BEDROCK GEOLOGY OF CHESTER QUADRANGLE
RANDOLPH COUNTY, ILLINOIS

Illinois Department of Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
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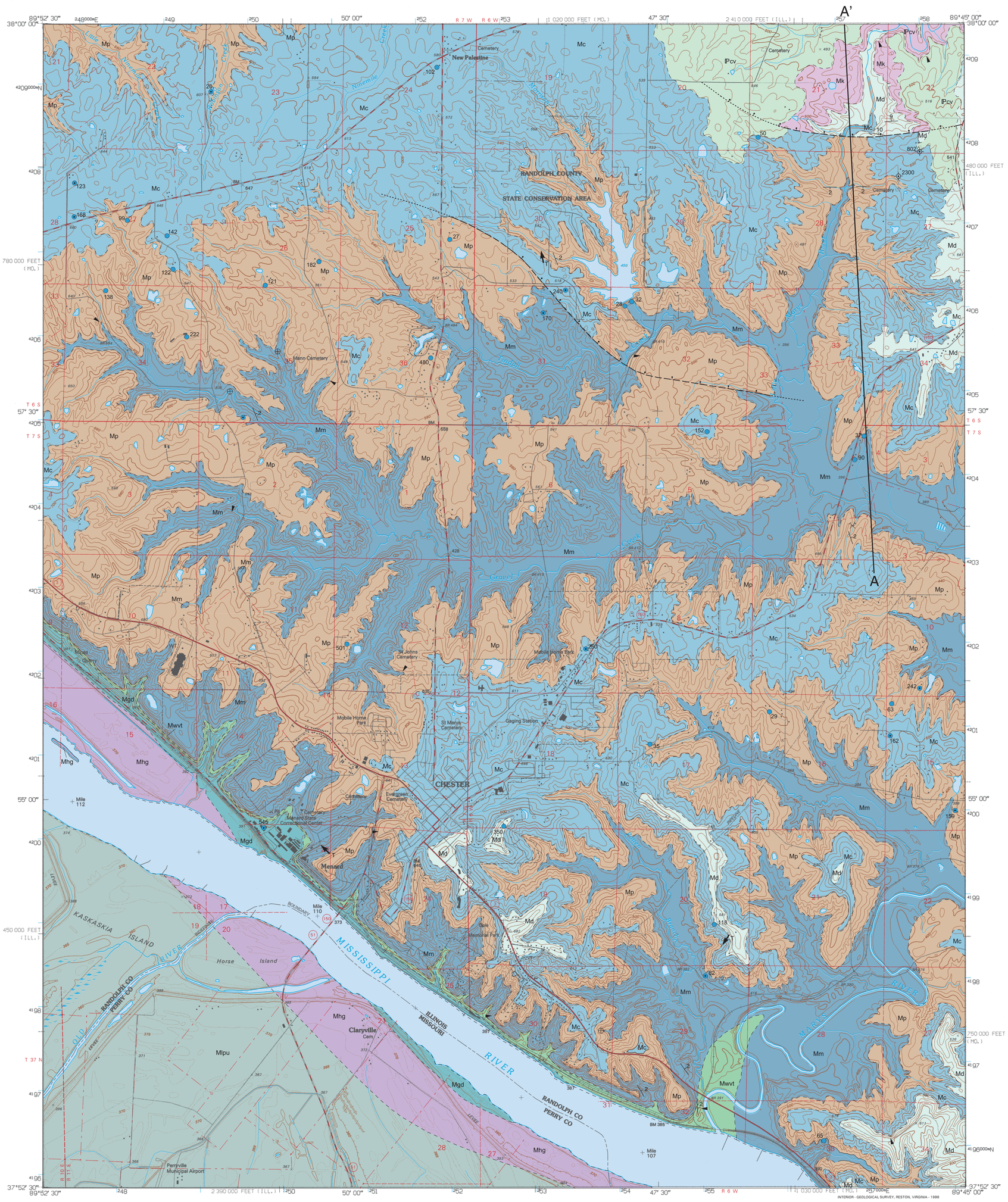
2006

STATEMAP Chester-BG



EXPLANATION

PENNSYLVANIAN	IPcv	Caseyville Formation	Morrowan
	Unconformity		
MISSISSIPPIAN	Mk	Kinkaid Limestone	Chesterian
	Md	Degonia Formation	
	Mc	Clore Formation	
	Mp	Palestine Formation	
	Mm	Menard Limestone	
	Mwvt	Waltersburg Formation Vienna Limestone Tar Springs Formation	
	Mgd	Glen Dean Limestone	
	Mhg	Hardinsburg Sandstone Golconda Formation	
	Mlpu	Lower Pope Group Undifferentiated	

Symbols

- 10 — Strike and dip of bedding; number indicates degree of dip
- Horizontal bedding
- Outcrop of special note, map unit contact or good exposure at time of mapping
- Type section
- Sandstone quarry abandoned

Drill Holes
from which subsurface data were obtained

- Water well
- Dry oil – test hole
- 120 Tpc — Numeric label indicates total depth of boring in feet. Unit label denotes formation at bottom. (br = bedrock) Dot indicates location accurate within 100 feet.

Line Symbols
dashed where inferred, dotted where concealed

- Contact
- Fault; bar and ball on downthrown side
- A—A′ Line of cross section

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

Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. Raster Feature Seperates. Compiled from imagery dated 1968. Revised from imagery dated 1993. PLSS and survey control current as of 1970. Contours and elevations current as of 1968. Map edited 1996.

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator
10,000-foot ticks: Illinois (east zone) and Missouri (west zone) State Plane Coordinate Systems (Transverse Mercator)
1,000-meter ticks: Universal Transverse Mercator grid system, zone 16

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
SUPPLEMENTARY CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Released by the authority of the State of Illinois: 2006

Geology based on field work by J. Devera, 2005–2006.

Digital cartography by J. Domier, M. Widener, and M. Bentley, Illinois State Geological Survey.

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ILLINOIS DEPARTMENT OF NATURAL RESOURCES

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4		5
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ADJOINING QUADRANGLES
1 Evansville
2 Walsh
3 Steeleville
4 Kaskaskia
5 Welge
6 Lithium
7 Belgique
8 Rockwood

APPROXIMATE MEAN DECLINATION, 2006

ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- Interstate Route
- U.S. Route
- State Route

INTERIOR - GEOLOGICAL SURVEY, RESTON, VIRGINIA - 1996

Structural Geology

The strata through out the study area are relatively flat but have a regional strike about N 50°W with a 2° dip to the northeast in the southwestern area of the quadrangle. On the eastern side of the quadrangle strike changes to nearly north south with a slight dip to the east.

In the northeastern corner of the study area two parallel faults were encountered both with an east-west trend and downward stepping on the north side of both faults. The fault farthest north occurs in section 21 and 22, T6S, R6W. Exposures along Little Mary's River yield Palestine Sandstone juxtaposed with upper Clore which gives a minimum throw ranging from 40 to 80 feet down to the north. The fault also shows Palestine juxtaposed with basal Degonia Sandstone in a side ravine which yields a maximum range of 80 to120 feet down to the north. The Chesterian section and the overlying Pennsylvanian sandstones of the Caseyville Formation show signs of faulting. The strike of the fault changes as it crosses the Little Mary's River from east-west to northwest. The second fault, about a mile and a half south in Sections 31 and 32, T6S, R6W was found by drill hole information and bedrock mapping along Tindall Creek. This fault parallels the aforementioned fault which also has an east-west strike and turns to the northwest as it crosses Tindall Creek. The Menard Limestone is juxtaposed with the Clore Formation which gives a maximum through of 60 to 80 feet down to the north. Both faults are probably related to the western-most extent of the Cottage Grove Fault Zone. The northern most fault is probably the "master fault" of the Gottage Grove Fault Zone (Nelson 2006). The Cottage Grove is thought to be a right-lateral strike-slip fault that was active during Late Pennsylvanian to Permian time (Nelson et. al. 1981; Duchek et. al. 2004).

Earlier workers recognized structure in the area. S. Weller (1915) discussed an anticline just north of Bremen, Illinois. Weller mapped the area in the northeastern part of the quadrangle and found N 70° E strike along the axis of what he called an anticline. The northern limb dips 7° to 10° north to northeast and the southern limb dips 2° south, southeast. A year later Kay (1916), named this structure the Bremen Anticline. During the winter field season of 2006 the author found slickensides in float along a western flowing tributary to the Little Mary's River. Dip reversals were observed. The southern dips were slight 2° south and across the fault dips reverse to 9° and 10° to the north. Although, no fault plane was observed in the study area stratigraphic offsets can be better explained by extensional faulting rather than an anticline. Drilling of this structure later in 1923 by Houston Oil Company was dry and abandoned. Earlier workers did not report the fault farther south in this area probably because of the lack of well information at the time. Direct evidence for faulting was found in the oil-test well immediately west in the Welge Quadrangle. Here in the southwest corner of Section 23, T6S, R6W, the O.R. McHughes #1 Wilson apparently penetrated the fault surface (Nelson 2006).

Stratigraphy

The Chesterian Series is the uppermost series of rocks of the Mississippian System that was named for Chester, Randolph County, Illinois (Worthen 1860, Weller 1913, and Swann 1963). The earliest name applied to this series of rocks was Kaskaskia Limestone by Hall (1857). A year later, Swallow (1858) called these rocks the Archimedes Limestone because of the prominent fenestrate bryozoan within these rocks. The time connotation of these rocks was established by J. M. Weller (1948). Current assignment of rocks to the Chesterian Series ranges from the bottom of the Ste. Genevieve to the top of the Kinkaid Limestone and is based on conodont and foraminifera biostratigraphy. Mainly the upper part of the Chesterian Series is exposed in the Chester Quadrangle from the Glen Dean Limestone to the Kinkaid.

Three type sections out of twenty-one occur in the Chester Quadrangle. These units were named for geographic locations within the quadrangle by Stuart Weller (1913). First, the type section of the Clore Formation takes its name from Clore School, Randolph, County which occurs in the southeast corner of Section 20, T7S, R6W. Currently, the type section of the Clore is located within a goat pasture. Second, the Palestine Sandstone was named after Palestine Township and occurs in tributaries of Tindall Creek, Sections 29 and 30, T6S, R6W, Weller (1913). Exposures of the type section mainly occur in the Randolph County State Conservation area. The lower contact is now below the level of a lake that was constructed for the State Conservation area. The lower contact can now be viewed along a road in the northwestern corner of Section 32, T6S, R6W, which parallels Tindall Creek. Third, the Menard Limestone takes its name for Menard, Randolph County, in the northeast corner of Section 23, T7S, R7W, Weller (1913). The type section is in an old quarry within the confines of Menard State Correctional Center. This formation is well exposed along the Mississippi River bluffs from Chester to Rockwood, Illinois.

Special notations (see explanation on map) show good exposures of these three type sections.

Economic Geology

Limestone Aggregate
There are a number of abandoned limestone quarries in the southwestern portion of the Chester Quadrangle along the Mississippi River bluff. These operations quarried the Glen Dean Limestone. The Glen Dean to Menard Limestone was quarried in what is now the Menard Correctional Center. Currently, there are no active limestone quarries in this quadrangle. Areas for quality limestone occur in the southwestern corner of Section 29, T7S, R6W. Here the Menard Limestone is exposed but the higher quality Glen Dean is only 50 feet below the base of the Menard Limestone because of a condensed interval between the Waltersburg and Tar Springs Sandstones.

Sandstone
Sandstone blocks were quarried from an area in the southeastern part of Section 4, T7S, R6E for the foundation of a covered bridge that crossed the Little Mary's River. It was the old route to Fort Kaskaskia. The large blocks of sandstone came from the tabular bedded portion of the Palestine Sandstone. The old quarry can be seen in a ravine that is a tributary to the Little Mary's River (see map).

Oil and Gas
After reports by Weller (1915) and Kay (1916) on the Bremen Anticline two oil tests were drilled in Section 22, T6S, R6W, within the Chester Quadrangle. The first one was drilled by Houston Oil Company in 1923 on the Gremmels property. This well went to a total depth of 802 feet. It was drilled into the upper parts of the Ste. Genevieve Limestone. It was dry and abandoned. The second oil test was drilled by Bufay Oil Company also on the Gremmels property on January 4, 1977. This well went to the Middle Devonian Limestone at 1,765 feet in total depth. Logs are on file at the Illinois State Geological Survey. This well was also dry and abandoned.

The only report of gas was just a half a mile east of the quadrangle on Kaskaskia Island 240 feet west of the Mississippi River within the Kaskaskia Quadrangle. About 1250 cubic feet per day was reported by W.F. Meents on January 29, 1975. Total depth was only 27 feet in river alluvium at the Cassoutt Estate.

References

Duchek, A.B., J.H. McBride, W.J. Nelson, and H.E. Leetaru, 2004, The Cottage Grove fault system (Illinois Basin): Late Paleozoic transpression along a Precambrian crustal boundary: Geological Society of America Bulletin, v. 116, no.11/12, p. 1465–1484.

Hall, J., 1857, Observations upon the Carboniferous limestones of the Mississippi Valley, abstract American Journal of Science, v. 23, p. 187–194.

Kay, F.H., 1916, Notes on Bremen Anticline Randolph County, Illinois State Geological Survey Bulletin 33, p. 101–103.

Nelson, W.J., 2006, Bedrock geology of Welge Quadrangle, Randolph County, Illinois: Illinois State Geological Survey, Illinois Preliminary Geologic Map, IPGM, Welge-BG 1:24,000.

Nelson, W.J. and H.F. Krausse, 1981, The Cottage Grove Fault System in Southern Illinois: Illinois State Geological Survey, Circular 522, 65 p. and 1 plate.

Swallow, G.C., 1858, Explanations of the geological map of Missouri and a section of its rocks: AAAS Proceedings 11, pt. 2, p.1–21.

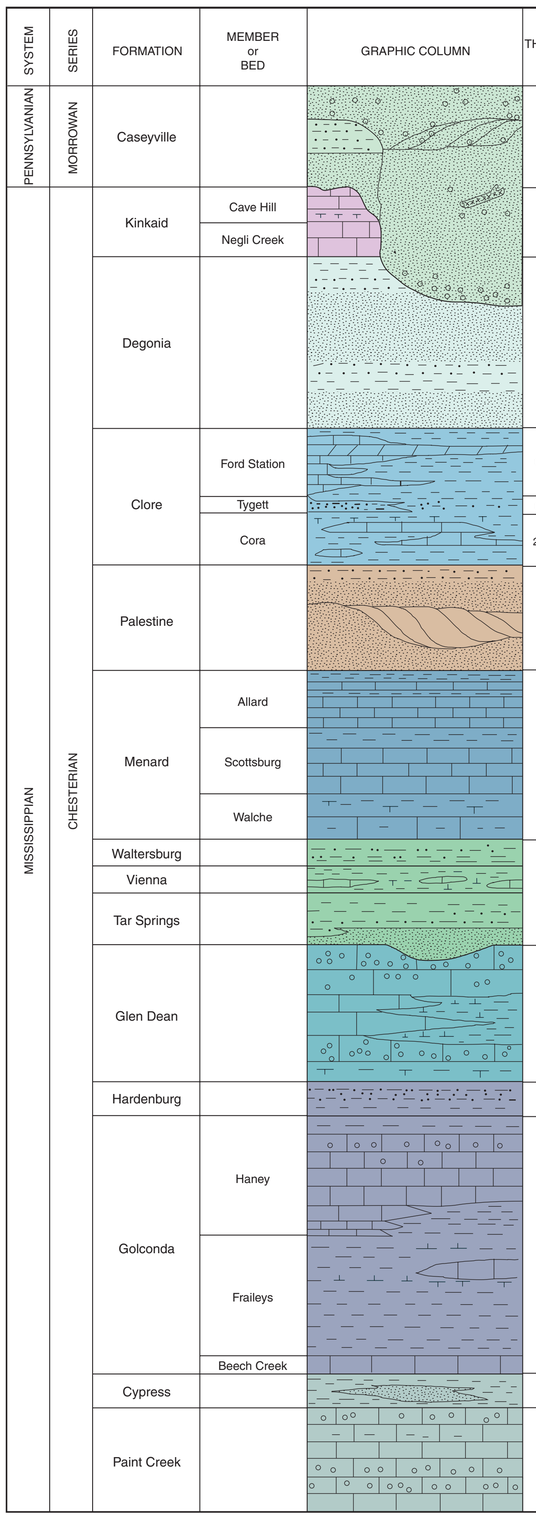
Swann, D.H., 1963, Classification of Genevievian and Chesterian (Late Mississippian) rocks of Illinois: Illinois State Geological Survey Report of Investigations 216, 91 p.

Weller, J.M., 1948, Correlation of the Mississippian formations of North America: GSA Bulletin, v. 59, p. 91–196.

Weller, S., 1915, Anticlinal structure in Randolph County, Illinois State Geological Survey Bulletin 31, p. 69–70.

Weller, S., 1913, Stratigraphy of the Chester Group in southwestern Illinois: Illinois Academy of Scientific Transactions, v, 6, p. 118–129.

Worthen, A.H., 1860, Remarks on the discovery of a terrestrial flora in the Mountain Limestone of Illinois: abstract AAAS Proceedings, v. 13, p. 312–313.



A Sandstone weathers brown white and sugary when freshly exposed, weathers to tan and brown with reddish staining from secondary iron, coarse to fine grained, poorly to moderately well sorted, subrounded to rounded, quartz arenite and contains quartz pebbles and granules and locally chert granules. Liesagang banding and iron staining common in this unit. Primary sedimentary structures include: current ripple-marks, load casts, tool marks and large-scale cross bedding. Fossils present are mainly plant fossil, sandstone impressions. The basal contact is unconformable and shows active erosion into the unit below by incorporating Mississippian invertebrate fossils and fossiliferous chert into the basal quartz pebble conglomerate.

B Limestone is a medium to dark gray fossil lime mudstone to wackestone. The basal unit is a dark micritic dense carbonate rock that contains dark chert and shows conchoidal fracture. The overlying limestone is more thinly bedded having shaly layers and abundant fossils invertebrates like spiriferid brachiopods, fenestrate bryozoans, small rugose corals, proetid trilobite pygitia, pelmatozoa, and echinoid spines. The basal contact is sharp but conformable.

C Sandstone with siltstone is white to tan, fine grained, well sorted, quartz arenite. This unit ranges from thin to thick bedded and created a large bluff forming sandstone in the southeastern corner of the map. Low angle cross bedding is common with planar, ripple, flaser, and micro-cross lamination are commonly rhythmic near the top of the formation. Some shale is present in the lower part of the formation as well as in the upper most part that becomes silty. The base of this sandstone can be locally erosional but gradational in the study area.

D Shaly Limestone is medium to dark gray, argillaceous, carbonate rock. Shale beds are both calcareous and non-calcareous. "Hour-glass" weathering is observed in the argillaceous limestone beds of this formation. Fossils common to this formation include: Composita subquadrata, Spirifer increbescense, derbid and other brachiopods, fenestrate and ramose bryozoans, the bivalve, Sulcatopinna missouriensis, pelmatozoa, blastoids and small rugose corals. A thin siltstone to fine grained sandstone occurs in the mid-portion of this formation. The lower part of the unit is dominated by shale and contains lenticular fossiliferous wackestones. The basal portion is gradational with the underlying unit.

E Sandstone is typically tan to white, fine grained, well sorted, quartz arenite. Fossil lepidodendron impressions occur in this sandstone. Cross bedded and ripple-marked sedimentary structures are common. Siltstones and shales occur in the upper part of the unit. The main body of the formation is composed of tabular thin to medium beds that outcrop as a 30 to 40 foot bench. The lower part of the package is conformable with the shaly limestone below.

F Limestone is gray with shaly partings through out the formation. It contains fossil lime mudstones, wackestones and packstones. Three resistive carbonate units are divided by shaly beds to make up this formation. Common fossils include bivalves, brachiopods, gastropods, pelmatozoa, bryozoans, corals and nautiloid cephalopods. Endolobus nodosus a rather large, rare, coiled cephalopod was found in the upper third of the formation. The base is conformable with the underlying shaly sandstone.

G Shale, sandstone and limestone comprise this map unit. Typically these three units are mapped as separate formations but in the study area, these formations are condensed. The basal sandstone is well exposed and grades upward into a shaly lenticular limestone that is poorly exposed. The upper shale has a thin sandy sections that becomes a prominent sandstone eastward. The basal sandstone is gradational but can be locally erosional on the limestone below.

H Limestone, is light gray to nearly white, contains massive, cross bedded oolitic grainstones at the top and mid-portions of the formation. Dark shale is present typically non-fossiliferous. The bulk of the unit is a light gray packstone to wackestone. The dominant fossil component is crinoid bioclasts, with bryozoan fronds which are disarticulated. Dark chert nodules occur through out the limestone beds below the upper oolitic beds. The base of the unit is a calcareous shale that grades into a thin silty shale.

I Siltstone and sandstone only seen in the drill hole data. The unit is thicker east of the study area but thins locally in the Chester Quadrangle. It is mainly a silty shale that contains sandstone lenses. Where present the sandstone is a light gray, fine grained quartz arenite. The basal shale is a varigated red and green claystone that grades into the limestone below.

J Limestone and shale is light gray to medium gray. The upper half of this unit is dominated by limestone. The limestone is composed of oolitic grainstones, packstones, wackestones and lime mudstones. The lower half is composed of shale. The shale is dark greenish gray, fissile to massive claystones containing occasional limestone lenses. The basal part is a thin, continuous, fossiliferous limestone that has a sharp contact with the unit below.

K Sandstone and shale is condensed in this unit within the study area. The sandstone is light gray fine grained, well sorted quartz arenite. The sandstone is calcareous in part and laminated with gray shale in the upper and lorew portions of the formation. It is only mentioned in drill holes within the quadrangle. The unit is dominated by gray shale and has a sharp conformable contact with the lower limestone.

L Limestone is light gray, and contains fossiliferous packstones, wackestones with grainstone beds. The grain supported carbonate rocks are composed of pelmatozoan and bryozoan fragments, some of the crinoidal columnals are stained red or pink and silicified in part, oolitic in the upper and middle of the unit. Shale is dark gray calcareous with invertebrate fossils. More shaly in the lower part and sandy in places. This unit is not exposed in the quadrangle it is only known from subsurface data.