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THE PLIOCENE-PLEISTOCENE MEDICINE ROOT GRAVEL OF SOUTHWESTERN SOUTH DAKOTA

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COVER: Blacksamson, Echinacea angustifolia, is a native perennial forb which grows along the valley of Medicine Root Creek. The root of this plant, when chewed, stimulates the salivary glands and affects the vision.

THE PLIOCENE-PLEISTOCENE *MEDICINE ROOT GRAVEL*[1] OF SOUTHWESTERN SOUTH DAKOTA[2]

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INTRODUCTION

The drainage pattern of South Dakota has undergone considerable modification since late Pliocene time. Not only has stream piracy changed the course of the smaller streams, but continental glaciation has shifted the continental divide a distance measurable in hundreds of miles. The sizable changes possible within a relatively short period of geologic time, both through the action of stream piracy and through glaciation, are well exemplified in South Dakota. The drainage transformations of the eastern part of the State have been recently discussed by Flint (1955), White (1964), and summarized by Lemke and others (1965). While these papers have contributed to our present knowledge of the glaciated part of the State, little work of recent date has been done on the drainage modifications in the area west of the Missouri River.

It has long been known that throughout the medial and late Cenozoic the Black Hills of South Dakota and Wyoming were drained by a series of eastward-flowing streams. These streams flowed from the Black Hills to join a larger drainage in the central part of eastern South Dakota. Along this 300 mile route the streams, with the help of wind, deposited nearly 1,000 feet of strata, referable to the White River, Arikaree, Ogallala, and other groups over most of central and western South Dakota. These streams were constantly shifting their channels, undergoing undulatory movements while they slowly deposited their load on a flat, wide plain. This type of deposition, which resulted in formations of generally uniform thickness that extended for many hundreds of miles, existed throughout the Oligocene and early Miocene Epochs. During the middle Myo-

[1]Name cleared by the Geologic Names Committee, United States Geological Survey.

[2]Publication approved by the Director, South Dakota Geological Survey.

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cene a new type of deposition was initiated, one of restricted cut and fill. Thereafter, a series of fluctuations in stream base level resulted in the streams eroding narrow channels several score of feet deep, and then refilling them before beginning a new sequence of cut and fill at some distance from the previous channel. This sequence of cut and fill occurred as many as ten times in the pliocene of western South Dakota. Near the Pliocene-Pleistocene boundary, the base level of western South Dakota was lowered by a considerable degree. The ancestral Cheyenne River was apparently stimulated more than its contemporary drainages, for at this time through a series of stream piracies, it monopolized the entire Black Hills drainage system.

Remnants of the pre-Cheyenne, Black Hills drainages can be found capping the divides at many localities in western South Dakota. One such series of channel remnants, occurring near Medicine Root Creek in Shannon and Washabaugh Counties, South Dakota, forms the basis for this paper.

Acknowledgments

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Previous Geologic Work

Despite the privations and the lack of "modern" transportation known by the early geologists in South Dakota, the work done by individuals such as N. H. Darton and J. E. Todd has proven to be remarkably sound. One of the first references in the literature to materials of, or derived from, the Medicine Root gravel of this paper was made by Todd (1894) when he remarked on a unit which he called "Aqueous Drift." He stated, "Under this head we would include an extensive deposit of boulders and gravel overspreading quite generally the country around the Black Hills for a distance of from 100 to 150 miles. It seems to have been nearly continuous at first over the whole country. It is found usually capping the high pinnacles of the Badlands between the Cheyenne and White Rivers."

Todd further stated that the "Aqueous Drift" had been referred by

Professor Jenny to the action of ice floating in a fresh water lake around the Black Hills, while Professor Crosby had concluded it to be residuum left after the removal of the softer portions of the Tertiary beds. Todd personally concluded that the "Aqueous Drift" was desposited by streams flowing from the Black Hills.

In later work Todd (1902) stated that the rivers once draining the Black Hills flowed eastward across the South Fork of the Cheyenne River. Todd claimed that this fact was abundantly attested to by the numerous erratics from the Black Hills capping areas in the valleys of the White and Bad Rivers. However, Todd also pointed out that some of the higher points in the Pine Ridge Indian Reservation and along the divide between the White and Niobrara Rivers were probably not strewn with these erratics.

Ward (1922) advocated the theory that the gravels mantling the surface of the region near Interior, South Dakota, were the more resistant parts of weathered *Protoceras* Channels. However, Wanless (1923) disputed this concept, stating that the size of the individual particles was four or five times larger than any observed in the upper part of the Brule Formation. In general, Wanless upheld the work of Todd (1894, 1898, 1902), disagreeing with him, however, on the age of the material. Todd (1902:31) suggested that the capture of the Black Hills drainages by the Cheyenne River occurred in Pliocene time, while Wanless (1923:266) felt more inclined to place the time of the capture with the Pleistocene. Wanless (1923:263) states that he had not investigated the country south of the White River, the area where the majority of known exposures of the Medicine Root gravel are found (see Figs. 1A and B).

While mapping the geology of the Sharps Corner 15 minute quadrangle in Shannon County, South Dakota, the author first realized the presence and significance of the Medicine Root gravel. In this publication (Harksen, 1965), the Medicine Root gravel was referred to as a Quaternary-Tertiary terrace deposit.

The Medicine Root gravel

Mantling many of the topographic highs in northern Shannon and Washabaugh Counties, South Dakota, are remnants of a former major Black Hills drainage (Fig. 1B). To these deposits the name *Medicine Root gravel* (new name) is applied. The name is derived from Medicine Root Creek (Fig. 1B). The name has been cleared by the Geologic Names Committee of the United States Geological Sur-

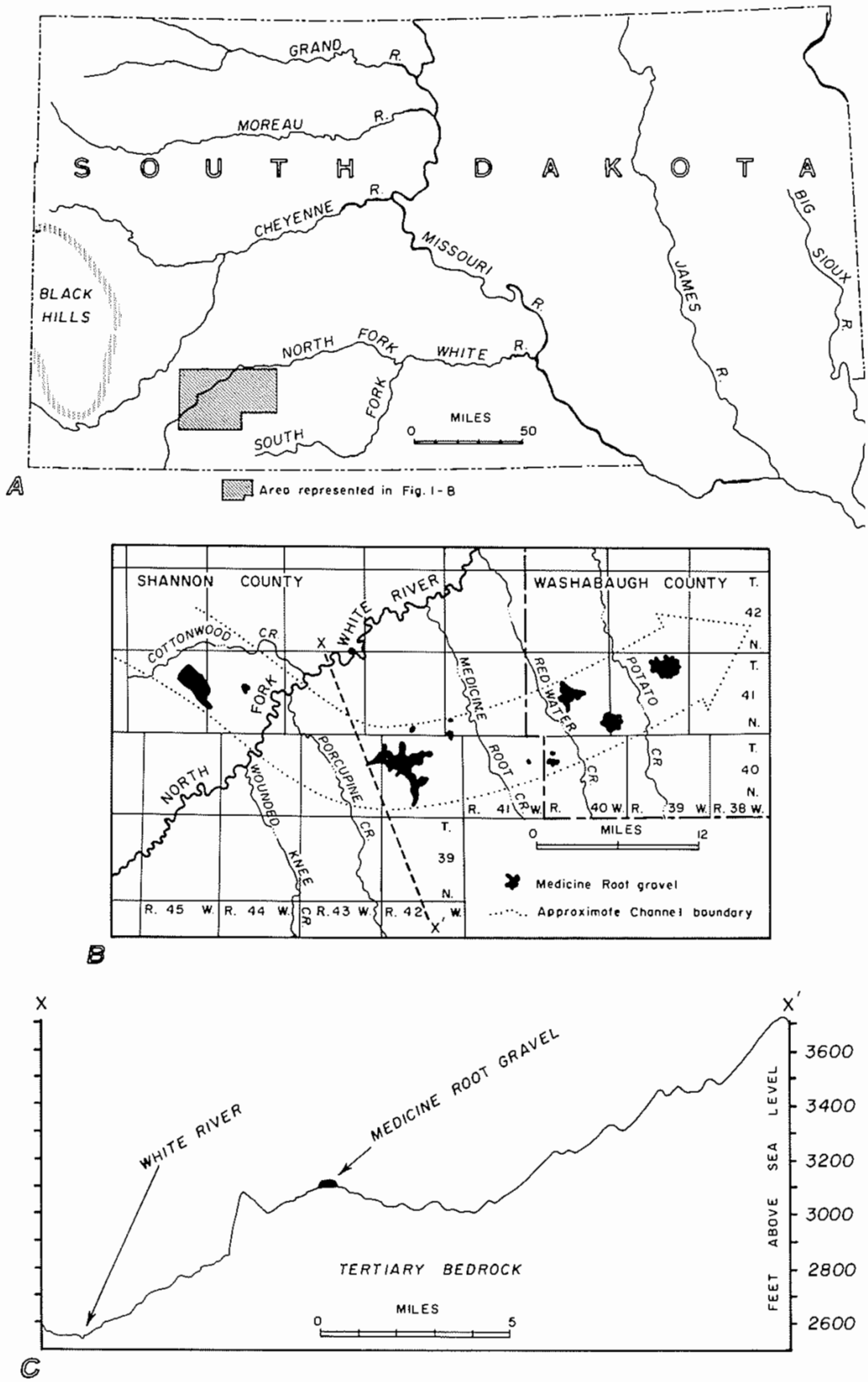

Figure. 1. A. Map of South Dakota showing the Black Hills and the present-day drainage system. The cross-hatched area is that which is represented in Fig. 1B B. Map showing the known outcrop area of the Medicine Root gravels. The black areas indicate the known deposits of the Medicine Root gravel while the dotted lines delineate the approximate channel boundaries of the Medicine Root River C. Cross section X to X′. This cross section was taken along the dashed line shown in Fig. 1B. The elevation at X′ represents the top of the Pine Ridge Escarpment

vey (George V. Cohee, *pers. communication*) and is proposed as an informal name in accordance with the Code of Stratigraphic Nomenclature (American Commission on Stratigraphic Nomenclature, 1961). The type area is here designated as that area represented in Figure 2.

The exposures of the Medicine Root gravel mark the course of an ancient Black Hills drainageway (Fig. 1B). This river was probably the major drainage of the southern Black Hills until the Cheyenne captured the entire Black Hills drainage system. The probable time and possible reasons for the capture of the Black Hills drainages by the Cheyenne River has been discussed by Todd (1902) and Wanless (1923).

In this report there are references to both the Medicine Root River and to Medicine Root Creek. To avoid misunderstanding, it should

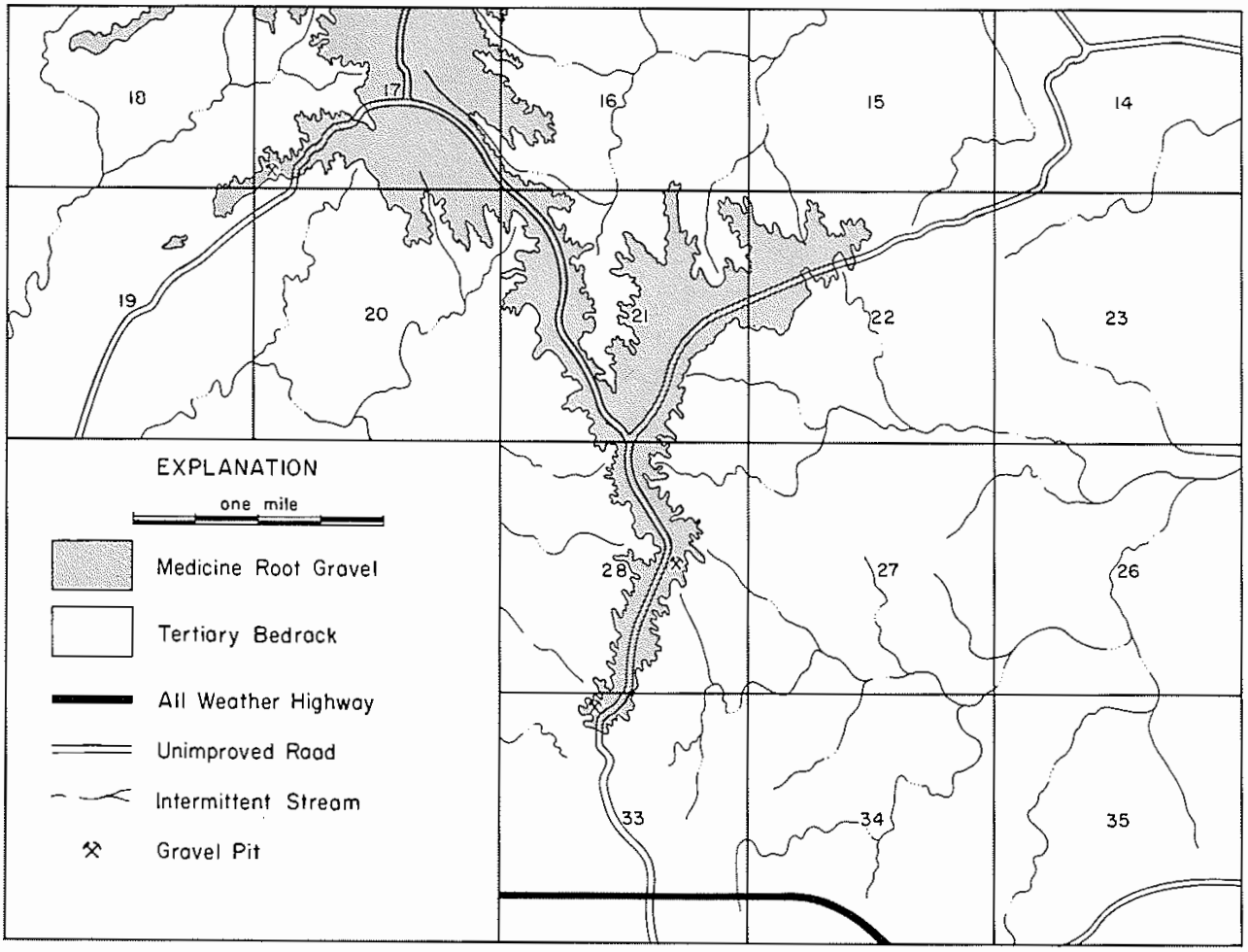

Figure 2. Type area for the Medicine Root gravel. The area represented above is in T. 40 N., R. 42 W., Shannon County, South Dakota.

be stated that Medicine Root Creek is the *present-day* drainage while the Medicine Root River is the old Black Hills drainage that deposited the Medicine Root gravel.

The Medicine Root gravel consists of deposits of sand and gravel. As the name of the unit would imply, gravel forms the major constituent. However, all other size factions from clay to boulders are present. Judging from particle size, this stream was one of the most powerful in regards to carrying capacity that ever existed west of the Missouri River in South Dakota. One blocky piece of sandstone, measuring approximately 204 x 280 x 306 mm, was found in sec. 30, T. 41 N., R. 39 W., Washabaugh County, South Dakota. It is estimated that this block had been transported for more than 70 miles before final deposition.

The gravels contain a high percentage of igneous and metamorphic rock derived from the core of the Black Hills. This ancient drainage, in its course from the central Black Hills out across the Great Plains, flowed across nearly every major formation found in southwestern South Dakota. For this reason it is possible that every form of pre-Quaternary rock found in southwestern South Dakota may be represented in the Medicine Root gravel.

Not only is the Medicine Root gravel extremely heterogeneous in lithology, but it is also heterogeneous in regard to fossil content. Cretaceous *Ostrea* and *Inoceramus* were found adjacent to water-worn fragments of vertebrate remains from the Oligocene and Miocene Epochs. This aglomeration of fossils from pre-existing deposits make difficult any dating of the Medicine Root gravel. Figure 1C shows that the "Medicine Root River" had locally cut down more than 500 feet into the pre-existing late Tertiary bedrock of the Great Plains at the time of deposition of the Medicine Root gravel.

Some horse and camel material, thought to be contemporaneous with the deposition of the Medicine Root gravel, has been collected. While this material shows the age of the Medicine Root gravel to be near the Pliocene-Pleistocene boundary, not enough material has been collected to positively pinpoint this unit in geologic time.

Two deposits of silty sands, occurring below the gravels and above the Tertiary bedrock, have been found. These deposits occur in sec 17, T. 40 N., R. 42 W., and sec. 30, T. 41 N., R. 44 W., Shannon County, South Dakota. The relation of these deposits to the overlying gravels is at this moment in question. When this relationship is clarified, the Medicine Root gravel will be proposed as a formal stratigraphic unit and a type section will be designated.

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