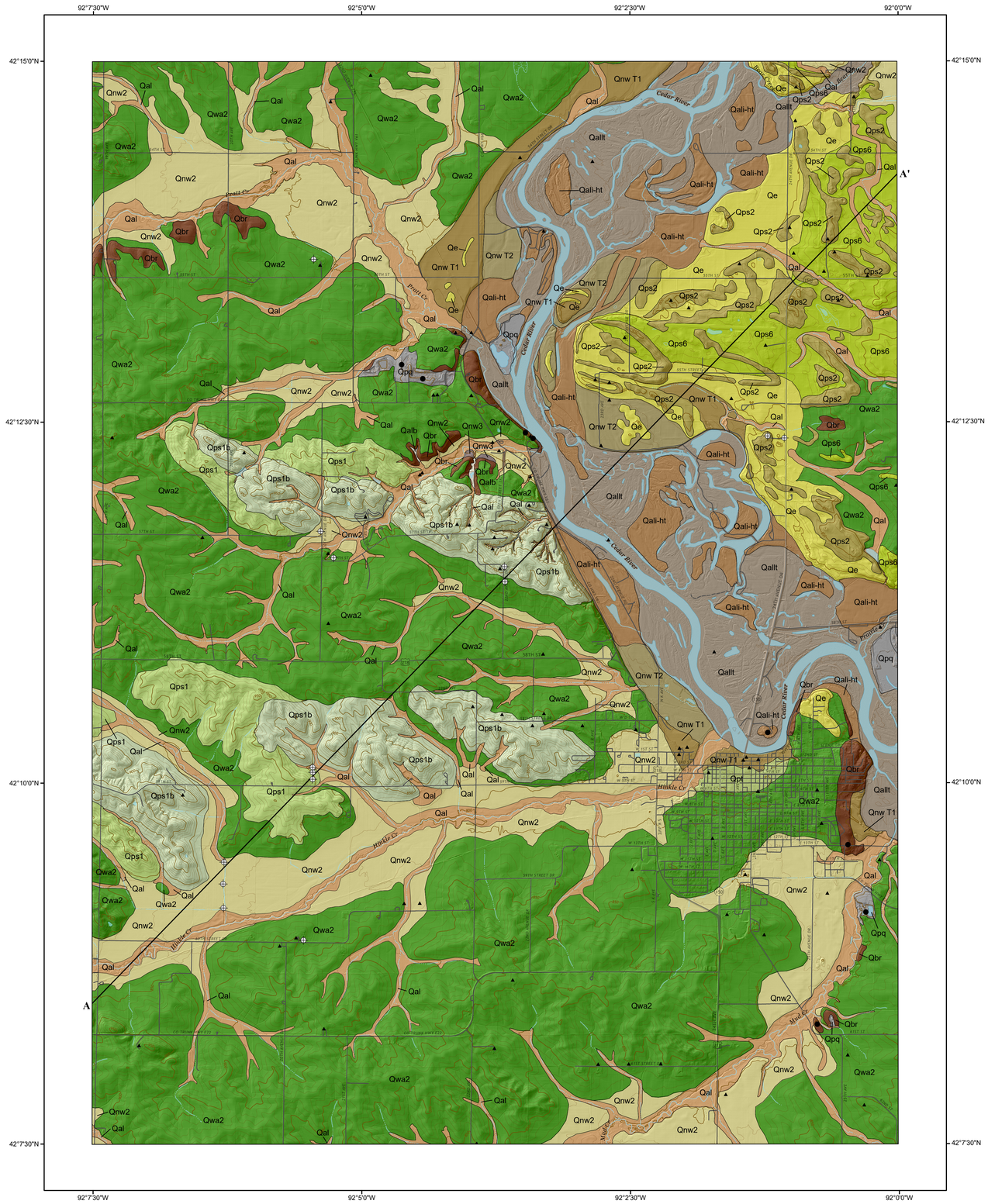
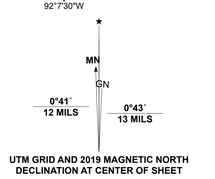
Surficial Geologic Map of the Vinton (Iowa) 7.5' Quadrangle





UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

1:24,000

0 0.5 1 2 3 4 Miles

0 0.5 1 2 3 4 Kilometers

CONTOUR INTERVAL 10 FEET

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, stratified silty clay loam, clay loam, loam to sandy loam alluvium and colluvium in stream valleys, on hill slopes and in closed depressions. May overlie Wolf Creek or Alburnett formation glacial tills, Peoria Formation loess or eolian sand, or Wisconsinan sand and gravel. Associated with low-relief modern floodplains, closed depressions, modern drainageways or toeslope positions on the landscape. Seasonal high water table and potential for frequent flooding.

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, 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 the Noah Creek, Wolf Creek/Alburnett formations, or fractured Devonian bedrock. Bedrock surface is within 5 m (16 ft) of the land surface. Associated with low-relief modern floodplains, closed depressions, modern drainageways, or toeslope positions on the landscape. Seasonal high water table and potential for frequent flooding.

Qalt - Low Terrace (DeForest Formation - Camp Creek and Roberts Creek members) Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous, stratified silty clay loam, loam, or clay loam, associated with the modern channel belt of the Cedar River and its tributaries. Overlies Wisconsinan sand and gravel of the Noah Creek Formation. Occupies the lowest position on the floodplains, i.e., the modern channel belts. Seasonal high water table and frequent flooding potential.

Qali-ht - Intermediate-High Terrace (DeForest Formation - Roberts Creek and Gunder members) Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous, silty clay loam to loam alluvium or colluvium. Overlies Wisconsinan sand and gravel of the Noah Creek Formation or Devonian aged bedrock. Occupies terrace and valley margin positions 1 to 2 m (3-7 ft) above the modern floodplain of the Cedar River and its tributaries. Seasonal high water table and low to moderate flooding potential.

HUDSON AND WISCONSIN EPISODE

Qnw2 - Sand and Gravel (Noah Creek Formation) Generally 2 to 10 m (6-33 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. A thin mantle of loess, reworked loess, or fine-grained alluvium may be present. This unit includes silty colluvial deposits derived from the adjacent map units. This unit encompasses "pre-Gunder Member" deposits that accumulated in low-relief stream valleys like Hinkle, Mud, and Pratt creeks during the Wisconsin and Hudson episodes. Seasonal high water table and some potential for flooding.

Qnw3 - Sand and Gravel Shallow to Bedrock (Noah Creek Formation) 1 to 6 m (3-20 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 3 m (10 ft) of silty alluvial material. In places, this unit can be mantled with fine to medium well-sorted feldspathic quartz sand derived from wind reworking of the alluvium. Fractured carbonate bedrock is less than 6 m (20 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.

Qe - Sand Dunes and Sand Sheets (Peoria Formation - sand facies) Generally less than 3 m (10 ft) of yellowish brown, massive, calcareous loamy sand to fine sand. It occurs as sand stringers or dunes overlying Wisconsin aged outwash or bedrock.

WISCONSIN EPISODE

Qps6 - Eolian Dunes and Sand Sheets Shallow to Glacial Till (Peoria Formation - sand facies) Generally 2 to 4 m (7-14 ft) of yellowish brown, massive to well-stratified, noncalcareous, fine to medium, well-sorted feldspathic quartz sand. Overlies pebbly loam erosion surface sediment which, in turn, overlies eroded massive, jointed, firm, loamy glacial till of the Wolf Creek or Alburnett formations.

Qps2 - Eolian Sand and Intercalated Silt (Peoria Formation - sand facies) Generally 5 to 15 m (16-49 ft) of yellowish brown to gray, moderately to well-stratified noncalcareous or calcareous, fine to medium, well-sorted, eolian sand. May contain interbeds of yellowish brown to gray, massive, silt loam loess. This unit may form large dunes in river valleys or the upland landscape. Overlies eroded, massive, fractured, loamy glacial till of the Wolf Creek or Alburnett formations or fractured Devonian-age carbonate bedrock.

Qps1 - Loess and Intercalated Eolian Sand (Peoria Formation - silt and/or sand facies) Generally 2 to 5 m (7-16 ft) of yellowish brown to gray, massive, fractured, noncalcareous grading downward to calcareous, silt loam and intercalated fine to medium, well-sorted sand. Sand is most abundant in the lower part of the eolian package. Overlies massive, fractured, loamy glacial till of the Wolf Creek or Alburnett formations with or without the intervening clayey Farmdale/Sangamon Geosol.

Qps1b - Thick Loess and Intercalated Eolian Sand (Peoria Formation - silt and/or sand facies) Generally 5 to 15 m (16-49 ft) of yellowish brown to gray, massive, noncalcareous grading downward to calcareous silt loam and intercalated fine to medium, well-sorted sand. Minimum thickness of 5 m (16 ft) on uplands. Maximum thickness of 2 to 7 m (6 - 23 ft) of loess occurs on adjacent slopes. Overlies massive, fractured, loamy glacial till of the Wolf Creek or Alburnett formations with or without the intervening clayey Farmdale /Sangamon Geosol.

Qpt - Loess Mantled Terrace (Peoria Formation - silt and/or sand facies) 2 to 8 m (7-26 ft) of yellowish brown to gray, massive, jointed, calcareous or noncalcareous, silt loam and intercalated fine to medium, well-sorted sand. May grade downward to poorly to moderately well-sorted, moderately to well-stratified, coarse to fine feldspathic quartz sand, loam, or silt loam alluvium (Late Phase High Terrace) or may overlie a Farmdale Geosol developed in Pisgah Silt which, in turn, overlies a well-expressed Sangamon Geosol developed in poorly to moderately well-sorted, moderately to well-stratified, coarse to fine sand, loam, or silt loam alluvium (Early Phase High Terrace). This unit is associated with the Cedar River valley.

Qnw T2 - Sand and Gravel (Noah Creek Formation) Up to 28 m (93 ft) of 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 Devonian carbonate bedrock or the Wolf Creek or Alburnett formations. This unit encompasses outwash deposits that accumulated in valleys during the Wisconsin Episode in the Cedar River valley. This unit represents the younger, lower terrace and generally sits 7 m (23 ft) above the modern channel.

Qnw T1 - Sand and Gravel (Noah Creek Formation) Up to 30 m (100 ft) of 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 Devonian carbonate bedrock or the Wolf Creek or Alburnett formations. This unit encompasses outwash deposits that accumulated in valleys during the Wisconsin Episode in the Cedar River valley. This unit represents the older, higher terrace and generally sits 3 m (10 ft) above the lower terrace and 10 m (33 ft) above the modern channel.

Qwa2 - Loamy and Sandy Sediment Shallow to Glacial Till (Unnamed erosion surface sediment) Generally 2 to 8 m (6-26 ft) of yellowish brown to gray, massive to weakly-stratified, well to poorly-sorted loamy, sandy and silty lowan Erosion Surface sediment. Map unit includes some areas mantled with less than 2 m (7 ft) of Peoria Formation materials (loess and eolian sand). Overlies massive, fractured, firm, glacial till of the Wolf Creek and Alburnett formations. Seasonal high water table may occur in this map unit.

PRE-ILLINOIS EPISODE

Qwa3 - Glacial Till (Wolf Creek or Alburnett formations) - Generally 3 to 15 m (10-50 ft) but can be more than 73 m thick (240 ft) within the bedrock valley in the southeast part of the mapping area. This mapping unit consists of very dense, massive, fractured, clay loam glacial till of the Wolf Creek or Alburnett formations. This mapping unit can be overlain by unnamed erosion surface sediments, colluvium, outwash, loess, eolian sand, or alluvium. This unit is shown only on the cross-section.

OTHER MAPPING UNITS

Qbr - Loamy Sediments Shallow to Dolomite, Limestone, and Shale (DeForest, Peoria, Wolf Creek and Alburnett 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 sediments that overlie the Devonian bedrock surface. All areas of bedrock outcrop or shallow to bedrock soils are shown in red on the map. For detailed description of bedrock units see the accompanying bedrock map, Lui et al., 2019.

OTHER FEATURES

Water features - Rivers, lakes and small ponds. Extent mapped as shown on the USGS 7.5' topo map.

New drill holes for this map project

Bedrock outcrops

IGS GEOSAM data points - records available at www.iowageologicalsurvey.org

W91585 **Wells used for geologic cross-section** - labels in bold represent new drill holes

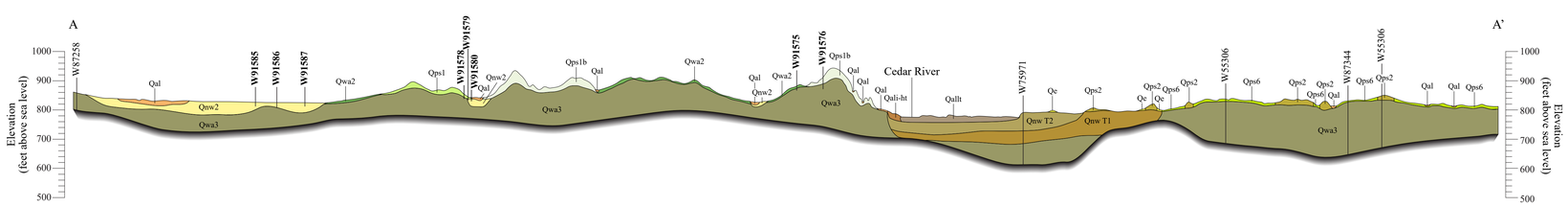
Qpq **Qpq - Pits and Quarries** - Sand and gravel pits and rock quarries. Extent mapped as shown on the county soil survey and as identified on aerial imagery.

Correlation of Map Units

General Lithology	Iowan Erosion Surface: Cedar River Valley	Iowan Erosion Surface: Pre-Illinoian Till Plain	Iowan Erosion Surface: Shallow Rock	Episode	Series	System
Alluvium	Qal; Qalt; Qali-ht	Qal	Qalb	Hudson	Holocene	Quaternary
Colluvium		Qnw2	Qnw3	Hudson and Wisconsin		
Eolian Sand	Qe	Qps6	Qe			
	Qps2			Wisconsin	Pleistocene	
Loess	Qpt	Qps1	Qps1b; Qps1b			
Outwash	Qnw T2; Qnw T1					
Erosion Surface and Glacial Till		Qwa2				
	Qwa3[1]			Pre-Illinois		
Bedrock	Qbr			Paleozoic		

[1]Shown only on the cross-section

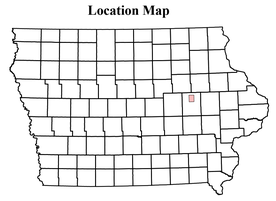
Geologic Cross-Section A-A'



Adjacent 7.5' Quadrangles

LA PORTE CITY, IOWA	BRANDON, IOWA	CHENEY, IOWA
GARRISON, IOWA	VINTON, IOWA	CENTER POINT NW, IOWA
KEYSTONE NORTH, IOWA	VAN HORNE, IOWA	CENTER POINT SW, IOWA

Location Map



Surficial Geologic Map of the Vinton 7.5' Quadrangle, Benton County, Iowa

Iowa Geological Survey
Open File Map OFM-19-8
June 2019

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Supported in part by the U.S. Geological Survey
Cooperative Agreement Number G18AC00194
National Cooperative Geologic Mapping Program (STATEMAP)
This work partially funded by a National Science Foundation Award:
Improving Undergraduate STEM Education: GP-IMPACT-1600429.

Acknowledgments

Special thanks to the landowners who allowed access to their properties for drilling: John Hansen, John Lindall, Larry Moody, Wayne Siela, and Dean and Christine Studer. A special thanks to the staff of the Benton County Conservation board for allowing access onto sites and for many discussions of the geology of the area. The majority of drilling was provided by Mathew Streeter of the Iowa Geological Survey (IGS) with the assistance of University of Iowa (UI) student Brennan Slater. Additional deep drilling was provided by Wendling Quarries, and a special thank you to Drew Frey and John Tuthill for providing that opportunity. UI students Travis Maher and Cornell College student Gabi Hiatt prepared well cutting samples for stratigraphic logging. UI student Nick Johnson assisted with well locations. Thanks also to Rick Langel (IGS) for managing the Iowa geologic sampling database (GeoSam). Special thanks to Kathy Woida of the Natural Resources Conservation Service (retired) and Art Bettis, UI Department of Earth and Environmental Sciences (retired), for assistance with core description and for numerous valuable discussions regarding the geology of the Iowan Erosion Surface. Casey Kohrt and Chris Kahle of the Iowa Department of Natural Resources provided GIS technical help. Administrative support was provided by Suzanne Doershuk, Melissa Eckrich, Teresa Gaffey, Carmen Langel, and Rosemary Tiwari.

Introduction to the Surficial Geologic Map of the Vinton 7.5' Quadrangle, Benton County, Iowa

The Vinton Quadrangle is located in central Iowa on the Iowan Surface landform region, commonly referred to as the Iowan Erosion Surface (IES) (Prior and Korht, 2006). The map area is dominated by dissected till plains with unnamed reworked sediments, sand sheets and dunes, and elongated loess-covered uplands called paha as well as larger 'erosional inliers' (Ruhe et al., 1968; Prior and Korht, 2006). The Cedar River has a signifiicant role in shaping the surficial geology in this area as well. Stratigraphically, this area contains Pre-Illinoian age glacial deposits above Paleozoic carbonates. There are a few areas of shallow bedrock where it is less than 2m (7 ft) from the surface. The thickness of Quaternary deposits in the Vinton Quadrangle is generally between 12 to 30 m (40-100 ft), but bedrock may be more than 60 m (200 ft) from the surface in the southwestern part of the mapping area and in areas along the Cedar River.

The map area has a rich and complex Quaternary geologic history punctuated by at least seven periods of glaciation between 2.6 million and 500,000 years ago (Boellstorff, 1978a, b; Hallberg, 1980, 1986). Episodic erosion over the last 500,000 years has led to the destruction of pre-existing glacial landforms associated with Pre-Illinoian glaciations. While this area was not glaciated during the last glacial episode, the Wisconsin, the effects of the paleoclimate can be seen in deposits throughout the area. This period had an intensely cold and windy environment from 21,000 to 16,500 years ago (Walter, 1994; Bettis and Autin, 1997; Mason, 2015). Due to this climate, a periglacial environment prevailed with intensive freeze-thaw action, solifluction, strong winds, thin plant cover, and a host of other periglacial processes (Baker et al., 1986; Walter, 1994; Mason, 2015; Kerr et al., 2019).

During the formation of the IES, soils that had developed on the upland landscape were removed and the underlying Pre-Illinoian till weathering zone was significantly eroded in this area; this resulted in the development of a region-wide colluvial lag deposit referred to as a "stone line." During this same interval, the Cedar River valley was filled with glacially derived deposits of sand and gravel from the Des Moines Lobe. This outwash provided a local source for wind-derived sediment. The distinctive features of this region are paha and the larger 'erosional inliers.' These are isolated landforms and may represent uneroded topographic highs of loess-mantled Pre-Illinoian till. They have a northwest to southeast alignment (McGee, 1891; Ruhe et al., 1968). This orientation seems to coincide with the regional paleo-prevailing winds (Muhs et al., 2013; Mason, 2015; Kerr et al., 2019). Paha and 'inliers' usually have a thick package of wind-blown material, with some locations in the mapping area having over 12 m (40 ft) of loess and fine sand. Where paha are not present, packages of stratified loamy and sandy sediment cover the upland and hill slope positions on the landscape. This material is thought to be the remnants of solifluction lobes associated with the formation of the IES. The toeslopes and smaller valleys have thick packages of coarse sand and gravel interspersed with loamy and silty layers. Some valleys, like Hinkle Creek, have over 7 m (24 ft) of this coarse material beneath a thin mantle of reworked loess. These valley deposits were developed in response to the shifting climate and base levels during the formation of the IES (Bettis and Autin, 1997).

Surficial deposits in the map area are composed of six formations: the DeForest, Noah Creek, Peoria, Pisgah, 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, and Woden members (Bettis, 1990a; Bettis et al., 1992). The Noah Creek Formation includes coarse sand and gravel associated with outwash from the Des Moines Lobe, as well as coarse to fine-grained fluvial and colluvial deposits associated with local stream and river valleys (Bettis et al., 1996). Unnamed erosion surface sediments consist of reworked till, slopewash, and soliflucted deposits associated with periglacial activity during the late Wisconsin Episode. The Peoria Formation is found across the mapping area and has a silt and sand facies deposited during the Late Wisconsinan Stage (McKay, 1979; Bettis et al., 2003). Generally, the sand facies is found downwind (southeast) of the Cedar River, while the silt facies is found on the upland, especially in paha. Thin deposits of Peoria Formation, less than 1 m (3 ft), are found across most of the mapping area. The Pisgah Formation is comprised of loess and colluvium deposited during the Middle Wisconsinan (Bettis, 1990b). Beneath these materials are Pre-Illinoian glacial deposits, which, in Iowa, consist of two formations: the younger Wolf Creek Formation and the Alburnett Formation (Hallberg, 1980). 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. This project had 17 new drill holes to assist with the geologic characterization.

Underlying the unlithified Quaternary materials are seven formations that are found at the bedrock surface: the Devonian aged Lithograph City, Coralville, Little Cedar, Pinicon Ridge, Otis and Bertram formations and the Silurian LaPorte City Formation. The bedrock surface is dominated by the Little Cedar Formation. Bedrock outcrops occur mainly along the Cedar River. Only eight outcrops were found in the mapping area due to the thickness of the overlying sediment. The Devonian and Silurian rocks are dominated by carbonates, varying between limestone and dolomite and accompanied by minor shale. For further information on the bedrock geology of the Vinton Quadrangle, see the accompanying bedrock geologic map by Liu et al. (2019).

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Base map from USGS Vinton 7.5' Digital Raster Graphic (IGS GIS file IA_Vinton_USGS_topo.tif) which was scanned and modified from the Vinton 7.5' Topographic Quadrangle map, published by The US Geological Survey in 2019
Land elevation contours (10' interval).

Iowa Geological Survey digital cartographic file Vinton_SurficialGeology.mxd, version 6/30/19 (ArcGIS 10.5)
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.

Research supported by the U. S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G18AC00194. 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.