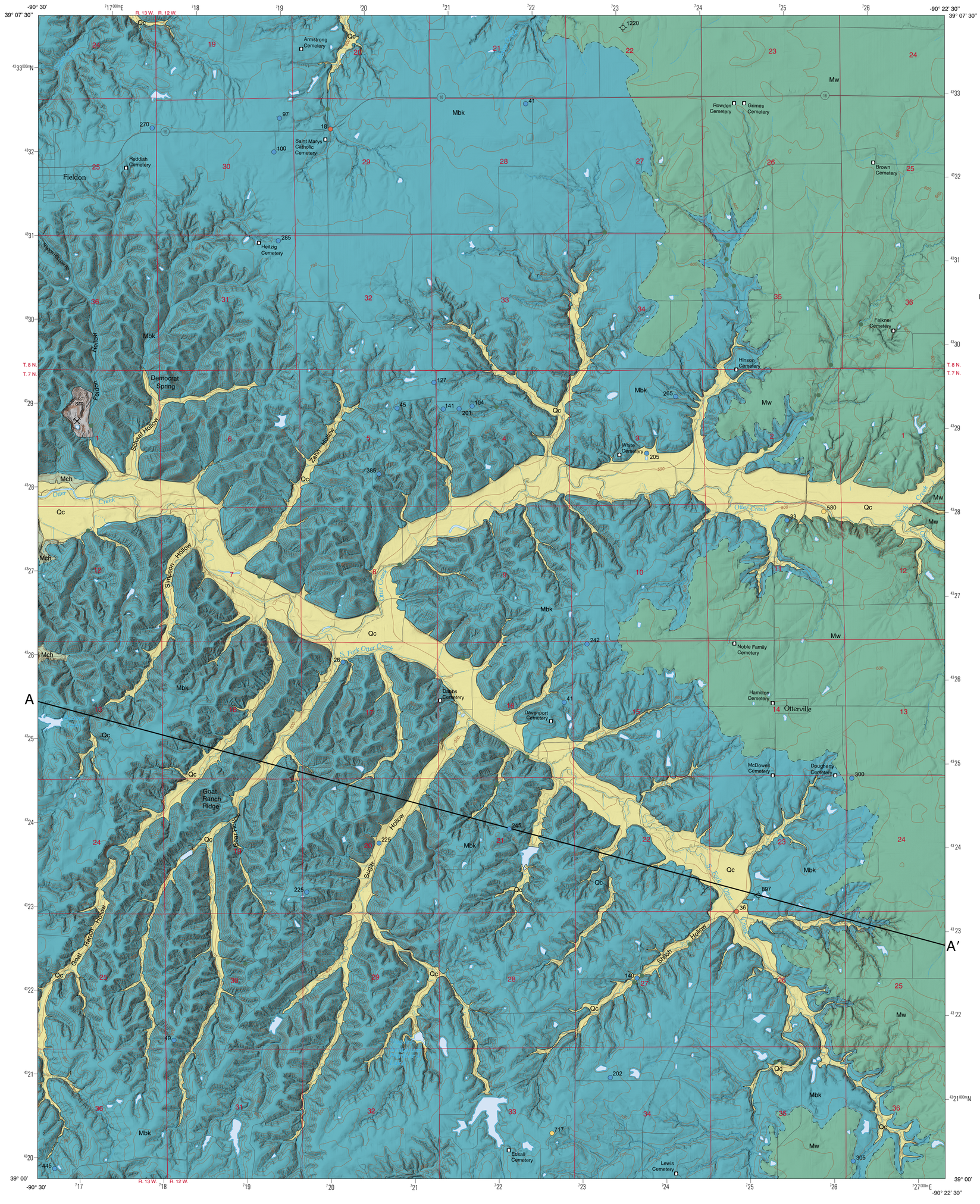
BEDROCK GEOLOGY OF OTTERVILLE QUADRANGLE
JERSEY COUNTY, ILLINOIS

Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

Jeremy R. Breeden, Joseph A. Devera, and F. Brett Denny
2019

STATEMAP Otterville-BG



EXPLANATION

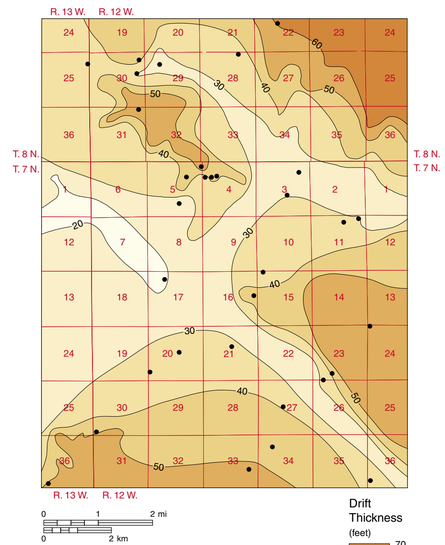
System			Series
	sm	Surface mined area	
Quaternary	Qc	Cahokia Formation	Holocene
	Unconformity		
	Qlt	Loess and till (column only)	Pleistocene
	Unconformity		
Mississippian	Mw	Warsaw Formation	Valmeyeran
	Mbk	Burlington, Keokuk, and Meppen Formations (Meppen not mapped)	
	Mch	Chouteau and Hannibal Formations	Kinderhookian
	Unconformity		
Devonian and Silurian	DS	Louisiana Limestone Unconformity Saverton Formation Unconformity Grassy Creek Shale Unconformity Sylamore Sandstone Unconformity	Upper Devonian
		Cedar Valley Limestone Unconformity	upper Middle Devonian
		Joliet Formation Unconformity	Niagraran
		Kankakee Formation Unconformity Bowling Green Formation (column and cross section only)	Alexandrian
	Unconformity		
Ordovician	Om	Maquoketa Formation (column and cross section only)	Cincinnatian
	Unconformity		
	Ok	Kimmswick Limestone (column and cross section only)	Champlainian
	Ou	Ordovician Undifferentiated (cross section only)	

Point Symbols
- Field Note
- Pit or Quarry

Drill Holes
from which subsurface data were obtained
- Stratigraphic boring
- Water-well boring
- Engineering boring
- Dry Hole
- Numeric labels indicate total depth of boring in feet.

Line Symbols
- Contact certain
- Contact inferred
- A—A′ Line of cross section

Note: Well and boring records are on file at the ISGS Geological Records Unit and are available online from the ISGS website.



Drift thickness of the Otterville Quadrangle. Localities of data that reliably indicate the thickness of Pleistocene sediments are shown. Map scale is 1:100,000.

Base map compiled by Illinois State Geological Survey from digital data (2018 US Topo) provided by the United States Geological Survey. Shaded relief derived from 2011 LiDAR elevation data.

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator
1,000-meter ticks: Universal Transverse Mercator grid system, zone 15

Recommended citation:
Breeden, J.R., J.A. Devera and F.B. Denny, 2019, Bedrock geology of Otterville Quadrangle, Jersey County, Illinois: Illinois State Geological Survey, USGS-STATEMAP contract report, 2 sheets, 1:24,000.

SCALE 1:24,000

1 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

BASE MAP CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1988

Geology based on field work by J. Devera, F. B. Denny, and J. Breeden, 2018 - 2019.

Digital cartography by Jeremy R. Breeden and Emily Bunse, Illinois State Geological Survey.

This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program under StateMap award number G18AC00290, 2018. 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.

This map has not undergone the formal Illinois Geologic Quadrangle map review process. Whether or when this map will be formally reviewed and published depends on the resources and priorities of the ISGS.

The Illinois State Geological Survey and the University of Illinois make no guarantee, expressed or implied, regarding the correctness of the interpretations presented in this document and accept no liability for the consequences of decisions made by others on the basis of the information presented here. The geologic interpretations are based on data that may vary with respect to the accuracy of geographic location, the type and quantity of data available at each location, and the scientific and technical qualifications of the data sources. Maps or cross sections in this document are not meant to be enlarged.

ILLINOIS
Illinois State Geological Survey

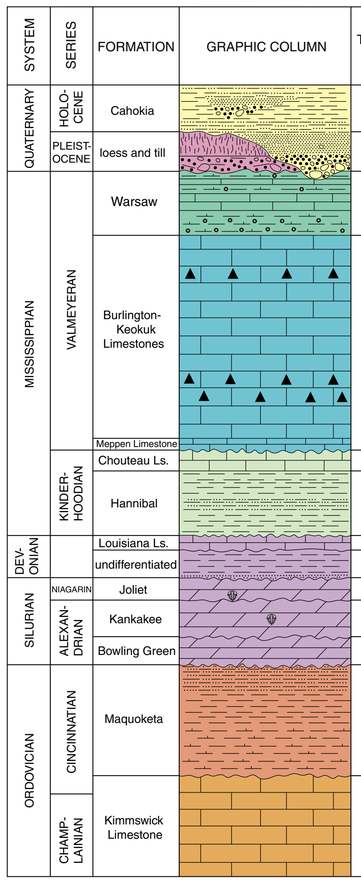
Prairie Research Institute
Illinois State Geological Survey
615 East Peabody Drive
Champaign, Illinois 61820-6918
(217) 244-2414
http://www.isgs.illinois.edu

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Hardin
2 Boyer Creek
3 Jerseyville North
4 Nutwood
5 Jerseyville South
6 Brussels
7 Grafton
8 Elsah

APPROXIMATE MEAN DECLINATION, 2019

ROAD CLASSIFICATION
- State Route
- Local road



A Cahokia Formation Alluvial deposits. Clay, silt, sand and cobbles, and boulders, which are angular to rounded clasts derived from local bedrock and distant sources. All sediment is confined to the Otter Creek system and its tributaries.

B Loess and till Loess consists of yellow brown to reddish brown silt. The windblown silt mantles the ridges of the quadrangle and gradually thins toward the east of the study area. Till consists of a diamicton of clay, silt, sand, gravel, and boulders made of angular local bedrock and rounded igneous and metamorphic erratics. Till is thickest in the northeast and east of the quadrangle.

C Warsaw Formation Mudstone, siltstone, limestone, and dolomite. In the study area this unit is dominated by bluish gray mudstones with thinly interbedded limestones and dolomites. The shale is slightly calcareous and silty in places. Limestones consist of medium to dark gray, crinoidal, bryozoan wackestones and packstones. Dolomite beds are grey to brown and thinly bedded. Fossils include brachiopods, *Archimedes* sp., *Syringapora* sp., gastropods, conularids, and branching, fenestrate, and encrusting bryozoans. Pelmatozoa in this unit are commonly intact. Quartz geodes are abundant in the shaley sequences within the study area. The contact with the underlying unit appears to be gradational with slight intertonguing.

D Keokuk, Burlington, and Meppen Limestones Limestone and chert. Thin to thickly bedded, white to light gray, crinoidal grainstone. Beds can occur as bioclastic cross beds as well. Brachiopods and bryozoans do occur but a majority of this unit is comprised of disarticulated pelmatozoan columns. Common crinoid fossils include *Platycrinites* sp. and *Cactocrinus* sp. Chert is commonly white and can also be fossiliferous and occurs in nodules and beds. The basal contact is unconformable.

E Chouteau Limestone Weathered surfaces of this unit are pale to yellow gray and fresh surfaces are light to medium gray mudstone, and greenish gray wackestones. Beds are thin and undulatory to wavy. Dark grey chert with white rims occurs at regular intervals throughout the unit. Fossils include crinoid and brachiopod fragments that are small and disarticulated. Calcite nodules rimmed with quartz occur on weathered surfaces throughout the unit. The lower contact is sharp and conformable.

F Hannibal Shale Greenish gray to gray, clay with some silty intervals that weathers into a sticky bluish gray clay. The unit can be fissile to massive and is non-calcareous. It was poorly exposed in this quadrangle. The basal contact is unconformable with the unit below.

Formations below do not outcrop in the study area and descriptions are taken from surrounding quadrangles and well log descriptions (Denny and Devera, 2002; Devera and Seid, 2008; Seid and Devera, 2008).

G Louisiana Limestone Brown to gray lime mudstone that conchoidally fractures when struck. The lower contact is unconfomable.

H Devonian undifferentiated Shale, limestone, sandstone. The Devonian section under the Louisiana Limestone of the study area is poorly described in available well logs and is thin and inconsistent as a whole in the region. Units that could occur in the subsurface of the quadrangle in sequence from below the Louisiana Limestone to the top of the Joliet Limestone are the Saverton Formation, Grassy Creek Shale, Sylamore Sandstone, Cedar Valley Limestone, and the Hoing Sandstone Member of the Cedar Valley Limestone. The base of this section is unconformable.

I Joliet, Kankakee, and Bowling Green Formations Dolomite is mostly yellow with a sucrosic appearance. Unit is thin to thick bedded, hard and massive. Thin pale green shales are interbedded in the lower and middle formations. All three formations have moldic porosity. Fossils include brachiopods, bryozoans and trilobites. The trilobite *Gravicalymene celebra* is common in the middle and upper formations. Nodules of white to caramel-colored chert occur throughout. Unconformities occur at the top and base of each unit.

J Maquoketa Formation Bluish gray shale that is calcareous in the lower part and grades to silty in the upper part. Fossil algae is found in an upper facies that is a tan to brown siltstone. The contact is unconformable with the underlying formation.

K Kimmswick Limestone White crinoidal grainstone to packstone in the lower part of the unit. The upper part of the formation has thin beds of fine grained fossil wackestones. Fossils incude the trilobites *Isotelus gigas*, *Calyptaulax* sp., *Bumastus* sp., and *Calliops* sp. *Fisherites reticulatus* (*Receptaculites* sp.), a dasycladasian algae, is an important index fossil for this unit. The brachiopod *Rafinesquina* sp. also occurs in the unit. The lower contact is sharp and conformable with the underlying unit.

Figure 1. Large outcrop of Burlington-Keokuk Limestone north of Yates Road Bridge in the South Fork of Otter Creek. The man in the picture is approximately 5.5' tall.

Figure 2. *Archimedes wortheni* found in the Warsaw Formation in which they are abundant. *Archimedes* sp. is an important index fossil for the Mississippian Period.

Introduction

The Otterville Quadrangle is located in Jersey County Illinois about 35 miles north of St. Louis, Missouri. The main rock types are limestone and shale of Mississippian age. These Paleozoic rocks are, for the most part, covered with Illinoian glacial till in the northeastern half of the quadrangle. The southwestern half of the quadrangle is mantled in loess. Bedrock exposures mainly occur in the southwestern half which yields highly dissected northeast flowing tributaries to Otter Creek. Few outcrops were found in the northeastern part. The overall geology is flat-lying and simple and bedrock dips to the east by northeast at 1° to 2°.

Methods

Geologic mapping was accomplished by traversing ravines and taking notes on natural exposures, examining and field checking old field notes from the ISGS library, and compiling oil and water well data from ILOIL and ILWATER, respectively. Edge matching was also taken in consideration with the Nutwood Quadrangle (Devera and Seid, 2008) to the west, Brussels Quadrangle (Seid and Devera, 2008) to the southwest, Grafton Quadrangle (Denny and Devera, 2002) to the south and Hardin Quadrangle (Seid and Devera, 2015) to the northwest of the Otterville Quadrangle. A drift thickness map (see inset) was constructed by hand based on outcrop and well control data.

Stratigraphy and Paleontology

The oldest unit in the study area is the Hannibal Shale. This shale is poorly exposed and is typically covered by alluvium in the western-most part of the quadrangle in Otter Creek. The Hannibal is a bluish gray shale or claystone that can have thin silty beds. Better exposures were seen in the adjacent Nutwood Quadrangle, Devera and Seid (2008). The Hannibal Shale was also projected into the study area one mile due south of Otter Creek on the western edge of the Otterville Quadrangle. The Hannibal Shale commonly contains the trace fossils *Zoophycus* and *Scalarituba missouriensis*. This unit belongs to the Kinderhookian Series. The Chouteau Limestone was not observed in the study area; however, it does occur in the Nutwood Quadrangle and reached 30 to 45 feet thick, (Devera and Seid, 2008). It occurs in wells in the subsurface of this quadrangle.

Above the Hannibal Shale/Chouteau Limestone is the Burlington/Keokuk Limestone which is a white crinoidal grainstone that contains abundant chert (Fig. 1). This is a calcium-rich limestone mainly comprised of echinoderm fragments and sparry cement. It is a high energy, shallow shelf deposit that can display cross bedding or shoaling. Some facies are devoid of chert. A large area, almost two-thirds of the Otterville Quadrangle is composed of the Burlington/Keokuk Limestones. The Burlington/Keokuk are in the basal part of the Valmeyeran Series.

The Burlington Limestone and Keokuk Limestone are difficult to distinguish because both are dominated by pelmatozoan fragments and are white to light tan or light gray. They can only be separated by the fossils they contain. Fossils restricted to the Burlington include: blastoids, *Globoblastus norwoodi* and *Cryptoblastus melo*, brachiopods, *Dictyoclostus burlingtonensis*, *Rhipidomella burlingtonensis*, and in the lower part of the Burlington is the conodont *Bactrognathus-Polygnatus communis* Zone whereas, the upper part of the Burlington is the *Bactrognathus-Taphrognathus* Zone (Collinson et al., 1971).

Fossils restricted to the Keokuk include: bryozoan, *Worthenopora*, brachiopod, *Orthoteles keokuk* and conodonts *Gnathodus texanus-Taprognathus* Zone (Collinson et al., 1971). The Keokuk typically contains more bryozoan fragments and is therefore generally finer grained than the Burlington Limestone.

Generally, a lithologic way to separate the Keokuk from the Burlington is by the Montrose Chert Member of the Keokuk (not observed in the quadrangle) which occurs at the base of the Keokuk. It is a 30 foot thick cherty limestone, where the chert is blue gray and can be highly brecciated (Collinson, 1964).

The highest bedrock unit in the quadrangle is the Warsaw Shale. It is a bluish gray shale that can contain siltstone beds. Geodes are also common. The most common fossil is the large "corkscrew" bryozoan *Archimedes* sp (Fig. 2). This unit occurs on the eastern side of the quadrangle and gently dips to the east into the basin. An outcrop in a creek in Sec. 2, T7N, R12W, 1300 feet from the east Section line by 2000 feet from the north Section line, contained gray shale and thin wackestone and packstone facies of the Warsaw. Fossils include the crinoid *Platycrinites* sp. (Fig. 3), the bryozoan *Archimedes* sp., and small colonial coral *Syringopora*. Most of the Warsaw is covered by glacial drift. The Warsaw Shale is within the Valmeyeran Series.

Except for the Alluvium, the surficial units were not mapped. The earliest till is the Glasford Formation of Illinoian Stage. It is a gray diamicton with clay, sand, and to boulder sized material. Glacial erratics are common in the drainages. Loess, both Illinoisan and Wisconsinan, are also present found capping the ridge tops.

Economic Geology

Oil tests in the study area have been all dry and abandoned. There is a quarry in the Burlington/Keokuk Limestone on the west side of the quadrangle in Fieldon Hollow, a south-flowing ravine to Otter Creek. There are two quarries in this ravine, one inactive and abandoned on the east side of Fieldon Hollow Road (Fig. 4), and the other semi-active on the west side of Fieldon Hollow Road. The Burlington/Keokuk Limestone is a calcium-rich limestone and is used for aggregate, agricultural lime and hydrated lime for the production of cement.

References

Collinson, C., C. B. Rexroad, and T. L. Thompson, 1971, Conodont zonation of the North American Mississippian: GSA Memoir 127, p. 353-395.

Collinson, C., 1964, Western Illinois: 28th Annual Tri-State Field Conference, Quincy, ILL, ISGS Guidebook Series, 6, 30 p.

Denny, F. B. and J. A. Devera, 2002, Bedrock geology of the Grafton Quadrangle, Jersey and Calhoun Counties, Illinois: Illinois State Geological Survey, IGQ Grafton-BG, 1:24,000 two sheets.

Devera, J. A. and M. J. Seid, 2008, Bedrock geology of Nutwood Quadrangle, Calhoun, Green and Jersy Counties, Illinois: Illinois State Geological Survey, IGQ Nutwood-BG, 1:24,000 two sheets.

Seid, M. J. and J. A. Devera, 2008, Bedrock geology of Brussels Quadrangle: Illinois State Geological Survey, IGQ Brussels-BG, 1:24,000 two sheets.

Seid, M. J. and J. A. Devera, 2015, Bedrock geology of Hardin Quadrangle: Illinois State Geological Survey, IGQ Hardin-BG, 1:24,000 two sheets.

Figure 3. *Platycrinites* sp. column from the Keokuk Formation. Four species of *Platycrinitids* occur within the Burlington, Keokuk, and Warsaw Formations which are prevelant throughout the study area.

Figure 4. Highwall of an abandoned and overgrown quarry in the Burlington Formation. Red arrow pointing to the vertical striation is a borehole drilled for blasting.