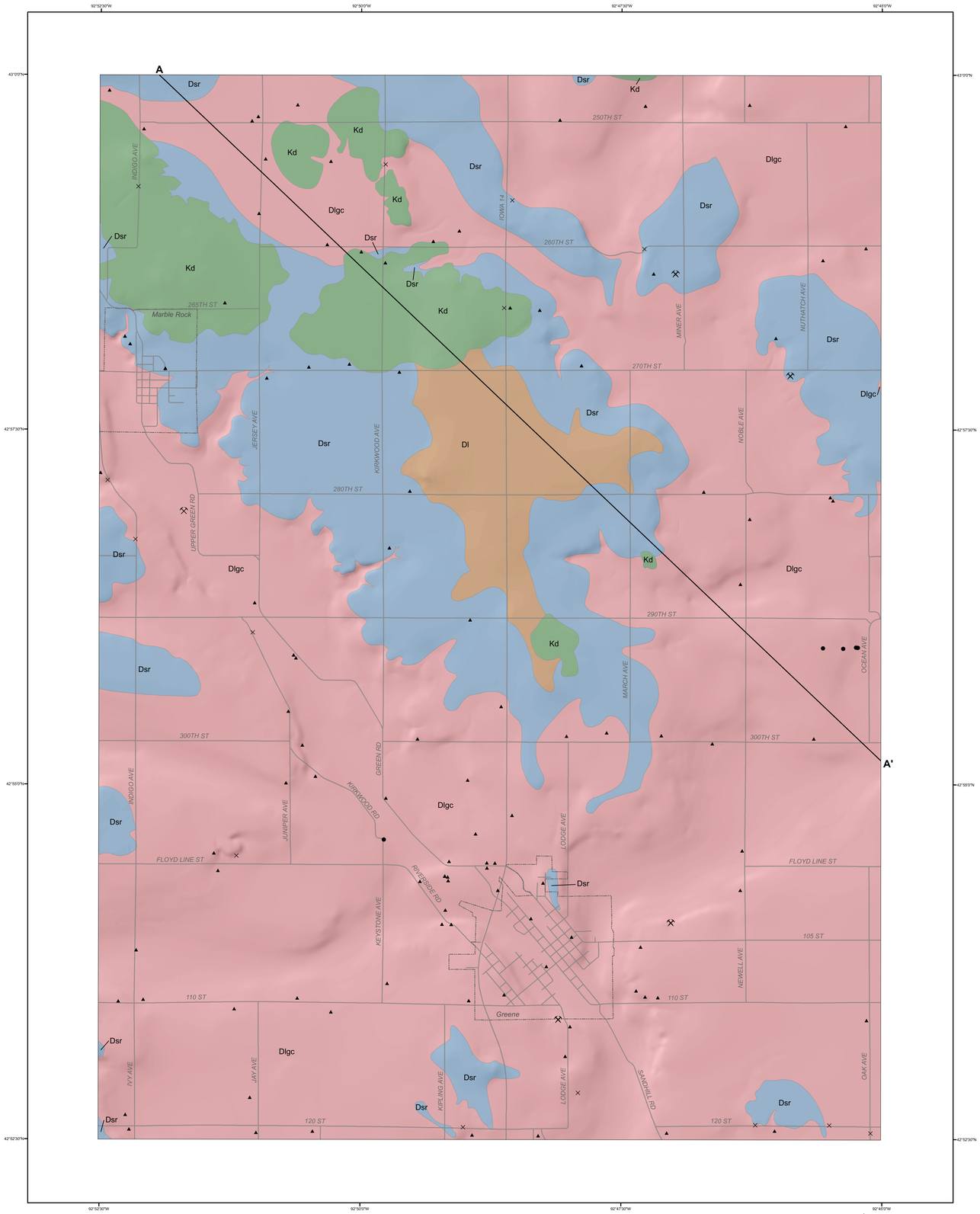
View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Iowa Research Online

Bedrock Geologic Map of the Greene (Iowa) 7.5' Quadrangle



1:24,000

0 0.5 1 2 3 4 Miles

0 0.5 1 2 3 4 Kilometers

MN 0°6´ 1 MILS

GN 0°6´ 2 MILS

UTM GRID AND 2017 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

CENOZOIC

QUATERNARY SYSTEM

Qu - Undifferentiated Unconsolidated Sediments (Quaternary System). The Quaternary deposits consist of loamy soils developed in loess, glacial till, and colluvium of variable thickness, and alluvial clay, silt, sand, and gravel. These deposits cover most of the land surface except in the valleys of the Shell Rock River and Flood Creek in the mapping area. The thickness of the Quaternary deposits usually varies between 9 and 24 m (30 and 80 ft), with a maximum up to 37 m (120 ft). This unit is shown only on the cross-section, not on the map.

MESOZOIC

CRETACEOUS SYSTEM

Kd - Sandstone, Mudstone, and Siderite Pellets (Dakota or Windrow Formation) "Msf"-Cretaceous. This map unit occurs as scattered erosional outliers and is mostly identified by the soil surveys in the northwestern part of the mapping area. This formation comprises a non-marine fluvial and pedogenic facies succession characterized by a variety of lithologies, commonly dominated by quartzose sandstones with secondary chert/quartz conglomerates, in part cemented by iron oxides. The thickness of this unit is variable, but is usually less than 6 m (20 ft) when present in the mapping area.

PALEOZOIC

DEVONIAN SYSTEM

Dl – Shale, Limestone, and Dolomite (Lime Creek Formation) Upper Devonian. This map unit occurs on the bedrock surface near the central part of the mapping area. Thickness of this unit is usually less than 8 m (25 ft) when it is presents in the quadrangle. This formation consists of calcareous shales in the lower portion and an upper part consisting of limestone, dolomitic limestone, and dolomite. Some layers are fossiliferous and pyrite-rich.

Dsr - Limestone, Dolomite, and Shale (Shell Rock Formation) Upper Devonian. This map unit occurs on the bedrock surface mainly in the northern part of the quadrangle. It usually has a thickness of 9 to 20 m (30-65 ft), but an outcrop of this unit just beyond the northern border of the quadrangle shows a total thickness less than 3 m (10 ft). This formation is characterized by limestone, dolomitic limestone and dolomite, with minor gray to light green shale and/or argillaceous carbonates. Fossiliferous layers, especially characterized by abundant bryozoans, brachiopods and stromatoporoids, commonly occur in the lower part of the unit.

Dlgc - Limestone, Dolomite, and Shale (Lithograph City Formation) Middle to Upper Devonian. This map unit forms most part of the bedrock surface of the quadrangle. The thickness of this unit is usually 21 to 30 m (70-100 ft) in the mapping area. It consists of limestone, dolomitic limestone, dolomite, and minor shale. This unit is usually characterized by interbeds of laminated lithographic and sub-lithographic limestone and dolomitic limestone, in part argillaceous. "Birdseye" structures, vugs and calcite vug-fills are common. Some intervals are fossiliferous and stromatoporoid-rich.

Dcv - Limestone and Dolomite (Coralville Formation) Middle Devonian. This map unit consists of limestone, dolomitic limestone, and dolomite, in part argillaceous or shaly. The thickness of this unit varies between 12 and 21 m (40-70 ft) in the mapping area. Brachiopods, echinoderm debris and corals usually occur in the limestone facies. This unit does not occur at the bedrock surface of the ma, and is only shown on the cross-section.

Dlc - Dolomite, Limestone, and Shale (Little Cedar Formation) Middle Devonian. This map unit is dominated by slightly argillaceous to argillaceous dolomite and dolomitic limestone, usually vuggy and partially laminated and/or cherty. Some minor shale may occur in the upper part of this formation. The thickness of this unit ranges from 27 to 40 m (90-130 ft) in the mapping area. This formation is commonly fossiliferous, and brachiopods are especially abundant in the lower portion. This unit does not occur at the bedrock surface of the map and is only shown on the cross-section.

OTHER FEATURES

- **Wells drilled for this mapping project**
- **Bedrock outcrops**
- **IGS GEOSAM data points** – records available at www.iowageologicalsurvey.org
- **Incorporated city boundary**
- **Quarries**
- **Roads**
- W29402 **Wells used for geologic cross-section**
- **Bedrock Hillshade -** shades of gray show the bedrock surface as it would be illuminated by an artificial light source from the NW direction

STRATIGRAPHIC COLUMN

System	Series	Stage	Lithostratigraphic Unit	Map Symbol	Lithology	Thickness (in feet)
Cretaceous	"Middle"		Dakota or Windrow formations	Kd		0-20
Devonian	Upper	Frasnian	Lime Creek Formation	Dl		0-25
			Cedar Valley Group: Shell Rock Formation	Dsr		10-65
			Cedar Valley Group: Lithograph City Formation	Dlgc		70-100
	Middle	Givetian	Cedar Valley Group: Coralville Formation	Dcv		40-70
			Cedar Valley Group: Little Cedar Formation	Dlc		90-130

Lithology Key

- Conglomerate
- Dolomitic limestone/ calcitic dolomite
- Dolomite
- Limestone
- Fine grained sandstone
- Shale
- Lithographic limestone
- Breccia

Symbol Key

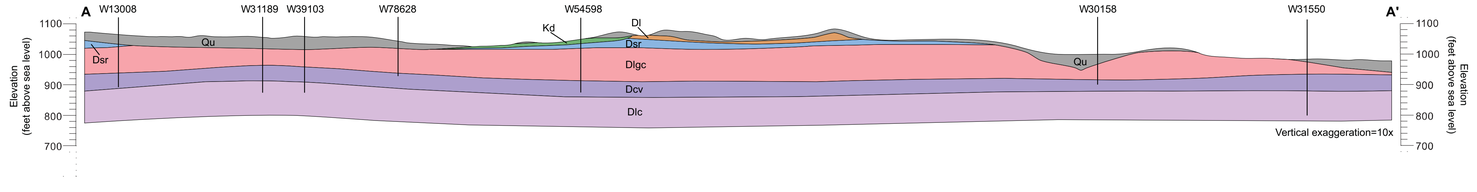
- Dolomitic
- Chert
- Sandy
- Shaly
- Stromatoporoids
- Unconformity
- Vugs

Adjacent 7.5' Quadrangles

ROCKFORD	ROSEVILLE	CHARLES CITY
AUREOLA	GREENE	NASHUA NW
DUMONT NORTH	ALLISON	CLARKSVILLE

Location Map

GEOLOGIC CROSS-SECTION A-A'



BEDROCK GEOLOGIC MAP OF THE GREENE 7.5' QUADRANGLE, BUTLER AND FLOYD COUNTIES, IOWA

Iowa Geological Survey
Open File Map OFM-17-1
June 2017

Huaibao Liu, Ryan Clark, Phil Kerr, and Stephanie Tassier-Surine

Iowa Geological Survey, IIHR-Hydroscience & Engineering, University of Iowa, Iowa City, Iowa

Iowa Geological Survey, Robert D. Libra, State Geologist

Supported in part by the U.S. Geological Survey
Cooperative Agreement Number G16AC00193
National Cooperative Geologic Mapping Program (STATEMAP)
Completed under contract with the Iowa Department of Natural Resources

ACKNOWLEDGMENTS

We thank Croell Co., Greene Limestone Co., and L. R. Falk Construction Co. for allowing us to work in their quarries in and around the mapping area. Special thanks to Nate & Traci Bartels, Ron & Sandra Lebeck, Doug Marsh, Ella Severs, and Brett & Lisa Steere for allowing and/or helping us to access bedrock outcrops on their properties. Zachary Demanett of the Iowa Geological Survey (IGS) and University of Iowa students Samantha Moser, Ryan McKeon, and Gia DeBartolo prepared well cutting samples for stratigraphic logging. New subsurface geologic data was generated by Tanner Hartsock and Diar Ibrahim, University of Iowa Department of Earth and Environmental Sciences students, by producing descriptive logs of water well drilling samples. Thanks also to Rick Langel (IGS) for managing the Iowa geologic sampling database (GeoSam). Adriana Schnoebelen of Iowa Department of Transportation provided important geologic information of some quarries in the mapping area. Jed Day of Illinois State University, Bill Bunker, Brian Witzke, Robert McKay, and Ray Anderson of the Iowa Department of Natural Resources (IDNR) provided valuable discussions regarding the geology of north-central Iowa. Bedrock topography is updated from Ray Anderson's previous work. Casey Kohrt and Chris Kahle of IDNR and Andrew Roers of IIHR Hydroscience & Engineering provided GIS technical help. Administrative support was provided by Megan Delaney, Rosemary Tiwari, Teresa Gaffey, Angi Roenneman, and Carmen Langel.

Introduction to the Bedrock Geologic Map of the Greene 7.5' Quadrangle, Butler and Floyd Counties, Iowa

The Greene 7.5' Quadrangle is located in Floyd and Butler counties, north-central Iowa. This quadrangle lies in the Iowan Surface landform region where the land surface had been modified by various episodes of erosion before and during the Wisconsin-age glacial events (Prior, 1991). Due to extensive glacial and erosional activities, the landscape of this area is characterized by relatively low topographic relief and commonly features large fieldstones of glacial origin known as glacial erratics.

The land surface of this mapping area is mostly covered by Quaternary sediments, including loess, glacial sediments, colluvium and alluvial deposits. The thickness of the Quaternary usually varies between 9 and 24 m (30 and 80 ft), with a maximum thickness up to 37 m (120 ft). These unconsolidated Quaternary sediments are undifferentiated in this map. For the detailed Quaternary stratigraphy and distribution, see the surficial geologic map of this quadrangle (Kerr et al., 2017).

Bedrock exposures commonly occur in the valleys along the Shell Rock River and the Flood Creek in the quadrangle. During the field investigation, shallow bedrock information from the digital soil surveys in Floyd and Butler counties (Voy, 1995; Buckner, 1974) was used for delineating potential bedrock outcrops. In the map area, 18 bedrock outcrops including several rock quarries were accessed and studied, which provided important regional stratigraphic information for the bedrock geologic map. Subsurface geologic information was mainly derived from the analysis of water well data stored in the IGS GeoSam database. Within the quadrangle, 111 private and public wells were studied, including 5 newly drilled holes especially for this mapping project. Among these studied wells, 45 have descriptive striplogs with cutting samples which are reposited at the Oakdale Rock Library of Iowa Geological Survey (IGS), and 33 of which were newly logged for this bedrock geologic mapping task. Bedrock stratigraphic information from the surrounding area, including bedrock outcrops, quarries, and well information, was also studied and utilized for this mapping project.

The bedrock surface of the Greene 7.5' Quadrangle is dominated by Devonian strata, with scattered Cretaceous deposits. Paleogeographically, the mapping area is within the northern portion of the Devonian Iowa Basin, a region of thickened shelf carbonate, shale and minor others deposited from the Eifelian through part of the Famennian age (Witzke et al., 1988; Witzke and Bunker, 2006; Day, 2006; Day et al., 2008). The Middle and lower Upper Devonian carbonate rocks form the important upper bedrock aquifer in the mapping area (Libra et al., 1984, 1994). This Devonian aquifer becomes vulnerable when it is shallow, and carbonate rocks, especially relatively pure limestones, are easily karstified (Moore, 1995). Due to its complex sedimentary lithology and depositional environments, the geology, paleoenvironments, paleontology and stratigraphy of the Devonian Iowa Basin have been intensively studied. Early studies include the publications of Belanski (1927, 1928) and Koch (1970). Recent studies of the Devonian Iowa Basin are represented by Witzke and Bunker (1984), Anderson (1984), Bunker and others (1986), Witzke and others (1988), Bunker (1995), Anderson and Bunker (1998), Groves and others (2008), McKay and Liu (2012), and Day and others (2006, 2008, 2013) Geologic mapping projects at 1:24,000 scale in north-central Iowa have been undertaken by the IGS since 2009. In addition to 7.5' quadrangle maps, 1:100,000 scale bedrock geologic maps have been recently completed for Bremer County (McKay et al., 2010), Worth County (Liu et al., 2012), Black Hawk County (Rowden et al., 2013), Cerro Gordo County (Liu et al., 2015), and Mitchell County (Clark et al., 2016) in the Devonian Iowa Basin. The Bedrock Geologic Map of Iowa (1:500,000) was completed by Witzke and others (2010). Results from these geologic studies and bedrock geologic mapping projects provide significant regional geologic information and new data for the present bedrock map.

Four bedrock formations, in descending order, the Cretaceous Dakota or Windrow Formation, the Devonian Lime Creek, Shell Rock, and Lithograph City formations comprise the bedrock surface of the map area, and the majority of which is occupied by the Lithograph City Formation. Two other formations, the Devonian Coralville and Little Cedar formations, are found in wells only and do not occur at the bedrock surface. The bedrock stratigraphic nomenclature and correlation of the Devonian strata for this map follow the stratigraphic framework proposed by Witzke and others (1988). The general lithologic features and thickness of each map unit are shown in the Stratigraphic Column and described in the Legend section of this map.

References:

Anderson, W.I. (ed.), 1984: General Geology of north-central Iowa. Guidebook for the 48th Annual Tri-State Geol. Field Conf., 150 p.

Anderson, R.R., and Bunker, B.J., (eds.), 1998: Fossil shells, glacial swells, piggy smells, and drainage wells: the geology of the Mason City, Iowa, area. Geol. Soc. of Iowa Guidebook No. 65, 71 p.

Belanski, C.H., 1927: The Shell Rock Stage of the Devonian. American Midland Naturalist, v. 10, p. 316-370.

Belanski, C.H., 1928: The Shell Rock Stage of the Devonian; Description of some typical fossils of the Shell Rock Stage. American Midland Naturalist, v. 11, p. 165-212.

Buckner, R.L., 1974: Soil Survey of Butler County, Iowa. U.S. Dept. of Agriculture, Soil Conservation Service, 209 p. with 70 map sheets.

Bunker, B.J., Witzke, B.J., and Day, J.E., 1986: Upper Cedar Valley Stratigraphy, North-Central Iowa, Lithograph City Formation. Geol. Soc. of Iowa Guidebook No. 44, 41 p.

Bunker, B.J., (ed.), 1995: Geology and hydrogeology of Floyd-Mitchell counties, north-central Iowa. Geol. Soc. of Iowa Guidebook No. 62, 169 p.

Clark, R., Liu, H., Kerr, P., Tassier-Surine, S., Rowden, R., and Streeter, M., 2016: Bedrock geologic Map of Mitchell County, Iowa. Iowa Geological Survey Open File Map OFM-16-1.

Day, J., 2006: Overview of the Middle-Upper Devonian sea level history of the Wapsipinicon and Cedar Valley Groups, with discussion of new conodont data from the subsurface Cedar Valley Group of southeastern Iowa. *in* Day, J., Luczaj, J., and Anderson, R., (eds.), New Perspectives and Advances in the Understanding of Lower and Middle Paleozoic Epeiric Carbonate Depositional Systems of the Iowa and Illinois Basins. Iowa Geological Survey Guidebook Series No. 25, p. 3-21.

Day, J., Witzke B., and Bunker, B.J., 2008: Overview of Middle and Upper Devonian Cedar Valley Group and Lime Creek Formation carbonate platform facies, faunas, and event stratigraphy of northern Iowa. *in* Groves, J.R., Walters, J.C., and Day, J., (eds.), Carbonate platform facies and faunas of the Middle and Upper Devonian Cedar Valley Group and Lime Creek Formation, northern Iowa. Iowa Geological Survey Guidebook No. 28, p. 15-39.

Day, J., Witzke B., and Lundy, S., 2013: Aspects of the Paleozoic history of epeiric seas of the Iowa basin. Iowa Geological and Water Survey Guidebook No. 29, 118 p.

Groves, J.R., Walters, J.C., and Day, J., (eds.), 2008: Carbonate platform facies and faunas of the Middle and Upper Devonian Cedar Valley Group and Lime Creek Formation, northern Iowa. Iowa Geological Survey Guidebook No. 28, 96 p.

Kerr, P., Tassier-Surine, S., Liu, H., and Clark, R., 2017: Surficial geologic map of the Greene 7.5' Quadrangle, Floyd and Butler counties, Iowa. Iowa Geological Survey Open File Map OFM-17-2.

Koch, D.L., 1970: Stratigraphy of the Upper Devonian Shell Rock Formation of north-central Iowa. Iowa Geological Survey Report of Investigations 10, 123 p.

Libra, R.D., Hallberg, G.R., Ressmeyer, G.G., and Hoyer, B.E., 1984: Groundwater quality and hydrogeology of Devonian-Carbonate aquifers in Floyd and Mitchell counties, Iowa. Iowa Geological Survey Open File Report 84-2, p. 1-106.

Libra, R.D., Quade, D.J., Hallberg, G.R., and Littke, J.P., 1994: Groundwater quality, hydrogeology, and agricultural drainage wells, Floyd and Mitchell counties, Iowa. Iowa Geological Survey Technical Information Series 29, 64 p.

Liu, H., McKay, R., Rowden, R., Quade, D., Tassier-Surine, S., and Giglierano, J., 2012: Bedrock Geology of Worth County, Iowa. Iowa Geological and Water Survey Open File Map OFM-12-1.

Liu, H., Clark, R., Fields, C., McKay, R., Rowden, R., Tassier-Surine, S., Kerr, P., and Streeter, M., 2015: Bedrock Geology of Cerro Gordo County, Iowa. Iowa Geological Survey Open File Map OFM-15-1.

McKay, R.M., Liu, H., and Giglierano, J.D., 2010: Bedrock Geology of Bremer County, Iowa. Iowa Geological and Water Survey Open File Map OFM-10-10.

McKay, R.M. & Liu, H., 2012: Cedar Valley Group: the Lithograph City – Shell Rock Formation contact at Mason City, Iowa. Geol. Soc. of Iowa Guidebook No. 90, 12 p.

Moore, F., 1995: Floyd County groundwater protection project and sinkhole cleanout. *in* Bunker, B.J., (ed.), Geology and hydrogeology of Floyd-Mitchell counties, north-central Iowa. Geol. Soc. of Iowa Guidebook No. 62, p. 75.

Prior, J.C., 1991: Landforms of Iowa. University of Iowa Press, Iowa City, 154 p.

Rowden, R., McKay, R., Liu, H., Quade, D., Tassier-Surine, S., and Giglierano, J., 2013: Bedrock Geology of Black Hawk County, Iowa. Iowa Geological and Water Survey Open File Map OFM-13-3.

Voy, K.D., 1995: Soil Survey of Floyd County, Iowa. U.S. Dept. of Agriculture, Soil Conservation Service, 260 p. with 63 map sheets.

Witzke, B.J. and Bunker, B.J., 1984: Devonian stratigraphy of north-central Iowa. Iowa Geological Survey Open File Report 84-2, p. 107-149.

Witzke, B.J. and Bunker, B.J., 2006: Middle shelf facies of the Cedar Valley Group (Devonian) and their stratigraphic relationships in eastern Iowa. *in* Day, J. E., Luczaj, J., and Anderson, R., (eds.), New Perspectives and Advances in the Understanding of Lower and Middle Paleozoic Epeiric Carbonate Depositional Systems of the Iowa and Illinois Basins. Iowa Geological Survey Guidebook Series No. 25, p. 23-46.

Witzke, B.J., Anderson, R.R., and Pope, J.P., 2010: Bedrock geologic map of Iowa (1:500,000). Iowa Geol ogical and Water Survey Open File Map OFM-10-1.

Witzke, B.J., Bunker, B.J., and Rogers, F.S., 1988: Eifelian through lower Frasnian stratigraphy and deposition in the Iowa area, central midcontinent, U.S.A. *in* McMillan, N.J., Embry, A.F., and Glass, D.J. (eds.): Devonian of the World. Canadian Soc. of Petroleum Geologists, Memoir 14, vol. I, p. 221-250.

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

Iowa Geological Survey digital cartographic file Greene_BedrockGeology.mxd, version 6/30/17 (ArcGIS 10.3)
Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15N, 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.

Research supported by the U. S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G16AC00193. 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.