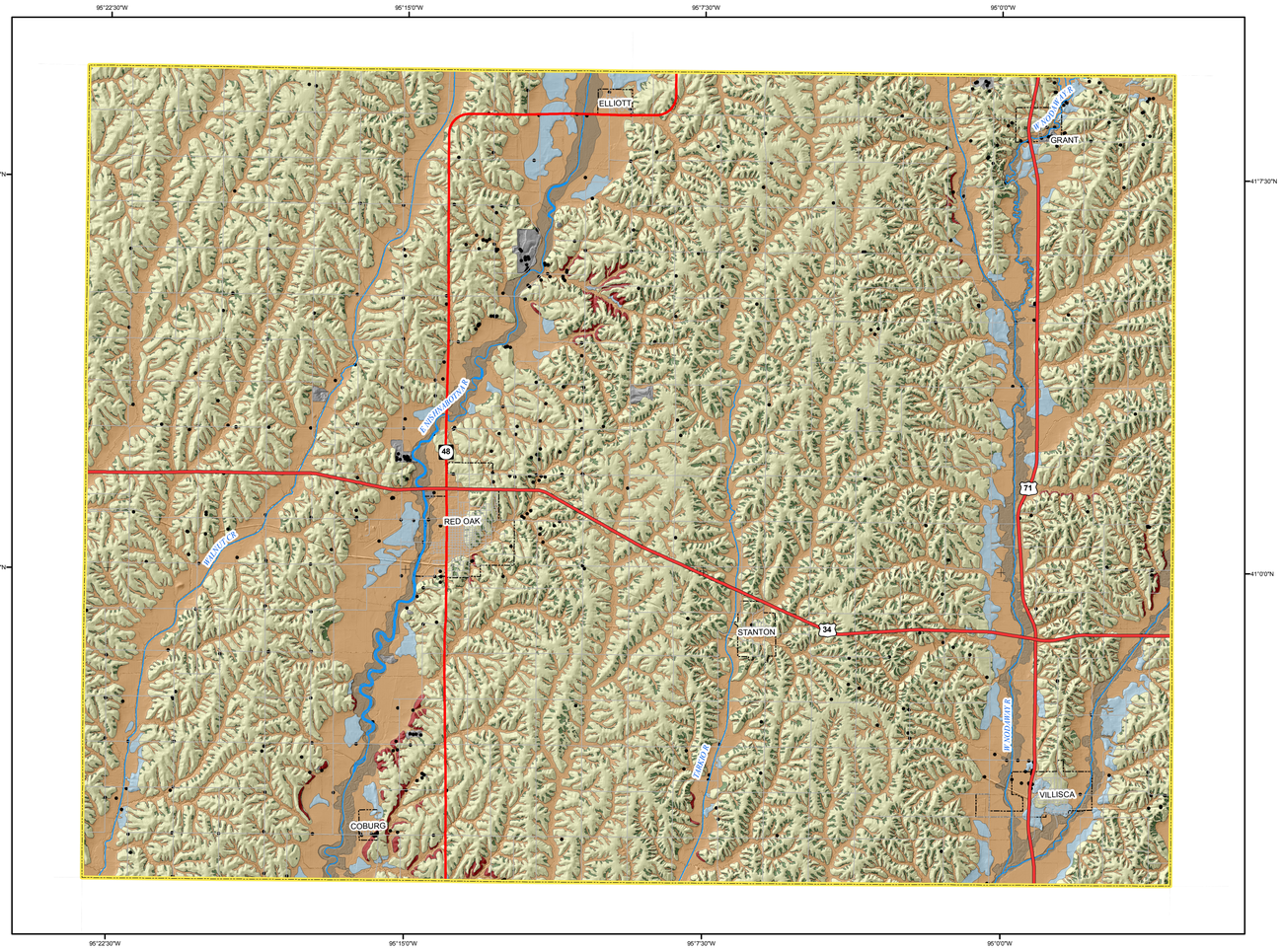
Surficial Geology of Montgomery County, Iowa



1:100,000

0 1 2 4 6 8 Miles

0 1 2 4 6 8 Kilometers

Map Location

N

Base map from iowa DOT Road Map Layers 2009. Shaded relief from Iowa Lidar Project 2007-2011.

MontgomeryCo_SurficialGeology2012.mxd, version 10/16/12 (ArcGIS 10.0)
Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15, datum NAD83.

The map is based on interpretations of the best available information at the time of mapping. Map interpretations are not a substitute for detailed site specific studies.

SURFICIAL GEOLOGY OF MONTGOMERY COUNTY, IOWA

Iowa Geological and Water Survey
Open File Map OFM-12-09
September 2012

prepared by

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LEGEND

CENOZOIC

QUATERNARY SYSYTEM

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 Pre-Illinoain glacial till of the Wolf Creek or Alburnett formations or Pre-Holocene fine-grained alluvium. Associated with low-relief modern floodplain, closed depressions, modern drainageways or toeslope positions on the landscape. Unit also includes colluvial deposits derived from adjacent map units. Seasonal high water table and potential for frequent flooding.

Qalt – River Channel Belt – Low Terrace (DeForest Formation-Camp Creek Mbr. and Roberts Creek Mbr.). 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 East Nishnabotna, West Nodaway, and Middle Nodaway river valleys and Seven Mile Creek. Overlies Pre-Holocene fine-grained alluvium. Occupies lowest position on the floodplain ie. modern and historic channel belts. Ox-bow lakes and meander scars are common features associated with this terrace level. Mapped primarily using aerial imagery and county soil survey data. Seasonal high water table and frequent flooding potential.

HUDSON AND WISCONSIN EPISODE

WISCONSIN EPISODE

Qpt- Loess Mantled Terrace (Peoria Formation –silt and/or sand facies) 2 to 7 m (7-23 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).

Qps – Loess (Peoria Formation—silt facies) Generally 2 to 8 m (6 to 25 ft) of yellowish to grayish brown, massive, jointed calcareous or noncalcareous silt loam to silty clay loam. Limited areas of fine eolian sand may be present near major river valleys. Overlies a grayish brown to olive gray silty clay loam to silty clay (Pisgah Formation—eroded Farmdale Geosol) which is less than 1.5 m (5 ft) thick. The Farmdale may be welded to an older Sangamon Geosol developed in loamy glacial till of the Wolf Creek or Alburnett formations. This mapping unit encompasses upland divides, ridgetops and convex sideslopes. Well to somewhat poorly drained landscape.

PRE-ILLINOIS EPISODE

Qwa3 – Till (Wolf Creek or Alburnett formations) Generally 15 to 100 m (49-328 ft) of very dense, massive, fractured, loamy glacial till of the Wolf Creek or Alburnett formations with or without a thin loess mantle (Peoria Formation—less than 2 m) and intervening clayey Farmdale/Sangamon Geosol. This mapping unit encompasses narrowly dissected interfluves and side slopes, and side valley slopes. Drainage is variable from well drained to poorly drained.

Other Mapping Units

Bedrock- Undifferentiated Paleozoic rock. May be mantled with up to 2 m (6 ft) of Quaternary materials from the adjacent mapping unit.

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 formed by blockage of drainageways and river channels. Extent mapped as shown in county soil surveys and as identified on aerial imagery.

Drill Holes

Introduction to the Surficial Geology of Montgomery County, Iowa

Montgomery County lies within the Southern Iowa Drift Plain (Prior and Kohrt, 2006) landform region of Iowa. Surficial materials consist of a mix of eolian deposits (loess), glacial tillouterop, alluvium, and limited areas of bedrock outcrop. Multiple periods of Quaternary glaciation and subaerial erosion have led to the landscape we see today. Generally speaking, the map area consists of loess of variable thickness overlying Pre-Illinois glacial sediments. These deposits are regionally extensive.

Previous surficial geologic mapping of the area is limited to the Des Moines 4° x 6° Quadrangle at a scale of 1:1,000,000 (Hallberg et al., 1991). Compilation mapping adjacent to the project area in Adams County was completed in 2010 (Tassier-Surine et al.) Lonsdale (1894) first described the Quaternary and mapped the Paleozoic bedrock geology of Montgomery County and discussed the stratigraphy of the Pennsylvanian and Cretaceous strata that comprise the county's bedrock units. Statewide bedrock geologic maps by Hershey (1969), and most recently, by Witzke, Anderson, and Pope (2010), depict the increased understanding of the distribution of geologic units at the bedrock surface across this region, including Montgomery County.

Early researchers believed there were only two episodes of Pre-Illinois glaciation in Iowa: Kansan and Nebraskan (Chamberlin, 1894, 1895; Bain, 1896; Shimek, 1909; Kay and Apfel, 1928; Ruhe, 1969). Later regional studies determined that the original concept of Kansan-Aftonian-Nebraskan was grossly oversimplified and flawed. It is now recognized that there were at least seven episodes of Pre-Illinois glaciation that occurred in this region from approximately 2.2 to 0.5 million years ago (Boellstorff, 1978a, 1978b; Hallberg, 1980a, 1986). Episodic erosion during the last 500,000 years has led to the destruction of pre-existing glacial landforms associated with these glaciations. Boellstorff (1978a, 1978b) and Hallberg (1980a, 1980b, 1986) undertook regional-scale projects that involved detailed outcrop and subsurface investigations including extensive laboratory work and synthesis of previous studies. These studies led to the abandonment of the classic glacial and interglacial terminology: Kansan, Aftonian, and Nebraskan. This study marked a shift from the use of time-stratigraphic terms to lithostratigraphic classification. The result of Boellstorff's and Hallberg's studies was the development of a lithostratigraphic framework for Pre-Illinois till. They developed a general stratigraphic framework for Iowa and eastern Nebraska based on physical stratigraphy, mineralogic criteria as well as magnetostratigraphy and tephrochronology. In western Iowa and eastern Nebraska three lithologically distinctive till assemblages were identified as the 'A', 'B', and 'C' tills, with paleosols sometimes delimiting multiple till units within the A and B till assemblages. Recent work by Balco and Rovey (2010) suggests that a single ice advance around 2.4 Ma deposited the C till and that the A and B till assemblages accumulated between about 1.3 and 0.5*Ma.

The Loveland Loess (Daniels and Handy, 1959; Ruhe, 1969; Bettis, 1990) is the only Illinois or late middle Plesitocene deposit that is currently recognized in western Iowa. Where observed in outcrop, the Sangamon Geosol is developed in the upper part of the Loveland. The Loveland Loess thins away from the Missouri River and the Sangamon Geosol merges with the thick and more weathered Yarmouth-Sangamon Geosol in southern Iowa (Ruhe, 1967).

In Montgomery County, the highly eroded and dissected Pre-Illinois upland and older terraces are mantled by Wisconsin loesses of variable thickness (Ruhe, 1969; Prior, 1976). The Wisconsin loesses are the youngest regionally extensive Quaternary materials and were deposited between 30,000 and 12,000 years ago. Two loess units were deposited across Iowa during Wisconsin time, the older Pisgah Formation and the younger Peoria Loess. The Pisgah is thin and includes loess and related slope sediments that have been altered by colluvial hillslope processes, pedogenic and periglacial processes. The upper part of the unit is modified by development of the Farmdale Geosol. It is not uncommon to see the Farmdale developed throughout the Pisgah and incorporated into the underlying older Sangamon Geosol. The Pisgah Fm. loess was deposited on the western Iowa landscape from about 55,000 to 26,000 years ago (Bettis et al., 2003). The Pisgah Formation is typically buried by Peoria Formation loess. The Peoria Formation loess accumulated on stable landsurfaces in western Iowa from 23,000 to 12,000 years ago.

Surficial deposits of the map area are composed of four formations: DeForest, Noah Creek, Peoria and undifferentiated Pre-Illinois tills. Hudson age deposits associated with fine-grained alluvial and colluvial sediments include the DeForest Formation which is subdivided into the Camp Creek, Roberts Creek, Gunder and Corrington members. The Noah Creek Formation includes coarser grained deposits associated with large valleys which are overlain by finer-grained alluvial material or eolian silt and sand. Peoria Formation eolian materials consist of wind-blown silt that may be up to 8 meters (25 feet) in thickness. Limited areas of eolian sand may be present adjacent to major river valleys (East Nishnabotna and West Nodaway rivers). Additional eolian materials may be intermittently present mantling Wisconsin Episode terraces. Pre-Illinois glacial deposits are exposed in the map area along drainages and where loess cover is thin. Based on existing well data, Pre-Illinois deposits may be as thick as 330' in bedrock valleys.

Soil series units from the Soil Survey of Montgomery County, Iowa (Clark, 1989) were categorized into surficial geologic units based on soil data and available subsurface geologic data from the Iowa Geological and Water Survey's GEOSAM database (water well log database) as well as other existing subsurface data for this compilation map project. Modeling and mapping of the glacial till outcrops was completed using ArcGIS 10.0, gvSIG open source GIS program, and the Sextante landscape classification subprogram.

* We disagree with the younger 0.2 Ma age estimate for Pre-Illinois glaciations presented by Balco and Rovey (2010) and suggest 0.5 Ma is more consistent with regional data and stratigraphic relationships.

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Correlation of Map Units

Alluvial Deposits	Eolian Deposits	Glacial Deposits			
Qal			Hudson	Holocene	QUATERNARY
Qalt					
	Qpt		Wisconsin	Pleistocene	
	Qps				
		Qwa3	Pre-Illinois		
		Ku-Pu			CRETACEOUS/ PENNSYLVANIAN