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The Brule-Gering (*Oligocene-Miocene*) Contact in the Wildcat Ridge Area of Western Nebraska

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*The Brule-Gering (Oligocene-Miocene)
Contact in the Wildcat Ridge Area of
Western Nebraska*

A Guide for the Stratigraphic
Collecting of Fossil Mammals





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ABSTRACT

*The Brule-Gering (Oligocene-Miocene) Contact in the
Wildcat Ridge Area of Western Nebraska*

A Guide for the Stratigraphic Collecting of Fossil Mammals

C. BERTRAND SCHULTZ CHARLES H. FALKENBACH CARL F. VONDRA

The contact between the Brule Formation (Oligocene) and the Gering Formation (Miocene) can be readily distinguished in the Wildcat Ridge area, as elsewhere in western Nebraska. At the critical fossiliferous exposures at Castle Rock in Scotts Bluff County, the contact on the south face between the two formations is defined as 129 feet above the base of the "Upper Ash" bed, which corresponds to the upper portion of Darton's (1899, Pl. C, Fig. D, following p. 754) "sandy phase" in the upper part of the Brule. Certain key beds in the Gering Formation can be traced laterally from a channel facies to a proximal-floodplain facies, then to a distal-floodplain facies, and finally to an interstream-divide facies. The sediments of the latter two facies are massive and very fine-grained, and in some respects, similar to the argillaceous siltstone of the underlying Whitney Member of the Brule Formation. Significant localities for observing the facies problems of the Gering Formation are to be found along the salient of Wildcat Ridge from Twin Sisters in Banner County to Castle Rock in Scotts Bluff County, Nebraska. The geographic location of the type locality of the Gering Formation also is discussed.

*The Brule-Gering (Oligocene-Miocene) Contact in
the Wildcat Ridge Area of Western Nebraska*

A Guide for the Stratigraphic Collecting of Fossil Mammals⁴

INTRODUCTION

The University of Nebraska State Museum, in cooperation with the Department of Geology, initiated in 1931 a broad program of stratigraphic studies of the Tertiary sediments in western Nebraska, with the purpose of establishing the precise stratigraphic documentation of fossil vertebrates for the field catalogues. Numerous field studies by staff members and graduate students, including mapping projects, have resulted, and several papers treating of stratigraphic correlations have been prepared. Included among the reports are two concerned with the Oligocene (Schultz, Tanner, and Harvey, 1955; Schultz and Stout, 1955), five with the Miocene (Schultz, 1938, [MS., 1941a], 1941b, 1942a, 1942b), and several field guides (Schultz and Stout, 1961).

Also, in the cooperative research program connected with the revision of the oreodonts by staff members of Frick Laboratory and the University of Nebraska State Museum in the 1930's and 1940's, it became evident (Schultz and Falkenbach, 1949, 1954, [MS., 1967]) that Darton (1899, 1903a, 1903b, 1903c, and 1905), in his classical pioneer studies, had not been consistent in correlating the graphic sections concerned with the Brule-Gering contact in the Wildcat Ridge of western Nebraska. Schultz visited with Nelson H. Darton (of the United States Geological Survey) on several occasions during the 1930's concerning the sections in question, and also with Erwin H. Barbour,⁵ who had worked with Darton in the field during the 1890's, when his original geological explorations were conducted.

¹ University of Nebraska State Museum and Department of Geology, Lincoln.

² Deceased in 1962, formerly a member of the staff (1918-1962) of Frick Laboratory, American Museum of Natural History, New York City, and a Research and Field Associate, University of Nebraska State Museum (1952-1962).

³ Department of Earth Science, Iowa State University, Ames, and associated with Division of Vertebrate Paleontology (in field and laboratory), University of Nebraska State Museum (1952-present).

⁴ The major portion of the research for this paper was completed prior to 1962.

⁵ Director of the University of Nebraska State Museum, 1891-1941; Chairman of Department of Geology, 1891-1934; and Director, Nebraska State Geological Survey, 1893-1921.

Darton and Barbour personally urged Schultz and Falkenbach to restudy the geology if necessary, since the original survey was intended to be only a reconnaissance. During the early 1950's faunal evidence connected with the revision of the oreodonts (especially the *Leptaucheniinae*, Schultz and Falkenbach, MS., 1967), made it necessary to reconsider the Brule-Gering contact in certain sections in western Nebraska, as at Redington Gap in Morrill County and in the Castle Rock area of Scotts Bluff County.⁶ Childs Frick generously agreed to finance a detailed geologic study and mapping program of the Gering Formation, and Carl Vondra accepted the principal responsibility for carrying on the study.

The purpose of this report is two-fold. First, it is necessary to consider the Brule-Gering contact (the approximate Oligocene-Miocene boundary) as presented by Darton (1899 and 1903a) and by Schultz and Stout (1955) at certain critical fossiliferous exposures in the vicinity of Castle Rock, Scotts Bluff County, Nebraska. Secondly, the relations at the nearby type locality of the Gering are illustrated. Although these relations are only shown graphically here, detailed lithologic descriptions will be provided by Vondra (MS., 1967, *in press*), and paleontologic evidence will be reported by Schultz and Falkenbach (MS., 1967, *in press*).

Figures 1 through 6 precede the text in order to better orient the reader as to the problems involved with the Brule-Gering contact. Figure 1 is concerned with the geographic location of the channel facies of the Gering Formation in a portion of Wildcat Ridge. Figures 2 and 3 are Darton's graphic sections (1899, Pl. C, Fig. D, and Fig. 218) showing the Brule-Gering contact at two localities in Wildcat Ridge. Figures 4, 5, and 6 illustrate the writers' concept of the Brule-Gering contact in the same localities.

⁶In these controversial areas, where the Museum's field collectors did not agree with Darton's contacts, the fossils were documented in the records in relation to the Upper Ash of the Whitney or to other easily recognized key deposits.

The Brule-Gering Contact

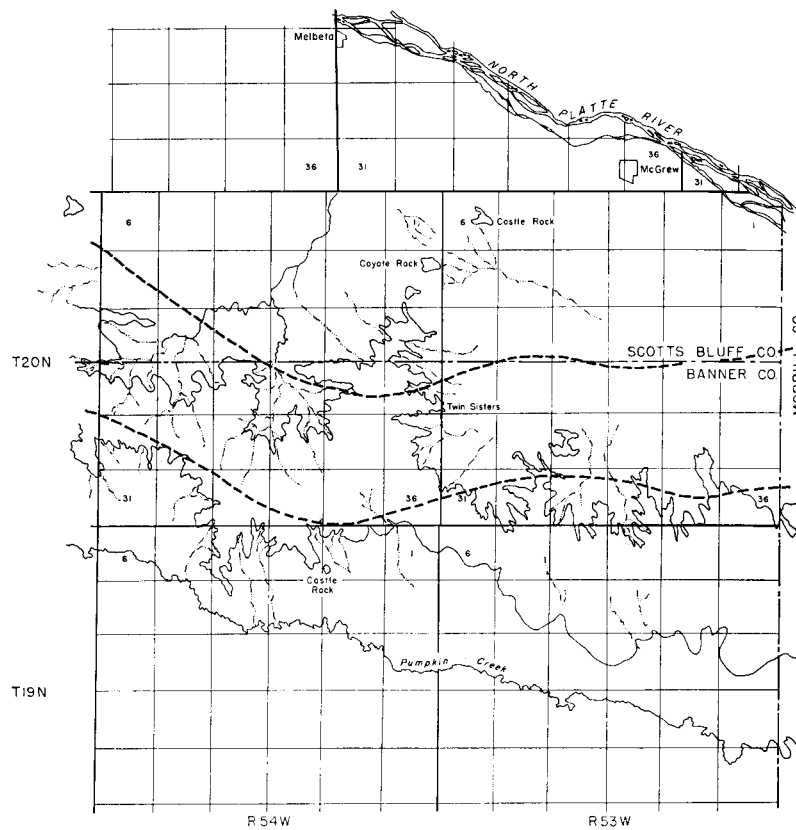


FIG. 1—A map showing the outline of Wildcat Ridge in western Nebraska, and the location of the main Gering channel in Scotts Bluff and Banner counties. The channel facies of the Gering Formation occurs predominantly within the dashed lines and grades laterally into the floodplain facies as far north as Castle Rock in Scotts Bluff County and as far south as Castle Rock in Banner County.

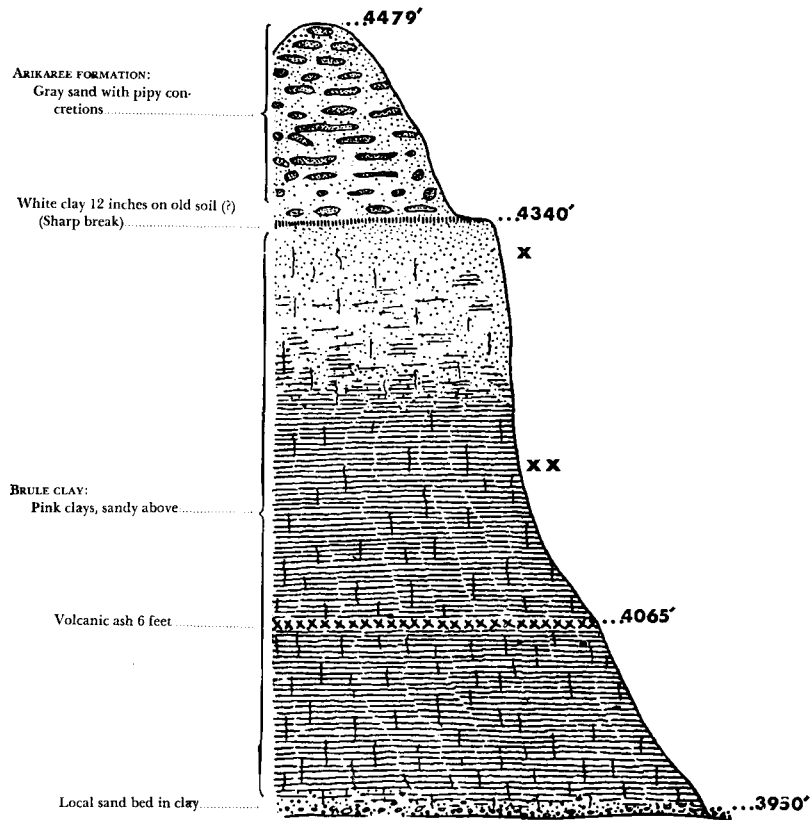


FIG. 2—A graphic section of the exposures at Castle Rock, Scotts Bluff County, Nebraska; from Darton (1899, Pl. C, Fig. D, following p. 754, and 1903a, Pl. 27, Fig. D, following p. 36). This section demonstrates that Darton recognized a change in lithology in the upper portion of what he called the Brule Formation. In other exposures, Darton included the upper portion of this silty, very fine-grained sandstone and sandy siltstone sequence in the Gering Formation rather than the Brule (*see* maps in Darton, 1903b and 1903c). The very fine-grained sandstone at Castle Rock can be traced laterally to the south along a major salient of the Wildcat Ridge. It represents a fine-grained floodplain facies, which thickens laterally and grades into the channel facies of the Gering Formation. Thus, the writers include this interval in the Gering Formation (*see* Fig. 5 this paper) and place the Brule-Gering contact at the change in lithology ("X" at right of section), which also appears to be the faunal break. The "XX" at right of section denotes the approximate position of the "Upper Ash" (Schultz and Stout, 1955, Fig. 10, Sec. 6). Numbers shown at right of section indicate elevation (in feet) above sea level.

The Brule-Gering Contact

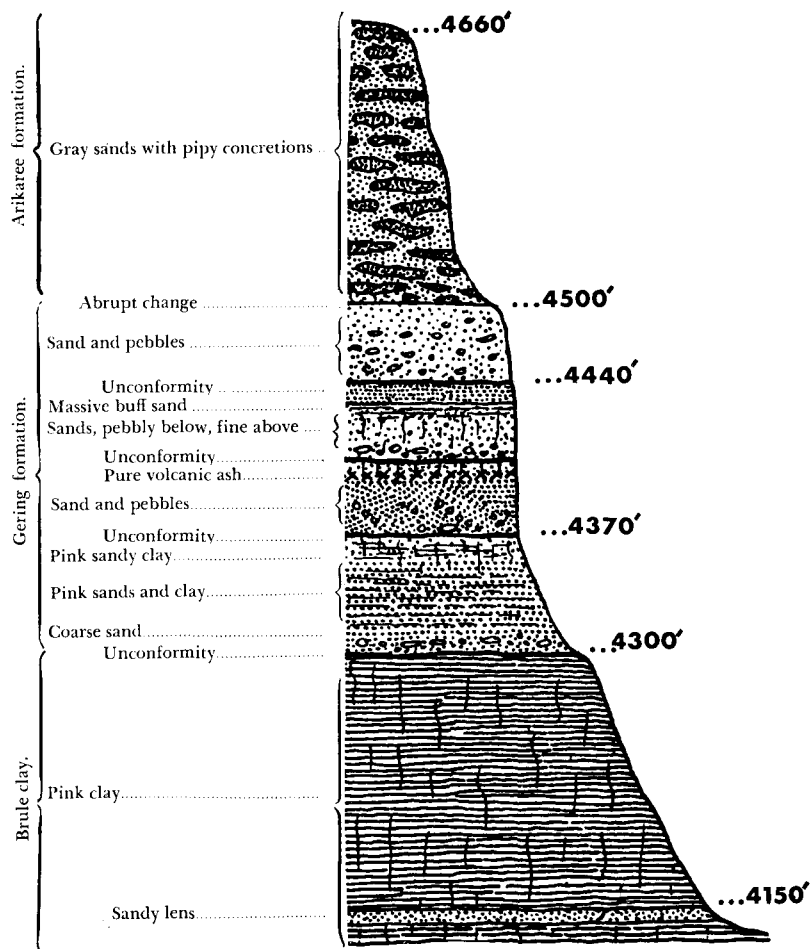


FIG. 3—A graphic "Section of the Gering and associated formations 6 miles south-southwest of Gering, Nebr.;" reproduced from Darton (1899, Fig. 218, p. 751, and 1903a, Fig. 11, p. 33). Darton (1899, p. 747, and 1903, p. 29) stated that the place where the Gering Formation has "Its greatest development in the Platte Valley is south-southwest of Gering, where 200 feet are exposed,..." Workers at the University of Nebraska State Museum and Department of Geology have long considered this to be an adequate description for typical exposures and of the type locality of the Gering. Numbers shown at right of section indicate elevation (in feet) above sea level. A similar section was given by Barbour (1903, p. 155, Fig. 78).

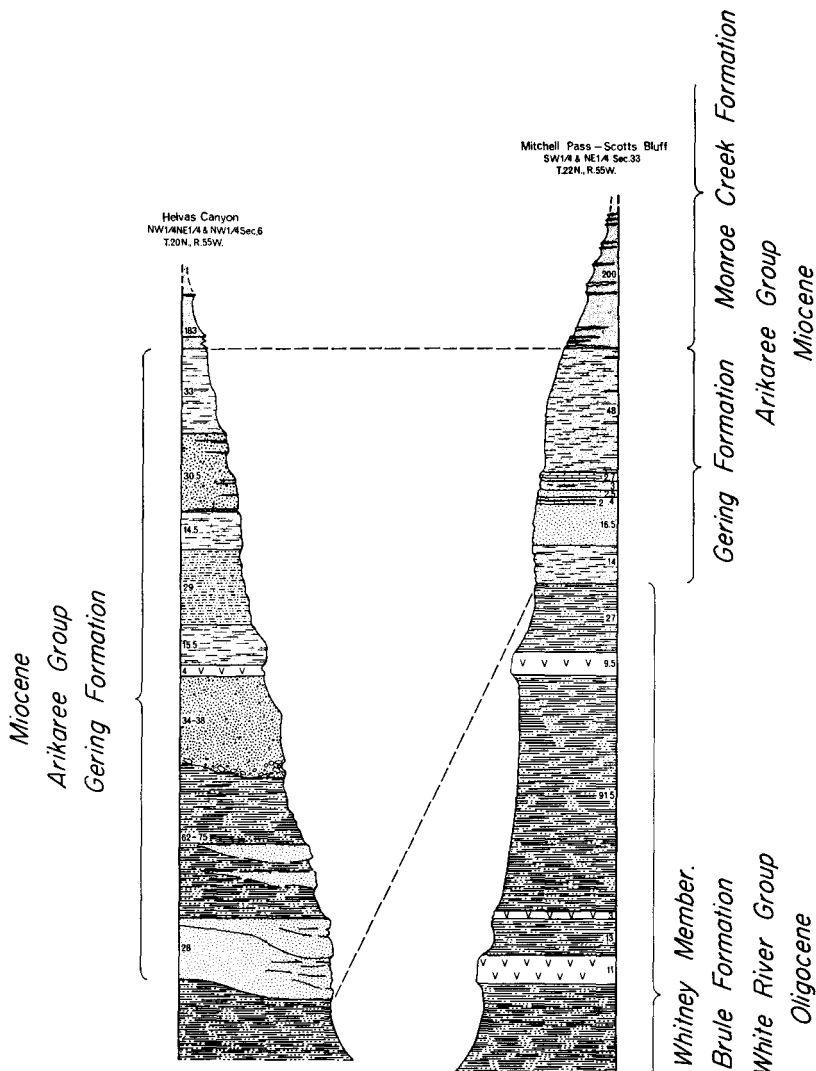


FIG. 4—Graphic sections of the Gering exposures at Helvas Canyon, and at Mitchell Pass and Scotts Bluff, in western Nebraska. That at Helvas Canyon is modified after Vondra (MS., 1963, p. 130) and from field sections by Schultz, 1932; T. M. Stout, Jack Graham, and Schultz, 1936; and Charles H. Falkenbach and Schultz, 1934-1940. The Helvas Canyon area has been considered the type locality of the Gering by the University of Nebraska State Museum field parties since 1932 (Schultz, MS., 1941, p. 167-168; Schultz and Stout, 1961, p. 51). The numerous collecting localities for fossil vertebrates in the Wildcat Ridge of Nebraska and in the Pine Ridge of Nebraska, Wyoming, and South Dakota have been correlated with the sediments in this locality. Erich Schlaikjer (1935, p. 118, and oral communication) and A. L. Lugin (1939, p. 1251 and 1267, and oral communication) also referred to this same site as the type locality of the Gering. From 1934 to 1937, many geologic sections also were measured by Falkenbach and Schultz at the various Early to Medial Miocene localities of the Frick Laboratory in eastern Wyoming, where extensive collections of vertebrate fossils were being made by Charles H. Falkenbach. These sections have been correlated with the Gering, Monroe Creek, Harrison, and Marsland type sections of Nebraska. Numbers shown at margins of sections in Fig. 4 indicate thicknesses of sediments in feet.

The Brule-Gering Contact

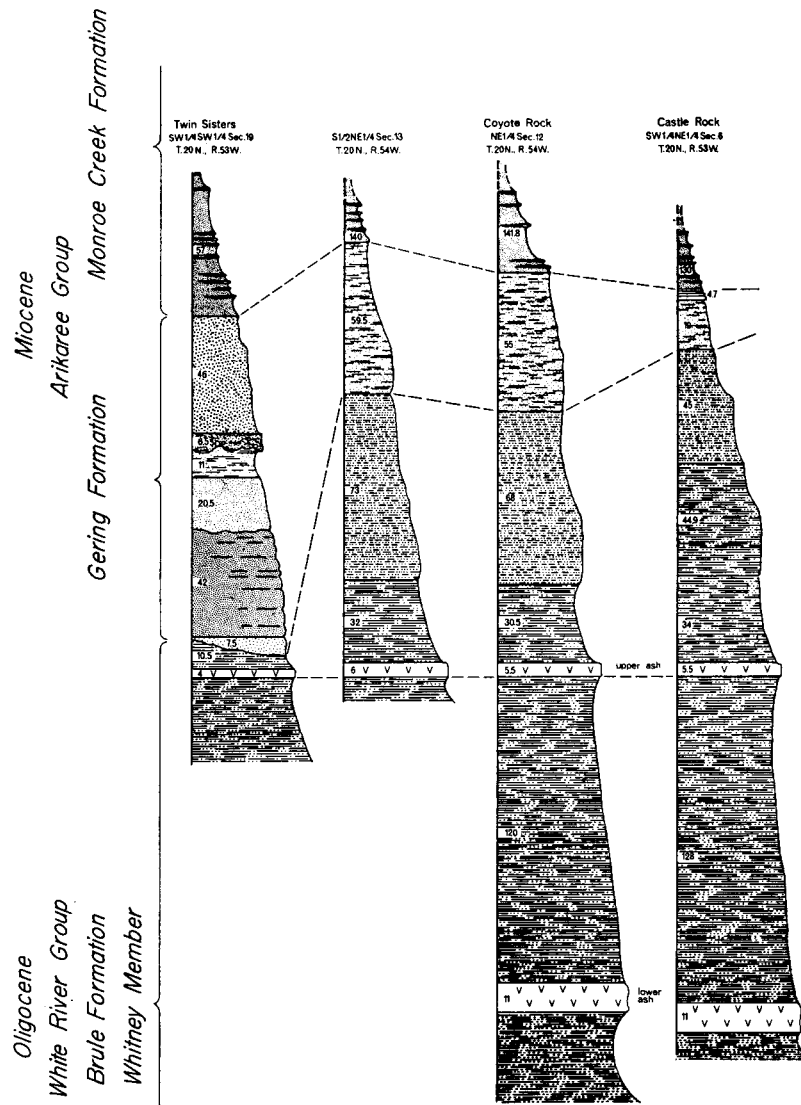
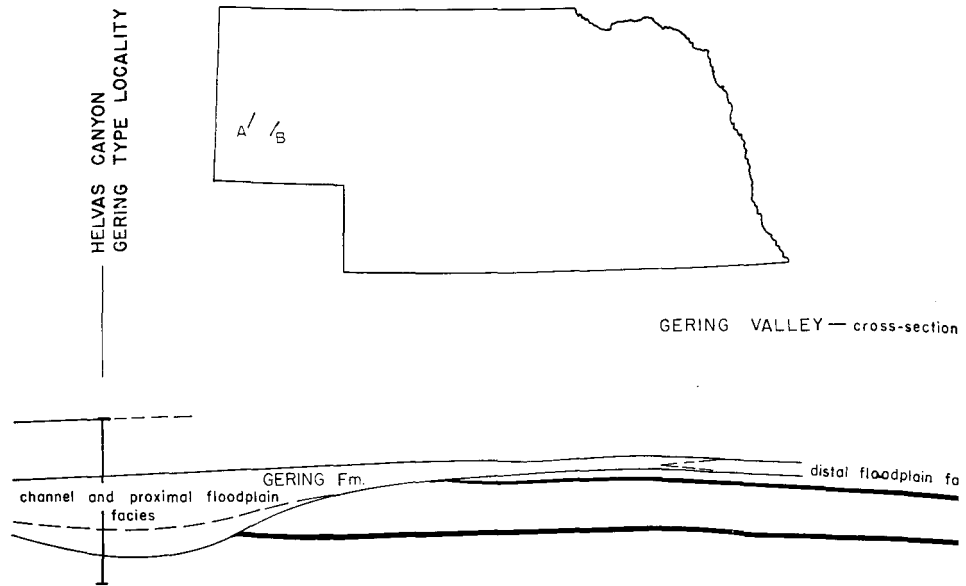
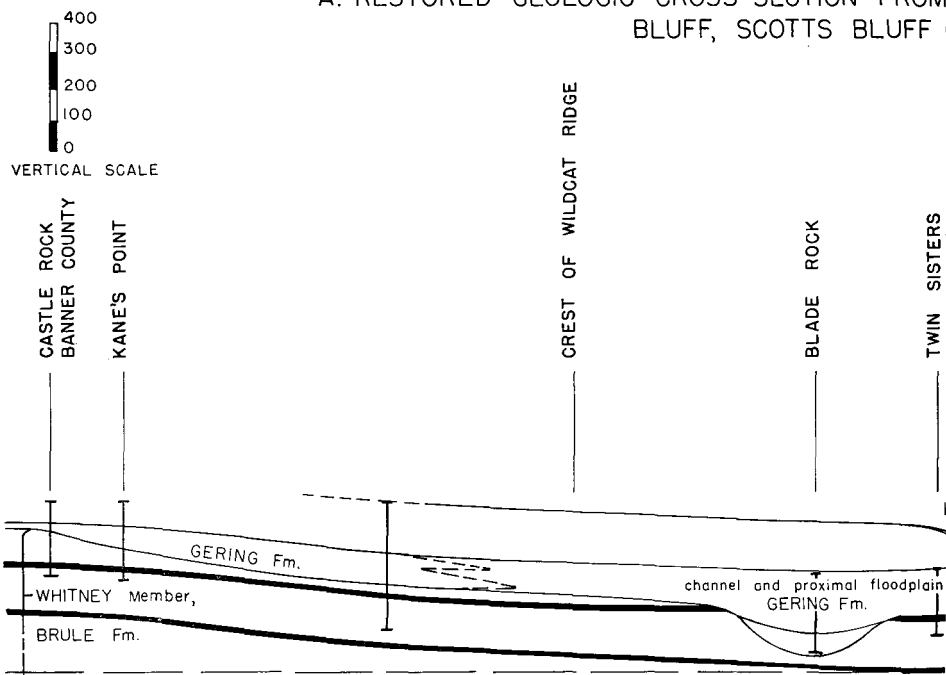


FIG. 5—Graphic sections of critical localities displaying the lateral variation in lithology of the Gering Formation from the channel facies at Twin Sisters to the distal floodplain facies at Castle Rock. Numbers shown at margins of sections indicate thicknesses of sediments in feet. (Modified after Vondra, MS., 1963)



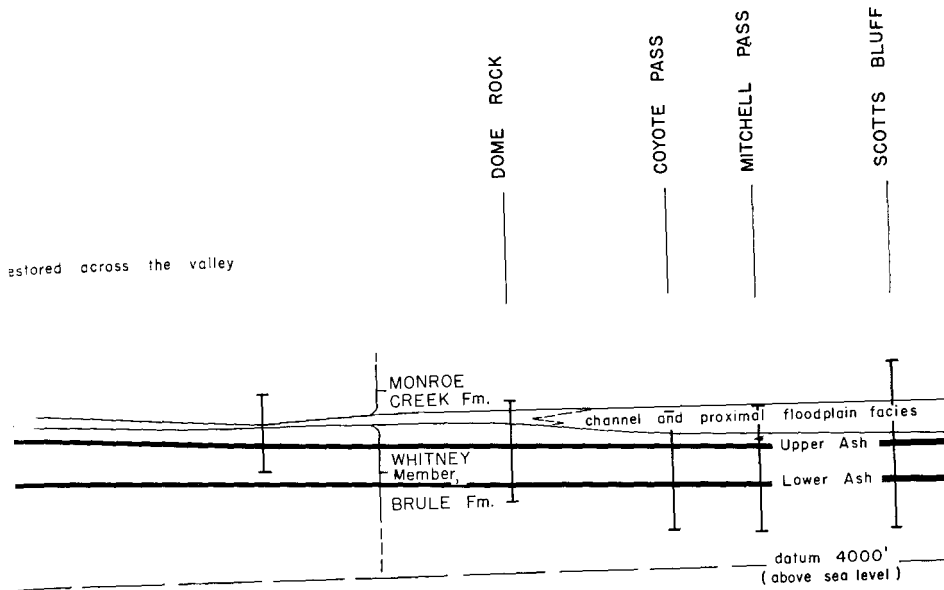
A. RESTORED GEOLOGIC CROSS-SECTION FROM
BLUFF, SCOTTS BLUFF COUNTY TO



B. RESTORED GEOLOGIC CROSS SECTION OF
BANNER COUNTY TO CASTLE ROCK, SCOTTS BLUFF COUNTY

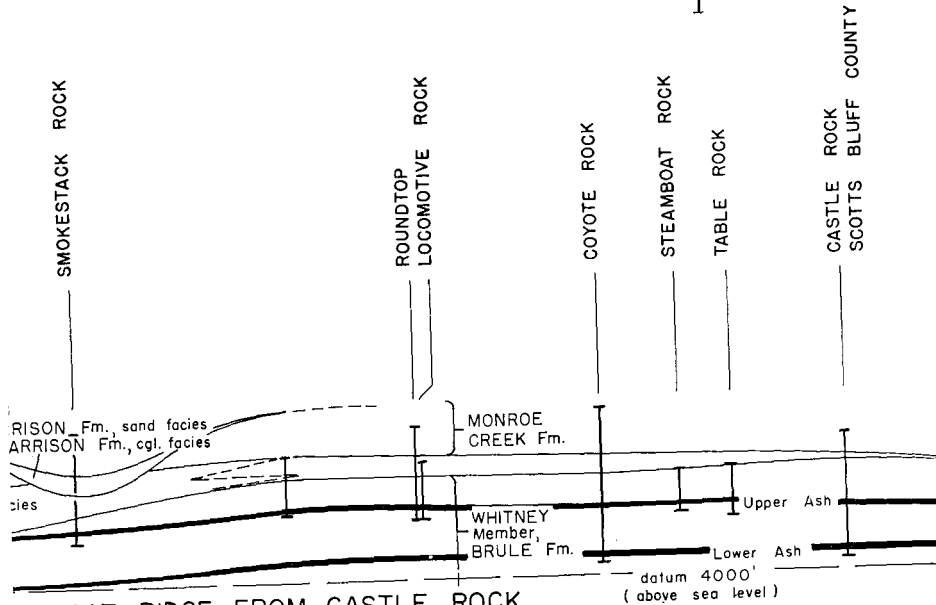
HORIZONTAL SCALE 0

FIG. 6—Restored geologic cross-sections of the Wildcat Ridge in western Nebraska from the mouth of the Gering River to Castle Rock in Scotts Bluff County, showing the lateral relationships of the several Gering



THE MOUTH OF HELVAS CANYON TO SCOTTS BLUFF COUNTY, NEBRASKA

VERTICAL EXTENT AND POSITION OF MEASURED AND DESCRIBED EXPOSURE



VILDCAT RIDGE FROM CASTLE ROCK, SCOTTS BLUFF COUNTY, NEBRASKA

0 2000 3000'

1 of Helvas Canyon to Scotts Bluff, Scotts Bluff County, and from Castle Rock, Banner County, facies.

CASTLE ROCK SECTION

Castle Rock (Figs. 1 and 2) is located 12 miles due east of the type locality of the Gering Formation (Figs. 3 and 4) in the southeastern part of Scotts Bluff County, Nebraska, both approximately two-and-one-half to three miles north of the boundary between Banner and Scotts Bluff counties. Darton (1899, Pl. C, Fig. D; 1903a, Pl. 27, Fig. D; *reproduced as Fig. 2*) as well as Schultz and Stout (1955, Fig. 10, Sec. 6) placed the contact of the Brule and Gering at Castle Rock at the base of the pond-and-soil complex which Schultz and Stout (1955, p. 46) termed the *Bayard Paleosol Complex*.⁷

On the basis of fossil and physical evidence now available, it is here proposed that the contact between the Whitney Member of the Brule Formation and the Gering Formation should be placed on the *south* face of Castle Rock at a point 129 feet above the base of the "Upper Ash" bed of Schultz and Stout (1955). Although the "Upper Ash" bed is not shown on Darton's section of Castle Rock, the Brule-Gering contact as here defined corresponds to the upper portion of Darton's "sandy phase" beneath the paleosol (*see Fig. 2; compare with the graphic section of Castle Rock, Fig. 5.*).

Darton (1899, p. 29) stated concerning areas on both sides of the ridge that "possibly where it [the Gering Formation] appears to be absent, it is represented either by clayey members which are not distinguished from the Brule clay or by fine sand with concretions resembling Ogallala beds." The writers are of the opinion that this is the case in the exposures in the vicinity of Castle Rock, as well as at several other localities in the Wildcat Ridge (*see Fig. 6*). Darton recognized the fine-grained facies as equivalent to the coarse-grained Gering deposits, and in some localities as distant as the Pine Ridge (in northwestern Nebraska), he formally included them in the Gering Formation (*see Fig. 7*).

⁷ T. M. Stout (personal communication) likewise emphasizes the regional importance of the Brule-Gering unconformity, but he prefers to continue considering the *Bayard Paleosol Complex* at the *north* side of Castle Rock as equal to the entire Gering, resting on the hardened surface of the Brule Formation there.

TYPE LOCALITY OF GERING

The Helvas Canyon Section (Figs. 3 and 4) is here emphasized as the type section of the Gering Formation, and it will be further discussed in more detail by Vondra (MS., 1967, *in press*). Osborn (1909 and 1918) suggested that the "typical horizon" of the Gering Formation was at "Scotts Bluff" or at "Scott's Bluffs." However, recently Mattes (1958, p. 26) indicated that the term, "'Scott's Bluffs', commonly referred to all of these hills, including the Wildcat Hills [Ridge]," and since Osborn did not present a graphic section or a description of the Gering, and also was not definite in his location, the writers do not consider this reference pertinent to the problem. The Gering section at the Scotts Bluff National Monument is similar to the type section, but the Gering is considerably thinner there. It consists of channel sand and silt similar to the sediments at the type section at Helvas Canyon, but a tributary to the main, ancient "Gering River" of this area is postulated (Figs. 4 and 6). Barbour's "Section of Gering" (1903, p. 155, Fig. 78) was of the Helvas Canyon Section; this preoccupies Osborn.

The Gering Formation and the regional unconformity separating it from the underlying Brule Formation can be traced in the north-extending dissected salient of Wildcat Ridge, from Twin Sisters to Castle Rock (Fig. 6). The Gering Formation thins and grades laterally from a coarse-grained channel facies at Twin Sisters to a progressively finer-grained, proximal floodplain facies and to a very fine-grained distal floodplain facies at Castle Rock (*see* Figs. 5 and 6).

Several students of the Gering Formation have based their concept of this formation on Darton's statements concerning the Brule-Gering contact in selected graphic sections, such as that at Redington Gap and in the Castle Rock area. This has resulted in confusion and controversy. They have suggested that the term *Gering* should be restricted to coarse-grained channel deposits, and that finer-grained marginal and contemporary deposits should be assigned to another member or formation.

It is impossible, in most instances, to obtain a complete understanding of a formation consisting of fluvial deposits from relations at a single locality, and in describing a formation, it is necessary to fit the type section into a regional perspective. In the case of the Gering, several other reference sections in the same fluvial paleo-valley are here selected to show the regional, basal unconformity with the Brule Formation, and the marked gradation to finer silt and sand marginal to the axis of the ancient valley (Fig. 6).

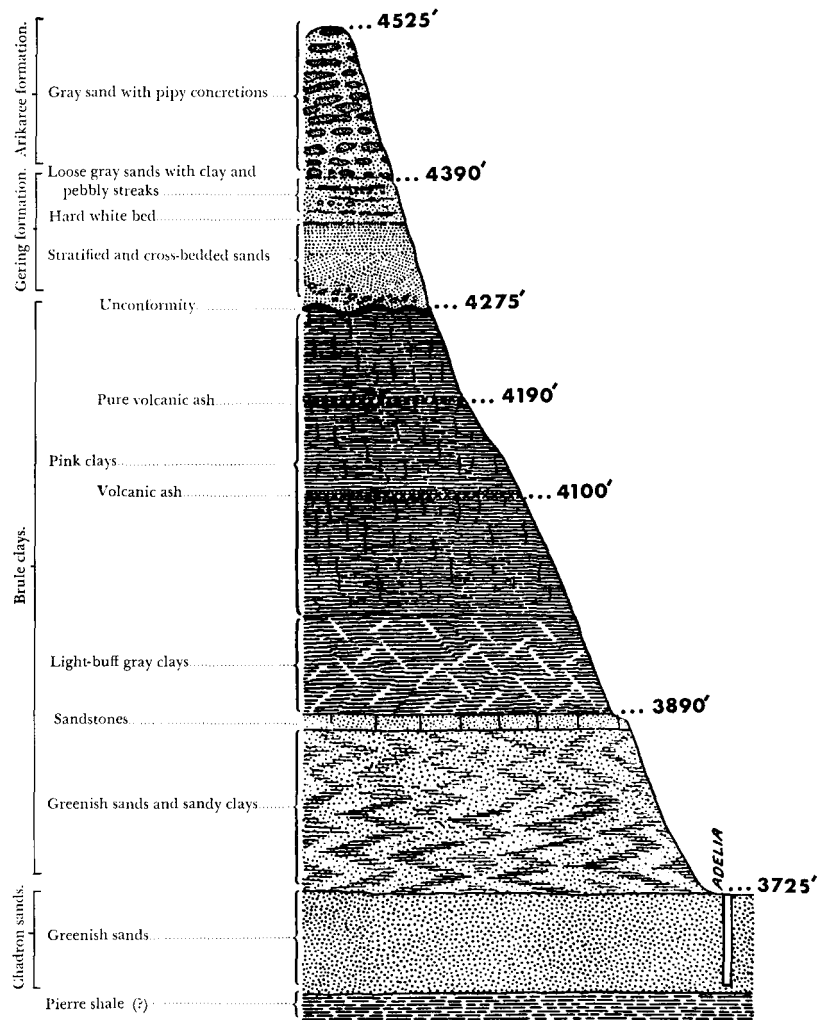


FIG. 7--"A Graphic Section from Round Top to Adelia station, Sioux County, Nebraska," from Darton (1899, Fig. 226, p. 757, and 1903a, Fig. 19, p. 39). This section in northwestern Nebraska indicates that Darton (1899; 1903a) included the finer-grained floodplain facies in his definition of the Gering Formation. A thick paleosol complex is developed at the top of the Whitney Member of the Brule Formation at this locality (Schultz, Tanner, and Harvey, 1955, p. 3), as it appears to be at Castle Rock and Roubedcau Pass in Scotts Bluff County, and at Redington Gap in Morrill County. The *Round Top-Adelia Section* also is the type locality of the Brule Formation (Darton, 1899; 1903a) as well as the type locality of the Orella and Whitney members (Schultz and Stout, 1955) of the Brule. Numbers shown at right of section indicate elevation (in feet) above sea level.

The Brule-Gering Contact

This should provide a sound basis for subsequent observers to become familiar with a representative fluvial formational unit and its variability. Such a reconstruction also makes possible comparative paleoecological studies of fossils collected from different facies of a valley-fill.

SUMMARY

Thus, the concept of the Gering Formation may be extended both locally and regionally from its type section (*see* Figs. 4 and 6), with the exposures at Castle Rock in Scotts Bluff County, at Kane's Point in Banner County, and at Redington Gap in Morrill County as further reference sections. A regional unconformity separates the Brule and Gering formations, and this is generally recognized as the Oligocene-Miocene boundary in the Central Great Plains.

ACKNOWLEDGMENTS

The writers are indebted to Thompson M. Stout for assistance in the field and for helpful suggestions concerning the present report, and to A. L. Lugin and Lloyd G. Tanner for aid in the collecting of paleontologic and stratigraphic evidence in the field. Thanks also are extended to the many members of the University of Nebraska State Museum paleontological expeditions, who collected fossils and geologic data in the Wildcat Ridge region of western Nebraska since 1930. Additionally, the writers are grateful to Morris F. Skinner and associates of the Frick Laboratory, American Museum of Natural History, who studied the geology and collected fossil mammals in the same area since the early 1950's.

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⁸ Some of the reports listed have been published or prepared since 1961, but they are included here for the convenience of those interested in additional information concerning this problem.

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