

**GEOLOGIC MAP OF THE CUT BANK 30' x 60' QUADRANGLE  
NORTHWESTERN MONTANA**

Compiled and Mapped

by

Richard B. Berg

Montana Bureau of Mines and Geology  
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This map has had preliminary reviews for conformity with technical and editorial standards of the Montana Bureau of Mines and Geology.

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## Introduction

Except for a small area in the southeastern corner of the Cut Bank quadrangle where the geology was mapped by the author during the fall of 2000, geologic information was compiled from Cannon's (1996) map of the Blackfeet Indian Reservation and Zimmerman's (1967) map of most of the eastern part of the quadrangle. Information from these published maps was modified only slightly in this compilation.

The Cut Bank quadrangle is situated on the west flank of the Kevin-Sunburst dome. Upper Cretaceous sedimentary rocks have a westerly regional dip of approximately 100 feet per mile in the Cut Bank area (Zimmerman, 1967). Several thrust faults in the southwest corner of the quadrangle are the leading edge of the Montana Disturbed Belt. Cretaceous beds in this area are intensely deformed (Cannon, personal communication, 2002) and the diagrammatic representation in the cross section is undoubtedly simplified. Bedrock is poorly exposed over much of the quadrangle. Glacial deposits of the continental ice sheet cover most of the eastern part of the quadrangle except for an escarpment trending generally north-south where the Virgelle and Telegraph Creek formations and Kevin Member of the Marias River Formation are exposed. Glacial till deposited by piedmont glaciers occupies a large area southwest of the city of Cut Bank.

Reviews by Michael R. Cannon, Karen Porter, and Richard Gibson improved the map and are appreciated.

## Descriptions of Map Units

- Qal Gravel, sand, silt, and clay alluvial deposits along major streams (Quaternary)**
- Qls Landslide deposit (Quaternary)**
- Qg Glacial deposits undivided (Pleistocene)** - Till deposited by continental ice sheets. Pebbly clay loam or loam till containing numerous granitic and metamorphic pebbles, cobbles, and boulders from Canada. The till is 15 to 70 feet thick in the lower Birch Creek and Two Medicine River drainage basins, and about 50 feet thick along the St. Mary River at the International Boundary. Includes till units deposited during the late Wisconsin and Illinoian glaciations. Also includes till deposited by piedmont glaciers (Wisconsin Stage) southwest of Cut Bank. This is gravelly to clayey till in ground moraine and in terminal, recessional, and lateral moraines. Includes gravel deposits in narrow buried channels and meltwater channels. Thickness of this till typically is from 1 to 15 feet, although in small areas thickness may be more than 50 feet. During the Wisconsin Stage of glaciation, moraines were formed by glaciers flowing eastward and northeastward from the high mountains onto the plains (Cannon, 1996).
- Qgo Glacial outwash (Pleistocene)** - Chiefly coarse gravel and cobbles in sand matrix. Includes nonglacial fluvial terrace and pediment gravel deposits that were reworked by glacial meltwater. Also includes sand and gravel deposited as outwash from melting glaciers. Thickness of sand and gravel locally is more than 38 feet (Cannon, 1996).
- QTab Alluvial deposits of braided streams** that spread out onto the plains from the mountains to the west (Quaternary and Tertiary) - This unit includes the Tg2 and Tg1 gravel deposits as shown by Cannon (1996). The following description applies to exposures of these deposits in the Valier 1<sup>0</sup> x 2<sup>0</sup> quadrangle (south of the Cut Bank quadrangle) where these deposits were either more prominently developed or are better preserved particularly in the area south of the town of Valier. These deposits do not form distinct terrace levels, but are remnants of alluvial surfaces covered by generally less than 15 feet of gravel. The gravel is composed mainly of quartzite clasts in the Cut Bank 30' x 60' quadrangle, but limestone clasts dominate farther to the south in the Valier 30' x 60' quadrangle. Metamorphic rocks derived from the Canadian Shield occur in the gravel where it was covered by continental ice sheets. Gradients of the bedrock surfaces on which the gravel was deposited range from 80 feet per mile near the mountain front to 25 feet per mile for those most distant from the mountains. The general trend of these surfaces, as now preserved, is east to slightly north of east.

**TKwc Willow Creek Formation (Paleocene and Upper Cretaceous)** - Variegated mudstone with some thin beds of sandstone. Upper part of the Willow Creek Formation is bright reddish-brown mudstone in beds as thick as 3 feet interbedded with gray, gray-green, and tan-gray mudstone (Mudge and Earhart, 1983). Lower part of Willow Creek Formation is variegated mudstone, dominantly grayish, green, gray, and locally tan, pinkish gray, purple, and red brown. Some thin interbeds contain irregular tufa-like nodules that probably contain barite. Thin, gray, poorly sorted fine- to medium-grained sandstone beds locally. Weathers to badlands topography where outcrops are extensive. At least 770 feet thick in north part of mapped area (Cannon, 1996).

**Ksm St. Mary River Formation (Upper Cretaceous)**- Mostly greenish-gray to grayish - olive mudstone interbedded with thin beds of fine-grained sandstone. Some poorly indurated, gray-brown to tan-gray, crossbedded sandstone beds fill small channels within the formation. Thin (3 feet) bed of carbonaceous shale, near the base of the St. Mary River Formation, commonly is overlain by a thin (3 feet) oyster bed (Mudge and Earhart, 1983). The St. Mary River Formation weathers to badlands topography. Thickness is about 980 feet in the northern part of the reservation (Stebinger, 1916). The St. Mary River Formation is similar to the Two Medicine Formation in this area; both consist of nonmarine sedimentary rocks (Cannon, 1996).

**Khbt Horsethief Formation and Horsethief-Bearpaw transition unit (Upper Cretaceous)** - The Horsethief Formation is gray to gray-brown, fine- to medium-grained marine sandstone, commonly crossbedded. Titaniferous magnetite sandstone locally is present in the upper 20 - 40 feet of the formation (Mudge and Earhart, 1983). Large calcareous concretions locally are present in the middle part. The Horsethief Formation is as thick as 165 feet and it forms prominent bluffs and ridges. The Horsethief-Bearpaw transition unit is dark-gray marine mudstone, interbedded with thin, fine- to medium-grained sandstone (Cobban, 1955). The sandstone beds are thicker and more abundant in the upper part. The unit is as thick as 400 feet in northern areas and it thins southward (Cannon, 1996).

**Kb Bearpaw Shale (Upper Cretaceous)**- The Bearpaw Shale is mostly dark-gray marine shale with ferruginous concretions, bentonite beds, and thin layers of sandstone (Cobban, 1955). Selenite (gypsum) crystals are common on weathered surfaces. The Bearpaw Shale is nearly 400 feet thick north of the Two Medicine River; it thins southward to about 225 feet along Blacktail Creek, where it is much sandier and contains beds of fine-grained, crossbedded sandstone as thick as 15 feet (Cannon, 1996).

**Ktm Two Medicine Formation (Upper Cretaceous)**- Nonmarine mudstone with some sandstone. Upper and middle parts mostly gray-green to gray mudstone with reddish-gray, red-brown, and purple interbeds. Fossils are common in the upper 490 feet, including dinosaur bones and pelecypods. The lower 560 feet contain many thick beds of gray- to greenish-gray sandstone interbedded with gray-green, olive-drab, and gray mudstone (Mudge and Earhart, 1983). Sandstone beds in the lower part are poorly indurated, fine- to medium-grained, massive to thinly bedded, and locally as thick as 165 feet. Thin coal beds are present at the top and base of the formation and in a zone about 250 feet above the base (Stebinger, 1916). The Two Medicine Formation has a maximum thickness of about 2,200 feet. Where outcrops are extensive, the Two Medicine Formation erodes into badlands topography, as does the St. Mary River Formation (Cannon, 1996).

**Kvt Virgelle Formation and Telegraph Creek Formation undivided.**

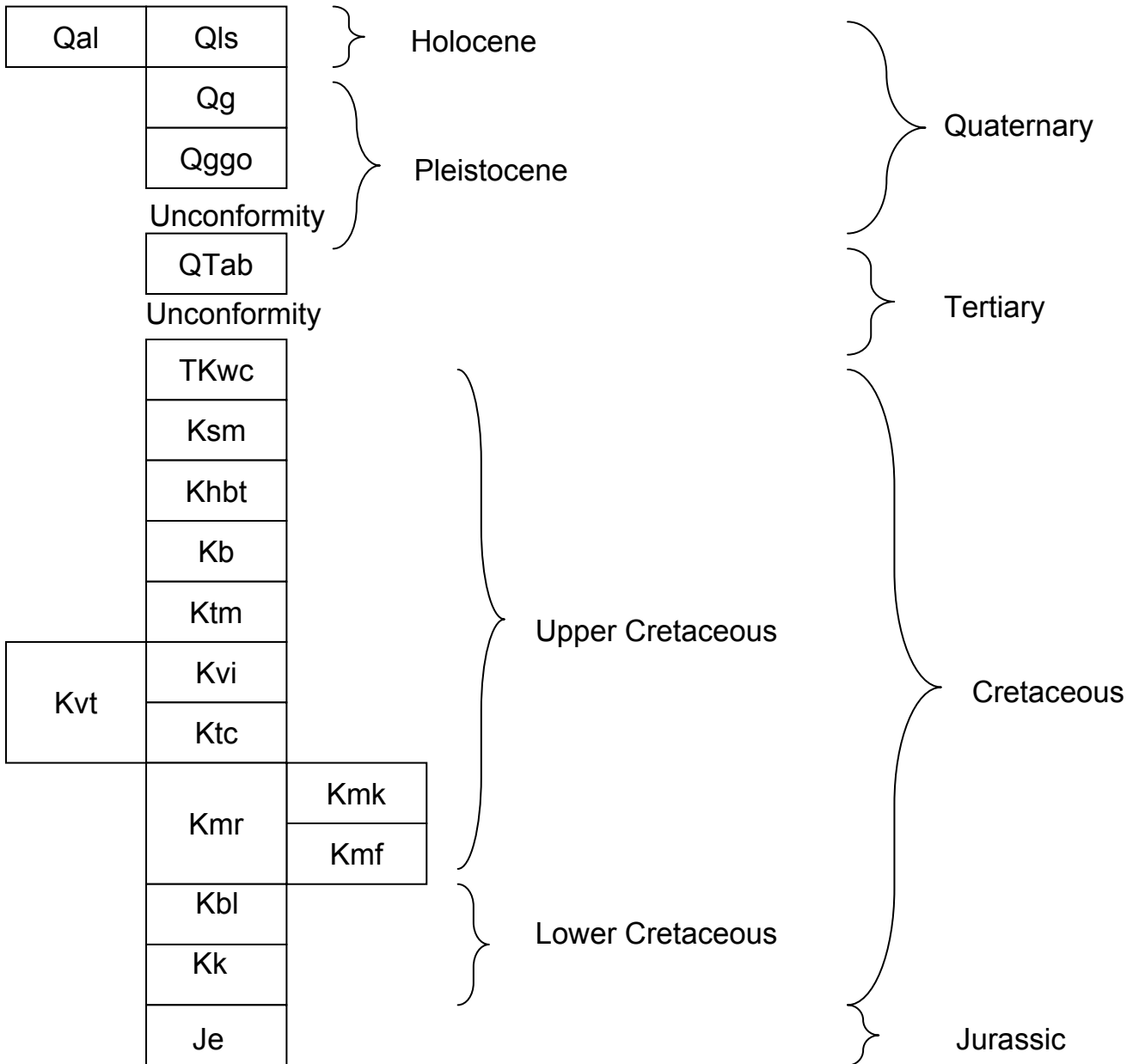
**Kvi Virgelle Formation (Upper Cretaceous)**- The Virgelle Formation is 115 to 180 feet thick but averages 160 feet. Light-gray to buff or whitish, fine- to medium-grained arkosic and slightly calcareous sandstone beds constitute most of the formation. The Virgelle Formation forms steep cliffs along much of its outcrop. Brownish-weathering calcareous sandstone concretions are abundant in the upper part of the formation and cap many weirdly eroded mounds and columns (hoodoos) along the outcrop (Zimmerman, 1967).

**Ktc Telegraph Creek Formation (Upper Cretaceous)**- The Telegraph Creek Formation is a transitional unit between underlying Marias River Shale and the overlying Virgelle Formation. It is similar to the transitional unit between the Bearpaw Shale and the Horsethief Formation (Mudge and Earhart, 1983). The Telegraph Creek consists mainly of gray mudstone interbedded with fine-grained sandstone. Sandstone beds are thicker toward the top of the formation and locally are crossbedded and ripple marked (Cannon, 1996). The Telegraph Creek Formation ranges from 120 to 170 feet thick (Zimmerman, 1967).

- Kmr** Marias River Formation (Upper Cretaceous) - Used only on cross section.
- Kmk** Kevin Member of the Marias River Formation - The Kevin Member can be subdivided into three units on the relative abundance of bentonite beds and the type of concretions. The lowest unit, 175-180 feet thick, is characterized by many beds of bentonite, calcareous concretions, and concretionary limestone. The middle unit, about 200 feet thick, is characterized by numerous beds of reddish-weathering ferruginous concretions and concretionary limestone and dolostone. The upper unit, about 200 feet thick, consists of dark-gray shale that contains many beds of yellowish-gray-weathering concretionary limestone and a few thin layers of shaly sandstone and bentonite (Cobban, 1976). The Kevin Member is covered by glacial till and only very poorly exposed in the Cut Bank quadrangle.
- Kmf** **Ferdig Member of the Marias River Formation-** The Ferdig Member consists of a lower dark-bluish-gray shale unit that contains hard red-weathering concretions of ferruginous dolostone, a medial gray sandy shale that contains gray and yellow-weathering calcareous concretions, and an upper dark-bluish shale unit with small gray calcareous concretions. Thickness at the type section about 5 miles east of the Cut Bank quadrangle is 224 feet (Cobban, 1976).
- Kbl** **Blackleaf Formation (Lower Cretaceous)-** Shown only on cross section - Thickness from well log for Self Service #1 Moliszwski in C, SW 1/4 SE 1/4 sec. 23, T. 34 N., R. 5 W.
- Kk** **Kootenai Formation (Lower Cretaceous)-** Shown only on cross section - Thickness from well log for Self Service #1 Moliszwski in C, SW 1/4 SE 1/4 sec. 23, T. 34 N., R. 5 W.
- Je** **Ellis Group (Middle and Upper Jurassic)-** Shown only on cross section - Thickness from well log for Self Service #1 Moliszwski in C, SW 1/4 SE 1/4 sec. 23, T. 34 N., R. 5 W.

# Correlation of Map and Cross Section Units

## Cut Bank 30' X 60' Quadrangle



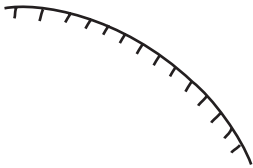
## Map Symbols



**Contact** - Approximately located. Dashed where inferred beneath glacial deposits or alluvium.



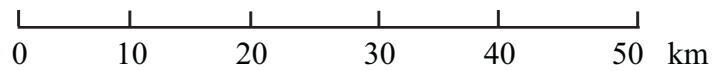
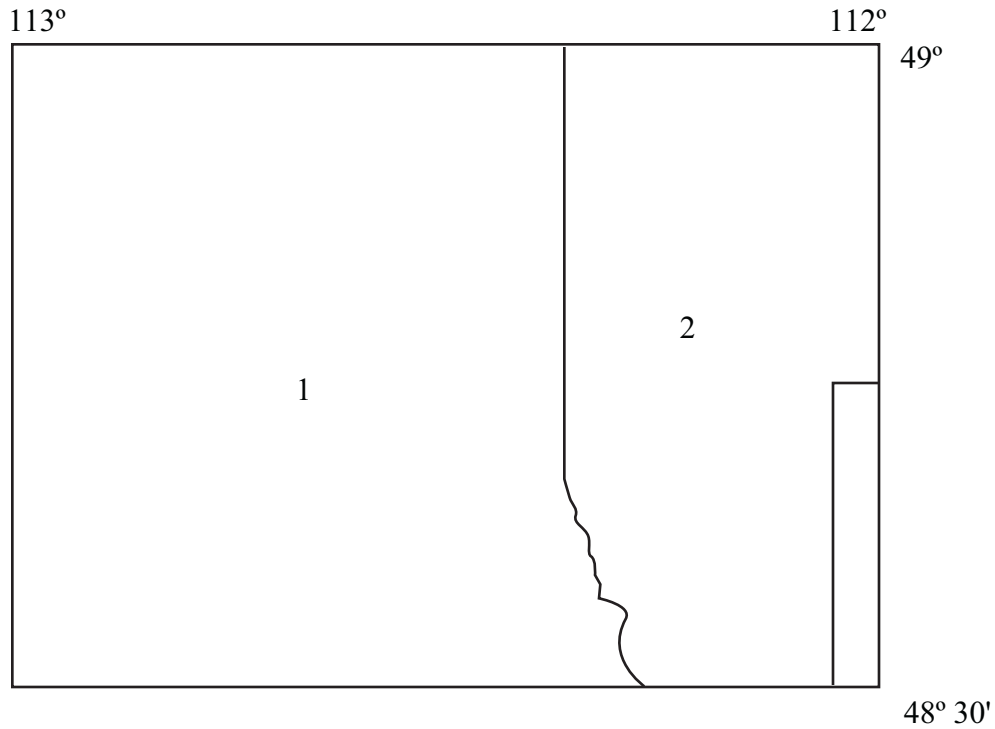
**Thrust fault** - Dashed where concealed by alluvial deposits. Sawteeth on upper plate.



**Glacial Lake** (Pleistocene) Discontinuous lake deposits include laminated clay and silt, some stratified sand and gravel, and scattered granitic pebbles, cobbles, and boulders (Cannon, 1996). The shoreline of Glacial Lake Cut Bank for the area east of the Blackfoot Indian Reservation is inferred on the basis of a spillway at approximately 3900 feet. Glacial Lake Twin River situated near the northern boundary of the map has a spillway at an elevation of 4010 feet (Horberg, 1954). Hachures on lake side.



## Published Geologic Maps Used in Compilation



1. Cannon, M.R., 1996, Geology and ground-water resources of the Blackfeet Indian Reservation, northwestern Montana: U.S. Geological Survey Hydrologic Investigations Atlas HA-737, map scale 1:125,000.
2. Zimmerman, E.A., 1967, Water resources of the Cut Bank area, Glacier and Toole Counties, Montana: Montana Bureau of Mines and Geology Bulletin 60, 37 p., map scale 1:71,512.

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- Stebinger, E., 1916, Geology and coal resources of northern Teton County, Montana: U.S. Geological Survey Bulletin 621, p. 117-156.

## Geologic Maps of Adjoining Areas

- Harrison, J.E., Whipple, J.W., and Lidke, D.J., (Compilers) 1998, Geologic map of the western part of the Cut Bank 1° x 2° quadrangle, northwestern Montana: U.S. Geological Survey Geologic Investigations Series I-2593, scale 1:250,000.
- Harrison, J.E., and Lidke, D.J., 1998, Geologic map and cross section across Belt terrane from Chewelah, Washington, to Glacier National Park, Montana: U.S. Geological Survey Geologic Investigations Series I-2594, scale 1:500,000.
- Lopez, D.A., (Compiler) 2002, Preliminary geologic map of the Conrad 30 x 60-minute quadrangle: Montana Bureau of Mines and Geology Open-file map MBMG 444, scale 1:100,000.
- Lopez, D.A., 1995, Geology of the Sweet Grass Hills, north-central Montana: Montana Bureau of Mines and Geology, Memoir 68, map scale 1:100,000.

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- Mudge, M.R., Earhart, R.L., Whipple, J.W., and Harrison, J.E., 1983, Geologic and structure maps of the Choteau 1<sup>0</sup> x 2<sup>0</sup> quadrangle, northwestern Montana: Montana Bureau of Mines and Geology Montana Atlas 3-A (also released as U.S. Geological Survey Miscellaneous Investigations Series Map I-1300), scale 1:250,000.