

INTRODUCTION

In 1978 the U.S. Geological Survey began a 4-year study of aquifers in the northern Great Plains. The purpose of this map, which is a product of that study, is to show the total thickness of the Judith River Formation. Other maps show the altitude of the top (Feltis, 1982a), cumulative thickness of sandstone (Feltis, 1982b), and potentiometric surface of water (Levings, 1982) in the Judith River Formation. These maps are part of a series that describes the geology and potentiometric surface of selected rock units of Jurassic or younger age in the plains area of Montana.

SOURCE OF DATA

Most geologic data used to compile the map have been obtained from records of oil and gas exploration wells on file in offices of the Montana Department of Natural Resources and Conservation and the U.S. Geological Survey. The data were derived from interpretation of geophysical logs of oil or gas test wells. One site per township was the optimum density of data selected for map compilation; however, geophysical logs were not available for all townships.

JUDITH RIVER FORMATION

The Upper Cretaceous Judith River Formation consists of eastward-pointing wedges of nonmarine, regressive-shoreline, and shallow-water marine strata that are enclosed by westward-pointing wedges of fine-grained Claggett and Bearpaw Shales. The source material for the Judith River Formation and other Cretaceous formations was mostly from a north-trending cordilleran highland in western Wyoming and Montana. The stratigraphy and geologic history of the Judith River Formation are described by Gill and Cobban (1973), who show by stratigraphic diagrams and strandline maps the relationship of the formation to other Cretaceous rocks and the position and directions of strandline movement.

In the Crazy Mountains basin of south-central Montana, the Judith River sediments interfinger with continental sediments of the Cokedale Formation of the Livingston Group. The Cokedale Formation is the westward nonmarine equivalent of the Claggett Shale and part of the Judith River Formation of central Montana, or to part of the Two Medicine Formation of northwestern Montana (Roberts, 1972, p. C45). The Two Medicine Formation crops out on the west flank of the Sweetgrass arch, in the northwest part of the study area. The Two Medicine also consists mostly of continental sediments and is equivalent to the Eagle Sandstone, the Claggett Shale, and the Judith River Formation of the area east of the Sweetgrass arch (Mudge, 1972, p. A73).

TOTAL THICKNESS

Areas of total thickness of the Judith River Formation were not identified in the Crazy Mountains basin or west of the Sweetgrass arch because of the complexity of the stratigraphy. However, on the west edge of the Crazy Mountains basin the Cokedale Formation is as much as 1,550 feet thick (Roberts, 1972, p. C77-C84) and west of the Sweetgrass arch the Two Medicine Formation is as much as 2,125 feet thick (Mudge, 1972, p. A131-A133). The regressive-shoreline and shallow-water marine deposits, which consist mostly of sandstone, are thickest (600 to 900 feet) in central Montana. The Judith River Formation in eastern Montana, which contains some sandstone, is 200 feet thick or less.

In the vicinity of the Bearpaw Mountains in north-central Montana, faulting has either thickened or thinned the formation at some sites. The complexity of the geology of the area of the Bearpaw Mountains is shown on maps by Hearn (1976) but is not shown on the State geologic map (Ross and others, 1955). However, the State map shows the thrust faults south of the mountains. Many gas wells have been drilled in the vicinity of the Bearpaw Mountains. A comparison of geophysical logs from these wells shows variations in thickness of the formation that have resulted from thickening or thinning of the formation by faulting. The geophysical logs selected for this map represent wells that penetrated the full thickness of the Judith River Formation.

REFERENCES CITED

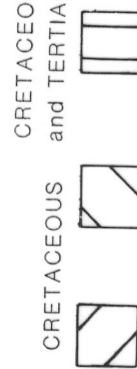
- Dobbin, C. E., and Erdmann, C. E., 1955, Structure contour map of the Montana Plains: U.S. Geological Survey Oil and Gas Investigations Map OM-178 B, scale 1:1,000,000.
- Feltis, R. D., 1982a, Map showing altitude of the top of the Judith River Formation, Montana: U.S. Geological Survey Water-Resources Investigations 82-4027, scale 1:1,000,000.
- , 1982b, Map showing cumulative thickness of sandstone in the Judith River Formation, Montana: U.S. Geological Survey Water-Resources Investigations 82-4038, scale 1:1,000,000.
- Gill, J. R., and Cobban, W. A., 1973, Stratigraphy and geologic history of the Montana Group and equivalent rocks, Montana, Wyoming, and North and South Dakota: U.S. Geological Survey Professional Paper 776, 37 p.
- Hearn, B. C., 1976, Geologic and tectonic maps of the Bearpaw Mountains area, north-central Montana: U.S. Geological Survey Miscellaneous Investigations Map I-919, scale 1:125,000.
- Levings, G. W., 1982, Potentiometric-surface map of water in the Judith River Formation in the northern Great Plains area of Montana: U.S. Geological Survey Open-File Report 82-562, scale 1:1,000,000.
- Mudge, M. R., 1972, Pre-Quaternary rocks in the Sun River Canyon area, northwestern Montana: U.S. Geological Survey Professional Paper 663-A, p. A1-A142.
- Roberts, A. E., 1972, Cretaceous and early Tertiary depositional and tectonic history of the Livingston area, southwestern Montana: U.S. Geological Survey Professional Paper 526-C, p. C1-C120.
- Ross, C. P., Andrews, D. A., and Witkind, I. J., 1955, Geologic map of Montana: U.S. Geological Survey, scale 1:500,000, 2 sheets.

METRIC CONVERSION TABLE

The following factors can be used to convert inch-pound units in this report to the International System of units (SI):

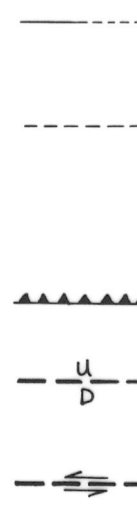
Multiply inch-pound unit	By	To obtain SI unit
foot	0.3048	meter
mile	1.609	kilometer

CRETACEOUS
and TERTIARY



LIVINGSTON GROUP AND LOWER PART OF THE FORT UNION FORMATION—Includes the Cokedale Formation, which is equivalent to the Claggett Shale and part of the Judith River Formation in central Montana

TWO MEDICINE FORMATION—Equivalent to the Eagle Sandstone, Claggett Shale, and Judith River Formation on the east flank of the Sweetgrass arch



CONTACT—Dashed where concealed by alluvium or terrace deposits

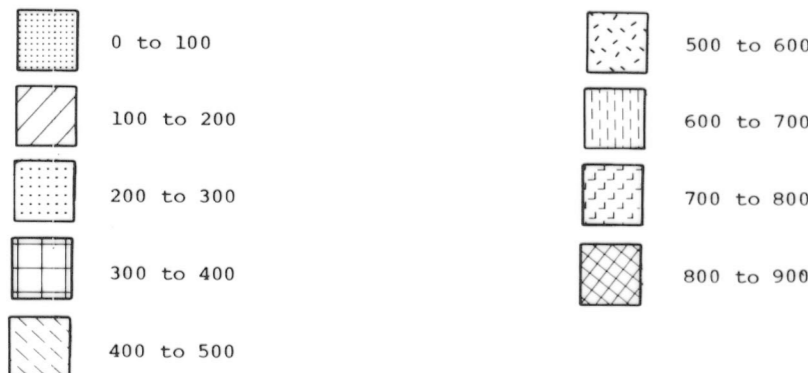
INFERRED CONTACT—The Judith River Formation has not been recognized in the Black Hills uplift, although an interval on geophysical logs indicates that an equivalent of the Judith River Formation is present in this area

THRUST FAULT—Sawtooth on upper plate

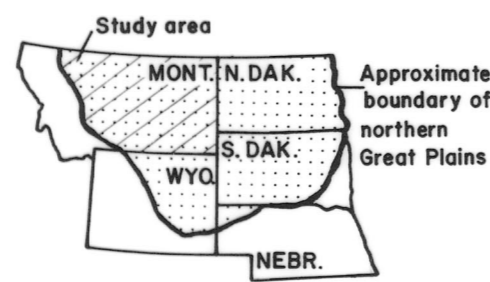
NORMAL FAULT—Approximately located. U, upthrown side; D, downthrown side

FAULT ZONE OR LINEAMENT—Arrows, where shown, indicate relative horizontal movement

GENERALIZED RANGE IN TOTAL THICKNESS OF THE JUDITH RIVER FORMATION, IN FEET

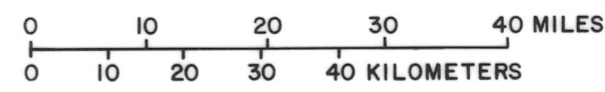


CONTROL POINT—Location of oil or gas test well. A control point within a circle indicates an anomalously large or small total thickness



Base from U.S. Geological Survey
State base map, 1968

Scale 1:1 000 000



Geologic contacts from Ross, Andrews,
and Witkind (1955). Structural features
from Dobbin and Erdmann (1955)

MAP SHOWING TOTAL THICKNESS OF THE JUDITH RIVER FORMATION, MONTANA

by
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1982