

Bedrock Geology of the Fertile NE (Iowa)

7.5' Quadrangle

BEDROCK GEOLOGY OF THE FERTILE NE 7.5' QUADRANGLE, WORTH COUNTY, IOWA

Iowa Geological and Water Survey
Open File Map OFM-11-01
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Introduction to the Bedrock Geology of the Fertile NE 7.5' Quadrangle

The Fertile NE 7.5' Quadrangle mostly within Worth County, Iowa, is located in the border area of the Des Moines Lobe landform region, which was the last area covered by Quaternary glacial drift in Iowa, and the Iowa Surface landform region, which was modified by various episodes of erosion before Wisconsinan glacial events (Prior, 1991).

The entire Fertile NE quad is covered by various Quaternary glacial deposits with a maximum thickness up to 46 m (150 ft). No bedrock outcrops were found during the field investigation. Subsurface information for bedrock mapping was mostly derived from the analysis of water well materials collected by Iowa Geological and Water Survey (IGWS) and stored in the GEOSAM database of IGWS. A total of 78 private and public wells within the quad were studied. Bedrock information from quarries in adjacent quadrangles was also helpful for the bedrock geologic mapping of this quad.

Middle and lower Upper Devonian rocks form the major bedrock surface and upper bedrock aquifer in the mapping area. This area is within the northern region of the Devonian Iowa Basin. The stratigraphy of this basin has been intensively studied by IGWS staff (e.g., Belanski, 1927, 1928; Koch, 1970) and re-studied and correlated by Witke and Bunker (1984), Bunker and others (1986), Witke and others (1988), Anderson and Bunker (1998), Groves and others (2008), etc. The stratigraphic nomenclature and correlation for this map follow the stratigraphic framework proposed by Witke and others (1988).

The youngest bedrock unit within the quad is the Cretaceous Windrow Formation, which usually occurs as iron-rich reddish erosional outliers a few meters thick in north-central Iowa (Witke et al., 2010). The Devonian rocks are dominated by carbonates varying between limestone and dolomite, accompanied with minor shale. Based on lithologic features and fossils, the Devonian bedrock in the mapping area can be subdivided into, in descending order, the Shell Rock, Lithograph City, and Coralville Formations. The Shell Rock Formation occurs in the southern part of the quad and is characterized by fossiliferous and stromatopore-rich carbonates. Shaly carbonates are also common in the middle portion of the Shell Rock Formation. The underlying Lithograph City Formation is usually represented by laminated lithographic and sublithographic limestone and dolomite and is the dominant bedrock unit in the quad. The Coralville Formation is characterized by limestone, dolomitic limestone, and dolomite, which are sometimes argillaceous. It forms the bedrock surface in bedrock valleys along northern border of the quad.

Cited References

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*.
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., Witke, B.J., and Day, J.E., 1986, Upper Cedar Valley Stratigraphy, North-Central Iowa, Lithograph City Formation. *Geol. Soc. of Iowa, Guidebook No. 44*.
Groves, J.R., Walters, J.C., and Day, J.E. (eds), 2008, Carbonate platform facies and faunas of the Middle and Upper Devonian Cedar Valley Group and Lime Creek Formation, northern Iowa. *IGS Guidebook No. 28*.
Koch, D.L., 1970, Stratigraphy of the Upper Devonian Shell Rock Formation of north-central Iowa. *IGS 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.
Witke, B.J., Anderson, R.R., and Pope, J.P., 2010, Bedrock geologic map of Iowa, 1:500,000. *IGS Open File Map OFM-2010-01*.
Witke, B.J., and Bunker, B.J., 1984, Devonian stratigraphy of north-central Iowa. *IGS Open File Report 84-2*, p. 107-149.
Witke, 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. 1, p. 221-250.

LEGEND

CENOZOIC

QUATERNARY SYSTEM

Qu - **Undifferentiated unconsolidated sediment**. Consists of loamy soils developed in loess, glacial till, and colluvium of variable thickness, and alluvial clay, silt, sand, and gravel. Total thickness can be up to 46 m (150 ft) in the quad. This unit is shown only on the cross-section, not on the map.

MESOZOIC

CRETACEOUS SYSTEM

Kw - **Sandstone, Mudstone, and Siderite Pellets (Windrow Formation)** "Mdf" Cretaceous. This map unit occurs as erosional outliers and is only found occasionally in well materials in the mapping area. The formation is characterized by reddish, shaly sandstone and mudstone or siderite pellets. Its thickness is variable, but usually less than 6 m (20 ft).

PALEOZOIC

DEVONIAN SYSTEM

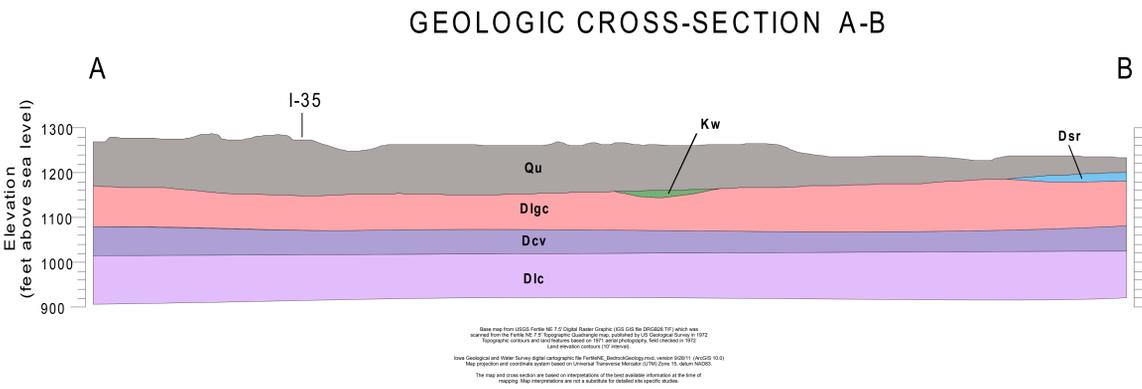
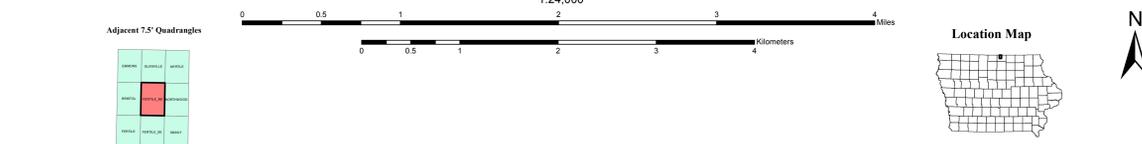
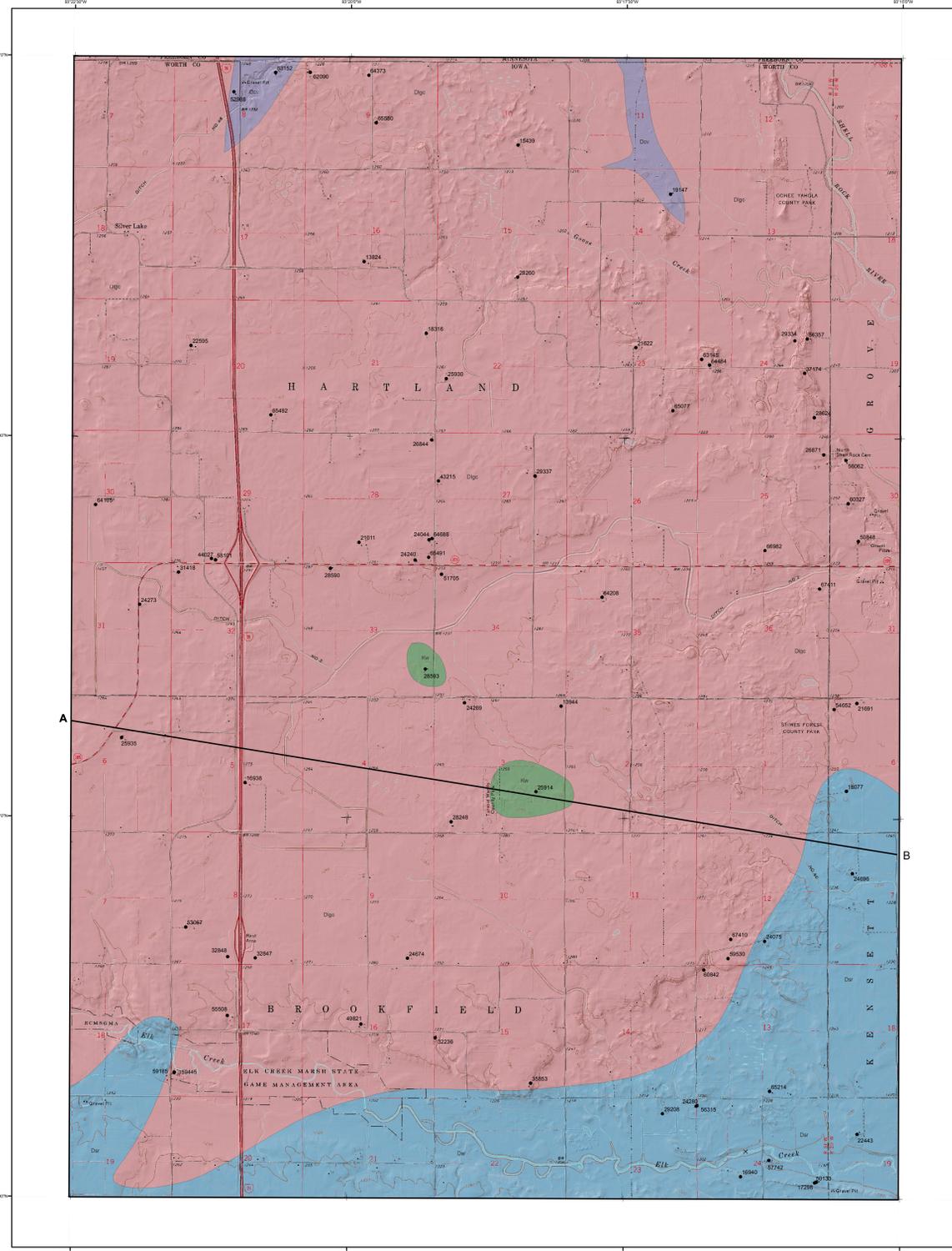
Dsr - **Limestone, Dolomite, and Shale (Shell Rock Formation)** Upper Devonian. This map unit usually has a thickness of 12 to 18 m (40-60 ft) and occurs in the southern part of the quad. The unit is characterized by fossiliferous carbonates with some grey to light green shale. Layers containing abundant sub-spherical and tabular stromatopores commonly occur in the lower part of the unit. Brachiopods, bryozoans, corals, and graptolites are abundant in some intervals.

Dlgc - **Dolomite, Limestone, and Shale (Lithograph City Formation)** Middle to Upper Devonian. This map unit forms the major uppermost bedrock in the quad with a maximum thickness of up to 33 m (110 ft). This unit consists of dolomite and dolomitic limestone, partially characterized by interbeds of laminated lithographic and sublithographic limestone and dolomitic limestone, in part argillaceous or with little shale. "Bedrocks" or structures are common in some intervals.

Dcv - **Limestone and Dolomite (Coralville Formation)** Middle Devonian. The thickness of this map unit varies between 10 and 18 m (35-60 ft) and is dominated by limestone, dolomitic limestone, and dolomite, in part laminated and argillaceous. Bush knots and corals usually occur in the limestone facies.

Dic - **Dolomite and Limestone (Lime Cedar Formation)** Middle Devonian. The thickness of this map unit ranges from 2 to 35 m (6-115 ft) in the study area. The 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. This unit is shown only on the cross-section, not on the map.

• Drill Holes
x Outcrops



Base map from USGS 7.5' Digital Raster Graphic (DRG) 500 500 for 2008081011, which was derived from the Fertile NE 7.5' Topographic Quadrangle Map, published by US Geological Survey in 1972. Topographic contours and bathymetric contours are 100' and 10' contours, respectively. See the legend for more information.

Iowa Geological and Water Survey digital cartography: the Fertile NE 7.5' Bedrock Geology map, version 20081111 (09/20/2011). This geologic map and correlation were prepared in accordance with the National Cooperative Geologic Mapping Program (NCGMP) standards. The map and cross-section are based on interpretations of the best available information at the time of mapping. This information is not a substitute for detailed site-specific studies.