

Bedrock Geology of the Cedar Falls (Iowa) 7.5' Quadrangle

BEDROCK GEOLOGY OF THE CEDAR FALLS 7.5' QUADRANGLE, BLACK HAWK COUNTY, IOWA

Iowa Geological and Water Survey
Open File Map OFM-12-03
September 2012

prepared by
Robert Rowden, Robert McKay, Huihao Liu, Stephanie Tassier-Surine, Deb Quade, and James Gigherano

Iowa Geological and Water Survey, Iowa City, Iowa



Iowa Department of Natural Resources, Chuck Gipp, Director
Iowa Geological and Water Survey, Robert D. Liben, State Geologist

Supported in part by the U.S. Geological Survey
Cooperative Agreement Number G11AC0204
National Cooperative Geologic Mapping Program (NCGMP)

ACKNOWLEDGMENTS

Special thanks to Sherman Lundy of BMC Aggregates and Lee Pries of Paul Norman Construction for allowing us access to their properties. New subsurface geologic data was mostly generated by University of Iowa students Kyle Brunker and Jaime Rice who produced descriptive logs of water wells and drilled samples. Michael Bunker and Tom Michael of the Iowa Geological and Water Survey (IGWS) provided additional descriptive logging of water wells. Jason Vogelsang (IGWS) prepared well drilling samples for stratigraphic logging. Bill Bunker, Roy Anderson, and William Wirtke (IGWS) provided valuable technical information concerning the bedrock topography, geology, and Devonian stratigraphy of the area. Casey Robert (IGWS) provided GIS mapping technical help.

Introduction to the Bedrock Geology of the Cedar Falls 7.5' Quadrangle

The Cedar Falls 7.5' Quadrangle within Black Hawk County, Iowa, is located in the south-central portion of the Iowa Surface landform region, which is characterized by various episodes of erosion before the Wisconsin glacial events (Prior, 1991).

The quadrangle area of Cedar Falls is covered by various Quaternary glacial deposits with a maximum thickness of up to 58.8 m (193 ft). One indubitable bedrock outcrop (actually an excavation for a lift station) was found in the south-central portion of the quad within the city of Cedar Falls during the field investigation. Subsurface information for the bedrock mapping was mostly derived from the analysis of water well materials and drill-hole information collected by the Iowa Geological and Water Survey (IGWS) and stored in the GEOSAM database of IGWS. A total of 172 private and public wells and 9 drill holes were reviewed within the quad. Bedrock information from surrounding quarries was also helpful in mapping the bedrock geology of the quad.

In the mapping area, Middle Devonian rocks form the major bedrock surface, and water wells are developed in both Devonian and Silurian rocks. Being part of a special depositional region within the Iowa Basin, the Devonian stratigraphy of the regional area has been intensively studied by IGWS staff (e.g., Belanski, 1927; Koch, 1970) and re-studied and correlated by Witzke and Bunker (1984), Witzke and others (1988), Anderson and Bunker (1998), Groves and others (2008), etc. Other studies in the area include Anderson and Garvin (1984) and Day and others (2006). The stratigraphic nomenclature and correlation in this map follow the stratigraphic framework proposed by Witzke and others (1988).

The youngest bedrock unit within the quad is the Devonian Coralville Formation, while the oldest rocks forming part of the bedrock surface are the Silurian Hopkinson and Blanding formations. The Devonian is dominated by carbonates varying between limestone and dolomite with accompanying minor shale. The Silurian is comprised of dolomite with varying amounts of chert and minor shale. Based on lithologic features and fossils, the Devonian rocks in the mapping area can be subdivided, in descending order, into the Corallville and Little Cedar formations and the Wapsipicon Group.

The Corallville Formation occurs mostly in the southwest and northeast quarters of the quad on bedrock highs and is characterized by a lower fossiliferous carbonate member with abundant marine fauna (Gizzard Creek Member) and an upper carbonate dominated unit with laminated, brecciated, or evaporitic textures and some restricted marine faunas (Iowa City Member).

The Little Cedar Formation is the dominant bedrock surface unit in the quad and is characterized by fossiliferous dolomite and dolomitic limestone in the lower part and by sparsely fossiliferous to unfossiliferous dolomite, shale, and limestone (laminated to brecciated) in the upper part.

The Wapsipicon Group is dominated by laminated or brecciated, unfossiliferous limestone and dolomite that is sometimes sandy and cherty at its base. Within the quad, only the Pincon Ridge Formation of the group is present, and it forms the bedrock surface in the deeper bedrock valleys in the north-central and eastern portions of the quad.

The Silurian Hopkinson and Blanding formations are comprised of fossil-moldic to vuggy dolomite that are cherty to very cherty with nodular to bedded chert in the upper part of the Blanding Formation. The Hopkinson rocks are generally more fossiliferous and less cherty than the underlying Blanding rocks. The Silurian rocks form the bedrock surface in the deepest parts of the bedrock valleys in the north-central portion of the quad.

Ordovician Maquoketa Formation rocks do not occur at the bedrock surface within the quad, but directly underlie the Silurian rocks. The Maquoketa rocks include interbedded green to gray dolomitic shale and shaly dolomite with minor limestone, and are variably cherty and fossiliferous.

Cited References:

Anderson, W.J., and Garvin, P.L. (eds), 1984. The Cedar Valley Formation (Devonian), Black Hawk and Buchanan counties: Carbonate Facies and Mineralization, *ana. Geol. Soc. of Iowa, Guidebook 42*, 47 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 65*, 71 p.

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

Day, J., Lucare, J., and Anderson, R. (eds), 2006. New Perspectives and Advances in the Understanding of Lower and Middle Paleozoic Epieric Carbonate Depositional Systems of the Iowa and Illinois Basins. *Guidebook for the 30th Annual Field Conference of the Great Lakes Section, Society for Sedimentary Geology (SEPM), and the 67th Annual Tri-State Field Conference*, September 29 - October 1, 2006, 167 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 Lane Creek Formation, northern Iowa. *KGS Guidebook 28*, 96 p.

Koch, D.L., 1970. Stratigraphy of the Upper Devonian Shell Rock Formation of north-central Iowa. *KGS Report of Investigations 10*, the state of Iowa, 123 p.

Prior, J.C., 1991. Landforms of Iowa. *Univ. of Iowa Press, Iowa City*, 154 p.

Witzke, B.J., Anderson, R.R., and Pope, J.P., 2010. Bedrock geologic map of Iowa, 1:500,000. *KGS Open File Map OFM-2010-01*.

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

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

LEGEND

CENOZOIC

QUATERNARY SYSTEM

Qu - **Undifferentiated unconsolidated sediment**. Consists of loamy soils developed in loess and glacial till of variable thickness, and alluvial clay, silt, sand, and gravel. Total thickness can be up to 58.8 m (193 ft) in the bedrock valleys within the quad. This unit is shown only on the cross-section, not on the map.

PALEOZOIC

DEVONIAN SYSTEM

Dcv - **Limestone and Dolomite** (Coralville Formation) Middle Devonian. The thickness of this map unit varies between 0 to 16 m (0-52 ft) within the quad. The lower Gizzard Creek Member is fossiliferous carbonate with abundant marine fauna and is dominated by dolomite and dolomitic limestone, becoming slightly argillaceous in part, with common calcite filled vugs, the low diversity fauna are characterized by crinoid debris and brachiopods and rare gastropods and bryozoans. The upper Iowa City Member is carbonate dominated, with laminated, brecciated, or evaporitic textures and some restricted marine faunas; the restricted marine fauna is dominated by fossiliferous corals and branching and domal stromatopora. Stromatopora rich biostromal intervals occur within and around the quad area.

Dlc - **Dolomite and Limestone** (Little Cedar Formation) Middle Devonian. The thickness of this map unit ranges from 0 to 37 m (0-121 ft) within the quad. The map unit is dominated by slightly argillaceous to argillaceous dolomite and dolomitic limestone, usually vuggy and partially laminated and/or cherty. This unit is commonly fossiliferous and brachiopods are especially abundant in the lower portion. The upper portion (Iowa City Member) is an unfossiliferous lithographic or sub-lithographic limestone or dolomitic limestone, with laminated, pitted, intracratic, and bed-eyes fabrics.

Dw - **Dolomite, Limestone, Shale, and minor Sandstone** (Wapsipicon Group) Middle Devonian. This map unit consists only of the Pincon Ridge Formation of the group, with a total thickness that varies from 0 to 12.3 m (0-75 ft) in the mapping area. It is dominated by laminated or brecciated, unfossiliferous limestone and dolomite that is sometimes sandy and cherty at its base.

SILURIAN SYSTEM

Shb - **Dolomite with Chert** (Hopkinson and Blanding formations) Lower Silurian. The total thickness of this map unit is up to 49 m (160 ft). The unit is fossil-moldic to vuggy dolomite and cherty to very cherty with nodular to bedded chert in the upper part of the Blanding Formation. Fossils include corals, brachiopods, and stromatopora. The Hopkinson rocks are generally more fossiliferous and less cherty than the underlying Blanding rocks.

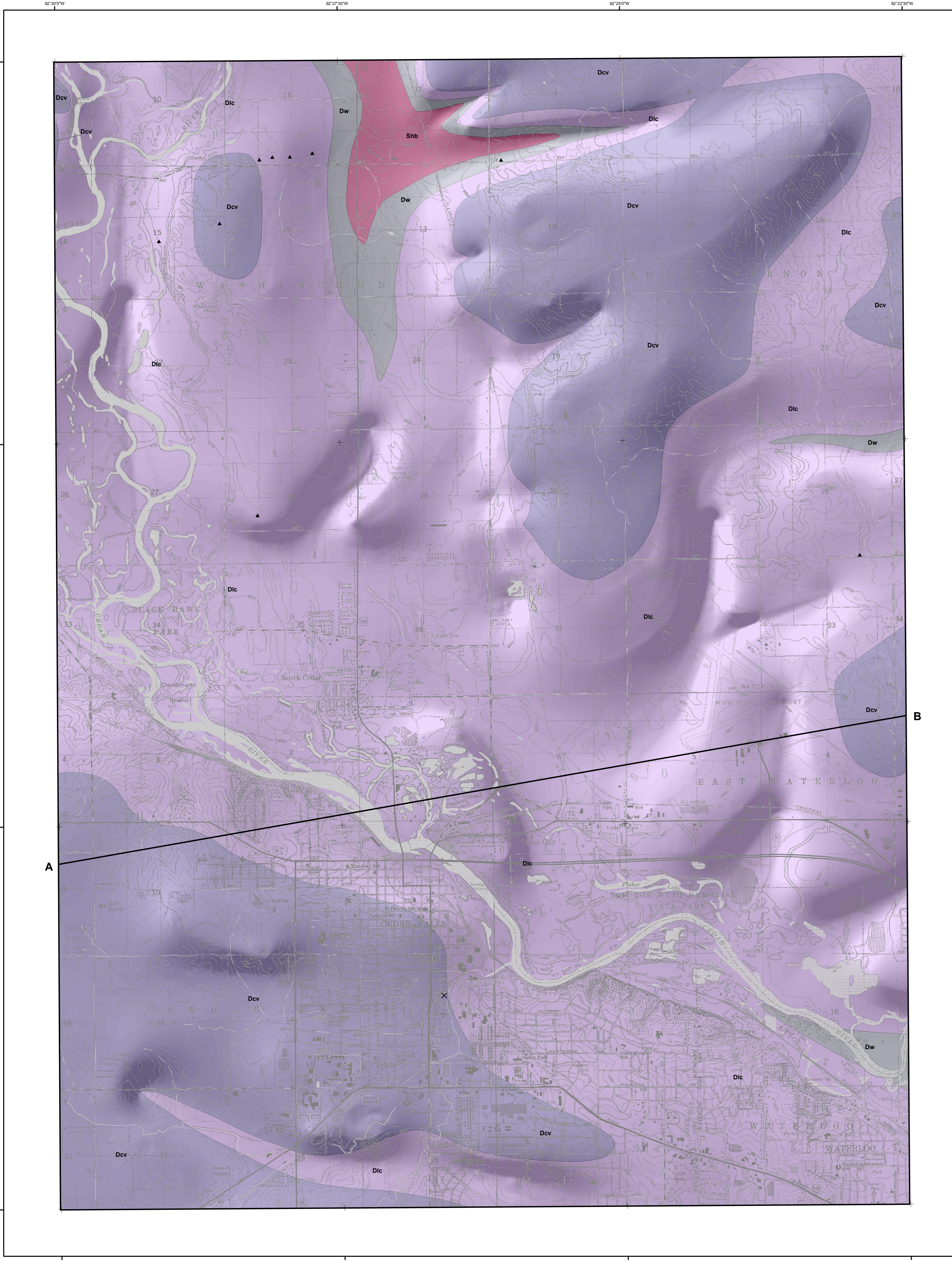
ORDOVICIAN SYSTEM

Om - **Shale and Dolomite** (Maquoketa Formation) Upper Ordovician. The total thickness of this map unit is up to 91 m (300 ft). The unit is composed of interbedded green to gray dolomitic shale and shaly dolomite with minor limestone, variably cherty and variably fossiliferous with brachiopods and graptolites; thin brown to gray dolomitic shale layers occur in the lower 10 m (33 ft). This unit is shown only on the cross-section, not on the map.

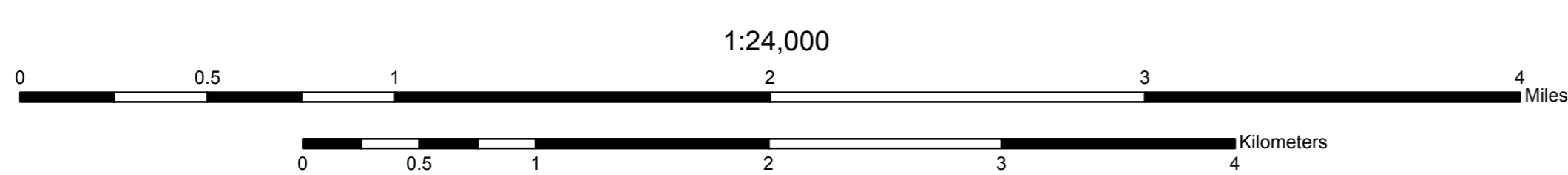
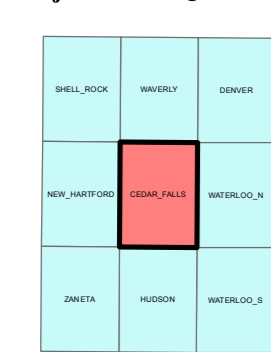
- Wells
- ▲ Drill Holes
- × Outcrops

Correlation of Map Units

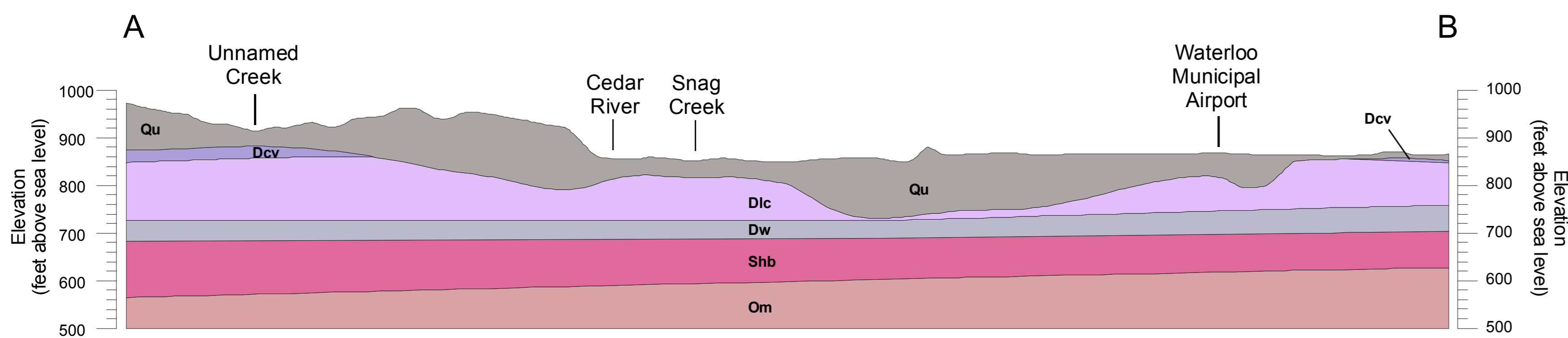
AGE (Ma)	SYSTEM	SERIES	STAGE	MAP UNIT
2.58	QUATERNARY			Qu
	DEVONIAN	Upper	Frasnian	
385				Dcv
390			Givetian	Dlc
	DEVONIAN	Middle	Eifelian	Dw
395				
	SILURIAN	Llanaboverian		
436			Aeronian	
439			Rhuddanian	Shb
445			Garnadonian	
			ORDOVICIAN	Cincinnatian
450				
	Maysvillian			
			Edenian	



Adjacent 7.5' Quadrangles



GEOLOGIC CROSS-SECTION A-B



Base map from USGS Cedar Falls 7.5' Digital Raster Graphic (IGS GIS file DRG135.TIF) which was scanned from the Cedar Falls 7.5' Topographic Quadrangle map, published by US Geological Survey in 1963, photorevised 1963. Topographic contours and land features based on 1956 and 1963 aerial photography, field checked in 1963. Land elevation contours (10' interval).

Iowa Geological and Water Survey, digital cartographic file Cedar Falls_BedrockGeology.mxd, version 9/28/12 (ArcGIS 10.0). 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.