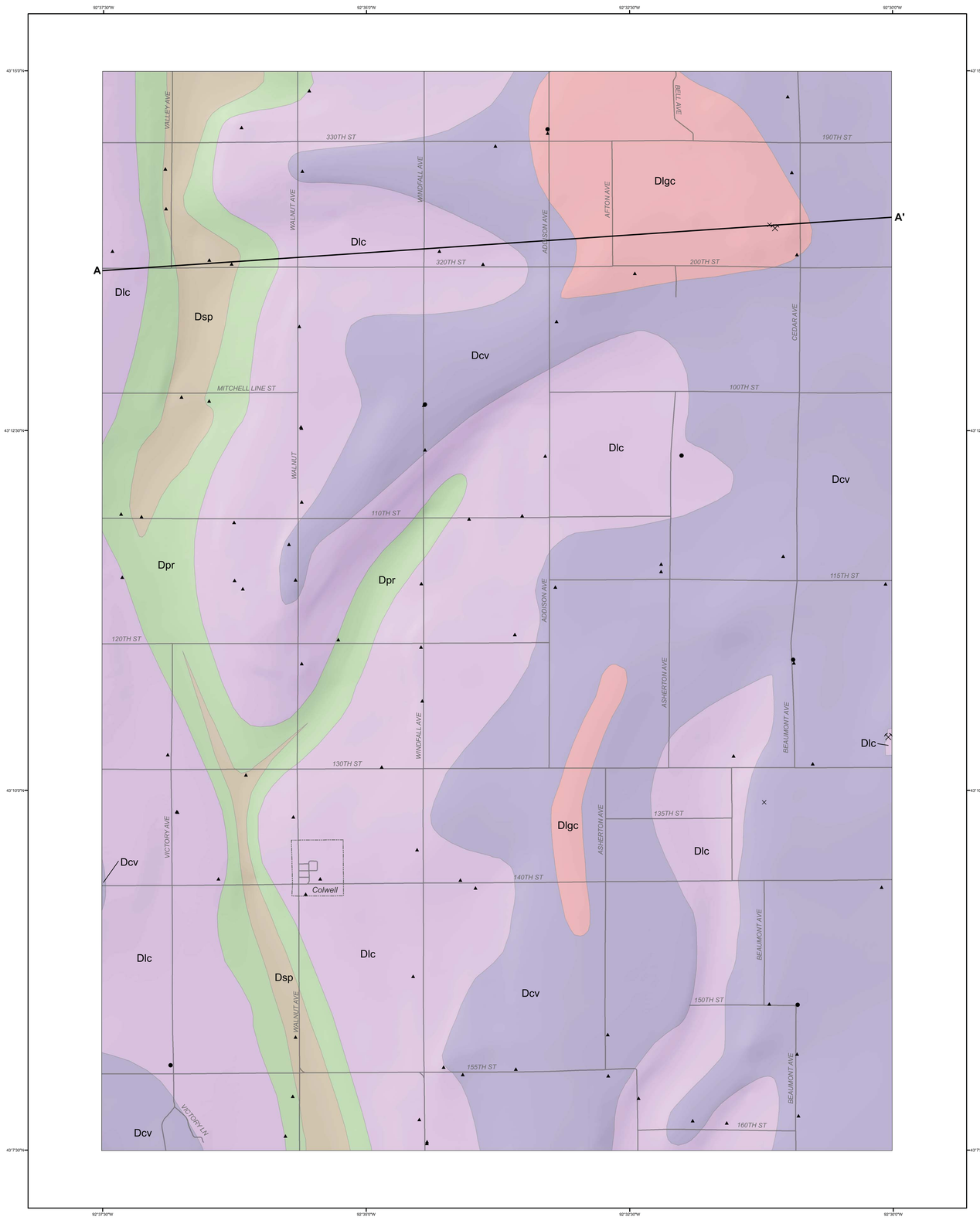
Bedrock Geologic Map of the Colwell (Iowa) 7.5' Quadrangle



1:24,000

0 0.5 1 2 3 4 Miles

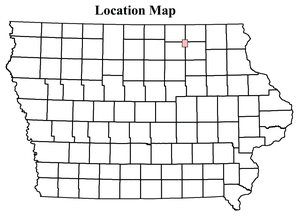
0 0.5 1 2 3 4 Kilometers

UTM GRID AND 2017 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Adjacent 7.5' Quadrangles

NEW HAVEN	RICEVILLE	SARATOGA
FLOYD	COLWELL	ELMA
CHARLES CITY	BASSETT	IONIA

Location Map



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. The Quaternary deposits cover almost all the mapping area with a thickness commonly more than 18 m (60 ft), and can be thicker than 90 m (295 ft) in a deep bedrock valley throughout the western part of the quadrangle. This unit is shown only on the cross-section, not on the map.

PALEOZOIC

DEVONIAN SYSTEM

Dlgc - Limestone, Dolomite, and Shale (Lithograph City Formation) Middle to Upper Devonian. This map unit mostly occurs on the bedrock surface in the northeast part of the quadrangle. The regional thickness of this unit is around 21 to 30 m (70-100 ft), but it is less than 6m (20 ft) in the mapping area because of erosion. This unit consists of limestone, dolomitic limestone, dolomite, and minor shale. It 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 occurs at the bedrock surface in the east part and the southwest corner of the quadrangle. The thickness of this map unit varies between 12 and 21 m (40-70 ft) in the mapping area. It consists of limestone, dolomitic limestone, and dolomite, in part laminated, argillaceous, or shaly. Brachiopods, echinoderm debris, and corals usually occur in the limestone facies.

Dlc - Dolomite, Limestone, and Shale (Little Cedar Formation) Middle Devonian. This formation dominates the bedrock surface of the west part beyond the deep bedrock valley of the quadrangle. The thickness of this formation ranges from 24 to 30 m (80-100 ft) in the mapping area. This unit is represented by slightly argillaceous to argillaceous dolomite and dolomitic limestone, usually vuggy and partially cherty. A shaly layer about 3 to 6 m (10-20 ft) thick commonly occurs in the upper part of the formation. This unit is commonly fossiliferous, and brachiopods are especially abundant in the lower portion.

Dpr - Dolomite and Dolomitic Limestone (Pinicon Ridge Formation) Middle Devonian. This map unit occurs at the bedrock surface along the deep bedrock valley throughout the western part of the quadrangle. This formation consists of dolomite and dolomitic limestone with varying textures (shaly, laminated, brecciated, sandy, and/or cherty). The thickness of this unit usually ranges from 6 to 14 m (20-45 ft). Compared to other Devonian strata in the mapping area, this formation is usually unfossiliferous.

Dsp - Dolomite (Spillville Formation) Middle Devonian. This map unit only occurs at the bedrock surface within the deep bedrock valley in the western part of the quadrangle. This unit is dominated by medium to thick bedded dolomite with scattered to abundant fossil molds, with a maximum thickness of approximately 21 m (70 ft) in the mapping area. Its basal part, where present, is variably sandy, shaly, and/or conglomeratic with reworked Ordovician cherty clasts.

OTHER FEATURES

- New drill holes for this map project
- Bedrock outcrops
- IGS GEOSAM data points – records available at www.iowageologicalsurvey.org
- Incorporated city boundary
- Quarries
- Roads
- W56388 — 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)
Devonian	Upper	Frasnian	Lithograph City Formation	Dlgc		0-20
Devonian	Middle	Givetian	Cedar Valley Group: Coralville Formation	Dcv		40-70
Devonian	Middle	Givetian	Cedar Valley Group: Little Cedar Formation	Dlc		80-100
Devonian	Middle	Eifelian	Wapsipinicon Group: Pinicon Ridge Formation	Dpr		20-45
Devonian	Middle	Eifelian	Wapsipinicon Group: Spillville Formation	Dsp		40-70

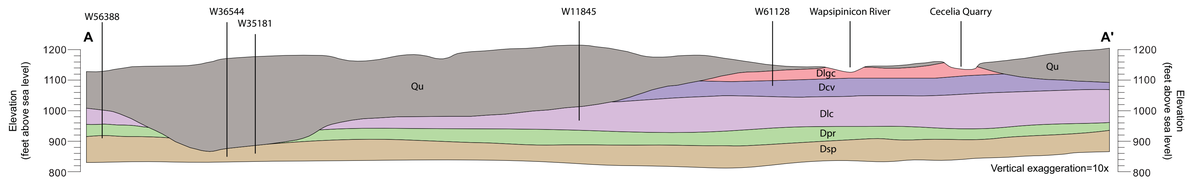
Lithology Key

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

Symbol Key

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

GEOLOGIC CROSS-SECTION A-A'



BEDROCK GEOLOGIC MAP OF THE COLWELL 7.5' QUADRANGLE, CHICKASAW, FLOYD, HOWARD, AND MITCHELL COUNTIES, IOWA

Iowa Geological Survey
Open File Map OFM-17-3
June 2017

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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 Bruening Rock Products Inc., Croell Co., and Falk L. R. Construction Co. for allowing us to work in their quarries in and around the mapping area. Special thanks to Shirley Kohliska, Dorothy & Dana Martin, Joe Meirick, and Gerald Reiss for allowing and/or helping us to access bedrock outcrops in their properties. Zachary Demarett 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 Hartnack 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 Schneebelen 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 Guffey, Angi Roemerman, and Carmen Langel.

Introduction to the Bedrock Geologic Map of the Colwell 7.5' Quadrangle, Chickasaw, Floyd, Howard, and Mitchell Counties, Iowa

The Colwell 7.5' Quadrangle is located in the connection area of Floyd, Mitchell, Howard and Chickasaw counties in north-central Iowa. In terms of landforms, this quadrangle lies in the Iowan Surface landform region where the land surface has 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. Thickness of the Quaternary is commonly more than 18 m (60 ft) in most of the mapping area except the far eastern portion of the quadrangle, and it reaches a maximum thickness of more than 90 m (295 ft) in a bedrock valley located in the western part of the mapping area. For the detailed Quaternary stratigraphy and distribution, see the surficial geologic map of this quadrangle (Kerr et al., 2017).

Only two rock quarries and no natural bedrock exposures are found in this quadrangle. Therefore, subsurface bedrock geologic information was mostly derived from the analysis of water well data stored in the IGS GeoSam database and the soil maps from the digital soil surveys in related counties (Buckner and Highland, 1974; Voy, 1995; Voy and Highland, 1975; Wilson, 1996). Within the mapping area, a total of 87 private and public wells were studied including 6 new drill holes for this project. Among these wells, 49 have descriptive striplogs with cutting samples which are reposited at the IGS Oakdale Rock Library. Twenty-six of these striplogs 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 bedrock geologic map.

The bedrock surface of the Colwell 7.5' Quadrangle is completely occupied by the Devonian strata deposited from Eifelian through early Frasnian. 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), Bunker (1995), Anderson and Bunker (1998), Witzke and others (1988), 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.

The bedrock surface of the map is comprised of five Devonian formations. They are (in descending order) the Lithograph City, Coralville, Little Cedar, Pinicon Ridge and Spillville formations. Among them, the carbonate Coralville and Little Cedar formations dominate most of the bedrock surface of the quadrangle, and the Pinicon Ridge and Spillville formations only occur in a deep bedrock valley throughout the western part of the mapping area. 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 Shellrock Stage of the Devonian. American Midland Naturalist, v. 10, p. 316-370.

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

Buckner, R.L., and Highland, J.D., 1974: Soil Survey of Howard County, Iowa. U.S. Dept. of Agriculture, Soil Conservation Service, 149 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 Colwell 7.5' Quadrangle, Floyd, Mitchell, Howard and Chickasaw counties, Iowa. Iowa Geological Survey Open File Map OFM-17-4.

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 – Shellrock 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.

Voy, K.D. and Highland, J.D., 1975: Soil Survey of Mitchell County, Iowa. U.S. Dept. of Agriculture, Soil Conservation Service, 125 p. with 70 map sheets.

Wilson, J.H., 1996: Soil Survey of Chickasaw County, Iowa. U.S. Dept. of Agriculture, Soil Conservation Service, 182 p. with 74 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 Geological 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 Colwell_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.