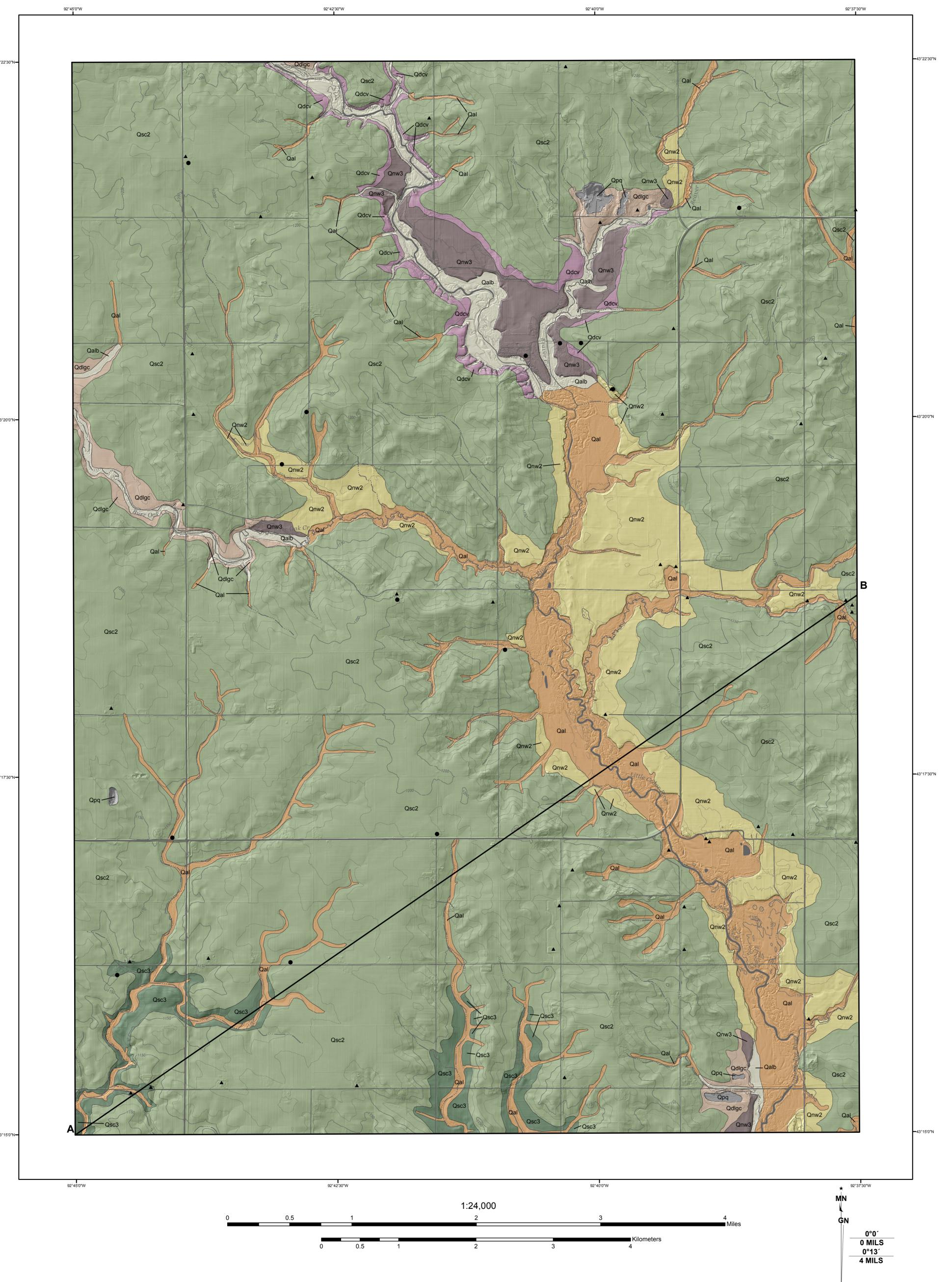
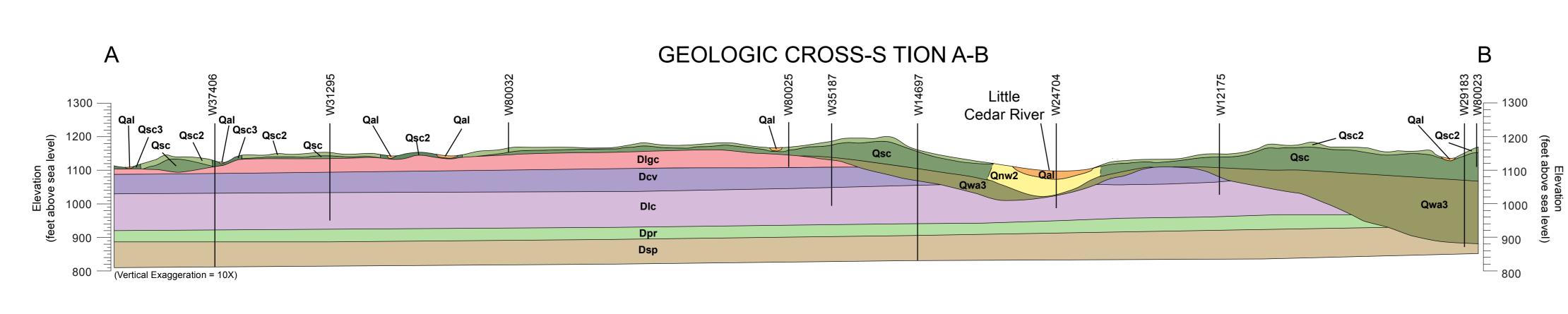
Surficial Geology of the New Haven (Iowa) 7.5' Quadrangle



UTM GRID AND 2015 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



LEGEND

CENOZOIC

QUATERNARY SYSTEM

HUDSON EPISODE

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

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.

area along the banks of Burr Oak Creek and in the southeastern area along the Little Cedar River

HUDSON and WISCONSIN EPISODES

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 attains a maximum thickness of up to 14 m (45 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 little shale. "Birdseye," vugs and calcite vug-fills are common. Some intervals are fossiliferous and stromatoporoid-rich. Outcrops of this map unit are primarily found in the west central part of the mapping

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 Beaver Creek channel.

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

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 - 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.

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 (eolian sand or silt). Overlies fractured Devonian carbonate rocks. Seasonal high water table may occur in this map unit.

Qsc - Glacial Till (Sheldon Creek Formation-Undifferentiated) - Generally 3 to 15 m (10-50 ft) of a yellowish brown to gray, calcareous

PRE-ILLINOIS EPISODE

fractured to massive clay loam; at depth 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. This unit is only shown on the

Qwa3 - Glacial 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), urnamed erosion surface sediments, loess, or alluvium. This unit is shown only on the cross-section.

PALEOZOIC DEVONIAN SYSTEM

of the mapping area along the banks of the Little Cedar River and Burr Oak Creek, and are otherwise restricted to quarries in the mapping area

Dlc - Dolomite and Limestone (Little Cedar Formation) Middle Devonian. Approximately 37 m (120 ft) thick This unit is dominated by

the bedrock surface near the base of the slope of the prominent bedrock valley along the eastern margin of the mapping area. This unit is shown

Dlgc - Dolomite, Limestone, and Shale (Lithograph City Formation) Middle to Upper Devonian - This map unit attains a maximum thickness of up to 14 m (45 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 little shale. "Birdseye," vugs and calcite vug-fills are common. Some intervals are fossiliferous and stromatoporoid-rich. Outcrops of this map unit are primarily found in the northern part

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. Sparse outcrops can be found along parts of the Little Cedar River and Beaver Creek. This unit is shown only on the cross-section.

slightly argillaceous to argillaceous dolomite and dolomitic limestone, usually vuggy and partially laminated and/or cherty, with a moderately continuous shale unit occurring within the upper half of the formation. It is commonly fossiliferous, especially in the lower portion. This unit occurs at the bedrock surface within an east-west trending bedrock valley near the middle of the quadrangle and along the slopes of a prominent bedrock valley along the eastern margin of the mapping area. This unit is shown only on the cross-section.

**Dpr - Dolomite and Limestone* (Pinicon Ridge Formation) Middle Devonian. Ranges from 9 to 15 m (30-50 ft) in thickness. This formation consists of unfossiliferous dolomite and limestone of varying textures (shaly, laminated, brecciated, sandy, and/or cherty) The unit occurs at

Dsp - Dolomite (Spillville Formation) Middle Devonian. Maximum thickness of approximately 24 m (80 ft). This unit is dominated by medium to thick bedded dolomite with scattered to abundant fossil molds. The basal unit, where present, is variably sandy, shaly, and/or conglomeratic with reworked Ordovician chert clasts. This formation only occurs at the bedrock surface within the deepest parts of the

OTHER FEATURES

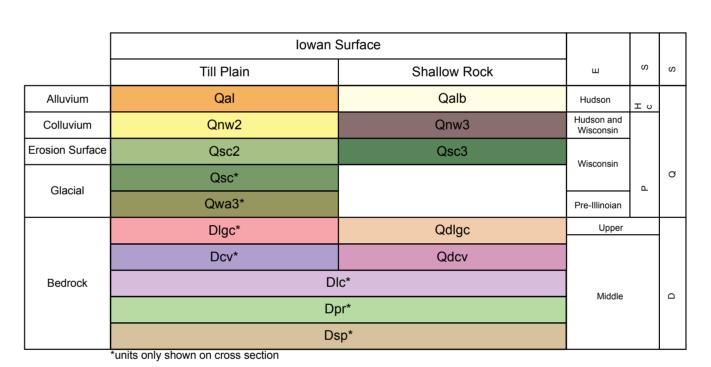
 Qpq − Pits and Quarries - Sand and gravel pits and rock quarries. Extent mapped as shown on the county soil survey and as identified on aerial imagery.

 New Drill Holes for this map project

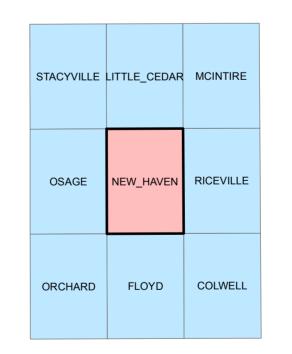
 IGS GEOSAM Data Points- records available at www.iowageologicalsurvey.com

prominent bedrock valley along the eastern margin of the mapping area. This unit is shown only on the cross-section.

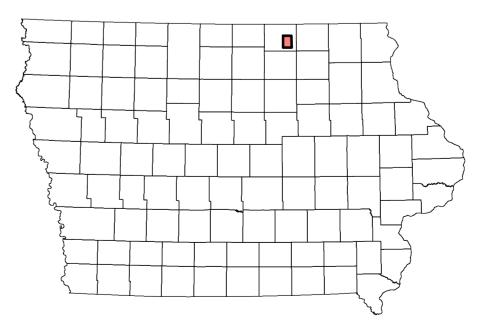
CORRELATION CHART



Adjacent 7.5' Quadrangles



Location Map



Base map from USGS New Haven 7.5' Digital Raster Graphic (IGS GIS file DRGC33.tif) which was scanned from the New Haven 7.5' Topographic Quadrangle map, published by US Geological Survey in 2013

Land elevation contours (10' interval).

lowa Geological Survey digital cartographic file NewHaven_SurficialGeology.mxd, version 6/30/15 (ArcGIS 10.3)
 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 G14AC00229. 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.

SURFICIAL GEOLOGY OF THE NEW HAVEN 7.5' QUADRANGLE,

MITCHELL COUNTY, IOWA

Iowa Geological Survey Open File Map OFM-15-4

Phil Kerr, Matthew T. Streeter, Stephanie Tassier-Surine, Ryan Clark, and Huaibao Liu Iowa Geological Survey, IIHR-Hydroscience & Engineering, University of Iowa, Iowa City, Iowa



Iowa Geological Survey, Robert D. Libra, State Geologist

Supported in part by the U.S. Geological Survey Cooperative Agreement Number G14AC00229



ACKNOWLEDGMENTS

Special thanks to Lindsey Falk of Falk Construction, Inc., Art Weisen, Dan Swann, and Ulland Brothers for allowing us access to their properties. Zachary Demanett and Austin Potthoff of the Iowa Geological Survey (IGS) prepared well cutting samples for stratigraphic logging. Zachary Demanett also assisted with drilling. Bill Bunker, Ray Anderson, Robert McKay, and Brian Witzke (IGS) provided valuable background information concerning the bedrock topography, geology, and Devonian stratigraphy of the area. Thanks also to Rick Langel (IGS) for managing the Iowa geologic sampling database (GEOSAM). Special thanks to the Mitchell County Conservation Board and the landowners who allowed access to their properties: Bill Johanns, Clem Johanns, Randy Kephart, Dorothy Niess, Robert Niess, Rick Sletter, and Dean Wright. 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. Administrative support was provided by Megan Hauswirth, Teresa Gaffey, and Sara Conrad.

Introduction to the Surficial Geology of the New Haven 7.5' Quadrangle, Mitchell County, Iowa

The New Haven 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 14 m (45 ft), but there are several bedrock valleys with the largest being up to 83 m (275 ft) below the surface on the eastern edge of the quadrangle. The map area is dominated by loamy sediments (unnamed erosion surface sediment) of variable thickness overlying Wisconsin-age Sheldon Creek Formation glacial sediments, Pre-Illinoisan glacial sediments, or shallow rock. These deposits are regionally extensive as shown on the Des Moines 4° x 6° Quadrangle at a scale of 1:1,000,000 (Hallberg et al., 1991). Areas of bedrock outcrop or areas with less than 4.5 m (15 ft) of loamy material over rock are present, especially along the Little Cedar River and its tributaries: Beaver Creek, Burr Oak Creek, and Fish 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 northeast Iowa, including Mitchell County. Previous surficial geologic mapping completed as part of the STATEMAP program near the project area includes Surficial Geology of Worth County, Iowa (Quade et al., 2012), Surficial Geology of the Clear Lake East Quadrangle (Quade et al., 2013), Surficial Geology of the Osage Quadrangle (Tassier-Surine, et al., 2014a), and Surficial Geology of the St. Ansgar Quadrangle (Tassier-Surine, et al., 2014b).

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 glacial 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 County 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 be found along the Little Cedar River, Beaver Creek, and Burr Oak Creek.

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 DeForest formation deposits include fine-grained alluvial, organic, and colluvial sediments that are subdivided into the Camp Creek, Roberts Creek, Gunder, Corrington, Flack, and Woden members. The Noah Creek Formation includes coarse sand and gravel 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-Illinoisan glacial deposits in Iowa consist of two formations: the younger Wolf Creek Formation and the Alburnett Formation. The Wolf Creek Formation is divided into the Winthrop, Aurora, and Hickory Hills members (oldest to youngest). The Alburnett Formation consists of several "undifferentiated" members.

Five bedrock mapping units (the Lithograph City, Coralville, and Little Cedar formations of the Cedar Valley Group and the Pinicon Ridge and Spillville formations of the Wapsipinicon Group) are present at the bedrock surface in the quadrangle, with the Lithograph City, Coralville and Little Cedar formations occurring at the bedrock surface over most of the mapping area. Twelve outcrops and three quarries are located in the map area. The Devonian rocks are dominated by carbonates varying between limestone and dolomite, accompanied with minor shale.

References

Bettis, E.A., III, 1989, Late Quaternary history of the Iowa River Valley in the Coralville Lake area *in* Plocher, O.W., Geologic Reconnaissance of the Coralville Lake area: Geological Society of Iowa Guidebook 51, p. 93-100.

Bettis, E.A. III, Quade, D.J., and Kemmis, T.J., 1996, in Hogs, bogs, and logs: Quaternary

deposits and environmental geology of the Des Moines lobe. Iowa Department of Natural Resources-Geological Survey Bureau, Guidebook Series No. 18, 170 p.

Bettis, E.A. III, 1997, Late-Middle and Early-Late Wisconsin Glaciation in North Central Iowa:

Geological Society of America North-Central Section Meeting Abstracts with Programs 29, Issue 4, p. 5.

Boellstorff, J., 1978a, North American Pleistocene Stages reconsidered in light of probable Pliocene-Pleistocene continental glaciation: Science, v. 202, p. 305-307.

Boellstorff, J., 1978b, Chronology of some late Cenozoic deposits from the central United States and the ice ages: Transactions of the Nebraska Academy of Science, v. 6, p. 35-49.
Calvin, S., 1902, Geology of Mitchell County: Iowa Geological Survey Annual Report, v. 13, p.

293-352.

Hallberg, G.R., 1980, Pleistocene stratigraphy in east-central Iowa: Iowa Geological Survey Technical Information Series, v. 10, 168 p.

Hallberg, G.R., 1986, Pre-Wisconsin glacial stratigraphy of the central plains region in Iowa, Nebraska, Kansas, and Missouri: *in* Sibrava, V., Bowen, D.Q., and Richmond, G.M., eds., Quaternary Glaciations in the Northern Hemisphere: Quaternary Science Reviews, v. 5, p. 11-

Hallberg, G.R., Lineback, J.A., Mickelson, D.M., Knox, J.C., Goebel, J.E., Hobbs, H.C., Whitfield, J.W., Ward, R.A., Boellstorf, J.D., and Swinehart, J.B., 1991, Quaternary geologic map of the Des Moines 4° x 6° quadrangle, United States: U.S. Geological Survey,

Miscellaneous Investigations Series, Map I-1420, 1:1,000,000 scale map sheet.

Hershey, H. G., 1969, Geologic map of Iowa: Iowa Geological Survey, scale 1:500,000.

Prior, J.C., 1976, Landforms of Iowa: Iowa City, Iowa, University of Iowa Press, 154 p.

Prior, J.C., 1976, Landforms of Iowa: Iowa City, Iowa, University of Iowa Press, 134 p.

Prior, J.C. and Kohrt, C.J., 2006, The Landform Regions of Iowa: Iowa Geological Survey, digital map, available on IDNR NRGIS Library.

Quade, D., Tassier-Surine, S., Liu, H., McKay, R.M., and Giglierano, J.D., 2012, Surficial

Geology of Worth County, Iowa, scale 1:100,000: Iowa Geological and Water Survey, Open File Map OFM-2012-2.

Quade, D., Tassier-Surine, S., Liu, H., McKay, R.M., Rowden, R., and Giglierano, J.D., 2013, Surficial Geology of the Clear Lake East 7.5' Quadrangle, Cerro Gordo County, Iowa, scale

1:24,000: Iowa Geological and Water Survey, Open File Map OFM-2013-2.

Ruhe, R.V., 1950, Reclassification and correlation of the glacial drifts of northwestern Iowa and adjacent areas: University of Iowa Department of Geology, Iowa City, unpublished Ph.D.

thesis, 124 p.
Tassier-Surine, S., Quade, D., Streeter, M., Kerr, P., Rowden, R., McKay, R., Liu, H., Clark, R., and Galer, R., 2014a, Surficial Geology of the Osage Quadrangle, Mitchell County, Iowa:

Iowa Geological Survey, Open File Map OFM-14-8, 1:24,000 scale map sheet.

Tassier-Surine, S., Quade, D., Streeter, M., Kerr, P., Rowden, R., McKay, R., Liu, H., Clark, R., and Galer, R., 2014b, Surficial Geology of the St. Ansgar Quadrangle, Mitchell County, Iowa: Iowa Geological Survey, Open File Map OFM-14-6, 1:24,000 scale map sheet

Walters, J.C., 1996, General and environmental geology of the Cedar Falls/Waterloo Area, The Iowan Surface, *in* general and environmental geology of Cedar Falls/Waterloo and surrounding area, Northeast Iowa: Iowa Geological Survey Guidebook Series No. 22, p. 7-9. Witzke, B.J., Anderson, R.R. and Pope, J.P., 2010, Bedrock Geologic Map of Iowa, scale: 1:500,000,: Iowa Geological and Water Survey, Open File Digital Map OFM-10-1.