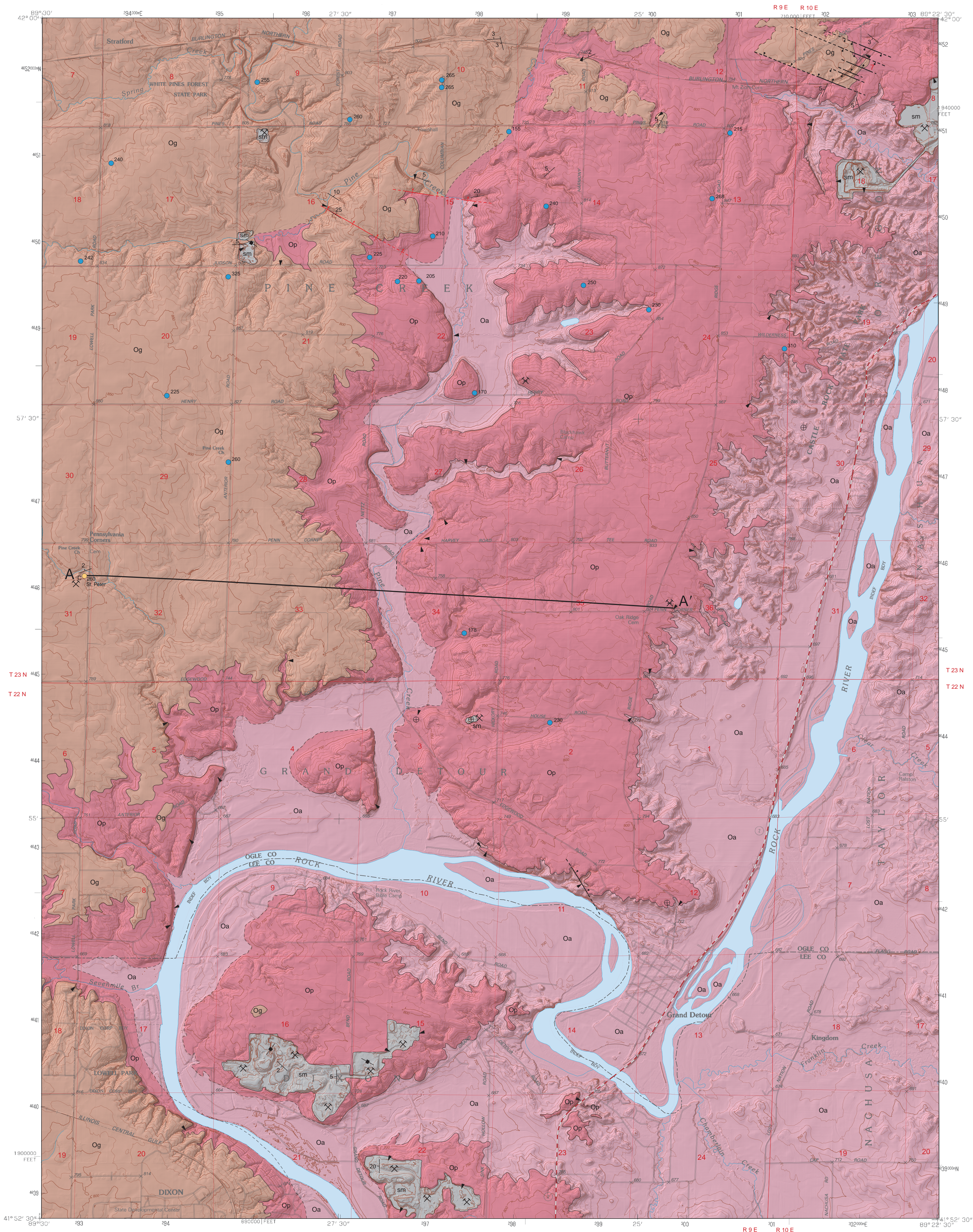


BEDROCK GEOLOGY OF GRAND DETOUR QUADRANGLE  
OGLE AND LEE COUNTIES, ILLINOIS

Prairie Research Institute  
ILLINOIS STATE GEOLOGICAL SURVEY

Illinois Geologic Quadrangle Map  
IGQ Grand Detour-BG

Dennis R. Kolata  
2012



EXPLANATION

Quarry mine

Galena Group

Platteville Group

Ancell Group

Ordovician

Mohawkian

Symbols

Strike and dip of bedding; number indicates degree of dip

Vertical joint

Horizontal bedding

Active quarry

Abandoned quarry

Outcrop of special note; shown where contact, map unit, or fault was well exposed at time of mapping

Drill Holes  
from which subsurface data were obtained

Stratigraphic boring

Water well

Labels indicate core (c).  
Numeric label indicates total depth of boring in feet.  
Unit label denotes formation at bottom.

Line Symbols  
dashed where inferred

Contact

Normal fault; bar and ball on downthrown side

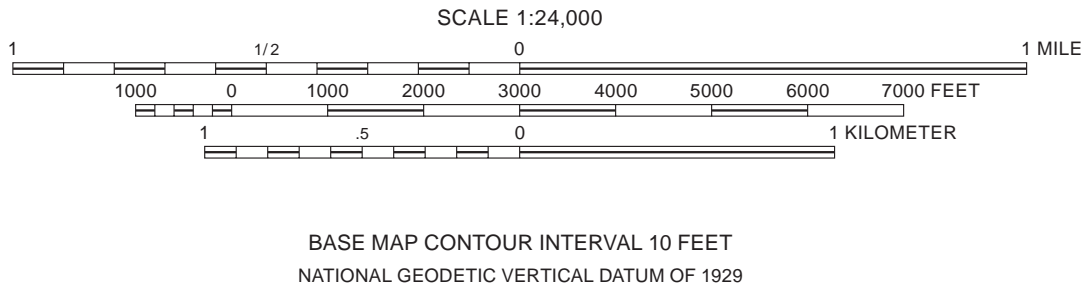
Monocline

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 1927 (NAD 27)  
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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Geology based on field work by D.R. Kolata, 2010–2011.

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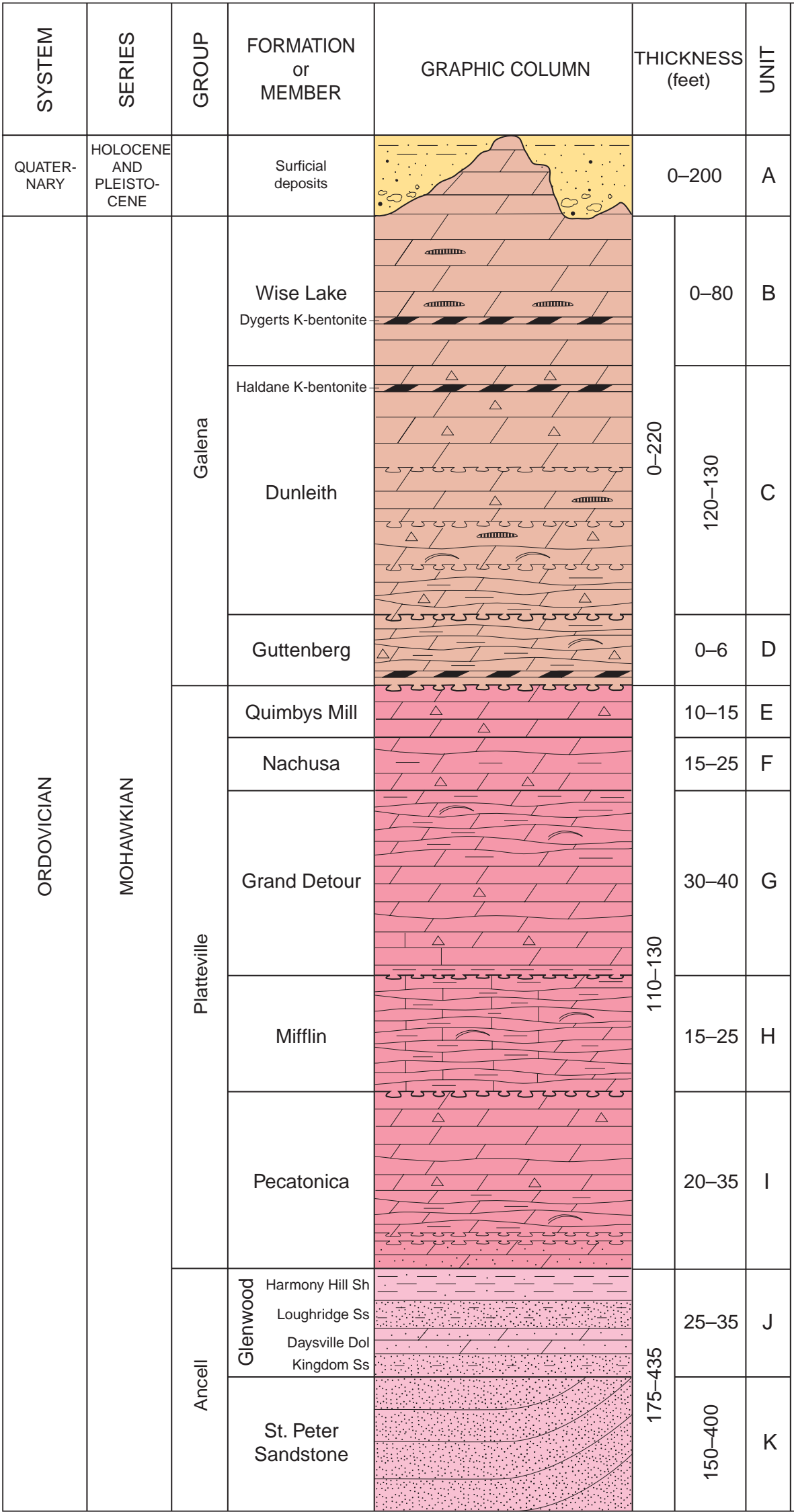
1	2	3
4	5	
6	7	8

ADJOINING QUADRANGLES  
1 Forrester South  
2 Mount Morris  
3 Oregon  
4 Polo  
5 Daysville  
6 Dixon West  
7 Dixon East  
8 Franklin Grove

2°  
N  
MAGNETIC DECLINATION  
APPROXIMATE MEAN  
DECLINATION, 2012

ROAD CLASSIFICATION  
Secondary highway, hard surface  
Light-duty road, hard or improved surface  
State Route





INTRODUCTION

The Grand Detour Quadrangle is situated in the southwestern part of Ogle and northernmost part of Lee Counties, Illinois. The name is derived from the small town of Grand Detour, which sits at the eastern end of a major bend in the Rock River. The river flows north past the town, rather than its normal south-western course; hence, the name Grand Detour.

The quadrangle lies in the Rock River Hill Country of the Central Lowlands Province. The upland areas are mostly cultivated for corn and soybeans. Limestone is mined for cement production and aggregate use in the southernmost parts of the quadrangle, and industrial sand is mined in the northeastern region. Other activities include public recreation in White Pines and Castle Rock State Parks as well as a moderate amount of residential and commercial developments.

Compilation of this map is based on an examination of bedrock exposures in quarries, road excavations, railroad cuts, and natural exposures along streams and waterways. Subsurface information was obtained from water well records, drill cuttings, and exploratory borings. In 2011 a continuous cored test hole was drilled to 260 feet by the Illinois State Geologic Survey (ISGS) in an abandoned quarry 5 miles north of Dixon, Illinois in Ogle County (IP 121412600200; ISGS core C15474 SE NE NE Sec. 31, T23N, R9E; latitude 41° 56' 30.45381" N and longitude 89° 29' 39.93540" W; height 775.3 feet). Wire-line logs were also obtained from this key reference boring and filed in the Geological Records Unit of the ISGS. The uppermost beds exposed in the quarry are of the lower Wise Lake Formation, which overlies approximately 20 feet of the Dunleith Formation. The core interval includes the remainder of the Dunleith Formation and the Quimbys Mill, Nachusa, Grand Detour, Mifflin, and Pecatonica Formations of the Platteville Group, the Glenwood Formation, and the uppermost St. Peter Sandstone. Field notes made by previous geologists and filed in the ISGS Library were another valuable source of information.

The bedrock in Lee and Ogle Counties was illustrated very generally on early statewide geologic maps (Worthen 1875, Weller 1906); however, the first concerted investigations of the Grand Detour area were published by Knappen (1926) in his report of the Dixon 15-minute Quadrangle, which includes the area covered by the Grand Detour 7.5-minute Quadrangle. A map showing the bedrock geology of Lee County, including the southern parts of the Grand Detour Quadrangle, was published by McGarry (1999). Stratigraphic and structural investigations in the Grand Detour area include those by Templeton and Willman (1952, 1963), Kolata and Buschbach (1976), Willman and Kolata (1978), and Kolata et al. (1978).

STRATIGRAPHY

Throughout most of the uplands in the Grand Detour Quadrangle, the bedrock is covered by less than 25 feet of glacial drift, and, in many areas between Pine Creek and Rock River, bedrock occurs at the surface. Quaternary valley train deposits range from 0 to 50 feet thick (Piskin and Bergström 1975). The stratigraphic units that are known to occur at the bedrock surface in the quadrangle include the Upper Ordovician Ancell, Platteville, and Galeana Groups. All were deposited in intertidal to subtidal marine environments. The Glenwood subdivisions that are present include the Kingdom Sandstone, Daysville Dolomite, Loughridge Sandstone, and Harmony Hill Shale Members. The Platteville and Galeana Groups consist mainly of dolomite and local occurrences of limestone (Platteville only). These groups are further subdivided into members and formations based on relative amounts of disseminated clay and silt as well as the presence or absence of chert. Recognizable units within the Platteville include the Pecatonica, Mifflin, Grand Detour, Nachusa, and Quimbys Mill Formations. Galeana rock units that are recognized in the Grand Detour Quadrangle include the Guttenberg, Dunleith, and Wise Lake Formations. Two or three K-bentonite beds are present in the Platteville and Galeana rocks in this part of Illinois. These ash deposits originated from volcanic arcs situated along the southeastern margins of the continent in the vicinity of present-day North Carolina and South Carolina (Kolata et al. 1996). For all practical purposes, the ash deposits are isochronous.

Several hardground omission surfaces within the Galeana and Platteville are widespread and persistent. They are readily identified in outcrop and drill core and are useful in correlating this part of the stratigraphic column. These planar surfaces are characterized by irregular solution cavities, mainly less than 2 inches across. They penetrate the bedding planes to depths of 2 to 3 inches, are stained by iron-rich minerals, and are backfilled with sediment from the overlying unit (Kolata et al. 1998, 2001). Some of the more significant surfaces include (1) approximately 15 to 20 surfaces in the lower part of the Dunleith Formation, (2) the top of the Guttenberg Formation, (3) the top of the Quimbys Mill Formation, (4) the top of the Mifflin Formation, (5) the top of the Pecatonica Formation, and (6) two or three surfaces in the lower 10 feet of the Pecatonica Formation.

STRUCTURAL GEOLOGY

The Grand Detour Quadrangle lies along the northern margin of the Illinois Basin and is situated in a structurally complex area near the termination of the Sandwich Fault Zone, Plum River Fault Zone, and the projected trend of the La Salle Anticlinorium. Lying parallel to and south of the Sandwich Fault Zone in Lee and Ogle Counties is the Ashton Anticline (fig. 1). This broad anticline brings Middle Ordovician and Upper Cambrian rocks to the bedrock surface along the south side of the Sandwich Fault Zone just east of the Grand Detour Quadrangle and is responsible for the pronounced west-southwest dip within the quadrangle (see cross section A-A').

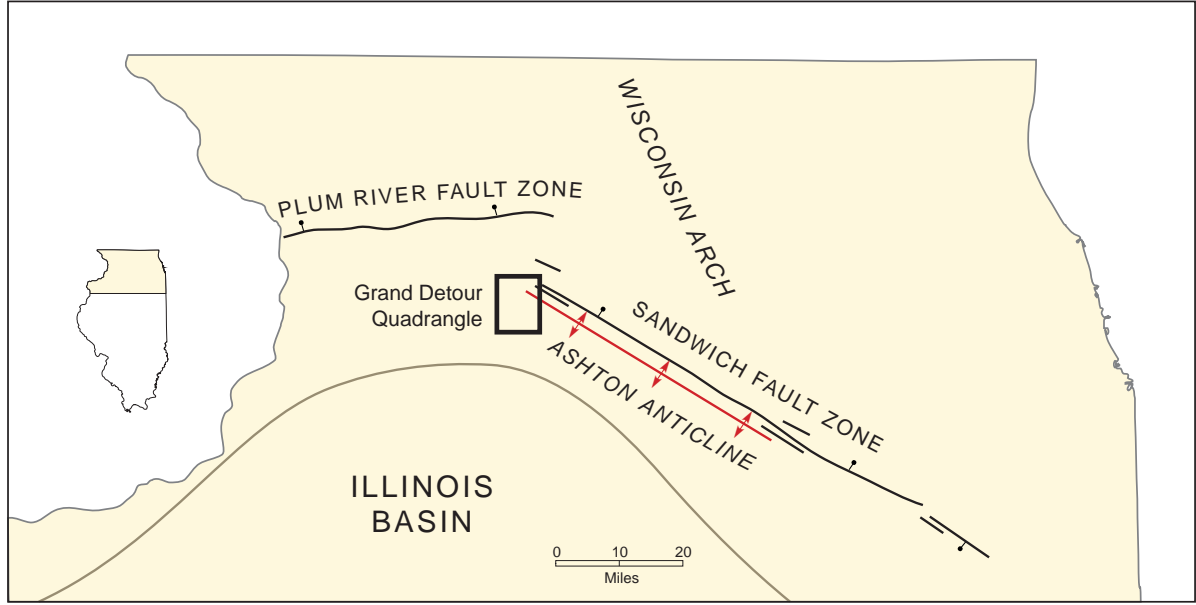


Figure 1 The Sandwich Fault Zone and the Plum River Fault Zone.

Sandwich Fault Zone

The Sandwich Fault zone extends in a northwesterly direction from near Manhattan, Will County, to central Ogle County, a distance of about 85 miles (Kolata et al. 1978). Outcrop and subsurface information indicate that the fault zone is about ½ to 2 miles wide and is upthrown on the south along most of its extent. The fault zone has a maximum cumulative displacement of about 800 feet at its midpoint in southeastern De Kalb County.

One of the best exposures of the fault zone can be seen in the northeast corner of the Grand Detour Quadrangle at the Burlington Northern Railroad cut (NW NW SE and NE SW Sec. 7, T23N, R10E) and at outcrops in nearby quarries (SE SE Sec. 7, and NW SW Sec. 8, T23N, R10E) (Templeton and Willman 1952, Kolata et al. 1978). Here the Sandwich Fault Zone is characterized by about two dozen northwest-trending high-angle faults that bound small graben and horst blocks that displace strata ranging from the Pecatonica Formation to the Wise Lake Formation. Most of the faults have small displacements of 1 to 10 feet but one fault near the southwest end of the railroad cut may have as much as 130 feet of displacement. The faults project northwestward toward the Mt. Morris Quadrangle. Stratigraphic relations indicate that the faulting is post-Niagaran (middle Silurian) to pre-Illinoian (Pleistocene) in age and likely to be contemporaneous with the late Paleozoic deformation that formed many of the structural features in the midcontinent United States.

During recent mining operations near the center of Sec. 18 (T23N, R10E), a high wall (fig. 2) was cut through the Late Ordovician St. Peter Sandstone and overlying Glenwood Formation. This outcrop is remarkable because it reveals a previously unknown episode of Late Ordovician structural deformation in northern Illinois (Seid and Kolata 2011). The exposure is approximately 100 feet high and 900 feet long and extends in an east-west direction along a north-facing wall. The St. Peter Sandstone is folded into a broad north-northeast-trending syncline and anticline. Structurally tilted up to 20 degrees, the St. Peter strata were subsequently erosionally truncated and covered by flat-lying shale, dolomite, and sandstone of the Glenwood Formation, forming a pronounced angular unconformity. Stratigraphic relations indicate that at least 100 feet of the St. Peter Sandstone was eroded from the crest of the anticline prior to deposition of the Glenwood. This site is situated along the northwestern termination of the Sandwich Fault Zone, which suggests that the folds are structurally associated with a zone of crustal weakness that was episodically reactivated by tectonic forces during the Paleozoic.

Small-Scale Domes, Folds and Faults

Some of the most extensive bedrock outcrops in the Grand Detour Quadrangle are exposed in the open pit limestone mines north of Dixon, Illinois (S½ Sec. 16, SW¼ 15, S½ NE¼ Sec. 21, and S½ Sec. 22, T22N, R9E). The common mining practice here has been to extract the Mifflin Formation for cement production leaving the hardground at the top of Pecatonica Formation exposed in wide areas of the quarry floor. Because the surface is parallel to bedding, widespread and easily recognized in outcrop, it makes an excellent structural horizon for detailed mapping. One of the most common structures observed in the quarry floor are small domes and folds that are superimposed on the west-southwest regional dip. Typically, the domes are round to elliptical, 30 to 200 feet in diameter, and up to 20 feet high. Some of the domes are sites where the Mifflin limestone has undergone significant dissolution forming clay-filled cavities. The folds consist mainly of northwest-trending monoclines and anticlines that appear to have as much as 25 feet of relief and are hundreds of feet long.

Similar but smaller folds are exposed in the banks of Pine Creek and its tributaries in Sec. 15 and 16, T23N, R9E. In the SW¼ of Sec. 16, flat-lying rocks of the Quimbys Mill Formation are widely exposed in the floor of a quarry. At the north end of the quarry, the Quimbys Mill dips abruptly 5 degrees to the north-northeast beneath a small eastward-flowing tributary to Pine Creek. On the north side of the tributary is a small quarry exposure of the Dunleith Formation. The dip brings the Dunleith down to the same elevation as the Quimbys Mill.

A monocline is prominently exposed nearby in the banks of Pine Creek and its tributaries (NW SE Sec. 16). Here Galeana strata have a northwest strike and dip about 25 degrees to the northeast. The fold trends in a southeasterly direction into the SW¼ SW¼ of Sec. 15. A second northwest-trending monocline is exposed in the west bank of Pine Creek in NW SE Sec. 15. Platteville strata dip about 20 degrees to the northeast. This monocline is on trend with and possibly continuous with a monocline exposed in a ravine across Pine Creek Valley about 2,000 feet to the west (NE NW SW Sec. 15). A concealed fault is inferred to be present north of and adjacent to this monocline (center of Sec. 15).

A northwest-trending fault is well exposed in a prominent ravine on the north side of Rock River approximately ½ mile west of Grand Detour (SW NE Sec. 11, T22N, R9E). Here the St. Peter Sandstone is upthrown at least 30 feet in juxtaposition with dolomite beds of the Platteville Group.

Bedrock fracture patterns indicate dominant northwest and subdominant southwest trends similar to other parts of northern Illinois.

ECONOMIC RESOURCES

**Limestone**  
High-calcium, low-magnesium limestone has been mined for cement production at St. Marys Cement Company in Dixon, Illinois (S½ Sec. 16, SW¼ 15, S½ NE¼ Sec. 21, and S½ Sec. 22, T22N, R9E). The Mifflin Formation is the primary target, but high-quality limestone locally is present in the lower 10 to 20 feet of the overlying Grand Detour Formation as well. The limestone facies extends west of the St. Marys quarries through the bluffs of the Rock River and northward into the Pine Creek area. Approximately 10 feet of limestone is present in the Mifflin Formation in a core drilled near the intersection of Lowell Park Road and Penn Corner Road (SE NE Sec. 31, T23N, R9E; IP number 121412600200; ISGS core C15474). About 15 feet of Mifflin limestone is exposed in the banks of a tributary to Pine Creek (NE NW Sec. 34, T23N, R9E) and in another tributary 1,000 feet to the northeast (SW SE Sec. 27, T23N, R9E). North of here through the Grand Detour Quadrangle the limestone grades to dolomite. No limestone is present in the extensive Platteville outcrops in the northwest-trending ravine between Harmony and Columbian Roads (NW Sec. 14, T23N, R9E) or in the Burlington Northern Railroad cut (NW NW SE and NE SW Sec. 7, T23N, R10E).

**Dolomite**  
In northern Illinois the Platteville and Galeana dolomite is widely quarried for use as aggregate, road surfacing material, agricultural lime, and rip-rap. Active quarries in the Grand Detour Quadrangle include those on the north side of Dixon, Illinois (S½ Sec. 16, SW¼ 15, S½ NE¼ Section 21, and S½ Sec. 22, T22N, R9E) and near the intersection of Judson and Anterior Roads. Commercial grade flagstone has also been mined from the latter.

**Sandstone**  
The St. Peter Sandstone is actively being mined by the UNIMIN Corporation in the northeastern part of the Grand Detour Quadrangle (Sec. 18, T23N, R10E). This sandstone is used for the manufacture of

bricks and tiles. The St. Peter Sandstone is also used in hydrofracturing of oil and gas wells, as well as water wells, in order to increase flow rates. The St. Peter occurs at the bedrock surface in a wide area along the east side of the quadrangle.

**Pecatonica Formation**  
Dolomite and limestone, light gray in fresh exposures, weathers to light buff or yellowish gray; pure to slightly argillaceous, fine grained, dense; 2- to 8-inch-thick even, well-defined beds with light greenish gray shale partings mainly less than ¼ inch thick; a few beds near the middle of the unit are wavy and nodular; contains white to medium gray chert nodules. The lower half of the formation contains St. Peter Sandstone-like quartz sand grains that are well-rounded and frosted and increase in abundance downward. Phosphatic grains and nodules are locally present in the lower 5 feet. The Pecatonica contains dolomite-mottled limestone near the town of Grand Detour and adjacent areas south and east of the Rock River. A deeply sculpted hardground omission surface is present at the top of the unit, and two or three are present in the lower 8 feet. Limestone is exposed in the cement quarries north of Dixon, Illinois (Sec. 22, T22N, R9E). The Pecatonica is less fossiliferous than the overlying Mifflin Formation, but a few beds in the lower part of the unit contain brachiopods, bryozoans, ostracodes, corals, trilobites, and echinoderms.

**Glenwood Formation**  
Shale, sandstone, siltstone, and dolomite. Four stratigraphic members can be recognized in the area of the Grand Detour Quadrangle. In ascending order these are the Kingdom Sandstone Member consisting of sandstone that is mainly greenish gray, silty, argillaceous, and pyritic; the Daysville Dolomite Member consisting mainly of dolomite that is argillaceous, silty, sandy, greenish gray, and chalky to dense; the Loughridge Sandstone Member composed mainly of sandstone that is silty, argillaceous, greenish gray or light brown, very fine to coarse grained, the mixed grain sizes producing a characteristic bimodal texture; and the Harmony Hill Shale Member consisting of shale that is medium to dark greenish gray or dark maroon, pyritic, partly silty and sandy, friable, and thinly laminated. The upper part of the Harmony Hill Shale contains phosphatic pellets and small nodules. The Glenwood Formation generally forms a sharp contact with the overlying dolomite of the Pecatonica Formation. The Glenwood is exposed in the upper reaches of the ravines in the western bluffs of the Rock River in Castle Rock State Park and in a quarry situated near the center of Sec. 18, T23N, R10E. Sclerodermites have been reported from the Glenwood (Templeton and Willman 1963), but the unit is largely unfossiliferous. The base is marked by an abrupt change to clean, white sandstone. Locally, the contact is an angular unconformity (fig. 2).

**St. Peter Sandstone**  
Sandstone, pure quartz sand that is very light gray to white, very fine to coarse grained, well-rounded, frosted, and sorted, friable, and thick bedded. The St. Peter is well exposed in the ravines in the western bluffs of Rock River in Castle Rock State Park and is mined for industrial sand in a quarry situated near the center of Sec. 18, T23N, R10E. The base is covered. Local water wells indicate thicknesses ranging from 100 to 350 feet.

ACKNOWLEDGMENTS

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Figure 2 North-facing highwall in a sandstone mine near the center of Sec. 18 (T23N, R10E) revealing an episode of Late Ordovician structural deformation. The St. Peter Sandstone is folded into a broad north-northeast-trending syncline and anticline. Structurally tilted up to 20 degrees, the St. Peter strata were subsequently eroded and covered by flat-lying shale, dolomite, and sandstone of the Glenwood Formation, forming a pronounced angular unconformity. The center of the highwall is approximately 100 feet high.

