Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

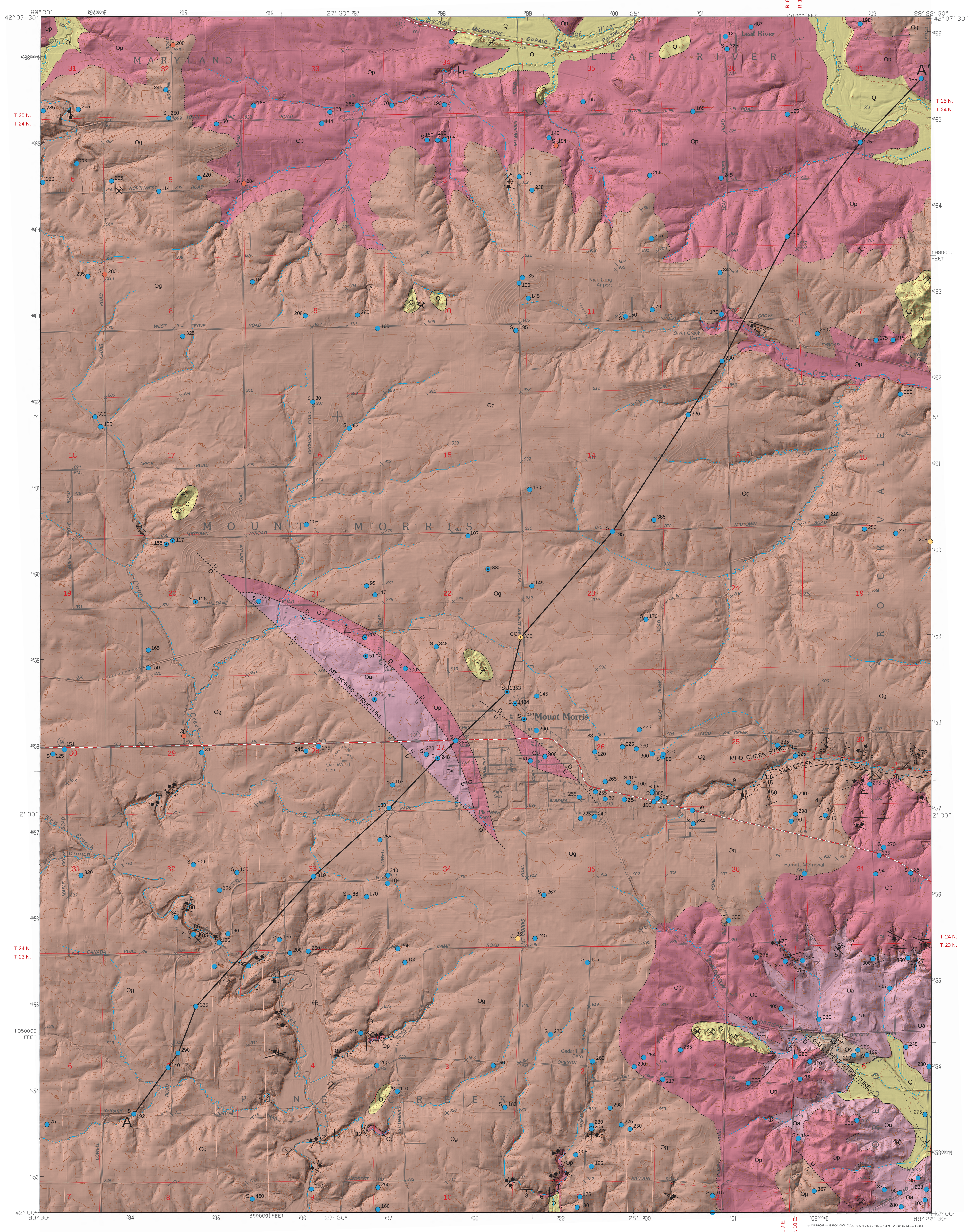
Bedrock Geology of Mount Morris Quadrangle

Ogle County, Illinois

Mary J. Seid

2011

STATEMAP Mount Morris-BG



EXPLANATION

Quaternary (Holocene and Pleistocene)

- **Q** — Quaternary: Cahokia Formation, Peoria Silt, Equality Formation, Roxana Silt, Pearl Formation, Glasford Formation

Unconformity

Ordovician

- **Og** — Galena Group: Wise Lake Formation, Dunleith Formation, Guttenberg Formation (Mohawkian)
- **Op** — Platteville Group: Quimbys Mill Formation, Nachusa Formation, Grand Detour Formation, Mifflin Formation, Pecatonica Formation (Mohawkian)

Unconformity

- **Oa** — Ancell Group: Glenwood Formation, St. Peter Sandstone (Mohawkian)

Unconformity

- **Os** — Shakopee Dolomite (Ibexian)

Symbols

- 40 — Strike and dip of bedding; number indicates degree of dip
- Horizontal bedding
- Vertical joint
- Inclined joint; box on down–dip side; number indicates degree of dip
- Abandoned pit or quarry

Drill Holes

from which subsurface data were obtained

- Stratigraphic boring
- Water well
- Engineering boring
- SGC 125 — Labels indicate samples (S), geophysical log (G), or core (C). Numeric label indicates total depth of boring in feet. Dot indicates location accurate within 100 feet.

Line Symbols

dashed where inferred, dotted where concealed

- Contact
- Syncline; direction of plunge indicated by arrow
- Fault; unknown displacement
- U/D — Fault; U on upthrown side, D 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 from the ISGS Web site.

Base map compiled by Illinois State Geological Survey from digital data (2009 TIGER/Line Shapefiles) provided by the United States Census Bureau.

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

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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 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology based on field work by M. Seid, 2010–2011.

Digital cartography by J. Domier and G. Woods, Illinois State Geological Survey.

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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.

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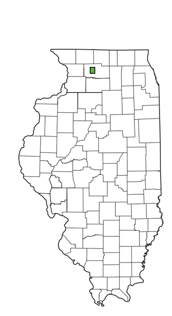


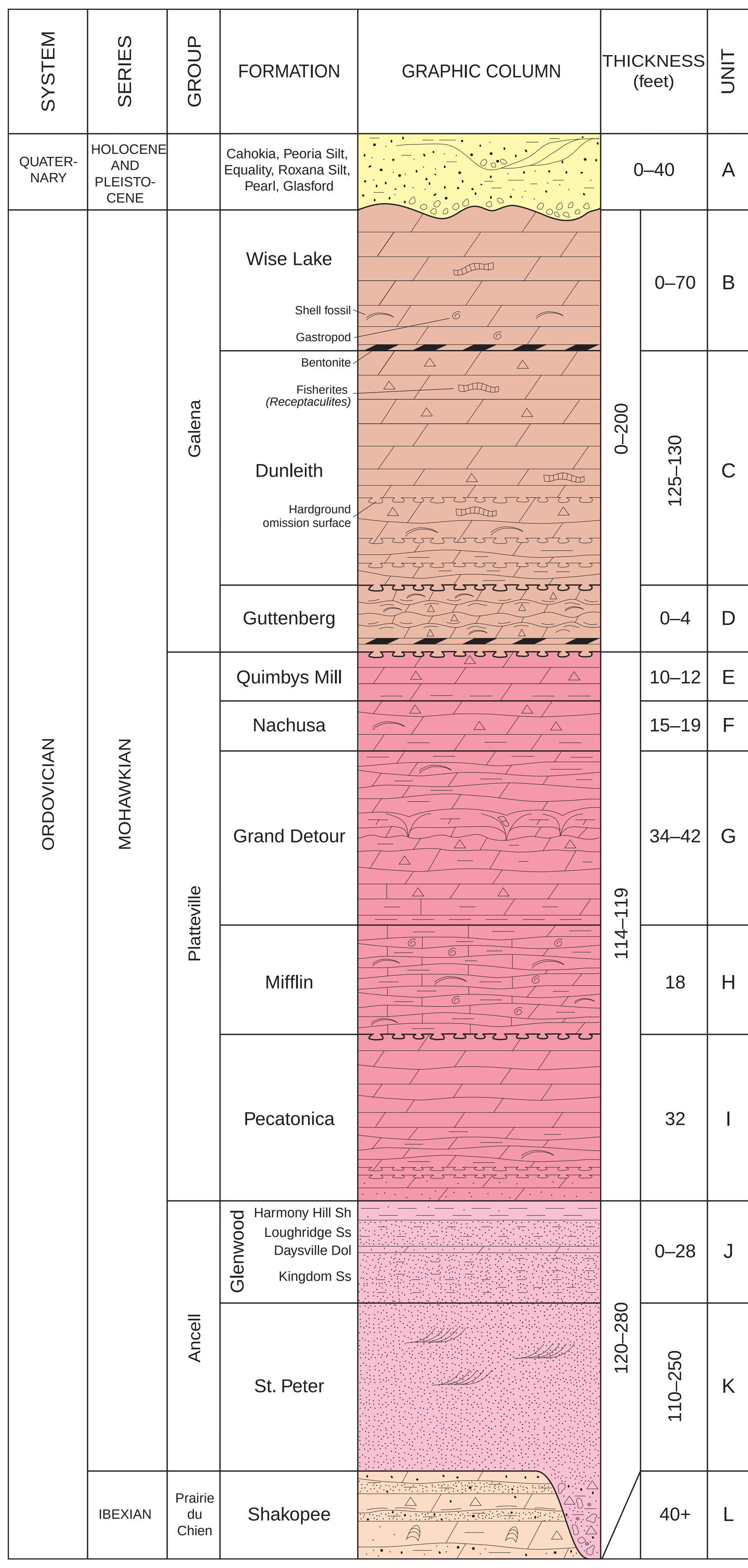
1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Forreston North
2 German Valley
3 Seward
4 Forreston South
5 Oregon
6 Polo
7 Grand Detour
8 Daysville

APPROXIMATE MEAN DECLINATION, 2011

ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- State Route



A Cahokia Formation, Peoria Silt, Equality Formation, Roxana Silt, Pearl Formation, and Glasford Formation Sand, silt, gravel, clay, and diamicton. Sand is tan to brown, fine to medium-grained, poorly sorted, friable, weakly to well-stratified, and occurs in floodplains and main tributary valleys (Cahokia Formation). Silt is gray to brown, occurs as a windblown sediment on hillslopes and as alluvium in floodplains (Cahokia Fm. and Peoria Silt). Recent gravel occurs in the floodplains of major rivers (Cahokia Fm.); older gravel and sand deposits occur on uplands and at high elevations in high in tributary valleys (Pearl Formation). Recent clay occurs in floodplains of major drainages (Cahokia Fm.); older clay occurs above modern floodplain elevation but beneath the Cahokia Fm. at low elevations in the tributaries to major rivers. Diamicton is sandy and silty, tan to gray-brown, and discontinuously interstratified with sand and gravel. Base of the unit is unconformable on the Galena below.

B Wise Lake Formation Dolomite. Light gray (10YR 7/2 wet) to light brownish gray (2.5Y 6/2) on fresh surface, weathers light yellowish brown (10YR 6/4); pure grainstone, contains no chert, but locally contains scattered light greenish gray clay (in ISGS corehole MM#1). Finely to medium crystalline, "sandy" texture, thin to medium bedded, bioturbated, knobby on weathered face. Fossils include the brachiopod *Rafinesquina*; gastropods *Hormotoma* and *Liospira*; coral *Streptelasma*; trilobite *Illaenus*; and blue-green algae *Fisherites* (*Receptaculites*). A 2-inch thick shale (K-bentonite bed) at the base of the Wise Lake in the ISGS MM #1 core probably correlates with the Dygerts Bentonite bed of Willman and Kolata (1978) because no chert is present above this bentonite bed. The Wise Lake occurs in the western part of the study area and on the downdropped northeast side of the Mount Morris uplift. The upper 13 feet of the Victory School section (1750'EL, 700'SL, Sec. 32, T. 24 N., R. 9 E.) of Willman and Kolata (1978) is Wise Lake. The basal contact is sharp but conformable with the Dunleith.

C Dunleith Formation Dolomite. In the MM #1 core, the upper part is light yellowish brown (10YR 6/4 wet), finely to medium crystalline, "sandy" texture, pure grainstone, intensely dolomitized, bioturbated, vuggy; it contains a few bedding-parallel shale partings and white to light gray fossiliferous chert in nodules or 1-inch-thick beds. The lower part is light brownish gray (2.5Y 6/2 wet), contains thin wavy shaly partings, multiple hardground surfaces, no chert, and is bioturbated. The lower part is darker gray, more argillaceous, and less weathered than the upper part. In outcrop, it appears massively bedded, but when examined closely, massive beds are composed of several thin, wavy, indistinct beds, and some beds are separated by thin, carbonaceous greenish shale partings. The lower 36 feet of the Victory School section of Willman and Kolata (1978; 1750'EL, 700'SL, Sec. 32, T. 24 N., R. 9 E.) as well as the bluffs of Pine Creek are Dunleith. Moldic porosity can occur on fresh faces; a pitted surface, or beehive weathering, commonly occurs on weathered faces. Light gray to white chert occurs in flat slabs or lenses; the chert can be irregularly scattered throughout or form well-defined layers. A few *Fisherites* (*Receptaculites*) zones occur within the formation; the calcareous algae *Fisherites* is an index fossil of the Galena and does not occur in the Platteville Group. Where *Fisherites* cannot be identified in the field or in core samples, the crystalline texture is characteristic and is the key to telling it apart from the formations of the Platteville Group. Several K-bentonite beds that are one-inch-thick or less have been identified from the Dunleith (Willman and Kolata 1978). Stylolites and hardground omission surfaces occur locally at the basal contact, but the two formations otherwise appear to be conformable.

D Guttenberg Formation Dolomite and shale. In the MM #1 core, dolomite is reddish brown (5YR 5/3), very fine grained, interbedded with dark reddish brown (5YR 3/2) shale; it is very fossiliferous, and pyrite crystals in vugs are abundant in the lower 2 feet. In outcrop, the shale weathers to light gray to light greenish gray "gummy" clay, the shale bedding is very wavy and contorted, coalesces into thick bands, and the interval contains white "egg-like", flat chert lenses. Fossils are generally abundant; strophomenid brachiopods are the most conspicuous and ubiquitous, including the brachiopods *Sowerbyella punctostriata* and to a lesser extent *Rafinesquina trentonensis*. The Elkport and Dickeyville K-bentonite Beds have been identified in the Guttenberg (Kolata et al. 1986). The Guttenberg forms a re-entrant in weathered quarry or outcrop exposures; it can be absent or extremely thinned from solution of the limestone within the formation. The high shale content can make this a useful horizon for electric log correlation, but the MM #1 gamma log did not show a shale kick in the Guttenberg interval. Guttenberg is exposed in the west bank of a west-southwestward flowing tributary to Pine Creek (100'WL, 3300'NL, Sec. 3, T. 23 N., R. 9 E.) and in the west bank of a southward flowing tributary to Pine Creek (1600'WL, 300'NL, Sec. 11, T. 23 N., R. 9 E.). The basal contact is gradational with the Quimbys Mill below.

E Quimbys Mill Formation Dolomudstone and chert. Light brownish gray (2.5Y 6/2 wet) when fresh, yellow (2.5Y 7/6) when weathered, mottled with medium gray dolomudstone in places because of infilling of burrows, abundant bands and smooth nodules of cherty dolomudstone, bioturbated, becomes slightly shaly downward (MM #1 gamma log). Beds are thin and tabular. The characteristic feature of the Quimbys Mill is that it fractures with smooth, curved surfaces; it is called "the glassrock" in the Mississippi Valley zinc-lead mining district. Fauna is not abundant but can include *Opikina* and *Streptelasma*; *Chondrites* is a common trace fossil in the middle of the unit. In general, the top of the unit is ferruginous and is capped by a prominent hardground omission surface. Quimbys Mill is exposed in the stream bed of a narrow east-southeast flowing tributary to Pine Creek (1650'WL, 1000'SL, Sec. 2, T. 23 N., R. 9 E.) and on the northwest cutbank of a S 20° W flowing tributary to Pine Creek (200'EL, 2000'SL, Sec. 32, T. 24 N., R. 9 E.). Very shaly at base; sharp but conformable contact with the Nachusa below.

F Nachusa Formation Dolomudstone. Light brownish gray (10YR 6/2 wet), relatively pure dolomite, some voids filled with very fine-grained crystalline dolomite, very thin very dark brown (10YR 2/2) shaly partings occur sparsely, bioturbated, sparse fossil molds. Thin bedded, but bedding is indistinct in places. In the MM #1 core, four white chert beds occur in the upper 9 feet of the unit; otherwise the unit is non-cherty. Chert is less abundant in the Nachusa than in the overlying Quimbys Mill. Fossils are generally moderately abundant in the lower part and include the tabulate coral *Foerstephyllum* and the trace fossils *Palaeophycus* and *Chondrites*. The upper contact with the overlying Quimbys Mill is sharp but conformable. The lower contact is gradational with the Grand Detour below.

G Grand Detour Formation Dolomudstone and shale. In the MM #1 core, dolomudstone is light brownish gray (10YR 6/2 wet); upper part is more argillaceous than lower part (see MM #1 gamma log), and beds are thin but indistinct. The upper part is identical to the Nachusa. The middle part (Forreston or Stillman Member?) contains an intraformational conglomerate (collapse zone) where bedding is contorted, abundant pyrite surrounds rounded dolomudstone clasts, and very thin very dark brown shaly partings are common. A few feet above the collapse zone, bedding dips 25°. The lower 13 feet is very cherty overall, bioturbated, contains few sparse fossil fragments, and dark brown shale partings become more common downward. One foot from the base, sphalerite is present in a small vug. The fauna is reported to be abundant and diverse, including the solitary rugose coral *Streptelasma*, the rhombiferan cystoids *Coronocystis durandensis*, the lithistid sponges *Anthaspidella* and *Zittelella*, and the trace fossils *Palaeophycus* and *Buthotrephis* (*Chondrites*). Hundreds of horn corals can be concentrated on the shaly horizons (Kolata, personal communication). Lower contact is gradational with the Mifflin below.

H Mifflin Formation Dolowackestone. In the MM #1 core, the Mifflin is dolowackestone, mottled light brownish gray with medium gray, frequent gray (10YR 5/1) wavy shale partings, bioturbated, contains fossiliferous layers, thin to very thin wavy bedded, and mudcracks occur. The unit is the most shale-rich formation in the Platteville (Kolata, personal communication). The Mifflin is locally very fossiliferous and contains various well-preserved bryozoans, brachiopods, bivalves, gastropods, ostracodes, and trilobite fragments. In the MM #1 core, the upper contact is marked by a 1-inch-thick mature grainstone bed, but in some places, the upper part contains a prominent hardground omission surface and a 6-inch-thick bed of shaly dolomite or limestone. The basal contact is sharp and scoured with the Pecatonica below.

I Pecatonica Formation Dolograinstone and dolomudstone. Light brownish gray dolograinstone mottled with dark brownish gray dolomudstone, thin to very thin wavy bedded, less shaly and less fossiliferous than the overlying Mifflin, bioturbated, vuggy. The top is marked by a pyritized hardground omission surface (represents submarine chemical erosion of the carbonate sea floor), and fossil content decreases dramatically below this boundary. In the MM #1 core, dolomite recrystallization, steeply dipping fractures, and extensive burrowing occurs in a four-foot-thick section in the middle of the formation. The lower one foot of the Pecatonica contains abundant fine to medium well-rounded sand grains (St. Peter-type) and phosphatic grains (MM #1 core; Templeton 1951). Slightly pyritic in basal one foot. Basal contact is sharp and scoured.

J Glenwood Formation Sandstone and shale. In the MM #1 core, sandstone is white, quartz arenite, fine to medium grained, well rounded, well sorted, frosted (St. Peter-type). Shale is greenish gray (5G 6/1 wet), silty, occurs in uppermost one foot; the remainder of the interval is sandstone with interstitial greenish gray clay. The Glenwood interval contains moderate pyrite. In outcrop, the greenish gray Harmony Hill Shale at the top weathers to dusky red (2.5YR 3/2) and is fissile to wavy bedded. The Glenwood is characterized by abrupt lateral changes in lithology, and in some places it is absent. It is exposed in the south cutbank of an east flowing tributary to Gale Creek (750'EL, 2800'SL, Sec. 1, T. 23 N., R. 9 E.) and on the south bank of an eastward flowing portion of Gale Creek (800'EL, 4050'N of the same section). The best exposure of Glenwood, however, is in a St. Peter quarry about four miles southeast of Mt. Morris. The basal contact was observed in this quarry face and showed a sharp angular unconformity with the St. Peter below, but in the MM #1 core, the basal Kingdom Sandstone Member is gradational with the St. Peter below.

K St. Peter Sandstone Sandstone and chert. Sandstone is white, quartz arenite, fine to medium grained, well rounded, well sorted, frosted, and well-indurated to friable. Cross bedded to thinly laminated within massive beds. It weathers to white sand and forms broad hills in most of its outcrop area; but where overlain by the Glenwood and Platteville Group dolomites, it is a low bluff-former and contains small sapping alcoves. The upper 30 feet contains green streaks along bedding planes; the color seems to stain the exterior of the grains. The basal Kress Member is present in a City of Oregon water well about two miles east of the study area (Sample Set 64615, Sec. 3, T. 23 N., R. 10 E.); it contains 78 feet of chalky, white chert, which has been weathered to tripoli; it is oolitic in part, and contains sandy, reddish brown shale. The Kress Member is not present everywhere and was not observed in outcrop within the study area. The St. Peter is penetrated, in some places, by thin (mm-scale) white silicified "deformation band shear zones" (this type of strain localization feature is discussed in Fossen et al. 2007) that cut at various angles to bedding. These cataclastic deformation bands are present in close proximity to inferred faults, and are identical to those observed in quartz arenites in the Ste. Genevieve Fault Zone (southern Illinois) and Laramide monoclines of the Colorado Plateau (Tindall and Davis 1999). The lower contact is sharp, unconformable, and scoured into several older formations as a result of pre-St. Peter uplift and erosion; the unconformity has considerable local relief.

L Shakopee Dolomite Dolomite, sandstone and shale. Dolomite is light yellowish brown (10YR 6/4) on fresh surface, dark brown on weathered surface, very finely crystalline, hard, and breaks with a conchoidal to hackly fracture; contains moderately abundant sand (St. Peter-type), which is mostly medium grained with a few coarse grains, well-rounded, and frosted. Thin, medium, and thick lenticular beds occur; bedding surfaces vary from rough and hummocky to smooth and flat, show mudcracks or ripple-marks, and are partly coated with films of green clay. Sandstone is brownish yellow (10YR 6/8) to bluish gray (5B 6/1), St. Peter-type sandstone with dolomite or chert cement; bedding occurs in various forms—indistinct, cross bedded, graded bedded, ripple-marked, to stratified, thin bedded. Shale is light greenish gray (5G 7/1) to maroon, silty in part, and is thinly laminated. The unit is stained with manganese and iron in vugs and cracks. Algal stromatolite domes (*Cryptozoon minnesotense*) occur on the order of one foot wide in the region, but none were identified in the study area. Templeton (ISGS field notes) identified low-spired, loosely-coiled gastropods, occasional pelecypods, and few brachiopods in the Gale Creek outcrop (location noted below). Only the upper part of the formation is exposed in the quadrangle; an outcrop and abandoned quarry exposes 35 feet of Shakopee (about 100' southeast of Oregon Trail Rd., 30' northeast of Gale Creek, 1700'WL, 3700'NL, Sec. 6, T. 23 N., R. 10 E.). The base of the formation is not exposed within the quadrangle, but stratigraphic relations in the adjacent Oregon Quadrangle (Seid 2010) suggest that the Shakopee either rests conformably on the New Richmond and/or Oneota Formations or is separated from them by only a minor unconformity (Templeton 1951).

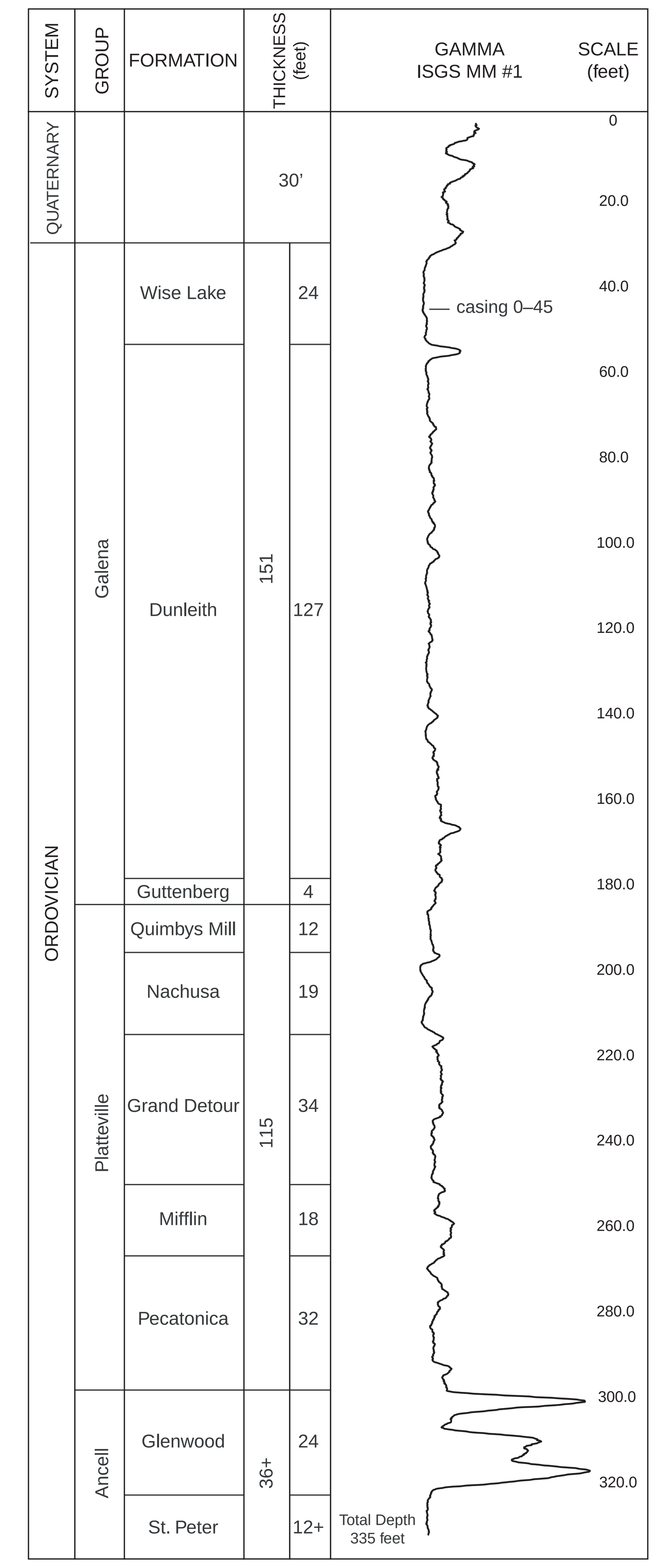


Figure 1 Gamma log of ISGS MM #1 borehole.

Introduction

The Mount Morris 7.5-minute Quadrangle is located in north-central Illinois in the west-central part of Ogle County, Illinois, about 25 miles southwest of Rockford, 40 miles south of the Illinois-Wisconsin border, 85 miles northeast of the Quad Cities and 115 miles west of Chicago. It covers a 55 square mile area that is bounded by 42° 00' 00" and 42° 07' 30" North latitude and 89° 22' 30" and 89° 30' 00" West longitude. The Mount Morris 7.5-minute Quadrangle occupies the southwest quarter of the Oregon 15-minute Quadrangle. It is bordered by eight 7.5-minute quadrangles, clockwise from top-left: Forreston North, German Valley, Seward, Oregon, Daysville, Grand Detour, Polo, and Forreston South. All of the stream drainages within the quadrangle flow toward the Rock River. The quadrangle lies within the Rock River Hill Country of the Central Lowland Province. Agricultural, commercial, industrial, and residential developments currently drive the region's economy.

Portions of this area were previously mapped by Bevan (1924) and Templeton (1940) but remain unpublished. The bedrock geology of the adjacent Oregon and Grand Detour 7.5-minute quadrangles are published by Seid (2010) and Kolata (2011).

Field work for this map was completed in 2010 and 2011 by the author. A total of about 200 field observations served as the basis for mapping geologic contacts and recording structural data. Water well records were extremely helpful in areas of sparse outcrop data; the records were accessed from the Illinois Water Well database (http://isgs.illinois.edu/maps-data-pub/wwdb/launchims.shtml, accessed 6/1/11) and the Illinois State Geological Survey Geological Records Unit (ISGS GRU) in Champaign, Illinois. Drill cuttings or sample sets (SS) on file at the ISGS were examined and provided subsurface data. Two hundred twenty-two boreholes were utilized to map the bedrock, and 12 of those were located within a 100 foot radius of confidence by field or plat (land ownership map) verification. One new borehole was drilled through the Galena, Platteville, Glenwood, and St. Peter units (fig. 1, API #:121412600300, Core name: MM #1, Total depth of 335 feet, located 260 feet from the east line, 1270 feet from the south line, Sec. 22, T24N, R9E, Latitude 42.0616° N, Longitude 89.43258° W, 881 feet elevation). A continuous core for this hole is on file at the ISGS core library, and stratigraphic descriptions and downhole geophysical logs are on file at the ISGS GRU.

A thin layer of glacial deposits (0 to 40 feet thick) obscures the bedrock in most of the quadrangle, except for main tributary valleys to Rock River. Bedrock exposures occur in the South Fork of Leaf River, Coon Creek, Pine Creek, Gale Creek, Mud Creek, and Silver Creek. Quaternary Pearl and Cahokia formations (Hansel and Johnson 1996) were mapped where the bedrock was deeper than 5 feet. Abandoned pits and quarries were mapped where they were observed in the field, as shown in soil maps (Acker et al. 1980, Soil Survey Geographic Database, accessed in July 2011), and from a study of road resources in Ogle County (Flint et al. 1931).

Stratigraphy

The bedrock formations that occur at or near the surface within the Mount Morris Quadrangle are all Ordovician dolomites and siliciclastics. These strata are assigned to the Ibexian (Ross et al. 1993) and Mohawkian Series (Thompson 1991), and they are further divided into the Prairie du Chien, Ancell, Platteville, and Galena Groups.

Figure 2 View looking west of the dark reddish brown wispy shale in the Guttenberg Formation at stream level. The ledge above is dolomite of the Galena Group. This outcrop is located in the west bank of a southwest flowing tributary to Pine Creek (100' WL, 3300' NL, elongate Sec. 3, T23N, R9E). Photo taken on November 2, 2010.

The MM #1 core hole provided much information about the stratigraphy from the Wise Lake Formation (Galena Group) down to the upper part of the St. Peter Sandstone (Ancell Group).

The oldest bedrock that outcrops at the surface in the quadrangle is the Shakopee Dolomite, which is assigned to the Prairie du Chien Group. Only the upper 35 feet is exposed in the quadrangle, but it probably reaches a maximum thickness of 80 feet. The Shakopee is composed mainly of dolomite, but locally it contains sandstone, shale and chert. The only outcrop in the study area is an abandoned quarry 1,700 feet from the west line, and 3,700 feet from the north line of Sec. 6, T23N, R10E, where 35 feet of Shakopee is overlain by St. Peter Sandstone (Templeton 1942). About 200 feet to the south of the abandoned quarry, there is a small Shakopee exposure on the east side of Gale Creek. The extent of the Shakopee in the study area is poorly constrained, and the mapped occurrence to the east in the Oregon Quadrangle is based solely on these two closely spaced exposures in the Mount Morris Quadrangle. The outcrop area of the Shakopee defines the northwesternmost extent of the Oregon Anticline (Bevan 1939) and is probably a pop-up structure related to the Sandwich Fault Zone (Kolata et al. 1978). The contact between the Shakopee and the St. Peter Sandstone is an erosional unconformity, except where it is uplifted by faulting.

The St. Peter Sandstone overlies the Shakopee. The contact at the base of the St. Peter is a major unconformity in Illinois. It separates the Sauk Sequence (below) from the Tippecanoe Sequence (above) (Willman et al. 1975). Locally the St. Peter Sandstone cuts deeply into Ibexian rocks, forming a very irregular erosional surface. The Kress Member represents a thick accumulation of residual materials at the base of the St. Peter.

The Platteville and Galena carbonates were "deposited in a stable, normal marine environment characterized by relatively low depositional energy" (Willman and Kolata 1978, p. 16). Although the Platteville is recognized at the Formation level in Minnesota (Mossler 2008, Tipping and Runkel 2008), the most recent work in Illinois stratigraphy recognizes the Platteville and Galena at the Group level. The Platteville and Galena Groups in northern Illinois are further divided into many thin intervals at the Formation and Member levels (Willman and Kolata 1978).

The Platteville Group is split into five formations, and four of the five formations are split into several members. The lowest formation in the Platteville Group is the Pecatonica Formation, which is split into the Hennepin, Chana, Dane, New Glarus, Medusa, and Oglesby Members, each attaining a thickness of 0 to 16 feet. The overlying Mifflin Formation is not divided into members. Within the succeeding Grand Detour Formation are the Cowen, Stillman, and Forreston Members, which are each roughly 5 to 15 feet thick. The Nachusa Formation is divided into the Eldena, Elm, and Everett Members, which each reach a thickness of no more than 10 feet. The uppermost Quimbys Mill Formation contains the Hazel Green, Shullsburg, and Strawbridge Members, and these range in thickness from 0 to 9 feet.

The five formations within the Platteville Group are mapped as a single unit because the combined thicknesses of the formations (114 to119 feet) constitute a mappable unit at the 1:24,000 scale.

The Galena Group is divided into three formations, and each formation is further split into members. The Guttenberg Formation (fig. 2) is divided into the Garnavillo and Glenhaven Members. The overlying Dunleith Formation is split into the Buckhorn, St. James, Beecher, Eagle Point, Fairplay, Loves Park (contains the Mortimer, Rivoli, Sherwood, and Wall sub-Members), and Wyota Members. The Wise Lake Formation contains the Sinsinawa and Stewartville Members. The uppermost Dubuque Formation does not occur in the study area but is present less than one mile to the west of the western edge of the map area, as indicated by well data. *Fisherites* (fig. 3, Finney and Nitecki 1979, old name: *Receptaculites*) is an index fossil of the Galena Group (Trentonian, Middle Ordovician) in the midwestern United States.

The three formations within the Galena Group—Wise Lake, Dunleith, and Guttenberg—are mapped together for two reasons: 1) the lithologic character of each formation is so similar that an accurate contact could not be reasonably estimated in the field and 2) the author believes that their combined thicknesses constitutes a mappable unit at the 1:24,000 scale.

Structural Geology

The Mount Morris Quadrangle is situated near the southeasternmost extent of the Wisconsin Arch, the northwestermost projection of the LaSalle Anticlinorium, to the north of the Illinois Basin and to the south of the Michigan Basin. The regional dip of strata is west-southwest, with a few broad folds in the bedrock beneath Quaternary deposits (see cross section A–A′). The local bedrock structure is influenced by the Sandwich Fault Zone to the southeast (refer to Kolata et al. 1978) and the Plum River Fault Zone to the north (see Kolata and Buschbach 1976, Bunker et al. 1985). Within the quadrangle, the bedrock is folded, broken, and sheared along several faults and folds in the study area—the Mount Morris structure; the Mud Creek fault and associated Mud Creek syncline; and the Gale Creek structure.

Mount Morris Structure

Examination of water wells revealed an uplifted block or dome of St. Peter Sandstone in the town of Mount Morris. The structure is defined by four water wells which reach St. Peter Sandstone just below surficial sediments. The wells require that the uplifted block is elongated in the northwest-southeast direction. The amount of displacement is between 100 and 250 feet, with the highest point in SW¼ NW¼ Sec. 27, T24N, R9E. This trend follows a small dome that Templeton and Willman (1952) depicted along the axis of the Oregon Anticline. The Mount Morris structure is in line with uplifted fault blocks of Shakopee (Prairie du Chien) and a large outcrop area of thick St. Peter Sandstone (containing Devils Backbone and Castle Rock State Park to the south in the Grand Detour Quadrangle, Kolata 2011).

Mud Creek Fault

The Mud Creek fault zone (Templeton and Willman 1952) trends roughly east-west along Mud Creek, is roughly 1000' wide and 3 miles long (from center Sec. 25, T24N, R9E eastward to center Sec. 28, T24N, R10E The displacement is downthrown to the north about 30 to 50 feet. Faulted, brecciated and sheared Dunleith (Galena) dolomites are exposed at many points along the length of Mud Creek. The fault relationships were well exposed in 1946 (Templeton and Willman 1952) in a small quarry located 2750'WL, 1100'SL, Sec. 30, T24N, R10E. This exposure is now poorly exposed and on private property.

Mud Creek Syncline (new name)

The Mud Creek syncline is a shallow N 80 to 85° W trending fold on the northern (downthrown) side of the Mud Creek fault. It runs approximately parallel to the fault zone and is characterized by Platteville and Galena dolomites dipping about 20° on the steeper south flank and 5° on the gentler north flank. The fold is a doubly plunging syncline, with an eastward plunge in the Mount Morris Quadrangle and a westward plunge in the Oregon Quadrangle. The lowest point of the syncline is approximately located at the border between the quadrangles, and the structural closure is roughly 50 feet.

Gale Creek Structure (new name)

The Gale Creek structure is defined by two closely-spaced outcrops of dipping Shakopee in Gale Creek surrounded by St. Peter Sandstone. The Shakopee is uplifted about 130 to 180 feet, with the highest point near the center of the W½, Sec. 6, T23N, R10E. Faulting probably occurred after St. Peter deposition and is related to faults that cut the Ancell, Platteville, and Galena units about one mile southward in the Grand Detour Quadrangle. Field observations could not confirm or deny a fault bounding the uplifted and tilted Shakopee block. Therefore, the author interprets the structure to be a faulted dome, with a concealed fault uplifting the southwest flank. The map view geometry is depicted as an arcuate pod of Shakopee in faulted contact with the St. Peter Sandstone, with a trend of N 50° W. The structure is about 1¼ miles in length and occurs in Sec. 6, T23N, R10E, The Gale Creek structure occurs at approximately the northwestern extent of the Oregon Anticline (Templeton 1951, Templeton and Willman 1952).

Origin and Timing of Structures

The root of these structures can likely be traced downward into the Precambrian basement, like other major faults in the Midcontinent USA (Duchek et al. 2004, McBride 1998, McBride and Nelson 1999). The stratigraphic relationships within the Oregon, Grand Detour and Mount Morris Quadrangles indicate tectonic activity during the following times: 1) post-Shakopee, pre-St. Peter, 2) post-St. Peter, pre-Glenwood, and 3) post-Galena, pre-Pleistocene. The structures in the study area are probably genetically related to multiple movements on the nearby Sandwich and Plum River fault zones.

Figure 3 Fisherites (old name: Receptaculites) fossil was found in a float block of Galena Group dolomite on the west bank of Pine Creek (1750'WL, 2800'NL, Sec. 4, T. 23 N., R. 9 E.). Fisherites is an index fossil of the Galena Group. A small exposure of Galena occurs where the float was found. Photo taken on November 3, 2010.

Future Research Questions

Geologic mapping of the Mount Morris, Oregon, and Grand Detour quadrangles indicate that several fault-bounded blocks of upthrown older strata occur. In map view, the strike of these faults is oblique to the Sandwich and Plum River fault zones. The fault trends suggest that the upthrown blocks were uplifted as a result of strike-slip motion on the Sandwich and Plum River structures. The faults and folds in central and southern Ogle County therefore represent an en echelon array of faults situated within a three-mile-wide step-over zone between the mapped extent of the Sandwich and Plum River fault zones. Marshak et al. (2003, p. 171) also proposed strike-slip movements on the Sandwich and Plum River fault zones, and Duchek et al. (2004) documented oblique-slip movement with as much as 300 m of strike-slip displacement on another Midcontinent USA structure, the Cottage Grove fault system.

However, in Ogle County, the geometry of the fault planes at depth (i.e. whether the faults are normal or reverse) is unclear. Further research should address the step-over zone between the Sandwich and Plum River fault zones in the subsurface (basement and overlying sediments). Geophysical imaging across the Mount Morris structure, the Mud Creek fault, the Gale Creek structure, the slice of Cambrian Franconia Formation (Oregon Quadrangle, Sec. 3, T23N, R10E), and the Burlington Railroad faults (Grand Detour Quadrangle, Sec. 7, T23N, R10E) could be performed to address the subsurface geometry of faults and folds in this region. The presence of positive or negative flower structures could provide clues as to whether these faults were developed in a transpressional or transtensional environment. If the sense of strike-slip motion could be determined, we could better understand the kinematics of the en echelon fault array in the step-over zone between the Sandwich and Plum River fault zones.

Economic Resources

Sand and Gravel

There are no active sand and gravel pits in the study area, but sand and gravel of the Quaternary Pearl Formation (Illinois episode of glaciation) has formerly been mined at the surface from many pits within the quadrangle.

Stone

One small long-abandoned quarry occurs in the Shakopee dolomite (1700'WL, 3700'NL, Sec. 6, T23N, R10E). Three abandoned quarries occur in the Platteville and Galena dolomites: Sec. 12, T24N, R9E (Dunleith Formation); Sec. 32, T24N, R9E (Dunleith and Wise Lake Formations); Sec. 30, T24N, R10E (Quimbys Mill and Dunleith Formations). None of the stone quarries were active during the time of mapping.

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References

Acker, L.L., M.S. Hodges, G.T. Keller, and R. Rehner, 1980, Soil Survey of Ogle County, Illinois: Illinois Agricultural Experiment Station and United States Department of Agriculture, 242 p., 109 map sheets.

Bevan, A.C., 1924(?), Surface geology of Oregon 15-minute quadrangle: Illinois State Geological Survey, Map Room 4107 d5.1-179, 3 sheets.

Bevan, A.C., 1939, Cambrian inlier in northern Illinois: American Association of Petroleum Geologists Bulletin, v. 23, no. 10, p. 1561–1564.

Bunker, B.J., G.A. Ludvigson, and B.J. Witzke, 1985, The Plum River Fault Zone and the structural and stratigraphic framework of Eastern Iowa: Iowa Geological Survey, Technical Information Series 13, 126 p.

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, p. 1465–1484, doi: 10.1130/B25413.1.

Finney, S.C., and M.H. Nitecki, 1979, Fisherites n. gen. *reticulatus* (Owen, 1844), a new name for Receptaculites oweni Hall, 1861: Journal of Paleontology, Vol. 53, No. 3, pp. 750–753.

Flint, R.J., A.C. Bevan, and J.H. Bretz, 1931, Road materials resources of Ogle County: Available from Illinois State Geological Survey Map Room, 4103.03 i5.4-2.

Fossen, H., R.A. Schultz, Z.K. Shipton, and K. Mair, 2007, Deformation bands in sandstone: a review, Journal of the Geological Society, v. 164, pp. 755–769.

Hansel, A.K., and W.H. Johnson, 1996, Wedron and Mason Groups: Lithostratigraphic reclassification of deposits of the Wisconsin Episode, Lake Michigan Lobe: Illinois State Geological Survey, Bulletin 104, 116 p.

Kolata, D.R., 2011, Bedrock geology of Grand Detour Quadrangle, Ogle and Lee Counties, Illinois: Illinois State Geological Survey, USGS-STATEMAP contract report, 2 sheets, 1:24,000.

Kolata, D.R., and T.C. Buschbach, 1976, Plum River Fault Zone of northwestern Illinois: Illinois State Geological Survey, Circular 491, 20 p.

Kolata, D.R., T.C. Buschbach, and J.D. Treworgy, 1978, The Sandwich Fault Zone of northern Illinois: Illinois State Geological Survey, Circular 505, 26 p.

Kolata, D.R., J.K. Frost, and W.D. Huff, 1986, K-bentonites of the Ordovician Decorah Subgroup, upper Mississippi Valley: Correlation by chemical fingerprinting: Illinois State Geological Survey, Circular 537, 30 p.

Marshak, S., W.J. Nelson, and J.H. McBride, 2003, Phanerozoic strike-slip faulting in the continental interior platform of the United States: examples from the Laramide Orogen, Midcontinent, and Ancestral Rocky Mountains, in Storti, F., Holdsworth, R.E., and Slavini, F., eds., Intraplate Strike-slip Deformation Belts: Geological Society of London Special Publication 120, p. 171–196.

McBride, J.H., 1998, Understanding basement tectonics of an interior cratonic basin: southern Illinois Basin, USA: Tectonophysics, v. 293, p. 1–20.

McBride, J.H., and W.J. Nelson, 1999, Style and origin of mid-Carboniferous deformation in the Illinois Basin, USA – Ancestral Rockies deformation?: Tectonophysics, v. 305, p. 275–286.

Mossler, J.H., 2008, Paleozoic stratigraphic nomenclature for Minnesota: Minnesota Geological Survey Report of Investigations 65, 84 p.

Ross, R.J., Jr., L.F. Hintze, R.L. Ethington, J.F. Miller, M.E. Taylor, and J.E. Repetski, 1993, The Ibexian Series (Lower Ordovician), a replacement for "Canadian Series" in North American chronostratigraphy: U.S. Geological Survey Open-File Report 93-598, 75 p.

Seid, M.J., 2010, Bedrock geology of Oregon Quadrangle, Ogle County, Illinois: Illinois State Geological Survey, USGS-STATEMAP contract report, 2 sheets, 1:24,000.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for Ogle County, Illinois. Available online at http://soildatamart.nrcs.usda.gov . Accessed July 22, 2011.

Templeton, J.S., ca. 1940, Draft geologic maps of the Oregon 15-minute Quadrangle: Illinois State Geological Survey, Map Room 4107 d5.1-180, 4 sheets, 1:62,500.

Templeton, J.S., ca. 1942, Unpublished fieldnotes: Available from Illinois State Geological Survey Library.

Templeton, J.S., 1951, The geology and mineral resources of the Oregon Quadrangle: Available from Illinois State Geological Survey Library, unpublished manuscript Ms. #3, 2 folders.

Templeton, J.S., and H.B. Willman, 1952, Central Northern Illinois: Guidebook for the 16th Annual Field Conference of the Tri-State Geological Society: Illinois State Geological Survey, Guidebook Series 2, 47 p.

Thompson, T.L., 1991, Paleozoic succession in Missouri, Part 2, Ordovician System: Missouri Department of Natural Resources, Division of Geology and Land Survey, Report of Investigation 70, 282 p.

Tindall, S.E., and G.H. Davis, 1999, Monocline development by oblique-slip fault propagation folding: The East Kaibab monocline, Colorado Plateau, Utah: Journal of Structural Geology, v. 21, 1303–1320, doi:10.1016/S0191-8141(99)00089-9.

Tipping, R.G., and A.C. Runkel, 2008, Geologic investigations to support Ground-Water Management II, Rochester metropolitan area, Minnesota: Minnesota Geological Survey Open-File Report 08-6, 15 p.

Willman, H.B. and D.R. Kolata, 1978, The Platteville and Galena Groups in northern Illinois: Illinois State Geological Survey, Circular 502, 75 p.

Willman, H.B., E. Atherton, T.C. Buschbach, C. Collinson, J.C. Frye, M.E. Hopkins, J.A. Lineback, and J.A. Simon, 1975, Handbook of Illinois stratigraphy: Illinois State Geological Survey, Bulletin 95, 261 p.