BEDROCK GEOLOGIC MAP OF THE MUSCATINE NW 7.5' QUADRANGLE, MUSCATINE COUNTY, IOWA

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Dpr

41.3750°

-91.2500

Base map from U.S. Geological Survey (USGS) Muscatine NW 7.5' Quadrangle map, pub-

lished by the USGS in 2022. Bedrock topography raster created internally for this map project MuscatineNW_BR_3m.mxd, version 7/01/24 (ArcGIS Pro 3.0). Map projection and co-

ordinate system based on Universal Transverse Mercator (UTM) Zone 15N, datum NAD83.

The man and cross-section are based on interpretations of the best available information at the time

of mapping. Map interpretations are not a substitute for detailed site-specific studies. 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.



Iowa Geological Survey

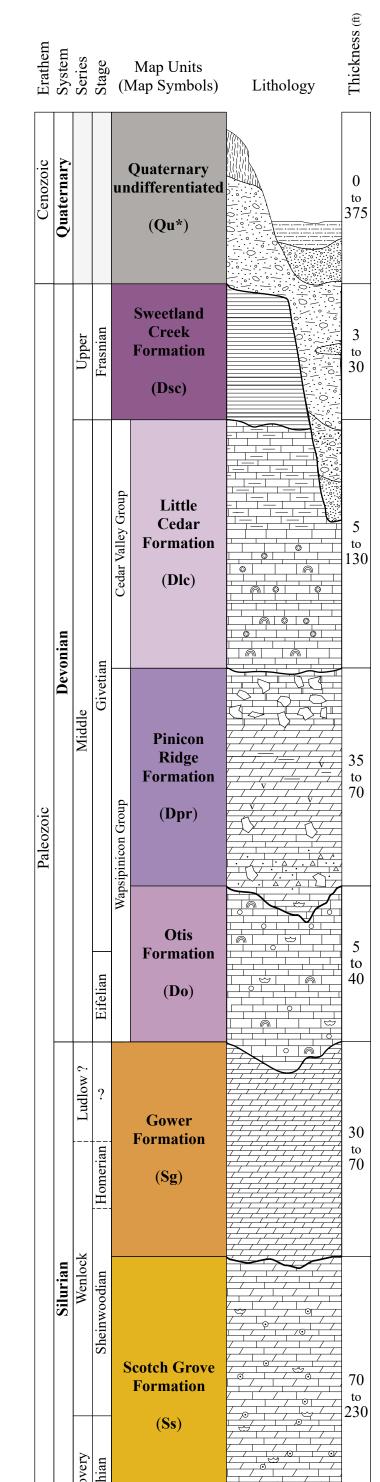
Open File Map: OFM-24-3 Keith Schilling, State Geologist Published June, 2024

Introduction

The Muscatine NW 7.5' Quadrangle in Muscatine County, Iowa, is located within the Southern Iowa Drift Plain (SIDP) and Iowa-Cedar Lowland (ICL) landform regions. There are no bedrock exposures in the map area due to burial by Quaternary materials. The SIDP is an area with surface topography defined by loess-mantled uplands and slopes, whereas the ICL is a low-relief floodplain consisting of sediment deposited by the Cedar River. The top of the till package of the SIDP in the map area is likely Pre-Illinoian-age diamicton of the Wolf Creek/Alburnett formations. The ICL is a broad, flat lowland that is comprised of outwash deposited during the Late Wisconsin Episode and the Cedar River has formed Holocene terraces in this valley. The shape of the ICL does not directly correspond with the underlying bedrock channel (Cleona Channel).

The Cleona Channel is a buried bedrock valley that trends in a southwest – northeast direction across the entirety of the map area and this channel can have a depth up to 325 feet below the modern surface. Although entirely buried by Quaternary deposits, the bedrock surface of the Muscatine NW 7.5' Quadrangle is dominated by Upper Devonian (Frasnian) strata of the Lime Creek Formation, as well as Middle Devonian (Givetian) strata of the Little Cedar Formation (Cedar Valley Group) and the Pinicon Ridge and Otis formations (Wapsipinicon Group). Silurian strata of the Gower and Scotch Grove formations make up the bedrock surface of the Cleona Channel. Just to the northeast of the mapping area these Paleozoic stratigraphic units are exposed in the Moscow Quarry (Wendling Quarries Inc., in the Wilton 7.5' Quadrangle; IGS Open File Maps OFM-24-01 and OFM-24-02). Due to sparse well data and the lack of bedrock exposures within the quadrangle, the contacts between these stratigraphic units are concealed and have been dashed on the map. The contact between the Gower and Scotch Grove formations is concealed and its location is also inferred. Further detail about the bedrock elevation and Quaternary thickness in the Muscatine NW 7.5' Quadrangle can be found on the accompanying map (IGS Open File Map OFM-24-04), whereas further detail about the Quaternary geology can be found on the Surficial Geologic Map of the Muscatine NW 7.5' Quadrangle of Muscatine County, Iowa (IGS Open File Map OFM-23-04).

STRATIGRAPHIC COLUMN AND LEGEND



Dlc

O¹⁴¹
O⁵⁰
O⁷⁸
O³⁰

-91.1250° 41.3750°

contact

656^{000m}E

ADJOINING

2 Atalissa, IA

3 Wilton, IA

4 Nichols, IA

7 Letts, IA

QUADRANGLES

1 West Liberty, IA

5 Muscatine, IA-IL

6 Columbus Junction, IA

Undifferentiated, unconsolidated Quaternary sediments deposited during the Hudson, Wisconsin, Illinois, and Pre-Illinois episodes. This unit consists of glacial diamicton, outwash, colluvium, loess, eolian sands, and alluvium. All unconsolidated sediments overlying Paleozoic bedrock are included in this unit, which only appears in the cross-section and is not depicted on the map.

Lithostratigraphic Unit Description

The Sweetland Creek Formation (upper Frasnian) consists predominantly of green-gray to gray calcareous shale and green-gray siltstone. This unit is unconformable with the underlying Little Cedar Formation.

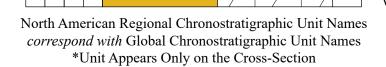
The Little Cedar Formation (upper Givetian) is comprised of the Solon and Rapid members (in ascending order) and unconformably overlies Wapsipinicon Group (Middle Devonian) or Silurian strata in the map area. The basal Solon Member is condensed in eastern Muscatine County and the fine skeletal packstone (with common to abundant corals and stromatoporoids - locally biostromal) contains multiple hardgrounds. The Rapid Member consists of argillaceous mudstone interstratified with skeletal wackestone/packstone.

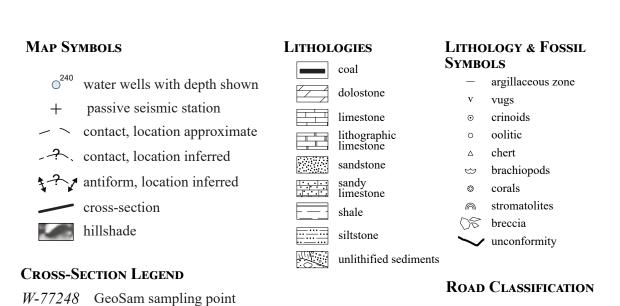
The Pinicon Ridge Formation (lower to middle Givetian) is comprised of the Kenwood, Spring Grove, and Davenport members (in ascending order). The basal Kenwood Member is an unfossiliferous, argillaceous dolostone with interbeds of gray to green shale (both lithologies contain abundant sand- to silt-sized grains of quartz and chert). This member includes gypsum and anhydrite evaporite units and where these facies are absent brecciated beds may be common. The Spring Grove and Davenport members consist primarily of unfossiliferous limestone and dolostone; the dolostone is interpreted to be a diagenetic facies transition, as such the boundary between the two units is gradational. Strata of the Spring Grove Member are predominantly thinly-laminated, vuggy to porous dolostone (which is petroliferous to varying degrees). A dense 'sublithographic' limestone characterizes the Davenport Member, however, discontinuous dolostone or thin argillaceous to shaly units may be present locally. In some areas the limestone is interbedded with evaporite facies and well-developed breccia is very common within the Davenport Member.

The Otis Formation (upper Eifelian, lower Givetian) consists of a limestone facies that includes: skeletal, skeletal-intraclastic, and peloidal skeletal packstone/grainstone and mudstone/wackestone (with low diversity faunas); peloidal and peloidal-intraclastic packstone/grainstone; coated-grain to oolitic packstone/grainstone (which may, locally, be oncolitic); laminated mudstone and stromatolitic units; and fenestral ("birdseye") limestone. The Otis Formation unconformably overlies an eroded Silurian surface.

The Gower Formation (mid-Wenlock to Ludlow?) is comprised of the Anamosa, LeClaire, and Brady members, and the base of this unit is usually marked by a laminated dolostone layer. Strata of the Anamosa Member consist of flat-lying, laminated dolostone interbedded with dense unfossiliferous dolostone layers, with occasional low diversity brachiopod- or coral-rich layers and represent inter-reef and inter-bank facies. The LeClaire Member is a complex carbonate bank and reef facies that consists of both horizontal and variably dipping mound and inter-mound facies composed of dolomitic mudstone to skeletal wackestone, with occasional skeletal packstones in mound flank facies. The LeClaire Member is laterally equivalent to the Anamosa Member, however the fauna of the LeClaire is very diverse, and vugular porosity is common. The Brady Member is a skeletal dolowackestone to dolopackstone, interbedded with dense laminated and nonlaminated dolomudstones and contains an abundant, low-diversity fauna (brachiopods and corals); this facies also forms mounds and is at least in part laterally equivalent to the Anamosa Member. The strata of the Brady Member exhibit flanking and over-stepping relationships with the mound facies of the Palisades-Kepler (P-K) Member (Scotch Grove Formation). Notably, the Gower Formation is truncated by pre-Middle Devonian erosion.

The Scotch Grove Formation (Telychian, Sheinwoodian) is comprised of the Johns Creek Quarry (JCQ), Welton, Buck Creek Quarry (BCQ), Waubeek, and Palisades-Kepler (P-K) members – the latter four members may, locally, be lateral equivalents of one another. The basal JCQ Member (upper Telychian) consists of mound and inter-mound facies with dense dolomudstone cores and coral fossils, flanked by crinoidal dolowackestone/dolopackstone or flat-lying strata which are dense and well-bedded and may be either sparsely fossiliferous, porous with large brachiopods, or have argillaceous partings; the JCQ Member may be a partial facies equivalent of the BCQ and Welton members. Strata of the BCQ Member (upper Telychian) are dense, fine to microcrystalline, very cherty (chalky dolomitized 'tripolitic' chert nodules), skeletal mudstone/wackestone with local dolopackstone containing large moldic pentamerid brachiopods and occasionally abundant silicified corals. The Welton Member (upper Telychian, lower Sheinwoodian) is often the dominant Scotch Grove lithology and is a thick-bedded to massive unit of porous (fossil-moldic), abundantly crinoidal dolowackestone with a diverse brachiopod fauna. A dense to vuggy (including quartz-lined vugs), finely crystalline dolomudstone to skeletal-moldic dolowackestone that is sparsely fossiliferous but contains a diverse fauna of brachiopods characterizes the Waubeek Member (Sheinwoodian). The uppermost *P-K Member* (Sheinwoodian) is a complex mound and inter-mound facies composed largely of skeletal (dominantly crinoidal) dolowackestone to dolopackstone flanked by crinoidal dolopackstone with some dolograinstone; the P-K Member may be a partial facies equivalent to the BCQ and







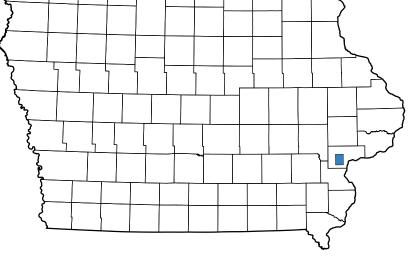
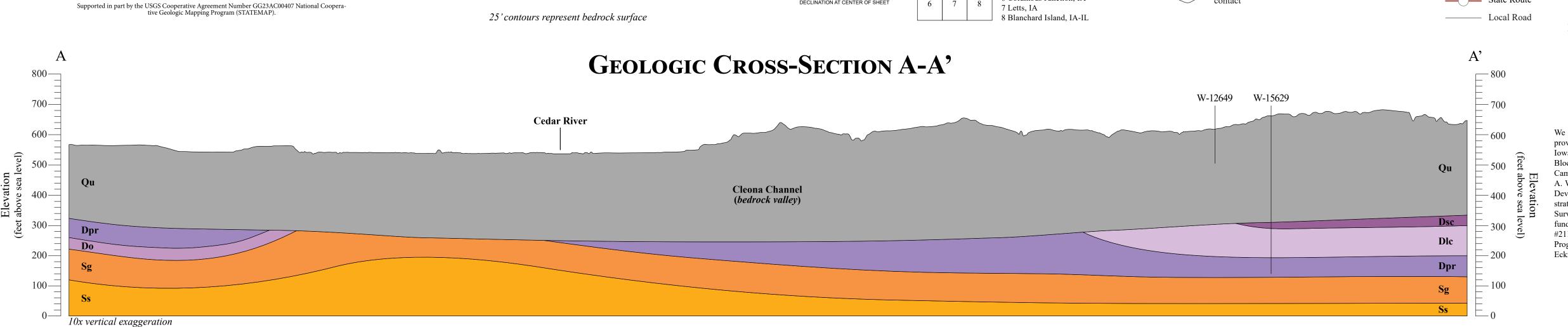


Figure 1. The location of Muscatine NW Quadrangle in Iowa.

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DECLINATION AT CENTER OF SHEET