ILLINOIS STATE GEOLOGICAL SURVEY
Prairie Research Institute
University of Illinois at Urbana-Champaign

Illinois Map 18
2014

Drift Thickness of the Middle Illinois River Valley

Bureau, LaSalle, Marshall, Peoria, Putnam, and Woodford Counties, Illinois

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2014

Figure 2 A history of the diversion of the ancient Mississippi River from the Middle Illinois River valley.

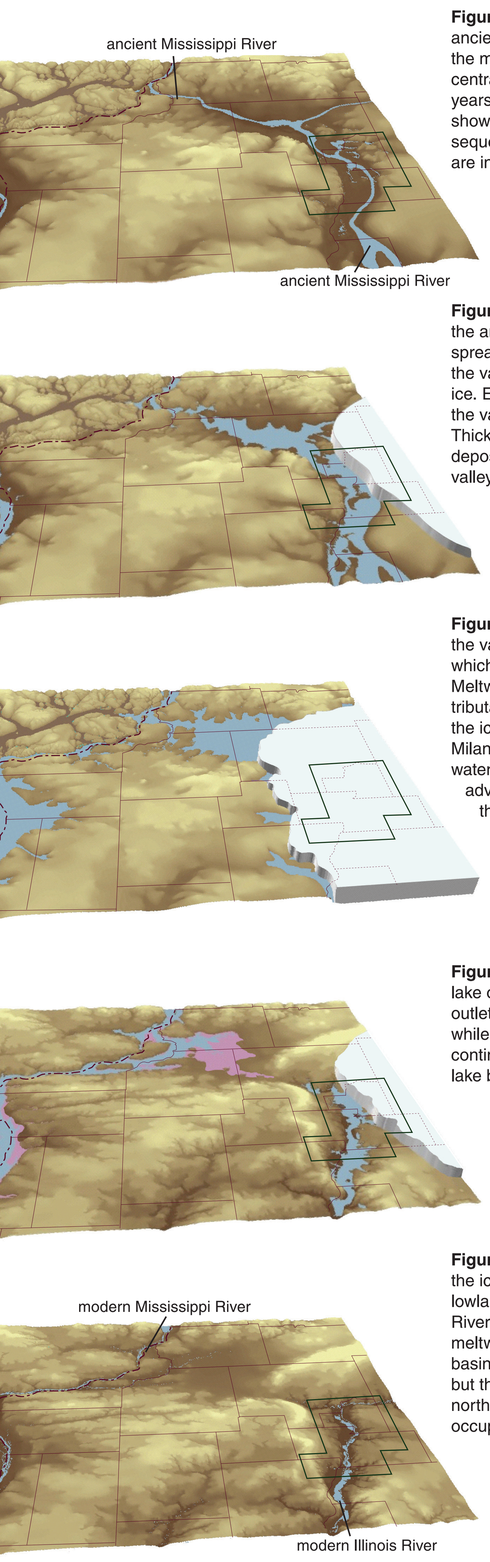


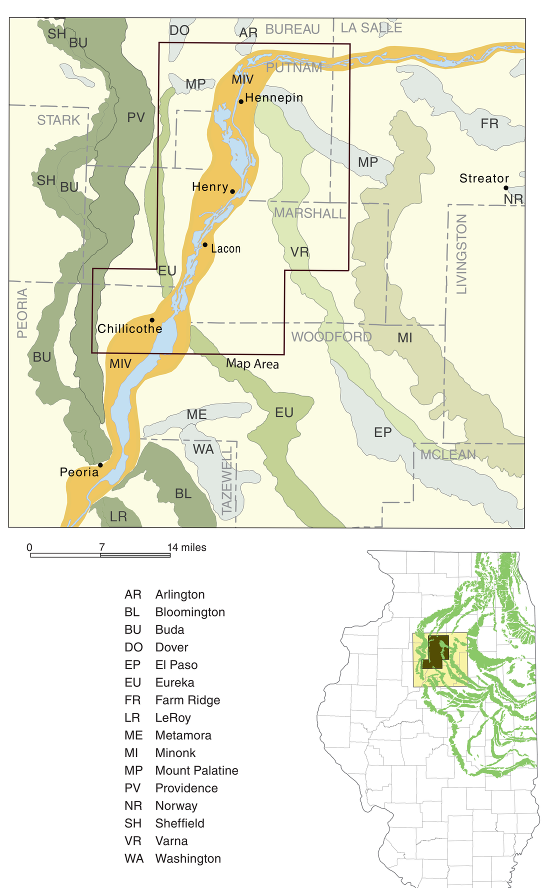
Figure 2a The preglacial course of the ancient Mississippi River flowed east from the modern Quad Cities area and ran across central Illinois between 130,000 and 25,000 years before present. The map area is shown with a green outline in these time-sequence drawings. Modern county lines are in red for reference.

Figure 2b Wisconsin-age ice approaches the ancient Mississippi Valley. The river spreads across its floodplain to transport the vast quantity of water flowing from the ice. Eventually, the ice begins to cross the valley and constricts the river's flow. Thick outwash sands and gravels are deposited along drainageways within the valley.

Figure 2c Wisconsin Episode ice overrides the valley about 24,770 years before present, which closes off drainage to the south. Meltwater floods into the main valley and its tributaries. Most of this water is dammed by the ice to the east, and a large lake (Lake Milan) is created. Sediments carried by the water are deposited in the lake. The ice advanced to its terminal extent, forming the Bloomington Morainic System (shown in Figure 3).

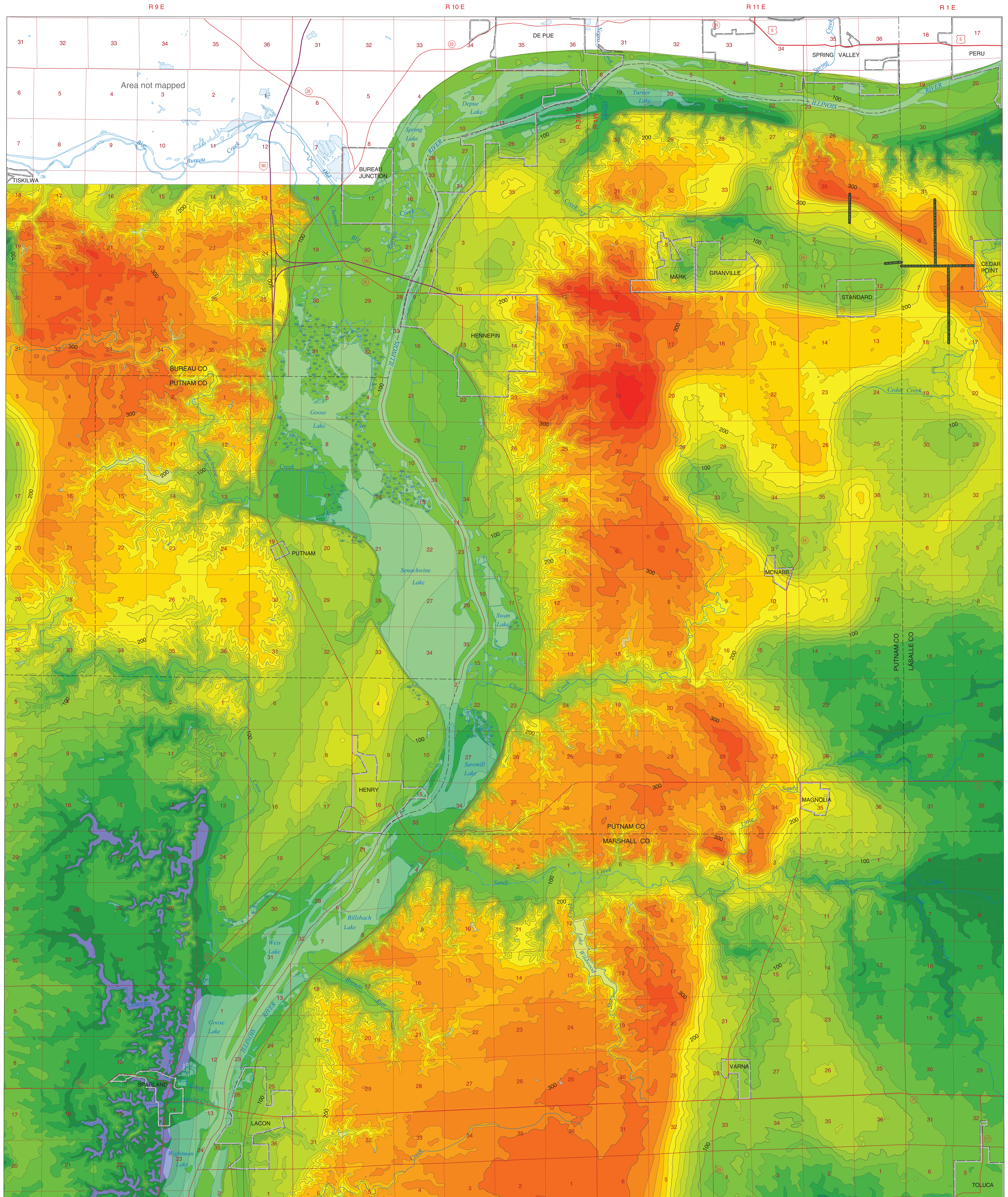
Figure 2d Eventually, the rapidly expanding lake overflows to the west, cutting a new outlet channel. Lake Milan partially drains while lake and meltwater deposits (in purple) continue to be deposited in the lowland lake basin.

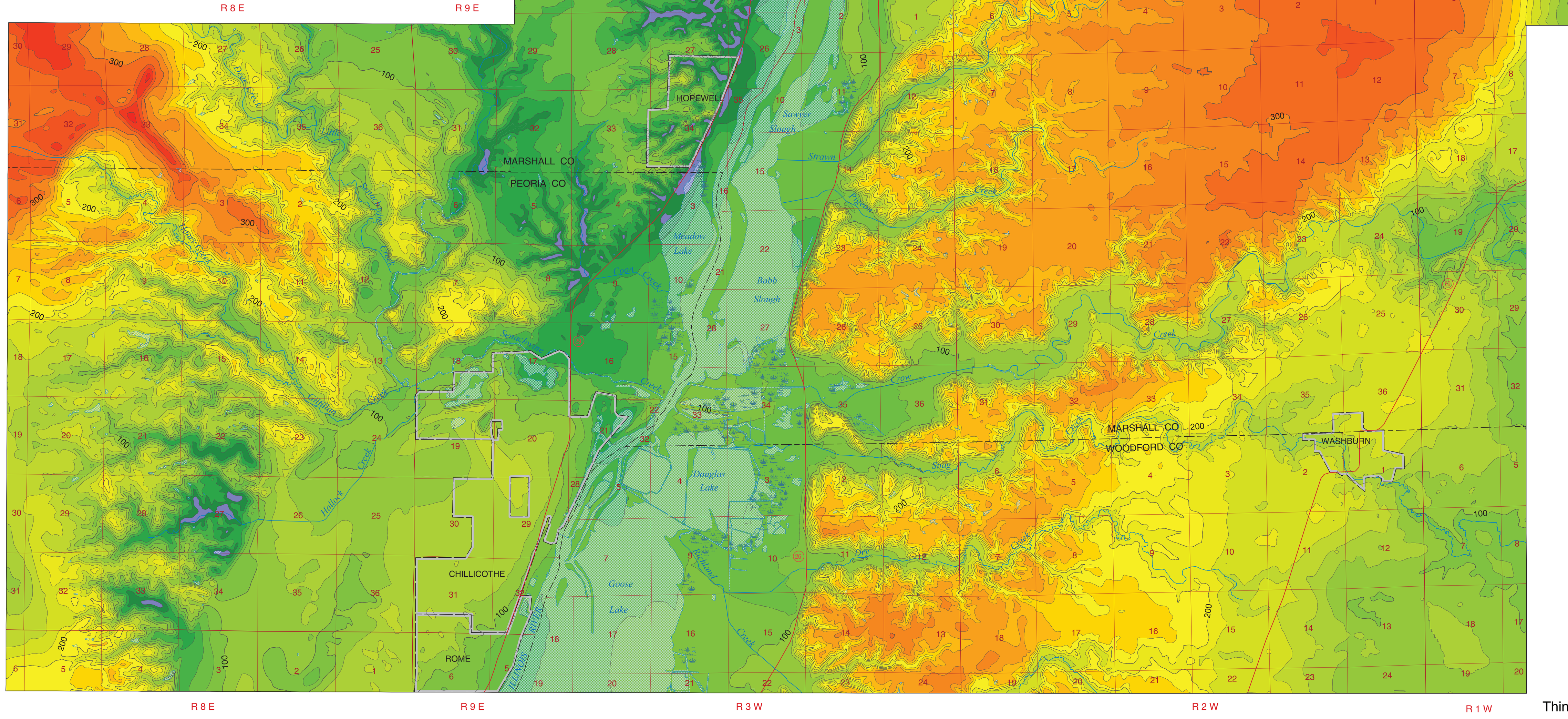
Figure 2e After the glacial event ends and the ice melts, the materials deposited in the lowland block the return of the Mississippi River to its ancient course. Subsequent meltwater floods from the Lake Michigan basin reopen the eastern portion of the valley, but this time exclusively for drainage from the northeast. A new river, the Illinois River, now occupies the ancient valley.



AR	Arlington
BL	Bloomington
BU	Buda
DO	Dover
EP	El Paso
EU	Eureka
FR	Farm Ridge
LR	LeRoy
ME	Metamora
MI	Minonk
MP	Mount Palatine
PV	Providence
NR	Norway
SH	Sheffield
VR	Varna
WA	Washington

Figure 3 Moraines of the Middle Illinois River valley (MIV) region (major moraines are in shades of green for emphasis, and the MIV floodplain is shown in gold).

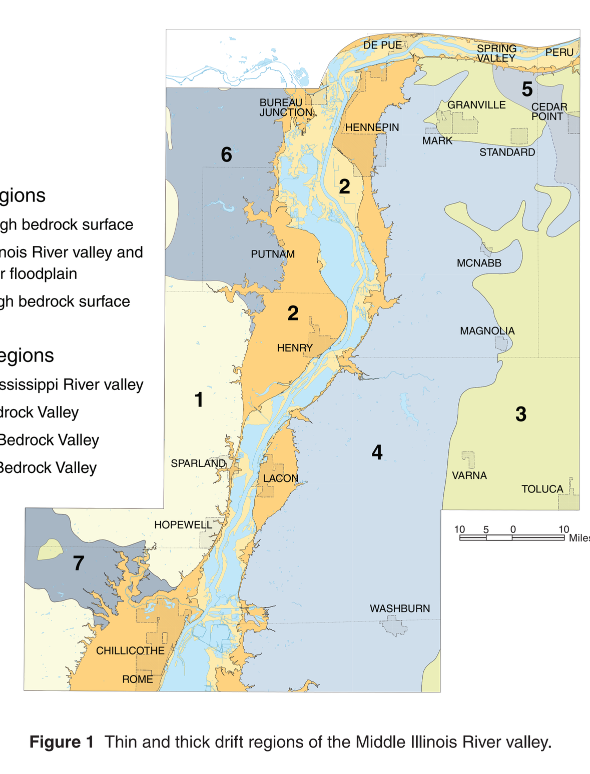




Drift Thickness (feet)

380, 360, 340, 320, 300, 280, 260, 240, 220, 200, 180, 160, 140, 120, 100, 80, 60, 40, 20, 0

- Contour
- Index contour (100-foot intervals)
- Seismic line (basal sand measurement)
- Municipal boundary line
- County line
- Bedrock outcrop
- Swampy lowland areas



Thin Drift Regions
1 Western high bedrock surface
2 Modern Illinois River valley and
2 Ilinois River floodplain
3 Eastern high bedrock surface

Thick Drift Regions
4 Ancient Mississippi River valley
5 Ticona Bedrock Valley
6 Princeton Bedrock Valley
7 Wyoming Bedrock Valley

Figure 1 Thin and thick drift regions of the Middle Illinois River valley.

Introduction

Glacial drift comprises unconsolidated sediments that overlie bedrock. Drift thickness variations on this map (ranging from zero to more than 380 feet thick) reflect (1) numerous glacial advances and retreats across the region that deposited glacial sediments; (2) subsequent deposition of postglacial sediments atop bedrock; (3) depositional and erosional processes of the ancient Mississippi River (AMR), the ancient Illinois River, and the modern Illinois River; and (4) the relief (i.e., hills and valleys) on the bedrock surface. Drift thickness is important for estimating the depth to bedrock for planned drilling, for predicting the distribution of shallow, economically significant rock resources, and as a guide for discovering new or underutilized buried sand and gravel deposits that are aquifers.

This map covers more than 500 square miles, including nine 1:24,000-scale U.S. Geological Survey (USGS) 7.5-minute quadrangles—Putnam, Florid, McNabb, Lacon, Henry, Varna, Rome, Chillicothe, and Washburn—and the southern half of three quadrangles—Princeton South, DePue, and Spring Valley. It revises smaller scale statewide drift thickness maps produced by Piskin and Bergstrom (1967, 1975). More detailed mapping of the drift thickness in this region was an outgrowth of geologic mapping for a proposed highway improvement project along Illinois Route 29 funded by the Illinois Department of Transportation, on the west side of the Illinois River north of Chillicothe (Berg et al. 2002, 2003). This map is complemented by a bedrock topography map (Berg et al. 2009) and the elevation of basal sand and gravel map (Berg et al. 2012) of the same region along the Middle Illinois River valley (MIV).

Methodology

Drift thickness was determined by subtracting bedrock elevations (see Berg et al. 2009) from land surface elevations. Specifically, the vector bedrock topography contours were converted into a raster surface grid in Esri's ArcMap, using the "Topo to Raster" tool. The surface model was compiled as a mosaic of nine USGS 30-m digital elevation models. The resulting bedrock surface grid was then subtracted from the land surface model using simple Raster Math, to obtain a grid of the drift thickness. Vector contour lines were created at 20-foot intervals, using the "Focal Statistics" and "Contour" tools in ArcMap, and subsequently were smoothed and edited in some areas to conform with borehole data. In addition, small non-data-supported polygons with a perimeter distance of <1,500 ft were deleted to reduce map complexity and margin of error. Although the "Grid Math" tool was administered on two data sets of similar resolutions (30-m-sized cells for both the bedrock elevation and land surface grids), the high degree of detail on the map is due to domination by the more detailed land surface elevation grid and the less detailed, smoothed, and further-spaced interpreted contours of the bedrock topography grid. As a result, the map indicates a higher degree of detail than is resolvable, and more testing is needed to verify calculated drift thickness values, particularly where the drift thickness lines appear closely spaced and jagged.

Bedrock is exposed at ground surface along the western valley wall of the MIV where glacial and postglacial sediments are absent. The bedrock elevation contours for the Princeton Bedrock Valley (Figure 1), and areas where few wells penetrate to bedrock along the western portion of the map, were based largely on smaller scaled regional contours from Herzog et al. (1994). For the largest part of the map, drift thickness was confirmed by evaluating logs of borings and seismic profiling records. A total of 621 logs of water wells, engineering borings, and coal test borings, as well as 21 Illinois State Geological Survey (ISGS) exploratory borings, and numerous field-described outcrops were used to determine drift thickness. These data are on file in the ISGS Geologic Records Unit. A total of 370 boreholes reached the bedrock surface. Many other borings ending in deposits above bedrock provided approximate drift thickness values, complementing nearby definitive drift thickness measurements.

In the northeastern portion of the map, seismic reflection profiling by Murphey (2005) was conducted along 5.15 miles of roads. These data (Figure 1) were used to define the geometry of the Ticona Bedrock Valley and determine the thickness of its contained drift. Logs of nearby water wells were used as a basis for estimating seismic velocities of glaciofluvial deposits, which allowed conversion of travel times to estimate bedrock surface elevations. Ninety-six estimates of the bedrock surface (virtual boreholes), taken from the seismic data along the transect (stations about 300 feet apart), provide an interpreted depth to bedrock, and subsequently drift thickness values, to supplement well records in that area.

Drift Thickness and Character

Geologic mapping along the Middle Illinois River valley has provided sufficient new data to better characterize Wisconsin Episode and older sediments associated with glaciers that overrode the valley several times during the last several hundred thousand years. The AMR reoccupied the valley after each glacial retreat until the river was blocked and diverted (Figure 2) by a glacier to its present Mississippi River course 24,770 ± 250 calendar years before present (McKay et al. 2008). Burial of the AMR valley by up to 330 feet of drift, the multiple subtle channels carved in the bedrock valley floor, and the up to 15-mile width of the bedrock valley (Figure 2) reflect the complexity of erosion and sedimentation associated with these events.

The study area has seven prominent thin and thick drift regions. Thin drift regions (Figure 1) include the following:

1. West of the Illinois River from just south of the Peoria/Marshall County line northward to about 3.5 miles north of Sparland is a high bedrock surface with numerous bedrock exposures along the west valley wall of the Illinois River and its tributaries. Along the upper slope of the west valley wall and beneath the adjacent uplands, recent mapping for this investigation revealed that where the bedrock is within 50 feet of the surface, loam-textured Batestown Member diamicton is <20 feet thick and it overlies loam-textured Tiskilwa Formation diamicton (McKay et al. 2008). As the bedrock surface elevation decreases, the thickness of the Tiskilwa increases.

2. In the present-day Illinois River valley and the tributaries to the east is a region where meltwater from multiple glaciers eroded the thick glacial deposits and incised into the bedrock. Present-day sediments are mainly composed of 50 to 75 feet of alluvium over sand and gravel outwash in the main channel, and 10 to 20 feet of sand and gravel in tributary valleys (McKay et al. 2007).

3. On the bedrock uplands east of the AMR valley (Figure 2) is about 125 feet of drift composed of about 50 feet of silty Yorkville Member and loamy Batestown Member diamictons overlying up to 75 feet of loamy Tiskilwa Formation diamicton.

Thick drift regions (Figure 1) include the following:

4. Glacial sediments east of the present-day Illinois River and extending to the eastern valley wall of the AMR contain about 25 feet of the Wisconsin Episode loamy Batestown diamicton overlying >100 feet of Tiskilwa diamicton. This in turn overlies 50 to 75 feet (up to 125 feet) of mainly loamy Illinois Episode diamictons over 75 feet of sand and gravel (McKay et al. 2007). Also in this thick drift area are high terraces along the Illinois River valley, often with 15 feet of dune sand overlying up to 150 feet of sand and gravel outwash.

   The stratigraphy of the thick glacial sediments above the eastern channel suggest that this region contains the oldest sediments (fluvial quartz sand below Wisconsin and Illinois Episode diamictons at a depth of about 330 feet was dated by optically stimulated luminescence at 185,000 to 190,000 years) preserved in the bedrock valley (McKay and Berg 2008). Other parts of the bedrock surface appear to have been eroded more recently, explaining why deposits older than the Illinois Episode have not been found (McKay et al. 2008). The raised landform of the Varna Moraine (Figure 3) extending southeastward from Hennepin to the Putnam/Marshall County line also contributes to some of the thicker drift in this region.

5. Glacial sediments within the Ticona Bedrock Valley (Figure 1) in the northeastern portion of the map are composed of about 150 feet of Wisconsin Episode silty Yorkville diamicton and the loamy Batestown and Tiskilwa diamictons, all overlying about 175 feet of sand and gravel (Murphey et al. 2005).

6. Recent investigations (McKay et al. 2008) show that thick glacial sediments overlying the Princeton Bedrock Valley (Figure 1) in the northwestern portion of the map are composed of about 30 feet of the Yorkville and Batestown diamictons overlying about 100 feet of Tiskilwa diamicton, and all overlying 80 feet of Wisconsin Episode sand and gravel. The Princeton Bedrock Valley was part of the AMR before its diversion westward to the modern valley of the Mississippi River.

7. Thick glacial sediment in the Wyoming Bedrock Valley in the southwestern portion of the map is composed of 150 to 200 feet of undifferentiated Wisconsin Episode diamicton, 50 to 75 feet of Illinois Episode diamicton, and 50 feet of sand and gravel (Stumpf 2010). Outside the bedrock valley, the drift can also be thick. On uplands, there can be as much as 200 feet of Wisconsin Episode diamicton overlying up to 150 feet of Illinois Episode diamicton. Terraces along the Illinois River valley in the southernmost portion of the map also have >100 feet of sand and gravel containing up to 20 feet of dune sand overlying outwash above the bedrock surface.

Acknowledgments

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Base map compiled by the Illinois State Geological Survey from digital and paper data provided by the United States Geological Survey.

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator

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SCALE 1:62,500
1 0 1 2 3 4 5 MILES
1 0 1 2 3 4 5 6 7 KILOMETERS

Geology based on field work by E. Donald McKay III and Richard C. Berg, 2001–2011.

Digital cartography by Barbara J. Stiff, Illinois State Geological Survey.

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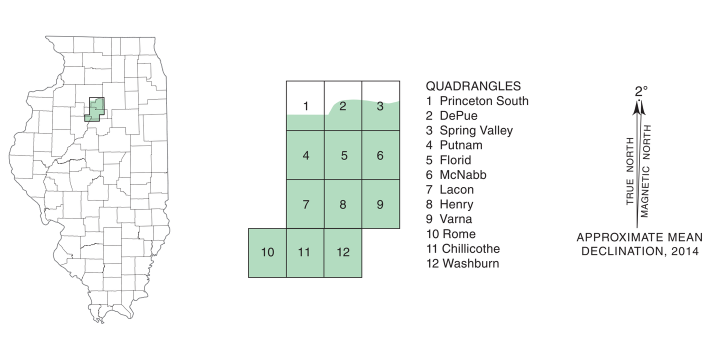

QUADRANGLES
1 Princeton South
2 DePue
3 Spring Valley
4 Putnam
5 Florid
6 McNabb
7 Lacon
8 Henry
9 Varna
10 Rome
11 Chillicothe
12 Washburn

2°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2014

- Interstate Route
- U.S. Route
- State Route