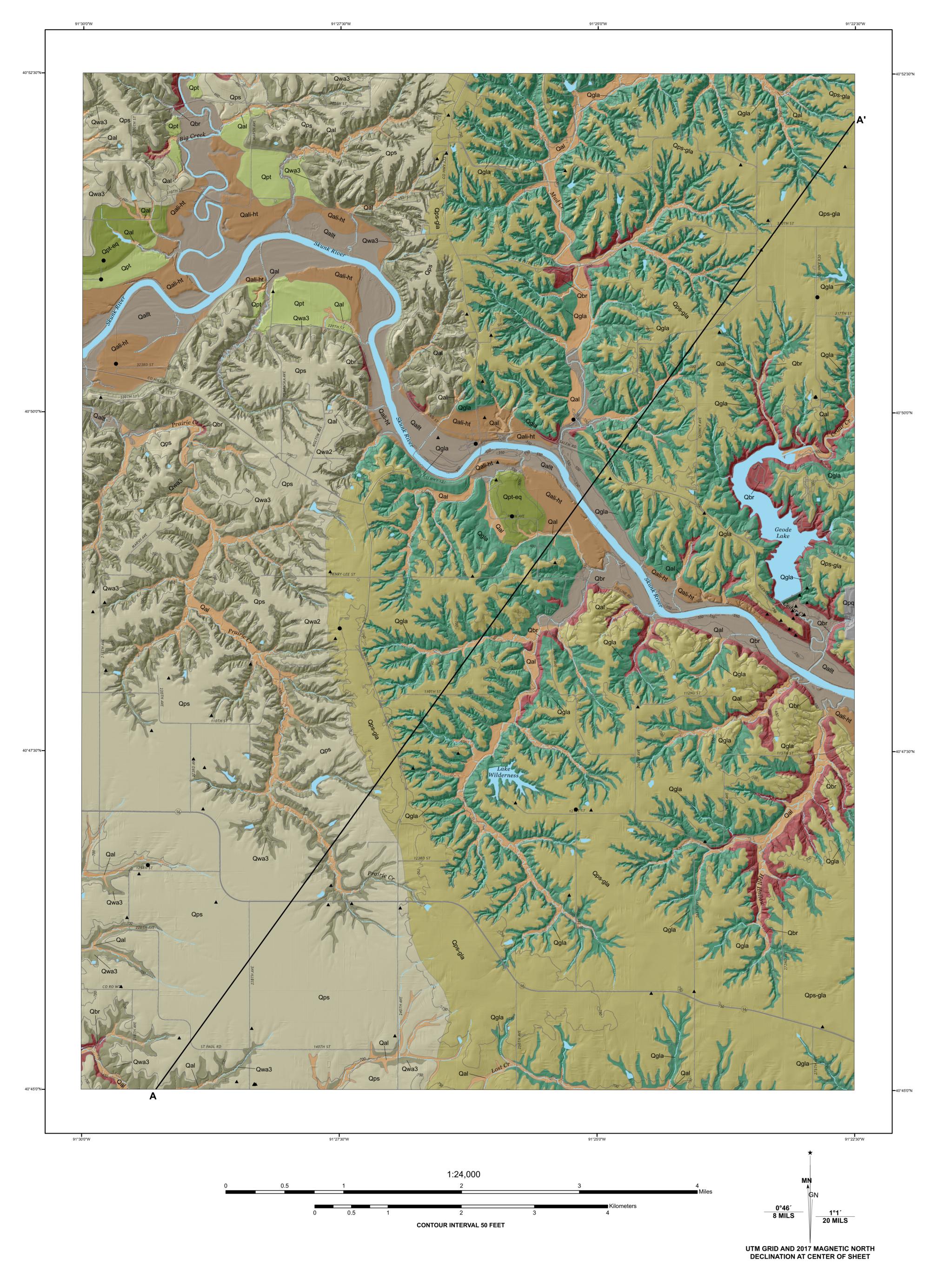
Surficial Geologic Map of the Lowell (Iowa) 7.5' Quadrangle





PALEOZOIC

CARBONIFEROUS SYSTEM

PENNSYLVANIAN SUBSYSTEM

Pcl - Sandstone and Shale (lower Cherokee Group) Lower-Middle Pennsylvanian. Pennsylvanian units occur as erosional outliers reaching a thickness of Pcl up to 14 m (45 ft) within the mapping area. This unit consists of shale/mudstone, light to medium gray, part silty to sandy and fine to medium sandstone, rarely conglomeratic. Some shales are carbonaceous to phosphatic, minor coal, and rare limestone lithologies.

MISSISSIPPIAN SUBSYSTEM

Mpsl - Limestone, Sandstone, and Dolomite (Pella or "St. Louis" formations) Middle-Upper Mississippian, Meramecian-lower Chesterian. This map unit ranges between 12 and 24 m (40 - 80 ft) thick in the mapping area. It is dominated by limestone, sandstone, dolomitic limestone, and dolomite with minor shale. Limestones of the Pella Formation are typically sub-lithographic with scattered to abundant fossils, primarily brachiopods, echinoderms, and ostracods. The "St. Louis" Formation is dominated by limestone, sandy limestone and dolomite, variably cherty, and partly fossiliferous with brachiopods, echinodems, and several varieties of coral. Some fossils are silicified. Sandstones of the "St. Louis" Formation are typically very fine to medium, quartz sandstones that are poorly to moderately cemented with calcite or quartz. Lower "St. Louis" units are more dolomitic, gray to dark brown, and commonly brecciated.

Mws - Shale, Dolomite, and Limestone (Warsaw Formation) Upper Osagean. The Warsaw Formation varies in thickness reaching a maximum thickness of approximately 17 m (55 ft). This unit can generally be divided into two major lithologic groupings, a lower argillaceous dolomite sequence and an upper shaledominated sequence. The upper shale is typically light to medium gray, silty, and variably dolomitic with minor chert, sand, and sparse quartz geodes. The lower dolomite, sometimes referred to as the "geode beds", is argillaceous to shaly, with scattered to abundant quartz geodes.

Mkeo – Limestone, Dolomite, Chert, and Shale (Keokuk Formation) Upper Osagean. The Keokuk Formation typically ranges from 12 to 23 m (40 – 75 ft) in thickness in the mapping area. This unit is dominated by tan to gray interbedded skeletal limestones displaying packstone/grainstone fabrics. Nodular to bedded chert, in part fossiliferous, is common in the lower half of the sequence. Dolomite, variably argillaceous, and thin shales also occur throughout the unit. The unit displays multiple hardground surfaces and bone beds with scattered to abundant fish debris, the most prominent of these serves as a marker bed at the base of the formation (sometimes referred to as the Burlington-Keokuk or B-K bone bed).

Mb – Limestone, Dolomite, and Chert (Burlington Formation) Lower Osagean. The Burlington Formation ranges in thickness from 18 to 26 m (60 – 85 ft) in the mapping area. This unit is subdivided into three members (in ascending order: the Dolbee Creek, Haight Creek, and Cedar Fork), characterized by distinct lithologic groupings. The Dolbee Creek Member is dominated by white to tan skeletal limestone displaying packstone/grainstone fabrics and nodular to bedded chert. The Haight Creek Member is characterized by dolomite with an intermittent unit of skeletal limestone (sometimes referred to as the "middle grainstone") and thick beds of chert. A glauconite-rich zone marks the lower contact between the Dolbee Creek and can be used as a regional marker bed. The Cedar Fork Member is a pure white crinoidal packstone limestone unit which is usually differentiated from the packstones of the overlying Keokuk Formation by its white appearance.

Mk – Dolomite, Limestone, and Siltstone (Kinderhookian formations) Lower Mississippian. The Kinderhookian sequence ranges in thickness from 12 to 23 m (40 - 75 ft) in the mapping area. This unit comprises three formations (in ascending order: the McCraney, Prospect Hill, and Wassonville), characterized by distinct lithologic groupings. The McCranev Formation is composed of alternating beds of sparsely fossiliferous, sub-lithographic limestone and dark brown, unfossiliferous dolomite, generating a unique "zebra striped" appearance in outcrop. The Prospect Hill Formation is a light to medium gray, dolomitic siltstone that grades to shale in some locations. The Wassonville Formation consists of massive dolomite that is variably cherty grading into dolomitic limestone lower in the section. The basal Starr's Cave Member is a fossiliferous limestone with packstone/grainstone fabrics and is commonly oolitic.

DEVONIAN SYSTEM

Der – Siltstone and Shale (English River Formation) Upper Devonian, lower to upper Famennian. The English River Formation is up to 6 m (20 ft) within the mapping area. This unit is dominated by gray to olive green siltstone with apparent bioturbated fabrics. Bivalves and brachiopods are common, especially in the upper beds, with scattered to abundant fossil molds as well.

Dss – Shale (Saverton Shale Formation) Upper Devonian, lower to upper Famennian. The Saverton Shale Formation can be up to 46 m (150 ft) within the mapping area. This unit is dominated by green-gray shale, commonly burrowed with sparse to absent macro-fossils.

OTHER FEATURES

- Water features Rivers, lakes and small ponds. Extent mapped as shown in the county soil surveys and as identified on aerial imagery.
- New drill holes for this map project
- IGS GEOSAM data points records available at www.iowageologicalsurvey.org

Qgla

W8749 Wells used for geologic cross-section

M

Dss

Glacial

Till

Qpq - Pits and Quarries - Sand and gravel pits and rock quarries. Extent mapped as shown on the county soil surveys and as identified on aerial imagery.

CORRELATION OF MAP UNITS

	Valley		ley	Illinoian Till Plain	Pre-Illinoian Till Plain	Episode	Series	System
	Alluvium	Qallt Qali-ht		Qal	Qal	Hudson	Holocene	
	Loess	Qpt-eq	Qpt	Qps-gla	Qps	Wisconsin		λuaternary
Γ	Outwash	Qnw*				VVISCOTISIT	ene	Quate

Illinoian

Pre-Illinoian

Location Map

Mud Creek, Cedar Creek, Sutton Creek and Hell Hollow.

maximum thickness of 64 m (210 ft) in the northern part of the mapping area. Bedrock outcrops are located

primarily in the eastern half of the quadrangle, along the Skunk River and its tributary creeks including

Mapping the Lowell and Danville quadrangles provides the first study of the regional Quaternary stratigraphy of southeast Iowa in almost 40 years since Hallberg (1980a,b) established the stratigraphy for the Illinoian and Pre-Illinoian glacial advances in eastern and southeastern Iowa. The majority of the drill cores and outcrops for those studies were north and east of the Lowell Quadrangle. Additional data available since that time (LIDAR, DEMs, and digital soil surveys), have allowed for the refinement of the Illinoian boundary and greater detail in mapping the valleys. The only other surficial map of the area consists of the Des Moines 4° x 6° Quadrangle at a scale of 1:1,000,000 (Hallberg et al., 1991). Several Iowa Geological Survey (IGS) field trip guidebooks outline the Pleistocene, Devonian, and Mississippian stratigraphy (Witzke et al., 2002; Witzke and Tassier-Surine, 2001), but their focus was on the area near Burlington (to the east).

The soil surveys of Des Moines, Henry, and Lee counties (Brown, 1983; Seaholm, 1985; and Lockridge, 1979) provided information regarding shallow rock areas, helped to guide valley mapping units, and defined slope areas where glacial till is exposed. Subsurface information was mostly derived from the analysis of water well cutting samples reposited by the IGS. Lithologic and stratigraphic information from these samples are stored in the online GeoSam database of the IGS. Additionally, IGS drilled 12 new cores in the quadrangle to characterize the Quaternary sediments and establish unit thickness.

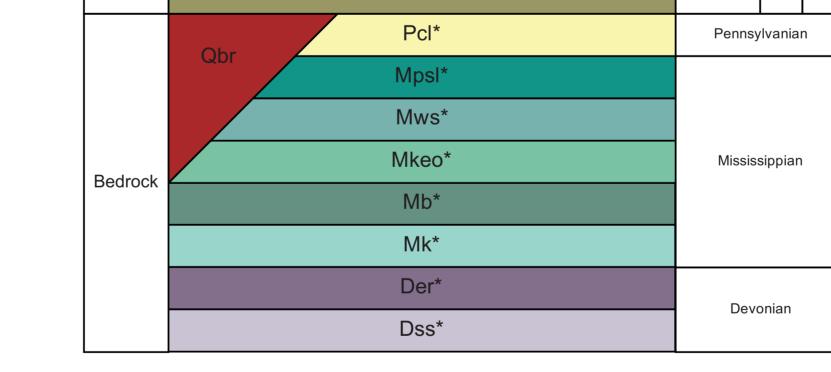
The glacial history of Iowa began more than two million years ago, as at least seven episodes of Pre-Illinoian glaciation occurred between approximately 2.6 and 0.5 million years ago (Boellstorff, 1978a,b; Hallberg, 1980a). In east-central Iowa, Hallberg formally classified the units into two formations on the basis of differences in clay mineralogy: the Alburnett Formation (several undifferentiated members) and the younger Wolf Creek Formation (including the Winthrop, Aurora and Hickory Hills members). Both formations are composed predominantly of till deposits, but other materials are present. Paleosols are formed in the upper part of these till units.

A limited area of southeastern Iowa was glaciated during the Illinois Episode, around 300,000-130,000 years ago (Hallberg, 1980b). The eastern half of the Lowell Quadrangle was glaciated during this time. The Illinoian till was deposited by the advancing Lake Michigan Lobe which moved across western Illinois into Iowa from the northeast (Leverett, 1899; Wickham, 1980). The Lake Michigan Lobe incorporated Paleozoic bedrock materials from the Lake Michigan Basin which are distinguished by both the clay mineralogy of the matrix as well as the pebbles and clasts (Lineback, 1980; Wickham, 1980). Hallberg (1980b) defined the formal stratigraphic nomenclature in Iowa. The only Illinoian Episode till present in Iowa is the Glasford Formation Kellerville Till Member (Willman and Frye, 1970). Following the Illinoian glaciation, this area underwent landscape development and erosion until the Wisconsin Episode loess began to be deposited. The Illinoian and Pre-Illinoian till are only exposed in drainages and relatively steep sideslopes.

In eastern Iowa, the highly eroded and dissected Illinoian and Pre-Illinoian upland and older terraces are mantled by two Wisconsin loesses. The older Pisgah Formation is thin and includes loess and related slope sediments that have been altered by colluvial hillslope processes. The unit is characterized by the presence of a weakly developed soil recognized as the Farmdale Geosol. It is not uncommon to see the Farmdale developed throughout the Pisgah Formation and into the underlying older Sangamon Paleosol. The Pisgah loess was most likely deposited on the eastern Iowa landscape from 30,000 to 24,000 years ago (Bettis, 1989) and is typically buried by Peoria Formation loess. The Peoria Formation loess accumulated on stable landsurfaces in eastern Iowa from 25,000 to 21,000 years ago. Peoria Formation eolian materials mantle the upland till units and are present on the Wisconsin outwash terraces. On the uplands, the Peoria Formation is a uniform silt loam; in the valleys the silt commonly grades downward to fine sand.

The Skunk River deposited coarse sand and gravel associated with glacial outwash (Noah Creek Formation) of the Des Moines Lobe during the Wisconsin Episode. Based on the alluvial framework established by Esling (1984), three terrace assemblages can be identified, the Early and Late Phase high terraces, and Low Terrace deposits. The high terraces are characterized by the presence of Peoria and Pisgah formation sediments overlying alluvium, with or without the intervening Sangamon Paleosol. Low Terrace deposits are younger and not overlain by the Peoria loess. These terraces may be found along the Skunk River and Big Creek. Also of significance is the presence of a relatively thick (greater than 20 ft) sequence of slackwater sediments below the highest elevation loess-mantled terrace. These materials are related to the Equality Formation (Willman and Frye, 1970) defined in Illinois and were deposited during a time of high flow in the Mississippi River that caused the Skunk River to back up (Curry and Grimley, 2006). Hudson age deposits are associated with fine-grained alluvial, organic, and colluvial sediments and include the DeForest Formation which is subdivided into the Camp Creek, Roberts Creek, and Gunder members. These deposits are present in valleys and upland drainages throughout the map area.

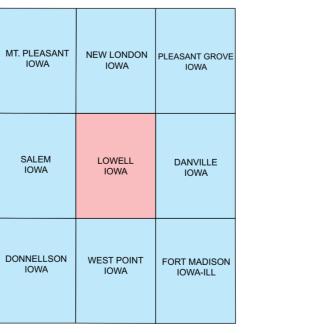
Surficial deposits in the map area are composed of seven formations (youngest to oldest): Hudson DeForest; Wisconsin Peoria, Pisgah, and Noah Creek; Illioian Glasford; and Pre-Illinoian Wolf Creek and Alburnett. Four bedrock mapping units (Pennsylvanian lower Cherokee Group; and the Mississippian Pella and "St. Louis", Warsaw, and Keokuk formations) are exposed at the bedrock surface in the Lowell Quadrangle. The Mississippian Pella and "St Louis" formations and the Pennsylvanian lower Cherokee Group comprise the bedrock in most of the map area, especially in the upland areas. The other



Qwa3*

*Units only shown on the Cross-Section

Adjacent 7.5' Quadrangles



Mississippian units occur within the bedrock valleys and tributaries. Seventeen rock outcrops and three quarries are located in the map area and were investigated in the field.

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Base map from USGS Lowell 7.5' Digital Raster Graphic (IGS GIS file IA Lowell USGS topo.tif) which was scanned from the Lowell 7.5' Topographic Quadrangle map, published by the US Geological Survey in 2015 Land elevation contours (10' interval).

lowa Geological Survey digital cartographic file Lowell_SurficialGeology.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.

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