Bedrock Geologic Map of Des Moines County, Iowa

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Open File Map: **OFM-23-1**
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Map projection and coordinate system based on WGS 1984 Web Mercator (auxiliary sphere). Bedrock topography raster created internally for this map project Des_Moines_BR_3m.mxd, version 7/01/23 (ArcGIS Pro 3.0).

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. 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.

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Introduction

Des Moines County is located on 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 county ranging from 0 to 23 m (0 – 75 ft), but can be up to 114 m (375 ft) thick in the eastern part of the mapping area. An accompanying map of the surficial geology of Des Moines County has been published concurrently with this map (Open File Map OFM-23-2; Tassier-Surine et al., 2023).

The bedrock surface of Des Moines County is dominated by strata of the Mississippian Subsystem that is riddled with deeply incised erosional channels, exposing shales of the Devonian System. Pennsylvanian units occur as minor erosional outliers in the southwestern part the county. All data from previous STATEMAP quadrangle bedrock geologic maps in Des Moines County (Lowell, Danville, Sperry, and West Burlington) were incorporated into the Bedrock Geologic Map of Des Moines County.

The majority of the bedrock exposures in Des Moines County were found along the bluffs of the Skunk and Mississippi rivers that border the county, as well as along Flint Creek near the middle of the map area. Des Moines County hosts more than 20 aggregate rock quarries, most of which are abandoned. Geologic reconnaissance of 64 bedrock outcrops, three active quarries, and five abandoned quarries within the mapping area was conducted during field activities. Sixteen abandoned quarries were identified from historical aerial photography, LiDAR, and previously published reports. Additional subsurface information was derived from the analysis of more than 1,100 water well and borehole records, over 100 of which have cutting samples that were described as part of this mapping project, 32 passive seismic data points, and 33 well records in Illinois. For a more detailed account of data resources, mapping methods, and stratigraphy, please refer to the Summary Map Report of Des Moines County, Iowa.

Legend

Map Symbols
- bedrock outcrop
- GeoSam point
- new drill core
- geophysics point
- quarry
- unit contact - *concealed*
- cross-section
- town boundary
- hillshade

Structure Symbols
- syncline *moderate confidence, location concealed*
- anticline *moderate confidence, location concealed*
- syncline *low confidence, location concealed*
- *plunge direction*

Road Classification
- U.S. Route
- State Route

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

Lithology Symbols
- geodes
- chert
- oolitic
- argillaceous zone
- breccia
- unconformity

Figure 1. Structures in Des Moines County, Iowa. 1:500,000 scale

Stratigraphic Column and Legend

System[1]	Subsystem[1]	Series[1]	Stage[1]	Regional Series[2]	Map Units (Map Symbols)	Lithology	Thickness (feet)
		Quaternary			Quaternary undifferentiated (Qu)		0 to 75
Carboniferous	Pennsylvanian				lower Cherokee Group (Pcl)		0 to 45
Carboniferous	Mississippian	Middle-Lower	Moscovian-Bashkirian	Desmoinesian-Atokan-Morrowan			
Carboniferous	Mississippian	Middle	Visean	Meramecian	Pella or "St. Louis" formations (Mpsl)		< 80
Carboniferous	Mississippian	Middle	Visean	Osagean	Warsaw Formation (Mws)		< 75
Carboniferous	Mississippian	Middle	Visean	Osagean	Keokuk Formation (Mkeo)		< 85
Carboniferous	Mississippian	Lower	Tournaisian	Osagean	Burlington Formation (Mb)		< 95
Carboniferous	Mississippian	Lower	Tournaisian	Kinderhookian	Kinderhookian formations (Mk)		< 75
Devonian	Upper	Famennian			English River Formation (Der)		< 25
Devonian	Upper	Famennian			Saverton Shale Formation (Dss)		< 160
Devonian	Upper	Famennian			Grassy Creek Formation (Dgc)		< 180

[1]Global Chronostratigraphic Units
[2]North American Chronostratigraphic Units

Lithostratigraphic Unit Description

Qu - Undifferentiated Unconsolidated Sediments - 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 typically varies between 0 and 23 m (0 – 75 ft) but can be up to 114 m (375 ft) thick in the eastern part of the mapping area. This unit is shown only on the cross-section, not on the map.

Pcl - Shale and Sandstone - Pennsylvanian units occur as relatively thin erosional outliers reaching a maximum thickness of 14 m (45 ft) in the southwestern part of the mapping area. This unit consists of light to medium gray shale/mudstone that is part silty to sandy, fine to medium quartz sandstone that is rarely conglomeratic, and coal. Some black shales are carbonaceous to phosphatic. Only one outcrop of this unit was identified in the mapping area.

Mpsl – Limestone, Sandstone, and Dolostone - This map unit reaches a maximum thickness of 24 m (80 ft) in the mapping area. It is characterized by limestone, sandstone, dolomitic limestone, and dolostone with minor shale and chert. The Pella Formation can have minor calcareous to dolomitic shale but is dominated by limestone, 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 dolostone with variable chert. The limestone facies of this unit can be fossiliferous with brachiopods, echinoderms, and several varieties of corals 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 dolostone that is locally brecciated and sandy, with minor shale seams, and rare fossils. A total of 10 exposures (two quarries and eight outcrops) of this mapping unit were identified in the mapping area.

Mws – Shale, Dolostone, and Limestone - The Warsaw Formation varies in thickness due to erosional disconformities at both the upper and lower contacts, reaching a maximum thickness of approximately 17 m (55 ft) within the mapping area. This unit can generally be divided into two major lithologic groupings, a lower argillaceous dolostone sequence and an upper shale-dominated sequence, however preservation is variable as either or both facies may exist in places. The upper shale is typically light to medium gray, silty, and variably dolomitic with minor chert, sand, and sparse quartz geodes. The lower dolostone, 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 they are more common in the carbonate lithologies. Only two exposures of this unit were observed in the mapping area.

Mkeo – Limestone, Dolostone, Chert, and Shale - The Keokuk Formation averages about 19 m (65 ft) in thickness but can be up to 26 m (85 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. Variably argillaceous dolostone 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 partially articulated specimens. Molds of sponge spicules can occur in the dolostone facies. Minor glauconite and locally abundant geodes are also associated with this unit. Calcite vug fills and rare sphalerite are noteworthy. A total of 16 exposures (three quarries and 13 outcrops) of this unit were observed in the mapping area.

Mb – Limestone, Dolostone, and Chert - The Burlington Formation averages about 19 m (65 ft) in thickness but can be up to 29 m (95 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 a pure white crinoidal packstone limestone with minor chert. The Haight Creek Member is characterized by dolostone 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 contact between the Haight Creek and Dolbee Creek and can be used as a regional marker bed. Fossil molds are also present in the dolostone facies. The Cedar Fork Member is dominated by white to tan skeletal limestone displaying packstone/grainstone fabrics, nodular to bedded chert, occasional fish debris, and traces of glauconite. Its light color helps differentiate this unit from the dominantly gray packstones of the overlying Keokuk Formation. This unit dominates the bedrock surface in the mapping area with 47 exposures (16 quarry and 31 outcrops). The Warsaw, Keokuk, and Burlington formations are difficult to differentiate in the northern part of Des Moines County. They tend to thin towards the north-northwest, loosing much of the fossiliferous limestone facies and becoming more dolostone-dominated.

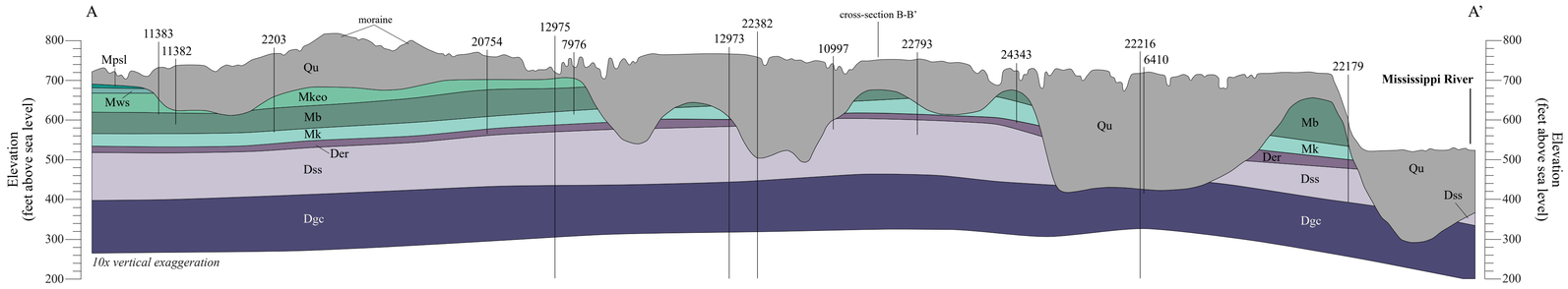
Mk – Dolostone, Limestone, and Siltstone - The Kinderhookian sequence reaches a maximum thickness of 23 m (75 ft) in the mapping area, generally thinning towards the north. This unit comprises three formations, in ascending order: the Louisiana (formerly "McCraney"), Prospect Hill, and Wassonville, characterized by distinct lithologic groupings. The Louisiana Formation is composed of alternating beds of sparsely fossiliferous, sub-lithographic limestone and dark brown, unfossiliferous dolostone, generating a unique "zebra-striped" appearance in outcrop. Calcite vug fills are common and 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, which now includes the former Starr's Cave Formation as the basal member, consists of massive dolostone with variable chert that grades 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 (partially articulated) are the dominant fossil type of the Starr's Cave Member. A diverse assemblage of brachiopods is also present with lesser amounts of blastoids, starfish, corals, bryozoans, and trilobites reported. A total of 20 exposures (six quarries and 14 outcrops) of this map unit were observed in the mapping area.

Der – Siltstone and Shale - The English River Formation ranges from 3 to 8 m (10-25 ft) thick in the mapping area. This unit is dominated by gray to olive green siltstone, locally shaly, with distinct bioturbated fabrics. Bivalves and brachiopods are common, especially in the upper beds, with scattered to abundant fossil molds as well. A total of six exposures (two quarries and four outcrops) of this unit were observed within the mapping area.

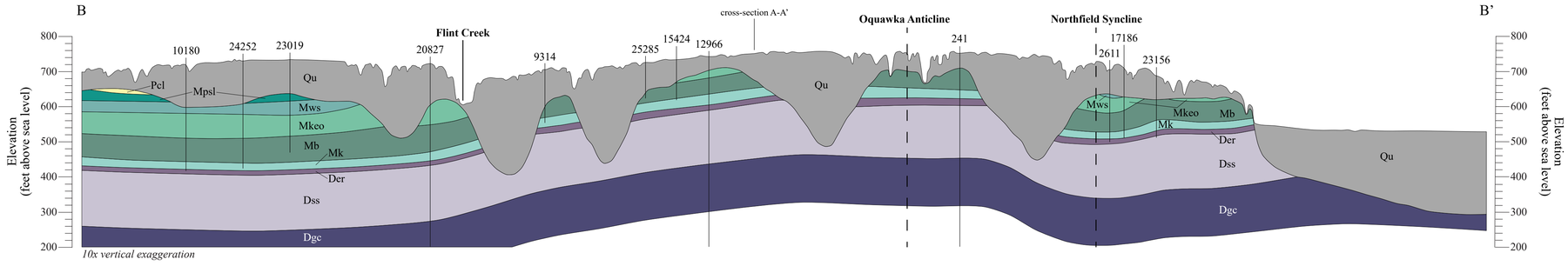
Dss – Shale - The Saverton Shale Formation can be up to 49 m (160 ft) thick in the mapping area. This unit is dominated by green-gray shale, commonly burrowed with sparse to absent macrofossils. Only one outcrop of this unit has been reported within the mapping area.

Dgc – Shale - The Grassy Creek Formation can be up to 55 m (180 ft) thick in 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. Exposures of this map unit were not identified within the mapping area.

Geologic Cross-Section A-A'



Geologic Cross-Section B-B'



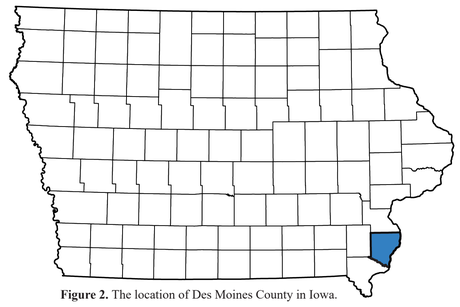


Figure 2. The location of Des Moines County in Iowa.

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