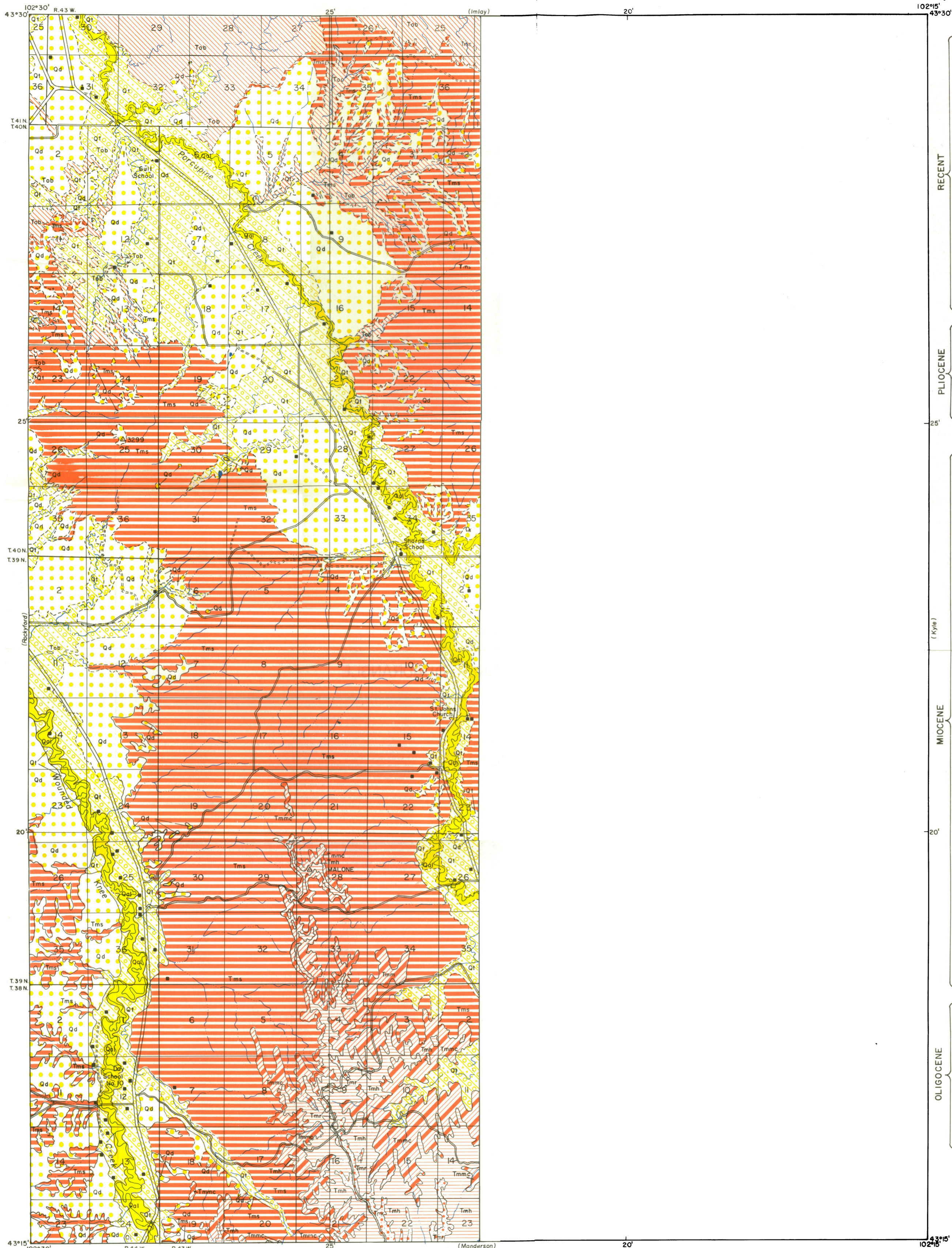


SOUTH DAKOTA GEOLOGICAL SURVEY
ALLEN F. AGNEW, STATE GEOLOGIST

STATE OF SOUTH DAKOTA
RALPH HERSETH, GOVERNOR



EXPLANATION



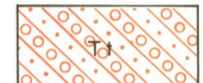
Alluvium
(Floodplain deposits of silt, sand, and gravel in valleys of present streams; local low terraces.)



Dune Sand
(Wind-blown deposits of quartz sand, in dunes and blowouts on upland.)



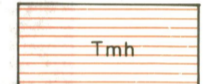
Terrace Deposits
(Stream deposits of silt, sand, and gravel at several levels above present valleys of major streams.)



Terrace Deposits
(Old stream deposit of gravel, sand, and silt about 100 feet above present valley of Wounded Creek.)



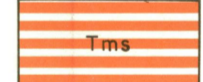
Rosebud Facies
(Light-tan to brown interbedded calcareous sand, silt, and clay, with layered tabular concretions; clay "pebbles" common; 235 feet.)



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.)



Monroe Creek Formation
(Compact, massive buff silty and very fine grained sand; small isolated concretions and fossil rootlets; 90 feet.)



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.)



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.)

RECENT

PLIOCENE

(Kyle)

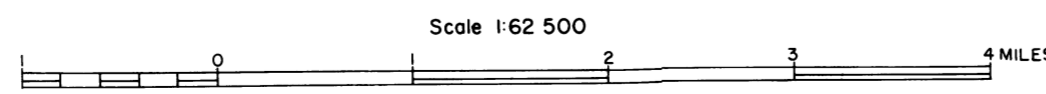
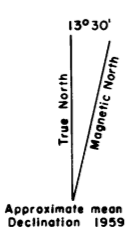
MIOCENE

OLIGOCENE

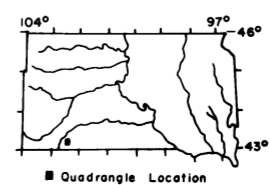
QUARTERNARY

TERTIARY

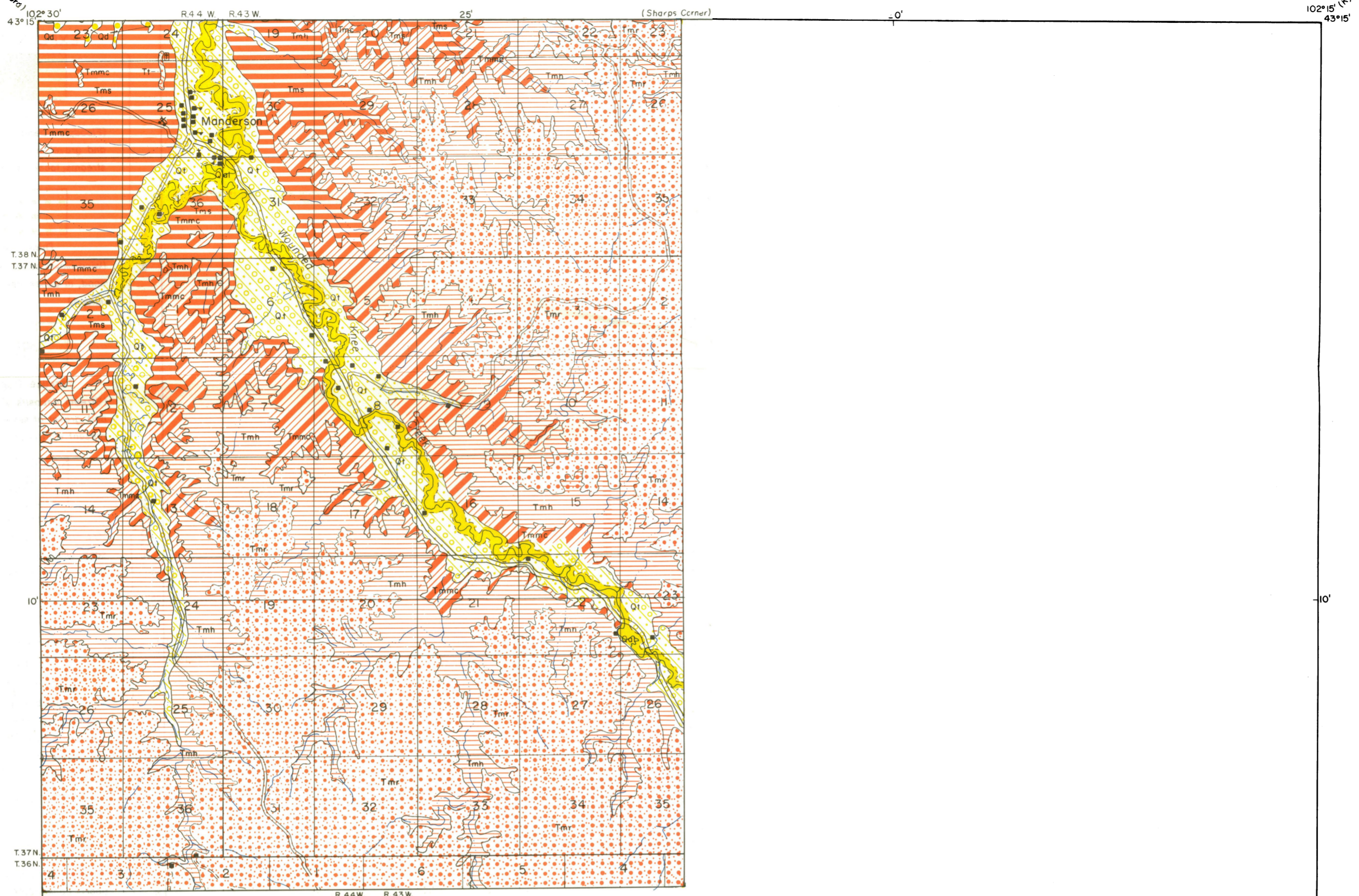
Geology by J.G. Markoen, 1959
Assisted by D.G. Gieser.
Vertical and horizontal control surveyed from triangulation and level lines of Federal surveys
Drafted by Bruno C. Petsch



Vermillion, South Dakota
1960



SHARPS CORNER QUADRANGLE



GEOLOGY OF THE SHARPS CORNER QUADRANGLE

By
John C. Harksen

White River Group

INTRODUCTION

The Sharp's Corner, Manderson, and Malone quadrangles comprise a north-south strip approximately 150 miles long and six miles wide, in central South Dakota (Pine Ridge Indian Reservation, South Dakota). The geologic mapping project was a cooperative one, with the National Science Foundation (NSF) providing field expenses and supporting publication, the South Dakota Geological Survey providing personnel 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 the U. S. Department of the Interior, (2) to continue the South Dakota Geological Survey's program of investigating the geology of the Tertiary tablelands of the western 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 text.

The maps are also a companion work to Dr. Macdonald's comprehensive publication on the vertebrate paleontology of the Miocene sediments of the American Museum of Natural History.

The geologic mapping was done on air photos with the field assistance of D. G. Gieser. Since thanks are due to S. C. Collins and W. D. Strain for geologic information and advice through several field contacts, it is their names that are placed in the type section of the Sharp's Formation. The writer also wishes to acknowledge the hospitality of Greener and Water Sharp of Sharp's Corner, where the field camp was established, and that of member Henry Grooms, north of Sharp's Corner.

LOCATION AND TOPOGRAPHY

Each of the three quadrangles, from north to south the Sharp's Corner, Malone, and Manderson, comprises approximately 34 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 Sharp's Corner quadrangle is in the extensive White River Badlands, a region indistinguishably rough topography.

The area is drained to the north by two major semi-permanent streams, Porcupine Creek on the east, and Wooded Knee Creek on the west, which enter the White River about one mile to the north; the tributary White Horse Creek joins Wooded Knee Creek at Manderson. All permanent water bodies are the result of artificial means.

The uplands are rolling hills that are capped by sandstone and shale, especially in the central (Manderson) and eastern (Malone) quadrangles. In the southern (Sharp's Corner) quadrangle there are two low, steeply sloping hills. Local relief averages 80-100 feet, with maximum local relief of more than 100 feet along the northern border. Altitudes above sea level range from about 1000 feet along Porcupine Creek in the northwestern corner of the area, to more than 1400 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 southwest of the area.

The ground is gravelly, all-weather roads are present in the area, following the valleys of Wooded Knee Creek and Porcupine Creek. Other than a few trails, there are no permanent roads known as fire trails, these trails are impassable when wet.

The climate is considered temperate, as it had a temperature range in 1958 from 104°F to -27°F, and received only 14 inches of annual rain, based on records at Manderson, 105 1/2 miles to the northeast and Pine Ridge 115 miles to the south. The major stream valleys are filled with oak, willow, elm, cottonwood, and boxelder trees. The tributary gullies are full of choke cherry and plum trees, such as the typical Manderson quadrangle. Hillsides on the Monroe Creek and Harrison Formations are covered with jackpine and yellow pine. The upper part of the Sharp's and Rosbud Formations have a sparse growth of bunch, blue stem, and buffaloe grass. The lower sand and shale deposits contain junce and grasses.

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 sandstone and shale. This thin bed of chloritic shales is the formation. In places the chloritic shales are so abundant that the surface of the rock looks like a thin slice of clay and ash also present, either positive or negative relief.

The greenish sandstone channel sands and the pinkish sandstone channel sands are present, respectively, in the upper and lower parts of the formation. Fairly well-developed layers of worm sandstone are present. The Brule weathers to a characteristic stair-step profile and is of Oligocene age.

Sharp Formation, Harksen, Macdonald, Sevon, and Agnew, 1961

The Sharp Formation, of Miocene age, was named from exposures 8 miles north and 5 miles west of Sharp's Corner, in the central (Manderson) and northern (Sharp's Corner) quadrangles of the area mapped. A distinctive basal unit, named the Rockyford ash member by Nicholson (1957), consists of as much as 18 feet of silty volcanic ash and may still be present in the white, buff, tan, and reddish-brown. The ash weathers conformably on the Brule, and is overlain conformably by the rest of the Sharp Formation. The Sharp Formation appears to occupy the same stratigraphic position as the basal Gering channel sandstone of the Miocene of Nebraska (Lugin, 1959, p. 127; Lugin, 1959, p. 127-128), but does not possess the same lithologic features nor show the same conditions of deposition.

The Sharp Formation, including the basal ash, attains a thickness of approximately 240 feet in the area. The formation is composed of massive poorly consolidated compact pinkish-tan silt, with a large number of scattered small, 1/2 to 1 inch, gray calcareous nodules, pebbles, and concretions. Some lenses of highly calcareous sandstone are present in several levels in the formation. The limestone normally contains fossil gastropods, and commonly 4 to 6 inch sponges. The sponges are present throughout but are not as common as in the Brule Formation below. Clastic and stratigraphic levels, and are highly calcareous. Algal limestone and clear chert of quartz are present and are deposited.

An unusual facies of siliceous cement occurs about a mile west of Sharp's Corner. The cement is a hard, brown, crystalline material, but is less calcareous and are brown in color. Peculiar, carrot-like structures are present in some places, but especially in the central corner of section 25, T. 40 N., R. 44 W., and a mile to the east along the valley in the SE 1/4 of section 26, T. 40 N., R. 44 W., and possibly it is due to the action of downward-percolating waters from an old lake or stream. Wentz (1925, 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, "O", or even air.

Arkaree Group

Monroe Creek Formation, Hatcher, 1902

The Monroe Creek Formation was named for exposures along Monroe Creek Canyon in Nebraska, about 10 miles to the southwest. In the mapped area, it consists of 80 feet of compact massive buff silty and very fine-grained sand that may have small scattered concretions and some fossil fossils. The cliff-forming character of Monroe Creek exposures recalls in many features and masses in the northern quadrangle, and in the west-southwest it separates the two levels of rolling prairie in the central quadrangle.

The Monroe Creek of this area possesses very few of the upper concretions characteristic of it in Nebraska (Lugin, 1959, p. 127). What appears to be a "Hault spring" is present in the SE 1/4 of section 14, T. 34 N., R. 43 W., in the southwestern part of the central (Manderson) quadrangle. The "Hault spring" is a brown chert-like cylindrical cemented structure, about 22 feet high and 12 feet across. It is calcareous and contains a few small concretions. The upper surface is covered with fossilized roots. 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 120-foot thick, consists entirely of massive gray to grayish-brown poorly consolidated fine to very fine sand. Layers of wormy grayish buff sandy marl, about 4 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 piper concretions characteristic of the Harrison in Nebraska (Lugin, 1959, p. 126), and (2) smaller superficial concretions with horizontal surfaces.

"Rosbud" facies (Manderson and Gieser, 1961)

The name Rosbud was applied to beds containing a variegated facies in exposures along Little White River in the vicinity of the Rosbud Indian Agency, South Dakota, 10 miles to the east. Although the original author wrote that the unit was lithologically unrecognizable because of its river and plain origin, nevertheless the present writer believes that it does possess a characteristic lithology.

However, the Rosbud area at the type locality are traceable southward into the three Gering, Monroe Creek, and Harrison Formations of the Arkaree Group, and possibly into part of the overlying Manderson Formation (Lugin, 1959, p. 127-128). Nevertheless, the "Rosbud" unit is mapped here as a Miocene unit, and is called informally "Rosbud" facies pending further study (see also Macdonald, 1957). In the mapped area it consists of light-tan to brown interbedded calcareous sandy, silt, and clay, with large amounts of irregularly shaped concretions and concentrated layers. The concretions are usually gray to light pinkish-gray, and calcareous. Clay pebbles ("pipers") are common in both the concretions and in the matrix. The cream to light gray clay are calcareous, whereas the pink, gray, and brown clay are not.

The "Rosbud" facies erodes into rolling hills that contain small bluffs or "pipers". The Rosbud is highly susceptible to wind erosion, and most of the surface is covered with a variable thickness of loose silt, however, was not exposed in mapping. At Rosbud, 10 miles east of the northern (Manderson) quadrangle, the upper contact of the Rosbud with the overlying Ash Hollow Formation is exposed in this area the Rosbud totals 25 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 (Sharp's Corner) quadrangle they occur at all elevations, with the coarsest material generally the lowest in position. In the middle (Manderson) 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 and alluvium.

Terrace-like deposits are present along the top of the "wash" in the northwestern corner of the area, but were not differentiated from the underlying Sharp Formation in mapping. They form terraces at the edge of the abrupt "wash" to the north, and are believed to be due to deposition by the nearly constant updraft of wind at the edge of the "wash".

A COLLIER (1959) (1959) of older gravel is exposed as a remnant of the northern (Sharp's Corner) quadrangle. 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 Amundson at Red Eagle oil well (NW 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. 3) 3366 feet	Depth (feet)	Formations
	0-400	Niobrara marl and Cretaceous shale
	400-450	Cretaceous limestone, Belle Fourche shale and Mowry shale
	450-500	Newcastle sandstone and Shell Creek shale
	500-1331	Fall River sandstone and Pusan shale
	1331-1488	Morrison shale and Sundance sandstone
	1488-2104	Spearfish shale
	2104-2445	Sioux shale
	2445-2475	Sioux shale
	2475-3150	Sioux shale
	3150-3567	Presbyterian granite
	3567	"Red Dug"

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 west, would appear to have caused a northeasterly dip of at least the pre-Tertiary rocks.

ECONOMIC GEOLOGY

Quartzite

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 Sharp 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 good grade of sand and gravel is present in the terrace deposits; it is available locally for road surfacing. The sand in the Harrison Formation, and the silt of the other bedrock sediments, are too fine for general use in road surfacing.

Clay

Clays from the "Rosbud beds" are used in the manufacture of Indian pottery.

Volcanic Ash

The volcanic ash in the basal Rockyford Member of the Sharp Formation is present in the northern part of the northern (Sharp's 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 favor west and southwest along the flank of the Black Hills suggest that potential oil and gas-bearing zones might include the Newcastle and Fall River sandstones, and sandstones in the Manderson Formation.

REFERENCES CITED

Harksen, J. C., Macdonald, J. R., Sevon, W. D., and Agnew, A. F., 1961. New Miocene Formation in South Dakota Territory. Amer. Jour. Sci., in press.

Lugin, A. L., 1959. Classification of the Tertiary System in Nebraska. Bull. Geol. Surv. America, v. 50, p. 124-74.

Macdonald, J. R., 1957. The "Rosbud" Formation of Western South Dakota. S. Dak. Acad. Sci. Proc., 1956-57, p. 11-13.

Nicholson, John, 1957. Investigation of the Basal Ash of the Arkaree Formation in Northern Shannon County, South Dakota. (Unpubl. Bull. Geol. Surv. Amer., v. 68, p. 184.) (Unpubl. M. S. thesis, S. Dak. Sch. Mines & Technology, Rapid City, 1957.)

Wentz, H. R., 1923. The Stratigraphy of the White River Beds of South Dakota. Amer. Geol. Soc. Proc., v. 42, no. 4, p. 107-247.

Geology by J. G. Harksen 1959
Assisted by D. G. Gieser.
Vertical and horizontal control surveyed from triangulation and level lines of Federal surveys
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Scale 1:62 500
Vermillion, South Dakota
1960

