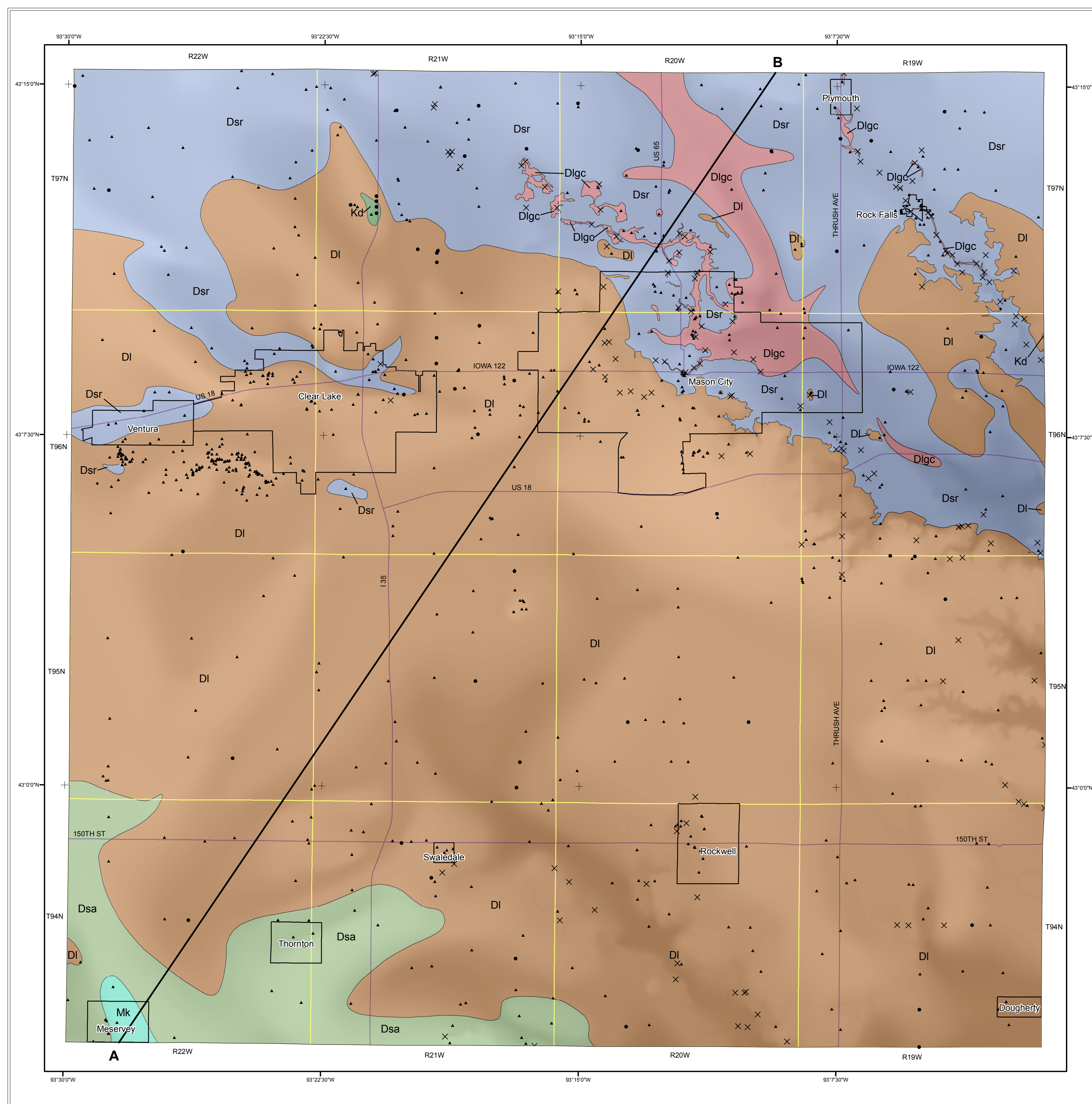


# Bedrock Geology of Cerro Gordo County, Iowa



### LEGEND

**CENOZOIC**

**QUATERNARY SYSTEM**

**Qu** - **Undifferentiated Unconsolidated Sediment** Consists of loamy soils developed in loess, glacial till, and colluvium of variable thickness, and alluvial clay, silt, sand, and gravel. Thickness of the Quaternary deposits is usually less than 15 m (50 ft), but can be up to 53 m (175 ft) in the mapping area. This unit is shown only on the cross-section, not on the map.

**MESOZOIC**

**CRETACEOUS SYSTEM**

**Kd** - **Sandstone, Mudstone, and Siderite Pebbles (Dakota/Window Formation) "Mid" Cretaceous** This map unit occurs as erosional outliers and is only found occasionally in well cuttings in the mapping area. The formation is characterized by reddish shaly sandstone with siderite pebbles. The thickness of this unit is variable, but usually less than 6 m (20 ft).

**PALEOZOIC**

**MISSISSIPPIAN SYSTEM**

**Mk** - **Limestone and Dolomite (Kinderhookian Stage) Lower Mississippian** This map unit includes Chapin and Maynes Creek formations occurring in the southwest corner of this map. Total thickness of this unit is about 9 m (30 ft) in the mapping area, characterized by limestone and dolomite with oolitic structure and abundant crinoid fossils. Cherty carboniferous often occurs in the upper part of this unit.

**DEVONIAN SYSTEM**

**Dsa** - **Shale, siltstone, Limestone, and Dolomite (Sheffield and Aplington formations) Upper Devonian** This map unit forms the bedrock surface in the southwest part of the map. Thickness of this unit varies between 9 and 18 m (30-60 ft) in the mapping area. The Sheffield Formation consists of gray shale with minor amounts of dolomite, some layers contain goodes. The Aplington Formation is characterized by argillaceous dolomite with discontinuous beds of chert.

**DI** - **Shale, Limestone, and Dolomite (Lime Creek Formation) Upper Devonian** This map unit occupies most of the bedrock surface in the mapping area. Thickness of this unit usually varies between 0 and 23 m (0-75 ft), but can be up to 49 m (160 ft) in the southern part of the county. This unit can be subdivided into a lower part of calcareous shales and an upper part of limestone, dolomite limestone, and dolomite. Thick yellowish siltstone is also reported in the southern part of the county.

**Dsr** - **Limestone, Dolomite, and Shale (Shell Rock Formation) Upper Devonian** This map unit forms the bedrock surface in the northern part of the mapping area, usually with a thickness between 12 and 23 m (40-75 ft) in the mapping area. The unit is characterized by fossiliferous limestone, dolomite limestone and dolomite, with some gray to light green shale and/or argillaceous carbonates. Layers containing abundant subspherical and tabular stromatolites commonly occur in the lower part of the unit. Brachiopods, bryozoans, corals, and crinoids are abundant in some intervals, especially in the upper part of the unit.

**Dlgc** - **Dolomite, Limestone, and Shale (Lithograph City Formation) Middle to Upper Devonian** This map unit occurs as the bedrock surface along the Winnebago River and Shell Rock River and in a bedrock valley in the north-central part of the map. The maximum thickness of this unit is about 34 m (110 ft) in the mapping area. It consists of dolomite and dolomite limestone, usually characterized by interbedded lithographic and sublithographic limestone and dolomite limestone, in part argillaceous or with minor shale. "Birdseye", "vugs" and calcite vug-fills are common. Some intervals are fossiliferous and stromatolite-rich.

**Dcv** - **Limestone and Dolomite (Coraville Formation) Middle Devonian** The thickness of this map unit varies between 11 and 18 m (35-60 ft). It is dominated by limestone, dolomite limestone, and dolomite, in part, laminated and argillaceous. Brachiopods, echinoderm debris and corals usually occur in the limestone facies. This unit is shown only on the cross-section, not on the map.

**Dic** - **Dolomite and Limestone (Little Cedar Formation) Middle Devonian** The thickness of this formation ranges from 27 to 46 m (90-150 ft) in the mapping area. This unit is dominated by slightly argillaceous to argillaceous dolomite and dolomite limestone, usually wavy and partially laminated and/or cherty. This unit is commonly fossiliferous, especially in the lower portion. This unit is shown only on the cross-section, not on the map.

**OTHER FEATURES**

- Roads
- Cities
- Outcrops
- New Drill Holes for this map project
- IGS GEOSAM Data Points records available at [www.iosandobasinsurvey.com](http://www.iosandobasinsurvey.com)
- W9046 Wells used for geologic cross-section

## BEDROCK GEOLOGY OF CERRO GORDO COUNTY, IOWA

Iowa Geological Survey  
Open File Map OFM-15-1  
June 2015

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### Introduction to the Bedrock Geology of Cerro Gordo County, Iowa

Cerro Gordo County lies along the border area of the Des Moines Lobe and the Iowan Surface landform regions. The Des Moines Lobe was the area covered by the last Quaternary glacial advance in Iowa, and the Iowan Surface landform region was modified by various episodes of erosion before Wisconsin-age glacial events (Prior, 1991). Due to extensive glacial and erosional activities, the land surface in this area has relatively low topographic relief except for the river valleys in the county.

The land surface of Cerro Gordo County is mostly covered by Quaternary deposits. Thickness of the undifferentiated Quaternary deposits are usually less than 15 m (50 ft), but can be up to 53 m (175 ft) thick in the western portion of the mapping area. Bedrock outcrops are common along the Winnebago, Shell Rock, and West Fork Cedar rivers and their tributaries. Some rock quarries and gravel pits are also located along these waterways. Shallow bedrock information from the soil survey in Cerro Gordo County (DeWitt, 1981) was used for identifying potential bedrock outcrops. More than 150 bedrock outcrops including quarries within the county were investigated in the field, and they provided important regional stratigraphic information for the bedrock geologic mapping. Subsurface geologic information was mostly derived from the analysis of water well data. More than 850 private and public wells within the mapping area were studied. Among them, 345 wells have descriptive strip logs and cutting samples deposited at the Iowa Geological Survey (IGS), 117 of which were newly logged for this bedrock geologic mapping task. Lithologic and stratigraphic information from these samples are stored in the online GEOSAM database of the IGS. Bedrock stratigraphic information from the surrounding area, including bedrock outcrops, quarries, and water wells, was also utilized for this mapping project.

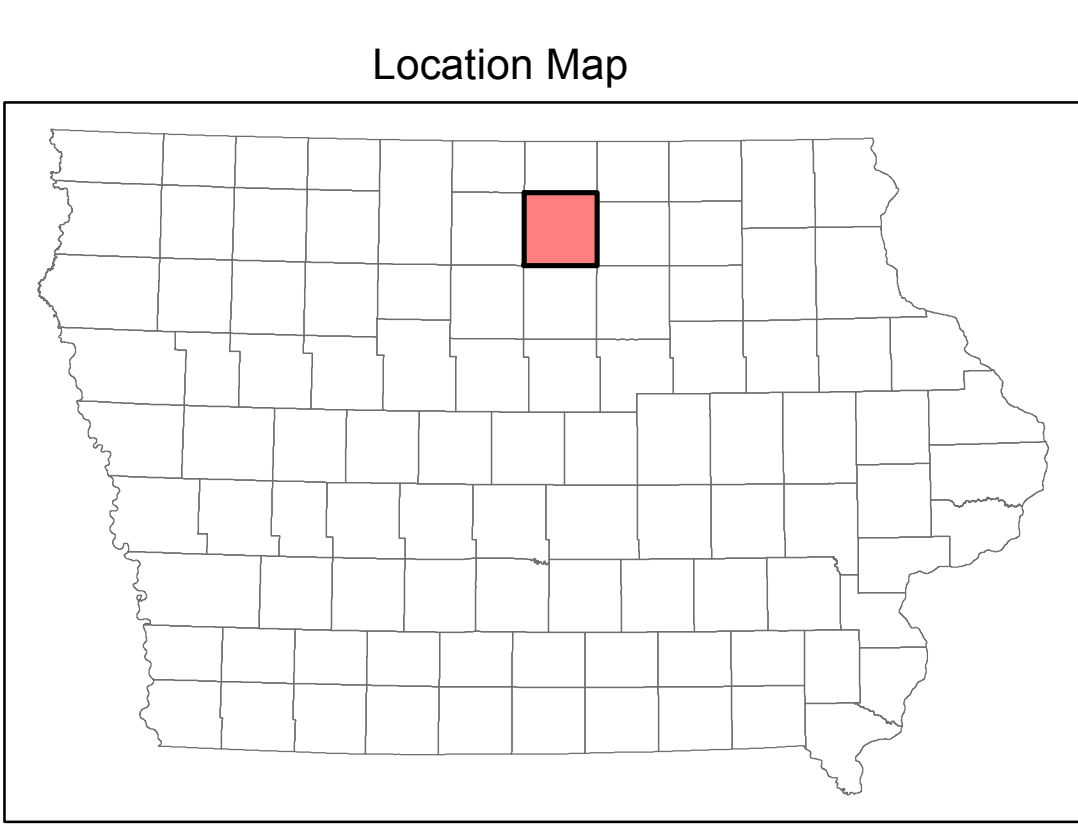
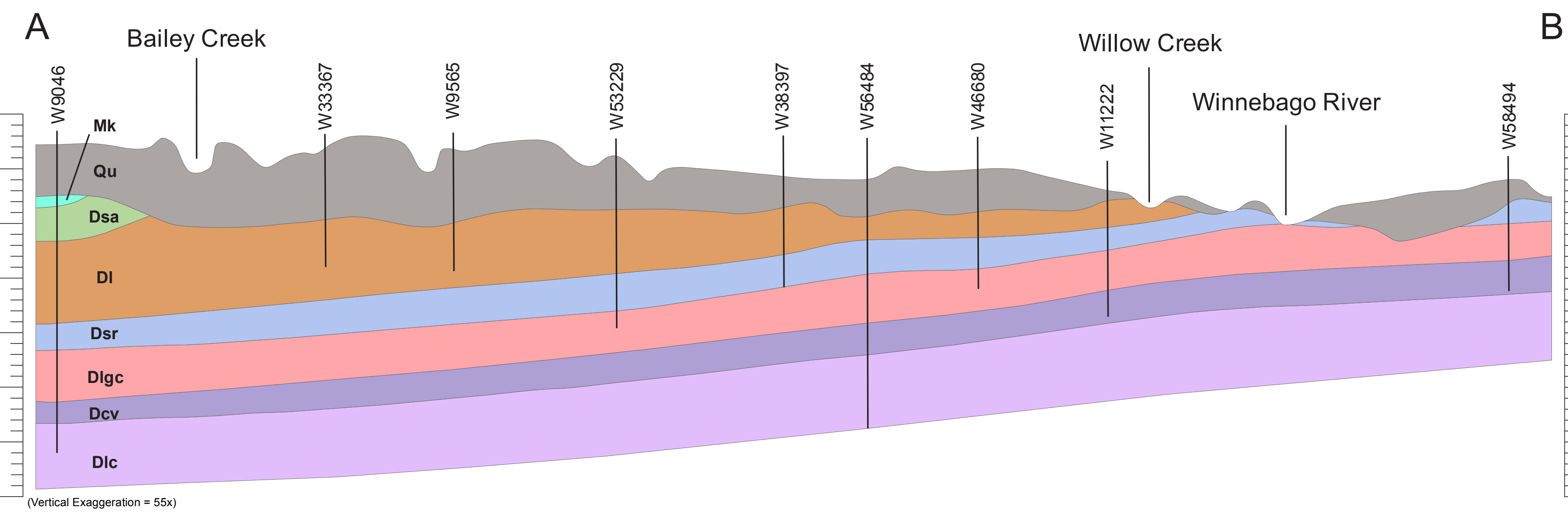
Sedimentary rocks occurring on the bedrock surface of Cerro Gordo County consists of strata deposited during the Devonian, Mississippian and Cretaceous. Paleogeographically, the mapping area is within the northern portion of the Devonian Iowa Basin, a region of thickened shelf carbonate and shale deposits. Middle and lower Upper Devonian rocks form the major bedrock surface and upper bedrock aquifer in this area. Due to its importance and stratigraphic completeness, the stratigraphy and depositional environments of the Devonian Iowa Basin have been intensively studied (e.g., Belanski, 1927, 1928; Koch, 1970). Several type sections of stratigraphic units of Devonian age are located within or surrounding this mapping area, such as the members of the Shell Rock and Lime Creek formations, and the Sheffield Formation. Recent geologic and stratigraphic studies of the Devonian Iowa Basin include Witke and Bunker (1984), Anderson (1984), Bunker and others (1986), Witke and others (1988), Bunker (1995), Anderson and Bunker (1998), Groves and others (2008), McKay and Liu (2012), and Day and others (2013). Bedrock geology within and surrounding the mapping area was recently mapped by Witke and others (2010) and Liu and others (2010a and b, 2011a and b, 2012, 2013, 2014a and b). Results from these studies and bedrock mapping projects provide an important stratigraphic framework for the present bedrock geologic map. The bedrock stratigraphic nomenclature and correlation of the Devonian for this map follows the stratigraphic framework proposed by Witke and others (1988). The Lower Mississippian strata occurs at the bedrock surface only in a small region within the mapping area. However, the stratigraphy of the Mississippian in the surrounding area has been studied by several previous authors (e.g., Van Tuyl, 1922; Dorheim et al., 1969; Woodson and Bunker, 1989). Here we take the stratigraphic framework of Witke and others (2010) and refer to them as the Kinderhookian Stage, consisting of the Chapin and Maynes Creek formations only in this mapping area.

The following describes the characteristics of each mapping unit. The youngest bedrock unit within the mapping area is the Cretaceous Dakota/Window Formation, which usually occur as erosional outliers a few meters thick represented by iron-rich shaly/silty sandstone in north-central Iowa. These materials were recognized only from a few wells in the mapping area. The Kinderhookian strata of Mississippian-age occurs in two wells located in the southwest corner of the mapping area with a total thickness of about nine meters (30 ft). They include the Chapin Formation, which consists of crinoidal to oolitic limestone and shaly dolomite, and the Maynes Creek Formation, which is characterized by cherty dolomite. Based on the limited information, these strata are combined here as undifferentiated Kinderhookian. The Devonian rocks are dominated by carbonates and shales in the mapping area. Based on lithologic features and fossils, the Devonian rocks are stratigraphically subdivided into, in descending order, the Aplington, Sheffield, Lime Creek, Shell Rock, Lithograph City, Coraville, and Little Cedar formations. The Aplington Formation is characterized by argillaceous dolomite with discontinuous thin beds of chert, and the Sheffield Formation consists of gray shale with minor amounts of dolomite, some layers contain somewhat spherical, quartz filled, goodes. Total thickness of these two formations varies between 9 and 18 m (30-60 ft), and occurs in the southwest portion of the mapping area. Because of their restricted and relatively thin presence, these two formations are combined as one mapping unit. The Lime Creek Formation forms most of the bedrock surface of the county. This formation is usually characterized by calcareous shales in the lower part and carbonates in the upper part. The lower part of the formation represents as bluish gray to greenish yellow shale, but a thick layer of siltstone underlying the upper carbonates has been recently recognized in southern Cerro Gordo County. The upper carbonates are comprised of dolomite, argillaceous carbonates, limestone, and dolomite limestone with minor shale. The Lime Creek Formation is usually fossiliferous, especially the lower shaly part is characterized by the abundance and variety of brachiopods and other fossils. Thickness of the Lime Creek Formation varies between 0 and 22 m (73 ft) in the north, but it can be up to 49 m (160 ft) in southern part of the county. The Shell Rock Formation is characterized by fossiliferous limestone, dolomite limestone and dolomite, with some gray to light green shale and/or argillaceous carbonates. Layers containing abundant subspherical and tabular stromatolites commonly occur in the lower part of the formation. Brachiopods, bryozoans, corals, and crinoids are also abundant, especially in the upper part of the unit. Thickness of the Shell Rock Formation varies between 12 and 23 m (40-75 ft) in the mapping area. The Lithograph City Formation is characterized by laminated lithographic and sublithographic limestone and dolomite, with minor shale. "Birdseye", "vugs", and calcite vug-fills are common in this formation. Some layers of this formation are fossiliferous with brachiopods, corals, and stromatolites. The Lithograph City Formation only occurs at the bedrock surface within a bedrock valley and places along the Shell Rock River, Winnebago River, and their tributaries in the northern part of the county. The maximum thickness of the Lithograph City Formation is about 34 m (110 ft) in this area. The underlying Coraville and Little Cedar formations of the Middle Devonian are mainly carbonates, somewhat argillaceous or shaly, and usually fossiliferous. These two formations are found in wells only and do not occur at the bedrock surface in the mapping area.

### Correlation of Map Units

AGE (Ma)	SYSTEM	SERIES	STAGE	MAP UNIT
2.588	QUATERNARY			Qu
145.0	CRETACEOUS			Kd
358.9	MISSISSIPPIAN Lower	Upper	Tournaisian	Mk
372.2			Famennian	Dsa
382.7			Frasnian	DI
				Dsr
				Dlgc
				Dcv
				Dic
387.7	DEVONIAN Middle		Givetian	
393.3			Eifelian	

### GEOLOGIC CROSS-SECTION A-B



Base map from Iowa DOT Road Map Layers 2006. Bedrock topography raster created internally for this map project.

Iowa Geological Survey digital cartographic file CerroGordo\_Co\_BedrockGeology.mxd, version 6/30/15 (ARCGIS 10.3)

Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15 N, datum NAD83.

The map 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.

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