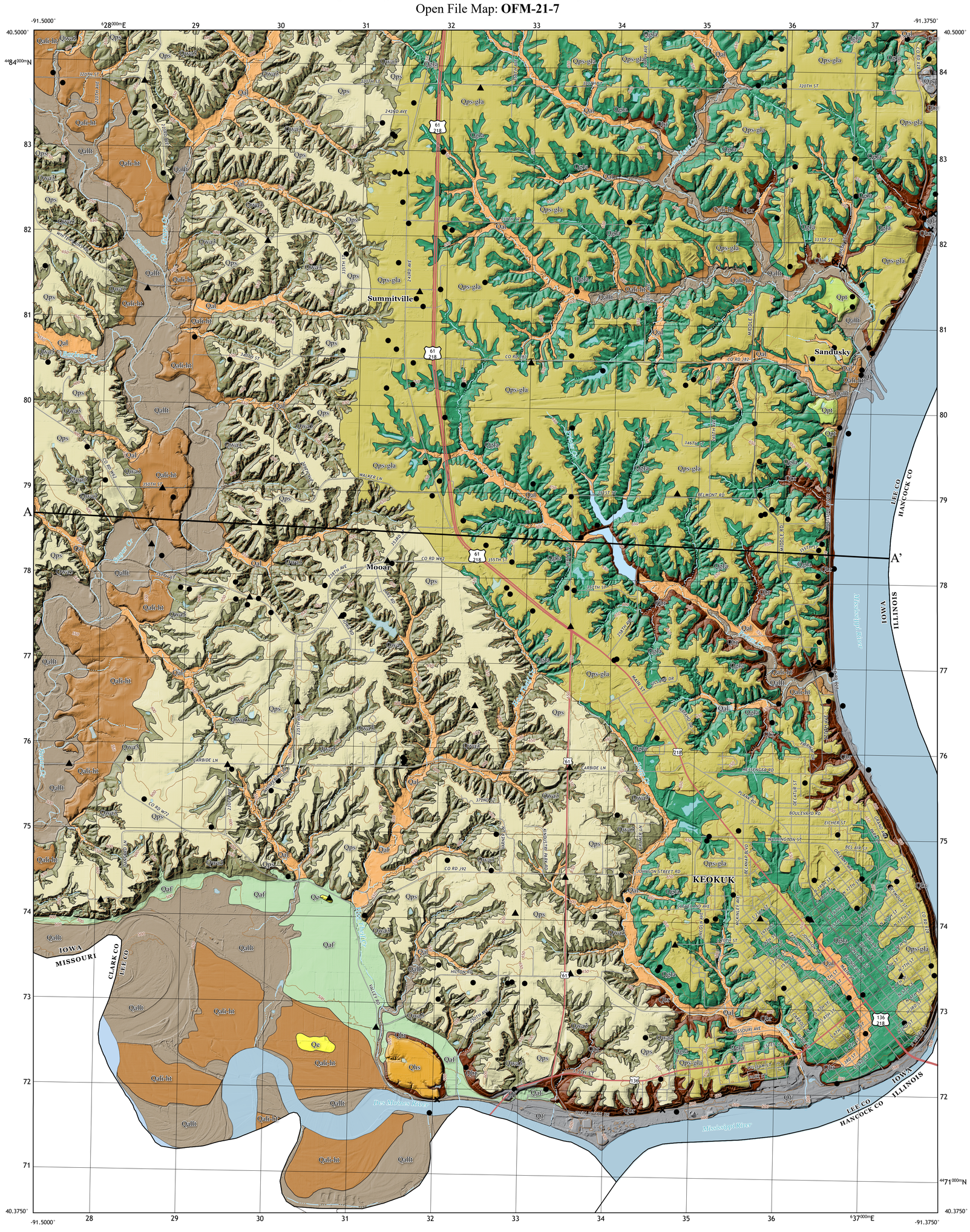
Surficial Geologic Map of the Keokuk 7.5' Quadrangle, Lee County, Iowa, Hancock County, Illinois, and Clark County, Missouri

Stephanie Tassier-Surine, Ryan Clark, and Phil Kerr
Iowa Geological Survey, IIHR-Hydroscience & Engineering, University of Iowa, Iowa City, Iowa

Open File Map: **OFM-21-7**



IOWA GEOLOGICAL SURVEY
Keith Schilling, State Geologist
Published October, 2021

Introduction

The Keokuk Quadrangle is located in Lee County on the Southern Iowa Drift Plain landform region. The map area is dominated by loess-mantled till plains in the uplands, and coarse- to fine- grained alluvial deposits within Sugar, Lamalees, and Prices creeks. Thick sequences of sand and gravel are found in the Des Moines River and are mantled with finer grained deposits. Glacial till is only exposed in drainages and steep side slopes. Stratigraphically, the landscape is mantled with 2 to 5 m (7 – 15 ft) of Peoria Formation loess overlying a paleosol formed in glacial till. In the eastern half of the quadrangle, the Peoria Formation overlies the Illinoian till plain. This glacier did not advance very far into Iowa and the terminal moraine extends roughly north-south through the quadrangle. The Illinoian till generally has a thickness ranging from 3 to 10 m (10 – 33 ft), but reaches a maximum thickness of 15 m (50 ft) near the terminal moraine. The Illinoian till overlies Pre-Illinoian deposits with an intervening Yarmouth Paleosol. To the west of the moraine, loess overlies a well-developed Yarmouth-Sangamon paleosol formed in Pre-Illinoian till. The thickness of Quaternary materials varies widely across the quadrangle ranging from 0 to 18 m (0 – 60 ft), reaching a maximum thickness of 92 m (300 ft) in the western part of the mapping area. Bedrock exposures are found along the Mississippi River and its tributaries. Mississippian and Pennsylvanian strata dominate the bedrock surface. An accompanying map of the bedrock geology of the Keokuk Quadrangle has been published concurrently with this map (Open File Map OFM-21-6; Clark et al., 2021).

New data collected for this mapping project included five drill cores, 19 passive seismic data points, and investigation of seven outcrops. Many more exposures are present along the Mississippi River bluff and have been described during previous investigations. Additional subsurface information was derived from the analysis of more than 240 water well records, 17 of which have cutting samples that were described as part of this mapping project. More detailed information about the surficial mapping units and stratigraphy may be found in the Summary Map Report of the Keokuk 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 Pre-Illinoian or Illinoian formation glacial till, Peoria Formation loess, or Noah Creek Formation sand and gravel. This unit may include local fan deposits in smaller drainages. 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. The depth to bedrock may be less than 8 m (26 ft) along tributaries of the Des Moines and Mississippi rivers.

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 belts of Sugar and Lamalees, Prices creeks and the Des Moines River. Overlies Noah Creek Formation sand and gravel. Occupies the lowest position on the floodplain (i.e. modern channel belts). Seasonal high water table and frequent flooding potential.

Qali-ht - Intermediate-High Terrace (DeForest Formation - Gunder Member) 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 Noah Creek Formation sand and gravel along Sugar, Prices, and Lamalees creeks and the Des Moines River. May be mantled with 1 to 2 m (3-7 ft) thick stringers of eolian sand along Sugar Creek. Occupies terrace and valley margin positions 1 to 2 m (3-7 ft) above the modern floodplain. Two terrace levels are present in some areas. Seasonal high water table and low to moderate flooding potential.

WISCONSIN EPISODE

Qaf - Alluvial Fan (DeForest Formation - Corrington Member) Variable thickness of 2 to 5 m (7-16 ft) of dark brown to yellowish brown, noncalcareous, silt loam to loam with interbedded lenses of fine sand and silts. A pebble lag is commonly found at or near the fan surface. Overlies thick sand and gravel of the Henry Formation along the Des Moines River River as steep angled fans at the base of low order drainages and colluvial slopes.

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 and small dunes overlying Holocene or Wisconsin alluvial deposits.

Qnw - Sand and Gravel (Noah Creek Formation) Generally 3 to 9 m (10-30 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. This unit is buried by Peoria Formation silt or younger Hudson-age alluvial deposits associated with Sugar Creek and the Des Moines River and encompasses deposits that accumulated in river valleys during the Wisconsin Episode. This unit is shown only on the cross-section.

Qhs - Outwash Sand and Pebbly Sand (Henry Formation, Sabula Member) Coarse to fine sand and pebbly sand mantled with up to 5 m (16 ft) of eolian sand. Comprises the Savanna Terrace complex in the Mississippi Valley.

Qpt - Loess Mantled Terrace (Peoria Formation-silt and/or sand facies) Generally 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 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 Formation- eroded Farmdale Geosol) which is less than 1.5 m (5 ft) thick. The Pisgah Formation is in the same stratigraphic position as the Roxanna Silt which is mapped in Illinois. The Farmdale Geosol 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.

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 Formation - eroded Farmdale Geosol) which is less than 1.5 m (5 ft) thick. The Pisgah Formation is in the same stratigraphic position as the Roxanna Silt which is mapped in Illinois. 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. Well to somewhat poorly drained landscape.

ILLINOIS EPISODE

Qgla - 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 loess mantle (Peoria Formation - less than 2 m) and intervening clayey Farmdale/Sangamon Geosol. The maximum thickness reaches 15 m (50 ft) near the terminal moraine. 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 well drained to poorly drained.

PRE-ILLINOIS EPISODE

Qwa3 - Till (Wolf Creek or Alburnett formations) Generally 10 to 18 m (33-60 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

Qbr - Loamy Sediments Shallow to Dolostone, Limestone, Shale, and Sandstone (DeForest, Noah Creek, Peoria, Glasford, Wolf Creek, or Alburnett formations) Generally 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 Pennsylvanian or Mississippian 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. Qbr is not shown on the cross-section; the corresponding bedrock unit is shown at the surface. Bedrock units are shown on the cross-section and may be identified on the bedrock map of the Keokuk Quadrangle.

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.

Qf - Fill Areas of cut and fill associated with major land disturbances including highways, railroads, and other land development. Deposits may be similar in character to those of adjacent map units, but may also have significant mantles of fill or deep cuts that expose underlying units.

Correlation Chart

General Lithology	Shallow Bedrock	Valley	Illinoian Till Plain	Pre-Illinoian Till Plain	Episode	Series	Stage
Alluvium	Qbr	Qallt	Qal	Qal	Hudson	Holocene	Quaternary
		Qali-ht					
		Qaf			Wisconsin	Pleistocene	
Loess		Qe / Qpt	Qps-gla	Qps			
Outwash		Qnw* / Qhs					
Glacial Till		Qgla			Illinoian		
		Qwa3			Pre-Illinoian		
Bedrock	Pcl*				Pennsylvanian		
	Mpsl*				Mississippian		
	Mws*						
	Mkeo*						
	Mb*						
	Mk*						
	Der*				Devonian		
	Dss*						
	Dgc*						

*Units only shown on the Cross-Section

Map Symbols

- bedrock outcrop
- GeoSam point
- new drill core
- geophysics collection point
- unit contact
- cross-section
- water body
- river/stream

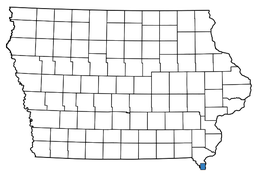
Road Classification

- U.S. Route
- State Route
- Local Road

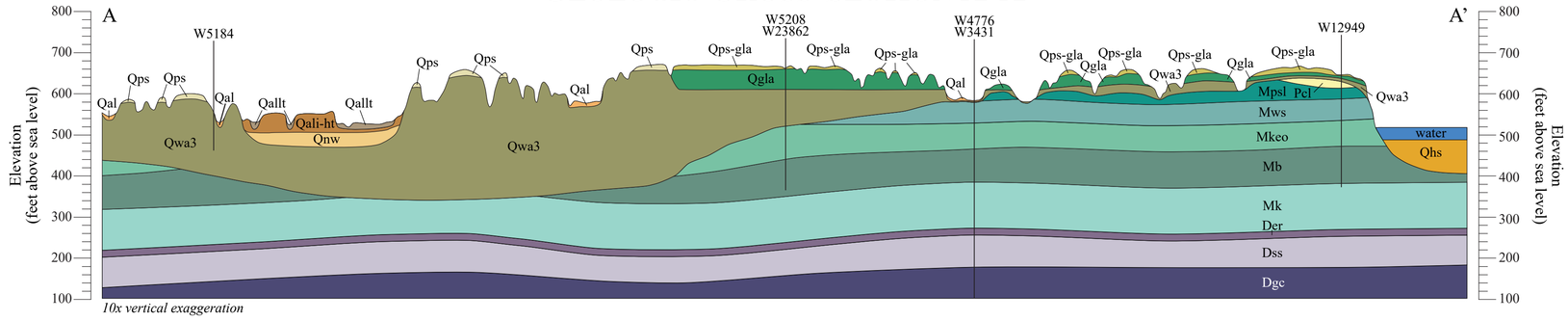
MN
GN
0°54' 17 MILS
0°22' 7 MILS
UTM GRID AND 2021 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

1:24,000
0 0.5 1 2 Miles
0 0.5 1 2 Kilometers
CONTOUR INTERVAL 50 FEET

ADJOINING QUADRANGLES
1 Argyle, IA-MO
2 Nauvoo, IA-IL
3 Niota, IL-IA
4 Wayland, MO-IA
5 Hamilton, IL-IA
6 Kahoka SE, MO
7 Warsaw, IL-MO
8 Sutter, IL



Geologic Cross-Section A-A'



10x vertical exaggeration

Base map from U.S. Geological Survey (USGS) Keokuk 7.5' Quadrangle map, published by the USGS in 2018. 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. 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.

Supported in part by the USGS Cooperative Agreement Number G20AC00243 National Cooperative Geologic Mapping Program (STATEMAP). This work was partially supported by a National Science Foundation Award: Improving Undergraduate STEM Education Grant GP-IMPACT-1600429.

Acknowledgements

Special thanks to the landowners who allowed access to their properties: Jerry and Joan Boecker, Danny and Anny Hodges, Nathan Unsworth (Executive Director) of the Lee County Conservation Board, and John Byrd (Iowa Department of Natural Resources) of Shimek State Forest. Thanks also to Don Smith of Cessford Construction, Co. (Oldcastle Materials) for allowing us to access quarries in and around the mapping area. Drilling was provided by Matthew Streeter of the Iowa Geological Survey (IGS). University of Iowa (UI) Department of Earth and Environmental Sciences (EES) students Dan Bloch, Alethea Kapolis, Allison Kusick, and Brennan Hill helped with various aspects of data collection and management including producing descriptive logs of water well cutting samples, updating well locations, and geophysical data acquisition. Thanks to Rick Langel (IGS) for managing the Iowa geologic sampling database (GeoSam). Special thanks to Kathy Wooda (retired) of the Natural Resources Conservation Service and Art Bettis (retired, UI-EES) for assistance with core description and for numerous valuable discussions regarding the geology of southeast Iowa. 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.