UNIVERSITY OF MINNESOTA
MINNESOTA GEOLOGICAL SURVEY
D.L. Southwick, Director

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COUNTY ATLAS SERIES
ATLAS C-14, PART A
Plate 2—Bedrock Geology

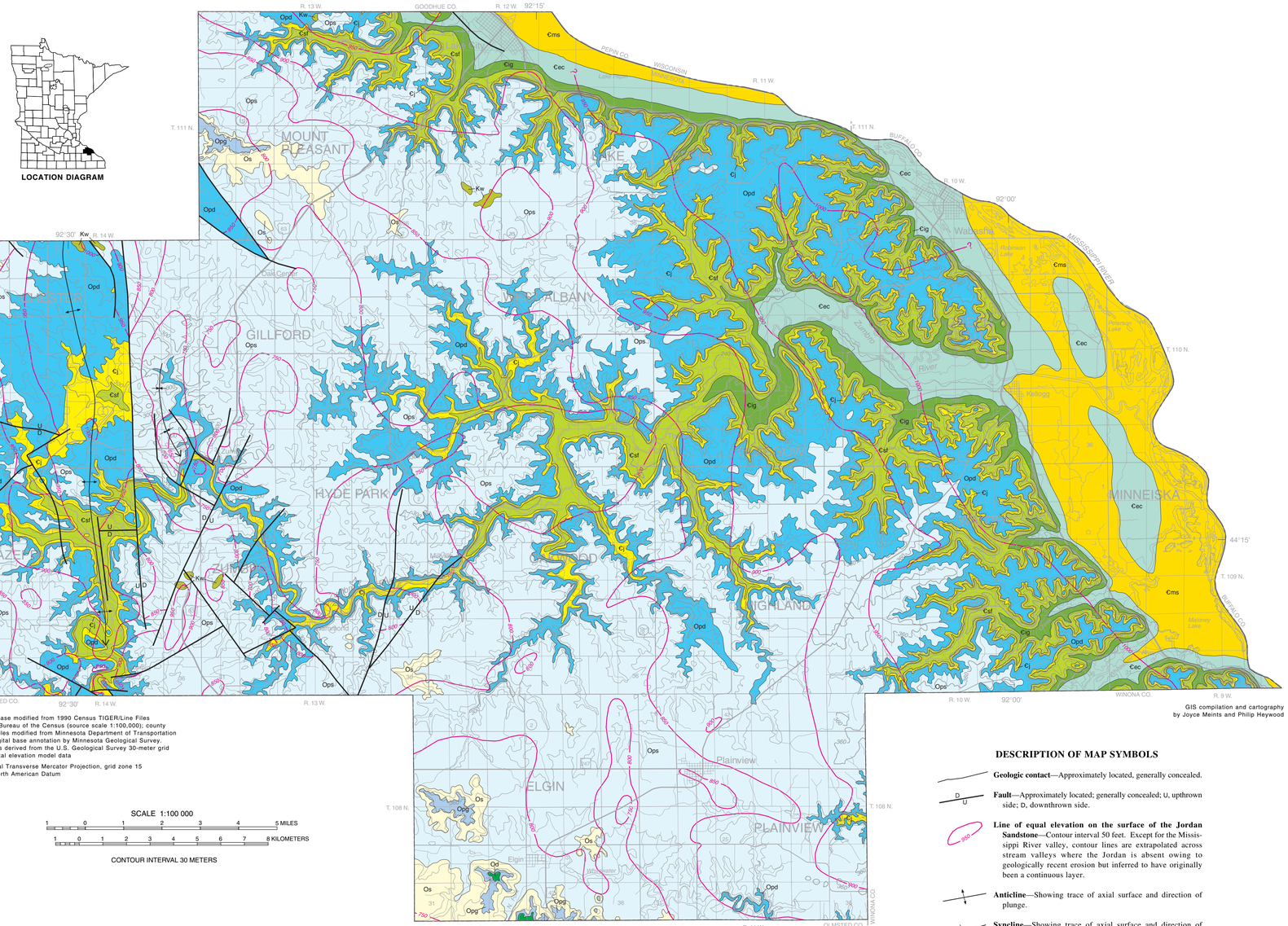
BEDROCK GEOLOGY

By

John H. Mossler

2001

LOCATION DIAGRAM



Digital base modified from 1990 Census TIGER/Line Files of U.S. Bureau of the Census (source scale 1:100,000); county border files modified from Minnesota Department of Transportation files; digital base annotation by Minnesota Geological Survey. Contours derived from the U.S. Geological Survey 30-meter grid cell digital elevation model data

Universal Transverse Mercator Projection, grid zone 15
1983 North American Datum

SCALE 1:100 000

1 0 1 2 3 4 5 MILES
1 0 1 2 3 4 5 6 7 8 KILOMETERS

CONTOUR INTERVAL 30 METERS

GIS compilation and cartography by Joyce Meints and Philip Heywood

DESCRIPTION OF MAP SYMBOLS

Geologic contact—Approximately located, generally concealed.

Fault—Approximately located; generally concealed; U, upthrown side; D, downthrown side.

Line of equal elevation on the surface of the Jordan Sandstone—Contour interval 50 feet. Except for the Mississippi River valley, contour lines are extrapolated across stream valleys where the Jordan is absent owing to geologically recent erosion but inferred to have originally been a continuous layer.

Anticline—Showing trace of axial surface and direction of plunge.

Syncline—Showing trace of axial surface and direction of plunge.

DESCRIPTION OF MAP UNITS

Kw **Windrow Formation (Cretaceous)**—Interpreted to be present mainly as crevice and sinkhole fillings on the karsted dolostone surface of the Prairie du Chien Group (Shakopee Formation and Oneota Dolomite). Scattered outliers are as thick as 50 feet but generally are thinner than 5–10 feet.

Ostrander Member—Sandstone, fine- to medium-grained, quartzose, grayish-orange to bright-yellow; claystone interbeds, light-gray to bright-yellow to dark-yellow-orange.

Iron Hill Member—Goethite-limonite, pale- to grayish-brown; sandstone interbeds, iron oxide-cemented, fine- to medium-grained.

Od **Decorah Shale (Middle Ordovician)**—Shale, green-gray; thin interbeds of fossiliferous limestone. The unit is present only in the extreme southern part of the county as an erosional remnant on a mesa; only the basal 5–10 feet of the formation is preserved.

Opg **Platteville Formation and Glenwood Formation, undifferentiated (Middle Ordovician).**

Platteville Formation—Limestone, fine-grained, fossiliferous, thin- to medium-bedded; sandy dolostone at base. Thin K-bentonite (altered volcanic ash bed) in upper part; upper contact with Decorah is gradational. Unit caps small mesas in southwestern and northwestern Wabasha County. The unit is estimated to be 20–24 feet thick.

Glenwood Formation—Shale, sandy, green-gray; sandstone interbeds, quartzose, thin, fine- to coarse-grained, and phosphatic grains, sand-sized, are common throughout. The unit has the same lateral distribution as the Platteville Formation and is 5–6 feet thick.

The Glenwood Formation possesses low hydrogeologic permeability owing to its shale content, but its limited distribution makes it an insignificant confining layer in Wabasha County.

Os **St. Peter Sandstone (Middle Ordovician)**—Sandstone, very fine grained to medium-grained, poorly cemented. The St. Peter generally is massive and unbedded; less commonly, it shows subtle cross-stratification in the uppermost part. Some intensely burrowed shaly intervals are present, as are discontinuous thin shale beds in the basal 3 feet of the formation. The basal contact is unconformable. The upper part of the unit is exposed in steep hill slopes of mesas capped by the Platteville Formation in western Wabasha County. Unit thickness is 100–105 feet.

Ops **Shakopee Formation (Prairie du Chien Group) (Lower Ordovician)**—The Shakopee Formation forms much of the bedrock surface on uplands in Wabasha County, where it is exposed in numerous quarries and roadcuts. Total unit thickness is 122–150 feet.

Willow River Member—Dolostone, thin- to medium-bedded; some sandy beds. Sandy dolostone may contain intraclasts. Minor sandstone, fine- to medium-grained and quartzose, in thin beds. Minor thin shale beds. Hemispherical stromatolites and algal mats are common. Scattered chert nodules. Member thickness is 80–100 feet or greater. Original maximum thickness is uncertain owing to Quaternary or earlier erosion.

New Richmond Member—Sandstone beds, fine- to medium-grained, quartzose (thickness as great as 4–5 feet); interbedded with and overlying intraclastic, oolitic, stromatolitic dolostone and sandy dolostone. Dolostone is generally thin bedded. Some oolitic zones contain nodular chert. Basal contact is a disconformity. Member is as thick as 50 feet.

Opd **Oneota Dolomite (Prairie du Chien Group) (Lower Ordovician)**—The Oneota caps bluffs along the Mississippi River and tributary streams through most of Wabasha County; numerous large natural exposures are found along the bluffs, as well as in man-made exposures in roadcuts and quarries. Total unit thickness is 133–188 feet.

Hager City Member—Dolostone and silty dolostone in medium to thick beds. Most beds are internally structureless or faintly laminated and have minor vuggy porosity. Some beds contain algal laminae (algal mats), but hemispherical stromatolites are uncommon. Chert nodules and vugs filled with coarse calcite spar are most common in the upper part of the member. Average member thickness is 133–140 feet, but it may be as thick as 158–160 feet.

Coon Valley Member—Interbedded sandstone and sandy dolostone. Sandstone is fine grained to medium or coarse grained, generally has thin to medium bedding, and is well cemented by dolomite or calcite. In places the member is ripple cross laminated or contains intraclasts. Minor amounts of greenish-gray shale are present in thin partings. Lower contact is an unconformity that is directly overlain by a bed of poorly sorted, pebbly sandstone. Average member thickness is 22–47 feet but may reach 60–66 feet.

Cj **Jordan Sandstone (Upper Cambrian)**—Sandstone consisting of an upward coarsening sequence of two distinct facies: (1) a quartzose facies of mostly friable, grayish-orange to light-gray sandstone that commonly has large areas of cross stratification, and (2) a feldspathic facies of very fine grained sandstone, siltstone, and shale in thick beds that generally show extreme bioturbation. The Jordan is exposed along bluffs beneath the Oneota Dolomite. Unit thickness is 98–146 feet.

Csf **St. Lawrence Formation and Franconia Formation, undifferentiated (Upper Cambrian)**—The St. Lawrence and Franconia Formations are exposed in roadcuts and natural exposures within ravines along the Mississippi River and lower reaches of major tributary streams.

St. Lawrence Formation—Dolostone and siltstone, buff to light-gray, well-cemented, thin- to medium-bedded. The dolostone contains variable amounts of clay, silt, sand, and glauconite. Beds of very fine grained sandstone are common in the upper part, and the upper contact with the Jordan Sandstone is gradational. Contains minor thin shale beds. Unit thickness is 34–74 feet.

Franconia Formation—Sandstone, mostly glauconitic, feldspathic, very fine grained to fine-grained. Shale, greenish-gray, and dolostone, pink or buff, sandy, and glauconitic, are present as thin beds. Intraclasts and burrow mottling are common. Generally coarser grained, more glauconitic, and more poorly cemented than the St. Lawrence Formation. Unit thickness is 150–175 feet.

Reno Member—Sandstone, very fine grained to fine-grained, glauconitic; siltstone and shale interbeds. The Reno Member composes the upper 90–100 feet of the Franconia Formation.

Tomah Member—Interbedded sandstone, siltstone, and shale. The sandstone is very fine grained; minor amounts of glauconite are present. This member is finer grained and shalier than adjacent members. The Tomah Member composes the medial 30–40 feet of the Franconia Formation.

Birkmose Member—Sandstone, very fine grained to fine-grained; abundant glauconite. Dolomite cement and sandy dolostone beds are common. The Birkmose Member composes the basal 30 feet of the Franconia Formation.

Cig **Ironton Sandstone and Galesville Sandstone, undifferentiated (Upper Cambrian)**—Sandstone, fine-grained to very coarse grained. Total unit thickness is 50–60 feet. The Ironton and Galesville crop out in roadcuts along the Mississippi River corridor.

Ironton Sandstone—Sandstone is more poorly sorted and has coarser grained sandstone beds than the Galesville Sandstone. Sandstone generally has a silty matrix. White, brown, or black fragments of brachiopod shells and sand-sized glauconite pellets are common in the upper 10–15 feet. Unit also includes thin beds of shale and siltstone.

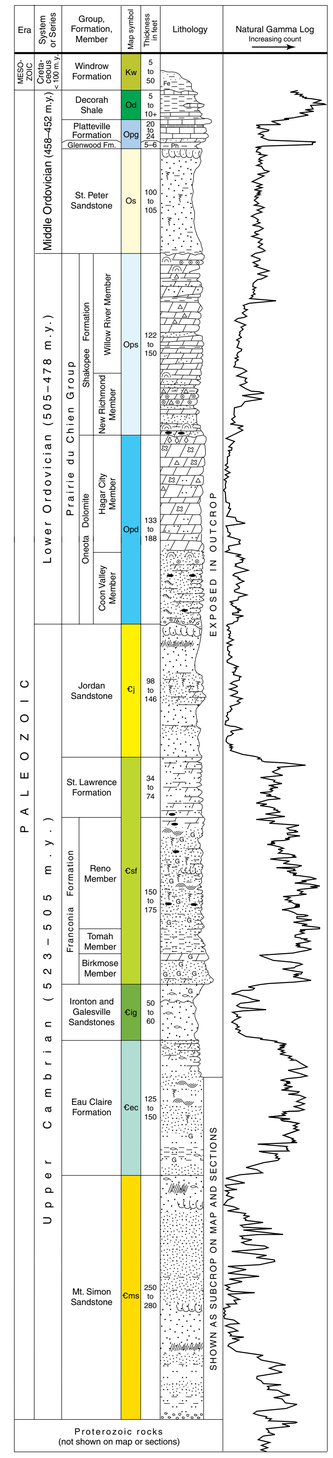
Galesville Sandstone—Sandstone, fine- to coarse-grained, well-sorted to moderately sorted; minor amounts of very fine grained sandstone, siltstone, and shale in beds. Lower one-third of the formation intertongues in places with feldspathic, very fine grained sandstone of the underlying Eau Claire Formation.

Cec **Eau Claire Formation (Upper Cambrian)**—Sandstone, siltstone, and shale interbedded in thin to medium beds. The sandstone is very fine grained to fine grained. The sandstone and siltstone are light to yellowish gray, variably glauconitic, and commonly contain gray to black brachiopod shell fragments. The shale is greenish gray. Unit coarsens upward, with siltstone and shale replaced in abundance by sandstone. Uppermost 10–20 feet is mostly very fine grained sandstone and minor amounts of siltstone. The unit is 125–150 feet thick. A tongue in the uppermost part of the Eau Claire Formation crops out near Wabasha.

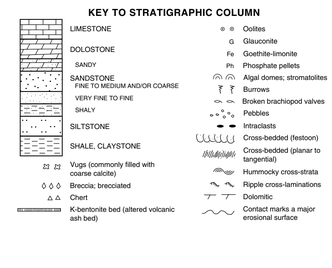
Cms **Mt. Simon Sandstone (Upper Cambrian)**—Quartz sandstone, mostly light- to yellowish-gray, silty, fine- to coarse-grained, friable. The top of the Mt. Simon is marked in places by a zone of fine to coarse iron oxide-coated sand grains, which is associated with the presence of abundant black brachiopod shell fragments. Where the iron is unoxidized, the grains are coated with finely divided iron sulfide. Beds of grayish-green shale, light-gray claystone, siltstone, and very fine grained sandstone are present throughout the formation. Pebbly sandstone is present in the lower part of the formation. The Mt. Simon is as thick as 250–280 feet. The Mount Simon is not exposed in Wabasha County.

Proterozoic rocks, undifferentiated—Not shown on map or sections. Probable arkosic red sandstone, shale, and siltstone of the Fond du Lac Formation. This information is drawn from records of deep municipal and railroad wells at Lake City and at Wabasha.

STRATIGRAPHIC COLUMN



KEY TO STRATIGRAPHIC COLUMN



INTRODUCTION

The map, stratigraphic column, and cross sections on this plate describe and show the distribution of bedrock that underlies Wabasha County. Bedrock is the consolidated sandstone, siltstone, dolostone, and shale that is exposed in steep bluffs and rock quarries, and in roadcuts, particularly along the Mississippi River and its tributaries. The bedrock of Wabasha County is mostly sedimentary rock that was laid down as sediment in shallow seas that covered the region from about 520 to 450 million years ago. As older layers of sediment were buried by succeeding layers, they gradually consolidated and lithified into the rock seen today. The rocks form distinguishable and mappable units that are given formal names, for example, Jordan Sandstone and Oneota Dolomite (Mossler, 1987). Characteristics of each rock formation and its constituent members are given in the Stratigraphic Column and in the Description of Map Units.

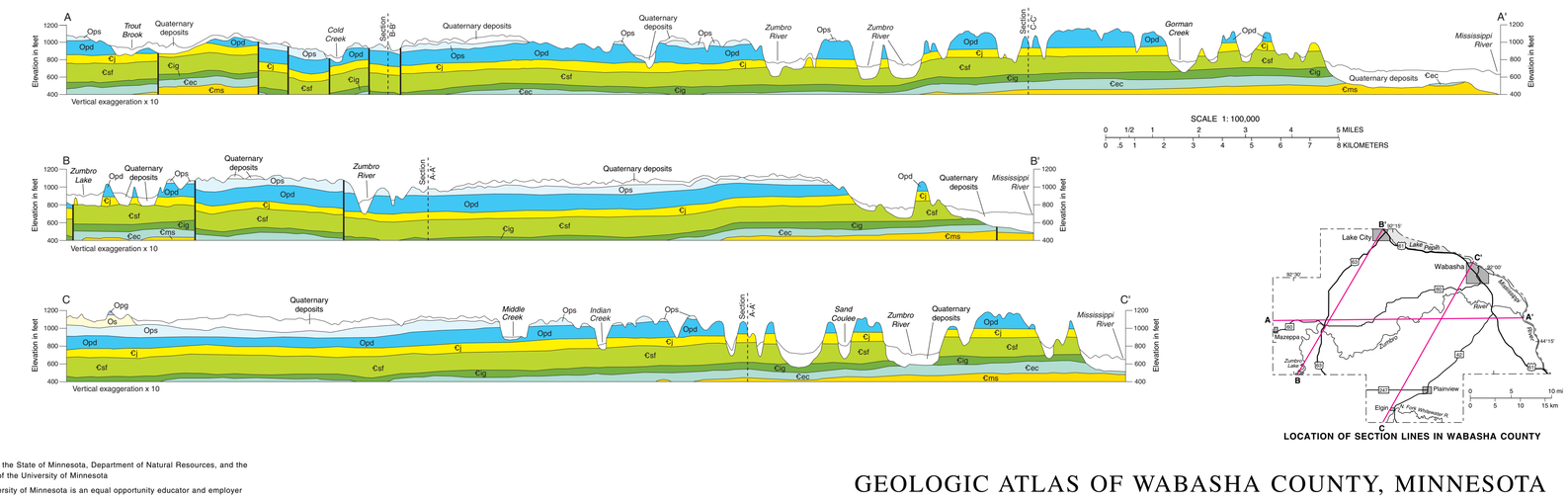
The map on this plate shows in plan view the bedrock exposed at the land surface or that lies directly beneath the unconsolidated deposits of Quaternary age (described on Plate 3). It shows how the bedrock would appear if it were viewed from an aerial perspective, as if all the overlying unconsolidated materials were stripped away. The bedrock geologic cross sections add the third dimension and show how the bedrock layers would appear if exposed in the side of trenches cut to a depth of 300 to 800 feet below land surface. The geologic formations are very thin compared to their areal extent and would only be one-tenth as thick as shown on the cross sections if no vertical exaggeration were used. However, it is necessary to show the vertical dimension ten times horizontal distance to show thinner geologic units. Where bedrock is buried by more than 100 feet of overburden (see Plate 4 for Depth to Bedrock), the geology is very generalized because data on bedrock type and depth are sparse. The lines of equal elevation drawn at the top of the Jordan Sandstone shown on the map indicate the approximate configuration (geological structure) of the upper surface of the Jordan Sandstone and, by implication, the configuration of adjacent bedrock layers.

The information used to create this map was compiled from examination of exposures of bedrock and from subsurface data, which include water-well cuttings, water-well drillers' logs, wireline geophysical logs, engineering drawings, and geotechnical logs. Additional data collected during this project from soil-probe borings and seismic-refraction surveying were also incorporated. Unpublished sources included field notes by Professor Emeritus Robert E. Sloan, University of Minnesota, for the years 1954 through 1960, and the doctoral dissertation of R.H. Cowie (1941). The author also consulted unpublished field maps prepared for the surficial map of this atlas (Plate 3) by H.C. Hobbs.

REFERENCES CITED

Mossler, J.H., 1987, Paleozoic lithostratigraphic nomenclature for Minnesota: Minnesota Geological Survey Report of Investigations 36, 36 p, 1 folded insert.

Cowrie, R.H., 1941, Geology of the Zumbro Valley region: Minneapolis, University of Minnesota, Ph.D. dissertation, 125 p.



LOCATION OF SECTION LINES IN WABASHA COUNTY

GEOLOGIC ATLAS OF WABASHA COUNTY, MINNESOTA