SURFICIAL GEOLOGIC MAP OF THE SPERRY (IOWA) 7.5' QUADRANGLE



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 Glasford Formation glacial till, Peoria Formation loess or eolian sand, or postIllinoian sand and gravel. 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.

Qallt - 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 Flint Creek. Overlies post-Illinoian sand and gravel. Occupies the lowest position on the floodplain, ie., 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 grav to brown, noncalcareous, silty clay loam to loam alluvium or colluvium. Overlies post-Illinoian sand and gravel along Flint Creek. Occupies terrace and valley margin positions 1 to 2 m (3-7 ft) above the modern floodplain. Seasonal high water table and low to moderate flooding potential.

WISCONSIN EPISODE

Qptlp - Late Phase High Terrace (LPHT) (Peoria Formation - silt and/or sand facies) 2 to 7 m (7-23 ft) of yellowish brown to gray, massive, jointed, alcareous or noncalcareous, silt loam and intercalated fine to medium, well sorted, sand. Grades downward to poorly to moderately well sorted, moderately to well stratified, coarse to fine feldspathic quartz sand, loam, or silt loam alluvium.

Qps-gla - Loess (Peoria Formation - silt facies) Generally 2 to 5 m (7-15 ft) of yellowish to grayish brown, massive, jointed, calcareous or noncalcareous silt loam to silty clay loam. May overlie a grayish brown to olive gray silty clay loam to silty clay (Pisgah Formaton - eroded Farmdale Geosol) which is less than Qps-g 1.5 m (5 ft) thick. The Pisgah Formation is in the same stratigraphic position as the Roxanna Silt which is mapped in Illinoi s. The Farmdale Geosol may be welded to an older Sangamon Geosol developed in loamy glacial till of the Glasford Formation. This mapping unit encompasses upland divides, ridgetops and convex sideslopes. Drainage is variable from well drained to poorly drained

ILLINOIS EPISODE

Ogla - Till (Glasford Formation) Generally 3 to 10 m (10-33 ft) of very dense, massive, fractured, loamy glacial till of the Illinoian Glasford Formation with or without a thin loss mantle (Peoria Formation - less than 2 m thick) and intervening clayey Farmdale/Sangamon Geosol. Overlies the Yarmouth Paleosol formed in Pre-Illinoian till. This mapping unit encompasses narrowly dissected interfluves and side slopes, and side valley slopes. Drainage is variable from moderately well drained to poorly drained.

PRE-ILLINOIS EPISODE

Qwa3 - Till (Wolf Creek or Alburnett formations) Generally 5 to 20 m (15-66 ft) of very dense, massive, fractured, loamy glacial till of the Wolf Creek or Alburnett formations. The Yarmouth Paleosol is formed in this unit, and it is overlain by Illinoian till. Drainage is variable from moderately well drained to poorly drained. This unit is shown only on the cross-section.

Qbr - Loamy Sediments Shallow to Dolomite, Limestone, Shale and Sandstone (DeForest, Peoria, and Glasford 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 Mississippian and Devonian bedrock surface. All areas of bedrock outcrop or shallow to bedrock soils are shown in red on the map, regardless of the bedrock mapping unit. Bedrock units are shown only on the cross-section and may be identified on the bedrock map of the Sperry Quadrangle with the following descriptions:

PALEOZOIC

CARBONIFEROUS SYSTEM

MISSISSIPPIAN SUBSYSTEM

Mkeo - Limestone, Dolomite, Chert, and Shale (Keokuk Formation) Upper Osagean. The Keokuk Formation can be up to 23 m (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 ossiliferous, 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). Brachiopods, crinoids, bryozoans, solitary corals, and fish bones and teeth occur throughout this unit as both abraded debris and partly articulated specimens. Molds of sponge spicules are noted in the dolomite facies. Traces of glauconite and minor geodes are also found in this formation. A handful of outcrops were found along small tributaries of Flint Creek in the south-central portion of the mapping area.

Mb – Limestone, Dolomite, and Chert (Burlington Formation) Lower Osagean. The Burlington Formation typically ranges between 12 to 18 m (40 – 60 ft) in thickness, reaching a maximum thickness of 26 m (85 ft) in the southwestern corner of the mapping ar ea. 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. Fossil molds are also present in the dolomite facies. 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. Occasional fish debris and glauconite are also observed in this member. Only a few outcrops of the Burlington Formation were found within the mapping area, along Big Hollow Creek, Yellow Spring Creek, and an unnamed tributary of Flint Creek.



IOWA GEOLOGICAL SURVEY OPEN FILE MAP OFM-18-4 JUNE 2018

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INTRODUCTION TO THE SURFICIAL GEOLOGIC MAP OF THE SPERRY 7.5' QUADRANGLE, DES MOINES COUNTY, IOWA

The Sperry Quadrangle is located in southeastern Iowa on the Southern Iowa Drift Plain landform region (Prior and Kohrt, 2006). The map area is dominated by loess mantled till plains in the uplands, and fine to coarse grained alluvial deposits within Flint Creek and its tributaries. Stratigraphically, this area contains Illinoian age glacial deposits, which are only present in a small area of southeastern Iowa. The terminal moraine for the Illinioian glacial advance is six to eight miles west of the mapping area. The thickness of Quaternary materials varies widely across the quadrangle ranging from 5 to 20 m (15-66 ft), reaching a maximum thickness of 110 m (360 ft) in the southeastern part of the mapping area. Bedrock outcrops are limited in the map area, occurring along Yellow Spring Creek and tributaries to Flint Creek. Mapping the Lowell and Danville quadrangles (Tassier-Surine et al., 2017a,b) provided the first study of the regional Quaternary stratigraphy of southeast Iowa in almost 40 years when Hallberg (1980a,b) established the stratigraphy for the Illinoian and Pre-Illinoian glacial advances in eastern and southeastern Iowa. Three of the drill cores and outcrops for those studies were located in the northern portion of the Sperry Quadrangle and provided a framework for data analysis. 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.

m (20-36 ft) in the mapping area. This unit comprises three formations (in ascending order: the McCraney, Prospect Hill, and Wassonville), characterized y distinct lithologic groupings. These formations are separated by minor unconformities noted by the occasional thinning or absence of one or more units observed within the mapping area. The McCraney 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. A basal oolite is locally present. The Prospect Hill Formation is a light to medium gray, dolomitic siltstone that grades to shale in some locations. This unit is often laminated with vertical and horizontal burrow fabrics and faint cross stratified bedforms. Fossils are rare to absent, although fossil molds are locally abundant. The Wassonville Formation, now including the former Starr's Cave Formation as the basal member, 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. Crinoids (partly articulated) are the dominant fossil type of the Starr's Cave Member. A diverse assemblage of brachiopods are present with lesser amounts of blastoids, starfish, corals, bryozoans, and trilobites reported. Outcrops of the Kinderhookian were not observed within the mapping area.

DEVONIAN SYSTEM

Der - Siltstone and Shale (English River Formation) Upper Devonian, lower to upper Famennian. The English River Formation is up to 7 m (23 ft) thick 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. Outcrops of the English River Formation were not observed within the mapping

Dss - Shale (Saverton Shale Formation) Upper Devonian, lower to upper Famennian. The Saverton Shale Formation can be up to 46 m (150 ft) thick within the mapping area. This unit is dominated by green-gray shale, commonly burrowed with sparse to absent macro-fossils. Outcrops of the Saverton Shale Formation were not observed within the mapping area.

- Shale (Grassy Creek Formation) Upper Devonian, lower to upper Famennian. The Grassy Creek Formation can be up to 52 m (170 ft) thick within he mapping area. This unit is dominated by organic-rich brown shale with minor green-gray shale in the upper part of the unit. Differentiation between the assy Creek and overlying Saverton Shale was primarily based on color and relative abundance of spore scarps identified in well cuttings. Outcrops of the Grassy Creek Formation were not observed within the mapping area.

OTHER FEATURES

- Water features Rivers, lakes and small ponds. Extent mapped as shown in the county soil survey and as identified on aerial imagery.
- New drill holes for this map project
- **Bedrock outcrops**
- IGS GEOSAM data points records available at www.iowageologicalsurvey.org
- W26162 Wells used for geologic cross-section

Dss

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. Qpc

CORRELATION OF MAP UNITS

	Shallow Bedrock	Flint Creek		Upland	Episode	Series	Stage
Alluvium		Qallt Qali-ht		Qal	Hudson	Holocene	λ
Loess	Qbr		Qptlp	Qps-gla	Wisconsin	e	laternar
Glacial Till		Qgla			Illinois	eistocer	β
		Qwa3*			Pre-Illinois	Pie	
Bedrock	Mkeo*						
	Mb*				Mississippian		
	Mk*						

The soil survey of Des Moines County (Brown, M.D., 1983) 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 nine 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 190,000-130,000 years ago (Curry et al., 2011). The Sperry 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 till is 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 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 terraces in Flint Creek. On the uplands, the Peoria Formation is a uniform silt loam; in the valleys the silt commonly grades downward to fine sand.

Coarse sand deposits, ranging in thickness from two to five meters (6-16 ft) are found below the Holocene alluvial units in Flint Creek. The age of these deposits is unknown, but they are younger than the Illinoian deposits. 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 six formations (youngest to oldest): Hudson DeForest; Wisconsin Peoria and Pisgah; Illinoian Glasford; and Pre-Illinoian Wolf Creek and Alburnett. Two bedrock mapping units, the Mississippian Keokuk and Burlington formations, are exposed at the bedrock surface in the Sperry Quadrangle. Four additional units are mapped on the bedrock surface in the quadrangle (Mississippian Kinderhookian formations and the Devonian English River, Saverton Shale, and Grassy Creek formations). See Clark and others (2018) for a detailed bedrock geologic map of the Sperry Quadrangle.

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KINGSTON,

IOWA-ILL.

IOWA-ILL.

Adjacent 7.5' Quadrangles

SPERRY.

IOWA

WEST

IOWA

BURLINGTON, BURLINGTON,

PLEASANT

GROVE, IOWA

DANVILLE,

IOWA





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

lowa Geological Survey digital cartographic file Sperry_SurficialGeology.mxd, version 6/30/18 (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.

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