BEDROCK GEOLOGIC MAP OF THE DONNELLSON 7.5' QUADRANGLE, LEE COUNTY, IOWA

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IOWA GEOLOGICAL SURVEY
Keith Schilling, State Geologist
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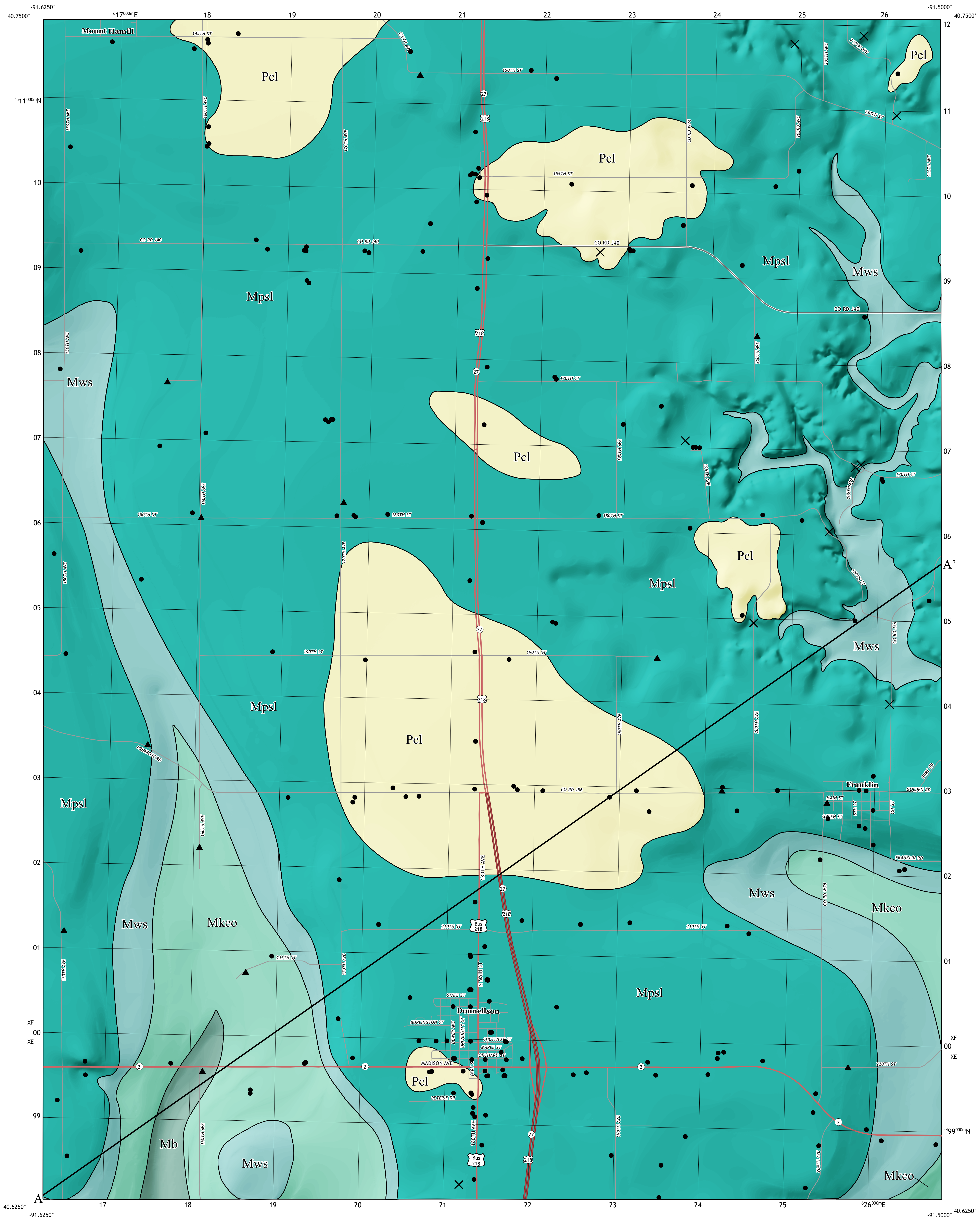

Base map from USGS Donnellson 7.5' Quadrangle map, published by the US Geological Survey in 2018. Bedrock topography raster created internally for this map project Donnellson_BR_3m.mxd, version 10/31/20 (ArcGIS 10.7.1). Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15N, datum NAD83.

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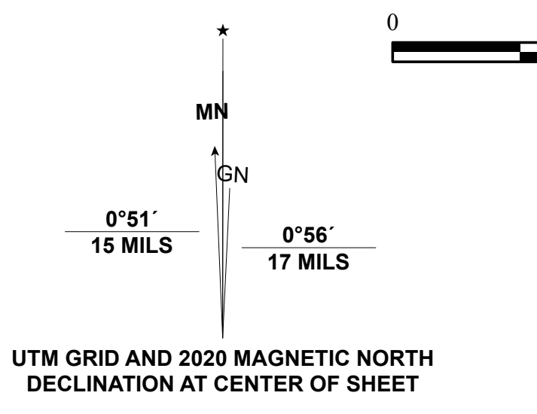
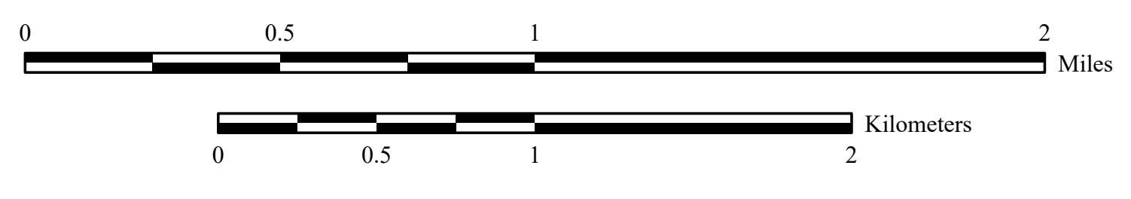
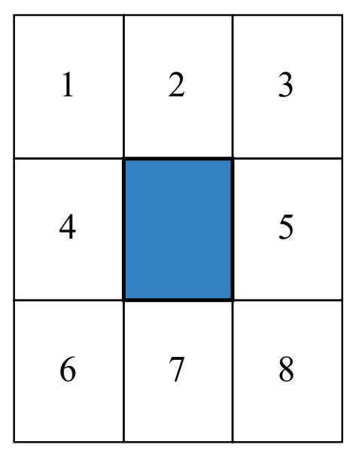


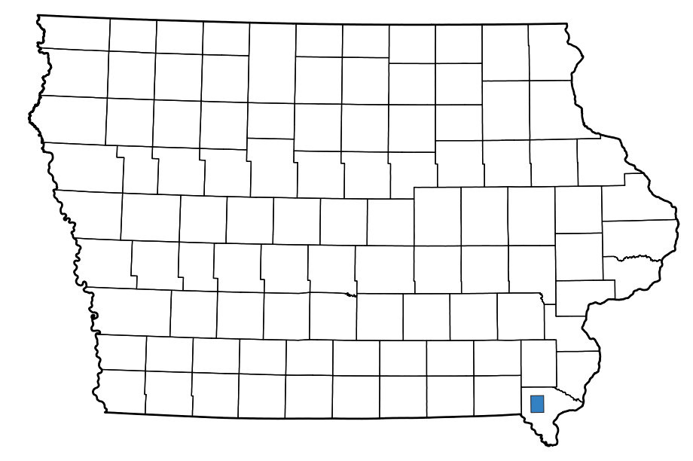
UTM GRID AND 2020 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

1:24,000





ADJOINING QUADRANGLES
1 Hillsboro, IA
2 Salem, IA
3 Lowell, IA
4 Farmington, IA
5 West Point, IA
6 Croton, IA-MO
7 Argyle, IA-MO
8 Nauvoo, IA-IL



INTRODUCTION

The Donnellson Quadrangle lies within the Southern Iowa Drift Plain landform region, which is dominated by loess mantled till plains in the uplands and fine to coarse grained alluvial deposits in stream valleys. The thickness of Quaternary materials overlying the bedrock surface varies widely across the quadrangle ranging from 0 to 18 m (0 – 60 ft), reaching a maximum thickness of 55 m (180 ft) in the southern part of the mapping area. An accompanying map of the surficial geology of the Donnellson Quadrangle has been published concurrently with this map.

The bedrock surface of the Donnellson Quadrangle is dominated by Mississippian units overlain by Pennsylvanian units occurring as minor erosional outliers. The majority of the bedrock exposures occur along Sugar Creek and its tributaries in the eastern part of the mapping area. Geologic reconnaissance of two active quarries, three abandoned quarries, and six exposures within the mapping area were conducted during field activities. Additional subsurface information was derived from the analysis of more than 280 water well records, more than 40 of which have cutting samples that were described as part of this mapping project, and 14 passive seismic data points. For a more detailed account of data resources, mapping methods, and stratigraphy of the Donnellson Quadrangle, please refer to the Summary Map Report.

STRATIGRAPHIC COLUMN AND LEGEND

System[1]	Subsystem[1]	Series[1]	Stage[2]	Lithostratigraphic Unit	Map Symbol	Lithology	Thickness (in feet)	Lithostratigraphic Unit Description
Quaternary				Quaternary undifferentiated	Qu		0-180	**Qu - Undifferentiated Unconsolidated Sediments -** Consists of loamy soils developed in loess, and glacial till of variable thickness, with alluvial and colluvial clay, silt, sand, and gravel. The total thickness of the Quaternary deposits varies between 0 and 18 m (0 – 60 ft), but can be as much as 55 m (180 ft) thick in the southeastern part of the mapping area. This unit is shown only on the cross-section, not on the map.
Carboniferous	Pennsylvanian	Middle	Desmoinesian-Atokan	Lower Cherokee Group	Pcl		<60	**Pcl - Shale and Sandstone** (Lower Cherokee Group) Middle Pennsylvanian. Pennsylvanian units occur as erosional outliers reaching a thickness of up to 18 m (60 ft) within the mapping area. This unit consists of shale/mudstone, light to medium gray, part silty to sandy and fine to medium quartz sandstone, rarely conglomeratic, and coal. Some shales are carbonaceous to phosphatic. One outcrop of this unit was identified in the mapping area.
	Mississippian	Upper Middle	Chesterian Meramecian	Pella or "St. Louis" fms.	Mpsl		<90	**Mpsl – Limestone, Sandstone, and Dolomite** (Pella or "St. Louis" formations) Middle-Upper Mississippian, Meramecian-lower Chesterian. This map unit ranges between 9 and 18 m (30 – 60 ft) thick and reaches a maximum thickness of 27 m (90 ft) in the mapping area. It is dominated by limestone, sandstone, dolomitic limestone, and dolomite with minor shale and chert. Limestones of the Pella Formation are typically sub-lithographic with scattered to abundant fossils, primarily brachiopods, echinoderms, and ostracods. The "St. Louis" Formation is dominated by limestone, sandy limestone, sandstone, and dolomite, variably cherty. The limestone facies of this unit can be fossiliferous with brachiopods, echinoderms, and several varieties of coral while the dolomitic facies typically exhibit fossil molds. Some fossils are silicified. Sandstones of the "St. Louis" Formation are typically very fine to medium quartz sandstones that are poorly to moderately cemented with calcite or quartz. The lower portion of the "St. Louis" Formation is commonly gray to dark brown dolomite, locally brecciated and sandy, with rare fossils. This mapping unit dominates the bedrock surface in the mapping area and is overlain by Quaternary sediments or Pennsylvanian outliers. Five outcrops, three abandoned quarries, and two active quarries exposing this mapping unit were identified in the mapping area.
			Osagean	Warsaw Fm.	Mws		<60	**Mws – Shale, Dolomite, and Limestone** (Warsaw Formation) Upper Osagean. The Warsaw Formation varies in thickness due to a disconformity at the upper contact, reaching a maximum thickness of approximately 18 m (60 ft). This unit can generally be divided into two major lithologic groupings, a lower argillaceous dolomite sequence and an upper shale dominated sequence. The upper shale is typically light to medium gray, silty, and variably dolomitic with minor chert, sand, and sparse quartz geodes. The lower dolomite, sometimes referred to as the "geode beds", is argillaceous to shaly, with scattered to abundant quartz geodes. Minor limestone units occur locally as thin, lenticular beds with crinoidal packstone/grainstone fabrics. Brachiopods, echinoderm debris, and bryozoans are found throughout this mapping unit, although more common in the carbonate lithologies. Outcrops of this unit were not observed in the mapping area.
		Lower		Keokuk Fm.	Mkeo		<90	**Mkeo – Limestone, Dolomite, Chert, and Shale** (Keokuk Formation) Upper Osagean. The Keokuk Formation can be up to 27 m (90 ft) thick in the mapping area. This unit is dominated by tan to gray interbedded skeletal limestones displaying packstone/grainstone fabrics. Nodular to bedded chert, in part fossiliferous, is common in the lower half of the sequence. Dolomite, variably argillaceous, and thin shales also occur throughout the unit. The unit displays multiple hardground surfaces and bone beds with scattered to abundant fish debris, the most prominent of these serves as a marker bed at the base of the formation (sometimes referred to as the Burlington-Keokuk or B-K bone bed). Brachiopods, crinoids, bryozoans, solitary corals, and fish bones and teeth occur throughout this unit as both abraded debris and partly articulated specimens. Molds of sponge spicules are noted in the dolomite facies. Traces of glauconite and locally abundant geodes are also commonly associated with this unit. Outcrops of this unit were not observed in the mapping area.
				Burlington Fm.	Mb		<80	**Mb – Limestone, Dolomite, and Chert** (Burlington Formation) Lower Osagean. The Burlington Formation can be up to 24 m (80 ft) thick in the mapping area. This unit is subdivided into three members (in ascending order: the Dolbee Creek, Haight Creek, and Cedar Fork), characterized by distinct lithologic groupings. The Dolbee Creek Member is dominated by white to tan skeletal limestone displaying packstone/grainstone fabrics and nodular to bedded chert. The Haight Creek Member is characterized by dolomite with an intermittent unit of skeletal limestone (sometimes referred to as the "middle grainstone") and thick beds of chert. A glauconite-rich zone marks the lower contact with the Dolbee Creek and can be used as a regional marker bed. Fossil molds are also present in the dolomite facies. The Cedar Fork Member is a pure white crinoidal packstone limestone unit which is usually differentiated from the packstones of the overlying Keokuk Formation by its white appearance. Occasional fish debris and glauconite are also observed in this member. Outcrops of the Burlington Formation were not found in the mapping area.
				Kinderhookian fms.	Mk		20-50	**Mk – Dolomite, Limestone, and Siltstone** (Kinderhookian formations) Lower Mississippian. The Kinderhookian sequence ranges in thickness from 5 to 15 m (20 – 50 ft) with a maximum thickness of 30 m (100 ft) in the mapping area. This unit comprises three formations (in ascending order: the McCraney, Prospect Hill, and Wassonville), characterized by distinct lithologic groupings. The McCraney Formation is composed of alternating beds of sparsely fossiliferous, sub-lithographic limestone and dark brown, unfossiliferous dolomite generating a unique "zebra striped" appearance in outcrop. A basal oolite is locally present. The Prospect Hill Formation is a light to medium gray, dolomitic siltstone that grades to shale in some locations. This unit is often laminated with vertical and horizontal burrow fabrics and faint cross stratified bedforms. Fossils are rare to absent although fossil molds are locally abundant. The Wassonville Formation, now including the former Starr's Cave Formation as the basal member, consists of massive dolomite that is variably cherty grading into dolomitic limestone lower in the section. The basal Starr's Cave Member is a fossiliferous limestone with packstone/grainstone fabrics and is commonly oolitic. Crinoids (partly articulated) are the dominant fossil type of the Starr's Cave Member. A diverse assemblage of brachiopods are present with lesser amounts of blastoids, starfish, corals, bryozoans, and trilobites reported. This map unit only appears in the cross-section.
Devonian		Upper	Famennian	English River Fm.	Der		<20	**Der – Siltstone and Shale** (English River Formation) Upper Devonian, lower to upper Famennian. The English River Formation is up to 6 m (20 ft) thick within the mapping area. This unit is dominated by gray to olive green siltstone with apparent bioturbated fabrics. Bivalves and brachiopods are common, especially in the upper beds, with scattered to abundant fossil molds as well. This unit only appears in the cross-section.
				Saverton Shale Fm.	Dss		<90	**Dss – Shale** (Saverton Shale Formation) Upper Devonian, lower to upper Famennian. The Saverton Shale Formation can be up to 27 m (90 ft) thick within the mapping area. This unit is dominated by green-gray shale, commonly burrowed with sparse to absent macro-fossils. This unit only appears in the cross-section.
				Grassy Creek Fm.	Dgc		<140	**Dgc – Shale** (Grassy Creek Formation) Upper Devonian, lower to upper Famennian. The Grassy Creek Formation can be up to 43 m (140 ft) thick within the mapping area. This unit is dominated by organic-rich brown shale with minor green-gray shale in the upper part of the unit. Differentiation between the Grassy Creek and overlying Saverton Shale was primarily based on color and relative abundance of spore carps identified in well cuttings. This unit only appears in the cross-section.

[1] Global stratigraphic units
[2] Regional stratigraphic units

MAP SYMBOLS

- ✕ bedrock outcrop
- ● GeoSam point
- ▲ geophysics collection point
- ⌒ unit contact
- ━ cross-section
- ▨ hillshade

ROAD CLASSIFICATION

- U.S. Route
- State Route
- Local road

LITHOLOGIES

- coal
- dolomite
- dolomitic shale
- fossiliferous limestone
- limestone
- lithographic limestone
- sandstone
- sandy limestone
- shale
- siltstone
- unlithified sediments

LITHOLOGY SYMBOLS

- ⊗ geodes
- ▵ chert
- ⊙ oolitic
- – argillaceous zone
- breccia
- ∼ unconformity

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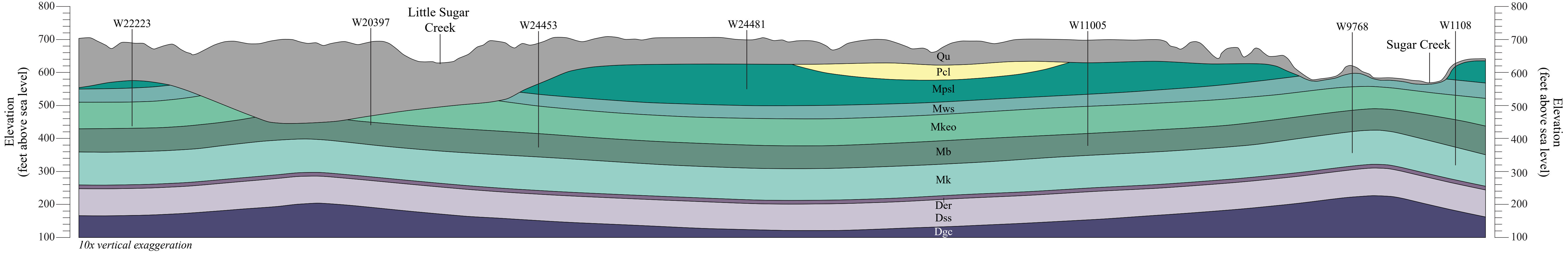
GEOLOGIC CROSS-SECTION A-A'



10x vertical exaggeration