HORIZON: Sharps formation, early Miocene.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 54275, partial cranium, from S.D.S.M. V5357.

DIAGNOSIS: P^4 with "entostyle" oriented anteroposteriorly. Molars with anterior cingula.

DESCRIPTION: Palate with wide, flat valley posterior to palatine-maxillary suture, widening to broad, flat plain anterior to P^4; palatine foramen on palatine-maxillary suture opposite anterior end of M^2; small foramina on maxillary lingual to tooth row between M^{1-2} and M^{2-3}; large foramen from base of orbit opening into palate by way of long, wide

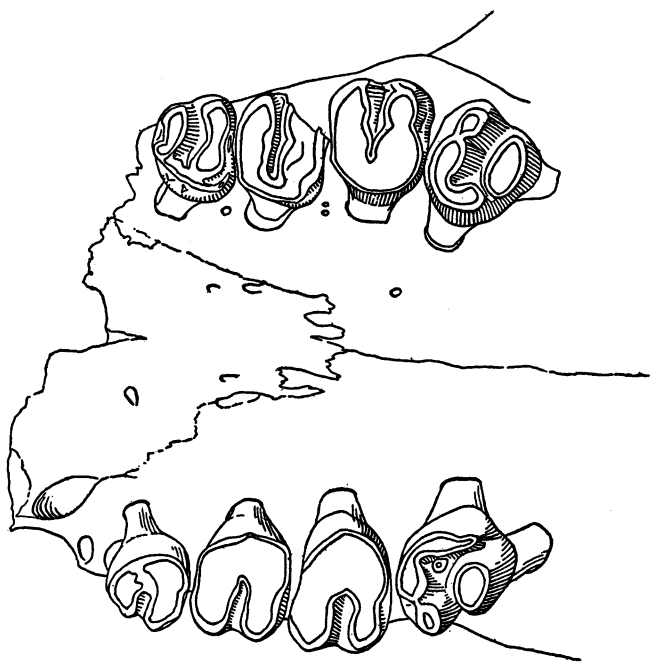


FIG. 13. *Grangerimus dakotensis*, new species. Type, S.D.S.M. No. 54248, partial cranium, with P^4–M^3, palatal view. ×10.

groove just posterior and lingual to M^3. P^4 having single, large, rounded cusp on protoloph; metaloph three-cusped; small "metacone," slightly larger "hypocone," and an anteroposteriorly elongated "entostyle" extending anteriorly along lingual margin to join base of anterior cusp; anterior face of anterior root entering maxillary nearly one tooth diameter anterior to crown. Left P^4 having small additional cusp in angle between "endostyle" and "metacone." M^1 having a small, anterior cingulum between paracone and protocone; lingual portion of protocone and other cusps obliterated by wear; lophs broadly joined by wear. M^2 heavily worn; slight remnant of anterior cingulum visible anterior to protostyle. M^3 heavily worn; suggestion of lingual cingulum lingual to protostyle.

DISCUSSION: This species can be distinguished from *G. oregonensis* Wood (1936a) by the greater rounding of the anterior cusp of P^4, the anteroposterior orientation and elongation of the "endostyle," and the presence of a small, anterior cingulum on the molars. The presence of the small, anterior cingula on the upper molars suggests that this species is slightly advanced over the genotypic species from the John Day beds of Oregon.

HETEROMYIDAE ALLEN AND CHAPMAN, 1893

HELISCOMYS COPE, 1873

Heliscomys COPE, 1873b, p. 3.

Heliscomys, species indeterminate

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 54365, four isolated molars, from S.D.S.M. V5413.

DISCUSSION: These four isolated molars resemble those of *Heliscomys senex* Wood (1935b) from Slim Buttes, South Dakota. Wood (1935b, p. 86) gives a middle Oligocene age to this species. As there is still some confusion about the age of the various strata exposed in the Slim Buttes area, it is possible that *H. senex* may be younger than middle Oligocene.

PROHETEROMYS WOOD, 1932

Proheteromys WOOD, 1932, p. 45.

Four species of *Proheteromys* are known from the Wounded Knee faunas. Wood (1935b) described *P. matthewi* from the middle Miocene Rosebud formation based on a jaw (A.M.N.H. No. 12896a) that was collected by the 1906 expedition. Three additional species from the Sharps formation are described below.

TABLE 8

MEASUREMENTS (IN MILLIMETERS) OF THE UPPER TEETH OF *Grangerimus dakotensis*, NEW SPECIES

	S.D.S.M. No. 54248, Type Right	Left	S.D.S.M. No. 54275
P^4			
Length	1.62	1.60	—
Width	1.65	1.65	—
M^1			
Length	1.55	1.52	1.70
Width	1.80	1.92	1.65
M^2			
Length	—	1.50	1.60
Width	—	1.78	1.91
M^3			
Length	1.27	1.30	1.40
Width	1.52	1.37	1.52

The three early Miocene species from the Sharps formation show a structural diversification that may represent a phylogenetic sequence. The most primitive of these is *Proheteromys fedti;* it has a small P_4, with an incipient anteroconid. *Proheteromys fedti* was found near the middle of the Sharps formation. *Proheteromys gremmelsi* came from near the top of the Sharps formation and has a large P_4 and a somewhat less conspicuous anteroconid. *Proheteromys bumpi* is the most advanced species; it has three well-developed cusps on the anterior loph of P_4. *Proheteromys bumpi* was found near the middle of the Sharps formation and also in the Godsell Ranch Channel faunule which is stratigraphically indeterminate within the Sharps formation.

Proheteromys fedti may well be the direct ancestor of *P. gremmelsi. Proheteromys bumpi* may also have been derived from *P. fedti*, or it may represent another branch from the same stem.

Proheteromys bumpi is an ideal ancestor for *Hitonkala andersontau*, which in turn may be in the line leading to *Peridiomys* Matthew.

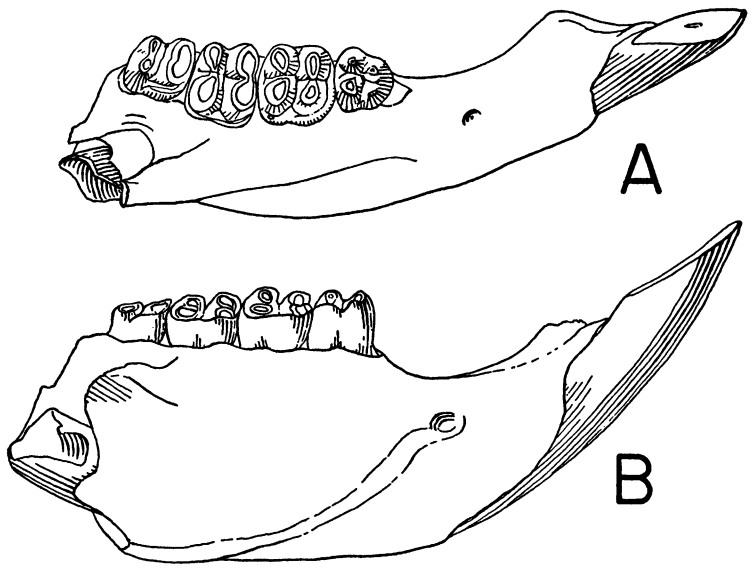


FIG. 14. *Proheteromys fedti*, new species. Type, S.D.S.M. No. 56121, right ramus, with C–M_3. A. Crown view. B. Labial view. Both approximately ×10.

Proheteromys fedti,[1] new species

Figure 14

TYPE: S.D.S.M. No. 56121, right ramus, with incisor and P_4–M_3.

TYPE LOCALITY: S.D.S.M. V5354.

HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: Relatively small P_4, with incipient anteroconid; triangular hypoconulid; incipient labial cuspule in base of transverse valley; M_1 with continuous anterior cingulum; and M_{1-2} with reduced hypostylid.

DESCRIPTION: Anterior loph of P_4 with two major cusps, small triangular hypoconulid on cingulum between posterior major cusps; major cusps joined in center of tooth by low connection; small labial cuspule at base of transverse valley; anteriad taper of crown more pronounced than in more advanced species. M_1 having continuous anterior cingulum; metaconid compressed anteroposteriorly; protoconid circular; both cusps joined anterocentrally by spurs to cingulum; curved, anterior, cingular cusps forming anterolabial corner of tooth, connected to protostylid by posterolabial spur; protostylid triangular in plan, joining base of protoconid, separated from hypolophid by deep, narrow valley except for thin labial spur connected to hypostylid; hypolophid with very small, laterally compressed hypostylid; large hypoconid; small hypoconulid; large entoconid; small, continuous, posterior cingulum. M_2 similar to M_1 except for smaller, anterolabial, cingular cusp. M_3 having hypostylid reduced to small cuspule; lophs separated equally lingually and labially. Masseteric crest terminating above mental foramen between incisor and P_4.

MEASUREMENTS OF TYPE: Length of P_4, 0.91 mm.; width of P_4, 0.96 mm.; length of M_1, 1.19 mm.; width of M_1, 1.19 mm.; length of M_2, 1.14 mm.; width of M_2, 1.23 mm.; length of M_3, 1.14 mm.; width of M_3, 0.96 mm.

DISCUSSION: This species is slightly advanced structurally over the primitive condition seen in *P. matthewi*. It is the structural beginning of the series of species that seems to lead to *Hitonkala* and possibly on to *Peridiomys*.

Proheteromys gremmelsi,[2] new species

Figure 15

TYPE: S.D.S.M. No. 5574, left ramus, with I–M_3.

[1] For Mr. Burton Fedt, with thanks for his assistance in the field in 1953.

[2] For Mr. Charles Gremmels, who was always willing to lend a hand when there was field work to be done.

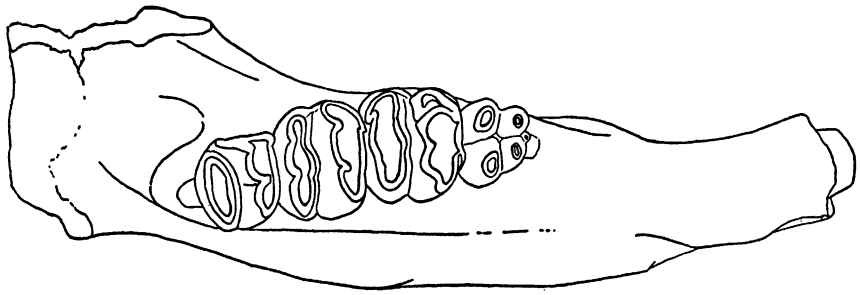


FIG. 15. *Proheteromys gremmelsi*, new species. Type, S.D.S.M. No. 5574, left ramus, with C–M_3, crown view. Approximately×10.

TYPE LOCALITY: S.D.S.M. V5362.

HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: Large P_4, with small, isolated, anterior, central, cingular cuspule.

DESCRIPTION: P_4 large; anterior loph with two large, conical cusps widely separated by central valley; small, central, anterior, cingular cuspule at base of cusps; deep, transverse valley separating anterior and posterior lophs; posterior loph with two larger conical cusps joined by posterior cingulum; posterior cingulum represented only by connection between posterior cusps. M_1 heavily worn; anterior loph with two cusps, anterolabial cingular cusp, and large triangular protostylid; posterior loph with three cusps; lophs slightly connected on midline and at labial edge. M_2 heavily worn, similar to M_1, with less prominent protostylid. M_3 similar to M_2; protostylid present but worn and broken away; posterior loph worn, cusps obscured by wear. Masseteric crest terminating between incisor and P_4 above mental foramen.

MEASUREMENTS OF TYPE: Length of P_4, 1.02 mm.; width of P_4, 1.12 mm.; length of M_1, 1.29 mm.; width of M_1, 1.45 mm.; length of M_2, 1.14 mm.; width of M_2, 1.52 mm.; length of M_3, 0.99 mm.; width of M_3, 1.19 mm.

DISCUSSION: Possibly this form should not be separated from *P. fedti*. The anteroconid of P_4 has not developed beyond that found in *P. fedti*, but P_4 is more massive and has become relatively larger, the definition of the lophs is stronger, and the posterior loph of M_3, although worn, is more strongly developed than that in the former species.

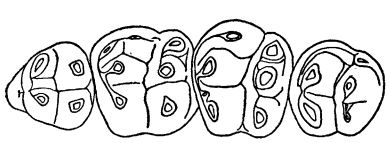


FIG. 16. *Proheteromys bumpi*, new species. Type, S.D.S.M. No. 54304, right P_4–M_3, crown view. Approximately×10.

Proheteromys bumpi,[1] new species

Figure 16

TYPE: S.D.S.M. No. 54304, right ramus, with incisor and P_4–M_3.

PARATYPE: S.D.S.M. No. 54306, fragment of right ramus, with incisor and P_4–M_1.

TYPE LOCALITY: S.D.S.M. V541.

HORIZON: Sharps formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna: S.D.S.M. No. 54257, left ramus, with incisor and P_4–M_3, from S.D.S.M. V5359; S.D.S.M. No. 5833, 39 isolated cheek teeth, from S.D.S.M. V5413.

DIAGNOSIS: Anterior loph of P_4 with three well-developed cusps.

DESCRIPTION: Incisor laterally compressed. P_4 having three well-developed cusps on anterior loph; central cusp smallest, laterally compressed; cusps united at early stage of wear; posterior loph having two cusps separated by deep groove (referred specimen with small, posterior, central, cingular cuspule); lophs united at late stage of wear. M_1 having short segment of anterior cingulum below metaconid; metaconid and protoconid connected anteriorly by cingulum; metaconid compressed anteroposteriorly; protoconid compressed laterally; curved, anterior, cingu-

[1] For the late Dr. James D. Bump, Director of the Museum of Geology, South Dakota School of Mines and Technology, Rapid City, South Dakota.

TABLE 9

MEASUREMENT (IN MILLIMETERS) OF THE LOWER TEETH OF *Proheteromys bumpi*, NEW SPECIES

	S.D.S.M. No. 54304, Type	S.D.S.M. No. 54306, Paratype	S.D.S.M. No. 54257
P_4			
Length	1.14	1.14	1.04
Width	1.02	1.02	1.02
M_1			
Length	1.32	1.27	1.27
Width	1.42	1.45	1.40
M_2			
Length	1.27	—	1.29
Width	1.57	—	1.57
M_3			
Length	1.14	—	1.29
Width	1.27	—	1.27

lar cusp forming anterolabial corner of tooth, connected to protoconid by anterolingual spur and to protostylid by posterolabial spur; protostylid triangular in plan, joining base of protoconid, separated from hypolophid by deep, narrow valley; hypolophid with small hypostylid; large, round hypoconid; anteroposteriorly compressed entoconid; small, posterior cingulum continuous except for slight break at base of hypoconid on type and paratype; posterior cingulum expanded into small, triangular cuspule at base of posterolingual corner of tooth on referred specimen. M_2 similar to M_1. M_3 having hypostylid reduced to small cuspule; lophs separated equally labially and lingually. Masseteric crest terminating above mental foramen between incisor and P_4.

DISCUSSION: This species is the most advanced of the Sharps forms herein described. The anterior loph of P_4 has three cusps of essentially the same size. Although greatly advanced over the condition found in *P. fedti*, this species has been retained in *Proheteromys*, as P_4 still has just two cusps on the posterior loph in contrast to the three cusps in *Hitonkala*.

Proheteromys matthewi Wood, 1935

Proheteromys matthewi WOOD, 1935b, p. 170, fig. 96a.

TYPE: A.M.N.H. No. 12896a, fragment of mandible, with P_4–M_1.

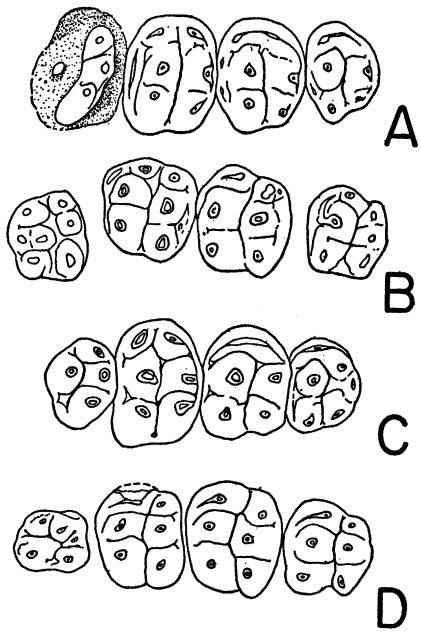


FIG. 17. *Hitonkala andersontau*, new species. A. Type, S.D.S.M. No. 56120, right P^4–M^3, crown view. B. Same specimen, right P_4–M_3, crown view. C. Paratype, S.D.S.M. No. 56141, right dP^4–M^3, crown view. D. Same specimen, right dP_4–M_3, crown view. All approximately ×10.

TYPE LOCALITY: A.M.N.H. "Rosebud" 18.

HORIZON: Rosebud formation, middle Miocene.

HITONKALA,[1] NEW GENUS

GENOTYPIC SPECIES: *Hitonkala andersontau*, new species.

GEOLOGIC RANGE: Early Miocene.

DIAGNOSIS: Deciduous fourth upper premolar and P^4 having single anterior cusp; upper molars having strong anterior cingula, complete lingual closure of transverse valleys; dP_4 having four principal cusps, two anterior cingular cusps, and one posterior cingular cusp; P_4 having six principal cusps; lower molars having anterior and posterior cingula; transverse valleys open both labially and lingually.

Hitonkala andersontau,[2] new species

Figure 17

TYPE: S.D.S.M. No. 56120, skull, with unworn dP^4_4, P^4_4–M^3_3. Upper and lower decidu-

[1] *Hitonkala*, mouse; in Sioux. Pronounced Hit-tóng-ahla.

[2] For Mr. and Mrs. R. N. Anderson, St. Paul, Minnesota; *-tau* is the Sioux possessive suffix.

TABLE 10

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Hitonkala andersontau*, NEW SPECIES

	S.D.S.M. No. 56120, Type Right	S.D.S.M. No. 56141, Paratype Right	Left
dP^4			
Length	1.02	1.02	—
Width	1.35	1.08	—
M^1			
Length	1.22	1.17	1.14
Width	1.40	1.57	1.57
M^2			
Length	1.14	1.07	1.07
Width	1.50	1.52	1.52
M^3			
Length	0.93	1.02	0.99
Width	1.30	1.32	1.32
P_4			
Length	1.02	—	—
Width	1.14	—	—
M_1			
Length	1.40	1.22	1.27
Width	1.40	1.27	1.40
M_2			
Length	1.27	1.27	1.40
Width	1.35	1.40	1.45
M_3			
Length	1.27	1.14	1.27
Width	1.14	1.08	1.14
dP_4			
Length	1.07	1.02	—
Width	0.81	0.86	—

ous fourth premolars removed (by writer) on right side to expose P_4^4.

PARATYPE: S.D.S.M. No. 56141, partial skull with unworn dP_4^4–M_3^3.

TYPE LOCALITY: S.D.S.M. V5354.

HORIZON: Sharps formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 5830, 36 isolated cheek teeth, from S.D.S.M. V5413.

DIAGNOSIS: As for the genus.

DESCRIPTION: Upper incisors laterally compressed, anterior face sharply rounded, without grooves. Deciduous fourth upper premolar having large, conical, anterior cusp; anterior cusp separated from posterior loph by deep, wide-arced valley; metaloph with large metacone, small hypocone, and low, laterally compressed entostyle; all cusps "swept-back"; metaloph extending anteriad of anterior cusp on labial side; single anterior root extending one tooth diameter anterior to crown. P^4 having single anterior cusp; metaloph arcuate, with large hypocone, smaller metacone, and endostyle. M^1 having large, conical paracone and protocone forming protoloph; protostyle diagonally elongated, more closely associated with anterior cingulum than with protoloph; anterior cingulum arising anterior to apex of paracone, extending labiad as shelf to anterolabial corner of protocone, turning diagonally across protocone and expanding into protostyle; deep notch partially separating protostyle from entostyle; entostyle joining hypocone with strong posterior connection, but not so closely associated as in *Proheteromys;* hypocone and metacone conical, connected posteriorly to form metaloph; transverse valley deeply open labially. M^2 similar to M^1; protostyle and entostyle not separated by notch, blended into arcuate ridge, with apex opposite lingual end of transverse valley. M^3 similar to M^2; anterior cingulum extended labially; hypocone somewhat flattened. Palate wide; cheek teeth mounted on raised and expanded base; palatines extending posteriorly to form tubular posterior choanae; bullae moderately large, not visible dorsally. Lower incisors laterally compressed, slightly rounded labially, without grooves. Deciduous fourth lower premolar having four major cusps, widely divided by anteroposterior and transverse valleys; anterior cingulum extending across anterior face of tooth (expanding posteriorly along labial side of anterolabial cusp on parastyle), with two small cuspules separated by median anteroposterior valley; posterior cingulum extending across posterior side of tooth, central, posterior, cingular cuspule partially blocking posterior end of anteroposterior median valley, cuspule attached to posterolabial cusp of type and to posterolingual cusp of paratype. P_4 having three anterior cusps, labial cusp deeply separated from median cusp; three posterior cusps, lingual cusp deeply separated from median cusp; transverse valley widely open labially. M_1 having two large cusps (metaconid and ?protoconid) forming metalophid, cusps widely separated for half of height of lophid; anterior cingulum swinging labially and posteriorly

from center of anterior face, rising rapidly to form curved "protostylid," posterior portion of "protostylid" expanding into ?protoconid; metalophid with three equal-sized, conical cusps; lophids separated by deep, transverse valley, valley opening widely labially; small posterior cingulum. M_2 similar to M_1; anterolabial curve of anterior cingulum not forming prominent "protostylid." M_3 having two major anterior cusps; anterior cingulum reduced, "protostylid" not developed, ?protoconid greatly reduced; transverse valley opening labially; metalophid with two major cusps tightly appressed, hypostylid greatly reduced. Ramus having large, mental foramen between P_4 and base of incisor; masseteric crest ending above posterodorsal corner of mental foramen; coronoid fossa long, extending dorsoventrally.

DISCUSSION: *Hitonkala* can be distinguished from *Proheteromys* Wood (1932) by the six-cusped P_4 and the posterior cingulum on the lower molars. It may well fill the phylogenetic gap between *Proheteromys* and *Peridiomys* Matthew. A comparison of the lower dentition with that of the type (A.M.N.H. No. 18894) of *Peridiomys rusticus* Matthew (1924) shows a striking similarity. The fourth lower premolars have a three-cusped anterior loph, with the labial cusp widely separated from the center cusp. The labial cusp of the posterior loph is greatly reduced in *P. rusticus*, but it is also smaller than the other cusps in *Hitonkala*. The molars of the type of *P. rusticus*, although well worn, have a nearly identical pattern, particularly in the development and position of the protoconid and protostylid. The upper molars are not so close, owing to the development of the anterior cingulum. The fourth upper premolars are similar, with a single anterior cusp and a tricusped posterior loph.

FLORENTIAMYS Wood, 1936

Florentiamys Wood, 1936b, p. 43.

Florentiamys agnewi,[1] new species

Figure 18

TYPE: S.D.S.M. No. 55120, fragment of left ramus, with broken incisor, slightly worn P_4–M_1, and the alveoli for M_2.

[1] For Dr. Allen F. Agnew, a state geologist who is interested in Tertiary stratigraphy.

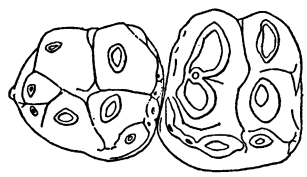


FIG. 18. *Florentiamys agnewi*, new species. Type, S.D.S.M. No. 55120, left P_4–M_1, crown view. ×10.

TYPE LOCALITY: S.D.S.M. V5360.

HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: P_4 having large metaconid and hypostylid. M_1 having large protostylid and hypostylid which join to block transverse valley; posterior cingulum very weak.

DESCRIPTION: Incisor asulcate; laterally compressed. P_4 having large, conical protoconid; anteroconid on midline, slightly anterior to protoconid, with spur extending posteriorly to base of loph between protoconid and metaconid; tiny anterior cuspule near anterior base of tooth below apex of anteroconid; small, cingular cusp labial to anteroconid and anterior to mesoconid; mesoconid smaller than protoconid; in later stage of wear protoconid, anteroconid, cingular cusp, and mesoconid forming long, curved lophid; hypoconid tightly appressed to mesoconid, blocking valley between metalophid and hypolophid on labial side; hypostylid at posterolabial corner of hypoconid, with cingular spur extending anteriorly to base of posterolabial corner of mesoconid; metaconid separated from hypoconid by deep, narrow valley; posterior cingulum extending from hypostylid across posterior face of tooth to posterolingual corner of metaconid. M_1 having small anterior and posterior cingula; metaconid largest cusp; protoconid tightly joined to metaconid; anterior cingulum expanding anteriorly to labial moiety of protoconid, forming cusp at anterolabial corner of tooth, continuing posteriorly, expanding into large protostylid which fills labial end of transverse valley, then expanding into well-developed, somewhat elongated hypostylid; hypoconid nearly conical, slightly separated from hypostylid; metaconid slightly elongated laterally, closely associated with hypoconid; transverse valley deep and developing into a small, labial lake at later stage of wear, opening lingually, completely blocked labially by

TABLE 11

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Tamias*, SPECIES INDETERMINATE, S.D.S.M. No. 58100 (DEEP-WELL SLIDE)

	Tooth Number							
	1	2	3	4	5	6	7	8
P_4								
Length	1.52	—	—	—	—	—	—	—
Width	1.22	—	—	—	—	—	—	—
M_3								
Length	—	1.74	—	—	—	—	—	—
Width	—	1.32	—	—	—	—	—	—
$M^{1 \text{ or } 2}$								
Length	—	—	1.27	1.19	1.32	1.14	—	—
Width	—	—	1.42	1.52	1.79	1.52	—	—
M^3								
Length	—	—	—	—	—	—	1.78	1.42
Width	—	—	—	—	—	—	1.92	1.52

protostylid and hypostylid. Ramus moderately deep; masseteric ridge terminating just above posterior border of mental foramen, about midway between P_4 and alveolus for incisor.

MEASUREMENTS OF TYPE: Length of P_4, 1.85 mm.; width of P_4, 1.68 mm.; length of M_1, 1.78 mm.; width of M_1, 1.95 mm.

DISCUSSION: This species is smaller than the genotypic species, *F. loomisi* Wood (1936b). P_4 differs from that of *P. loomisi* as follows: the anterior cingulum is represented by a small cuspule, the metaconid, hypostylid, and protoconid are larger, and the posterior cingulum is more strongly developed. M_1 is much the same in the two species except for a weakening of the posterior cingulum in that of *F. agnewi*.

Wood (1936b, pp. 45–46) indicated that the cusp identification on P_4 of the genotypic species is extremely difficult, as the cusp origins are unknown. Possibly *F. loomisi* was derived from *F. agnewi* and P_4 of *F. loomisi* resulted from the reduction of the anterior labial cusps and the splitting of the anterolingual cusp into a closely twinned cusp.

SCIURIDAE GRAY, 1821

TAMIAS ILLIGER, 1811

Tamias ILLIGER, 1811, p. 83.

Tamias, species indeterminate

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 58100, nine isolated cheek teeth, from S.D.S.M. V5413.

DESCRIPTION AND DISCUSSION: A small collection of isolated cheek teeth, which includes a fourth lower premolar, a third lower molar, a fourth upper premolar, four first or second upper molars, and two third upper molars, was collected from the Godsell Ranch Channel locality.

Although these teeth should not form the basis of a formal description, it is important that they should be included in the record. They appear to represent a primitive chipmunk. P_4 has a moderately expanded posterior moiety smaller than that seen in most of the Recent squirrels and chipmunks. M_3 is diamond-shaped and very symmetrical in plan view. The cusps are low and not so strongly developed as are those in the Recent species. P^4 has a moderately expanded anterolabial corner which is suggestive of P^4 in *Eutamias* Trouessart (1880). The upper molars taper lingually and are not so wide at the protocone as are those in the squirrels, the metaloph has a slight suggestion of a metaconule, and the mesostyle is close to the paracone in three of the molars and midway between the paracone and metacone in one of the molars. The anterior cingulum of M^3 is not so well developed as is that of M^3 of the modern forms, and the metaloph is missing, as it is in *Tamias* and *Tamiasciurus* Trouessart (1880).

These teeth represent a sciurid that shares characters with *Tamiasciurus*, *Tamias*, and *Eutamias*, a condition that should be expected in the early Miocene. Although I refer this material to *Tamias*, as it seems to share more characteristics with that genus, it may well represent a form that is near the ancestry of both *Tamias* and *Eutamias*. It may also be related to *Tamiasciurus*.

CASTORIDAE GRAY, 1825

The published studies of the early North American beavers have been primarily concerned with the description of new forms, many of which were based on inadequate materials. The only published comprehensive review of this group is that of Stirton (1935), in which an excellent summary of the material then available is given.

The oldest recorded North American beavers are the two described species of the Oligocene genus *Agnotocastor* Stirton (1935). *Agnotocastor coloradensis* Wilson (1949) is found in the Cedar Creek member of the White River formation of northeastern Colorado and is therefore the oldest known species. So far as I know, there have been no discoveries of this form in the middle Oligocene beds of Nebraska, South Dakota, or Wyoming, where extensive exposures of the White River group are found. The genotypic species, *A. praetereadens* Stirton (1935), is from the late Oligocene Protoceras channels of South Dakota. *Agnotocastor* can be distinguished from the later beavers by its retention of a small, peglike, upper third premolar. In addition, it has a long rostrum and a narrow, elongated, and low-vaulted cranium. *Agnotocastor* is not considered a possible ancestor to the early Miocene North American beavers because of the rounded anterior faces of the incisors and the pattern of the cheek teeth. Stirton (1935, p. 396) mentioned a skull (U.C.M.P. No. 30570) from the "Oreodon beds of the White River formation in South Dakota" that had a shorter rostrum than that of *Agnotocastor* and incisors with flat anterior faces. This unnamed form may represent the ancestor of the early Miocene beavers found in the same area.

A comparison of the type of *Agnotocastor praetereadens* and *Capatanka gradatus* (Cope, 1879b) shows a general similarity in the pattern of the sagittal crest, the development of the palate, and the ventral surface of the rostrum. It may well be that the ancestor of the beavers described below will be found in a form like Stirton's undescribed specimen. Such a possibility again points to the important fact that, in spite of the extensive collecting that has been done during the past 110 years in the Oligocene deposits of the Great Plains, we still know relatively little of the mammalian microfauna. While beavers are extremely abundant in the early Miocene Sharps formation, it should not be assumed that they went through a period of explosive evolution in a very short geologic time. In order to find the answer to this diversification, efforts to find more material from the late Oligocene beds of the Brule formation should be encouraged.

PALAEOCASTOR LEIDY, 1869

Palaeocastor LEIDY, 1869, p. 306.

GENOTYPIC SPECIES: *Steneofiber nebrascensis* Leidy, 1856.

EMENDED DIAGNOSIS: Palatal notch terminating opposite anterior edge of M^3. Bullae high and rounded. Superorbital ridges converging to form sagittal crest at point of greatest interorbital constriction or just posterior to interorbital constriction. Lambdoidal crest moderately developed. M^{1-2}_{1-2} nearly same diameter as P^4_4. Anterior enamel faces of incisors flat. P_4 having very short mesostriid and longer hypostriid; P^4 having short mesostria and long hypostria; hypostriid and hypostria not extending to base of teeth. Cheek teeth subhypsodont. M^3_3 tending to be reduced.

DISCUSSION: *Palaeocastor nebrascensis* (Leidy) was first described in 1856 as *Steneofiber nebrascensis*. Leidy, in his report on the extinct mammalian fauna of Dakota and Nebaska in 1869, further described and figured the type specimen, and at that time established the genus *Palaeocastor* with *P. nebrascensis* as the genotypic species.

Matthew (1907, p. 206), in describing *Steneofiber simplicidens* from the Wounded Knee area, briefly referred to *P. nebrascensis* when he stated, "Brain case and occiput not so wide as in the other species, except *S. nebrascensis;* bullae rather small, intermediate between *nebrascensis* and the later forms." The posterior portion of the brain

case in Leidy's type has been eroded away and the bullae are not exposed; so it is probable that in this instance Matthew was referring to the cranium (A.M.N.H. No. 1428) which he referred to *S. nebrascensis* in his review of the beavers (1902, p. 301). This specimen is the type of *Agnotocastor praetereadens* Stirton (1935, p. 396, fig. 13).

Stirton (1935, p. 401), when reviewing *Palaeocastor*, suggested that the genotype was actually from the early Miocene rather than from the Oligocene as had been generally supposed. He states, "Exact locality not known; either the Leptauchenia beds of the White River or the Rosebud of the Arickaree formation; probably the latter."

A comparison of the type of *Palaeocastor nebrascensis* with a series of skulls and crania from the Sharps formation just beyond the borders of the White River Badlands on the south side of the White River suggests that the type did indeed come from the early Miocene beds. The preservation of the type is quite similar to the nodular preservation that is common in the Sharps formation.

The map of Nebraska and Dakota compiled by Gouverneur K. Warren (United States Army, Department of Engineers, 1867) shows that, in October of 1857, Warren's party, which included F. V. Hayden, crossed the White River near the mouth of Wounded Knee Creek, proceeded south along the creek for a distance of about 3 miles (thus arriving near the base of the Sharps formation), and then turned west to the mouth of White Earth Creek (now called White Clay Creek) where they headed generally south and east until they again crossed Wounded Knee Creek near its headwaters on the South Dakota-Nebraska border. The trace of Wounded Knee Creek between these two crossings is shown with considerable accuracy; therefore, it is very probable that side trips were made to prominent lookouts beyond the route of the main party. Such evidence is admittedly flimsy, but it strengthens the possibility that the type of *Palaeocastor nebrascensis* did indeed come from the Sharps formation.

As a matter of interest, it should be noted that Warren's map shows a high point, "Porcupine Tail," just east of Wounded Knee Creek at a point 17 miles north of the forty-third parallel. At approximately that point there is a lone erosional spire composed of the Sharps and Monroe Creek formations that is locally known as "The Needle." When viewed from the southeast, it resembles a mitten with an isolated thumb. Two South Dakota School of Mines localities, V5362 and V5365, are within a few hundred yards of this prominent landmark. It may be that this mapped point is supposed to be Porcupine Butte, just west of Porcupine Creek. If so, it is misplaced about 8 miles on the 1867 map. At any rate, if "The Needle" and "Porcupine Tail" are the same promontory, some members of the 1857 party must have traveled south on Wounded Knee Creek to a point near the present location of the town of Manderson.

Two species from the Wounded Knee faunas can be referred to *Palaeocastor*: *P. nebrascensis* from the Sharps formation and *P. simplicidens* from the Monroe Creek formation and possibly from the lowest part of the Harrison formation. *Palaeocastor peninsulatus* (Cope, 1881b) from the John Day formation of Oregon is specifically distinct but can also be referred to this genus.

Olson (1940, p. 501), in his description of *Palaeocastor milleri*, which may be referable to one of these species, stated that *Palaeocastor* did not have infrapremaxillary foramina. Such a statement is not borne out by the material at hand. The type of *P. simplicidens* and all the pertinent crania in the present assemblage, which have the anterior portion of the rostrum preserved, have these foramina.

Palaeocastor nebrascensis (Leidy), 1856

Steneofiber nebrascensis LEIDY, 1856a, p. 89.
Palaeocastor nebrascensis (Leidy) LEIDY, 1869, pp. 338–341, pl. 26, figs. 18–21. STIRTON, 1935, p. 401, figs. 19–20.

TYPE: Partial skull (no number), Academy of Natural Sciences of Philadelphia.

TYPE LOCALITY: "From the Mauvaises Terres of White River" (Leidy, 1869, p. 338).

HORIZON: Unknown; probably Sharps formation, early Miocene.

EMENDED DIAGNOSIS: Anterior ventral surface of rostrum broad and grooved. Last molar moderately reduced, transverse diameter of M^3 not less than 85 per cent of M^2; M_3 not less than 90 per cent of M_2. Bullae low and round, moderately expanded ventro-

medially, ventrolateral face concave at base of external auditory meatus.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. Locality Numbers	S.D.S.M. Specimen Numbers
V5339	53429, mandible
V5340	53368, mandible
V5341	53347, skull
V5345	53370, mandible
V5349	5474, 5475, mandibles
V5350	53362, 5498, 5499, 54100, mandibles
V5351	53346, cranium; 53514, partial skull; 53355, 53392, 5480, 5482, 5488, 5593, mandibles
V5352	53515, cranium
V5353	53344, cranium
V5354	53341, 53354, 53361, 53363, 53366, 53371, 53373, 5429, 54341, mandibles
V5357	53356, mandible; 5473, partial skull
V5358	53378, cranium; 53369, 5492, 5494, 5495, 54104, 54105, mandibles
V5359	5491, 54113, 54114, 54117, 54119, 5665, mandibles
V5360	55115, partial cranium; 53336, 53431, 5484, 5486, 5675, 5676, mandibles
V5361	55108, cranium; 5452, 55109, mandibles
V5362	53350, skull; 54209, cranium; 5427, partial cranium; 53376, 53377, 5447, 5448, 5449, 5458, 5471, 54209, 5698, 56100, mandibles
V5365	53365, mandible
V541	5432, partial skull; 5442, 5443, partial crania; 5433, 5434, 5435, 5437, 5438, 5439, 5459, 5461, 5470, 54166, 55122, 55143, mandibles
V542	5441, skull; 5465, 5466, 5467, 5468, 54195, 54196, 54197, mandibles
V543	5456, cranium; 5454, mandibles
V544	54106, mandibles
V5410	52146, skull; 55147, 55148, 55149, 55151, mandibles

DESCRIPTION: The available suite of specimens from the Sharps formation, although the specimens are generally fragmentary and badly cracked, presents a composite picture of the skull of this species. The nasals are rounded anteriorly and tapered posteriorly to their junction with the frontals just behind the anterior edge of the zygoma. The dorsal surfaces of the premaxillaries form a thin lateral border on the upper surface of the rostrum and terminate posteriorly on the same general line as the nasals. A very small part of the maxillary is exposed on the dorsal surface of the cranium at the anterior end of the zygoma. The frontals form a very small portion of the dorsal surface of the cranium, terminating posteriorly just behind the interorbital constriction. The parietals extend anterior to the frontals on the sides of the cranium, expanding posteriorly to form the major portion of the roof of the mastoidal breadth; posteriorly they terminate against the lambdoidal crest, except on the midline where they are separated by a large interparietal which is in the form of an equilateral triangle, a square, or a diamond with a flattened base. The supraorbital ridges coalesce either at, or slightly posterior to, the interorbital constriction to form a narrow sagittal crest, a wide sagittal ridge, or, in the case of an old individual (S.D.S.M. No. 53344), a very wide pseudo-lyrate ridge.

The side of the rostrum consists primarily of the premaxillaries which join the maxillaries just anterior to the infraorbital foramina. The maxillaries form the wide anterior plate of the zygoma and support the upper cheek teeth; unfortunately, all the available specimens are so badly cracked that the detail of the osteology of the orbital region cannot be determined. The jugal forming the central portion of the zygomatic arch expands vertically above the flattened maxillary portion of the zygoma to surround partially the orbit; posteriorly it becomes reduced and terminates below the squamosal at the posterior end of the zygoma. The squamosal rises out of the orbit to form the posterior dorsal surface of the zygoma and to form the lateral edges of the cranial roof; it terminates posteriorly against the lambdoidal crest and the mastoid. Just posterior to the zygoma the cranial roof is deeply notched to form the glenoid fossa and to receive the terminus of the external auditory meatus. The mastoid is very narrow, lying between the squamosal and the occipital to form the lateral posterior corner of the cranium.

Anteriorly the palate is formed by the premaxillaries; just posterior to the incisive alveoli are the very small interpremaxillary foramina; posteriorly the premaxillaries join the maxillaries at the posterior margins of the

anterior palatine foramina. The maxillaries form a fairly wide palate, with a median valley extending from the anterior edge of P^4 to the anterior palatine valleys. Along the midline of the palate from P^4 to the palatal notch, there is a median ridge with lateral foramina. The smooth curve from the palate to the anterior zygomatic plate is broken only by the expanded guard over the anterior opening of the infraorbital foramina; this flap primarily projects anteriorly, but in some individuals it may also cover the ventral edge of the foramina. The maxillaries are widely separated posteriorly on the palate by the palatines which extend anteriorly to a point opposite the anterior border of M^1. Posteriorly the palatines join the pterygoids just posterior to M^3. The palatal notch extends anteriorly to a point in the general area of the anterior edge of M^3. The pterygoids extend posteriorly until they nearly touch the bullae.

The bullae are broadly rounded, although not greatly expanded ventrally. The external auditory meatus rises at an angle of 45 degrees from its origin high on the side of the bulla and extends to a point opposite the top of the zygomatic arch. Most bullae have a round depression on the lateral surface at the base of the external auditory meatus. This may be a fairly constant condition in the species, or it may represent a zone of weakness where crushing without breaking often occurs in preservation. The basioccipital is exposed as a long triangle between the bullae; it is deeply furrowed on each side of the central ridge and rises to a high ridge on the inner border of the bullae, so that the posterior lacerate foramina are partially covered. These lateral ridges taper away, as does the central ridge, until the basisphenoid and the presphenoid become slightly concave on the ventral surface.

The lower jaw is not remarkable; it is little different, except in size, from jaws of its contemporaries.

The upper incisor has a flat anterior enamel face that is square on the inner corner and only slightly rounded on the outer corner. The enamel covers little of the sides of the tooth beyond the inner and outer curves. P^4 has a rounded anterolingual corner. The hypostria is longer than the mesostria but does not reach the base of the subhypsodont tooth. The crown pattern shows a basic hypoflexus and mesoflexus, with a large parafossette and a small round metafossette. There may be an additional small fossette between the parafossette and the mesoflexus, which in some teeth opens into the mesoflexus; in addition, a small secondary metafossette may be present. The upper molars have a hypoflexus, with the hypostria not extending to the base of the tooth; the mesoflexus is short term as the mesostria is very short; the number of fossettes is highly variable, with some teeth having as many as seven. M^{1-2} have essentially the same transverse diameter as P^4; M^3 is only slightly reduced in this species.

The lower incisor is similar to the upper, although there seems to be a little more curvature on the outer corner. The deciduous fourth lower premolar has a wide but short hypoflexid, with the hypostriid reaching almost to the base of the tooth; the mesoflexid is very narrow but long, and the mesostriid is not so long as the hypostriid, but it also extends nearly to the base of the tooth. There are two parafossettids and two metafossettids. P_4 has a long hypoflexid which in some cases breaks into the metafossettid; the hypostriid does not reach the base of the tooth; the mesoflexid slightly overlaps the hypoflexid; the mesostriid is rather short; the parafossettid and the metafossettid are generally the only lakes present, although in a few individuals there may be small, additional, shallow fossettids.

The lower molars have essentially the same pattern as that of P_4, except that they are not so expanded anteroposteriorly. An interesting minor variation in these teeth is the position of the lingual termination of the hypoflexid; in some individuals it terminates opposite the labial end of the metafossettid and in others between the metafossettid and the lingual end of the mesoflexid. As in the upper molars, M_{1-2} have nearly the same transverse diameter as P_4, and M_3 is only slightly reduced.

DISCUSSION: *Palaeocastor nebrascensis* is the most abundant species of beaver found in the Wounded Knee-Sharps fauna. The South Dakota School of Mines Museum of Geology collections contain the remains of slightly more than a hundred individuals. This material was collected throughout the entire vertical range of the Sharps formation, al-

TABLE 12

CRANIAL MEASUREMENTS (IN MILLIMETERS) OF *Palaeocastor nebrascensis* AND *Palaeocastor simplicidens*

	P. nebrascensis S.D.S.M. No. 52164	*P. simplicidens* A.M.N.H. No. 12900
Condylobasal length	64.2	*ca.* 60.3
Basal length	62.0	*ca.* 59.2
Basilar length	57.5	*ca.* 54.5
Palatal length	35.2	34.6
Palatilar length	31.2	30.9
Length, cheek teeth (occlusal surface)	12.8	12.4
Width of interorbital constriction	6.4	8.4
Mastoid breadth	29.6	—
Length, diastema, P^4 (exclusive) to incisors (exclusive)	20.6	21.2

though only one cranium has been found in the Rockyford member on Sheep Mountain Table. Most of the specimens are isolated lower jaws. There are about 20 partial skulls or crania.

This species is very close to the slightly younger *P. simplicidens* (Matthew) from the Monroe Creek formation and possibly the Harrison formation. The rostrum of *P. simplicidens* is slightly shorter and the palatal groove is more pronounced, as it extends to the posterior border of the anterior palatine foramen without the flattening that is found in *P. nebrascensis*. M^3 of the type of *P. simplicidens* is greatly reduced; it is less than 80 per cent of the diameter of M^2. The bullae are smaller, and, although expanded ventrally, are much smaller in diameter.

There seems to be little reason to doubt the temporal succession of these two species.

As a point of interest, I compared the cranial measurements of the best-preserved specimen of *P. nebrascensis* from the Wounded Knee fauna with those of the type specimen of *P. simplicidens* (see table 12). In addition, the best-preserved specimens of *P. nebrascensis* from the Wounded Knee fauna show the following range of measurements: length of upper cheek-tooth row in five moderately worn specimens, 12.8 to 12.9 mm.; length of lower cheek-tooth row in 10 moderately worn specimens, 12.0 to 14.4 mm.

Palaeocastor simplicidens (Matthew), 1907

Steneofiber simplicidens MATTHEW, 1907, pp. 205–207, figs. 19–20.

Palaeocastor simplicidens (Matthew) STIRTON, 1935, pp. 401–404, fig. 21.

TYPE: A.M.N.H. No. 12900, partial cranium.

TYPE LOCALITY: A.M.N.H. "Rosebud" 8.

HORIZON: Probably Monroe Creek formation, early Miocene.

EMENDED DIAGNOSIS: Contrasted with *P. nebrascensis*, rostrum slightly shorter, palatal groove more pronounced, and bullae smaller in diameter although much more expanded ventrally. M^3 less than 80 per cent of diameter of M^2.

DISCUSSION: Although Stirton (1935) referred all the beavers in the American Museum collections from the Wounded Knee area to this species, I have resegregated them on the basis of the large collection of older beavers from the same area that is now available. *Palaeocastor simplicidens* appears to be a direct descendant of *P. nebrascensis* from the Sharps formation and is, I believe, distinct from the other species that Matthew (1907) described in his review of the "Rosebud" faunas.

CAPATANKA,[1] NEW GENUS

GENOTYPIC SPECIES: *Capatanka cankpeopi*, new species.

GEOLOGIC RANGE: Early Miocene.

DIAGNOSIS: Massive skull, with supraorbital ridges that join to form sagittal crest at least midway between interorbital constriction and lambdoidal crest. Well-developed lambdoidal crest. Glenoid fossa well developed. Bullae large; expanded anteroposteriorly. Palatal notch opposite M^3. First and second molars with transverse diameters nearly as great as premolars; last molars slightly reduced.

Capatanka cankpeopi,[2] new species

Figures 19, 20

TYPE: S.D.S.M. No. 53421, skull.

[1] *Capa*, beaver, and *tanka*, large, in Sioux. Pronounced Cháh-pah Tahn-kah.

[2] *Cankpeopi*, Wounded Knee, in Sioux. Pronounced Chahnk-páy-oh-pee.

TYPE LOCALITY: S.D.S.M. V5354.

HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: Bullae expanded anteriorly and posteriorly; supraorbital ridges strongly developed; anterior face of incisors slightly curved laterally.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5354	53340, 53372, 56119, mandibles
V5355	53348, partial cranium
V5359	54226, 54228, skulls
V5360	5672, skull; 5953, partial skull; 53512, cranium; 5440, partial cranium; 54115, 55115, mandibles
V5362	54179, partial skull; 53374, mandible
V542	5469, mandible

DESCRIPTION AND DISCUSSION: The available crania are not suitable for a detailed description of the osteology. The skulls, particularly the type, are massive, with heavy pitting on the parietals and squamosals over the roof of the cranium. A unique feature of the cranial roof, which is also seen in *Capatanka gaulodon* (Matthew, 1907) from the Wounded Knee-Harrison fauna, is the outward development of a flange between the posterior base of the zygoma and the posterolateral arm of the squamosal, forming a strong glenoid fossa for the articulation of the mandible. This condition is not found in *Palaeocastor*, *Capacikala*, or *Castor*. It suggests a powerful jaw mechanism that was quite different from that of the modern beavers.

The supraorbital ridges are strongly developed and unite into a strong sagittal crest at a point about midway between the interorbital constriction and the junction of the sagittal crest with the lambdoidal crest. The process that protects the anterior opening of the infraorbital foramen from the masseter muscle is strongly developed and extends much farther ventrally than in the other beavers from this fauna. The bullae are not expanded ventrally, although they are large and are expanded anteroposteriorly, so that they are not so round as are those of *Palaeocastor* or *Capacikala*.

The incisors are massive, and the anterior enamel face is somewhat rounded laterally.

TABLE 13

CRANIAL MEASUREMENTS (IN MILLIMETERS) OF *Capatanka cankpeopi*, NEW SPECIES

	S.D.S.M. No. 53421, Type	S.D.S.M. No. 53512
Condylobasal length	*ca.* 76.0	63.4
Basal length	—	69.0
Basilar length	—	64.5
Palatilar length	—	36.4
Palatal length	—	41.0
Interorbital constriction	9.4	9.0
Mastoid breadth	35.3	—
Length, upper cheek-tooth row	13.4	13.5
Length, lower cheek-tooth row	15.4	—

The molars are nearly the size of the premolars, except for the last molar which is slightly reduced. The crown pattern, the length of striae, and the height of the crown are similar to these features in the two other contemporaneous genera.

Capatanka brachyceps (Matthew), 1907

Steneofiber brachyceps MATTHEW, 1907, p. 208.

Euhapsis gaulodon MATTHEW, 1907, pp. 208–210, figs. 21–23.

Palaeocastor simplicidens (Matthew) STIRTON, 1935, pp. 401–404, figs. 22–27.

TYPE: A.M.N.H. No. 12902, skull.

TYPE LOCALITY: A.M.N.H. "Rosebud" 12.

HORIZON: Probably Monroe Creek formation, possibly Harrison formation, early Miocene.

EMENDED DIAGNOSIS: Smaller than *C. cankpeopi*, with a great shortening of postorbital portion of cranium. Sagittal and lambdoidal crests much more prominent than those of *C. cankpeopi*.

REFERRED SPECIMENS: From the Wounded Knee-Harrison fauna: A.M.N.H. No. 12897, skull (type of *Euhapsis gaulodon* Matthew), from A.M.N.H. "Rosebud" 7; A.M.N.H. No. 12903, partial skull, from A.M.N.H. "Rosebud" 21.

DISCUSSION: This species is probably very close to *Euhapsis platyceps* Peterson (1905), although it does not have the broadening of the skull or the sloping posterior cranial wall that characterize that species.

Matthew described one of the specimens,

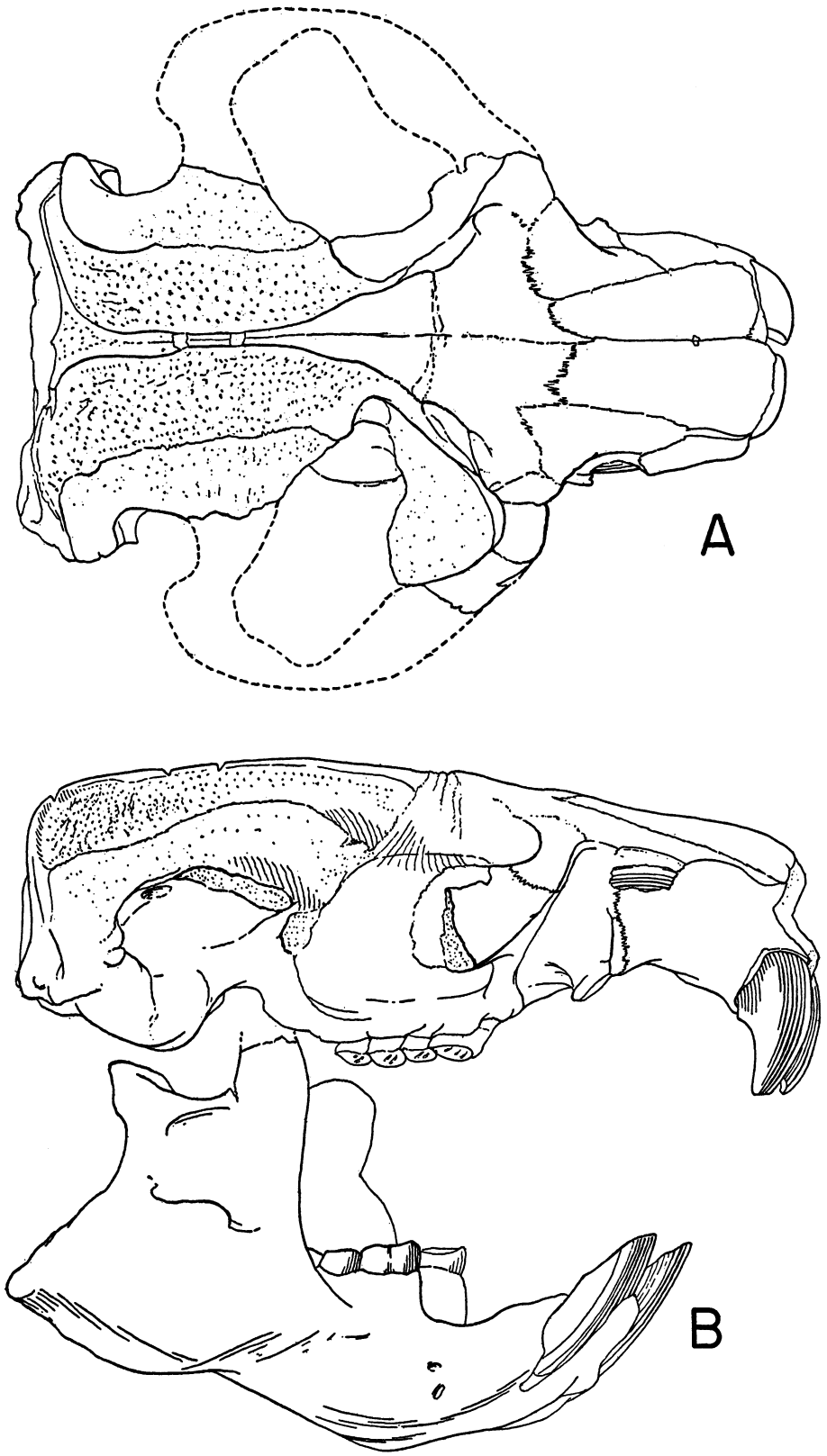


FIG. 19. *Capatanka cankpeopi*, new species. Type S.D.S.M. No. 53421, skull. A. Dorsal view. B. Lateral view. Both×1.5.

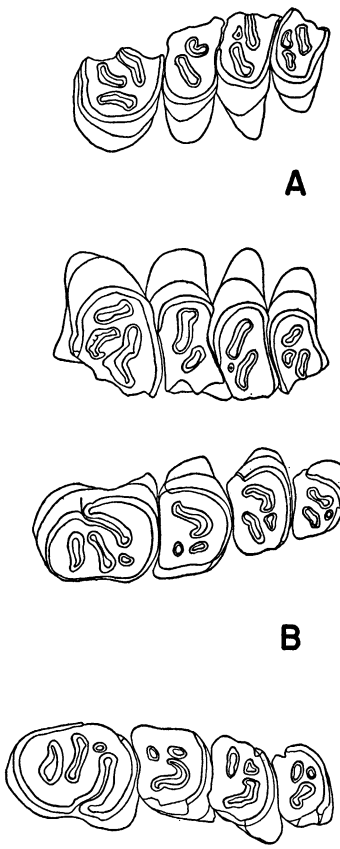


FIG. 20. *Capatanka cankpeopi*, new species. A. Type, S.D.S.M. No. 53421, P^4–M^3, crown view. B. P_4–M_3, crown view Both approximately×2.

A.M.N.H. No. 12897, as the type of *Euhapsis gaulodon*, based primarily on the general resemblance between it and Peterson's species, which was unfortunately emphasized by the crushing of the "Rosebud" specimen.

Capatanka brachyceps may prove to be referable to *Euhapsis*, if more material from the type locality of *E. platyceps* becomes available. Possibly *C. brachyceps* was ancestral to *Euhapsis* or closely related to that ancestral line.

Since it is not possible to determine, on the basis of the material available at present, whether *C. brachyceps* should be considered an advanced species of *Capatanka* or a primitive species of *Euhapsis*, I have used *Capatanka cankpeopi* as the genotypic species. The earlier described species is represented by three skulls. My disregard of that species is deliberate, and, I hope, excusable.

CAPACIKALA,[1] NEW GENUS

GENOTYPIC SPECIES: *Steneofiber gradatus* Cope, 1879.

GEOLOGIC RANGE: Early Miocene.

DIAGNOSIS: Very small beaver. Mastoid breadth equal to or slightly greater than distance from interorbital constriction to posterior edge of cranium at junction of sagittal crest and lambdoidal crest. Strongly developed, lyrate, sagittal crest. Cheek teeth gradually becoming reduced in transverse diameter from P^4 through M^3. Palatal notch terminating opposite M^2. Bullae large, rounded, and expanded ventrally.

Capacikala gradatus (Cope), 1879

Steneofiber gradatus COPE, 1879b, p. 1.

Castor gradatus (Cope) COPE, 1884a, pp. 839, 844, pl. 63, fig. 22.

Palaeocastor gradatus (Cope) STIRTON, 1935, p. 409.

TYPE: A.M.N.H. No. 7008, cranium.

TYPE LOCALITY: John Day region, Oregon.

HORIZON: John Day formation, early Miocene.

EMENDED DIAGNOSIS: As for the genus.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5350	54101, 5580, mandibles
V5351	53423, cranium; 53367, 5481, mandibles
V5354	54120, cranium; 53352, 53357, 5430, 5431, 54109, 54110, 54111, 5660, 56117, mandibles
V5355	53359, mandible
V5356	5472, mandible
V5358	53360, 5493, 54102, 54103, mandibles
V5359	5460, partial skull; 54118, mandible
V5360	5483, cranium; 53338, palate; 53339, maxillary; 53343, 53345, 53430, 5463, 5464, 55116, 55117, 5677, mandibles
V5361	5451, 5490, 55107, mandibles
V5362	5699, palate
V541	5426, cranium; 5436, 5455, mandibles
V543	5453, mandible
V5410	55146, partial skull

DESCRIPTION: Except for the shorter and

[1] *Capa*, beaver, and *cikala*, small, in Sioux. Pronounced Cháh-pah Chée-kah-lah.

broader cranium and the well-developed, lyrate, sagittal crest, the skull of *Capacikala* does not differ greatly from that of *Palaeocastor*. There is a relatively greater expanse of the premaxillary exposed on the posterior part of the dorsal surface of the rostrum, and there is relatively less of the maxillary exposed in the same area. The parietals are much broader, so that they cover most of the roof of the cranium, and the interparietal is short and broad. The supraorbital ridges are broadly separated across the interorbital constriction and join to complete a lyrate ridge between one-third and two-thirds of the distance between the interorbital constriction and the lambdoidal crest. The lyrate ridge is elevated throughout its length with a slightly higher outer border. The occipital condyles are broader than those of *Palaeocastor;* the bullae are relatively larger and somewhat higher, but the external auditory meatus is somewhat shorter.

The cheek teeth, both upper and lower, do not differ in pattern from those in *Palaeocastor*, except for the gradual reduction in size from the premolar through the third molar.

DISCUSSION: Although referred to *Palaeocastor* by Stirton (1935, p. 409), this little beaver is quite distinct. The seven referred skulls and crania from the Sharps formation, four of which have the top of the cranium preserved, indicate that the development of the lyrate sagittal crest is a consistent feature of this species.

Olson (1940) described *Palaeocastor milleri* from the "Lower Harrison, Miocene. Niobrara River, Wyoming," which was characterized by the presence of a lyrate sagittal crest. The measurements of this specimen, as given by Olson, slightly exceed those of the largest of the Wounded Knee series. *Palaeocastor milleri* is certainly referable to *Capacikala* and may be referable to *C. gradatus*.

?Capacikala sciuroides (Matthew), 1907

Steneofiber sciuroides MATTHEW, 1907, p. 207.
Palaeocastor simplicidens (Matthew) STIRTON, 1935, pp. 401–404, fig. 28.

TYPE: A.M.N.H. No. 12901, partial skull.
TYPE LOCALITY: A.M.N.H. "Rosebud" 15.
HORIZON: Harrison formation, early Miocene.

DISCUSSION: The type and only specimen referable to this species is the partial skull of a young individual. The entire basal cranial region is missing from the posterior end of the presphenoid to the posterior suture of the interparietal. The premolars are lightly worn, and the top of the cranium is unpitted and without any sign of crests or ridges.

On the basis of size, general conformation of the cranium, and the shape of the interparietal, I am questionably referring this species to *Capacikala*. As it most closely conforms to this genus, in spite of the lack of a lyrate ridge, I think that no other disposition is possible without additional material.

CRICETIDAE ROCHEBRUNE, 1883

EUMYS LEIDY, 1856

Eumys LEIDY, 1856a, p. 90.

The various species of *Eumys* are common members of the Oligocene fauna of the Great Plains. It is not surprising, therefore, to find two species of this genus continuing into the early Miocene in the Wounded Knee area. The two forms described below can be considered further variations on the basic *Eumys* theme, and, although they are sufficiently different to permit their being assigned to one new genus or even two new genera, I can see no practical advantage in splitting these forms away from the parent genus, particularly in view of the lack of known descendants from these forms. If these phyla are later found to continue into widely divergent groups, it would then be reasonable to make such a taxonomic break. However, in light of the presumed termination of these phyla, no advantage exists in separating these two species from the genus *Eumys*.

Eumys blacki,[1] new species

Figure 21

TYPE: S.D.S.M. No. 5574, right ramus, with M_{1-3}.
TYPE LOCALITY: S.D.S.M. V5410.
HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: Anterolophid extending full width of anterior end of all lower molars and connecting to metaconids, separated from protoconids by deep valleys; mesolophids

[1] For Dr. Craig Black, who contributed some valuable comments on rodents.

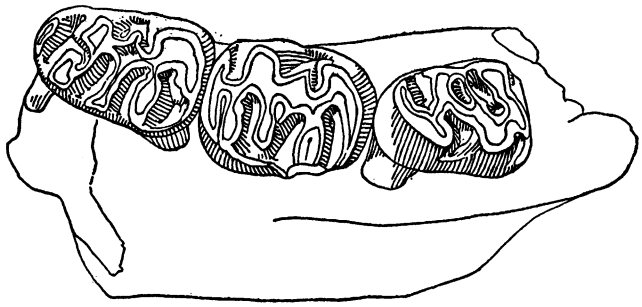


FIG. 21. *Eumys blacki*, new species. Type, S.D.S.M. No. 5574, right M_{1-3}, crown view Approximately ×10.

connecting to metaconids to form fossettids. Mesoconids on M_{1-2} well developed, extending as ridge into buccal reëntrant.

DESCRIPTION: M_1 having anterolophid extending across anterior end of tooth, connected to anterolingual corner of metaconid and to base of protoconid at anterolabial corner; metalophid extending from posterolingual corner of metaconid to posterolingual corner of protoconid, cut by deep valley extending in curve from center of lophid to posterior of central portion of metaconid; mesolophid expanding lingually and connected to base of metaconid, forming fossettid between metalophid and mesolophid; mesoconid well developed at junction of mesolophid and ectolophid, labial spur extending from mesoconid toward labial side of tooth; ectoconid and hypoconid connected by hypolophulid I; hypolophulid II connected broadly to hypoconid and faintly to entoconid; very small hypoconulid represented by posterolophid; buccal valley blocked by cingulum (?ectostylid). M_2 having strong anterolophid extending across entire anterior end of tooth, connected to center of metalophulid I and anterior border of metaconid, no connection to protoconid; metaconid slightly anterior to protoconid, connected to protoconid by metalophulid I and metalophulid II which joins metaconid at posterolingual half of cusp; ectolophid expanded to form mesoconid; mesolophid short, joining metalophulid II midway between metaconid and ectolophid; mesoconid with short labial spur; entoconid joined to hypoconid by hypolophulid I at termination of ectolophid and wide-swinging hypolophid II; no sign of hypoconulid at this stage of wear; buccal valley blocked by cingulum (?ectostylid). M_3 having anterolophid extending across entire anterior end of tooth; broadly connected to metalophulid I and to anterolingual corner of metaconid, not connected to protoconid; metalophulid II extending to lingual enamel border without being connected to metaconulid, small spur lingual to protoconid extending toward posterolabial corner of metaconid but not connected; ectolophid extending from posterolingual corner of protoconid to anterolingual corner of hypoconid; mesolophid connected to hypolophulid II at lingual end, enclosing large fossettid; hypolophid connected to hypoconid and entoconid, enamel wall enclosing deep fossettid between entoconid and mesolophid; buccal valley closed by cingulum (?mesostylid).

MEASUREMENTS OF TYPE: Length of M_1, 2.18 mm.; width of M_1, 1.52 mm.; length of M_2, 2.11 mm.; width of M_2, 1.65 mm.; length of M_3, 1.95 mm.; width of M_3, 1.52 mm.

DISCUSSION: The molars of the type suggest that there is a slight increase of crown height in this species. Whether or not such is actually the case cannot be determined until additional unworn material is found or until possible descendants in the overlying formations are discovered.

Eumys woodi,[1] new species

Figure 22

TYPE: S.D.S.M. No. 54330, fragment of left ramus, with M_{1-2}.

TYPE LOCALITY: S.D.S.M. V542.

HORIZON: Sharps formation, early Miocene.

[1] For Dr. Albert E. Wood, who gave me advice on rodents which I did not heed in every case.

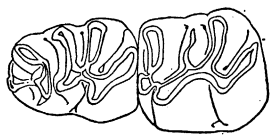


FIG. 22. *Eumys woodi*, new species. Type, S.D.S.M. No. 54330, left M_{1-2}, crown view. Approximately ×10.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 54305, left ramus with M_2 and roots of M_1 and M_3, from S.D.S.M. V541.

DIAGNOSIS: Anteroconid forming anterolabial corner of M_{1-2}; well-developed mesostylid at termination of mesolophids.

DESCRIPTION: M_1 having anteroconid at anterolabial corner of tooth, connected to metaconid by short anterolophid and to protoconid by short longitudinal spur; metaconid prominent and conical; apex of protoconid posterior to line opposite posterior edge of metaconid, lozenge-shaped, with lingual spur curving to connection with posterior midline of metaconid; short ectolophid, with small mesoconid; mesoconid with well-developed mesolophid terminating in mesostylid; large, elongated entoconid, connected to ectolophid by short hypolophid; small hypoconid; posterolophid extending from hypoconid to base of entoconid; small labial valley between anteroconid and protoconid open to base; lingual valleys open to base except for valley between posterolophid and entoconid. M_2 similar to M_1 except broader and anterior end flattened rather than rounded; mesostylid small, mesoconid not expanded.

DISCUSSION: *Eumys woodi* represents another variation on the *Eumys* theme. The development of the anteroconid into a prominent cornerstone at the anterolabial corner of the molars greatly changes the basic aspect of these teeth. This condition is not foreshadowed in any of the known species from the Oligocene. Wood (1937, p. 256) described a specimen from the Brule of Nebraska which he named *Cricetodon nebraskensis*. Reference to *Cricetodon* was based on the development of a long mesolophid in this form. It is possible that *E. woodi* was derived from such a species, or, more probably, *Eumys* gave rise to various forms converging toward the European *Cricetodon* in this particular character.

MEASUREMENTS OF TYPES: Length of M_1, 1.70 mm.; width of M_1, 1.40 mm.; length of M_2, 1.62 mm.; width of M_2, 1.57 mm.

Schaubemys Wood (1935a) from the "Lower Rosebud" on Potato Creek in Washabaugh County, South Dakota, also shows a great development of the mesolophid. In this form the anteroconid of M_1 is centrally located and completely detached from the protoconid and the metaconid. This situation suggests still another version of the *Eumys* pattern.

SCOTTIMUS WOOD, 1937

Scottimus Wood, 1937, p. 255.

Scottimus, species indeterminate

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 58101, two isolated second upper molars, from S.D.S.M. V5413.

DISCUSSION: These two teeth closely resemble the type (M.C.Z. No. 5064) of *Scottimus lophatus* Wood (1937) from the upper part of the Brule formation near Chimney Rock, Nebraska.

The teeth from Wounded Knee are not so

TABLE 14

MEASUREMENTS (IN MILLIMETERS) OF SECOND UPPER MOLAR OF *Scottimus* SPECIMENS

	S.D.S.M. No. 58101 (Deep-Well Slide) Tooth Number		*S. lophatus*[a]	
	1	2	M.C.Z. No. 5064, Type	P.U. No. 11385
Length	1.78	1.80	2.30	1.94
Width of protoloph	1.60	1.60	1.83	1.62
Width of metaloph	1.35	1.52	1.71	1.56

[a] From Wood (1937).

heavily worn as those of the type, so the anteroposterior crests are not so prominent. Possibly the Miocene material is slightly higher-crowned; however, there is a difference in crown height between the two specimens at hand.

CARNIVORA Bowdich, 1821

CANIDAE Gray, 1821

Although represented by less than perfect material, the dogs are surprisingly abundant in the Wounded Knee faunas. Six genera are found in the very early Miocene Sharps formation, and only two additional genera have been found in the overlying beds. Unless we envision mass immigration from outside the areas where late Oligocene fresh-water sediments are found in North America, this situation again points to the need for a continuing study of the White River group and other beds of equivalent age.

On the basis of our present knowledge, the known early Miocene dogs of North America were derived either from *Hesperocyon* Scott (1890) or from *Hesperocyon* and *Daphoenus* Leidy (1853). Matthew (1930) indicates that the Amphocyoninae and the Ursidae were derived from *Daphoenus* and the remainder of the Canidae and the Procyonidae from *Cynodictis*, i.e., *Hesperocyon*. In 1932, Loomis derived all the canids with basined talonids from *Nothocyon*, i.e., *Hesperocyon*, and those with trenchant talonids from *Daphoenus*. Hough, in her reviews of the ear region of the Oligocene and Miocene carnivores (1944, 1948a, and 1948b), moved *Daphoenus*, *Protemnocyon* Hatcher (1903), *Daphoenocyon* Hough (1948a), and some later genera to the family Daphoenidae and removed *Daphoenus* from the ancestry of the dogs with trenchant talonids.

The material from the Wounded Knee faunas sheds no further light on the early origins of these later dogs. It merely indicates that at this level the dogs were divided into two rather distinct groups, one with basined talonids and the other with trenchant talonids. The phylogeny in figure 23 indicates the possible relationships at this level.

The Wounded Knee faunas now include

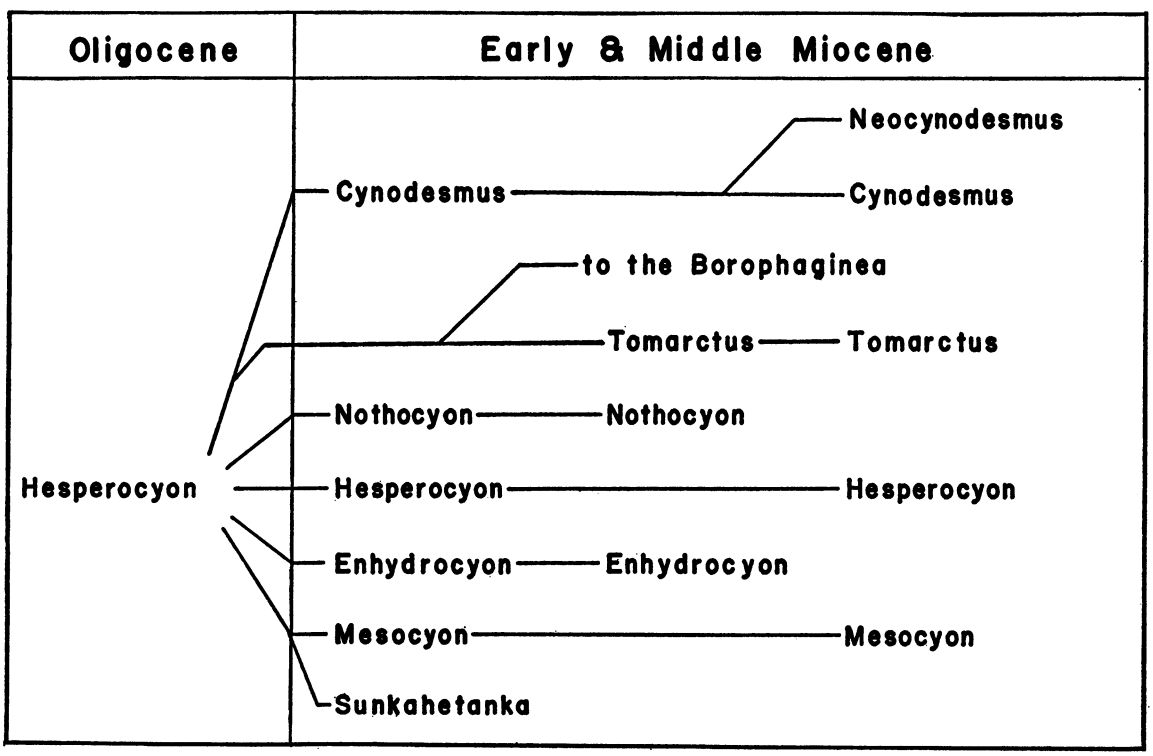


Fig. 23. Phylogeny of some North American canids.

TABLE 15

COMPARISON OF DENTAL CHARACTERISTICS OF SOME NORTH AMERICAN MIOCENE CANIDS

	P_1^{1-3}	M_1	M_2	M_3	P^4	M^1	M^2
Hesperocyon	—	Entoconid present; one or two interoconids; deeply basined talonid; talonid closed posteriorly	—	—	Large anterior deuterocone; small parastyle	—	—
Nothocyon	—	Small; talonid opening posteriorly; stout hypoconid; entoconid taller than hypoconid; slight indication of a cross ridge; trigonid cusps round and small	—	—	Small; small deuterocone either lateral or anterior; transverse shear; small parastyle or none	With metaconule; talon broad and square	—
Cynodesmus	—	Entoconid present; no cross ridge; no interoconids; metaconid posterior	—	—	Large; prominent anterior deuterocone; large parastyle	No metaconule; talon "swept back", narrow	—
Neocynodesmus	Small and narrow	Similar to that of *Cynodesmus*	—	Absent	—	—	—
Tomarctus	—	With interoconids; no entoconulid or hypoconulid; cross ridge between entoconid and hypoconid	—	—	Large parastyle; large deuterocone	With metacone; talon square, "swept back"	—
Tephrocyon	—	No interoconid; no cross ridge; metaconid somewhat posterior; hypoconulid closing rear of basin	—	Small and round	Large parastyle; large deuterocone; deuterocone lateral or anterior	Large metaconule; talon broad, "swept back"	—
Mesocyon	Laterally compressed; accessory cusps missing or simple	Large, trenchant hypoconid; small entoconid; short metaconid	Low crown; simple	Greatly reduced	Elongated; large parastyle; deuterocone lateral or anterior; deuterocone small	Large hypocone; no metaconule	—
Sunkahetanka	Wide-based; P_1 present or absent	Wide-based; small metaconid; very large, trenchant hypoconid; small entoconid	—	Present or absent	Elongated; parastyle present; long, anterior deuterocone	Small metaconule and protoconule; large hypocone; elongated lingually	Greatly compressed anteroposteriorly
Mammacyon	P_{2-3} low, wide-based, blunt, single cusp	—	—	—	Wide and blunt protocone and metastyle; large, round, lateral deuterocone	Large, round, blunt cusps; protocone only lingual cusp, surrounded by cingulum	Similar to M^1
Temnocyon	Large and laterally compressed	Large, trenchant hypoconid; small entoconid; trigonid sharply inflected at carnassial notch	Reduced to two cusps	Greatly reduced; two cusps	Large protocone; metastyle laterally compressed; large lateral deuterocone; variable parastyle; transverse shear	Elongated transversely; large hypocone	Similar to M^1; moderately reduced
Enhydrocyon	Small and robust; P_1^1 absent	Large, trenchant hypoconid; entoconid missing; metaconid missing	Greatly reduced	Missing	Protocone slightly larger than metastyle; elongated lateral deuterocone; broadly rounded parastyle	Elongated talon; large paracone and metacone; small hypocone	Greatly reduced

nine genera of dogs. The primitive genus *Hesperocyon* is represented in the Sharps formation by *H. leptodus* (Schlaikjer, 1935) which was described from the "lower Harrison" of the Goshen Hole, Wyoming, area and the type of *Hesperocyon gregorii* (Matthew, 1907) which was found in the Harrison formation.

Nothocyon Matthew (1899) was defined to include three species from the John Day beds of Oregon: *N. latidens* (Cope, 1881a), *N. lemur* (Cope, 1879c), and *N. geismarianus* (Cope, 1879b). One of the primary characters used to define this genus was the presence of a small accessory cusp on the posterolabial corner of the protoconid of M_1. This cusp was designated as the "opisthoconid" by Green (MS), who pointed out that it does not occur in all the species. Actually the two unifying characters of the assigned species are the posterior opening of the basin of the talonid of M_1 and the reduction in size of the upper carnassials. *Nothocyon geismarianus* occurs in the

Sharps formation and in the Monroe Creek formation in the Wounded Knee area. *Nothocyon lemur* is found in the Sharps formation, *N.* near *latidens* was found in either the Monroe Creek or the Harrison formation, and *N. roii*, new species, from the Sharps formation is described below.

Scott (1893) established *Cynodesmus* based on *C. tooides* from the Deep River beds of Montana. This genus is represented by three species in the Wounded Knee faunas: *Cynodesmus cooki*, new species, from the Sharps formation; *C. vulpinus* (Matthew, 1907) from the Harrison formation; and *C. minor* Matthew (1907) from the Rosebud formation. Many species were erroneously assigned to *Cynodesmus*, until White (1941) pointed out that five of these were referable to *Tomarctus* Cope (1873a). Olsen, in his paper on the Thomas Farm Caninae (1956, figs. 3, 4), illustrated the basic differences between the upper and lower first molars in *Cynodesmus iamonensis* (Sellards, 1916) and *Tomarctus canavus* (Simpson, 1932). These characteristics are found throughout the two genera.

Tomarctus was based on *T. brevirostrus* Cope (1873a) from the Miocene of northeastern Colorado. The type (A.M.N.H. No. 8302) is a fragmentary mandible, with an unworn M_1. Matthew (1899, p. 68) listed this species but did not refer to it in his discussion of the Tertiary Canidae (Wortman and Matthew, 1899). This genus was not used until Matthew (1924) revived it and assigned to it the material from the Sheep Creek and Snake Creek faunas which he and Cook had referred to *Tephrocyon* Merriam (1906). Although there may be some doubt that the Snake Creek specimens are conspecific with the type of *T. brevirostrus*, this material cannot be distinguished from the type. As a result, the concept of *Tomarctus* is based on the excellent material from the Snake Creek beds. *Tomarctus thomsoni* (Matthew, 1907) from the Rosebud formation is the only representative of this genus in the Wounded Knee faunas.

Olsen (1956, fig. 4) indicates an accessory cusp on the lingual side of the talonid of *Tomarctus canavus*. This accessory cusp, lying between the metaconid and the entoconid, is quite common in the dogs. Olsen labeled this cusp the "lingual subsidiary cusp." Green (MS) named this cusp the "interoconid"; I propose that the latter name be adopted.

Mesocyon Scott (1890) is represented by a single species in the Wounded Knee faunas. *Mesocyon robustus* Matthew (1907) was described from the Harrison formation. Additional material from the Sharps formation is referred to this species, as it cannot be distinguished from the type.

Enhydrocyon Cope (1879a) is found in both the Sharps formation and the Harrison formation. A single species is recognized from the Wounded Knee faunas, the type of *E. crassidens* Matthew (1907), with two other referable specimens from the Harrison formation. Two additional referable crania are known from the Sharps formation.

Mammacyon obtusidens Loomis (1936a) is still known only from the type (A.C.M. No. 34–41) which came from either the Monroe Creek formation or the Harrison formation.

Two new genera are proposed for the remainder of the Wounded Knee dogs. *Neocynodesmus* is proposed for *Pachycynodon delicatus* Loomis (1932) from the Monroe Creek formation or the Harrison formation. Further preparation of the type shows that it is not referable to *Pachycynodon*, but that it is a small form that probably was derived from a small species of *Cynodesmus*.

A third genus, derived from *Mesocyon*, is described below. *Sunkahetanka*, based on *Mesocyon geringensis* Barbour and Schultz (1935), is well represented in the South Dakota School of Mines collections with material from the Sharps formation that is referable to the genotypic species. In addition, another larger species, *S. pahinsintewakpa* from the Sharps formation, is described below.

A suggested phylogeny showing the possible relationships of these and some other Miocene species is shown in figure 23. A key to the more important genera of Miocene canids is given in table 15. This key is based on the cheek teeth because most of the available material is fragmentary, and the teeth make up the major portion of the collected remains.

HESPEROCYON Scott, 1890

Hesperocyon Scott, 1890, p. 38.
Pseudocynodictis Schlosser, 1911, p. 50.

Hesperocyon leptodus (Schlaikjer), 1935

Nothocyon leptodus Schlaikjer, 1935, pp. 131–133, fig. 6.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5353	53323, rostrum, with P^4
V5359	54280, fragment of right ramus, with P_3–M_2
V541	54292, cranium, with P^3–M^2; 54338, cranium, with I^{1-3}, P^1–M^2, and the roots of the canines
V541	55145, fragment of left ramus, with M_2

DISCUSSION: The type of *Hesperocyon leptodus* (Schlaikjer) is a fragment of a left mandible, with P_4–M_2 (M.C.Z. No. 2878), and was found in the Goshen Hole area of Wyoming, in beds that are either an extension of the Sharps formation or of equivalent age.

Schlaikjer (1935, pp. 131–132) indicated that *H. leptodus* is close to *Nothocyon latidens* (Cope, 1881a) and *N. annectens* Peterson (1906a). The size and general tooth proportions are similar to those of *N. annectens*, while the uncrowded premolars and depth of the mandible are similar to the condition found in *N. latidens*. If the reduction of the carnassials and the posterior opening of the talonid basin of the M_1 are to be considered

TABLE 16

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Hesperocyon leptodus*

	M.C.Z. No. 2878, Type	S.D.S.M. No. 54279	S.D.S.M. No. 54280	S.D.S.M. No. 55145	S.D.S.M. No. 54338		S.D.S.M. No. 54292	
					Right	Left	Right	Left
P_2								
Length	—	4.0	—	—	—	—	—	—
Width	—	1.4	—	—	—	—	—	—
P_3								
Length	—	—	4.5	—	—	—	—	—
Width	—	—	1.5	—	—	—	—	—
P_4								
Length	5.7	—	—	—	—	—	—	—
Width	2.2	—	—	—	—	—	—	—
M_1								
Length	9.5	—	8.5	—	—	—	—	—
Width	3.6	—	3.4	—	—	—	—	—
M_2								
Length	4.9	—	5.0	4.7	—	—	—	—
Width	3.2	—	3.0	3.0	—	—	—	—
P^1								
Length	—	—	—	—	2.7	2.4	—	—
Width	—	—	—	—	1.2	1.3	—	—
P^2								
Length	—	—	—	—	4.2	4.2	—	—
Width	—	—	—	—	1.5	1.4	—	—
P^3								
Length	—	—	—	—	4.6	4.5	—	4.6
Width	—	—	—	—	2.3	2.4	—	2.0
P^4								
Length	—	—	—	—	7.7	7.8	7.7	7.4
Width	—	—	—	—	8.8	8.4	8.8	9.2
M^1								
Length	—	—	—	—	6.5	6.5	5.7	5.8
Width	—	—	—	—	—	8.2	7.3	7.4
M^2								
Length	—	—	—	—	3.6	3.7	3.4	3.5
Width	—	—	—	—	5.7	5.3	4.6	4.4

typical of *Nothocyon*, then this species, while close to the *Nothocyon* stem, must be referred to *Hesperocyon*.

The lower jaws from the Wounded Knee-Sharps fauna are essentially identical to those of the type specimen from Wyoming. The crania that are herein referred to *H. leptodus* are typically *Hesperocyon* in aspect. It is true that none of them were found at the same stratigraphic levels in nearby localities. While the identity of tooth-row size and occlusability may not be taken as proof of identity, these factors support the supposition that the crania are of the same species as the mandibles.

The mandibles show little variation in the dentition. P_2 has a very small anterior cingular cusp and a somewhat larger posterior cingular cusp. P_3 and P_4 have posterior and anterior cingular cusps and a posterior accessory cusp. M_1 has a strong anterior labial cingulum; the metaconid is well separated from the protoconid; the talonid is deeply basined, with a large hypoconid, a small entoconulid, a small entoconid, and two small interoconids that form a connecting ridge between the entoconid and the base of the metaconid. M_2 has a strong anterolabial cingular shelf and a well-developed trigonid with low cusps; the protoconid is the tallest; the centrally located paraconid is very short; the talonid is equal to the trigonid in size and is a reduced version of that found on M_1. M_3 is represented only by the alveolus.

The referred crania have an unreduced muzzle, large bullae, and the sagittal crest divided into long, lyrate ridges that extend anteriorly from the postcranial constriction near the lambdoidal crest. I^{1-2} have been broken away. I^3 is large and two-lobed as in other species. The canine is missing. P^1 is small and laterally compressed and has a small posterior cingular cusp. P^2 has a very faint anterior and labial cingulum and a prominent lingual cingulum; the posterior cingular cusp is strongly developed. P^3 is similar to P^2, with a posterior accessory cusp in addition to the posterior cingular cusp. The third right upper premolar of S.D.S.M. No. 54338 has a median lingual root. P^4 has a strong cingulum, an isolated conical deuterocone, and a ridge from the protocone to the high point on the cingulum midway between the deuterocone and the parastyle. M^1 has a strong continuous cingulum and a well-developed parastyle; the paracone is larger than

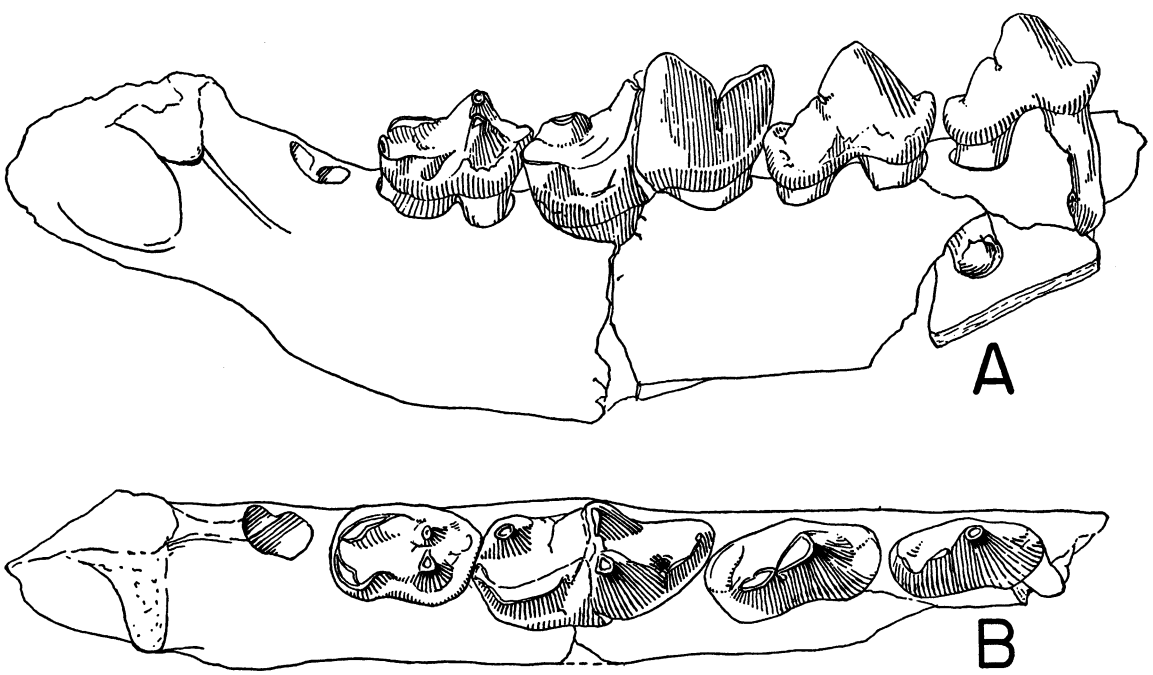


FIG. 24. *Nothocyon roii*, new species. Type. S.D.S.M. No. 53321, right ramus, with P_3–M_2. A. Labial view. B. Crown view. Both approximately ×5.

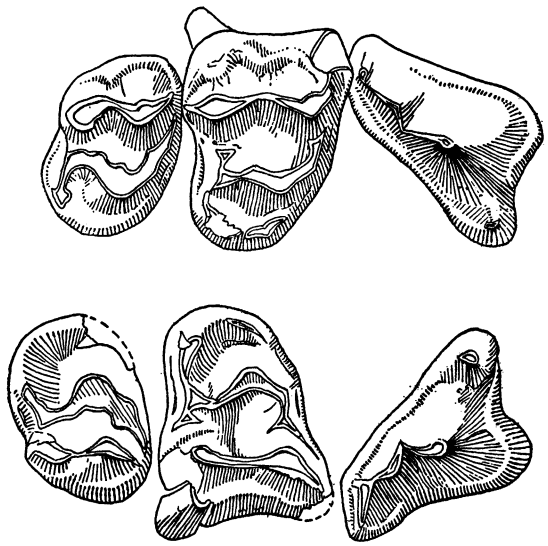


FIG. 25. *Nothocyon roii*, new species. Referred specimen, S.D.S.M. No. 54132, upper dentition, with P^4–M^2, crown view. Approximately ×5.

the metacone; the protocone is much larger than the protoconule (judged from the worn bases), and the hypocone is quite large. M^2 is a reduced version of M^1; the parastyle is not so prominent; and the posterolabial corner at the metacone is reduced so that it does not extend beyond the general posterior border of the tooth.

Although contemporaneous with early species of *Nothocyon*, *H. leptodus* is close to the ancestry of that genus. It may be assumed that a continuing line of *Hesperocyon* is represented by *H. leptodus* in the Sharps formation and *H. gregorii* (Matthew, 1907) in the Harrison formation. If so, future exploration and collecting in the intervening Monroe Creek formation should produce a connecting form.

Hesperocyon gregorii (Matthew), 1907

Nothocyon gregorii MATTHEW, 1907, p. 183, fig. 1.

TYPE: A.M.N.H. No. 12879, partial skull, with P^3–M^2 and P_3 (the type figure shows M_{1-2}, but these teeth are no longer present), and parts of the appendicular skeleton.

TYPE LOCALITY: A.M.N.H. "Rosebud" 19.

HORIZON: Harrison formation, early Miocene.

EMENDED DIAGNOSIS: Cranium and dentition massive; M^2 little reduced.

DESCRIPTION: Cranium massive. P^3 having small, posterior, accessory cusp and posterior cingular cusp. P^4 having isolated round deuterocone, no parastyle, protocone moderately low, and lingual cingulum moderately developed. M^1 having "bulbous" or "inflated" cusps, paracone slightly larger than metacone, protocone slightly larger than metaconule, hypocone large and rounded, and parastyle only moderately developed. M^2 having "bulbous" or "inflated" paracone and metacone, protocone large, metaconule possibly present, but that area of crown worn, labial cingulum poorly developed. M^2 larger than that of other species of *Hesperocyon*.

DISCUSSION: This species, although assigned to *Nothocyon* by Matthew in 1907, does not have the reduced upper carnassial that distinguishes that genus, but it does fall within the definition of *Hesperocyon*. It cannot be considered a small primitive species of *Tomarctus* because of the transverse width of the upper molars and the general shape of these teeth. However, the general aspect of the dentition suggests that which might be expected in the ancestor of *Tephrocyon*.

NOTHOCYON MATTHEW, 1899

Nothocyon MATTHEW, 1899, p. 62.

Nothocyon roii,[1] new species

Figures 24, 25

TYPE: S.D.S.M. No. 53321, partial right mandible, with P_3–M_2 and alveolus for M_3.

PARATYPE: S.D.S.M. No. 54252, fragment of left mandible, with unworn P_4–M_1.

TYPE LOCALITY: S.D.S.M. V5354.

HORIZON: Sharps formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. Locality Numbers	S.D.S.M. Specimen Numbers
V5350	5581, fragment of right mandible, with P_4–M_1
V5354	54132, partial cranium, with P^4–M^2
V5358	53322, fragment of left mandible, with M_{1-2}, alveolus for M_3, and part of P_4
V5360	54273, fragment of left mandible, with M_1

[1] For Mr. L. F. "Roy" Macdonald, St. Helena, California.

DIAGNOSIS: Lower cheek teeth shorter and relatively broader than those of *N. lemur;* entoconid and interoconid less prominent; protoconid and metaconid of M_2 close together; premolars larger than those of *N. harlowi.*

DESCRIPTION: P_3 having small posterior accessory cusp; slight indication of anterior cingular cusp; posterior cingulum slightly expanded laterally; very faint posterior cingular cusp. P_4 similar to P_3; posterior accessory cusp slightly larger; small, anterior cingular cusp; posterior cingulum expanded laterally; small, posterior cingular cusp. M_1 having trigonid and talonid of about equal length; cingulum extending from anterior base of paraconid to point just below carnassial notch; small segment on talonid between base of metaconid and base of hypoconid, and small segment between base of hypoconid and entoconid; metaconid stout and prominent but short; hypoconid broad and low, connected to base of metaconid below apex; connecting spur having suggestion of three minor cuspules; entoconid tall, laterally compressed, connected to base of posterolingual base of metaconid through interoconid; talonid slightly basined, opening posteriorly between hypoconid. M_2 rectangular; protoconid and metaconid subequal; paraconid missing; anterior portion of crown forming broad, flat shelf; talonid similar to that in M_1 except for somewhat more posterior closure of talonid basin.

The fragmentary cranium (S.D.S.M. No. 54132) contains P^4–M^2. P^4 is small, with a large, conical deuterocone that projects anterolingually from the base of the paracone; the cingulum is well developed, on the labial side extending anteriorly from the carnassial notch across the anterior end of the tooth to the base of the deuterocone, on the lingual side forming a very prominent shelf extending posteriorly from the deuterocone to the point where it is obscured by M^1. M^1 has a strong parastyle and metastyle connected by a

TABLE 17

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Nothocyon roii*, NEW SPECIES

	S.D.S.M. No. 53321, Type	S.D.S.M. No. 54252, Paratype	S.D.S.M. No. 5581	S.D.S.M. No. 53322	S.D.S.M. No. 54273	S.D.S.M. No. 54132 Right	S.D.S.M. No. 54132 Left
P_3							
Length	4.0	—	—	—	—	—	—
Width	1.6	—	—	—	—	—	—
P_4							
Length	4.6	4.6	5.0	—	—	—	—
Width	2.0	2.2	2.1	—	—	—	—
M_1							
Length	6.3	6.6	6.7	5.7	6.6	—	—
Width	2.7	2.8	3.0	2.5	3.1	—	—
M_2							
Length	3.6	—	—	3.7	—	—	—
Width	2.5	—	—	2.2	—	—	—
M_3							
Length	1.8[a]	—	—	—	—	—	—
Width	1.0[a]	—	—	—	—	—	—
P^4							
Length	—	—	—	—	—	5.8	5.8
Width	—	—	—	—	—	3.8	4.1
M^1							
Length	—	—	—	—	—	4.5	—
Width	—	—	—	—	—	6.0	6.3
M^2							
Length	—	—	—	—	—	3.3	3.5
Width	—	—	—	—	—	5.2	5.3

[a] Alveolus.

broad cingulum, the paracone and metacone subequal and connected by a low broad ridge; the protocone is large and low, with a broad connection to the paracone and with a somewhat less prominent connection to the metacone; a large circular basin is formed by these connections; the metaconule is well developed, with a shallow valley separating it from the metacone; the hypocone is very large, located at the posterolingual corner of the tooth, strongly connected to the metaconule; a large spur extends anteriorly from the hypocone and terminates as part of the anterior cingulum; a large "tadpole"-shaped valley is formed between this spur, the hypocone, the metaconule, and the protocone; the anterior and posterior cingula are well developed. M^2 is similar to M^1 except that the metastyle is missing.

DISCUSSION: This species is separated from *Nothocyon lemur* on the basis of the proportions of the lower cheek teeth and the position and development of the cusps of M_1 and M_2. The premolars are not so greatly reduced as those of *Nothocyon harlowi* (Loomis, 1932) from the "upper Harrison" near Van Tassel, Wyoming. *Nothocyon roii* is ideally an ancestor to *N. harlowi*, as there is very little modification of the lower molars during the intervening time, and the major difference is the reduction of the premolars in the younger species.

The fragmentary cranium (S.D.S.M. No. 54132) is referred to *N. roii* because it is smaller than that of *N. lemur* from the John Day region. *Nothocyon* cf. *lemur* is also present in the Wounded Knee-Sharps fauna, and the referred cranium does not appear to be

TABLE 18

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Nothocyon geismarianus*

	John Day Formation A.M.N.H. No. 6885, Type	Monroe Creek Formation A.M.N.H. No. 12872	Sharps Formation S.D.S.M. No. 54272	Sharps Formation S.D.S.M. No. 56110
Canine (exclusive)–M_3	46.2	—	—	—
Canine (exclusive)–M_2	43.1	43.6	—	—
P_{1-4}	22.1	—	—	—
P_1–M_2	39.8	—	—	—
P_1–M_3	42.5	—	—	—
M_{1-2}	17.4	16.9	—	—
M_{1-3}	20.8	—	—	—
P_1				
Length	1.7	—	—	—
Width	1.4	—	—	—
P_2				
Length	4.8	—	—	—
Width	1.9	—	—	—
P_3				
Length	6.5	6.2	—	5.6
Width	2.5	2.2	—	2.0
P_4				
Length	6.4	6.7	—	—
Width	3.0	2.8	—	—
M_1				
Length	11.2	11.2	9.8	10.4
Width	4.6	4.7	3.8	4.2
M_2				
Length	6.2	5.5	5.4	5.6
Width	3.7	3.7	3.4	3.2
M_3				
Length	3.2	—	—	—
Width	2.5	—	—	—

compatible with the lower jaw that is questionably referred to that species.

Nothocyon geismarianus (Cope), 1879

Canis geismarianus COPE, 1879b, p. 71.
Galecynus geismarianus (Cope) COPE, 1884a, p. 920.
Nothocyon geismarianus (Cope) MATTHEW, 1899, p. 62.

REFERRED SPECIMENS: From the Wounded Knee Fauna: S.D.S.M. No. 55101, fragment of right ramus, with P_3, M_{1-2}, and roots of P_4, Sharps formation, from S.D.S.M. V5351; S.D.S.M. No. 54272, fragment of left ramus, with M_{1-2}, Sharps formation, from S.D.S.M. V5361; S.D.S.M. No. 56110, fragment of right ramus, with M_{1-2}, Sharps formation, from S.D.S.M. V541; A.M.N.H. No. 12872, fragmentary ramus, with P_3–M_2, Monroe Creek formation, from A.M.N.H. "Rosebud" 8.

DISCUSSION: The four specimens listed above from the Wounded Knee area are so closely similar to the material from the John Day of Oregon that there is no justification for separating them into a local species. A comparison of this material with the lower jaw and dentition of the excellent skull that Wortman collected from Haystack Valley in 1879 (A.M.N.H. No. 6885) and that Cope (1884a, pp. 920–923, pl. 70, fig. 2) referred to *Galecynus geismarianus* shows only minor differences in size that are well within the variations to be expected in any population of small dogs.

Nothocyon lemur (Cope), 1879

Canis lemur COPE, 1879c, p. 371.
Galecynus lemur (Cope) COPE, 1884a, p. 915.
Nothocyon lemur (Cope) MATTHEW, 1899, p. 62.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna: S.D.S.M. No. 54307, fragment of right mandible, with P_4–M_2, from S.D.S.M. V5359; S.D.S.M. No. 55134, fragment of left mandible, with M_1, from S.D.S.M. V5410.

DISCUSSION: These two fragments closely match the mandible (A.M.N.H. No. 6892) from the John Day that was figured and described by Cope (1884a, pp. 934–935, pl. 70, fig. 7). Had these specimens been found in the John Day area, there would be no question about their assignment to *N. lemur*. M_1 of S.D.S.M. No. 55134 has a small accessory cusp (?hypoconulid) which is represented by a small enamel fold on the posterior edge of the talonid basin of M_1 in A.M.N.H. No. 6892 and S.D.S.M. No. 54307.

TABLE 19

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Nothocyon lemur*

	A.M.N.H. No. 6892	S.D.S.M. No. 55134	S.D.S.M. No. 54307
P_4			
Length	5.4	5.2	—
Width	2.2	2.3	—
M_1			
Length	7.3	7.5	7.1
Width	3.1	3.1	3.2
M_2			
Length	4.5	4.4	—
Width	2.7	2.8	—

Nothocyon near **latidens**

Galecynus latidens COPE, 1881a, p. 181.
Nothocyon near *latidens* MATTHEW, 1907, p. 185.

REFERRED SPECIMEN: From the Wounded Knee fauna, A.M.N.H. No. 12873, jaw fragment, with M_1, from A.M.N.H. "Rosebud" 32.

HORIZON: Monroe Creek formation or Harrison formation, early Miocene.

DISCUSSION: This specimen approaches *Nothocyon latidens* (Cope, 1881a) in the development of the lower carnassial and in size. A definite specific assignment is not prudent because of the fragmentary nature of the specimen.

Tomarctus COPE, 1873

Tomarctus COPE, 1873a, p. 2.

Tomarctus thomsoni (Matthew), 1907

Cynodesmus thomsoni MATTHEW, 1907, pp. 186–188, figs. 4–5.
Tomarctus thomsoni (Matthew) WHITE, 1941, p. 95.

TYPE: A.M.N.H. No. 12874, skull and part of the skeleton.

TYPE LOCALITY: A.M.N.H. "Rosebud" 24.

HORIZON: Rosebud formation, middle Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Rosebud fauna: A.M.N.H. No. 12875, fragmentary skull, from A.M.N.H. "Rosebud" 17; S.D.S.M. No. 5585, fragmentary ramus, with P_4–M_1, from S.D.S.M. V554.

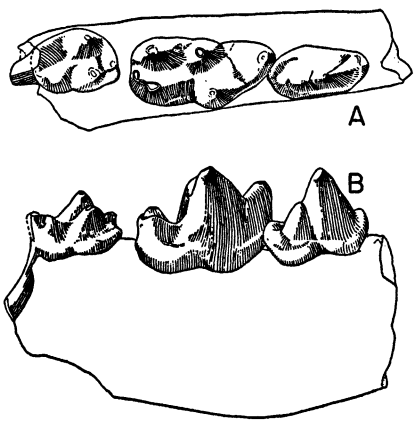


FIG. 26. *Cynodesmus cooki*, new species. Type, S.D.S.M. No. 54308, right ramus, with P_4–M_2. A. Crown view. B. Labial view. Both approximately ×3.

DISCUSSION: This species is typical of the genus *Tomarctus* in every respect. I believe that Matthew originally referred it to *Cynodesmus* because of the obscurity of *Tomarctus* at that time. It was not until the faunas from the Snake Creek quarries became known that a firm concept of *Tomarctus* was possible.

CYNODESMUS SCOTT, 1893

Cynodesmus SCOTT, 1893, p. 660.

Cynodesmus cooki,[1] new species

Figures 26, 27

TYPE: S.D.S.M. No. 54308, fragment of right mandible, with P_4–M_2.

TYPE LOCALITY: S.D.S.M. V5359.

HORIZON: Sharps formation, early Miocene.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 55132, fragment of right mandible, with M_{1-3} and a portion of P_4, from S.D.S.M. V5410.

DIAGNOSIS: Very small; M_1 with entoconid larger than hypoconid; small hypoconulid; talonid basin deeply open lingually; M_2 with trigonid triangular, metaconid largest cusp, wide anterolabial cingulum; talonid roundly basined.

DESCRIPTION: P_4 having strongly developed anterior and posterior cingula, well-developed anterior and cingular cusps; large posterior accessory cusp. M_1 having short trigonid; metaconid widely separated from protoconid, slightly posterior to protoconid; tall and conical; paraconid very short, triangular in plan; protoconid slightly smaller than metaconid; talonid deeply basined; large hypoconid connected to base of protoconid;

[1] For Dr. Harold J. Cook, Agate, Nebraska.

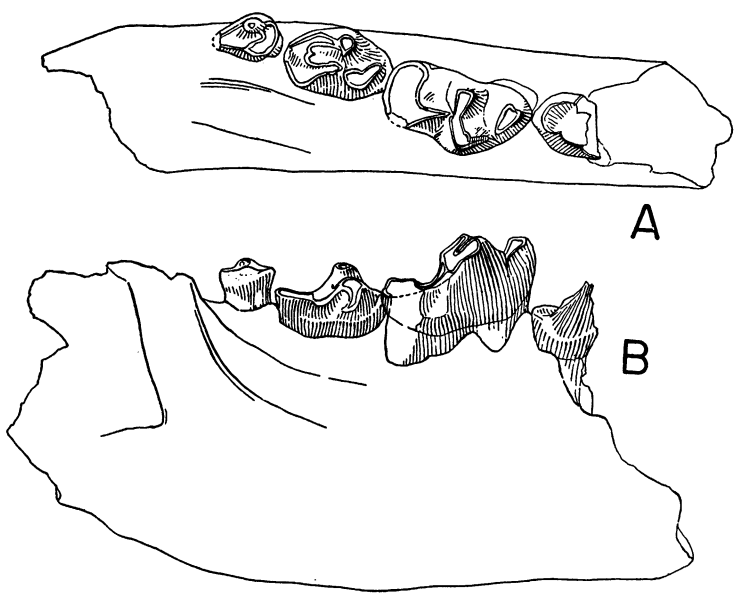


FIG. 27. *Cynodesmus cooki*, new species. Referred specimen, right ramus with M_{1-3} and a portion of P_4. A. Crown view. B. Labial view. Both approximately ×3.

entoconid broken or worn away, connected to hypoconid by high crest that closes posterior end of talonid basin; basin widely open lingually; cingulum absent except for large shelf at anterolabial corner.

DISCUSSION: The referred specimen (S.D.S.M. No. 55132) is somewhat larger than the type. Although M_1 is essentially the same size in both, the referred specimen has a much deeper and more massive ramus, and M_2 is longer. There is a small, round M_3 that has been well worn. The trigonid is horseshoe-shaped and the paraconid and protoconid have been worn flat, but the conical metaconid is unworn. The talonid is diamond-shaped, with a suggestion of a small, elongated, central, anteroposterior ridge along the midline.

TABLE 20

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Cynodesmus cooki*, NEW SPECIES

	S.D.S.M No. 54308, Type	S.D.S.M. No. 55132
P_4		
Length	3.8	—
Width	2.2	2.6
M_1		
Length	6.3	6.8
Width	3.1	3.5
M_2		
Length	4.2	4.7
Width	2.6	3.8
M_3		
Length	—	2.4
Width	—	1.8

Cynodesmus vulpinus (Matthew), 1907

Nothocyon vulpinus MATTHEW, 1907, pp. 183–184, fig. 2.

TYPE: A.M.N.H. No. 12883, lower jaw, with I_3–M_3 and roots of I_{1-2}.

TYPE LOCALITY: A.M.N.H. "Rosebud" 7.

HORIZON: Harrison formation, early Miocene.

EMENDED DIAGNOSIS: Small, slender-jawed, with spaced premolars, talonid valley of M_1 opening widely lingually.

DESCRIPTION: I_1 and I_2 represented by roots only, I_1 very small, I_2 intermediate in size between I_1 and I_3. I_3 heavily worn, two-lobed. Canine broken, slender, recurved. P_1 single-rooted, simple, with small heel. P_2 having anterior and posterior cingular cusps, possibly posterior accessory cusp broken or worn away. P_3 having posterior accessory and cingular cusps, no anterior cusps. P_4 having small, anterior, cingular cusp, small, posterior, cingular cusp on large heel, well-developed, posterior, accessory cusp. M_1 having paraconid and protoconid separated by tightly closed carnassial notch, metaconid well developed and well separated from protoconid, hypoconid much larger than entoconid, small accessory cusp at base of protoconid connected to anterior base of hypoconid, posterior connection between hypoconid and entoconid possibly representing entoconulid, talonid valley opening lingually through wide notch between entoconid and metaconid. M_2 having very weak paraconid, metaconid larger than protoconid; talonid, as on M_1, including small accessory cusp at base of protoconid; anterolabial corner of tooth "squared" by shelf-like cingulum. M_3 having larger protoconid and small metaconid which are opposite and connected by low ridge, anterolingual portion of trigonid a shallow basin, with anteromedial cusp and small cusp anterior to metaconid forming anterior and lingual wall of basin; talonid also a shallow basin ringed by small lingual cusp posterior to metaconid and larger posteromedial cusp. Two mental foramina, anterior and larger below the diastema between P_1 and P_2, smaller beneath anterior root of P_3.

MEASUREMENTS OF TYPE: The following measurements are taken from Matthew (1907, p. 184): length of lower dentition, 60.0 mm.; length of premolar dentition, 27.5 mm.; length of true molars, 22.4 mm.; length of M_1, 11.8 mm.; width of M_1, 4.8 mm.; length of M_2, 6.9 mm.; width of M_2, 4.0 mm.

DISCUSSION: This species is placed in *Cynodesmus* because the type does not have lingual cusps on the talonid of M_1 between the metaconid and the entoconid, the posterior end of the talonid basin is not closed, and the hypoconid is larger than the entoconid. Each of these characteristics is typical of *Cynodesmus* and none is found in *Nothocyon*.

Cynodesmus minor Matthew, 1907

Cynodesmus minor MATTHEW, 1907, p. 189.

TYPE: A.M.N.H. No. 12877, fragment of skull, with P^4–M^2 and P_2–M_1.

TYPE LOCALITY: A.M.N.H. "Rosebud" 22.

HORIZON: Rosebud formation, middle Miocene.

REFERRED SPECIMEN: From the Wounded Knee-Rosebud fauna, A.M.N.H. No. 12878, fragment of ramus, with P_4–M_3, from A.M.N.H. "Rosebud" 5.

DISCUSSION: The type of this small species is the only example of the upper dentition of *Cynodesmus* recorded from the Wounded Knee area.

NEOCYNODESMUS, NEW GENUS

GENOTYPIC SPECIES: *Pachycynodon delicatus* Loomis, 1932.

GEOLOGIC RANGE: Early Miocene.

DIAGNOSIS: Lower cheek teeth slender and delicate; M_1 with talonid widely open lingually as in *Cynodesmus;* M_2 without paraconid; M_3 absent.

Neocynodesmus delicatus (Loomis), 1932

Pachycynodon delicatus LOOMIS, 1932, pp. 325–326, fig. 8.

TYPE: A.C.M. No. 31102, left mandible, with P_2–M_2 and alveoli for the canine and P_1.

TYPE LOCALITY: A.C.M. "Rosebud" 3.

HORIZON: Monroe Creek formation or Harrison formation, early Miocene.

DIAGNOSIS: As for the genus.

DESCRIPTION: Jaw and teeth quite delicate. P_2 having a single cusp, with its apex above anterior root, anterior blade concave, sweeping into extended heel. P_3 similar to P_2 except that there is a small, anterior, cingular cusp, and posterior blade slightly swollen just anterior to heel. P_4 having anterior cingular cusp and well-developed, posterior, accessory cusp that greatly shortens heel. M_1 less robust version of M_1 of type of *Cynodesmus cooki*, new species, described above. M_2 differing from M_2 of *C. cooki* in reduction of paraconid to small, semicircular ridge connecting protoconid and metaconid, and in slight reduction of anterolabial cingulum. No sign of M_3. Two mental foramina, one below P_1, the other below P_2.

MEASUREMENTS OF TYPE: Length of P_2, 2.5 mm.; width of P_2, 0.9 mm.; length of P_3, 3.3 mm.; width of P_3, 1.1 mm.; length of P_4, 3.4 mm.; width of P_4, 1.4 mm.; length of M_1, 5.4 mm.; width of M_1, 2.3 mm.; length of M_2, 2.5 mm.; width of M_2, 1.5 mm.; P_2–M_2, 19.5 mm.; P_2–P_4, 10.8 mm.; M_1–M_2, 8.4 mm.

DISCUSSION: Loomis (1932, p. 325) states that the type of this species came from "Porcupine Creek, So. Dakota, in the Lower Rosebud beds." It is impossible to tell whether this locality is in the Monroe Creek or the Harrison formation. In any event, the age is early Miocene.

The close resemblance of the carnassial to that of *Cynodesmus cooki* suggests that this form may have been derived from that slightly older species. The jaw fragment (S.D.S.M. No. 55132), which is herein referred to *C. cooki*, has a greatly reduced M_3 which appears to be at the point of complete loss.

The specimen was originally described without complete preparation and was assigned to the Old World genus *Pachycynodon* Schlosser on the basis of general size and the loss of the last lower molar.

MESOCYON SCOTT, 1890

Mesocyon SCOTT, 1890, p. 38.

Mesocyon robustus Matthew, 1907

Mesocyon robustus MATTHEW, 1907, p. 185, fig. 3.

TYPE: A.M.N.H. No. 12884, pair of rami, with I_1–M_3.

TYPE LOCALITY: A.M.N.H. "Rosebud" 7.

HORIZON: Harrison formation, early Miocene.

EMENDED DIAGNOSIS: Premolars not crowded; P_{2-3} simple, without accessory cusps. M_1 having small entoconid, hypoconid large. M_2 with incipient metaconid. Ramus slender.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5354	54242, fragment of right mandible, with partial M_1 and alveoli for M_{2-3}
V5358	53327, fragment of left mandible, with M_1

TABLE 21

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Mesocyon robustus* AND *Mesocyon hortulirosae*

	Mesocyon robustus			*Mesocyon hortulirosae*			
	A.M.N.H. No. 12884, Type		S.D.S.M. No. 54249	M.C.Z. No. 2102, Type		M.C.Z. No. 2882, Paratype	
	Right	Left		Right	Left	Right	Left
P_1–M_3	57.8	—	—	—	53.6	53.6	—
P_{1-4}	33.4	—	—	—	31.1	31.4	—
P_{2-4}	28.5	28.1	26.6	27.0	26.6	26.0	26.2
M_{1-3}	24.1	—	—	23.2	—	23.3	23.1
M_{1-2}	20.5	20.6	21.6	19.2	19.2	19.1	19.2
P_1							
Length	4.1	—	—	—	3.2	3.0	—
Width	2.7	—	—	—	1.9	1.7	—
P_2							
Length	7.3	7.5	7.3	—	6.8	6.4	6.8
Width	3.3	3.4	2.8	—	3.0	3.0	2.8
P_3							
Length	7.8	8.2	—	—	—	8.0	8.2
Width	4.2	4.2	—	—	—	3.7	3.4
P_4							
Length	9.2	9.1	8.7	—	—	8.8	8.6
Width	4.1	4.2	3.8	—	—	3.6	3.5
M_1							
Length	14.4	14.2	13.5	13.4	13.5	13.0	12.7
Width	6.0	6.0	5.7	5.6	5.7	5.4	5.2
M_2							
Length	6.3	6.0	7.6	6.4	5.7	6.1	5.8
Width	4.1	3.9	4.3	4.0	4.1	3.7	3.5
M_3							
Length	3.4	—	—	4.2	—	3.9	4.0
Width	2.2	—	—	2.9	—	2.7	2.7

V5359 54131, right mandible, with broken M_1

V541 55145, fragment of right mandible, with M_1

V542 54249, left mandible, with P_2, P_4–M_2, and alveoli for P_1, P_3, and M_3

DISCUSSION: The referred specimens from the Sharps formation vary but little from Matthew's type. Three specimens (S.D.S.M. Nos. 53327, 54242, and 55145) show a more robust M_1, with a slightly more trenchant hypoconid. In addition, one of these (S.D.S.M. No. 54242) probably had slightly larger M_2 and M_3, judging from the size of the alveoli. These slight differences may well be expected within a population of dogs, even though this species is found to extend throughout at least half of the early Miocene.

Mesocyon hortulirosae Schlaikjer (1935) from the "Lower Harrison formation" (p. 133) of Goshen Hole, Wyoming, is very likely synonymous with *M. robustus*. Schlaikjer (1935, p. 139) stated in his discussion of this specimen: "One other species, *M. robustus* Matthew, has been described from the Great Plains region. This species was based on a pair of lower jaws collected from the lower Harrison (lower Rosebud) of South Dakota. In one character, the incipient development of the metaconid on M_2, *M. robustus* is distinct from all other species and is close to *Temnocyon*. In addition, *M. hortulirosae* is different from *M. robustus* in its smaller size, in the relatively smaller P_2–M_1, and in the relatively larger M_2 and M_3." Actually, the metaconid on M_2 of *M. robustus* is hardly more than a large wrinkle in the enamel. The remaining "difference" is the

relative simplicity of the lower premolars of *M. robustus*. The type and S.D.S.M. No. 54249 do not show posterior accessory cusps on P_{2-3}, but they are present (although small) on both the type and paratype of *M. hortulirosae*. In view of the greater similarities between these two populations, it seems reasonable to refer *M. hortulirosae* to *M. robustus*.

SUNKAHETANKA,[1] NEW GENUS

GENOTYPIC SPECIES: *Mesocyon geringensis* Barbour and Schultz, 1935.

GEOLOGIC RANGE: Very early Miocene.

DIAGNOSIS: Talonid of M_1 like that of *Mesocyon*. Cheek teeth massive, with premolars greatly expanded owing to thickening of cingula; P_1 present or absent.

DISCUSSION: *Sunkahetanka* is a derivative of the *Mesocyon* line; it is represented by two species in the Wounded Knee area. When this genus was known only from the genotypic species, it was logical to assign it to *Mesocyon*. Now that another species is known, the establishment of a new genus based on this material is justified.

Sunkahetanka geringensis (Barbour and Schultz), 1935

Mesocyon geringensis BARBOUR AND SCHULTZ, 1935, pp. 407–418, figs. 192–197.

TYPE: N.S.M. No. 4-28-8-31, skull and nearly complete skeleton.

TYPE LOCALITY: "400 feet west of the road in Redington Gap, near the center of the S. ½, sec. 14, T. 19 N., R. 52 W., west of Bridgeport, Morrill County, Nebraska" (Barbour and Schultz, 1935, p. 407.)

HORIZON: "Gering formation, fifteen feet above Brule" (Barbour and Schultz, 1935, p. 407.)

EMENDED DIAGNOSIS: Cranium short and broad. Robust zygomatic arches. Mandible massive. Cheek teeth and lower incisors crowded; cheek teeth massive. Canines and incisors erect. Anterior blade of P^4 directed posteriorly. Metaconid of M_2 equal to protoconid. M_1 having small entoconid and moderate entoconid ridge extending nearly to base of metaconid.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5354	53334, rostrum, with P^3–M^2 and roots or alveoli for incisors, canines, and anterior premolars
V5358	53324, fragment of left mandible, with broken M_1
V5360	5667, left mandible, with P_3–M_1, and alveoli for P_2 and M_2
V541	54331, fragmentary pair of mandibles, with dP_{1-4} and unerupted canine and M_{1-2}

DISCUSSION: The type of this species was collected from beds which, although mapped as Brule by Darton in 1898, are described as "Gering formation" by Barbour and Schultz (1935). An examination of the site suggested to the present writer that these beds have a strong resemblance to those that are herein described as the Sharps formation. Regardless of what formation this horizon may be referred to, the Nebraska specimen is from beds that are post-Brule (*sensu stricto*) and pre-Monroe Creek in age.

The Sharps material closely agrees with the type specimen and is certainly conspecific. One jaw fragment (S.D.S.M. No. 54331) indicates the character of the deciduous teeth in this species. The first lower deciduous premolar is single-rooted, in it the blade is compressed and pyramidal in outline, and there is a small posterior accessory cuspule. The second lower deciduous premolar has a small anterior accessory cusp and a small posterior accessory cusp about midway up the edge of the blade. The third lower deciduous premolar has anterior and posterior cingular cusps and a suggestion of a posterior accessory cusp near the top of the blade. M_1 is completely formed deep in the ramus and is typical of the species. M_2 is broken but can be seen to be emerging horizontally from the anterior face of the ascending ramus.

Sunkahetanka pahinsintewakpa,[2] new species

Figure 28

TYPE: S.D.S.M. No. 53325, right mandible, with canine, P_2–M_1, and alveoli for M_{2-3}.

[1] *Sunka*, dog, and *he*, tooth, and *tanka*, large, in Sioux; literally, "large-toothed dog." Pronounced Súng-kah Hee Táhn-kah.

[2] *Pahin sinte*, something-that-sticks-up (on the) tail (the Sioux convention for porcupine), and *wakpa*, creek; meaning "from Porcupine Creek." Pronounced Pah-hée(ng) Sín-tay Wálk-pah; "ng" denotes nasal vowel, as is common in French.

TABLE 22

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Sunkahetanka geringensis*

	N.S.M. No. 4-28-8-21, Type[a]	S.D.S.M. No. 53334 Right	S.D.S.M. No. 53334 Left	S.D.S.M. No. 5667	S.D.S.M. No. 54331
$C-M^3$	64.0	62.0	—	—	—
M^{1-3}	17.0	15.0	—	—	—
P^{1-4}	40.0	40.0	—	—	—
P^1					
Length	4.5	—	—	—	—
Width	4.8	—	—	—	—
P^2					
Length	10.0	—	—	—	—
Width	5.2	—	—	—	—
P^3					
Length	10.5	9.4	9.3	—	—
Width	6.2	—	5.4	—	—
P^4					
Length	16.0	14.0	13.8	—	—
Width	10.0	8.3	—	—	—
M^1					
Length	11.5	—	—	—	—
Width	17.0	—	17.8	—	—
M^2					
Length	5.3	—	—	—	—
Width	8.5	9.8	—	—	—
P_1					
Length	4.1	—	—	—	—
Width	3.5	—	—	—	—
P_2					
Length	8.0	—	—	—	—
Width	4.7	—	—	—	—
P_3					
Length	9.0	—	—	8.0	—
Width	5.5	—	—	4.8	—
P_4					
Length	11.3	—	—	10.1	—
Width	6.5	—	—	5.7	—
M_1					
Length	18.0	—	—	17.6	—
Width	8.2	—	—	7.6	—
M_2					
Length	9.0	—	—	7.6	—
Width	5.8	—	—	—	—
M_3					
Length	5.0	—	—	—	—
Width	4.4	—	—	—	—
dP_1					
Length	—	—	—	—	3.6
Width	—	—	—	—	3.3
dP_2					
Length	—	—	—	—	6.0
Width	—	—	—	—	3.1
dP_3					
Length	—	—	—	—	7.5
Width	—	—	—	—	3.5

[a] From Barbour and Schultz (1935, pp. 412, 414).

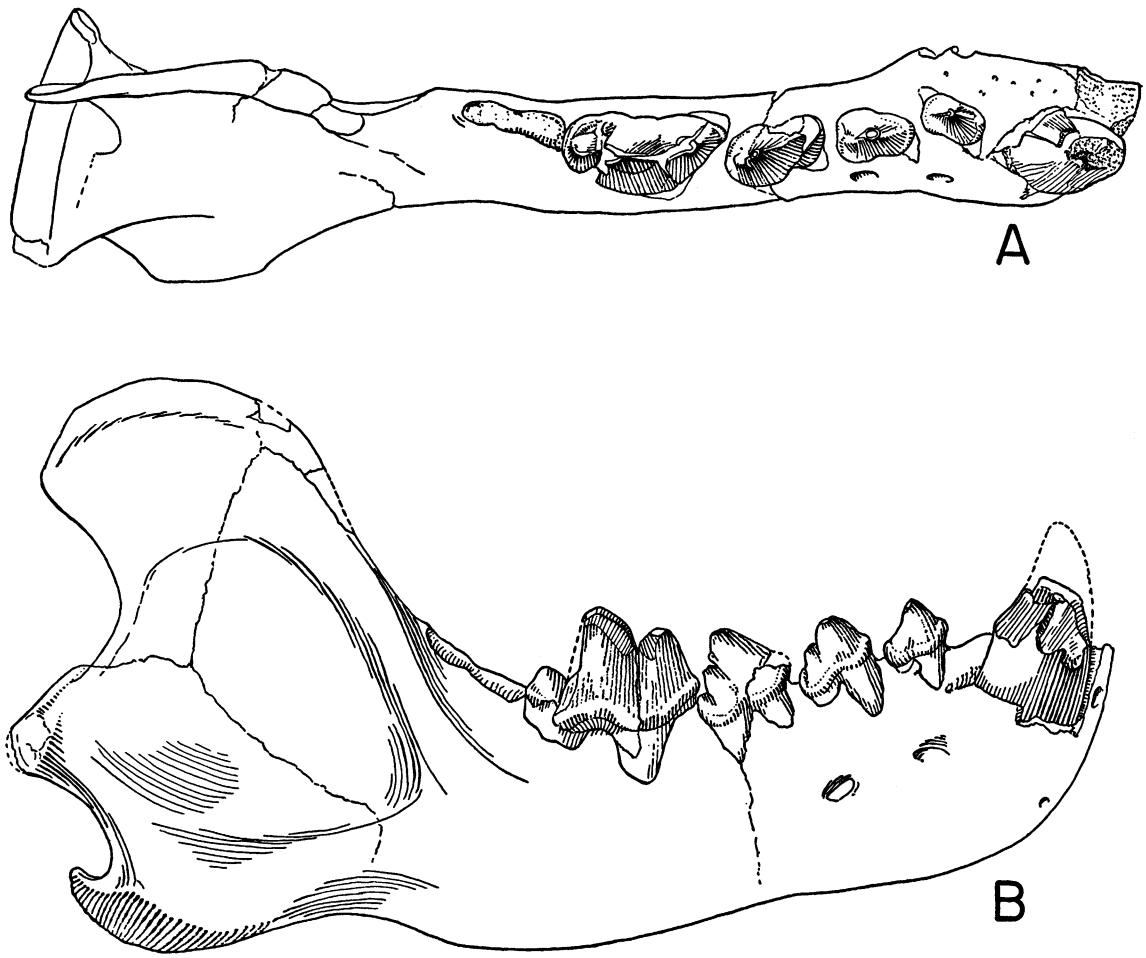


FIG. 28. *Sunkahetanka pahinsintewakpa*, new species. Type, S.D.S.M. No. 53325, right ramus, with C–M_1. A. Crown view. B. Labial view. Both×1.

TYPE LOCALITY: S.D.S.M. V5361.

HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: Ramus and dentition large and massive; metaconid of M_1 large but relatively reduced.

DESCRIPTION: Canine broken, appearing short and massive. P_1 missing. P_2 separated from canine by short diastema; apex above anterior root, no anterior or posterior accessory cusps; sides of tooth parallel. P_3 having anterior and posterior cingular cusps; well-developed posterior accessory cusp; apex of principal cusp above anterior edge of posterior root; greatest transverse diameter at posterior accessory cusp. P_4 broken; apex of principal cusp over posterior root, anterior blade of principal cusp sloping sharply to rear; large, posterior, accessory cusp, well-developed posterior cingular cusp; greatest transverse diameter at principal cusp. M_1 massive, metaconid well developed but relatively small; talonid with large, trenchant hypoconid posterior to center of protoconid; entoconid ridges short, poorly developed, extending diagonally across anterolingual corner of talonid; cingulum well developed around entire tooth except across posterior end. M_2 represented by alveolus only. Anterior mental foramen below anterior root of P_2, posterior mental foramen below posterior root of P_3.

MEASUREMENTS OF TYPE: Length of P_2, 8.8 mm.; width of P_2, 5.6 mm.; length of P_3,

9.8 mm.; width of P_3, 6.8 mm.; length of P_4, about 13.0 mm.; width of P_4, about 7.7 mm.; length of M_1, 21.8 mm.; width of M_1, 10.4 mm.; P_2–M_1, 56.3 mm.

DISCUSSION: This species is the "*Aelurodon*" of the Wounded Knee-Sharps fauna. It is very little larger than *Enhydrocyon crassidens* but has the appearance of being much more massive and formidable. Except for the relatively greater width of the premolars, the metaconid on M_1, the relatively greater size of M_1, and the presence of a well-developed M_3, as indicated by the alveolus, it could well represent a particularly robust individual of *E. crassidens*. The jaw suggests that of *Temnocyon*, but the relative width of the premolars and M_3 seem to exclude it from that genus. It certainly was a competitor of *E. crassidens*, judging from the general similarity in adaptive characteristics.

ENHYDROCYON COPE, 1879

Enhydrocyon COPE, 1879a, p. 56.

Enhydrocyon crassidens Matthew, 1907

Enhydrocyon crassidens MATTHEW, 1907, pp. 190–193, figs. 6–7.

TYPE: A.M.N.H. No. 12886, skull and partial skeleton.

TYPE LOCALITY: A.M.N.H. "Rosebud" 12.

HORIZON: Monroe Creek formation or Harrison formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee faunas: A.M.N.H. No. 12870, fragmentary mandible, Harrison formation, from A.M.N.H. "Rosebud" 1; A.M.N.H. No. 12869, fragmentary lower jaws, Harrison formation, from A.M.N.H. "Rosebud" 15; S.D.S.M. No. 53320, cranium, Sharps formation, from S.D.S.M. V5360; S.D.S.M. No. 54180, cranium, Sharps formation, from S.D.S.M. V5362.

DIAGNOSIS: "The species is somewhat larger than *E. stenocephalus*, the premolars simpler, the molar heel more reduced, and M_2^2 smaller. The skull is a little more robust throughout, the brain-case considerably larger. The second upper molar is minute on one side, absent on the other; M_2 is small but not so much reduced as the corresponding upper tooth. The size is about the same as in *E.* (*Hyaenocyon*) *sectorius*, the M^2 more reduced, P^3 with broader heel but less robust protocone, and P^2 set obliquely but in the opposite direction from the corresponding tooth in *sectorius*, its anterior end lying inside instead of outside the canine. The Rosebud species is smaller and less robust than *E.* (*Hyaenocyon*) *basilatus*, and the anterior premolars are less massive. The fragmentary nature of the types of the John Day species precludes any further comparison, but *E. crassidens* is quite clearly distinct from the referred skull of *E. stenocephalus* and more advanced in many respects" (Matthew, 1907, pp. 190–191).

DISCUSSION: Matthew's final statement is somewhat ambiguous, but a comparison of the type of *E. crassidens* with the John Day cranium (A.M.N.H. No. 6901) shows some differences that may be of specific value. P^4 and M^1, although badly worn and broken, are much smaller than those of the Rosebud skull, while M^2 is larger but about the same size as M^2 of the more complete Sharps specimen (S.D.S.M. No. 53320). The general aspect of the John Day cranium suggests that it is somewhat shorter and broader than either of the Wounded Knee specimens. These two forms may well be distinct species, but they are certainly quite closely related.

Another skull (A.M.N.H. No. 13799) from the Wounded Knee area was collected from the "Upper Rosebud" 6 miles west of American Horse Creek. Although the level from which this specimen was obtained is unknown, the specimen is referable to *E. crassidens*.

The good cranium from the Sharps formation (S.D.S.M. No. 53320) is a close match to the type. The only major differences are the somewhat broader anteroposterior diameter of M^1 and the much larger M^2. The deuterocone is not so prominent as that of the type, possibly the result of the somewhat heavier wear on this specimen which has tapered the crown from the protocone to the base of the tooth above the anterior lingual root. In the Wounded Knee area, *E. crassidens* is known to range from Sharps into Harrison time. In the John Day region of Oregon, four valid species have been described: *E. basilatus* Cope (1879a) from Haystack Valley, Grant County; *E. sectorius* Cope (1883) and *E. stenocephalus* Cope (1879a) from the John Day beds of Oregon; and *E. oregonensis* Thorpe (1922) from Turtle Cove, Grant

TABLE 23

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Enhydrocyon crassidens* AND *Enhydrocyon stenocephalus*

	Enhydrocyon crassidens						*Enhydrocyon stenocephalus*	
	A.M.N.H. No. 12886, Type		A.M.N.H. No. 13799		S.D.S.M. No. 53320		A.M.N.H. No. 6901	
	Right	Left	Right	Left	Right	Left	Right	Left
I^3–M^1	83.8	—	—	—	78.2	78.1	72.2	—
P^2–M^1	57.0	—	—	—	50.3	49.7	47.2	47.5
P^2–P^4	49.0	48.2	47.5	—	42.6	42.2	—	—
P^4–M^1	30.8	30.6	—	31.3	—	28.7	—	—
P^2								
Length	9.2	9.3	9.1	—	9.7	9.7	9.8	10.2
Width	4.8	4.8	5.4	—	5.8	5.6	—	5.1
P^3								
Length	13.1	13.2	13.2	13.4	12.2	12.0	11.1	11.2
Width	6.5	6.5	7.0	6.9	7.5	7.5	6.7	6.0
P^4								
Length	21.8	21.7	22.7	21.8	—	18.7	—	—
Width	—	—	—	—	—	—	—	—
M^1								
Length	10.6	11.4	11.0	11.2	12.2	12.3	—	—
Width	18.7	18.3	19.7	19.5	19.4	18.4	—	—
M^2								
Length	—	2.8	3.9	—	4.5	4.6	—	—
Width	—	4.4	—	—	10.4	9.0	—	—
I^2–condyle	180.6	—	—	—	183.2	—	172.8	—
P_2–M_2	—	63.4	—	—	—	—	—	—
P_2–P_4	—	34.5	—	—	—	—	—	—
M_1–M_2	—	30.0	—	—	—	—	—	30.6
P_2								
Length	—	7.7	—	—	—	—	—	—
Width	—	4.2	—	—	—	—	—	—
P_3								
Length	10.8	10.2	—	—	—	—	—	11.0
Width	6.0	6.2	—	—	—	—	—	7.0
P_4								
Length	—	13.5	—	—	—	—	—	13.5
Width	—	7.7	—	—	—	—	—	8.0
M_1								
Length	22.5	23.4	—	—	—	—	—	22.7
Width	9.1	9.3	—	—	—	—	—	9.8
M_2								
Length	7.8	7.4	—	—	—	—	—	8.5
Width	5.1	4.9	—	—	—	—	—	5.8

County. Thorpe, in his description of the latter species (1922, p. 174), suggests that *E. basilatus* and *E. sectorius* are virtually the same as, or at the most subspecies of, the same species. He makes the following comparison between *E. oregonensis* and *E. crassidens:* "This species differs from *E. crassidens* chiefly in the smaller size; wider P^3; larger M^2; different outline of superior dental series; different incisor forms; smaller deuterocone of P^4; more posterior [should read anterior] position of the infra-orbital foramen; larger orbit; more robust malar below orbit; and slightly more elongate face" (Thorpe, 1922, p. 175). Although closely related, this form is very likely a distinct species.

Loomis (1936a, pp. 49–50) refers *Temnocyon venator* Cook (1909) to *Enhydrocyon* and suggests that *T. wallovianus* Cope (1881a) is either referable to *Enhydrocyon* or worthy of generic distinction. As the types of these species exhibit the compressed premolars that characterize *Temnocyon*, there seems to be no valid reason for changing their generic designation.

MAMMACYON LOOMIS, 1936

Mammacyon LOOMIS, 1936a, p. 44.

Mammacyon obtusidens Loomis, 1936

Mammacyon obtusidens LOOMIS, 1936a, p. 44, 47, fig. 1.

TYPE: A.C.M. No. 34–41, skull and partial skeleton.

TYPE LOCALITY: A.C.M. "Rosebud" 2.

HORIZON: Monroe Creek formation or Harrison formation, early Miocene.

MUSTELIDAE SWAINSON, 1835

PALAEOGALE MEYER, 1846

Palaeogale MEYER, 1846, p. 474.

Palaeogale dorothiae,[1] new species

Figure 29

TYPE: S.D.S.M. No. 53326, fragment of right mandible, with P_4–M_2 and alveoli for P_{2-3}.

TYPE LOCALITY: S.D.S.M. V5357.

HORIZON: Sharps formation, early Miocene.

DIAGNOSIS: P_4 without posterior accessory cusp; protoconid of M_1 not expanded laterally.

DESCRIPTION: P_4 nearly symmetrical; apex above center; very small, posterior, cingular cusp; no posterior accessory cusp. M_1 having paraconid broken away; protoconid not expanded anteriorly; probably separated from paraconid for entire depth of carnassial notch; talonid with single trenchant cusp slightly labial to midline. M_2 low, with protoconid elongated anteroposteriorly; two small ridges, one extending anterolingually and other lingually, suggesting remnants of paraconid and metaconid; talonid with small, posterior cusp connected to protoconid by low, flattened ridge. Mental foramen below center of P_2.

[1] For Miss Dorothy Macdonald, Seattle, Washington.

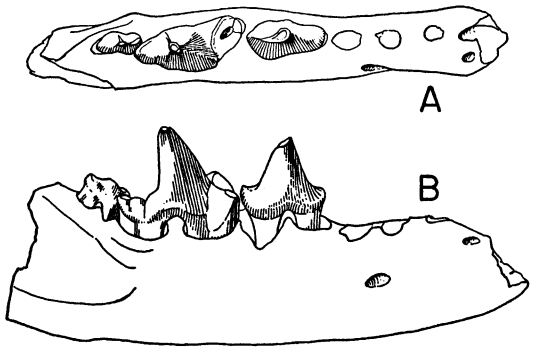


FIG. 29. *Palaeogale dorothiae*, new species. Type, S.D.S.M. No. 53326, right ramus, with P_4–M_2. A. Crown view. B. Labial view. Both ×3.

MEASUREMENTS OF TYPE: Length of P_4, 3.6 mm.; width of P_4, 1.4 mm.; length of M_1, about 4.5 mm.; width of M_1, 2.0 mm.; length of M_2, 1.9 mm.; width of M_2, 1.1 mm.

DISCUSSION: As Simpson (1946) pointed out, there is a great deal of variation among individuals within mustelid populations. He indicated that the characteristics used to separate the described North American Oligocene species of *Palaeogale* may be only normal variations within a population or between populations. This observation is equally valid when applied to this early Miocene form. Until more material is available, we cannot be positive that this form is not conspecific with the earlier forms from the Oligocene. Because both diagnostic features cited above are strikingly different from those of the known specimens of this genus, the naming of a new species seems warranted.

PROMARTES RIGGS, 1942

Promartes RIGGS, 1942, p. 59.

Promartes lepidus (Matthew), 1907

Oligobunis lepidus MATTHEW, 1907, pp. 194–195, figs. 8–9.

Promartes lepidus (Matthew) RIGGS, 1942, p. 60; 1945, pp. 79–80.

TYPE: A.M.N.H. No. 12865, fragmentary skull.

TYPE LOCALITY: A.M.N.H. "Rosebud" 5.

HORIZON: Rosebud formation, middle Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Rosebud fauna, as listed below:

A.M.N.H. Locality Numbers	A.M.N.H. Specimen Numbers
"Rosebud" 17	12866, partial cranium; 12868, mandible
"Rosebud" 27	12867, mandible
"Rosebud" 29	12984, fragmentary mandible

Discussion: Matthew, in describing this species (1907, pp. 194–195), figured not the type but, instead, the partial cranium (A.M.N.H. No. 12866) and one of the mandibles (A.M.N.H. No. 12867) which, in the table of measurements, are labeled as "var. *robustior*." In the text, he separated these from the type because of their more robust appearance, the absence of P^1, and the small size of P_1. However, he stated (p. 195), "In the absence of more material for comparison I do not think it advisable to distinguish these as separate species."

Thorpe, in the discussion of a new species, *Oligobunis darbyi* from the Monroe Creek formation of Sioux County, Nebraska (1921c, p. 482), also referred to the Wounded Knee specimens. He called the figured specimens paratypes of *Promartes lepidus*, stating, "These paratypes Matthew designated in his table of measurements as a new variety, *robustior*, although I think that additional material would elevate them to the rank of a new species, more advanced in development than any of the others." As the additional material has not yet materialized, I believe that the Wounded Knee-Rosebud specimens should still be considered as a single species. Matthew's varietal name "*robustior*" should be used for the new species whenever such separation becomes necessary.

Riggs (1945, pp. 79–80) reports the presence of *Promartes lepidus* from "Raw Hide Butte, Wyoming, and the horizon apparently the upper levels of buff sand, designated by Peterson as Upper Harrison beds." This occurrence aids in confirming the dating of the Rosebud formation as an equivalent of the "Upper Harrison" or Marsland formation of Nebraska and Wyoming.

Promartes gemmarosae (Loomis), 1932

Oligobunis gemmarosae Loomis, 1932, pp. 317–321, figs. 1–4.

Promartes gemmarosae (Loomis) Riggs, 1945, pp. 81–82, fig. 30.

Type: A.C.M. No. 31-33, nearly complete skeleton.

Type Locality: A.C.M. "Rosebud" 1.

Horizon: Monroe Creek formation or Harrison formation, early Miocene.

MEGALICTIS Matthew, 1907

Megalictis Matthew, 1907, p. 195.

Megalictis ferox Matthew, 1907

Megalictis ferox Matthew, 1907, pp. 195–204, figs. 10–16. Riggs, 1945, pp. 94–96.

Type: A.M.N.H. No. 12880, partial skull and skeleton.

Type Locality: A.M.N.H. "Rosebud" 22.

Horizon: Rosebud formation, middle Miocene.

Referred Specimen: From the Wounded Knee-Rosebud fauna, A.M.N.H. No. 12881, partial skeleton, from A.M.N.H. "Rosebud" 5.

Discussion: Riggs (1945, pp. 94–96, fig. 38) described some limb material from a "small residual deposit of the Upper Harrison beds, as described by Peterson, lying directly upon an eroded surface of the *Daimonelix* beds" (presumably from Nebraska or Wyoming) which he referred to *Megalictis ferox*. As this material is the only reported additional occurrence of this form, nothing can be added to Matthew's original description and discussion.

FELIDAE Gray, 1821

The cats, although never abundant in fossil faunas, are very rare in the Wounded Knee faunas. Only two specimens are recorded from the area under consideration: the type of *Nimravus sectator* Matthew (1907) and the type of *Ekgmoiteptecela olsontau* which is described below. The South Dakota School of Mines Museum of Geology also has a cranium (S.D.S.M. No. 56122) from the Rockyford member of the Sharps formation which may be referable to *Nimravus brachyops* Cope (1879b). As this specimen came from the north side of the White River Badlands near the Pinnacles, some 30 miles northeast of the Rockyford post office, it is not considered a part of the Wounded Knee faunas.

NIMRAVUS Cope, 1879

Nimravus Cope, 1879d, p, 169.

Nimravus sectator Matthew, 1907

Nimravus sectator MATTHEW, 1907, pp. 204–205, figs. 17–18.

TYPE: A.M.N.H. No. 12882, left ramus.

TYPE LOCALITY: A.M.N.H. "Rosebud" 8.

HORIZON: Probably Monroe Creek formation, possibly Harrison formation, early Miocene.

DISCUSSION: Although Toohey (1959) did not mention *Nimravus sectator* in his review of *Nimravus*, it is quite possible that this species is synonymous with *N. brachyops* Cope (1879b). Without additional material, I think that the designation of this species should not be changed.

EKGMOITEPTECELA,[1] NEW GENUS

GENOTYPIC SPECIES: *Ekgmoiteptecela olsontau*, new species.

GEOLOGIC RANGE: Early Miocene.

DIAGNOSIS: Small, short-faced cat with dentition like that of *Eusmilus* Gervais, 1875.

DISCUSSION: Three small, cobby-faced cats are now recorded from the early Miocene of western North America: *Hoplophoneus cerebralis* (Cope, 1880) from the John Day of Oregon; *H. belli* Stock (1933) from Las Posas Hills, California; and *Ekgmoiteptecela olsontau*, new species, which is described below, from the Wounded Knee-Sharps fauna. The two species from the West Coast were placed in *Eusmilus* by Toohey (1959, p. 78). As these two species are based on crania without lower dentitions, they cannot be compared with the new species from South Dakota. I believe that additional material will show that these three species are congeneric and should be differentiated from *Eusmilus*.

Ekgmoiteptecela olsontau,[2] new species

Figure 30

TYPE: S.D.S.M. No. 54247, right ramus, with P_4–M_1.

TYPE LOCALITY: S.D.S.M. V549.

HORIZON: Rockyford member of the Sharps formation, early Miocene.

[1] *Ekgmo*, cat, and *ite*, face, and *ptecela*, short, in Sioux, literally, "short-faced cat." Pronounced Igg-uh-moo Eé-tay P'tay-chay-lah.

[2] For Mr. and Mrs. Walter W. Olson, Buhl, Idaho; *-tau* is the Sioux possessive suffix.

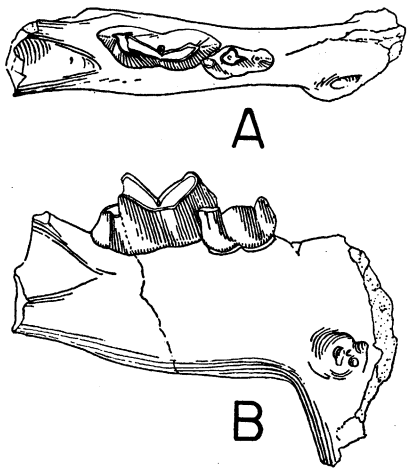


FIG. 30. *Ekgmoiteptecela olsontau*, new species. Type, right ramus, with P_4–M_1. A. Crown view. B. Labial view. Both ×1.

DIAGNOSIS: Small machairodont, short-faced, teeth laterally compressed, and M_1 with very minute talonid.

DESCRIPTION: P_4 having tall major cusp and subequal anterior and posterior cusps (protoconid, paraconid, and metaconid of Sinclair and Jepsen, 1927); cusps in straight line; tooth laterally compressed, lateral walls tapering, narrow anteriorly, widening to greatest transverse diameter below anterior edge of posterior cusp; posterior cusp overlapping M_1 labially. M_1 having paraconid subequal to protoconid; tip of protoconid broken; metaconid, if present, broken away; posterior end of protoconid narrowing abruptly to thin vertical ridge possibly indicating presence of metaconid; small talonid at base of posterior blade of tooth. Ramus very short. Ventral flange for upper canine apparently relatively large. Large mental foramen just anterior to posterior border of flange. Coronoid fossa deep, terminating just below talonid of M_1.

MEASUREMENTS OF TYPE: Length of P_4, 8.7 mm.; width of P_4, 3.7 mm.; length of M_1, 16.4 mm.; width of M_1, 5.6 mm.

DISCUSSION: With three widely separated species of a short-faced machairodont known from essentially contemporaneous beds in the western United States, the origin of these forms is somewhat of a problem. The dentition is similar to that of *Eusmilus*, which is known from two species in the middle and late Oligocene of the White River Badlands. *Eu-*

TABLE 24

MEASUREMENTS (IN MILLIMETERS) OF P_2–M_3 OF *Miohippus equinanus* AND *Miohippus* NEAR *equinanus*

Miohippus equinanus	
A.M.N.H. No. 12916	64.8
A.M.N.H. No. 12917e	67.9
A.M.N.H. No. 12919	67.7
Miohippus near *equinanus*	
S.D.S.M. No. 53391 (left)	70.9
S.D.S.M. No. 53391 (right)	71.5

smilus dakotensis Hatcher (1895) is known from the lower part of the Brule formation, and *E. sicarius* Sinclair and Jepsen (1927) comes from the upper part of the Brule formation. Both are large species and seem to be unlikely ancestors. There is a good probability that *Ekgmoiteptecela* arose from an unknown North American Oligocene form, or that it is a very late Oligocene or early Miocene immigrant.

PERISSODACTYLA OWEN, 1894

EQUIDAE GRAY, 1821

MIOHIPPUS MARSH, 1874

Miohippus MARSH, 1874, p. 249.

Miohippus equinanus Osborn, 1918

Miohippus equinanus OSBORN, 1918, pp. 65–66, fig. 45, pl. 3, fig. 6.

TYPE: A.M.N.H. No. 12912, partial palate, with P^1–M^3.

TYPE LOCALITY: A.M.N.H. "Rosebud" 1.

HORIZON: Harrison formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Harrison fauna, as listed below:

A.M.N.H. LOCALITY NUMBERS	A.M.N.H. SPECIMEN NUMBERS
"Rosebud" 7	12916, pair of mandibles, with I_1–M_3
"Rosebud" 7	12917c, maxillary fragment, with dP^{1-4}
"Rosebud" 7	12917d, maxillary fragment, with dP^{2-4}, P^1, and M^1
"Rosebud" 7	12917e, mandible, with P_2–M_3
"Rosebud" 7	12919, mandible, with P_2–M_3

From the Wounded Knee-Monroe Creek or Harrison fauna:

A.M.N.H. LOCALITY NUMBERS	A.M.N.H. SPECIMEN NUMBERS
"Rosebud" 30	12913, mandible, with P_1–M_1
"Rosebud" 31	12914, maxillary fragment with P^2–M^1
"Rosebud" 31	12920, fragment of jaw, with P_3–M_3, fragments of feet

Miohippus near equinanus

Miohippus equinanus OSBORN, 1918, p. 65.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5350	55142, fragment of mandible, with M_{2-3}
V5354	53391, pair of mandibles, with P_1–M_3
V5360	54294, fragment of mandible, with dP_{1-3}
V5360	5689, fragment of maxillary, with two teeth

DISCUSSION: These specimens are close to the suite of specimens that Osborn (1918, pp. 65–66) described as *Miohippus equinanus*. The pair of jaws from the Sharps formation (S.D.S.M. No. 53391) has slightly longer tooth rows than the three more complete specimens in the American Museum collection (A.M.N.H. Nos. 12916, 12917e, and 12919). Beyond this slight difference in size, there is little that can be used to distinguish among these specimens.

Miohippus cf. gemmarosae

Miohippus gemmarosae OSBORN, 1918, pp. 66–68, fig. 47, pl. 44, figs. 1, 3, 4.

REFERRED SPECIMENS: From the Wounded Knee-Harrison fauna, as listed below:

A.M.N.H. LOCALITY NUMBERS	A.M.N.H. SPECIMEN NUMBERS
"Rosebud" 7	12917a, maxillary fragment, with dP^{2-4}
"Rosebud" 7	12917c, maxillary fragment, with dP^{1-4}
"Rosebud" 10	12928, fragment of mandible, with P_2–M_3

DISCUSSION: The above specimens are labeled as paratypes in Osborn's (1918, fig.

47) description of *Miohippus gemmarosae*. The type of this species is a maxillary (A.M.N.H. No. 13808) from the "Lower Rosebud" on Bear-in-the-Lodge Creek between the towns of Potato Creek and Wanblee, South Dakota. A.M.N.H. "Rosebud" 7 and 10 are at least 32 miles from the type locality. Although the mandible (A.M.N.H. No. 12928) matches the type in size, I do not believe that this material can be referred to *M. gemmarosae* with any degree of confidence.

Miohippus equiceps (Cope), 1879

Anchitherium equiceps COPE, 1879b, p. 73.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. Locality Numbers	S.D.S.M. Specimen Numbers
V5347	55152, fragment of mandible, with P_3–M_3
V5350	53390, fragment of mandible, with dP_{3-4}, M_1
V5351	53393, fragment of mandible, with P_3–M_3
V5358	53394, fragment of mandible, with P_3–M_1
V5359	54121, fragment of maxillary, with dP^{2-4}
V5360	54293, fragment of mandible with P_4–M_3
V5362	5696, isolated M_3
V541	54287, skull; 54337, isolated upper cheek tooth

DISCUSSION: The skull (S.D.S.M. No. 54287) from the middle of the Sharps formation has a complete and unworn dentition. Unfortunately, most of the top and sides of the cranium are either missing or badly crushed. A comparison of this specimen with most of the types of the described species of *Miohippus* suggests that it is referable to *M. equiceps* (Cope) from the John Day beds in Oregon.

The type of *Miohippus equiceps* (Cope, 1879b) is a skull (A.M.N.H. No. 7261) with moderately worn dentition. I believe that *M. brachylophus* (Cope, 1879b) and *M. acutidens* Sinclair (1905), both from the John Day beds, are also synonyms of *M. equiceps*. The differences among these three John Day species seem to be minor variations that could appear in a single population. These species were separated on the basis of variations in the size of the cingula and the presence or absence of minor tubercles between the protocones and hypocones. Table 25 lists these variations and indicates their presence or absence in the critical specimens.

The remains of horses are very rare in the Wounded Knee faunas, and most of the material from the Wounded Knee-Sharps fauna is poor. Specimens referable to *Miohippus equiceps* have all been found in the upper half of the formation. It is significant that the "common" horse from the Sharps formation is referable to a species from the John Day beds of Oregon.

TABLE 25

COMPARISON OF "CRITICAL" DENTAL CHARACTERISTICS IN THREE "SPECIES" OF *Miohippus*

	M. equiceps		*M. brachylophus*		*M. acutidens*
	A.M.N.H. No. 7261, Type	S.D.S.M. No. 54287	A.M.N.H. No. 7260, Type	A.M.N.H. No. 7262	U.C.M.P. No. 376, Type
Tubercule between protocone and hypocone	Yes	Yes	No	Yes	Yes
Cingulum around base of protocone	Yes	Faint	No	No	No
P^2 with cingulum around lingual face of protocone and hypocone	Yes	Yes	—	No	No
Large, triangular hypostyle	Yes	Yes	Yes	Yes	Yes
Strong external cingulum	Yes	Yes	Yes	Yes	Yes
Prominent ribs	Yes	Medium	Yes	Yes	Yes
Metaloph connects high to ectoloph	Yes	Yes	No	Yes	Yes

TABLE 26

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF *Miohippus equiceps*

	M. equiceps				*"M. brachylophus"*		
	A.M.N.H. No. 7261, Type		S.D.S.M. No. 54287		A.M.N.H. No. 7260,	A.M.N.H. No. 7262	
	Right	Left	Right	Left	Type	Right	Left
P^1–M^3	—	90.4	93.8	—	—	—	90.0
P^1–P^4	—	51.0	53.1	52.8	—	—	50.4
P^2–P^4	—	40.0	44.7	44.5	—	40.9	41.5
M^1–M^3	—	40.3	45.7	—	—	41.7	42.5
P^1							
Length	9.6	11.0	10.2	10.3	—	—	11.1
Width	6.4	—	7.8	7.5	—	—	7.0
P^2							
Length	15.7	15.2	15.8	15.6	—	14.8	14.9
Width	14.7	14.4	16.0	15.8	—	14.8	14.4
P^3							
Lenth	14.6	14.0	15.5	15.5	—	13.7	13.8
Widtgh	16.0	16.0	17.7	17.9	—	—	15.5
P^4							
Length	13.8	14.0	14.6	14.8	14.8	14.9	13.9
Width	—	16.6	18.4	18.3	16.0	16.5	16.4
M^1							
Length	14.5	13.5	15.7	15.7	—	13.5	13.8
Width	16.5	—	17.2	17.7	—	16.3	16.0
M^2							
Length	13.6	16.9	16.0	17.0	—	14.0	14.0
Width	17.0	—	19.7	19.4	—	17.0	16.7
M^3							
Length	13.4	17.2	15.0	15.8	—	15.4	15.0
Width	16.7	—	17.8	18.0	—	17.3	17.2
P_2–M_3	—	89.2	88.3	89.9	—	—	—
P_2–P_4	—	43.9	41.8	42.0	—	—	—
M_1–M_3	—	45.7	46.3	48.5	—	—	—

PARAHIPPUS LEIDY, 1858

Parahippus LEIDY, 1858, p. 26.

Parahippus pristinus Osborn, 1918

Parahippus pristinus OSBORN, 1918, pp. 76–77, fig. 52, pl. 6, fig. 5, pl. 7, fig. 9, pl. 25, fig. 1, pl. 36, fig. 1.

TYPE: A.M.N.H. No. 12918, partial skull.

TYPE LOCALITY: A.M.N.H. "Rosebud" 7.

HORIZON: Harrison formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Harrison fauna, all from A.M.N.H. "Rosebud" 7: A.M.N.H. No. 12915, palate, with P^1–M^1; A.M.N.H. No. 12921, palate, with I^1–M^2 (badly worn); A.M.N.H. No. 12923, forefeet and hind feet.

From the Wounded Knee-Monroe Creek or Harrison fauna, from A.M.N.H. "Rosebud" 32, A.M.N.H. No. 12922, hind feet.

Parahippus coloradensis praecurrens Osborn, 1918

Parahippus coloradensis praecurrens OSBORN, 1918, pp. 13, 74, 75, 83, fig. 58, pl. 8, fig. 1, pl. 9, fig. 1, pl. 35, figs. 2, 3.

TYPE: A.M.N.H. No. 13018, maxillary, with P^2–M^3 and hind foot.

TYPE LOCALITY: A.M.N.H. "Rosebud" 16.

HORIZON: Probably Harrison formation, early Miocene.

REFERRED SPECIMEN: From the Wounded Knee-Rosebud fauna, A.M.N.H. No. 12925, fragment of mandible, with P_{1-4}, and parts of skeleton, from A.M.N.H. "Rosebud" 17.

DISCUSSION: This situation is another in which the paratype and the type are recorded

from different localities and different levels. The type probably came from the Harrison formation and the paratype from the Rosebud formation. These localities are presumably about 3 miles apart, if their designations are correct. If the measurement of distance from various landmarks was very crude, it is possible that these localities may be identical. There is no indication of such a possibility in the 1906 field notes, so the localities must be assumed to be separate.

Parahippus texanus Leidy, 1868

Parahippus texanus LEIDY, 1868, p. 231. OSBORN, 1918, p. 84, pl. 8, fig. 3, pl. 9, fig. 10.

REFERRED SPECIMEN: From the Wounded Knee-Rosebud fauna, A.M.N.H. No. 12924, partial skull, from A.M.N.H. "Rosebud" 17.

DISCUSSION: Osborn (1918, p. 84) referred this specimen to *P. texanus* Leidy. It should be noted that he indicated (*ibid.*, p. 79) that, in 1913, Matthew referred this material to *Parahippus nebrascensis* Peterson. I can find no citation to this specimen in Matthew's short paper on the "Evolution of the Horse" which was published in 1913.

HYRACODONTIDAE Cope, 1879

HYRACODON Leidy, 1856

Hyracodon LEIDY, 1856b, p. 91.

Hyracodon apertus Sinclair, 1922

Hyracodon apertus SINCLAIR, 1922, p. 73.
?Hyracodon apertus Sinclair GREEN, 1958, pp. 587–588, fig. 1.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. 54141, partial skull, with complete dentition, from S.D.S.M. V545.

DISCUSSION: Green (1958, pp. 587–588, fig. 1) described and figured this specimen. The locality is in an extensive basin of badlands at the headwaters of the West Fork of Grass Creek which is the next drainage west of Wounded Knee Creek. Most of the exposures in these badlands are in the upper part of the Brule formation, but a thick rim of Sharps formation surrounds most of the basin. Although the lithology of the two formations is similar in this area, and the basal Rockyford member of the Sharps formation is quite thick, there is no reason to doubt that this specimen was found in the lower portion of the Sharps formation.

?Hydracodon, species indeterminate

Cf. *Hyracodon,* GREEN, 1958, p. 588.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 54183, partial mandible, with broken P_4–M_3, from S.D.S.M. V549.

DISCUSSION: S.D.S.M. V549 is in a thick section of the Rockyford member of the Sharps formation. The specimen is either contemporaneous with, or very slightly younger than, the skull of *Hyracodon apertus* Sinclair from the Grass Creek locality, S.D.S.M. V545.

RHINOCEROTIDAE Owen, 1845

DICERATHERIUM Marsh, 1875

Diceratherium MARSH, 1875, p. 242.

Diceratherium gregorii Peterson, 1920

Diceratherium gregorii PETERSON, 1920, pp. 402, 421, fig. 12, pl. 59. GREEN, 1958, pp. 588–590, figs. 2–6.
Metacaenopus gregorii (Peterson) TROXELL, 1921, p. 208.

TYPE: A.M.N.H. No. 12933, skull.

TYPE LOCALITY: A.M.N.H. "Rosebud" 21.

HORIZON: Probably Rosebud formation, middle Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. Locality Numbers	S.D.S.M. Specimen Numbers
V5354	54339, fragment of maxillary, with P^2–M^1
V542	54165, isolated M^2
V542	54188, fragment of mandible, with roots of P_{2-4} and worn M_{1-2}
V542	54198, fragment of mandible, with unerupted M_1
V543	54144, partial skull

DISCUSSION: Green (1958, pp. 588–560) discussed this suite of specimens and was satisfied that they were referable to the Wounded Knee-Rosebud species. The lowest stratigraphic occurrence of these specimens is at S.D.S.M. V542 in the lower half of the Sharps formation, which gives *Diceratherium gregorii* a range that extends throughout most of the

early Miocene and into the earliest part of the middle Miocene.

Diceratherium cf. gregorii

Diceratherium gregorii PETERSON, 1920, p. 402.
Diceratherium ?gregorii GREEN, 1958, pp. 590–591.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna: S.D.S.M. No. 53418, fragment of maxillary, with P^1 and dP^{2-3}, from S.D.S.M. V5358; S.D.S.M. No. 53419, fragment of mandible, with dP_{2-3}, from S.D.S.M. V5360.

DISCUSSION: Green (1958, pp. 590–591) questionably referred these specimens to *D. gregorii* Peterson (1920), as they were not referable to *D. cooki* Peterson (1906b). Although there is some resemblance to *D. annectens* (Marsh, 1873), there is no other evidence of that John Day species in the collection.

Diceratherium armatum Marsh, 1875

Diceratherium armatum MARSH, 1875, p. 242. GREEN, 1958, pp. 591–593, figs. 7–9.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna: S.D.S.M. No. 53584, fragmentary skull, from S.D.S.M. V5350; S.D.S.M. No. 54150, isolated M_2, from S.D.S.M. V543.

DISCUSSION: These specimens are from the middle part of the Sharps formation and from its very top near the contact with the Monroe Creek formation. The occurrence of this species in these beds is still another tie with the John Day fauna of Oregon. As sound stratigraphic data of the John Day collection are yet to be published, precise correlations with the elements of that fauna cannot be made.

ARTIODACTYLA OWEN, 1848

LEPTOCHOERIDAE MARSH, 1894

LEPTOCHOERUS LEIDY, 1856

Leptochoerus LEIDY, 1856a, p. 88.

Leptochoerus, species indeterminate

Leptochoerus sp. MACDONALD, 1957b, p. 673.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 56101, fragment of ramus, with $?M_2$, from S.D.S.M. V5354.

DISCUSSION: This specimen extends the known range of *Leptochoerus* into the early Miocene.

AGRIOCHOERIDAE LEIDY, 1869

AGRIOCHOERUS LEIDY, 1850

Agriochoerus LEIDY, 1850, p. 121.

Agriochoerus, species indeterminate

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 54161, maxillary fragments and lower jaws, from S.D.S.M. V542.

DESCRIPTION AND DISCUSSION: These fragments represent a medium-sized species of *Agriochoerus*. In common with several other species, it has a well-developed, triangular hypocone on P^4, with a cingulum extending from the posterior edge of the protocone across the posterior face of the hypocone. A similar situation is found in the smaller *A. antiquus* Leidy (1850) from the lower Brule formation, and in some specimens of *A. guyotanius* Cope (1879b) and *A. ferox* (Cope, 1879c) from the John Day beds. *Agriochoerus latifrons* Leidy (1869) also has the well-developed hypocone, but the cingulum completely surrounds the protocone.

MEASUREMENTS OF S.D.S.M. No. 54161: P^4–M^3, 53.5 mm.; M^1–M^3, 48.3 mm.; P_4–M_3, 61.0 mm.; M_1–M_3, 48.5 mm.

MERYCOIDODONTIDAE THORPE, 1923

MESOREODON SCOTT, 1893

Mesoreodon SCOTT, 1893, p. 661.

Mesoreodon megalodon cf. sweeti

Mesoreodon megalodon sweeti SCHULTZ AND FALKENBACH, 1949, p. 147.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, S.D.S.M. No. 54220, partial cranium, with canine, dP^{3-4}, and M^{1-2}, from S.D.S.M. V5358.

DISCUSSION: This specimen was identified by Charles Falkenbach of the Frick Laboratory. Because of the immaturity of the individual represented by this specimen, a positive identification was not possible.

PHENACOCOELUS PETERSON, 1906

Phenacocoelus PETERSON, 1906a, p. 29.

Phenacocoelus stouti Schultz and Falkenbach, 1950

Phenacocoelus stouti SCHULTZ AND FALKENBACH, 1950, p. 111.

REFERRED SPECIMEN: From the Wounded Knee-Rosebud fauna, A.M.N.H. No. 12969, cranium, from A.M.N.H. "Rosebud" 17.

PROMERYCOCHOERUS DOUGLASS, 1901

Promerycochoerus DOUGLASS, 1901a, p. 82.

Promerycochoerus carrikeri Peterson, 1906

Promerycochoerus carrikeri PETERSON, 1906a, p. 24. SCHULTZ AND FALKENBACH, 1949, pp. 101–102.

REFERRED SPECIMENS: From the Wounded Knee-Harrison fauna: A.M.N.H. No. 12951, cranium, from A.M.N.H. "Rosebud" 7; A.M.N.H. No. 12966, mandible, from A.M.N.H. "Rosebud" 15.

Promerycochoerus barbouri Schultz and Falkenbach, 1949

Promerycocheerus (*Parapromerycochoerus*) *barbouri* SCHULTZ AND FALKENBACH, 1949, p. 118.

REFERRED SPECIMENS: From the Wounded Knee-Harrison fauna: A.M.N.H. No. 12950, cranium, from A.M.N.H. "Rosebud" 7; A.M.N.H. No. 12965, partial skull, from A.M.N.H. "Rosebud" 15.

Promerycochoerus minor pygmyus Loomis, 1924

Promerycochoerus pygmyus LOOMIS, 1924, p. 27, fig. 13.

Promerycochoerus vantasselensis pygmyus (Loomis) THORPE, 1937, p. 150, fig. 111, pl. 20, figs. 2, 3.

Promerycochoerus (*Pseudopromerycochoerus*) *minor pygmyus* (Loomis) SCHULTZ AND FALKENBACH, 1949, pp. 124–126, figs. 8–10.

TYPE: A.M.N.H. No. 12967, cranium.

TYPE LOCALITY: A.M.N.H. "Rosebud" 20.

HORIZON: Harrison formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee faunas: A.M.N.H. No. 12968, partial skull and skeleton, Harrison formation, from A.M.N.H. "Rosebud" 21; A.M.N.H. No. 12971, skull, Harrison or Rosebud formation, from A.M.N.H. "Rosebud" 23.

Promerycochoerus (Pseudopromerycochoerus) montanus pinensis Schultz and Falkenbach, 1949

Promerycochoerus sp. GREGORY, 1920, p. 189, fig. 159.

Promerycochoerus thomsoni ("female" example only) LOOMIS, 1924, p. 22, figs. 9, 11. THORPE, 1937, p. 145, fig. 107, pl. 19, fig. 2, pl. 20, fig. 1.

Hypselochoerus gregoryi (referred) LOOMIS, 1933, p. 729, fig. 9.

Promerycochoerus (*Pseudopromerycochoerus*) *montanus pinensis* SCHULTZ AND FALKENBACH, 1949, pp. 128–130, figs. 6, 8–12.

TYPE: A.M.N.H. No. 12948, skull.

TYPE LOCALITY: A.M.N.H. "Rosebud" 7.

HORIZON: Harrison formation, early Miocene.

DESMATOCHOERUS THORPE, 1921

Desmatochoerus THORPE, 1921a, p. 241.

Desmatochoerus curvidens gregoryi (Loomis), 1924

Promerycochoerus gregoryi LOOMIS, 1924, p. 23, fig. 12. THORPE, 1937, p. 119, fig. 79, pl. 12.

Hypselochoerus gregoryi (Loomis) LOOMIS, 1933, p. 728.

Desmatochoerus curvidens gregoryi (Loomis) SCHULTZ AND FALKENBACH, 1954, pp. 183–185, figs. 4–7.

TYPE: A.M.N.H. No. 12964, skull.

TABLE 27

REFERRED SPECIMENS OF *Promerycochoerus* (*Pseudopromerycochoerus*) *montanus pinensis* FROM THE WOUNDED KNEE FAUNAS

Specimens	Formations	Localities
A.M.N.H. No. 12940, cranium	Harrison	A.M.N.H. "Rosebud" 1
A.M.N.H. No. 12943, partial cranium	Harrison	A.M.N.H. "Rosebud" 2
A.M.N.H. No. 12945, cranium	Harrison	A.M.N.H. "Rosebud" 3
A.M.N.H. No. 12956, partial skull	Harrison	A.M.N.H. "Rosebud" 12
A.M.N.H. No. 12958, partial mandible	Harrison	A.M.N.H. "Rosebud" 15
A.M.N.H. No. 12959, skull	Harrison	A.M.N.H. "Rosebud" 15
A.M.N.H. No. 12963, partial skull	Harrison	A.M.N.H. "Rosebud" 15
A.C.M. No. 1931–109, cranium	Harrison	A.C.M. "Rosebud" 4
F:A.M. No. 37228, partial mandible	Harrison	F:A.M. "Rosebud" 2
A.M.N.H. No. 12954, partial mandible	?Monroe Creek	A.M.N.H. "Rosebud" 8
A.M.N.H. No. 12955, skull and partial skeleton	?Monroe Creek	A.M.N.H. "Rosebud" 8

TYPE LOCALITY: A.M.N.H. "Rosebud" 15.

HORIZON: Harrison formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Harrison fauna: A.M.N.H. No. 12941, partial skull, from A.M.N.H. "Rosebud" 1; A.M.N.H. No. 12949, skeleton, from A.M.N.H. "Rosebud" 7.

Desmatochoerus hatcheri geringensis Schultz and Falkenbach, 1954

Desmatochoerus hatcheri geringensis SCHULTZ AND FALKENBACH, 1954, p. 189.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna: F:A.M. No. 49632, partial cranium, with I^2–M^3 and partial scapula, radius, vertebrae, and associated fragments, and F:A.M. No. 49633, partial ramus, with P_3–M_3; both from F:A.M. "Rosebud" 1.

Desmatochoerus (Paradesmatochoerus) wyomingensis Schultz and Falkenbach, 1954

Desmatochoerus (Paradesmatochoerus) wyomingensis SCHULTZ AND FALKENBACH, 1954, p. 202.

REFERRED SPECIMEN: From the Wounded Knee-Sharps fauna, F:A.M. No. 49638, partial cranium, from F:A.M. "Rosebud" 1.

MERYCOCHOERUS LEIDY, 1858

Merycochoerus LEIDY, 1858, p. 24.

Merycochoerus matthewi Loomis, 1924

Merycochoerus matthewi LOOMIS, 1924, p. 27, figs. 14–15. THORPE, 1937, p. 156, pl. 23, figs. 4–6. SCHULTZ AND FALKENBACH, 1940, pp. 289–290, figs. 12, 15, 17, 18.

TYPE: A.M.N.H. No. 12970, skull and partial skeleton.

TYPE LOCALITY: A.M.N.H. "Rosebud" 18.

HORIZON: Rosebud formation, middle Miocene.

MERYCHYUS LEIDY, 1858

Merychyus LEIDY, 1858, p. 25.

Merychyus minimus Peterson, 1906

Merychyus minimus PETERSON, 1906a, p. 67. SCHULTZ AND FALKENBACH, 1947, pp. 221–222. THORPE, 1937, p. 225, fig. 164, pl. 32, figs. 9–10.
Merychyus delicatus LOOMIS, 1924, p. 33, fig. 22.

REFERRED SPECIMENS: From the Wounded Knee-Rosebud fauna, as listed below:

A.M.N.H. LOCALITY NUMBERS	A.M.N.H. SPECIMEN NUMBERS
"Rosebud" 5	12975, partial skull
"Rosebud" 5	27854, parts of three individuals
"Rosebud" 5	27855, parts of two individuals
"Rosebud" 5	27857, partial mandible
"Rosebud" 5	27858, mandible
"Rosebud" 5	27862, partial skull
"Rosebud" 17	12980, partial skeleton, type of *M. delicatus*
"Rosebud" 26	27863, parts of three individuals
"Rosebud" 27	27860, partial cranium
"Rosebud" 28	27856, partial skull
"Rosebud" 28	27859, partial skull

CYCLOPIDIUS COPE, 1878

Cyclopidius COPE, 1878, p. 221.

Cyclopidius schucherti Thorpe, 1921

Cyclopidius schucherti THORPE, 1921b, pp. 415–418, figs. 4–6; 1937, pp. 256–258, figs. 183–185.

TYPE: Y.P.M. No. 10123, cranium.

TYPE LOCALITY: "Near Hermosa, South Dakota" (Thorpe, 1937, p. 256).

HORIZON: "Middle Miocene (Sheep Creek)" (Thorpe, 1937, p. 256).

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5348	53437, partial cranium, with dP^{2-4}, M^{1-2}
V5354	53524, palate, with C–M^3
V5354	54222, crushed cranium, with P^3–M^3
V541	54218, partial skull, with P^2_2–M^3_3
V572	5772, palate, with P^2–M^3

DISCUSSION: The type of this species was collected in 1894 by H. F. Wells. At that time Hermosa, South Dakota, was a shipping point, and many of the specimens collected in the White River Badlands during the late 1800's were given a locality designation of "Hermosa, South Dakota" (see Macdonald, 1956, p. 634, footnote). Quite possibly the type specimen was collected from the Sharps formation in an outlier between Hermosa and the White River or even south of the White River in the area between Clay Creek and Porcupine Creek. No beds that are either lithologically or temporally equivalent to the Sheep Creek formation are known in western South Dakota.

TABLE 28

MEASUREMENTS (IN MILLIMETERS) OF THE UPPER TEETH OF *Cyclopidius schucherti*

	C–M^3	M^{1-3}	P^{1-4}	Length of M^3
Y.P.M. No. 10123[a]	53.0	28.5	20.0	11.2
S.D.S.M. No. 53524	54.0	31.0	20.5	12.5
S.D.S.M. No. 5772	54.5	28.5	22.5	13.5
S.D.S.M. No. 54222	—	28.6	—	12.5
S.D.S.M. No. 54218	—	27.0	—	—

[a] From Thorpe (1921b).

Cyclopidius simus Cope, 1878

Cyclopidius simus COPE, 1878, p. 221.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna: S.D.S.M. No. 54232, palate, with C–M^3, from S.D.S.M. No. V5361; S.D.S.M. No. 54217, cranium, with P^3–M^3, from S.D.S.M. V541; S.D.S.M. No. 54345, skull, with P^1–M^3 and P_2–M_3, from S.D.S.M. V541.

DISCUSSION: Schlaikjer (1935, pp. 165–168), in reviewing the species of *Leptauchenia* and *Cyclopidius* of the Goshen Hole, Wyoming, area, suggested that *Cyclopidius emydinus* Cope (1884b) was a synonym of *C. simus*. Although Thorpe (1937, pp. 249–250, 252–254), in his review of the Merycoidodontidae, separates these two species, he suggested that they were probably synonyms.

At the present time these genera are being reviewed by Schultz. The available specimens from the Wounded Knee-Sharps fauna seem to fit into the size range given for *C. simus-emydinus* by both Thorpe and Schlaikjer. For this reason I refer these specimens to *C. simus*, although possibly the Schultz and Falkenbach review will indicate that some or all of these specimens are unique.

TAYASSUIDAE PALMER, 1897

DESMATHYUS MATTHEW, 1907

Desmathyus MATTHEW, 1907, p. 217.

Desmathyus pinensis Matthew, 1907

Desmathyus pinensis MATTHEW, 1907, pp. 217–218.

TYPE: A.M.N.H. No. 12936, skull.

TYPE LOCALITY: A.M.N.H. "Rosebud" 16.

HORIZON: Harrison formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee fauna: A.M.N.H. No. 12937, partial skull, Harrison formation, from A.M.N.H. "Rosebud" 16; A.M.N.H. 12938, partial skull, Rosebud formation, from A.M.N.H. "Rosebud" 17; A.M.N.H. No. 12939, partial skull, Rosebud formation, from A.M.N.H. "Rosebud" 17.

DISCUSSION: Matthew (1907, p. 217) states: "Two other skulls, one with lower jaws complete, the other with lower teeth only, and a lower jaw with fragments of the skull are referred to the species. All are from the same horizon and locality." The 1906 field notes (Matthew and Thomson, MS) show that the specimens from A.M.N.H. "Rosebud" 16 were collected by Matthew on July 24, while the specimens from A.M.N.H. "Rosebud" 17 were collected by Thomson on July 31 and August 1. The localities as described in the notes are at least 2 miles apart. No specimens were collected by Matthew after July 24, and, according to Thomson's report (Thomson, MS), Matthew returned to New York on July 26. While it is possible that all these specimens came from the same level, the evidence indicates that the type came from the Harrison formation and the later pair from the Rosebud formation.

ANTHRACOTHERIIDAE GILL, 1872

ARRETOTHERIUM DOUGLASS, 1901

Arretotherium DOUGLASS, 1901b, p. 269.

Arretotherium leptodus (Matthew), 1909

Ancodon (?=*Bothriodon*) *leptodus* MATTHEW, 1909a, pp. 1–7.

Ancodon leptodus Matthew (*nomen vanum*) MACDONALD, 1956, p. 616.

TABLE 29

MEASUREMENTS (IN MILLIMETERS) OF *Cyclopidius simus* AND *Cyclopidius emydinus*

	C. simus[a]	*C. simus*[b]	*C. emydinus*[b]	S.D.S.M. No. 54232	S.D.S.M. No. 54217	S.D.S.M. No. 54345
Bizygomatic width	—	85.0	93.0	—	—	88.0
Postorbital constriction	—	21.0	25.0	—	—	19.8
Brain-case width	—	37.0	44.0	—	—	41.2
Width between middle of orbits	—	44.0	49.0	—	—	42.6
Length of orbits	—	20.0	23.0	—	—	21.4
Malar, depth below orbits	—	23.0	24.0	—	—	18.8
Length of bulla	—	23.0	25.0	—	25.2	—
Palate, width at P^1	—	20.0	18.0	20.2	—	—
Palate, width at M^3	—	28.0	28.5	28.5	—	—
C–M^3	—	62.0	65.0	61.4	—	66.5
M^{1-3}	33.5–35.5	33.0	34.3	34.4	36.5	36.4
P^{1-4}	24.0–25.0	25.0	25.4	28.5	—	27.0
M^3, length	—	14.6	15.0	14.5	16.5	16.8
P_{1-4}	—	—	—	—	—	24.8
P_1–M_3	—	—	—	—	—	65.2
M_{1-3}	—	—	—	—	—	41.0

[a] From Schlaikjer (1935).
[b] From Thorpe (1937).

TYPE: A.M.N.H. No. 13005, skull and partial skeleton.

TYPE LOCALITY: A.M.N.H. "Rosebud" 20.

HORIZON: Harrison formation, early Miocene.

EMENDED DIAGNOSIS: Upper molars with reduced mesostyle, transverse groove not prominent labially, short diastema between upper canine and P^1, canine moderately compressed.

DISCUSSION: In my review of the North American anthracotheres (Macdonald, 1956, p. 616), I stated that this species was a *nomen vanum* owing to the heavy wear on the molars of the type specimen. Time has not improved this specimen, although it may have improved the perspicacity of the writer.

This species is herein referred to *Arretotherium* on the basis of its temporal position, the general aspect of the badly distorted and partially destroyed cranium, the modest diastema between the upper canine and P^1, and the lateral compression of the upper canine. Because of the excessive wear on the upper molars, the presence or absence of the protoconule cannot be determined. As the absence of the protoconule is the "key" feature in the diagnosis of *Arretotherium*, the possibility still remains that this species is referable to a different but unknown genus.

Arretotherium, species indeterminate

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna: S.D.S.M. No. 55102, isolated lower molar, from S.D.S.M. V5354; S.D.S.M. No. 54278, isolated lower molar, from S.D.S.M. V544.

DISCUSSION: These isolated teeth are referred to *Arretotherium* on the basis of the geologic horizon from which they came.

CAMELIDAE GRAY, 1821

OXYDACTYLUS PETERSON, 1904

Oxydactylus PETERSON, 1904, p. 434.

Oxydactylus cf. wyomingensis

Oxydactylus wyomingensis LOOMIS, 1936b, p. 60.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5348	53523, partial cranium, with P^3–M^3
V5362	54129, partial mandible, with P_4–M_3 and roots of P_{1-3}
V5410	5576, partial cranium, with dP^{3-4}, M^{1-2}, unerupted P^1, and roots of dP^2
V5410	55139, partial mandible, with dP_{3-4} and M_{1-2}

TABLE 30

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF THE TYPE OF *Arretotherium leptodus*, A.M.N.H. No. 13005

	Right	Left
Canine		
Length	—	12.3
Width	—	6.6
P^2		
Length	—	15.4
Width	—	10.2
P^3		
Length	18.5	—
Width	13.6	—
P^4		
Length	17.7	13.4
Width	17.1	16.8
M^1		
Length	17.8	—
Width	—	—
M^2		
Length	23.0	23.3
Width	24.2	24.5
M^3		
Length	—	25.3
Width	29.2	27.2
Diastema, C–P^1	—	24.2
P^2–M^3	—	109.7
P^3–M^3	*ca.* 95.0	94.1
P^4–M^3	*ca.* 81.0	80.6
M^1–M^3	*ca.* 67.0	66.8

DESCRIPTION AND DISCUSSION: These specimens are questionably referred to *Oxydactylus wyomingensis* (Loomis, 1936b) on the basis of size and stratigraphic position. As the type of *O. wyomingensis* is a juvenile, a comparison with the two specimens from S.D.S.M. V5410 is possible. The Wounded Knee specimens are slightly larger than the type but show the same relative width of the upper molars, the reduction in the size of the styles, and the slender and elongated rostrum.

The adult mandible (S.D.S.M. No. 54129) and the adult cranium (S.D.S.M. No. 53523) are similar in size and may represent the adults of *O. wyomingensis*. The mandible is more massive than that of the type of *O. exilis* Matthew (Matthew and Macdonald, 1960) from the Wounded Knee-Rosebud fauna, although the tooth row is a little shorter and the teeth are not so massive. The upper tooth row is much shorter than that either of *O. exilis* or of *O. lacota* Matthew (Matthew and Macdonald, 1960), and the molars are much shorter anteroposteriorly and not so massive.

TABLE 31

MEASUREMENTS (IN MILLIMETERS) OF THE TEETH OF ADULT SPECIMENS OF *Oxydactylus* cf. *wyomingensis*

	S.D.S.M. No. 53523	S.D.S.M. No. 54129
P^3–M^3	65.5	—
M^{1-3}	45.3	—
P^3		
Length	10.5	—
Width	7.3	—
P^4		
Length	10.0	—
Width	9.8	—
M^1		
Length	12.9	—
Width	13.4	—
M^2		
Length	15.4	—
Width	14.6	—
M^3		
Length	18.0	—
Width	16.5	—
P_2–M_3 (alveolar)	—	83.0

Oxydactylus exilis Matthew, 1960

Oxydactylus exilis MATTHEW, *in* Matthew and Macdonald, 1960, pp. 2–6, figs. 1–4.

TYPE: A.M.N.H. No. 12997, partial skull and limbs.

TYPE LOCALITY: A.M.N.H. "Rosebud" 5.

HORIZON: Rosebud formation, middle Miocene.

DISCUSSION: The type of this species and of *Oxydactylus lacota* Matthew were collected by the American Museum expedition of 1906. The material was originally described by Matthew in his manuscript entitled "A revision of the extinct Camelidae with a discussion of their affinities and phylogeny." In order that these names would appear in the literature prior to the publication of the present paper, Matthew's descriptions and diagnoses were published in a short note by Matthew and Macdonald (1960).

Oxydactylus lacota Matthew, 1960

Oxydactylus lacota MATTHEW, *in* Matthew and Macdonald, 1960, p. 6, fig. 5.

TYPE: A.M.N.H. No. 12999, skull and partial skeleton.

TYPE LOCALITY: A.M.N.H. "Rosebud" 5.

HORIZON: Rosebud formation, middle Miocene.

DISCUSSION: (See remarks under *Oxydactylus exilis*.)

?Oxydactylus, species indeterminate

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5362	54297, fragment of mandible, with P_3–M_1
V5363	53415, fragment of mandible, with P_4–M_3
V572	5766, fragment of mandible, with P_3–M_2

DISCUSSION: These mandibles represent adults with moderate and well-worn dentitions. They are smaller than those of the juvenile specimens (S.D.S.M. Nos. 5576, 55139) that are referred above to *Oxydactylus* cf. *wyomingensis*.

HYPERTRAGULIDAE COPE, 1879

NANOTRAGULUS LULL, 1922

Nanotragulus LULL, 1922, p. 116.

Nanotragulus ordinatus (Matthew), 1907

Hypertragulus ordinatus MATTHEW, 1907, pp. 218–219.

Nanotragulus loomisi Lull MATTHEW, 1926, p. 3.

Nanotragulus ordinatus (Matthew) FRICK, 1937, p. 641, fig. 64.

TYPE: A.M.N.H. No. 13011, left mandible, with P_2–M_3.

TYPE LOCALITY: A.M.N.H. "Rosebud" 14.

HORIZON: Harrison formation, early Miocene.

REFERRED SPECIMENS: From the Wounded Knee-Monroe Creek or Harrison fauna, as listed below:

A.M.N.H. LOCALITY NUMBERS	A.M.N.H. SPECIMEN NUMBERS
"Rosebud" 31	13013, fragment of mandible, with P_2–M_3
"Rosebud" 31	13013x, fragment of mandible, with M_{1-3}
"Rosebud" 31	13012, fragment of mandible, with dP_4–M_2

Nanotragulus intermedius Schlaikjer, 1935

Nanotragulus intermedius SCHLAIKJER, 1935, p. 178.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. LOCALITY NUMBERS	S.D.S.M. SPECIMEN NUMBERS
V5341	5582, mandible
V5347	53407, mandible
V5353	53405, mandible
V5354	53397, 53398, 53400, 53401, 53406, 53433, 53434, 54127, 54243, 55113, 56115, mandibles
V5357	54260, mandible
V5358	54270, 54285, 55127, mandibles
V5359	53404, mandible; 5358, 53408, 54280, maxillaries
V5360	54263, 55119, 5669, 5670, 5671, 5692, mandibles
V5361	55104, 55110, mandibles; 54281, maxillary
V5362	53403, mandible
V541	54323, 54329, 54336, 55123, mandibles; 54324, pair of maxillaries; 55136, mandible and maxillary
V549	54316, mandible
V5410	55138, mandible

DISCUSSION: This entire suite of specimens, although spread throughout the greater portion of the Sharps formation, can be referred to the same species. There is some variation from one specimen to another, but the general pattern is quite consistent. Three rami (S.D.S.M. Nos. 54270, 53397, and 55110) have short diastemata between P_2 and P_3. One maxillary fragment (S.D.S.M. No. 55136) shows no development of the inner cusp on P^3. There are minor variations in the size and location of the pillars between the crescents of both the upper and the lower teeth and the development of the cingula on the anterior and posterior faces of the lower molars. In spite of such variations and slight differences in size, these specimens show a unity of character that marks them as a single species.

Nanotragulus cf. **loomisi**

Nanotragulus loomisi LULL, 1922, p. 111.

REFERRED SPECIMENS: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. Locality Numbers	S.D.S.M. Specimen Numbers
V5354	53432, fragment of mandible, with M_{1-2}
V5354	54340, fragment of maxillary, with P^4–M^2
V5354	5995, fragment of maxillary, with M^{2-3}
V5354	59109, fragment of maxillary, with M^{2-3}
V5362	53402, fragment of mandible, with M_{2-3}

Discussion: The type of *N. loomisi* Lull (1922), Y.P.M. No. 10330, was collected, "at Castle Butte, Big Muddy River, near Spanish Mines, Wyo." (Lull, 1922, p. 116). Schlaikjer (1935, p. 120) considers the "Lower Harrison" beds at this locality (Spanish Diggings) to be the same as the beds at Goshen Hole, Wyoming, and the equivalent of the "Lower Rosebud."

The specimens from the Sharps formation closely approach Lull's diagnosis for *N. loomisi*. The lower molars are without accessory pillars between the outer lobes, and the cingula on the anterior faces of the lower molars are only slightly developed. The upper dentition is very similar to that of the type. It should be noted that the above specimens are distinctly smaller than the other material from the Wounded Knee-Sharps fauna that is referred to *Nanotragulus*.

LEPTOMERYX Leidy, 1853

Leptomeryx Leidy, 1853, p. 394.

Leptomeryx, species indeterminate

Referred Specimens: From the Wounded Knee-Sharps fauna, as listed below:

S.D.S.M. Locality Numbers	S.D.S.M. Specimen Numbers
V5353	53412, fragment of right ramus, with M_{1-2}
V5359	54124, fragment of left ramus, with M_{1-3}
V5359	54310, fragment of right ramus, with M_{1-2}
V5360	5666, fragment of left ramus, with P_{2-4}
V5410	55137, fragment of right ramus, with M_{2-3}

Discussion: These specimens, although too fragmentary for specific identification, are probably referable to *Leptomeryx*. The premolars are low and elongate, and M_3 has the cusp of the third lobe offset posteriorly as in the earlier species of *Leptomeryx*.

CERVIDAE Gray, 1821

BLASTOMERYX Cope, 1877

Blastomeryx Cope, 1877, p. 350.

Blastomeryx (Problastomeryx) primus Matthew, 1908

Blastomeryx primus Matthew, 1908, p. 537.
Problastomeryx primus (Matthew) Frick, 1937, p. 256.

Referred Specimen: From the Wounded Knee-Rosebud fauna, A.M.N.H. No. 13016, partial mandible, with M_{1-3}, and partial skeleton, from A.M.N.H. "Rosebud" 5.

Blastomeryx (Pseudoblastomeryx) advena Matthew, 1907

Blastomeryx advena Matthew, 1907, p. 219; 1908, p. 543, figs. 4, 6, 12, and 13.
Pseudoblastomeryx advena (Matthew) Frick, 1937, p. 258, figs. 24, 25A.

Type: A.M.N.H. No. 13014, partial mandible, with P_3–M_3.

Type Locality: A.M.N.H. "Rosebud" 29.

Horizon: Rosebud formation, middle Miocene.

Referred Specimen: From the Wounded Knee-Rosebud fauna, A.M.N.H. No. 13015, partial skull and skeleton, from A.M.N.H. "Rosebud" 16.

Blastomeryx, species indeterminate

Blastomeryx sp. Matthew, 1908, p. 536.

Referred Specimen: From the Wounded Knee-Rosebud fauna, A.M.N.H. No. 13017, pair of mandibles, with dP_3–M_1 and dP_4–M_2, from A.M.N.H. "Rosebud" 18.

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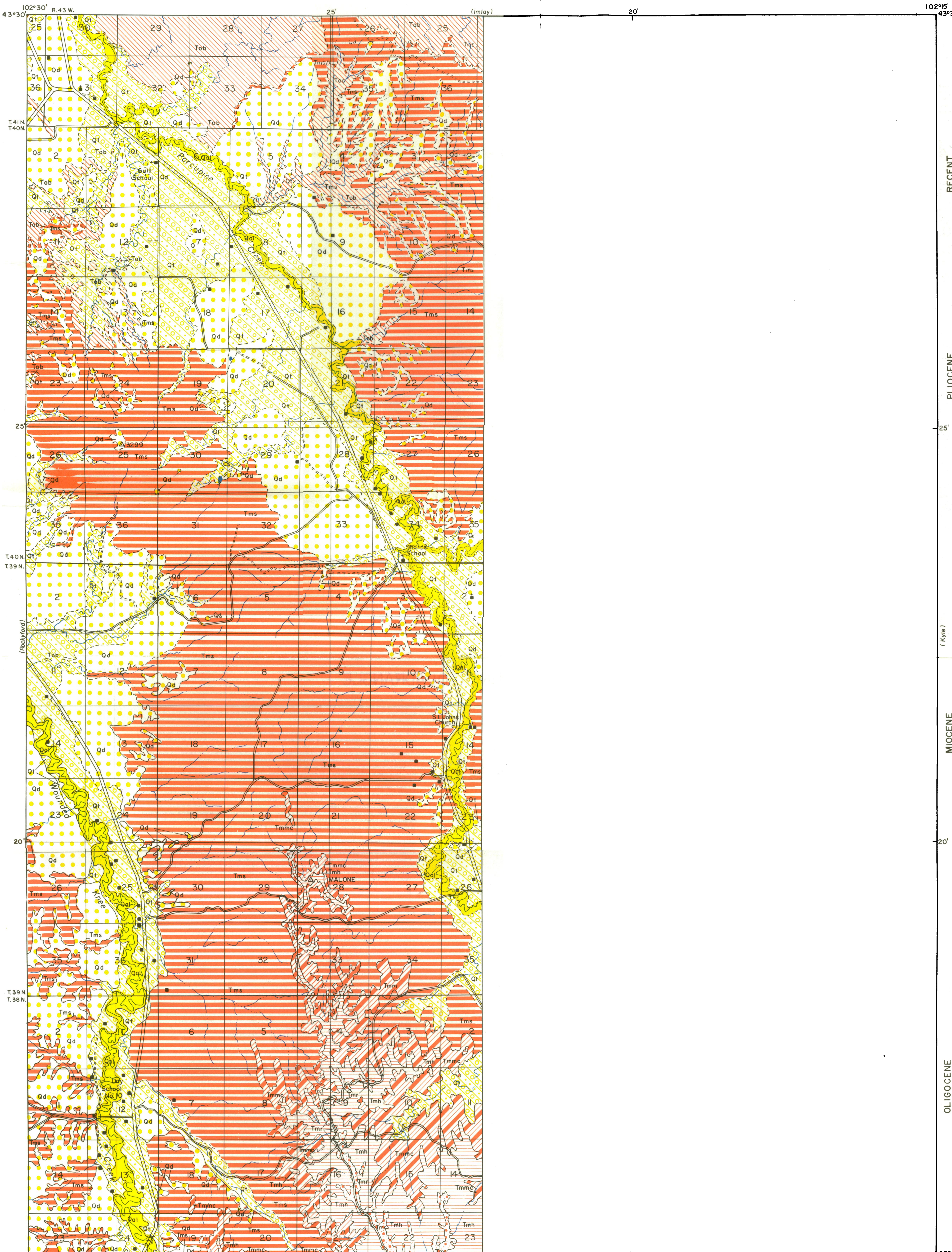
SOUTH DAKOTA GEOLOGICAL SURVEY
ALLEN F. AGNEW, STATE GEOLOGIST

STATE OF SOUTH DAKOTA
RALPH HERSETH, GOVERNOR

GEOLOGY of the SHARPS CORNER QUADRANGLE SOUTH DAKOTA



EXPLANATION

QUARTERNARY

RECENT

Qal — Alluvium
(Floodplain deposits of silt, sand, and gravel in valleys of present streams; local low terraces.)

Qd — Dune Sand
(Wind-blown deposits of quartz sand, in dunes and blowouts on upland.)

Qt — Terrace Deposits
(Stream deposits of silt, sand, and gravel at several levels above present valleys of major streams.)

PLIOCENE

Tt — Terrace Deposits
(Old stream deposit of gravel, sand, and silt about 100 feet above present valley of Wounded Creek.)

UNCONFORMITY

TERTIARY

MIOCENE

Tmr — Rosebud Facies
(Light-tan to brown interbedded calcareous sand, silt, and clay, with layered tabular concretions; clay "peaballs common; 235 feet.)

?

Tmh — Harrison Formation
(Massive gray partly cross-bedded-poorly consolidated fine to very fine sand; layers of wormy grayish white sandy marl; pipey and spherical concretions; 125 feet.)

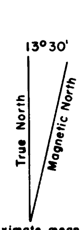
Tmmc — Monroe Creek Formation
(Compact, massive buff silty and very fine grained sand; small isolated concretions and fossil rootlets; 90 feet.)

Tms — Sharps Formation
(Massive poorly consolidated compact pinkish-tan silt; many scattered small gray calcareous "potato-ball" concretions; local lenses of impure limestone with silicified gastropods; clastic and chalcedonic dikes common, and calcareous channel sand and gravel at several levels; distinctive Rockyford ash member at base, up to 38 feet thick; thickness of Sharps 375 feet.)

OLIGOCENE

Tob — Brule Formation
(Interbedded pinkish to greenish clay, silt, and sand; thin dikes of chalcedony common; *Protoceras* greenish channel sands and pinkish *Metamynodon* channel sands in upper and lower part, respectively; 200 feet.)

Geology by J. G. Harksen, 1959
Assisted by D. G. Gieser.
Vertical and horizontal control surveyed from triangulation and level lines of Federal surveys
Drafted by Bruno C. Petsch



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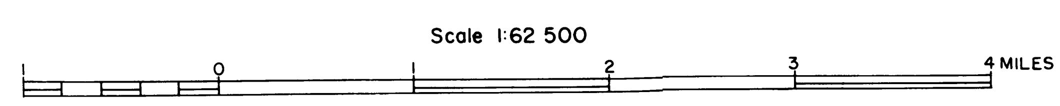
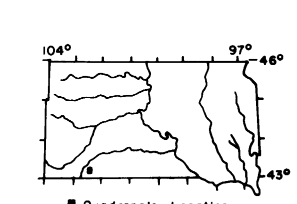


Vermillion, South Dakota
1960



SHARPS CORNER QUADRANGLE

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GEOLOGY
of the
MANDERSON QUADRANGLE
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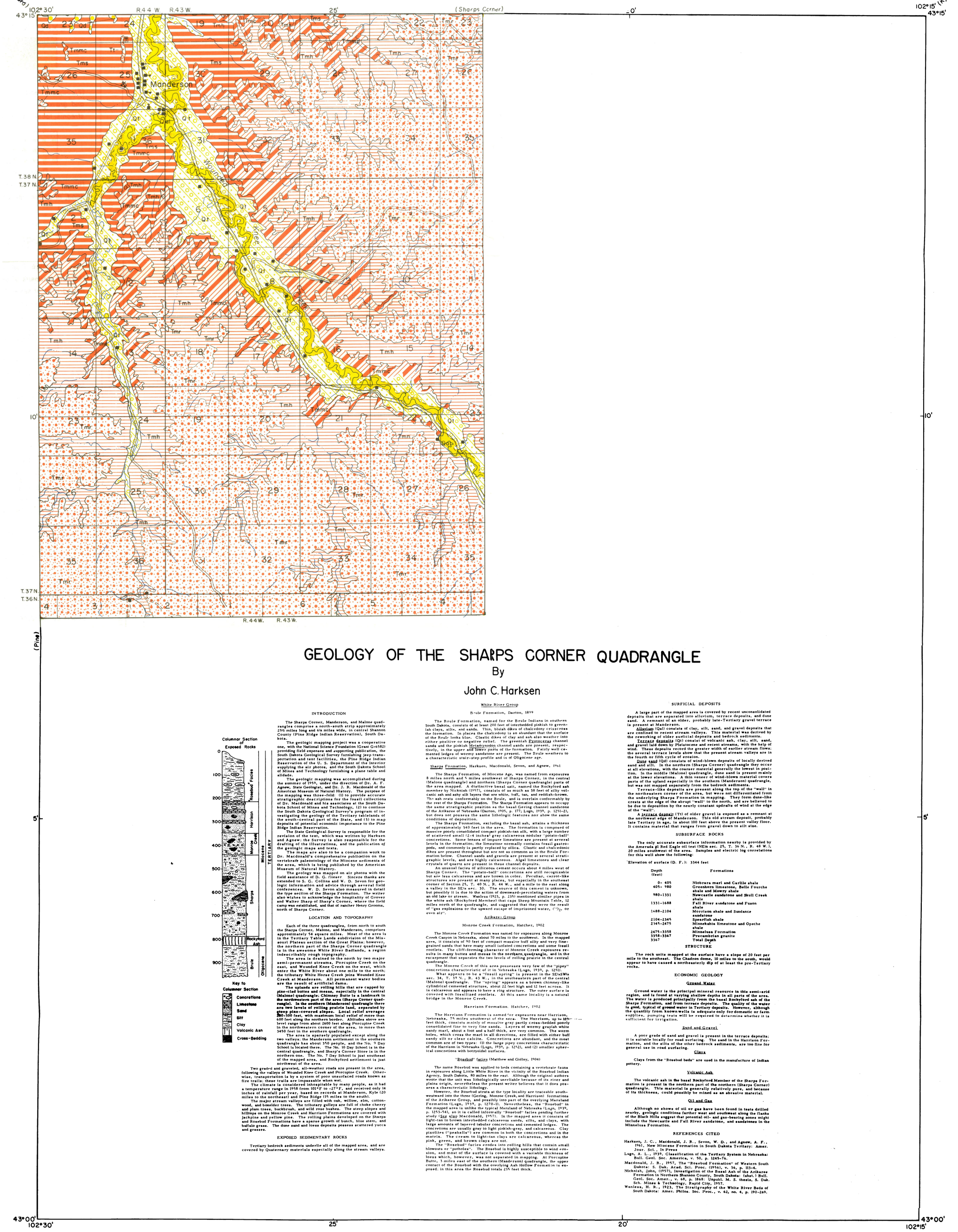

GEOLOGY OF THE SHARPS CORNER QUADRANGLE

By

John C. Harksen

INTRODUCTION

The Sharps Corner, Manderson, and Malone quadrangles comprise a north-south strip approximately 25½ miles long and 6¼ miles wide, in central Shannon County (Pine Ridge Indian Reservation), South Dakota.

The geologic mapping project was a cooperative one, with the National Science Foundation (Grant G-6582) providing field expenses and supporting publication, the South Dakota Geological Survey furnishing jeep transportation and tent facilities, the Pine Ridge Indian Reservation of the U. S. Department of the Interior supplying the air photos, and the South Dakota School of Mines and Technology furnishing a plane table and alidade.

The geologic mapping was accomplished during the summer of 1959, under the direction of Dr. A. F. Agnew, State Geologist, and Dr. J. R. Macdonald of the American Museum of Natural History. The purpose of the mapping was three-fold: (1) to provide accurate stratigraphic descriptions for the fossil collections of Dr. Macdonald and his associates at the South Dakota School of Mines and Technology, (2) to continue the South Dakota Geological Survey's program of investigating the geology of the Tertiary tablelands of the south-central part of the State, and (3) to map deposits of potential economic importance to the Pine Ridge Indian Reservation.

The State Geological Survey is responsible for the revision of the text, which was written by Harksen and Agnew; the Survey is also responsible for the drafting of the illustrations, and the publication of the geologic maps and texts.

The maps are also to be a companion work to Dr. Macdonald's comprehensive publication on the vertebrate paleontology of the Miocene sediments of the area, which is being published by the American Museum of Natural History.

The geology was mapped on air photos with the field assistance of D. G. Gieser. Sincere thanks are extended to S. G. Collins and W. D. Sevon for geologic information and advice through several field conferences. W. D. Sevon also measured in detail the type section of the Sharps Formation. The writer also wishes to acknowledge the hospitality of Grover and Walter Sharp of Sharp's Corner, where the field camp was established, and that of rancher Henry Grooms, north of Sharps Corner.

LOCATION AND TOPOGRAPHY

Each of the three quadrangles, from north to south the Sharps Corner, Malone, and Manderson, comprises approximately 54 square miles. Most of the area is in the Tertiary Table Lands subdivision of the Missouri Plateau section of the Great Plains; however, the northern part of the Sharps Corner quadrangle is in the awesome White River Badlands, a region indescribably rough topography.

The area is drained to the north by two major semi-permanent streams, Porcupine Creek on the east, and Wounded Knee Creek on the west, which enter the White River about one mile to the north; the tributary White Horse Creek joins Wounded Knee Creek at Manderson. All permanent water bodies are the result of artificial dams.

The uplands are rolling hills that are capped by pine-clad buttes and mesas, especially in the central (Malone) quadrangle; Chimney Butte is a landmark in the northwestern part of the area (Sharps Corner quadrangle). In the southern (Manderson) quadrangle there are two levels of rolling prairie land, separated by steep pine-covered slopes. Local relief averages 200-300 feet, with maximum local relief of more than 600 feet along the northern border. Altitudes above sea level range from about 2600 feet along Porcupine Creek in the northwestern corner of the area, to more than 3450 feet in the southern quadrangle.

The area is sparsely populated except along the two valleys; the Manderson settlement in the southern quadrangle has about 350 people, and the No. 9 Day School is located there. The No. 10 Day School is in the central quadrangle, and Sharp's Corner Store is in the northern one. The No. 7 Day School is just southeast of the mapped area, and Rockyford settlement is just northwest of the area.

Two graded and graveled, all-weather roads are present in the area, following the valleys of Wounded Knee Creek and Porcupine Creek. Otherwise, transportation is by a system of poor unsurfaced roads known as fire trails; these trails are impassable when wet.

The climate is considered inhospitable by many people, as it had a temperature range in 1958 from 101°F to -27°F, and received only 14 inches of rainfall per year, based on records at Manderson, Kyle (20 miles to the northeast) and Pine Ridge (15 miles to the south).

The major stream valleys are filled with oak, willow, elm, cottonwood, and boxelder trees. The tributary gullys are full of choke cherry and plum trees, buckbrush, and wild rose bushes. The steep slopes and hilltops on the Monroe Creek and Harrison Formations are covered with jackpine and yellow pine. The rolling plains developed on the Sharps and Rosebud Formations have a sparse growth of bunch, blue stem, and buffalo grass. The dune sand and loess deposits possess scattered yucca and grasses.

EXPOSED SEDIMENTARY ROCKS

Tertiary bedrock sediments underlie all of the mapped area, and are covered by Quaternary materials especially along the stream valleys.

White River Group

Brule Formation, Darton, 1899

The Brule Formation, named for the Brule Indians in southern South Dakota, consists of at least 200 feet of interbedded pinkish to greenish clays, silts, and sands. Thin, bluish dikes of chalcedony crisscross the formation. In places the chalcedony is so abundant that the surface of the Brule looks blue. Clastic dikes of clay and ash also weather into either positive or negative relief. The greenish Protoceras channel sands and the pinkish Metamynodon channel sands are present, respectively, in the upper and lower parts of the formation. Fairly well cemented ledges of wormy sandstone are present. The Brule weathers to a characteristic stair-step profile and is of Oligocene age.

Sharps Formation, Harksen, Macdonald, Sevon, and Agnew, 1961

The Sharps Formation, of Miocene Age, was named from exposures 8 miles north and ¼ miles southwest of Sharps Corner, in the central (Malone quadrangle) and northern (Sharps Corner quadrangle) parts of the area mapped. A distinctive basal unit, named the Rockyford ash member by Nicknish (1957), consists of as much as 38 feet of silty volcanic ash and ashy silt layers that are white, buff, tan, and reddish-brown. The ash rests conformably on the Brule, and is overlain conformably by the rest of the Sharps Formation. The Sharps Formation appears to occupy the same stratigraphic position as the basal Gering channel sandstone of the Arikaree of Nebraska (Darton, 1905, p. 177; Lugn, 1939, p. 1251-2), but does not possess the same lithologic features nor show the same conditions of deposition.

The Sharps Formation, excluding the basal ash, attains a thickness of approximately 340 feet in the area. The formation is composed of massive poorly consolidated compact pinkish-tan silt, with a large number of scattered small (2-4 inches) gray calcareous nodular "potato-ball" concretions. Some lenses of impure limestone are present at several levels in the formation; the limestone normally contains fossil gastropods, and commonly is partly replaced by silica. Clastic and chalcedonic dikes are present throughout but are not as common as in the Brule Formation below. Channel sands and gravels are present at several stratigraphic levels, and are highly calcareous. Algal limestones and clear crystals of quartz are present in these channel deposits.

An unusual facies of siliceous cement occurs about 4 miles west of Sharps Corner. The "potato-ball" concretions are still recognizable but are less calcareous and are brown in color. Peculiar, carrot-like structures are present at many places, but especially in the southeast corner of Section 25, T. 40 N., R. 44 W., and a mile to the east along a valley in the SE¼ sec. 30. The source of this cement is unknown, but possibly it is due to the action of downward-percolating waters from an old lake or stream. Wanless (1923, p. 235) mentioned similar pipes in the white ash (Rockyford Member) that caps Sheep Mountain Table, 12 miles north of the quadrangle, and suggested that they were the result of "gas explosions or the upward escape of imprisoned water, CO_2, or even air".

Arikaree Group

Monroe Creek Formation, Hatcher, 1902

The Monroe Creek Formation was named for exposures along Monroe Creek Canyon in Nebraska, about 70 miles to the southwest. In the mapped area, it consists of 90 feet of compact massive buff silty and very fine-grained sands that have many small isolated concretions and some fossil rootlets. The cliff-forming character of Monroe Creek exposures results in many buttes and mesas in the northern quadrangle, and in the escarpment that separates the two levels of rolling prairie in the central quadrangle.

The Monroe Creek of this area possesses very few of the "pipey" concretions characteristic of it in Nebraska (Lugn, 1939, p. 1251).

What appears to be a "fossil spring" is present in the SE¼SW¼ sec. 34, T. 39 N., R. 43 W., in the southeastern part of the central (Malone) quadrangle. The "spring" appears as a brown chimney-like cylindrical cemented structure, about 22 feet high and 12 feet across. It is calcareous and appears to have a ring structure. The outer surface is covered with fossilized rootlets. At this same locality is a natural bridge in the Monroe Creek.

Harrison Formation, Hatcher, 1902

The Harrison Formation is named for exposures near Harrison, Nebraska, 75 miles southwest of the area. The Harrison, up to 125 feet thick, consists mainly of massive gray partly cross-bedded poorly consolidated fine to very fine sands. Layers of wormy grayish white sandy marl, about a foot and a half thick, are very common. The worm holes, which cross the marl in all directions, are filled with either buff sandy silt or clear calcite. Concretions are abundant, and the most common are of two types: (1) the large pipey concretions characteristic of the Harrison in Nebraska (Lugn, 1939, p. 1252), and (2) smaller spherical concretions with botryoidal surfaces.

"Rosebud" facies (Matthew and Gidley, 1904)

The name Rosebud was applied to beds containing a vertebrate fauna in exposures along Little White River in the vicinity of the Rosebud Indian Agency, South Dakota, 80 miles to the east. Although the original authors wrote that the unit was lithologically unreliable because of its river and plains origin, nevertheless the present writer believes that it does possess a characteristic lithology.

However, the Rosebud strata at the type locality are traceable southwestward into the three (Gering, Monroe Creek, and Harrison) formations of the Arikaree Group, and possibly into part of the overlying Marsland Formation (Lugn, 1939, p. 1270-1). Nevertheless, the "Rosebud" in the mapped area is unlike the typical Marsland of Nebraska (Lugn, 1939, p. 1253-54), so it is called informally "Rosebud" facies pending further study (See also Macdonald, 1957). In the mapped area it consists of light-tan to brown interbedded calcareous sands, silts, and clays, with large amounts of layered tabular concretions and cemented ledges. The concretions are usually gray to light pinkish-gray, and calcareous. Clay pisolites ("peaballs") are common in both the concretions and in the matrix. The cream to light-tan clays are calcareous, whereas the pink, green, and brown clays are not.

The "Rosebud" facies erodes into rolling hills that contain small blowouts or "potholes". The Rosebud is highly susceptible to wind erosion, and most of the surface is covered with a variable thickness of loess which, however, was not separated in mapping. At Porcupine Butte, 3 miles east of the southern (Manderson) quadrangle, the upper contact of the Rosebud with the overlying Ash Hollow Formation is exposed; in this area the Rosebud totals 235 feet thick.

SURFICIAL DEPOSITS

A large part of the mapped area is covered by recent unconsolidated deposits that are separated into alluvium, terrace deposits, and dune sand. A remnant of an older, probably late-Tertiary gravel terrace is present at Manderson.

Alluvium (Qal) consists of clay, silt, sand, and gravel deposits that are confined to recent stream valleys. This material was derived by the reworking of older surficial deposits and bedrock sediments.

Terrace deposits (Qt) consist of volcanic ash, clay, silt, sand, and gravel laid down by Pleistocene and recent streams, with the help of wind. These deposits record the greater width of earlier stream flows; the several terrace levels show that the present stream valleys are in the fourth or fifth cycle of erosion.

Dune sand (Qd) consists of wind-blown deposits of locally derived sand and silt. In the northern (Sharps Corner) quadrangle they occur at all elevations, with the coarser material generally the lowest in position. In the middle (Malone) quadrangle, dune sand is present mainly at the lower elevations. A thin veneer of wind-blown material covers parts of the upland especially in the southern (Manderson) quadrangle, but was not mapped separately from the bedrock sediments.

Terrace-like deposits are present along the top of the "wall" in the northeastern corner of the area, but were not differentiated from the underlying Sharps Formation in mapping. They form dune-like crests at the edge of the abrupt "wall" to the north, and are believed to be due to deposition by the nearly constant updrafts of wind at the edge of the "wall".

A terrace deposit (Tt) of older gravel is exposed as a remnant at the northwest edge of Manderson. This old stream deposit, probably late Tertiary in age, is about 100 feet above the present valley floor. It contains material that ranges from gravel down to silt size.

SUBSURFACE ROCKS

The only accurate subsurface information nearby is provided by the Amerada #1 Red Eagle oil test (NE¼ sec. 25, T. 36 N., R. 48 W.), 20 miles southwest of the area. Samples and electric log correlations for this well show the following:

Elevation of surface (D. F.): 3344 feet

Depth (feet)	Formations
0- 405	Niobrara marl and Carlile shale
405- 980	Greenhorn limestone, Belle Fourche shale and Mowry shale
980-1331	Newcastle sandstone and Skull Creek shale
1331-1688	Fall River sandstone and Fuson shale
1688-2104	Morrison shale and Sundance sandstone
2104-2345	Spearfish shale
2345-2475	Minnekahta limestone and Opeche shale
2475-3358	Minnelusa Formation
3358-3367	Precambrian granite
3367	Total Depth

STRUCTURE

The rock units mapped at the surface have a slope of 20 feet per mile to the southeast. The Chadron dome, 10 miles to the south, would appear to have caused a northeasterly dip of at least the pre-Tertiary rocks.

ECONOMIC GEOLOGY

Ground Water

Ground water is the principal mineral resource in this semi-arid region, and is found at varying shallow depths in all parts of the area. The water is produced principally from the basal Rockyford ash of the Sharps Formation, and from terrace deposits. The quality of the water is good, typical of ground water in Tertiary deposits. However, although the quantity from known wells is adequate only for domestic or farm supplies, pumping tests will be required to determine whether it is sufficient for irrigation.

Sand and Gravel

A poor grade of sand and gravel is present in the terrace deposits; it is suitable locally for road surfacing. The sand in the Harrison Formation, and the silts of the other bedrock sediments, are too fine for general use in road surfacing.

Clays

Clays from the "Rosebud beds" are used in the manufacture of Indian pottery.

Volcanic Ash

The volcanic ash in the basal Rockyford Member of the Sharps Formation is present in the northern part of the northern (Sharps Corner) quadrangle. This material is generally relatively pure, and because of its thickness, could possibly be mined as an abrasive material.

Oil and Gas

Although no shows of oil or gas have been found in tests drilled nearby, geologic conditions farther west and southwest along the flanks of the Black Hills suggest that potential oil- and gas-bearing zones might include the Newcastle and Fall River sandstone, and sandstones in the Minnelusa Formation.

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Geology by J. G. Harksen 1959

Assisted by D.G. Gieser.

Vertical and horizontal control surveyed from triangulation and level lines of Federal surveys

Drafted by Bruno C. Petsch

Scale 1:62 500

1 0 1 2 3 4 MILES

Vermillion, South Dakota
1960