DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

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 cumulative thickness of sandstone in the combined Eagle Sandstone and Telegraph Creek Formation. Other maps show the altitude of the top of the Eagle Sandstone (Feltis, 1982a), total thickness of the combined Eagle Sandstone and Telegraph Creek Formation, (Feltis, 1982b), and potentiometric surface of water in the Eagle Sandstone and equivalent units (Levings, 1982). 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.

EAGLE SANDSTONE AND TELEGRAPH CREEK FORMATION

The Upper Cretaceous Eagle Sandstone is an eastward-pointing wedge of nonmarine, regressive-shoreline, and shallow-water marine strata. The Eagle generally consists of the basal Virgelle Sandstone Member, a middle shale, and an upper sandstone unit. The underlying Upper Cretaceous Telegraph Creek Formation is a sequence of shallow-water marine shale, siltstone, and fine-grained sandstone that is transitional between shale of the Colorado Group and the Eagle. Overlying the Eagle is a westward-pointing wedge of the Claggett Shale. The source material for the Eagle Sandstone and other Cretaceous formations was mostly from a north-trending cordilleran highland in western Wyoming and Montana. The stratigraphy and geologic history of the Eagle Sandstone and Telegraph Creek Formation are described by Gill and Cobban (1973), who show by stratigraphic diagrams and strandline maps the relationship of the formations to other Cretaceous rocks and the position and direction of strandline movement.

The Eagle Sandstone of central Montana grades into a sandy shale in east-central Montana. Johnson and Smith (1964, p. 40) report this gradation from sec. 17, T. 15 N., R. 30 E., southeastward to sec. 22, T. 14 N., R. 31 E., where "***both the upper and lower members grade laterally into sandy shale and cannot readily be identified; in this area also, the Eagle Sandstone and underlying Telegraph Creek Formation cannot be differentiated." Similar descriptions of this lateral gradation are given by Knechtel (1959, p. 743) for the Little Rocky Mountains area and Richards (1955, p. 58) for the Little Bighorn River area in south-central Montana. In eastern Montana, the top of the Eagle Sandstone was picked on geophysical logs at the base of the Ardmore Bentonite Bed of the Claggett Shale.

In central Montana the Upper Cretaceous marine sandstone and shale sequence of rocks grades laterally and interfingers with continental deposits from the west. On the west side of the Sweetgrass arch, the Eagle is represented only by the Virgelle Sandstone Member. The middle and upper members of the Eagle, as known east of the Sweetgrass arch, are equivalent to part of the continental deposits of the Two Medicine Formation west of the arch (Mudge, 1972, p. A73-A74). In the western part of the Crazy Mountains basin the Eagle Sandstone is gradationally overlain by the Cokedale Formation of the Livingston Group (Roberts, 1972, p. C31) and in the eastern part of the basin the Eagle is overlain by the Claggett Shale that contains numerous beds of sandstone. Because of the complexity of the stratigraphy, with interfingering of sandstone beds of the Cokedale, Claggett, and Eagle Formations, the thickness lines were not extended across the Crazy Mountains basin.

In the vicinity of the Bearpaw Mountains in north-central Montana, faults are associated with local variations in formation thickness. The complexity of the geology in the area of the Bearpaw Mountains is described by Reeves (1925) and Hearn (1976), but is not shown on the State geologic map (Ross and others, 1955). However, the State map shows areas of thrust faults south of the mountains. Many gas wells have been drilled in the vicinity of the Bearpaw Mountains and a comparison of geophysical logs indicates the variations in the thickness of the formation caused by faulting. The geophysical logs selected for this map represent wells that penetrated the full thickness of the Eagle Sandstone and Telegraph Creek Formation.

CUMULATIVE SANDSTONE THICKNESS

As shown on the map, the cumulative sandstone thickness of the combined Eagle Sandstone and Telegraph Creek Formation ranges from zero in eastern Montana to 225 feet in south-central Montana. The most significant thinning occurs from west to east in the vicinity of 108 degrees longitude. In the northwest part of the study area, where only the Virgelle Sandstone Member of the Eagle Formation is present, the cumulative sandstone thickness ranges from about 50 to 150 feet.

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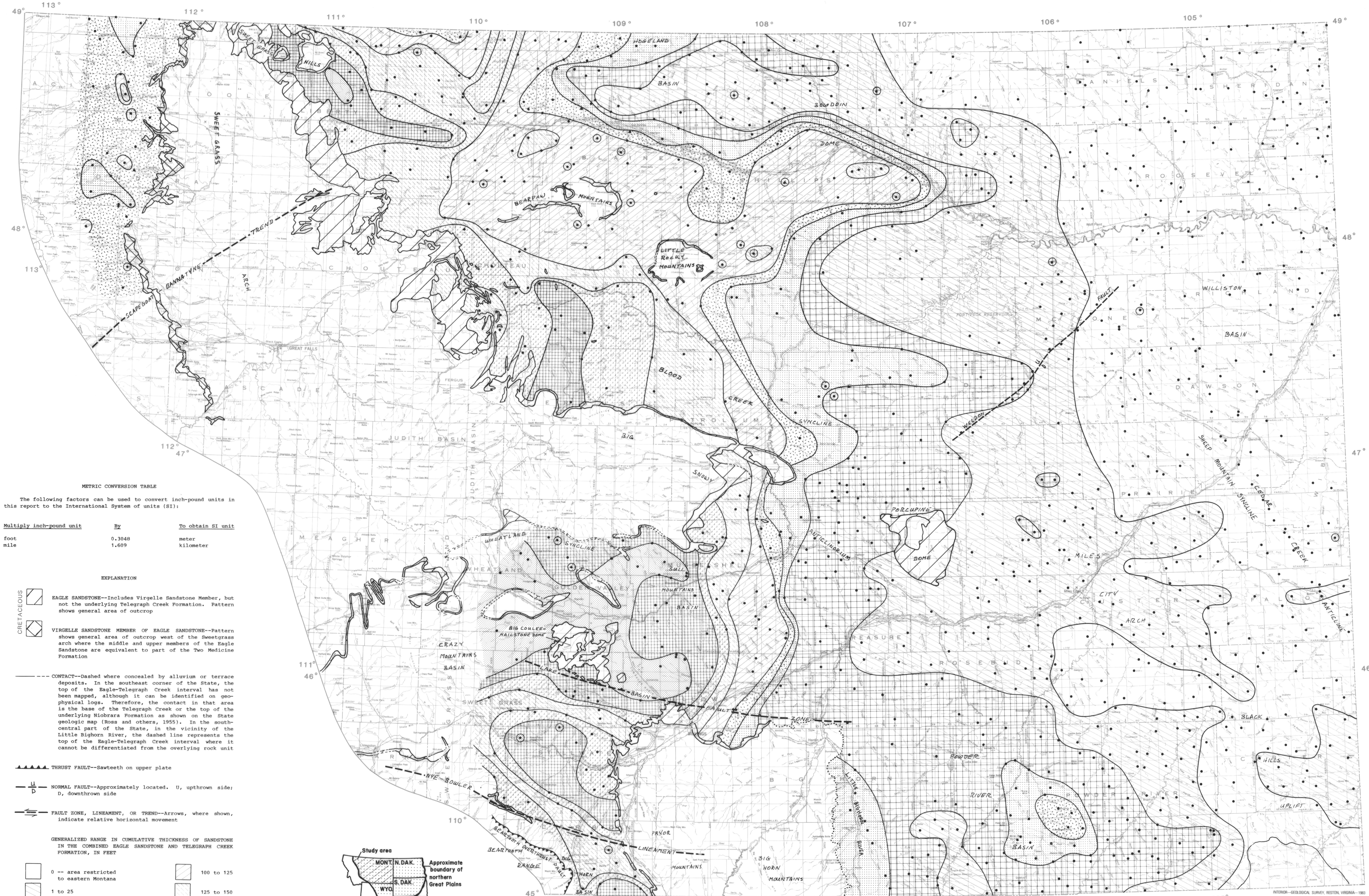

METRIC CONVERSION TABLE

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

EXPLANATION

CRETACEOUS

EAGLE SANDSTONE--Includes Virgelle Sandstone Member, but not the underlying Telegraph Creek Formation. Pattern shows general area of outcrop

VIRGELLE SANDSTONE MEMBER OF EAGLE SANDSTONE--Pattern shows general area of outcrop west of the Sweetgrass arch where the middle and upper members of the Eagle Sandstone are equivalent to part of the Two Medicine Formation

CONTACT--Dashed where concealed by alluvium or terrace deposits. In the southeast corner of the State, the top of the Eagle-Telegraph Creek interval has not been mapped, although it can be identified on geophysical logs. Therefore, the contact in that area is the base of the Telegraph Creek or the top of the underlying Niobrara Formation as shown on the State geologic map (Ross and others, 1955). In the south-central part of the State, in the vicinity of the Little Bighorn River, the dashed line represents the top of the Eagle-Telegraph Creek interval where it cannot be differentiated from the overlying rock unit

THRUST FAULT--Sawteeth on upper plate

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

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

GENERALIZED RANGE IN CUMULATIVE THICKNESS OF SANDSTONE IN THE COMBINED EAGLE SANDSTONE AND TELEGRAPH CREEK FORMATION, IN FEET

0 -- area restricted to eastern Montana
1 to 25
25 to 50
50 to 75
75 to 100
100 to 125
125 to 150
150 to 175
175 to 200
200 to 225

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

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

Scale 1:1 000 000

0 10 20 30 40 MILES

0 10 20 30 40 KILOMETERS

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

MAP SHOWING CUMULATIVE THICKNESS OF SANDSTONE IN THE EAGLE SANDSTONE AND TELEGRAPH CREEK FORMATION, MONTANA

by
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1982

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