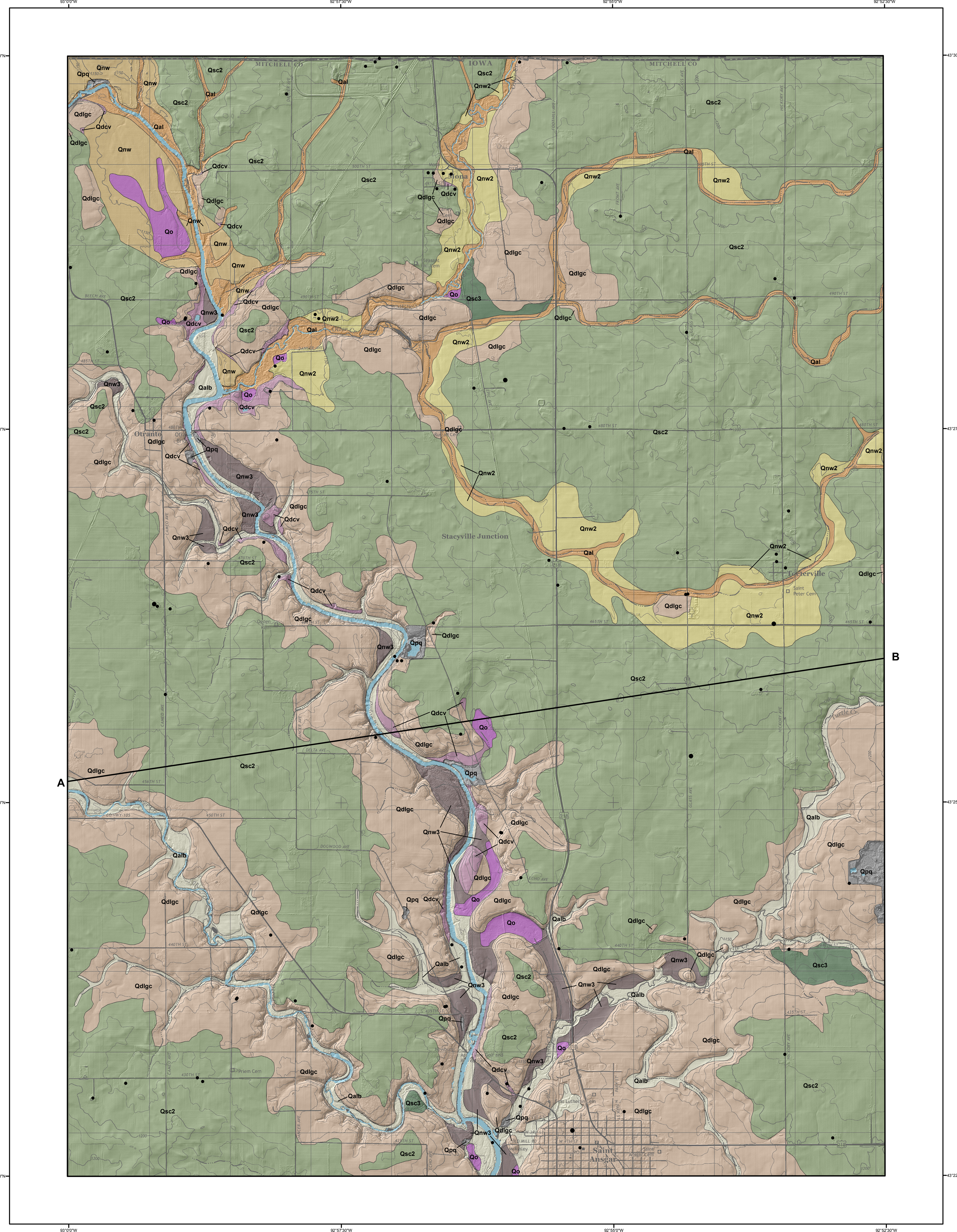
Surficial Geology of the St. Ansgar (Iowa) 7.5' Quadrangle



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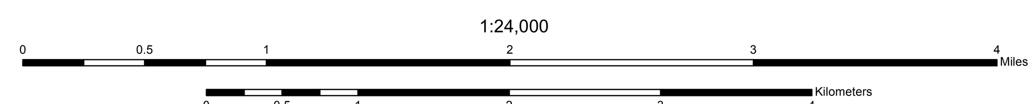
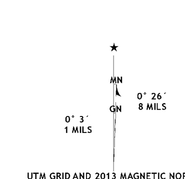
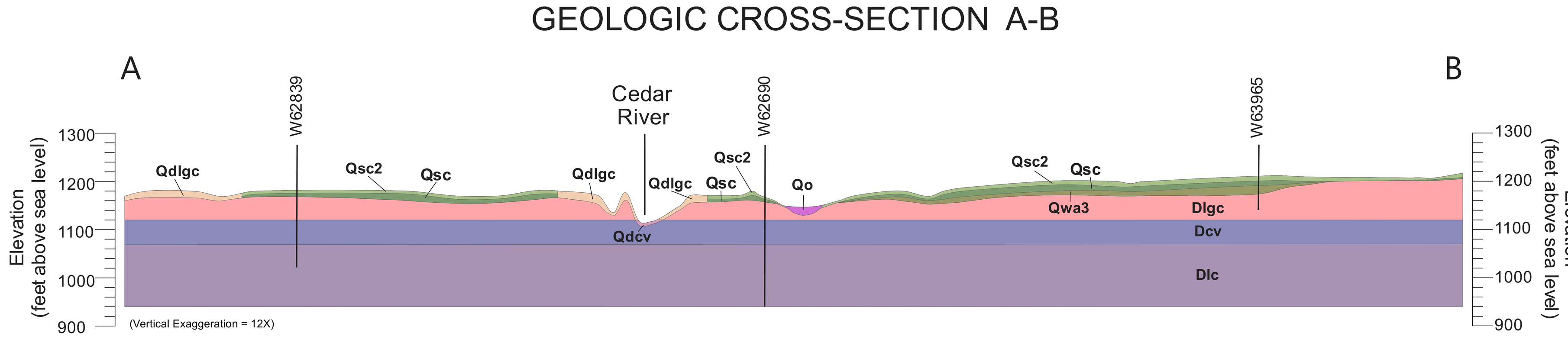




GEOLOGIC CROSS-SECTION A-B



LEGEND

CENOZOIC

QUATERNARY SYSTEM

HUDSON EPISODE

Qo

Qo - Depressions (DeForest Formation-Woden Member) - Generally 2.5 to 6 m (8-20 ft) of black to very dark gray, calcareous, muck, peat and silty clay loam colluvium and organic sediments in drained and undrained closed and semi-closed depressions. Overlies gray, calcareous, loam diamicton (Sheldon Creek, Wolf Creek, or Alburnett formations) or Noah Creek Formation sand and gravel. Associated with low relief features that occupy depressions and low sags on the landscape. Supports wetland vegetation and can be permanently covered by water. High water table.

Qal

Qal - Alluvium (DeForest Formation-Undifferentiated) - Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous to calcareous, massive to stratified silty clay loam, clay loam, loam to sandy loam alluvium and colluvium in stream valleys, on hillslopes and in closed depressions. May overlie Noah Creek, Sheldon Creek, Wolf Creek or Alburnett formations or fractured Devonian carbonate bedrock. Associated with low-relief modern floodplain, closed depressions, modern drainageways or toeslope positions on the landscape. Seasonal high water table and potential for frequent flooding.

Qalb

Qalb - Alluvium Shallow to Bedrock (DeForest Formation-Undifferentiated) - Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous to calcareous, stratified silty clay loam, clay loam, loam to sandy loam alluvium and colluvium in stream valleys, on hillslopes and in closed depressions. May overlie the Noah Creek Formation or Devonian carbonate bedrock. Bedrock surface is within 5 m (16 ft) of the land surface. Associated with low-relief modern floodplain, closed depressions, modern drainageways or toeslope positions on the landscape. Seasonal high water table and potential for frequent flooding. *This unit is too thin to be shown on the cross section.*

HUDSON and WISCONSIN EPISODES

Qdlgc

Qdlgc – Loamy Sediments Shallow to Limestone, Dolomite, and Shale (DeForest, Noah Creek , and Lithograph City formations) - 1 to 2 m (3-7 ft) of yellowish brown to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty alluvial sediments that overlie the Middle to Upper Devonian bedrock surface. The Lithograph City Formation comprises most of the bedrock surface and attains a maximum thickness of up to 24 m (80 ft) within the mapping area. It consists of dolomite and dolomitic limestone, partially characterized by interbeds of laminated lithographic and sublithographic limestone and dolomitic limestone, in part argillaceous or with minor shale. "Birdseye," vugs and calcite vug-fills are common. Some intervals are fossiliferous and stromatoporoid-rich.

Qdcv

Qdcv– Loamy Sediments Shallow to Limestone, Dolomite, and Shale (DeForest, Noah Creek, and Coralville formations) - 1 to 2 m (3-7 ft) of yellowish brown to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty alluvial sediment that overlies the Middle Devonian bedrock surface. The thickness of the Coralville Formation varies between 12 and 18 m (40-60 ft) within the mapping area. It is dominated by limestone, dolomitic limestone, and dolomite, in part, laminated and argillaceous. Brachiopods, echinoderm debris and corals usually occur in the limestone facies. This unit occurs at the bedrock surface within the Cedar River channel throughout the mapping area as well as in the Otter Creek channel.

Qnw2

Qnw2 - Sand and Gravel (Noah Creek Formation) - 2 to 12 m (7-40 ft) of yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel with few intervening layers of silty clay. Along many valleys, a thin mantle of loess, reworked loess, or fine-grained alluvium (Qal) may be present. This unit includes silty colluvial deposits derived from the adjacent map units. In places this unit is mantled with 1 to 3 m (3-10 ft) of well sorted fine to medium sand derived from wind reworking of the alluvium. This unit encompasses deposits that accumulated in low-relief stream valleys during the Wisconsin and Hudson episodes. Seasonal high water table and some potential for flooding.

WISCONSIN EPISODE

Qnw

Qnw - Sand and Gravel (Noah Creek Formation) - Generally less than 10 m (33 ft), but there may be significantly thinner coarse-grained deposits in smaller stream valleys. Yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel. In the map area this unit overlies the middle Wisconsin-age Sheldon Creek Formation. This unit encompasses outwash deposits that accumulated in valley trains during the Wisconsin Episode.

Qnw3

Qnw3 - Sand and Gravel Shallow to Bedrock (Noah Creek Formation) - 1 to 3 m (3-10 ft) of yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel. May be overlain by up to 2 m (7 ft) of silty alluvial sediments. In places mantled with fine to medium well-sorted feldspathic quartz sand derived from wind reworking of the alluvium. Fractured carbonate bedrock is less than 5 m (16 ft) below the land surface. The unit encompasses deposits that accumulated in river and stream valleys during the late Wisconsin as well as exhumed Pre-Illinois Episode deposits of the Wolf Creek and Alburnett formations.

Qsc2

Qsc2 - Loamy Sediments Shallow to Glacial Till (Unnamed erosion surface sediment) - 1 to 6 m (3-20 ft) of yellowish brown to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty erosion surface sediment. Map unit includes some areas mantled with less than 1 m (3 ft) of Peoria Formation (silt or sand facies). Overlies massive, fractured, slightly firm glacial till of the Sheldon Creek Formation.

Qsc

Qsc - Glacial Till (Sheldon Creek Formation-Undifferentiated) - Generally 3 to 15 m (10-50 ft) of yellowish brown to gray, calcareous fractured to massive clay loam; this unit can be variably textured and contain significant sand and gravel bodies. The upper 3 to 7 m (10-20 ft) may be periglacially altered. This unit overlies Pre-Illinois diamicton or Devonian carbonate bedrock and is only shown on the cross-section.

Qsc3

Qsc3 - Loamy and Sandy Sediment Shallow to Rock (Unnamed erosion surface sediment) - Generally 1 to 6 m (3-20 ft) of yellowish brown to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty erosion surface sediment. Map unit includes some areas mantled with less than 3 m (10 ft) of Peoria Formation sand facies (eolian sand). Overlies fractured Devonian carbonate bedrock.

PRE-ILLINOIS EPISODE

Qwa3

Qwa3 - Till (Wolf Creek or Alburnett formations) - Generally 3 to 15 m (10-50 ft) of very dense, massive, fractured, loamy glacial till of the Wolf Creek or Alburnett formations. This mapping unit can be buried by glacial sediments (Sheldon Creek Formation), unnamed erosion surface sediments, loess, or alluvium and is shown only on the cross-section.

PALEOZOIC

DEVONIAN SYSTEM

Dlgc

Dlgc - Dolomite, Limestone, and Shale (Lithograph City Formation) Middle to Upper Devonian - This map unit comprises most of the bedrock surface and attains a maximum thickness of up to 24 m (80 ft) within the mapping area. It consists of dolomite and dolomitic limestone, partially characterized by interbeds of laminated lithographic and sublithographic limestone and dolomitic limestone, in part argillaceous or with minor shale. "Birdseye," vugs and calcite vug-fills are common. Some intervals are fossiliferous and stromatoporoid-rich. This unit is shown only on the cross-section, not on the map.

Dcv

Dcv - Limestone and Dolomite (Coralville Formation) Middle Devonian - The thickness of this map unit varies between 12 and 18 m (40-60 ft) within the mapping area. It is dominated by limestone, dolomitic limestone, and dolomite, in part, laminated and argillaceous. Brachiopods, echinoderm debris and corals usually occur in the limestone facies. This unit occurs at the bedrock surface within the Cedar River channel throughout the mapping area as well as in the southern portion of the Otter Creek channel. This unit is shown only on the cross-section, not on the map.

Dlc

Dlc - Dolomite and Limestone (Little Cedar Formation) Middle Devonian - The thickness of this formation is approximately 40 m (130 ft) within 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, especially in the lower portion. This unit is shown only on the cross-section, not on the map.

OTHER FEATURES

Qpq

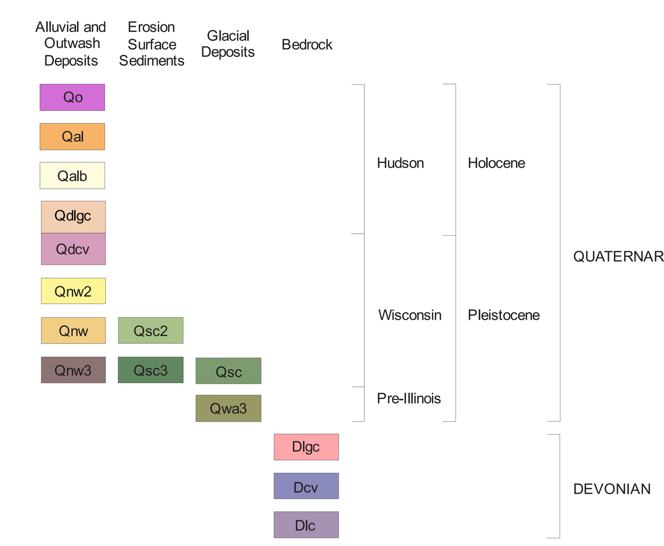
Qpq – Pits and Quarries Sand and gravel pits and rock quarries - Extent mapped as shown in county soil surveys and as identified on aerial imagery.

Water Features - Rivers, lakes, and small ponds. Extent mapped as shown in county soil surveys and as identified on aerial imagery.

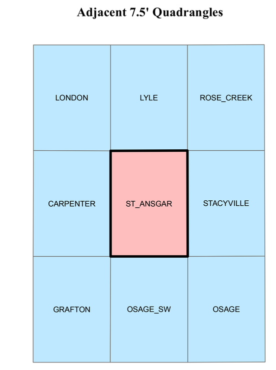
New Drill Holes for this map project

IGS GEOSAM Data Points- records available at www.iowageologicalsurvey.com

CORRELATION CHART



Adjacent 7.5' Quadrangles



SURFICIAL GEOLOGY OF THE ST. ANSGAR 7.5' QUADRANGLE, MITCHELL COUNTY, IOWA

Iowa Geological Survey
Open File Map OFM-14-6
September 2014

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Iowa Geological Survey, Robert D. Libra, State Geologist

Supported in part by the U.S. Geological Survey
Cooperative Agreement Number G13AC00175
National Cooperative Geologic Mapping Program (STATEMAP)

ACKNOWLEDGMENTS

Special thanks to Robert and Andrea Wrage and Eric Kline, as well as the Croell Redi-Mix, Green Limestone, Heartland Asphalt, Martin Marietta, and L.R. Construction companies for allowing us access to their properties. New subsurface geologic data was mostly generated by Michael Bounk of the Iowa Department of Natural Resources (IDNR) by producing descriptive logs of water well drilling samples. Jason Vogelgesang and Zachary Demanett of the Iowa Geological Survey (IGS) prepared well cutting samples for stratigraphic logging. Bill Bunker, Ray Anderson, and Brian Witzke (IDNR) provided valued background information concerning the bedrock topography, geology, and Devonian stratigraphy of the area. Mary Howes and Casey Kohrt (IDNR) provided GIS technical help. Special thanks to the landowners who allowed access to their properties: Marcella Brandt, Larry Bless, Curt Halvorson, Deb Igou, and Dave Tollefson, Mayor, City of St. Ansgar. Also, a special thanks to the Natural Resources Conservation Service staff for collaboration and providing drilling assistance: James Johnson, driller, and Joe Thompson and Kathy Woida, geologists.

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Introduction to the Surficial Geology of the St. Ansgar 7.5' Quadrangle, Mitchell County, Iowa

The St. Ansgar Quadrangle is located in Mitchell County in north-central Iowa. The quadrangle is located on the Wisconsin-age Iowan Surface Landform Region (Prior and Kohrt, 2006). Quaternary deposits in this quadrangle generally vary in thickness from 0 to 16m (0 to 52 ft). The map area is dominated by unnamed loamy sediments (unnamed erosion surface sediment) of variable thickness overlying Wisconsin-age Sheldon Creek Formation glacial sediments, Pre-Illinoian glacial sediments, or shallow rock. These deposits are regionally extensive as shown by the Des Moines 4° x 6° Quadrangle at a scale of 1:1,000,000 (Hallberg et al., 1991). Significant areas of bedrock outcrop or areas with less than 4.5m (15 ft) of loamy material over rock are present, especially along the Cedar River and its tributaries of Otter Creek, Deer Creek, and Turtle Creek.

Calvin (1902) described and mapped the Quaternary and Paleozoic bedrock geology of Mitchell County. He noted the extreme variability of the till units in Mitchell County and also the presence of significant sand and gravel bodies. Statewide bedrock geologic maps by Hershey (1969), and most recently by Witzke, Anderson, and Pope (2010), depict increased understanding of the complex distribution of geologic units at the bedrock surface across north-central Iowa, including Mitchell County. Previous surficial geologic mapping completed as part of the STATEMAP program adjacent to the project area includes Surficial Geology of Worth County, Iowa (Quade et al., 2012) and Surficial Geology of the Clear Lake East Quadrangle (Quade et al., 2013).

The map region has a rich and complex geologic history punctuated by at least seven periods of glaciation between 2.6 million to 500,000 years before present (Boellstorff, 1978a, b; Hallberg, 1980, 1986). In this area, Pre-Illinois Episode glacial deposits and associated buried soils are overlain by much younger Wisconsin-age glacial deposits. During the earlier and mid Wisconsin-age, ice advances dating from approximately 40,000 to 26,000 years before present deposited materials throughout the map area. In Iowa, this glacial deposit is formally recognized as the Sheldon Creek Formation (Bettis et al., 1996, Bettis, 1997) and in earlier literature is referred to as the "Tazewell till" (Ruhe, 1950). Results from this mapping program and others in Worth and Cerro Gordo counties indicate that the Sheldon Creek glacial materials extend much farther east than was previously thought.

A period of intense cold occurred during the Wisconsin full glacial episode from 21,000 to 16,500 years before present (Bettis, 1989). This cold episode and ensuing upland erosion led to the development of the distinctive landform recognized as the Iowan Surface (Prior, 1976). A periglacial environment prevailed during this period with intensive freeze-thaw action, solifluction, strong winds, and a host of other periglacial processes (Walters, 1996). The result was that surface soils were removed from the Iowan Surface, and the Sheldon Creek and Pre-Illinois till surface was significantly eroded, resulting in the development of a region-wide colluvial lag deposit referred to as a "stone line." Thick packages of stratified loamy and sandy sediments located low in the upland landscape and adjacent to streams are remnants of solifluction lobes associated with the formation of the Iowan Surface. These materials can commonly be found along tributaries of the Cedar River.

Surficial deposits within the map area are composed of six formations: DeForest, Noah Creek, Peoria, Sheldon Creek, Wolf Creek, and Alburnett formations, as well as unnamed erosion surface sediments. Hudson age deposits associated with fine-grained alluvial, organic, and colluvial sediments include the DeForest Formation which is subdivided into the Camp Creek, Roberts Creek, Gunder, Corrington, Flack, and Woden members. The Noah Creek Formation includes coarse sand and gravel associated with outwash from the Des Moines Lobe, as well as coarse to finer grained fluvial deposits associated with local stream and river valleys. Unnamed erosion surface sediments consist of reworked till and slopewash deposits associated with periglacial activity during the Wisconsin ice advance. Areas of Peoria Formation eolian materials are intermittently present mantling most other mapping units, and are more abundant near stream valleys. Sheldon Creek Formation glacial deposits are undifferentiated and occur in northwest and north-central Iowa. The maximum extent of these deposits is still not fully understood. Pre-Illinoian glacial deposits in Iowa consist of two formations: the younger Wolf Creek Formation and the Alburnett Formation. The Wolf Creek is divided into the Winthrop, Aurora, and Hickory Hills members (oldest to youngest). The Alburnett Formation consists of several "undifferentiated" members.

Two bedrock mapping units (Devonian Lithograph City and Coralville formations) are present at the bedrock surface in the quadrangle. The Lithograph City Formation occurs at the bedrock surface over most of the mapping area, and the Coralville Formation is exposed along the Cedar River and Otter Creek. Twenty-six outcrops and one quarry are located in the map area. The Devonian rocks are dominated by carbonates varying between limestone and dolomite, accompanied with minor shale.

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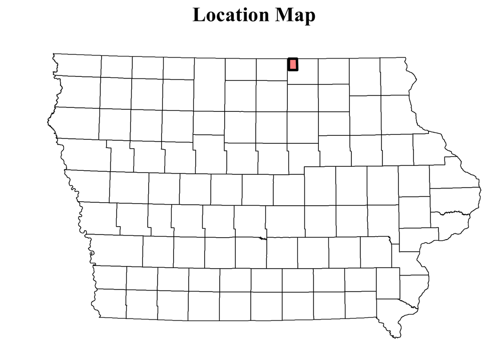
Location Map



Base map from USGS St. Ansgar 7.5' Digital Raster Graphic (IGS GIS file DRGB31.tif) which was scanned from the St. Ansgar 7.5' Topographic Quadrangle map, published by US Geological Survey in 2013 Land elevation contours (10' interval).

Iowa Geological Survey digital cartographic file StAnsgar_SurficialGeology.mxd, version 9/15/14 (ArcGIS 10.1) 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.

Research supported by the U. S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G13AC00175. 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.