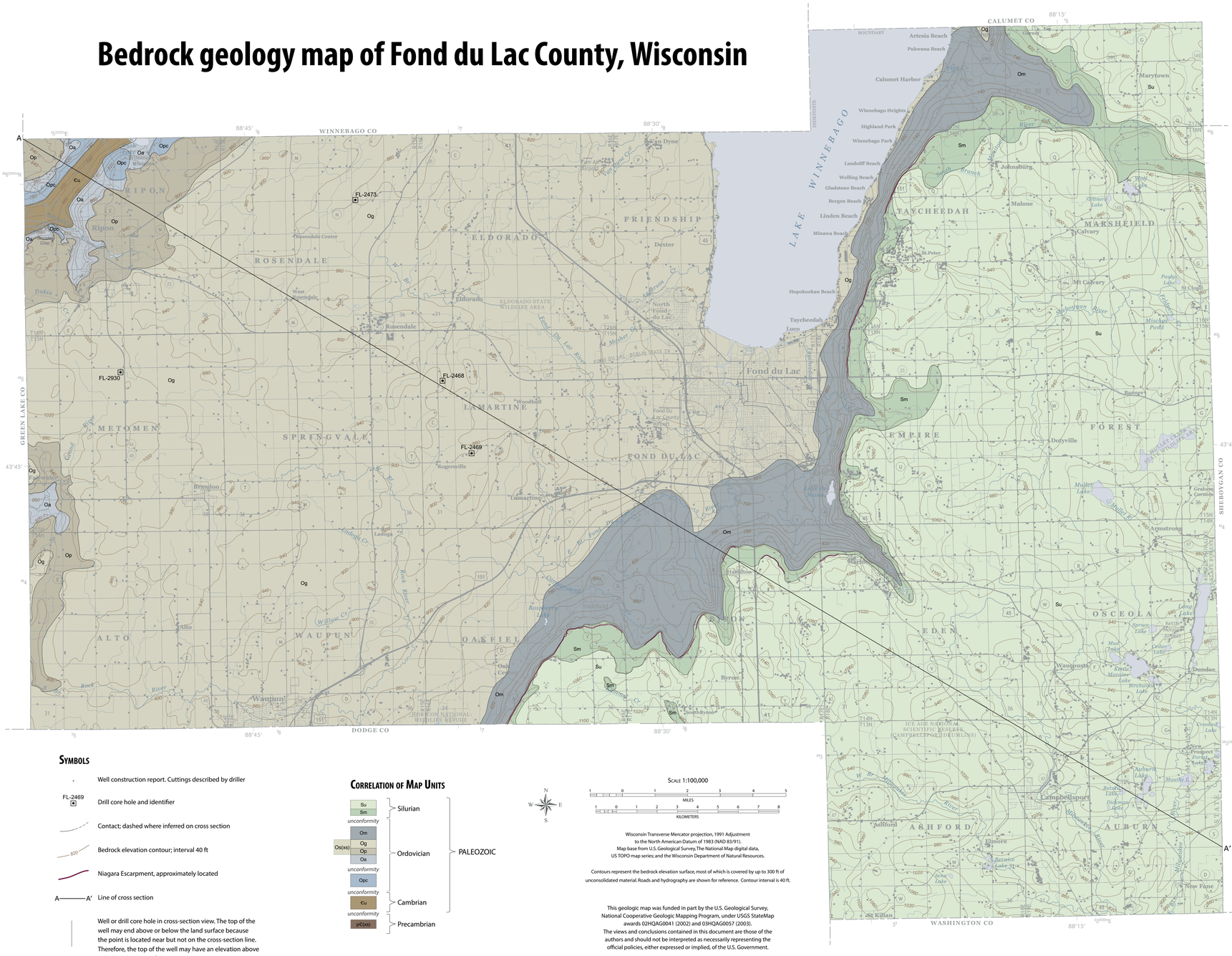
Bedrock Geology of Fond du Lac County, Wisconsin
M505 • Plate 1
2018

William G. Batten

Bedrock geology map of Fond du Lac County, Wisconsin



Geologic units

QUATERNARY, UNDIFFERENTIATED

Qu — Bedrock units shown on map are covered throughout the county by poorly sorted till and by glacial meltwater lake and stream sediment that range in thickness from less than 5 ft to more than 300 ft. Bedrock is exposed along the Niagara Escarpment, in quarries near the escarpment, and in the Ripon and Waupun area. Shown only on cross section.

SILURIAN SYSTEM

Su / Sm — Undifferentiated Silurian (Su) consists of dolostones likely belonging to the Engadine and Manistique Formations, and the Burnt Bluff Group. These units, indistinguishable in drill cuttings, are generally white to light gray dolostones with zones of darker gray, shaly dolostone. Corals, brachiopods, and gastropod fossils are present at different intervals in these units based on core and outcrop data in other areas of eastern Wisconsin. The lowermost Silurian unit, the Mayville Formation (Sm), is commonly a light gray dolostone containing occasional fossils of brachiopods and corals. Large white chert nodules are common in lower parts of the unit. The Mayville Formation forms the cliff portions of the Niagara Escarpment. It is generally about 80-ft thick in the east-central part of the county.

ORDOVICIAN SYSTEM

Maquoketa Formation

Om — The Maquoketa Formation consists of three members, the Brainard, the Fort Atkinson, and the Scales. The Brainard Member is generally a light green dolomitic shale. The Fort Atkinson Member is a light green to gray shaly dolostone and the Scales Member is a dark green shale. The known uneroded thickness of the Maquoketa Formation ranges from about 200 to 270 ft. Commonly called the Maquoketa shale.

Sinnipee Group

Os(xs) — Two predominantly dolomitic formations, the Galena (Og) and the Platteville (Op), form the Sinnipee Group (Os). The total thickness of the Sinnipee Group, where it underlies the Maquoketa shale, is about 200–230 ft. The Sinnipee Group is undifferentiated in the cross section.

Og — **Galena Formation**
The upper Galena Formation is a tan to gray dolostone with minor shaly zones becoming dark gray, shaly dolostone at its base. Sulfide minerals are common in fractures and occasional vugs. Maximum uneroded thickness is 150–180 ft.

Op — **Platteville Formation**
The Platteville Formation is a gray dolostone with considerable dark shale laminae and minor bedded nodular chert zones. It becomes sandy near its base. The Platteville Formation is uniformly thick, ranging from about 45 to 55 ft throughout the county.

Ancell Group

Oa — The Ancell Group is not divided on the map, but the following formations and members can be recognized in outcrops and the subsurface.

Glenwood Formation
The Glenwood Formation, as described in drill cuttings, is a slightly shaly sandstone, with some dolomite cement and pyrite. The formation is thin (< 5 ft) and rarely present in Fond du Lac County.

St. Peter Formation
The St. Peter comprises the Tonti and Readstown Members. The Tonti Member is the most recognizable part of the Ancell Group and consists of mature quartz sandstone with varying amounts of carbonate or iron-sulfide cement. Sulfide mineralization is common, particularly in the uppermost part of the Tonti. The Readstown Member is a complex mixture of sandstone, dolomitic sandstone, and soft variously colored clays, but is best recognized by presence of red to purple shales. The formation has known thicknesses ranging from absent to over 50-ft thick in Fond du Lac County; however, based on subsurface data from the surrounding region, it is likely that the formation may exceed 200 ft.

Prairie du Chien Group

Opc — The Prairie du Chien Group is not divided on the map. It consists of the Shakopee and Oneota Formations. Both formations are predominantly dolostone, often vuggy, and occasionally shaly. Oolites are common, especially near the base of the Oneota Formation. The Oneota Formation also contains abundant floating quartz grains. A thin (<10 ft) sandstone unit, the New Richmond Member, can be locally present at the base of the Shakopee Formation, but appears to be absent in Fond du Lac County. The contact with the overlying St. Peter is an erosional unconformity. In areas where minor or no erosion of the Prairie du Chien Group occurred, it is directly overlain by Sinnipee Group dolostone. The Prairie du Chien Group is 150–200 ft thick.

CAMBRIAN SYSTEM

Cambrian sandstones, undifferentiated

Cu — The Cambrian comprises three groups, the Trempealeau, the Tunnel City, and the Elk Mound. Drill cuttings identified as the Trempealeau Group typically consist of 30–60 ft of fine to medium sandstone, dolomitic siltstone, and silty dolomite, sometimes interbedded. This unit varies in color from gray to pink, buff, and red, and contains some glauconite. Underlying the Trempealeau Group is the Tunnel City Group. It is generally 80–100 ft of fine to medium sandstone; the upper part is often dolomitic and glauconitic, with occasional thin siltstone and dolomitic layers. It is typically light gray to light pink in color. The Elk Mound Group consists of mostly gray sandstone, occasionally silty or shaly. The Elk Mound Group ranges from absent at the Precambrian high in western Fond du Lac County to over 500-ft thick.

PRECAMBRIAN SYSTEM

pC — Known lithologies include rhyolite, quartzite, and granite. Recognized only from subsurface samples in few drilled water wells and in two drill core holes. Shown only on cross section.

Symbols

- Well construction report. Cuttings described by driller
- FL-2469 — Drill core hole and identifier
- Contact; dashed where inferred on cross section
- 820 — Bedrock elevation contour; interval 40 ft
- Niagara Escarpment, approximately located
- A — A′ — Line of cross section

Well or drill core hole in cross-section view. The top of the well may end above or below the land surface because the point is located near but not on the cross-section line. Therefore, the top of the well may have an elevation above or below elevation of the cross section.

Correlation of Map Units

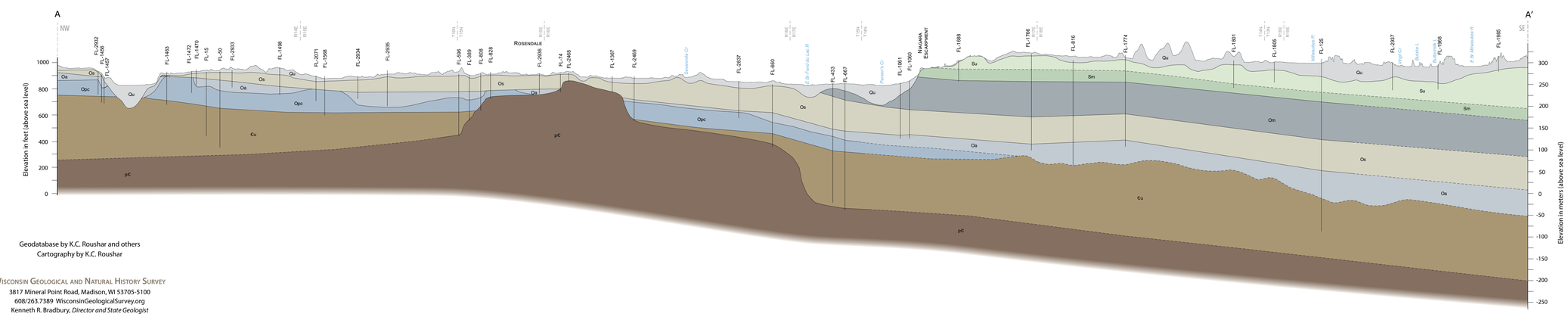
Su, Sm	Silurian	PALEOZOIC
unconformity		
Om, Os(xs), Og, Op, Oa	Ordovician	
unconformity		
Opc		
unconformity		
Cu	Cambrian	
unconformity		
pC(xs)	Precambrian	

Scale 1:100,000

Wisconsin Transverse Mercator projection, 1991 Adjustment to the North American Datum of 1983 (NAD 83/91).
Map base from U.S. Geological Survey, The National Map digital data, US TOPO map series; and the Wisconsin Department of Natural Resources.

Contours represent the bedrock elevation surface, most of which is covered by up to 300 ft of unconsolidated material. Roads and hydrography are shown for reference. Contour interval is 40 ft.

This geologic map was funded in part by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS StateMap awards 02HQAG0041 (2002) and 03HQAG0057 (2003).
The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.



Vertical exaggeration of cross section approximately 20x

Geodatabase by K.C. Roushar and others
Cartography by K.C. Roushar

Wisconsin Geological and Natural History Survey
3817 Mineral Point Road, Madison, WI 53705-5100
608/263.7389 WisconsinGeologicalSurvey.org
Kenneth R. Bradbury, *Director and State Geologist*

About the map

The bedrock geology map shows the distribution of Paleozoic bedrock units that subcrop directly beneath unconsolidated Quaternary glacial deposits. This bedrock surface is believed to be the result of more than 300 million years of erosion prior to deposition of overlying glacial and modern sediments during the Quaternary Period. Glacial deposits are locally variable and range in thickness from absent, where bedrock outcrops, to over 300 ft.

Bedrock primarily consists of Cambrian sandstones, overlain by Ordovician and Silurian carbonates (dolostones), shale, and sandstones, originally deposited as both nearshore and offshore marine sediments between about 500 and 420 million years ago. Ordovician Galena Formation dolostone and Silurian dolostone are the uppermost bedrock units throughout most of the western and eastern half of the county, respectively. These two units directly underlie glacial deposits in over 90 percent of the county. The western extent of the Silurian dolostone is the Niagara Escarpment, a prominent but discontinuous ridge that runs northeast to southwest through the east-central part of the county. Along the escarpment, vertical exposures of Silurian dolostone can be found ranging from several feet to several tens of feet high. The vertical face exposes dolostones near the base of the Silurian at or near its contact with the underlying, easily eroded shales of the Ordovician Maquoketa Formation. The Maquoketa is absent in western Fond du Lac County, exposing the dolostone of the underlying Ordovician Galena and Platteville Formations. These dolostones are absent in two small areas along the extreme western edge of the county, thus exposing the Ancell Group (St. Peter) sandstone, Prairie du Chien Group dolostone, and Cambrian sandstone. Both Ordovician and Cambrian rocks unconformably overlie Precambrian igneous and metamorphic basement rocks that do not subcrop anywhere within the county.

Buried bedrock surface

Contour lines on the map show the elevation of the bedrock surface in feet above mean sea level. In the western half of the county, the erosional surface that developed on the Galena Formation dolostone is gently rolling. This surface generally slopes southeastward from about 1,000 ft above sea level on the west edge of the county to close to 600 ft above sea level near its contact with the overlying Maquoketa shale near the center of the county. The surface of the Silurian dolostone is similarly rolling but it is generally more deeply dissected than the Ordovician surface. The Silurian dolostone surface also slopes southeastward, dipping from 1,000 to 1,100 ft above sea level along the edge of the Niagara Escarpment to around 840 ft above sea level along the east edge of the county. The top of the Silurian dolostone along the Niagara Escarpment rises 300–400 ft above the buried surface of the Maquoketa shale and Galena dolostone along Lake Winnebago and the city of Fond du Lac.

Two buried bedrock valleys can be found in the county. In the northwest, just north of the City of Ripon, erosion of younger Ordovician units has exposed Cambrian sandstone along the base of a narrow northeast–southwest-trending preglacial valley. The sandstone floor of the valley is also about 250–300 ft below the adjacent ridge tops capped by more erosion-resistant Ordovician dolostones. In the northeastern corner of the county, a prominent regional bedrock valley extends from near Lake Winnebago southeast into Sheboygan County. The entire thickness of Silurian dolostone has been eroded, exposing the Maquoketa shale in a large portion of this buried valley. Sections of this buried valley floor lie more than 300 ft below adjacent Silurian dolostone ridge tops.

Geologic cross section

The accompanying geologic cross section shows the stratigraphic relationships and approximate thicknesses of the various bedrock units. It illustrates how the layered sedimentary bedrock units would appear along the side of a deep trench extending from the northwestern corner to the southeastern corner of the county. The trace of the cross section runs roughly parallel to the regional northwest–southeast dip of the layered Paleozoic bedrock units. Bedrock layers generally dip about 15 ft/mile in the western half of the county and about 25 ft/mile in the eastern half of the county.

The range and variability in thicknesses of bedrock units as depicted on the cross section are typical of the entire county. Of particular note is a large Precambrian-surface high in the west-central part of the county. Two bedrock cores, FL-2468 and FL-2469, were drilled to determine the stratigraphy associated with this high. In core hole FL-2468, Precambrian (quartzite) was encountered at about 58 ft below land surface and is unconformably overlain by about 45 ft of Ordovician Galena Formation dolostone. It is likely no older rocks were ever deposited on this Precambrian high. In core hole FL-2469, located approximately 2.4 miles southeast of FL-2468, Precambrian quartzite was encountered at a depth of about 336 ft. It is overlain, in descending order, by about 170 ft of Sinnipee Group dolostone, 10 ft of Ancell Group sandstone, 140 ft of Prairie du Chien Group, and less than 4 ft of Cambrian sandstone. The absence and near absence of Cambrian sandstone, the major aquifer for high-capacity wells in the county, indicates a significant limit to groundwater availability in this area. Based on limited well data, it is likely that substantial relief on the Precambrian surface exists in other areas of the county.

Uses of the map

The bedrock geologic map is useful when combined with the accompanying depth-to-bedrock map to identify areas where dolostone (carbonate) bedrock is near land surface. Near-surface dolostone bedrock is desirable as a commercial source of crushed aggregate and dimension stone for construction purposes. Fractured dolostone bedrock near land surface also has been shown to be a significant contributing factor to groundwater contamination from private septic system effluent and from industrial waste, animal waste, and agricultural chemicals. The geologic map provides part of the basic information needed for informed land-use decisions concerning location of quarries for commercial stone and protection of groundwater supply.

Compiling the map and cross section

The primary source of lithological data used to construct this map are geologic logs published by the Wisconsin Geological and Natural History Survey (WGNHS). The logs are based on detailed examinations of drill cuttings from approximately 50 high-capacity municipal- and industrial-supply wells to determine the subsurface lithology and stratigraphic contacts. Continuous bedrock cores collected from four core holes drilled in the western part of the county provide stratigraphic detail. Additionally, drillers' geologic logs from approximately 6,050 well construction reports on file at WGNHS and at the Wisconsin Department of Natural Resources were interpreted and used to further refine subsurface stratigraphic contacts throughout the county. All well and core hole locations are shown on the map.

An accurate land-surface elevation for each well was extracted from the U.S. Geological Survey's National Elevation Dataset 10-ft digital elevation model (DEM). This model divides the entire county land surface area into 10-meter by 10-meter cells and assigns a land-surface value, in feet above mean sea level, to each cell. The geologic logs were used to determine the elevation of the top of specific bedrock units to create structure-contour maps for each mapped bedrock unit. Contours for each mapped unit were then compared with the structure-contour map of the bedrock surface to define the areal extent of the subcrop area of each unit as shown on the bedrock geology map.

The cross section was compiled using data from two core holes and 37 geologic logs from water wells. The logs were selected based on well depth, completeness of description, and proximity to the cross-section trace (within 2 miles). Well locations were projected perpendicularly onto the cross section.

Sources

Kluessendorf, J., and Mikulic, D.G., 2004, The lake and the Ledge: Geological links between the Niagara Escarpment and Lake Winnebago: 65th Annual Tri-State Geological Field Conference Guidebook, 64 p.

Luczaj, J.A., 2013, Geology of the Niagara Escarpment in Wisconsin: Geoscience Wisconsin, v. 22, part 1, 34 p.

McLaughlin, P.I., 2013, Preliminary bedrock geology of Sheboygan County, Wisconsin: Wisconsin Geological and Natural History Survey Open-File Report 2013-03, scale 1:100,000.