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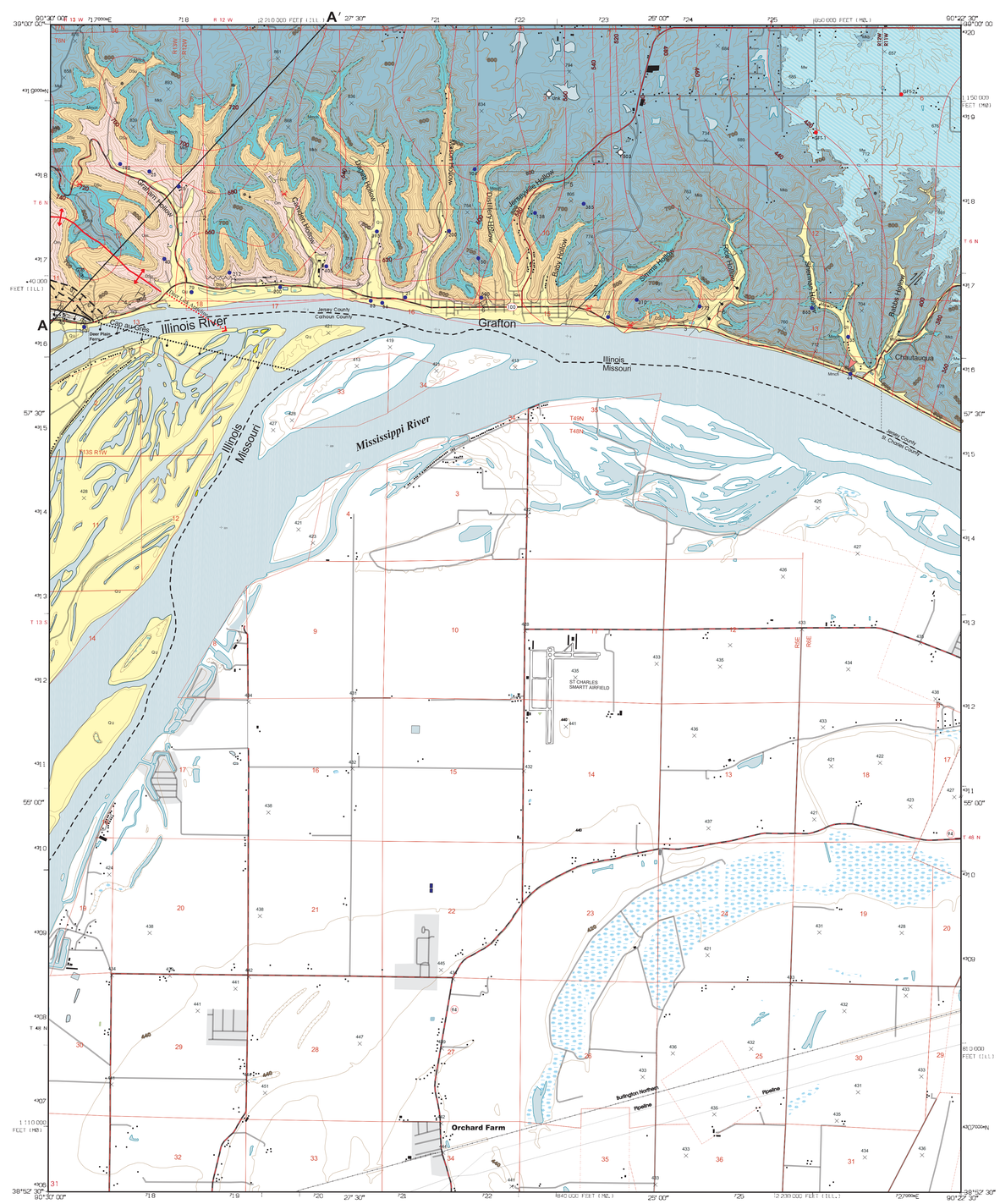
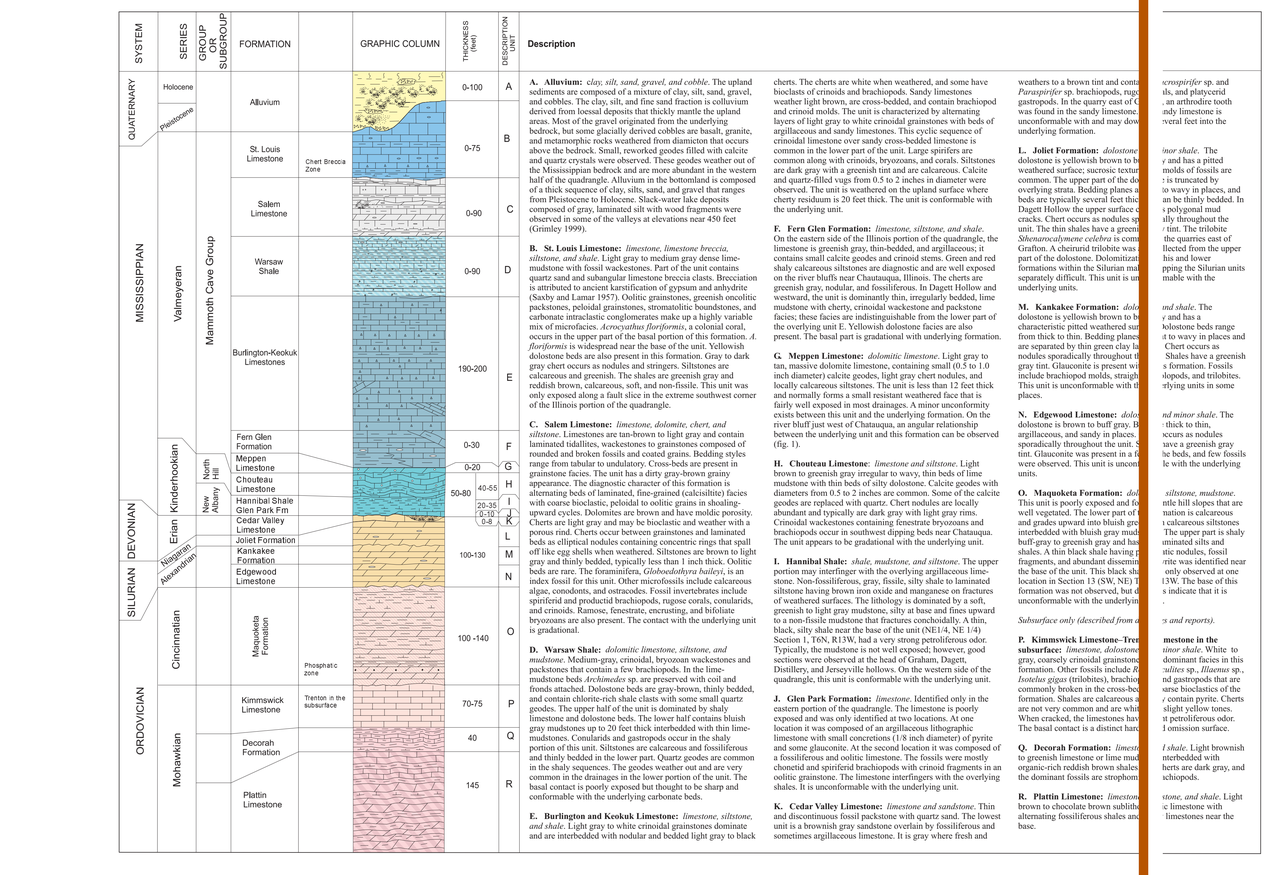
Illinois Geologic Quadrangle Map: IGQ Grafton-BG
2002

BEDROCK GEOLOGY MAP

Grafton Quadrangle (Illinois Portion), Jersey and Calhoun Counties, Illinois

F. Brett Denny and Joseph A. Devera





A. Alluvium: *clay, silt, sand, gravel, and cobble.* The upland sediments are composed of a mixture of clay, silt, sand, gravel, and cobbles. The clay, silt, and fine sand fraction is colluvium derived from loessal deposits that thickly mantle the upland areas. Most of the gravel originated from the underlying bedrock, but some glacially derived cobbles are basalt, granite, and metamorphic rocks weathered from diamicton that occurs above the bedrock. Small, reworked geodes filled with calcite and quartz crystals were observed. These geodes weather out of the Mississippian bedrock and are more abundant in the western half of the quadrangle. Alluvium in the bottomland is composed of a thick sequence of clay, silts, sand, and gravel that ranges from Pleistocene to Holocene. Slack-water lake deposits composed of gray, laminated silt with wood fragments were observed in some of the valleys at elevations near 450 feet (Grimley 1999).

B. St. Louis Limestone: *limestone, limestone breccia, siltstone, and shale.* Light gray to medium gray dense lime-mudstone with fossil wackestones. Part of the unit contains quartz sand and subangular limestone breccia clasts. Brecciation is attributed to ancient karstification of gypsum and anhydrite (Saxby and Lamar 1957). Oolitic grainstones, greenish oncolitic packstones, peloidal grainstones, stromatolitic boundstones, and carbonate intraclastic conglomerates make up a highly variable mix of microfacies. *Acrocyathus floriformis*, a colonial coral, occurs in the upper part of the basal portion of this formation. *A. floriformis* is widespread near the base of the unit. Yellowish dolostone beds are also present in this formation. Gray to dark gray chert occurs as nodules and stringers. Siltstones are calcareous and greenish. The shales are greenish gray and reddish brown, calcareous, soft, and non-fissile. This unit was only exposed along a fault slice in the extreme southwest corner of the Illinois portion of the quadrangle.

C. Salem Limestone: *limestone, dolomite, chert, and siltstone.* Limestones are tan-brown to light gray and contain laminated tidalites, wackestones to grainstones composed of rounded and broken fossils and coated grains. Bedding styles range from tabular to undulatory. Cross-beds are present in grainstone facies. The unit has a dirty gray-brown grainy appearance. The diagnostic character of this formation is alternating beds of laminated, fine-grained (calcisiltite) facies with coarse bioclastic, peloidal to oolitic grains in shoaling-upward cycles. Dolomites are brown and have moldic porosity. Cherts are light gray and may be bioclastic and weather with a porous rind. Cherts occur between grainstones and laminated beds as elliptical nodules containing concentric rings that spall off like egg shells when weathered. Siltstones are brown to light gray and thinly bedded, typically less than 1 inch thick. Oolitic beds are rare. The foraminifera, *Globoedothyra baileyi*, is an index fossil for this unit. Other microfossils include calcareous algae, conodonts, and ostracodes. Fossil invertebrates include spiriferid and productid brachiopods, rugose corals, conularids, and crinoids. Ramose, fenestrate, encrusting, and bifoliate bryozoans are also present. The contact with the underlying unit is gradational.

D. Warsaw Shale: *dolomitic limestone, siltstone, and mudstone.* Medium-gray, crinoidal, bryozoan wackestones and packstones that contain a few brachiopods. In the lime-mudstone beds *Archimedes* sp. are preserved with coil and fronds attached. Dolostone beds are gray-brown, thinly bedded, and contain chlorite-rich shale clasts with some small quartz geodes. The upper half of the unit is dominated by shaly limestone and dolostone beds. The lower half contains bluish gray mudstones up to 20 feet thick interbedded with thin lime-mudstones. Conularids and gastropods occur in the shaly portion of this unit. Siltstones are calcareous and fossiliferous and thinly bedded in the lower part. Quartz geodes are common in the shaly sequences. The geodes weather out and are very common in the drainages in the lower portion of the unit. The basal contact is poorly exposed but thought to be sharp and conformable with the underlying carbonate beds.

E. Burlington and Keokuk Limestone: *limestone, siltstone, and shale.* Light gray to white crinoidal grainstones dominate and are interbedded with nodular and bedded light gray to black cherts. The cherts are white when weathered, and some have bioclasts of crinoids and brachiopods. Sandy limestones weather light brown, are cross-bedded, and contain brachiopod and crinoid molds. The unit is characterized by alternating layers of light gray to white crinoidal grainstones with beds of argillaceous and sandy limestones. This cyclic sequence of crinoidal limestone over sandy cross-bedded limestone is common in the lower part of the unit. Large spirifers are common along with crinoids, bryozoans, and corals. Siltstones are dark gray with a greenish tint and are calcareous. Calcite and quartz-filled vugs from 0.5 to 2 inches in diameter were observed. The unit is weathered on the upland surface where cherty residuum is 20 feet thick. The unit is conformable with the underlying unit.

F. Fern Glen Formation: *limestone, siltstone, and shale.* On the eastern side of the Illinois portion of the quadrangle, the limestone is greenish gray, thin-bedded, and argillaceous; it contains small calcite geodes and crinoid stems. Green and red shaly calcareous siltstones are diagnostic and are well exposed on the river bluffs near Chautauqua, Illinois. The cherts are greenish gray, nodular, and fossiliferous. In Dagett Hollow and westward, the unit is dominantly thin, irregularly bedded, lime mudstone with cherty, crinoidal wackestone and packstone facies; these facies are indistinguishable from the lower part of the overlying unit E. Yellowish dolostone facies are also present. The basal part is gradational with underlying formation.

G. Meppen Limestone: *dolomitic limestone.* Light gray to tan, massive dolomite limestone, containing small (0.5 to 1.0 inch diameter) calcite geodes, light gray chert nodules, and locally calcareous siltstones. The unit is less than 12 feet thick and normally forms a small resistant weathered face that is fairly well exposed in most drainages. A minor unconformity exists between this unit and the underlying formation. On the river bluff just west of Chatauqua, an angular relationship between the underlying unit and this formation can be observed (fig. 1).

H. Chouteau Limestone: *limestone and siltstone.* Light brown to greenish gray irregular to wavy, thin beds of lime mudstone with thin beds of silty dolostone. Calcite geodes with diameters from 0.5 to 2 inches are common. Some of the calcite geodes are replaced with quartz. Chert nodules are locally abundant and typically are dark gray with light gray rims. Crinoidal wackestones containing fenestrate bryozoans and brachiopods occur in southwest dipping beds near Chatauqua. The unit appears to be gradational with the underlying unit.

I. Hannibal Shale: *shale, mudstone, and siltstone.* The upper portion may interfinger with the overlying argillaceous lime-stone. Non-fossiliferous, gray, fissile, silty shale to laminated siltstone having brown iron oxide and manganese on fractures of weathered surfaces. The lithology is dominated by a soft, greenish to light gray mudstone, silty at base and fines upward to a non-fissile mudstone that fractures conchoidally. A thin, black, silty shale near the base of the unit (NE1/4, NE 1/4) Section 1, T6N, R13W, had a very strong petroliferous odor. Typically, the mudstone is not well exposed; however, good sections were observed at the head of Graham, Dagett, Distillery, and Jerseyville hollows. On the western side of the quadrangle, this unit is conformable with the underlying unit.

J. Glen Park Formation: *limestone.* Identified only in the eastern portion of the quadrangle. The limestone is poorly exposed and was only identified at two locations. At one location it was composed of an argillaceous lithographic limestone with small concretions (1/8 inch diameter) of pyrite and some glauconite. At the second location it was composed of a fossiliferous and oolitic limestone. The fossils were mostly chonetid and spiriferid brachiopods with crinoid fragments in an oolitic grainstone. The limestone interfingers with the overlying shales. It is unconformable with the underlying unit.

K. Cedar Valley Limestone: *limestone and sandstone.* Thin and discontinuous fossil packstone with quartz sand. The lowest unit is a brownish gray sandstone overlain by fossiliferous and sometimes argillaceous limestone. It is gray where fresh and weathers to a brown tint and conta… *Paraspirifer* sp. brachiopods, rugu… gastropods. In the quarry east of … was found in the sandy limestone. … unconformable with and may dow… underlying formation.

L. Joliet Formation: *dolostone* … dolostone is yellowish brown to b… weathered surface; sucrosic textur… common. The upper part of the do… overlying strata. Bedding planes a… beds are typically several feet thic… Dagett Hollow the upper surface … cracks. Chert occurs as nodules sp… unit. The thin shales have a green… *Sthenarocalymene celebra* is com… Grafton. A cheirurid trilobite was … part of the dolostone. Dolomitizat… formations within the Silurian ma… separately difficult. This unit is un… underlying units.

M. Kankakee Formation: *dolo…* dolostone is yellowish brown to b… characteristic pitted weathered sur… from thick to thin. Bedding planes … are separated by thin green clay la… nodules sporadically throughout … gray tint. Glauconite is present wi… include brachiopod molds, straigh… This unit is unconformable with t… places.

N. Edgewood Limestone: *dolo…* dolostone is brown to buff gray. B… argillaceous, and sandy in places. … sporadically throughout the unit. S… tint. Glauconite was present in a f… were observed. This unit is uncon… units.

O. Maquoketa Formation: *dol…* This unit is poorly exposed and fo… well vegetated. The lower part of … and grades upward into bluish gra… interbedded with bluish gray mud… buff-gray to greenish gray and has… shales. A thin black shale having … fragments, and abundant dissemin… the base of the unit. This black sha… location in Section 13 (SW, NE) T… formation was not observed, but … unconformable with the underlyin…

Subsurface only (described from a… …s and reports).

P. Kimmswick Limestone–Tren… subsurface: *limestone, dolostone… …inor shale.* White to … dominant facies in this … *…ulites* sp., *Illaenus* sp., … nd gastropods that are … arse bioclastics of the … formation. Shales are calcareous … are not very common and are whit… mullion-like planes, which had general tre… movement was probably horizontal, but th… right or left was not readily apparent. A sec… fied along Babbs Hollow (1,100 feet WL, … R11W). The fault zone was less than 5 fee… central breccia zone down-dropped less th… N30° E to N40° E and is located in the bas… Keokuk Limestone. Indications are that th… lateral. A third fault is concealed under allu… was inferred from the 10 to 15 feet elevati… Devonian and Silurian units across the Ho…

Q. Decorah Formation: *limest…* to greenish limestone or lime mud… organic-rich reddish brown shales … the dominant fossils are strophom…

R. Plattin Limestone: *limeston… …stone, and shale.* Light brown to chocolate brown sublith… …ic limestone with alternating fossiliferous shales an… …limestones near the base.

These faults and the anticlines suggest a n… …t to southwest maximum principal stress direction. The most plausib… …planation for the Cap au Grès feature was postulated by Rubey (19… …arrison (1997), Nelson and Lumm (1985), and Nelson (1995) who dis… …e possibility of a deep-seated reverse basement fault. The Cap au … …esembles monoclinal drape folds found on the Colorado Plateau that f… …in sedimentary strata overlying reactivated basement faults (Har… 1993). Nelson and Lumm (1985) compared the Cap au Grès flexure … …aramide monoclines in the Rocky Mountains and Colorado Plateau, w… …olds in sedimentary cover overlie faults in the Precambrian crystallin… …ment.

The timing of the Cap au Grès/Lincoln Fol… …t is constrained by stratigraphic relationships. Facies variation… …the structure occur in the Kinderhookian through lower Valmeyeran … …ssion. Detailed mapping near the Cap au Grès indicates that these l… …Mississippian rocks apparently thin toward the structure. There… …ve suggest that the structure was active starting in Late Devonian and c… …ed sporadically through the earliest Pennsylvanian. Outliers of Pennsy… …n Carbondale Formation occur at only slightly different elevations … …er side of the Cap au Grès in Calhoun County (Rubey 1952). The St. … …Formation is the youngest unit significantly displaced, which indicate… …major movement took place on the structure between Valmeyeran … …Desmoinesian times.

The eastern quarter of the quadrangle is no… …ificantly influenced by the Cap au Grès and has a regional easterly di… …ughly 50 feet per mile.

Economic Geology of the Grafton Quadrangle

Stone

Several quarries once mined Silurian dolomites in the quadrangle. Currently, none of these operations are active. According to local residents, most of the quarries were operated for local supply of aggregate and building stone.

The Burlington and Keokuk Formations in the Grafton area are nearly identical in lithologic character and were mapped as a single unit. Both units are composed in part of calcium-rich limestone. Portions of these units contain white crinoidal grainstones to packstones, which commonly are high in calcium carbonate. Hindering the quarrying in this unit are the cherty intervals located above and below the high-calcium zones. Relatively thick chert-free beds of economically important limestone are present locally.

Oil

Two oil tests have been drilled in the quadrangle. According to an oil well report written by consulting geologist Lawrence Bengal, the first well had a show of oil, and the second well drilled in 1984 (Section 2, T6N, R12W) was interpreted by the geologist as intersecting a fault and repeating the Devonian and Silurian units (Bengal 1984). This interpretation would require at least 150 feet of vertical displacement. No field evidence to support a fault of this size was identified. The chance for economic oil production in this quadrangle is marginal because of the shallow depth to the pay zones along the anticlines and because of faulting in the area along the Cap au Grès. Nevertheless, the shales and the limestone of the Ordovician Decorah contain hydrocarbons. Qualitative distillation tests in the area have reported the Decorah to produce between 15 to 25 gallons of crude oil per ton (Rubey 1952).

Sand and Gravel

Sand and gravel are available in the alluvial deposits of the Illinois and Mississippi Rivers (see Grimley 1999).

Structural Geology of the Grafton Quadrangle

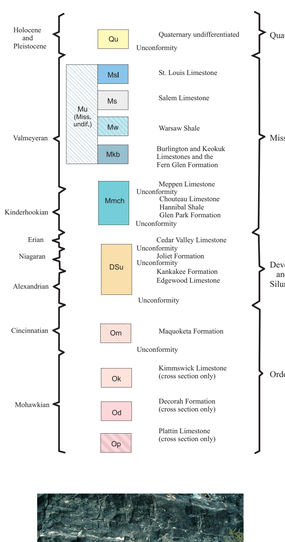
The major structural feature of the quadrangle is the Cap au Grès Faulted Flexure (Keyes 1894). The Cap au Grès is the southeastern extension of the Lincoln Fold, which extends over 165 miles into northeast Missouri (Nelson 1995). The axis of the Lincoln Fold follows a general northwesterly trend but turns easterly at its southernmost exposures. The south-easternmost portion of this structure in Missouri and Illinois is called the Cap au Grès.

In this quadrangle, the Cap au Grès is a faulted monocline with dips averaging less than 30° to the southwest and less than 4° to the northeast. The faulted blocks strike N80° W and dip between 40° to 80° to the south. The fault in this quadrangle juxtaposes Silurian age dolomites with Mississippian carbonates. Geologic reconstruction of the flexure indicates as much as 950 feet of vertical displacement may be present along this fault zone at the Deer Plain Ferry location. Evidence for the structure can be observed in road cuts along Illinois Highway 100 just west of Graham Hollow north of the Deer Plain Ferry landing. At this location the Mississippian St. Louis Limestone dips to the south up to 70°.

Along the bluffs west of Grafton, several large blocks of Silurian dolomite are exposed that are interpreted to be rotational slumps. Several more slump blocks were observed along a drainage on the west side of Graham Hollow. The basal failure plane of these slumps occurs in the underlying Maquoketa Shale. The failure plane was not observed because of the lack of bedrock exposures of the Maquoketa in the immediate area of the slump blocks.

Rubey (1952) mapped the Hardin and Brussels 15-minute quadrangles to the west of the Grafton Quadrangle. He identified an oval-shaped uplift located in Deer Lick Hollow just west of the Grafton Quadrangle, which he named the Deer Lick Dome. We traced this feature into the Grafton Quadrangle and determined that it was more accurately described as a plunging anticline. The Deer Lick Anticline is closely related to the Dome described by Rubey and may be considered the eastern limit of the Deer Lick Dome. A second anticline was identified on the structure contours to the northeast of the Deer Lick Anticline. This second anticline roughly parallels the Deer Lick Anticline but the dips of both limbs are less than 4°. This anticline also plunges to the southeast where it is concealed by the alluvial sediments of the Illinois and Missi… Dome observed on the *Bedrock Geologic … the St. Louis 30 × 60 Minute Quadrangle and Report* (Harrison … tion of the second unnamed anticline in th…

Two northeasterly trending strike-slip fault… half of the quadrangle. The first was locate… The fault zone was 10 feet wide and conta… and secondary calcite veinlets. No vertical … Silurian dolomite. The fractures were near… mullion-like planes, which had general tre… movement was probably horizontal, but th… right or left was not readily apparent. A sec… fied along Babbs Hollow (1,100 feet WL, … R11W). The fault zone was less than 5 fee… central breccia zone down-dropped less th… N30° E to N40° E and is located in the bas… Keokuk Limestone. Indications are that th… lateral. A third fault is concealed under allu… was inferred from the 10 to 15 feet elevati… Devonian and Silurian units across the Ho…



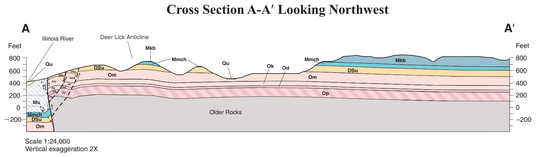
Data Type

Line symbols are solid where observed, dashed where inferred, dotted where concealed

- Contact
- Fault: bar and ball on downthrown side
- Landslide failure plane
- Strike-slip fault: arrow indicates direction of movement
- A A′ — Line of cross section
- 400 — Structure contour top of the top of the Cedar Valley/Joliet Formation (contour interval 20 feet)
- Anticline: direction of plunge indicated by the arrows
- 2 — Strike and dip of bedding: number indicates degree of dip
- Horizontal bedding
- Vertical joints
- 35 — Water well: number indicates depth of boring (feet)
- OG3 — Oil well: number indicates depth of boring (feet)
- GIR-1 — Engineering or ISGS boring: letters indicate ISGS number
- Abandoned quarry
- Location of photograph
- 691 — Elevation (feet) of benchmark or survey point

Figure 1 Contact between the Chouteau Limestone and the Meppen Limestone. The contact at this location is clearly angular. It may be an angular unconformity or a depositional feature related to a mud reef facies. Location: 13-6N-12W.

Cross Section A-A′ Looking Northwest



Digital base map compiled at the Illinois State Geological Survey (ISGS) from digital line graphs (DLG) provided by the U.S. Geological Survey

1927 North American Datum is shown by dashed corner ticks
1983 North American Datum Projection and 1,000-meter ticks
Universal Transverse Mercator grid, zone 15, 10,000-foot ticks

Original base map compiled from photogrammetric methods from 1952 photography. Field checked 1954 and updated 1995

Buildings and structures are omitted in Grafton, Chautauqua, and gray-colored areas

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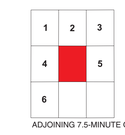
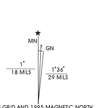


1 Nutwood
2 Otterville
3 Jerseyville South
4 Brussels
5 Elsah
6 Kampville

ADJOINING 7.5-MINUTE QUADRANGLES



UTM GRID AND 1915 MAGNETIC NORTH DECLINATION AT THE CENTER OF THE SHEET

IMPORTANT INFORMATION ON THE USE OF THIS DOCUMENT

This document has been carefully reviewed and edited and meets the scientific and technical standards of the Illinois State Geological Survey. It is suited to the purposes and uses intended by its authors and presents reasonable interpretations of the geology of the area described based on the data then available. The interpretations are based on data that may vary with respect to accuracy of geographic location, the type and quantity of data available at each location, and the scientific and technical qualifications of the data sources. Consequently, the accuracy of unit boundaries and other features shown in this document may vary from place to place. Any map or cross section in this document is not meant to be enlarged. Enlarging the scale of a published map or cross section, by whatever means, does not increase the inherent accuracy of the information and scientific interpretations it portrays.

This document provides a conceptual model of the geology of the area on which further work can be based. Any large-scale (1:24,000-scale) map and/or cross section shown herein may be used to screen the region for potentially suitable sites for a variety of purposes, but use of this document for such screening does not eliminate the need for detailed studies to fully understand the geology of a specific site. The Illinois State Geological Survey, the Illinois Department of Natural Resources, and the State 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.

Acknowledgments

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