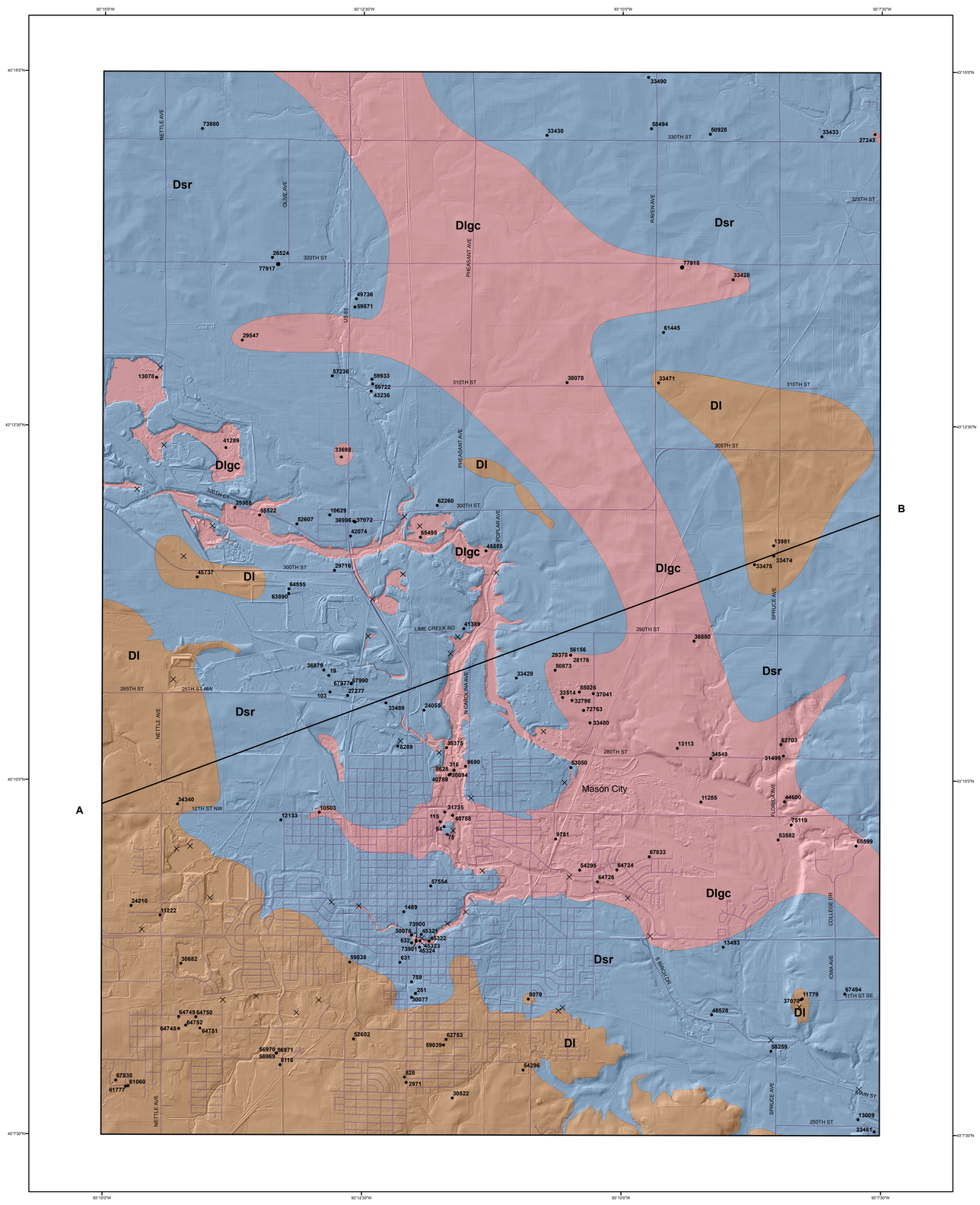
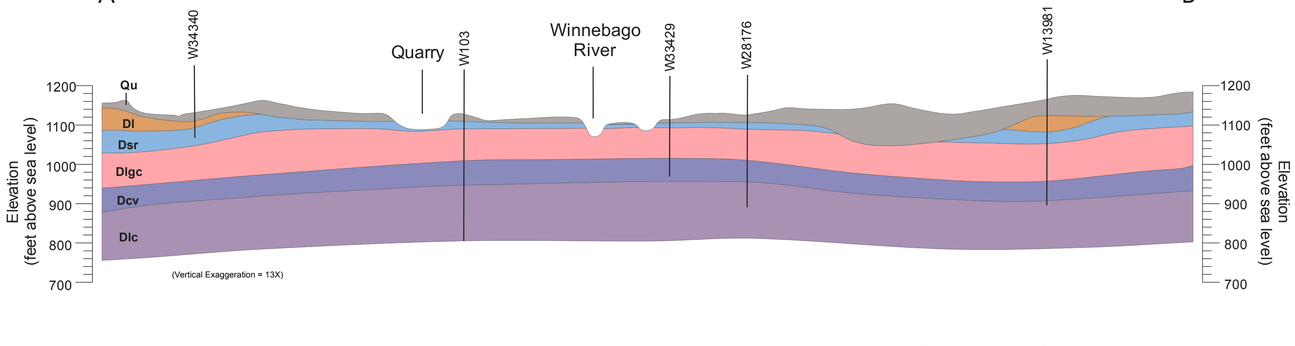
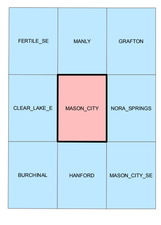
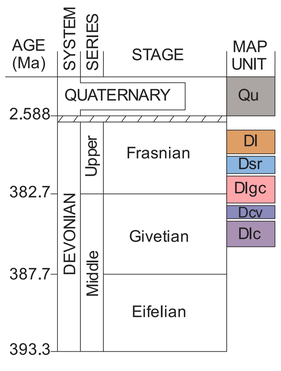
Bedrock Geology of the Mason City (Iowa) 7.5' Quadrangle



GEOLOGIC CROSS-SECTION A-B







BEDROCK GEOLOGY OF THE MASON CITY 7.5' QUADRANGLE, CERRO GORDO COUNTY, IOWA

Iowa Geological Survey
Open File Map OFM-14-1
September 2014

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IOWA GEOLOGICAL SURVEY

Iowa Geological Survey, Robert D. Libra, State Geologist

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Introduction to the Bedrock Geology of Mason City 7.5' Quadrangle, Cerro Gordo County, Iowa

The Mason City quad lies along the border area of the Des Moines Lobe landform region, which was the last area covered by a Quaternary glacial advance in Iowa, and the Iowan Surface landform region, which was modified by various episodes of erosion before Wisconsin glacial events (Prior, 1991). Due to extensive glacial and erosional activities, the land surface in this area has relatively low topographic relief, except the area along the Winnebago River in the southern part of the quad.

The land surface of the Mason City quad is mostly covered by Quaternary deposits. The undifferentiated Quaternary deposit in the quad varies between 0 and 24 m (0 to 80 ft). It is usually thicker in the north and thin in the south. The thickest Quaternary deposits occur along a bedrock valley trending NW-SE through the quad. Bedrock outcrops exist mostly in the western and southern portions of the quad, and along the Winnebago River and Willow Creek. Several rock quarries are also located along these two water bodies. More than 40 bedrock outcrops and quarries within the quad were investigated in the field, which provided significant information concerning regional bedrock stratigraphy. Subsurface geologic information was mostly derived from the analysis of water well cutting samples reposited at the Iowa Geological Survey (IGS). Lithologic and stratigraphic information from these samples are stored in the online GEOSAM database of the IGS. Geologic information from about 140 private and public wells within the mapping area was used for bedrock geologic mapping purposes. Shallow bedrock information from the soil survey in Cerro Gordo County (DeWitt, 1981) was used for identifying potential bedrock outcrops in the field. Stratigraphic information from the surrounding area, including bedrock outcrops, quarries, and well samples, was also utilized for this mapping project.

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 stratigraphic completeness, the stratigraphy and depositional environments of the Devonian Iowa Basin have been intensively studied (e.g., Belanski, 1927, 1928; Koch, 1970). Recent geologic and stratigraphic studies of this basin include Witzke and Bunker (1984), Anderson (1984), Bunker and others (1986), Witzke and others (1988), Bunker (1995), Anderson and Bunker (1998), Groves and others (2008), and McKay and Liu (2012). Bedrock geology of the surrounding area was recently mapped by Witzke and others (2010) and Liu and others (2010a & b; 2011a & b; 2012; 2013). Results from these studies and bedrock mapping projects provide an important stratigraphic framework for this bedrock geologic map. The bedrock stratigraphic nomenclature and correlation for this map follows the stratigraphic framework proposed by Witzke and others (1988).

The bedrock surface of the Mason City quad comprises Devonian rocks varying between carbonates and shale. Based on lithologic features and fossils, these bedrocks are stratigraphically subdivided into, in descending order, the Lime Creek, Shell Rock, and Lithograph City formations. The Lime Creek Formation comprises the bedrock surface mostly in the southwestern part and bedrock highs of the mapping area. This formation is usually characterized by calcareous shale in the lower part and carbonates in the upper part. Only the lower part of the formation occurs in the quad, represented as bluish gray and greenish yellow shale. The maximum thickness of the Lime Creek Formation is about 25 m (83 ft), but is usually less than 15 m (50 ft) in the mapping area. The Shell Rock Formation forms most of the bedrock surface of the Mason City quad, and is comprised of fossiliferous limestone, dolomitic limestone and dolomite, with minor shale. Commonly, a 2-meter-thick stromatoporoid-rich biostrome facies occurs near the base of the formation in this area. Shaly and/or argillaceous carbonates usually occur in the middle and upper portions of the Shell Rock Formation. Thickness of the Shell Rock Formation is usually about 12-21 m (40-70 ft), but can be less than 9 m (30 ft) at places within the quad. The Lithograph City Formation is characterized by laminated lithographic and sublithographic limestone and dolomite. "Birdseye," vugs, and calcite vug-fills are common in this formation. Some layers of this formation are fossiliferous with brachiopods, corals and stromatoporoids. The Lithograph City Formation occurs at the bedrock surface mostly within the bedrock valley, and along the Winnebago River and Willow Creek, or at quarries where the overlying bedrock units have been removed by mining. The maximum thickness of the Lithograph City Formation is about 34 m (110 ft) in this area. Underlying Coralville and Little Cedar formations of the Middle Devonian are found in wells only and do not occur at the bedrock surface in the Mason City quad.

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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. The total thickness of the Quaternary deposits varies between 0 and 24 m (0 to 80 ft) in the quad. This unit is shown only on the cross-section, not on the map.

PALEOZOIC

DEVONIAN SYSTEM

Dl – Shale, Limestone, and Dolomite (Lime Creek Formation) Upper Devonian. This map unit occurs on the bedrock surface in the southwestern part and bedrock highs of the mapping area. The thickness of this unit varies between 0 and 25 m (0-83 ft), but is usually less than 15 m (50 ft) in the mapping area. This unit usually can be subdivided into three parts: a lower unfossiliferous calcareous shale, a middle fossiliferous calcareous shale, and an upper limestone, dolomitic limestone, and dolomite. Only the shaley parts of the unit occur in the quad.

Dsr – Limestone, Dolomite, and Shale (Shell Rock Formation) Upper Devonian. This map unit forms most of the bedrock surface in the mapping area. Thickness of this unit is about 12 to 21 m (40-70 ft), but can be less than 9 m (30 ft). The unit is characterized by fossiliferous limestone, dolomitic limestone and dolomite, with some grey to light green shale and/or argillaceous carbonates. Layers containing abundant subspherical and tabular stromatoporoids 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 along the Winnebago River and Willow Creek, and in a bedrock valley through the quad. The maximum thickness of this unit is about 34 m (110 ft) in the mapping area. It consists of dolomite and dolomitic limestone, usually characterized by interbeds of laminated lithographic and sublithographic limestone and dolomitic limestone, in part argillaceous or with minor shale. "Birdseye," vugs and calcite vug-fills are common. Some intervals are fossiliferous and stromatoporoid-rich.

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

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

77202 **New Drill Holes for this map project**

× **Outcrops**

103 IGS GEOSAM Data Points - records available at www.iowageologicalsurvey.com

Roads

Base map from Iowa DOT Road map Layers 2006. Shaded relief from Iowa Lidar Project 2007-2011.

Iowa Geological Survey digital cartographic file MasonCity_BedrockGeology.mxd, version 9/15/14. (ArcGIS 10.1)
Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15, 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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