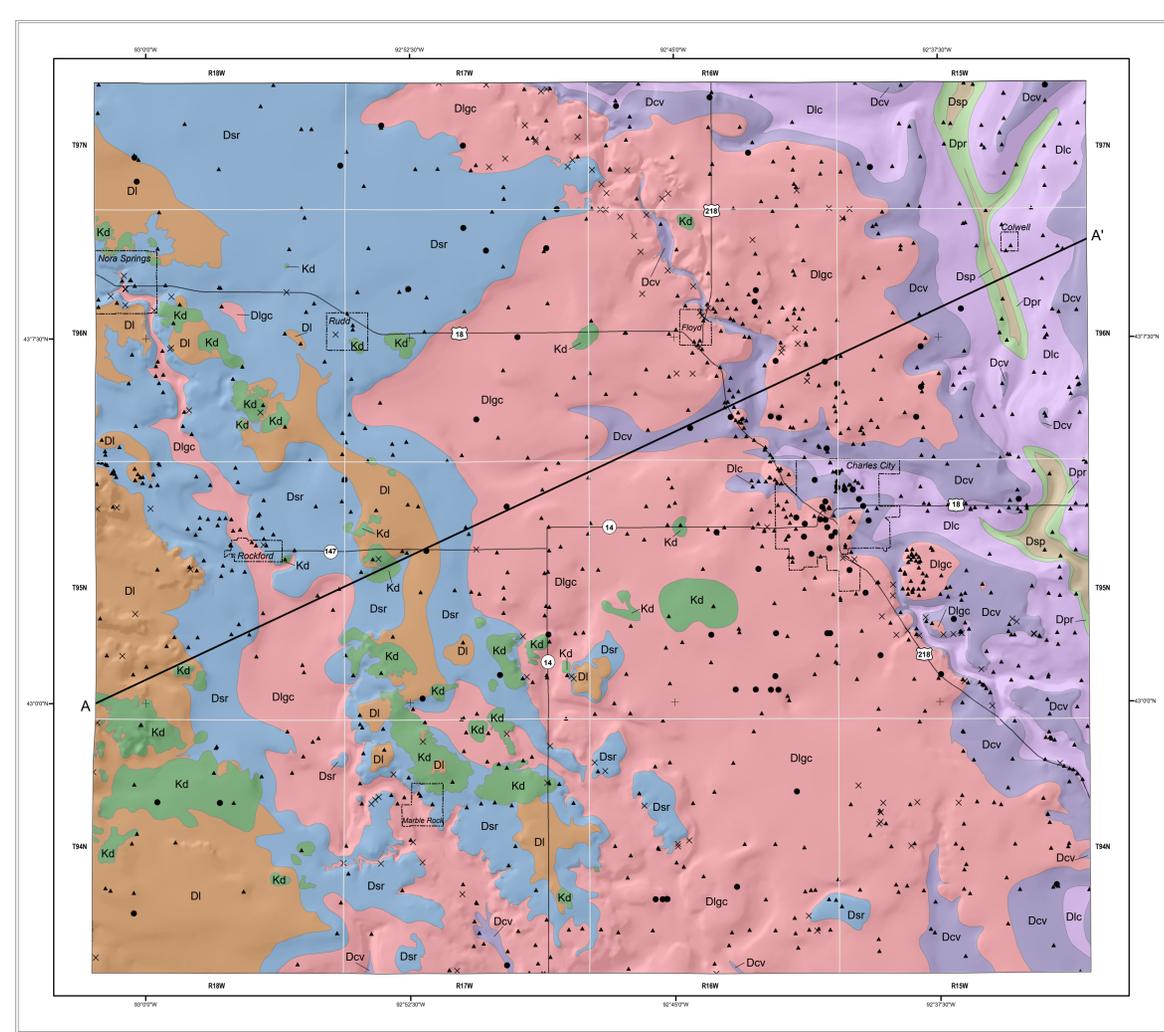


BEDROCK GEOLOGIC MAP OF FLOYD COUNTY, IOWA

BEDROCK GEOLOGIC MAP OF FLOYD COUNTY, IOWA



LEGEND

CENOZOIC
QUATERNARY SYSTEM

Qu - **Unconsolidated 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 thickness of the Quaternary deposits usually varies between 2 and 24 m (6 and 80 ft) and can be thicker than 90 m (295 ft) in the deep bedrock valley in the northeast part of the mapping area. This unit is shown only on the cross-section, not on the map.

MESOZOIC
CRETACEOUS SYSTEM

Kd - **Kanabenton, Madison, and Sibley (Dakota Window Formation) Middle**. This map unit occurs as scattered residual outcrops and is mostly identified by the soil survey in the western part of the mapping area. This formation consists of calcareous shales in the lower portion and limestone, dolomitic limestone, and dolomite in the upper portion. Some layers are fossiliferous and gray-rich.

Dsp - **Limestone, Dolomite, and Shell (Shell Rock Formation) Upper**. This map unit occurs on the bedrock surface in the western part of the county. It usually has a thickness of 9 to 20 m (30 to 65 ft), but shales and shales may occur in the eastern part of the mapping area. This formation is characterized by limestone, dolomitic limestone, and dolomite, with some gray to light green shale and argillaceous carbonates. Fossiliferous layers, especially characterized by abundant bryozoans, brachiopods and stromatopora, commonly occur in the lower part of the unit.

Dpr - **Limestone, Dolomite, and Shell (Little Cedar Formation) Middle**. This map unit occurs at the bedrock surface mainly along a bedrock valley in the eastern part of the mapping area. The general thickness of this unit is around 21 to 37 m (70 to 120 ft), but can be thicker than 35 m (115 ft) in the mapping area. This unit consists of limestone, dolomitic limestone, dolomite, and some cherty dolomite. It is usually characterized by limestone and sub-lithographic limestone and dolomite limestone, with some gray to light green shale and argillaceous carbonates. Fossiliferous layers, especially characterized by abundant bryozoans, brachiopods and stromatopora, commonly occur in the lower part of the unit.

Dcv - **Limestone, Dolomite, and Shell (Lime Creek Formation) Upper**. This map unit occurs at the bedrock surface mainly along a bedrock valley in the eastern part of the mapping area. The thickness of this unit usually varies between 14 and 20 m (45 to 65 ft), but can be thicker than 21 m (70 ft) in the mapping area. This formation consists of limestone, dolomitic limestone, and dolomite, in part laminated and argillaceous. "Bridgeway" structures, intercalated fabrics, vugs and calcite vug-fills are common. Some intervals are fossiliferous and stromatopora-rich.

Dlc - **Dolomite, Limestone, and Shell (Little Cedar Formation) Middle**. This formation dominates the bedrock surface of the deep bedrock valley in the eastern part of the mapping area. This unit is usually fossiliferous, and brachiopods are especially abundant in the lower portion.

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

Dsr - **Dolomite (Spillville Formation) Middle**. This map unit only occurs at the bedrock surface within the deep bedrock valley in the northeast part of the map. This unit is dominated by medium to thick bedded dolomite with scattered to abundant fossil fossils. Thickness of this formation usually varies between 12 and 21 m (40 to 70 ft), with a maximum thickness of approximately 30 m (100 ft) in the mapping area. This basal part, where present, is variably sandy, shaly, and/or conglomeratic with reworked Ordovician chert clasts.

OTHER FEATURES

- IGS drill holes for this mapping project
- × Bedrock outcrops
- IGS Geoscan data points - records available at www.iowageologic.gov
- - - Incorporated city boundary
- ⊗ Quarries
- ⊠ Roads
- W77151 Well 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

IOWA GEOLOGICAL SURVEY
 OPEN FILE MAP OFM-18-1
 JUNE 2018

Huaibin Liu, Ryan Clark, Phil Kerr, and Stephanie Tassier-Surine
 Iowa Geological Survey, IBHR-Hydroscience & Engineering, University of Iowa, Iowa City, Iowa

IOWA GEOLOGICAL SURVEY
 Iowa Geological Survey, Keith Schilling, Associate State Geologist

Supported in part by the U.S. Geological Survey
 Cooperative Agreement Number G17AC0025
 National Cooperative Geologic Mapping Program (NCGMP)
 Completed under contract with the Iowa Department of Natural Resources
 The work reported here is a National Science Foundation Award
 Improving Undergraduate STEM Education: GPM-IMPACT-100429

THE UNIVERSITY OF IOWA
 DNR

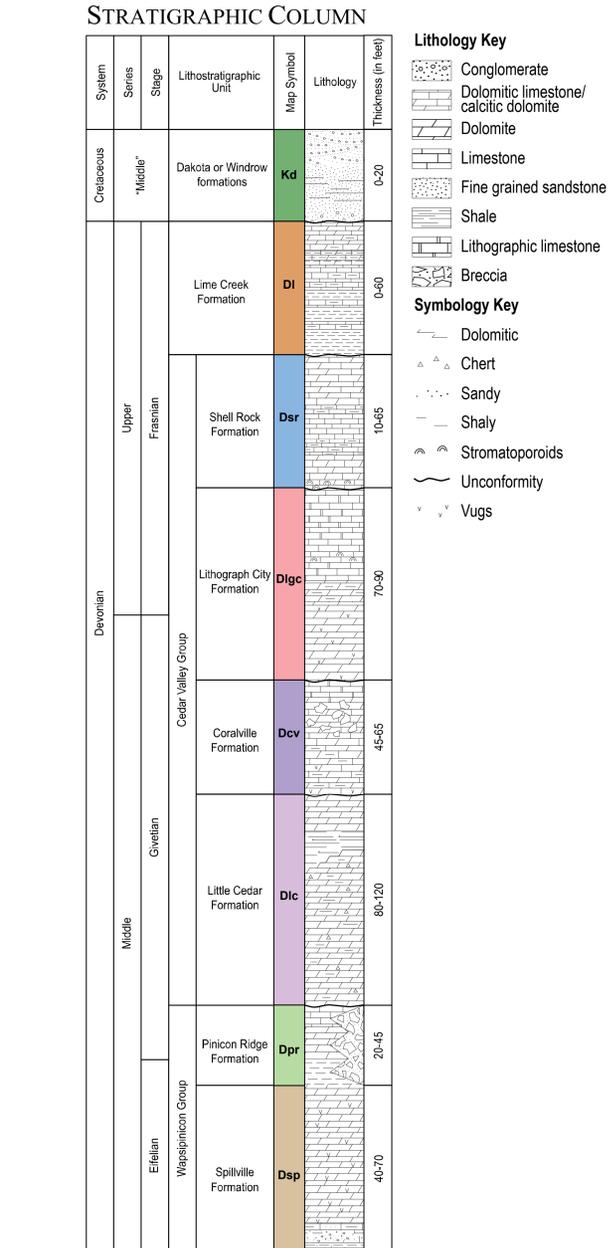
ACKNOWLEDGMENTS

We thank Basin Materials Corp., Breuninger Rock Products Inc., Covell Rock Products, Inc., Geneva Limestone Co., Hartland Asphalt Inc., L. R. Falk Construction Co., Lehigh Cement Co., and Martin Marietta Co. for allowing us to work in their quarries and around the mapping area. Special thanks to Steve A. Truitt, Bureau of Geology, Graham & Jacobi Construction, Tom Baker, Bureau of Labor, David D. Dyer, Dyer & Sons, Sherry Schellinger, Tom & Karen, Lathrop, Sherry Schellinger, Tom & Karen, Lathrop, Sherry Schellinger, Doug Marsh, Dorothy & Dana Martin, Joe Marzetti, Dennis & Patricia Peterson, Gerald Reiss, Joe & Ann Schellinger, Ella Swens, Tom & Sherry Swens, Brent & Lisa Swens, and Douglas Temple for allowing us to access bedrock outcrops on their properties. Well drilling samples for stratigraphic mapping were prepared by University of Iowa (UI) students Travis Maher and Casey Ames. New subsurface geologic data were generated by Tassier-Surine, Dyer, Dyer & Sons, Sherry Schellinger, UI Department of Earth and Environmental Sciences students by producing well drilling samples. Thanks also to Rick Langert, Iowa Geological Survey, for managing the Iowa geologic sampling database (Geology). Adams Schellinger of Iowa Department of Transportation provided important geologic information of some quarries in the mapping area. James "Bud" Day of Illinois State University, Bill Bunker, and Roy Anderson of Iowa Geological Survey, and Roy Anderson of Iowa Department of Natural Resources provided valuable discussions regarding the geology of north-central Iowa. Bedrock topography is updated from Roy Anderson's previous work. Cheng Kohler and Chris Kahl of IHSN provided GIS technical help. Administrative support was provided by Megan Bostrom, Melissa Fitchell-Rosenberry, Tricia, Teresa Coffey, Angie Rosenberry, and Carmen Langert.

INTRODUCTION TO THE BEDROCK GEOLOGIC MAP OF FLOYD COUNTY, IOWA

Floyd County is located in north-central Iowa. In terms of landforms, it lies in the lowland 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 the extensive erosional activities, the landscape of this area is characterized by relatively low topographic relief and predominantly features large fields of glacial origin known as glacial terraces.

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 varies from zero along major rivers to thicker than 90 m (295 ft) in a bedrock valley located in the northeast part of the mapping area. For the detailed Quaternary stratigraphy and distribution of the mapping area, see the Surficial Geologic Map of Floyd County, Iowa (Kerr et al., 2018).



This map is compiled from all available geologic data including bedrock exposures and subsurface geologic information derived from the analysis of water well data stored in the IGS Geoscan database. Soil maps from the digital soil surveys of Floyd and surrounding counties (Voy and Highland, 1975; Devint, 1981; Bunker, 1982; Voy, 1995; Wilson, 1996) were used for delineating potential bedrock outcrops and for determining some of the occurrence of the Cretaceous strata. A total of 129 bedrock outcrops including 29 operating or abandoned quarries in the county were accessed and investigated in the field. Within the mapping area, 1,045 private and public wells, including 29 new drill holes for this project, and 306 descriptive stratigraphic logs with cutting samples which are deposited at the IGS Okdale Rock Library, and 143 of these stratigraphic logs 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. All the above data provide necessary primary information for the bedrock geologic mapping in Floyd.

Although some Cretaceous outcrops are present in western portion, the bedrock surface of Floyd County is mainly occupied by the Devonian strata deposited from the Eifelian through early Frasnian. Paleogeographically, the mapping area is within the northern portion of the Devonian Iowa Basin, a region characterized by thickened shelf carbonates, shale and minor others (Witzke et al., 1988; Witzke and Bunker, 2006; Day et al., 2008), and the Devonian carbonate rocks from the important upper bedrock aquifer in the mapping area (Libra et al., 1984, 1994). The 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 and paleogeology of the Devonian Iowa Basin have been extensively studied. Early studies include the publications of Hall and Whitney (1858), Belanski (1927, 1928), Koch (1970). Recent studies of the Devonian Iowa Basin are represented by Witzke and Bunker (1984), Anderson (1984), Bunker et al. (1986), Witzke et al. (1988), Bunker (1995), Anderson and Bunker (1998), Groves et al. (2008), McKay and Liu (2012), and Day et al. (2018, 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). The Bedrock Geologic Map of Iowa (1:500,000) was compiled by Witzke et al. (2010). Results from these geologic studies and bedrock geologic mapping projects provide significant regional geologic information and new data for the present bedrock geologic map.

Based on the lithology, structure and fossils, the bedrock surface of the map is subdivided into Cretaceous Dakota (or Windrow Formations) and 7 formations of the Devonian. Distribution of the Cretaceous is mostly derived from the Soil Maps of Floyd (Voy, 1995). The bedrock stratigraphic nomenclature and correlation of the Devonian strata follow the stratigraphic framework proposed by Witzke et al. (1988), they are (in descending order) the Lime Creek, Shell Rock, Lithograph City, Coralville, Little Cedar, Pinicon Ridge and Spillville formations. Matching the regional distribution pattern, the Devonian strata become younger from northeast to southwest in the mapping area, and the older Devonian strata only occur along a deep bedrock valley throughout the eastern part of the mapping area. The general lithologic feature and thickness of each map unit are shown in the Stratigraphic Column and described in the Legend section of this map.

References:

Anderson, R.R., and Bunker, B.J. (eds.), 1988. 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 smellys, 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.

Bunker, B.J., 1982. Soil Survey of Butler County, Iowa. U.S. Dept. of Agriculture, Soil Conservation Service, 209 p, with 84 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 Wapiniticum and Cedar Valley Groups, with discussion of new correlative 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 Epitaxial 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.

DeWitt, T.A., 1981. Soil Survey of Cerro Gordo County, Iowa. U.S. Dept. of Agriculture, Soil Conservation Service, 214 p, with 84 map sheets.

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.

Hall, J., and Whitney, J.D., 1858. Report on the Geological Survey of the State of Iowa: embracing the results of investigations made during 1855, '56, & '57. Vol. 1 (Part 2: Paleontology). State of Iowa, 724 p.

Kerr, P., Tassier-Surine, S., Streeter, M., Liu, H., and Clark, R., 2018. Surficial geologic map of Floyd County, Iowa. Iowa Geological Survey Open File Map OFM-18-2.

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., Ressemeyer, G.G., and Hoyt, B.E., 1984. Groundwater quality and hydrogeology of Devonian-Carboniferous 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 Litke, 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 Gagliardi, 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 Gagliardi, 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 Gagliardi, 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, 269 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.

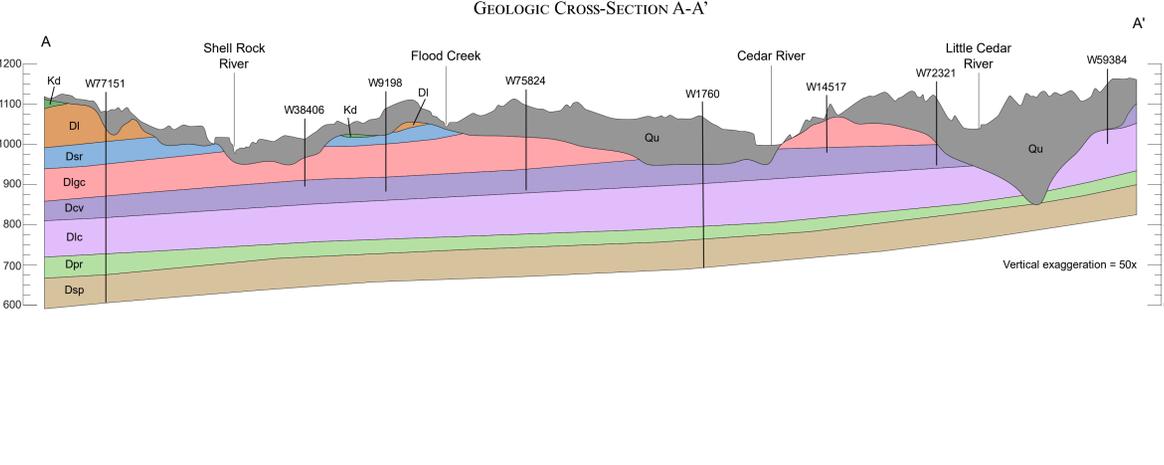
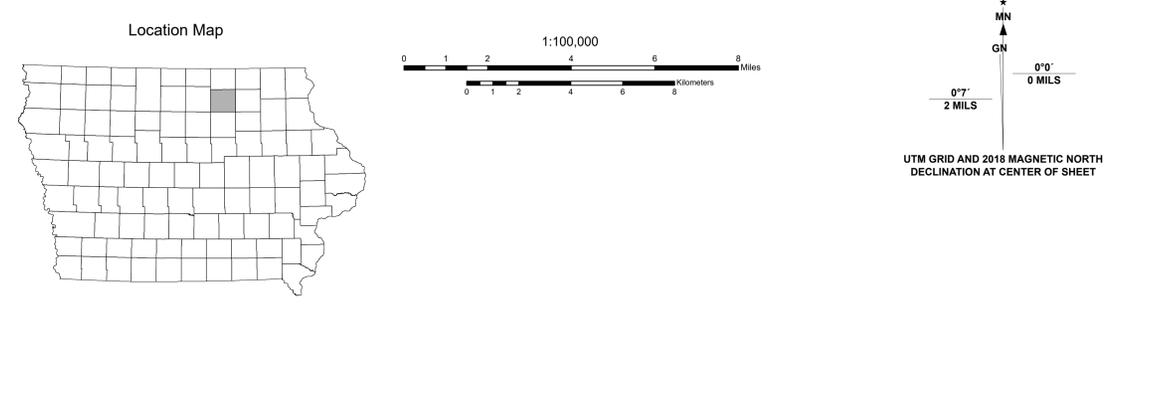
Wilson, J.H., 1996. Soil Survey of Chickasaw County, Iowa. U.S. Dept. of Agriculture, Soil Conservation Service, 182 p, with 74 map sheets.

Witzke, B.J., 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. 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 Epitaxial Carbonate Depositional Systems of the Iowa and Illinois Basins. Iowa Geological Survey Guidebook Series No. 25, p. 23-46.

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., Enby, A.F., and Glas, D.J. (eds.), Devonian of the World. Canadian Soc. of Petroleum Geologists, Memoir 14, vol. 1, p. 221-250.



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

Iowa Geological Survey digital cartographic file Floyd_Co_BedrockGeology.mxd, version 6/30/18 (ArcGIS 10.5)

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.

Research supported by the U. S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G17AC0025. 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.