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MISCELLANEOUS INVESTIGATIONS NO. 3

NEW MIOCENE FORMATION IN SOUTH DAKOTA

by
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J. C. Harksen², J. R. Macdonald³, and W. D. Sevon⁴

The Tertiary deposits of an area in Shannon County, South Dakota (fig. 1), were mapped by Harksen for the State Geological Survey in the summer of 1959. This work corroborated Macdonald's view that a distinctive new stratigraphic unit (herein named the Sharps Formation) is present between the Brule Formation of the Oligocene White River Group below, and the Monroe Creek Formation of the Miocene Arikaree Group, above.

The Sharps Formation is named for exposures near Sharps Corner in Shannon County, South Dakota, and consists of 390 feet of massive tan silt and volcanic ash.

The Sharps Formation includes a basal volcanic ash bed, called the Rockyford ash by Nicknish (1957). The type section of the Rockyford is at Sheep Mountain Table, in SE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 32, T. 43 N., R. 44 W.; the name is taken from the settlement of Rockyford, 10 miles to the southeast. The ash consists of white, buff, tan, and reddish brown layers with varying amounts of silt impurities, and is as much as 38 feet thick. The ash is poorly consolidated but well compacted.

The remainder of the Sharps Formation is typically exposed in two localities: (1) the lower 270 feet is excellently displayed in the Badlands in the SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 31, T. 41 N., R. 42 W., about 8 miles north of Sharps Corner, and (2) the upper 340 feet is well displayed along the rolling upland from the NW $\frac{1}{4}$ sec. 30 northeastward to the NE $\frac{1}{4}$ sec. 20, T. 39 N., R. 43 W., about 5 miles southwest of Sharps Corner. The two sections overlap for about 215 feet in the middle of the formation (see measured sections, and Figure 2).

MEASURED SECTION OF TYPE LOCALITY OF SHARPS FORMATION OF ARIKAREE GROUP

by W. D. Sevon

Lower part of formation: Measured on north face of "wall" in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 31, T. 41 N., R. 42 W., Shannon County, South Dakota.

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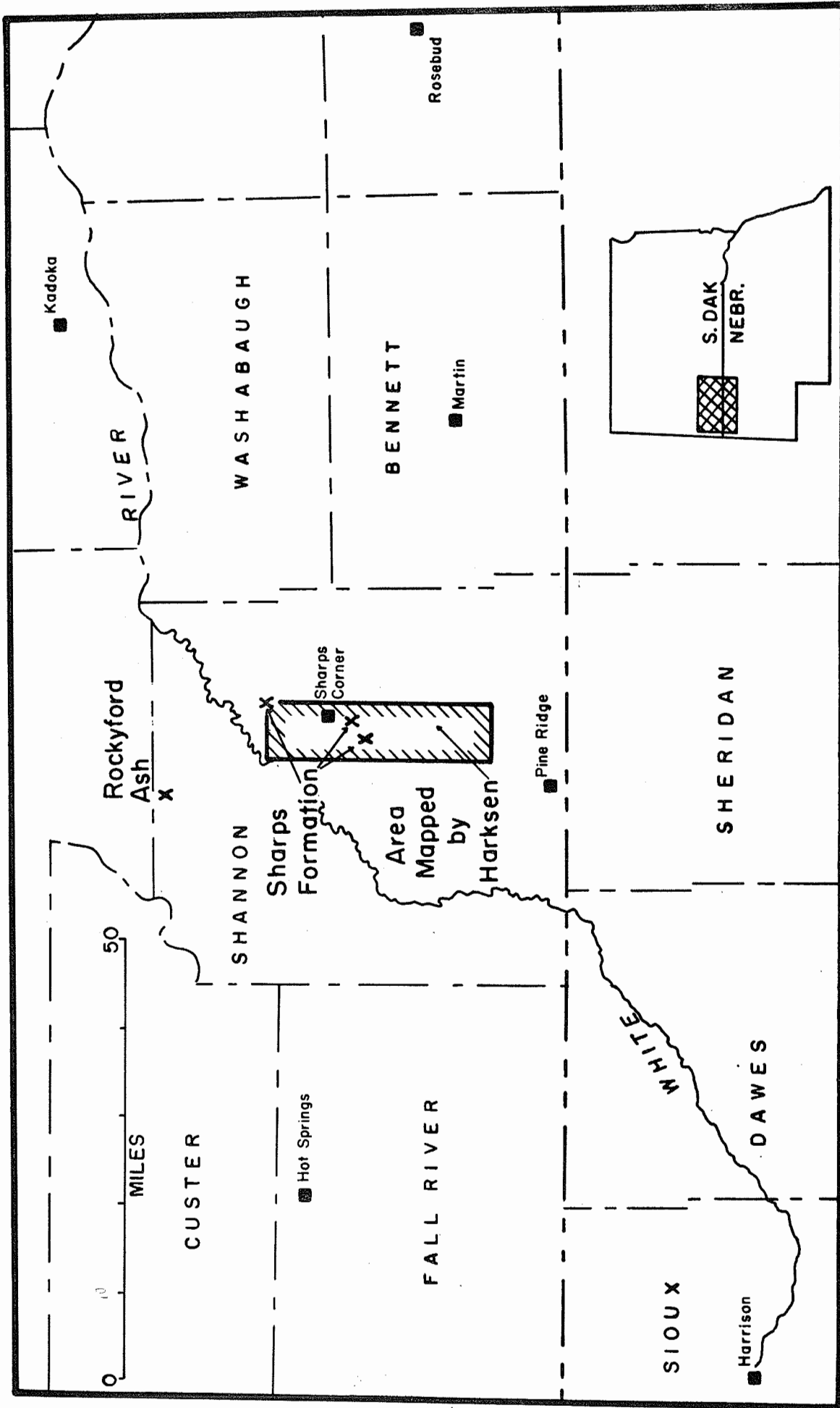


Figure 1. --Map showing type locality of Sharps Formation and Rockyford ash, and area mapped by Harksen.

Slope,
Secs 30,20,
T. 39N., R. 43 W.

Figure 2.

Columnar sections of
Sharps Formation.

400-

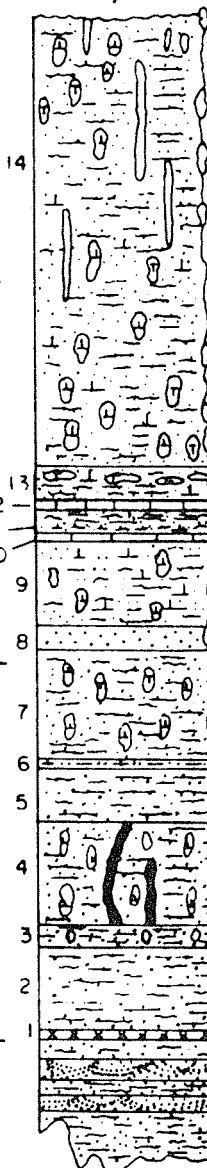
300-

200-

100-

0-
Feet

Wall,
Sec. 31,
T. 41N., R. 42W.



14c

14b

14a

datum

13

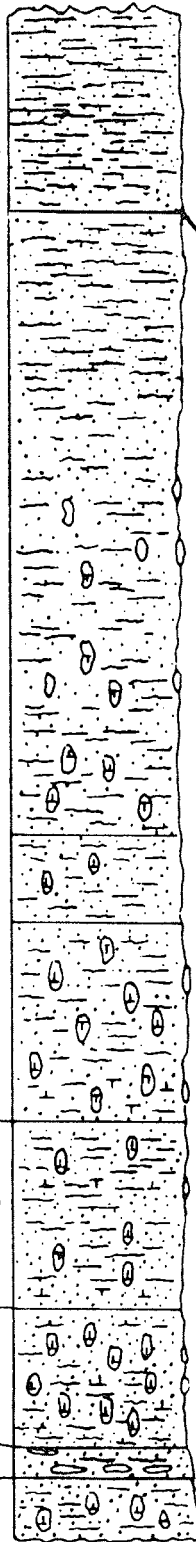
10

8

7

5

4



MONROE CREEK

SHARPS

ARIKAREE GROUP

MIOCENE










TERTIARY

BRULE

WHITE RIVER GROUP

OLIGOCENE

EXPLANATION

-  Silt
-  Siltstone
-  Sand
-  Sandstone
-  Limestone
-  Ashy clay
-  Calcareous concretions
-  Chalcedony dikes
-  Claystone veins

Lower part of Sharps Formation type section (continued)

(from top to bottom)

Miocene Series:

Arikaree Group:

Sharps Formation:

	Thickness, feet
14. Silt, pinkish-tan, calcareous, weathers light-tan, compact; weathers to smooth slope punctuated with randomly scattered calcareous vertically elongate nodular concretions, 1-2 inches in diameter and 1-4 inches in length, which increase in abundance upward; upper 20 feet may be reworked to some extent.	121.0
13. Silt, pinkish-tan, calcareous, clayey, compact; weathered surface very light tan and highly cracked into small polygons; contains horizontal concretion layers at 3 and 5 feet above base; concretions are light gray calcareous, irregularly shaped, 2 inches thick, and weather brown.	10.0
12. Limestone, creamy white, dense, massive; weathers brown; fresh surface shows scattered black dots; grades into underlying and overlying units.	0.5
11. Silt, very light-tan to very light-brown, calcareous, massive, well-compacted.	4.5
10. Limestone, creamy white, dense, massive; weathers brown; fresh surface shows scattered black dots and weathered surface has some brown lichens; grades into underlying and overlying units, forms thin ledge.	1.5
9. Silt, light-tan to light-brown, calcareous, compact; weathers to light tan; forms smooth slope which is steep because of capping limestone unit; contains a few randomly scattered light-gray calcareous vertically elongate nodular concretions, 1-2 inches in diameter, 2-3 inches in length, which weather brown.	23.0
8. Sand, greenish-gray, noncalcareous, compact; weathers white.	6.0
7. Silt, tan to light-brown, compact, noncalcareous to slightly calcareous where fresh, calcareous where weathered; weathers to smooth slope punctuated by abundant calcareous vertically elongate nodular concretions, 1-4 inches in diameter, 2-6 inches in length.	29.5

Lower part of Sharps Formation type section (continued)

	Thickness, feet
6. Siltstone, reddish-brown, calcareous, hard, brittle, laminated in beds as much as 1/4-inch thick; forms thin ledge.	0.5-1.0
5. Silt, light-brown to tan, noncalcareous, compact, light-tan weathered, somewhat clayey; weathers to slightly calcareous smooth slope.	14.2
4. Silt, very light-tan, noncalcareous, massive, compact, somewhat clayey, weathers grayish-white and very slightly calcareous; weathered surface is pebbly and very hard; contain irregularly shaped and sporadic light-tan calcareous vertically elongate nodular concretions which weather brown, and range from 2 to 8 inches in diameter and 3 to 12 inches in length; in the upper 10 feet of this unit the concretions are almost traceable laterally; criss-crossed randomly with vertical chalcedony veins 1/4 to 2 inches thick and locally traceable laterally for several hundred yards; the interiors of veins are transparent, margins rough and dark brown; silt at margins of veins appears to have been compressed by vein growth, and tends to form slight ridge at vein margin on weathered surface; veins break into plates forming abundant talus debris and give slopes a dark color; veins appear most abundant between top of unit and base of Sharps Formation, but do persist downward into underlying Brule Formation.	27.5
3. Silt, very light-tan, very slightly calcareous, massive, clayey; gradational with underlying unit; contains a few scattered calcareous light-gray vertically elongate nodular concretions which weather brown and are 1-2 inches long weathered surface polygonally cracked and hard.	5.5
2. Silt, light-brown, weathers tan, noncalcareous clayey, massive; slightly calcareous weathered; compact, weathered surface hard and abundantly cracked with irregular polygons; clay in this unit causes a slight swelling on weathered surface, making it porous; lower 2 feet varies to light reddish-brown color laterally.	22.0

Lower part of Sharps Formation type section (continued)

	Thickness, feet
1. Clay, white, noncalcareous, ashy, hard; weathers to a pebbly and locally wormy appearance; laterally traceable over large area; seems to separate characteristic smooth slopes of overlying Sharps Formation from stairsteps and pinnacles of underlying Brule Formation.	1.0-2.0
Total, Sharps	268.2

Oligocene Series:

White River Group:

Brule Formation:

Siltstone, sandstone, and clay pinnacles and stairsteps as result of alternating layers; upper 20-30 feet contain several layers of siltstone and sandstone which weather to characteristic wormy appearance, and in some places show steep cross-bedding.	100.0+
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Upper part of formation: Measured along drainage from NW $\frac{1}{4}$ sec. 30, T. 39 N., R. 43 W., northeastward to NE $\frac{1}{4}$ sec. 20, T. 39 N., R. 43 W.

(from top to bottom)

	Thickness, feet
Miocene Series:	
Arikaree Group:	
Monroe Creek Formation:	
Silt, pinkish-tan, noncalcareous, massive compact, no concretions; lichen cover gives the unit slight gray color; forms vertical cliff above slopes of Sharps Formation; has channel sands 15-20 feet above base.	100.0+

Sharps Formation:

- 14c. Silt, pinkish-tan, calcareous to noncalcareous, massive, compact, weathers to smooth steep very light-tan slopes; random vertically elongate light-tan to light-gray calcareous nodular

Upper part of Sharps Formation type locality (continued)

	Thickness, feet
concretions, 1/2-2 inches in diameter, 1-3 inches in length, become less abundant in upper 50 feet, and almost entirely absent in upper 20 feet; contains local vertical veins 1/2-2 inches wide of hard calcareous brittle pinkish clay-stone which breaks into small sharply angular fragments having conchoidal fracture and are traceable for only short distances, and contain local patches of pink montmorillonite; upper part of unit grades into overlying Monroe Creek Formation.	166.0
14b. Silt, pinkish-tan, noncalcareous, massive, compact, weathers very light-tan, small amount of very fine-grained sand; contains fewer nodular concretions than the underlying unit.	22.0
14a. Silt, pinkish-tan, varies from slightly calcareous in lower part to noncalcareous in the upper part, massive, compact; contains abundant random very light-gray calcareous vertically elongate nodular concretions which range from small balls 1 inch in diameter to "potatoes" 2 inches in diameter and 4 inches in length.	55.0
13-8. Silt, pinkish-tan, varies from slightly calcareous in lower part to noncalcareous in upper part, massive, compact; contains a few random very light-gray calcareous vertically elongate nodular concretions 1-2 inches in diameter and 2-4 inches in length.	49.5
7. Silt, pinkish-tan, slightly calcareous, massive, compact; contains abundant random very light-gray calcareous nodular concretions which range from small balls 1 inch in diameter to "potatoes" 2 inches in diameter and 3-4 inches in length.	33.0
6. Not present.	

Upper part of Sharps Formation type locality (continued)

	Thickness, feet
5. Silt, pinkish-tan, noncalcareous, massive, compact, weathers very light tan, smooth steep weathered slopes; contains four discontinuous layers of irregularly shaped concretions which are light gray, calcareous, and range from elongate nodules 3-5 inches in diameter and 8-10 inches in length to almost continuous irregular masses laterally, and weather brown; horizontal layers at base, and 2.9, 6.8, and 8.3 feet above base.	8.3
4. Silt, very light-tan, noncalcareous, massive, compact; contains a few random irregularly shaped light-gray calcareous concretions which weather brown, and range from balls 1 inch in diameter to vertically elongate irregular masses 3 inches in diameter and 4-5 inches in length.	15.5+
Total, Sharps	349.3+

The Sharps Formation, excluding the basal Rockyford ash, is composed of massive poorly consolidated compact pinkish-tan silt, with many scattered small (2-4 inches) gray calcareous nodular "potato-ball" concretions (see fig. 3). Some lenses of impure limestone are present at several levels in the formation; the limestone usually contains fossil gastropods and commonly is partly replaced by silica. Clastic and chalcedony 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. Many show peculiar organ-pipe-structure. The source of this cement is unknown, but it is probably due to the action of vertically moving ground waters heavily charged with silica. Wanless (1923, p. 235) and Nicknish (1957) mentioned similar pipes in the Rockyford ash member at Sheep Mountain Table and elsewhere; Wanless suggested that they were the result of "gas explosions or the upward escape" of fluids, and Nicknish agreed.

Harksen and Sevon have traced the Sharps Formation eastward 50 miles or more, where it appears to lose its character in the lower Arikaree strata near Rosebud, in Todd County (fig. 1). Similarly, it seems to be recognizable 75 miles southwest, near Harrison, in Sioux County, Nebraska. Although the stratigraphic position of the Sharps Formation is similar to that of the basal, or channel-fill Gering Formation of the Arikaree Group in that both underlie the Monroe Creek Formation directly, the lithologic characteristics are so dissimilar that the sediments herein discussed cannot be called Gering.

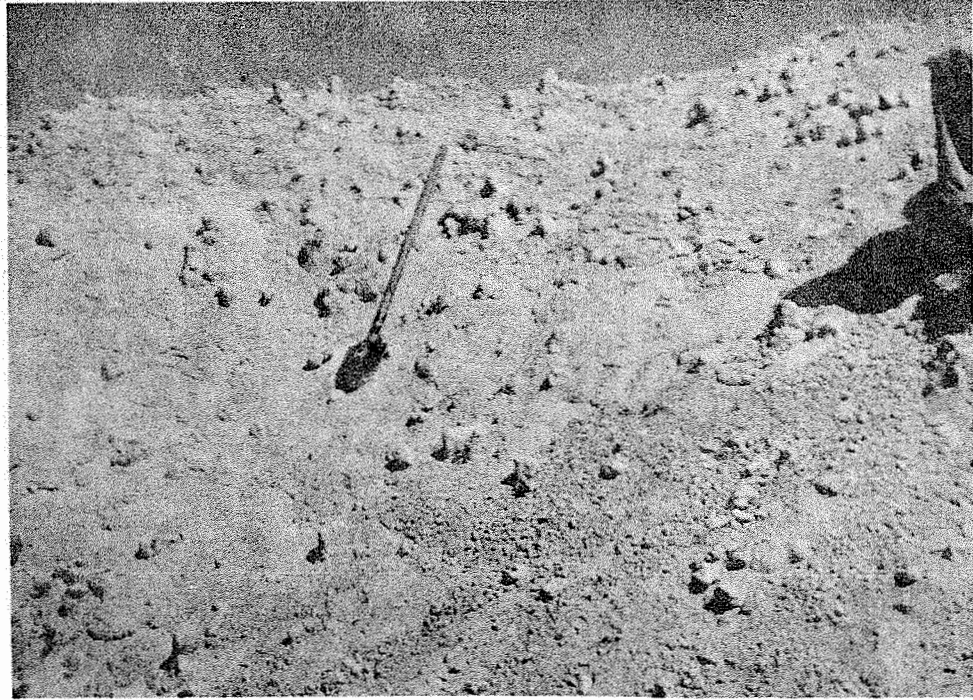


Figure 3. --Potato-ball character of Sharps Formation.

The vertebrate fauna from the Sharps Formation, identified by Macdonald with the support of a National Science Foundation grant and the American Museum of Natural History, include the following previously described species:

<u>Species</u>	<u>Other Occurrences</u>
Insectivora	
<u>Arctoryctes terrenus</u> Matthew.	(Rosebud facies of Wounded Knee area)
Lagomorpha	
<u>Palaeolagus philoi</u> Dawson.	("Lower Harrison" of Wyoming)
<u>Palaeolagus hypsodus</u> Schlaikjer.	("Lower Harrison" of Wyoming)
<u>Megalagus primitivus</u> (Schlaikjer).	("Lower Harrison" of Wyoming)
Rodentia	
<u>Pleurolicus leptophrys</u> Cope.	(John Day Formation of Oregon)
<u>Palaeocastor gradatus</u> (Cope).	(John Day Formation of Oregon)
<u>Palaeocastor nebrascensis</u> Leidy.	
Carnivora	
<u>Hesperocyon leptodus</u> (Schlaikjer).	("Lower Harrison" of Wyoming)
<u>Nothocyon geismarianus</u> Cope.	(John Day Formation of Oregon)
<u>Nothocyon lemur</u> (Cope).	(John Day Formation of Oregon)
<u>Mesocyon robustus</u> Matthew.	(Harrison Formation of Wounded Knee area)
<u>Mesocyon geringensis</u> Barbour and Schultz.	(Gering Formation of Nebraska)
<u>Enhydrocyon crassidens</u> Matthew.	(Monroe Creek Formation of Wounded Knee area)
Perissodactyla	
<u>Miohippus</u> cf <u>M. equinanus</u> Osborn.	
<u>Miohippus equiceps</u> (Cope).	(John Day Formation of Oregon)
<u>Hyracodon apertus</u> Sinclair.	(Brule Formation of South Dakota)
<u>Diceratherium gregorii</u> Peterson	(Harrison Formation of Wounded Knee area)
<u>Diceratherium armatum</u> Marsh.	(John Day Formation of Oregon)
Artiodactyla	
<u>Leptochoerus</u> sp.	
<u>Desmatochoerus hatcheri geringensis</u> Schultz and Falkenbach.	(Gering Formation of Nebraska)
<u>Desmatochoerus wyomingensis</u> Schultz and Falkenbach.	(Gering Formation of Wyoming)
<u>Arretotherium</u> sp.	
<u>Oxydactylus</u> cf <u>O. wyomingensis</u>	
<u>Nanotragulus</u> cf <u>N. loomisi</u>	
<u>Nanotragulus intermedius</u> Schlaikjer.	("Harrison" of Nebraska)

The Sharps Formation appears to lie conformably on the Brule Formation (although Nicknisch, 1957, reported a disconformity at the base of the Rockyford ash) and is overlain conformably by the Monroe Creek Formation.

The Sharps Formation is characterized by rolling plains that have a sparse cover of bunch, blue stem, and buffalo grass. On the other hand,

the Brule has typical Badlands fluted pinnacles with stairstep profile, and the Monroe Creek weathers to steep slopes that support jack pine and yellow pine.

The age of the Sharps Formation appears to be very Early Miocene, based on present collections by Macdonald.

References Cited

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