Institute of Natural Resource Sustainability
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ILLINOIS STATE GEOLOGICAL SURVEY
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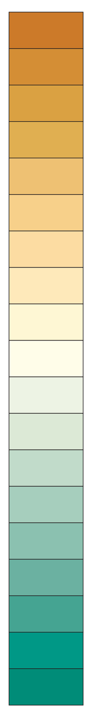
Illinois Map 15
2009

Bedrock Topography of the Middle Illinois River Valley

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

Richard C. Berg, C. Pius Weibel, Andrew J. Stumpf, and E. Donald McKay III
2009

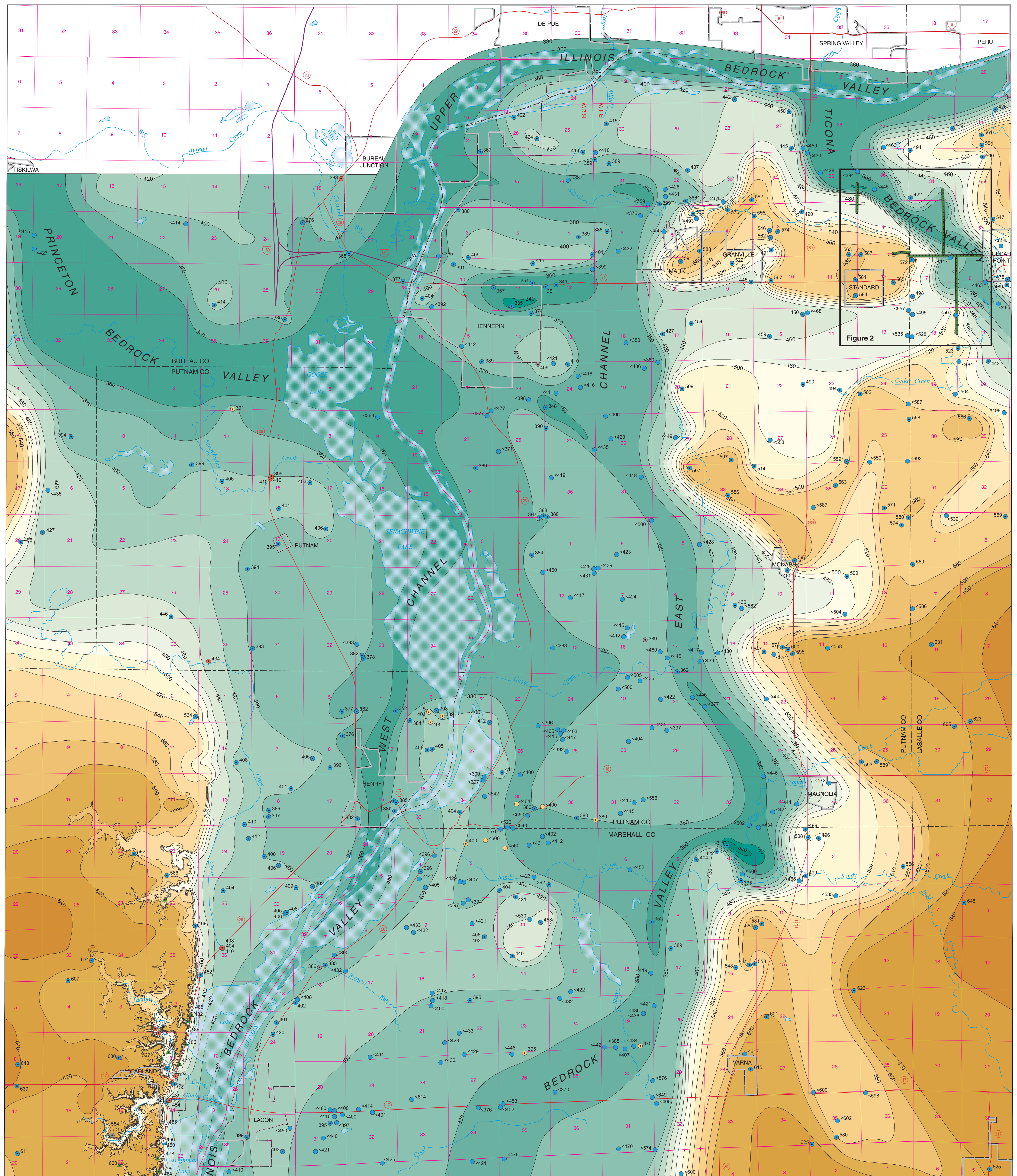
Bedrock Elevation
(feet above mean sea level)

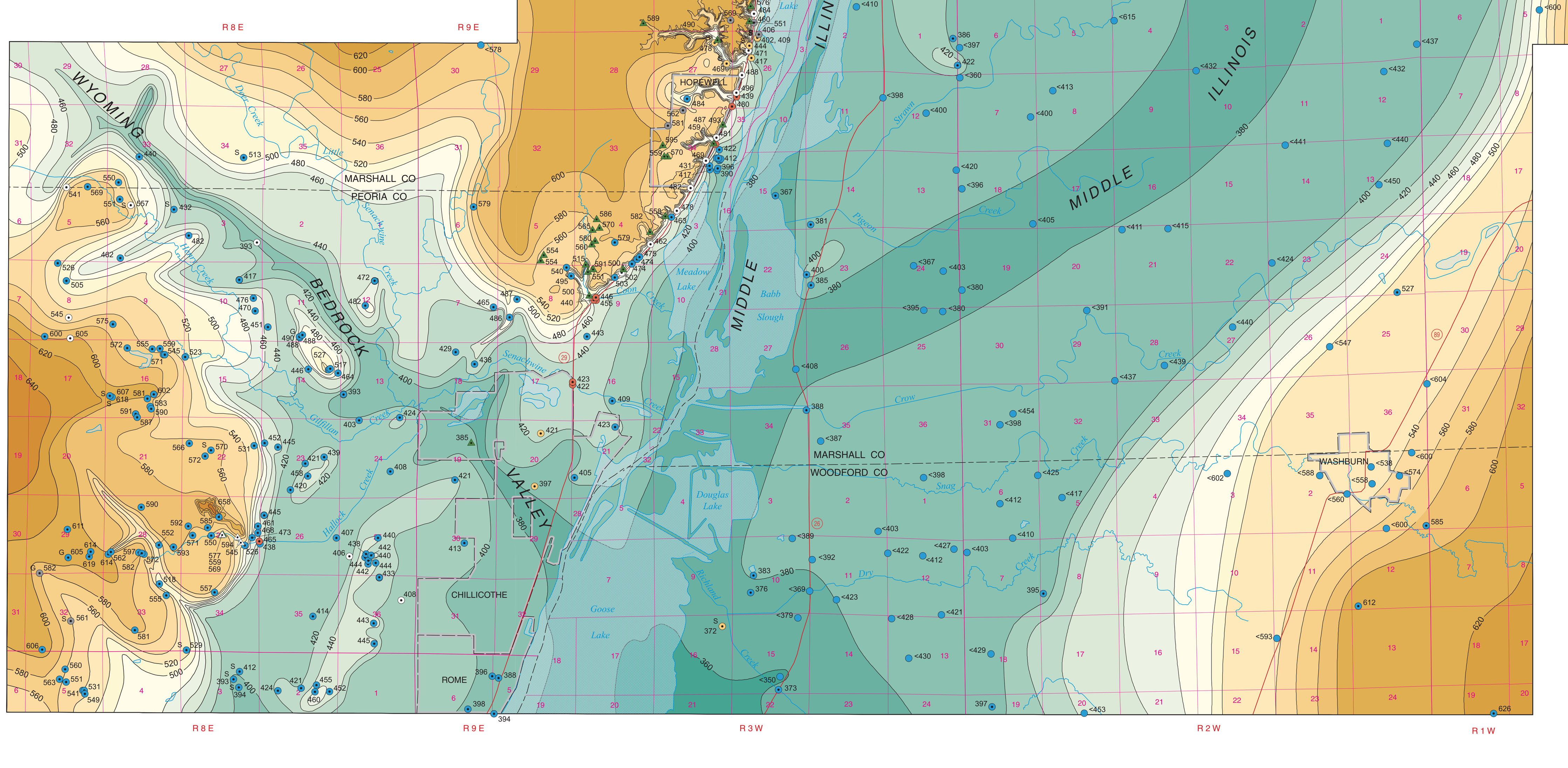


Data Type

- Bedrock outcrop
- Outcrop in field notes (ISGS archives)
- Stratigraphic test boring (ISGS)
- Water-well boring
- Engineering boring
- Coal boring
- Other boring
- SG <406 Labels indicate samples (s) or geophysical log (g). Boring labels indicate bedrock elevation in feet above mean sea level. Less than symbol (<) indicates boring did not reach bedrock. Bedrock elevation is lower than the value given. Dot indicates boring is to bedrock.
- Geophysical profile transect

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





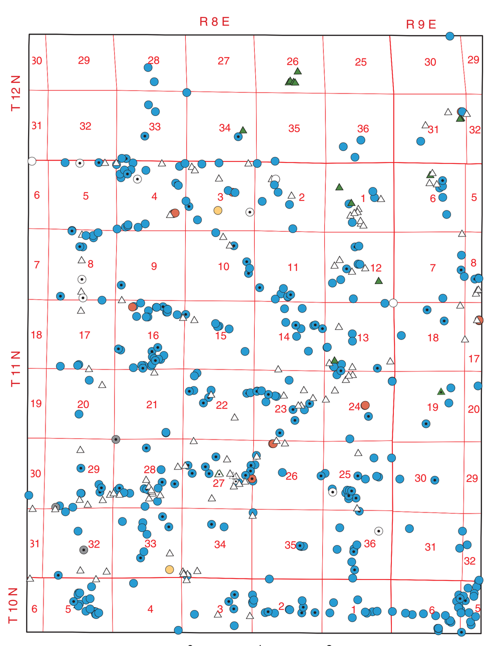


Figure 1 All well and boring locations within the Rome Quadrangle. On the Rome portion of the main map, to reduce map clutter, only wells and borings that reach bedrock are shown.

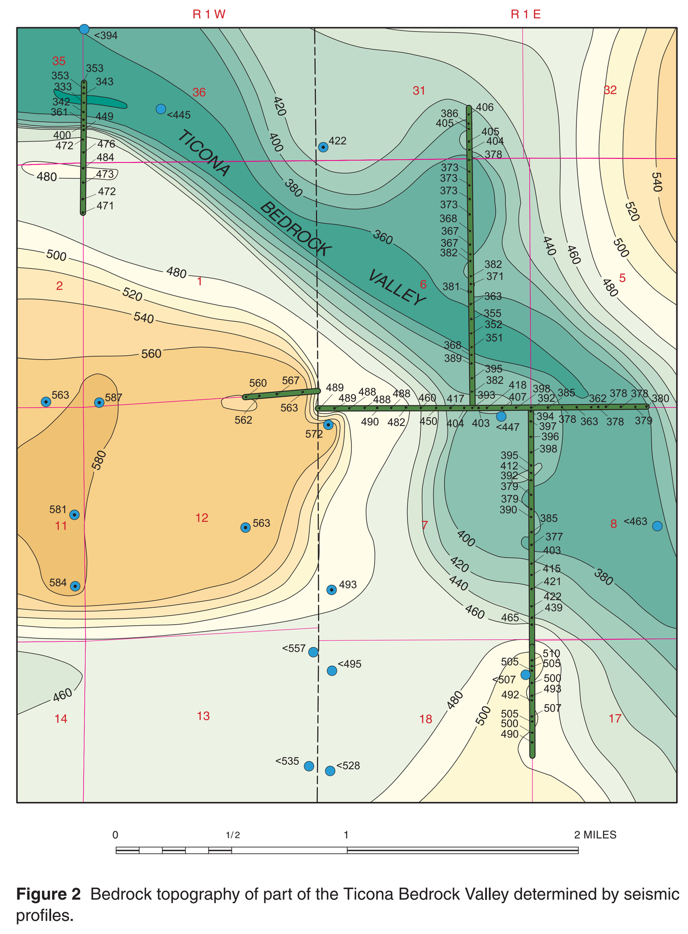


Figure 2 Bedrock topography of part of the Ticona Bedrock Valley determined by seismic profiles.

Introduction

This bedrock topography map reveals geomorphic features created by the ancient Mississippi River, the ancient Illinois River, the modern Illinois River, and numerous glacial advances and retreats. In the map area, the bedrock surface is buried beneath as much as 330 feet of glacial and post-glacial sediments. The overall relief (i.e., hills and valleys) of the bedrock surface affects the types of bedrock at its surface. This relationship is important for depicting the depth to bedrock for drilling operations and for predicting the distribution of shallow, economically significant rock resources. Most important, mapping of the bedrock topography delineates buried bedrock valleys, which often contain sand and gravel deposits that are aquifers.

At the northern edge of the map is an east-west–trending deep channel (<360 feet in elevation), which is the downstream end of the Upper Illinois Bedrock Valley. The modern Illinois River flows within this channel. Entering this reach is the downstream portion of the Ticona Bedrock Valley (Willman 1940). West of this juncture is the "Big Bend" (near Hennepin), where the axis of the Illinois River valley changes to a southerly orientation. The Big Bend is the point at which the relatively narrow Upper Illinois Bedrock Valley widens to the 10- to 15-mile-wide Middle Illinois Bedrock Valley (MIV). It is also from this point that the MIV bifurcates into two newly recognized valley-bottom channels (herein called the MIV East and MIV West Channels) that extend south for more than 20 miles in the central portion of the map. The two channels are separated by a low-lying rise that is elevated 20 to 40 feet, and near the Marshall-Putnam County boundary, they are connected by a smaller, shallow, northwest-southeast channel. About 5 miles south of the Big Bend, the Princeton Bedrock Valley, part of the ancient Mississippi River, joins the MIV from the northwest. In the southern portion of the map, the two channels merge to form a single channel about 4 miles north of the junction (near Chillicothe) of the tributary Wyoming Bedrock Valley and the MIV. Beyond the southern map boundary, the MIV extends to the Peoria-Pekin area where it merges with the Danvers, Mackinaw, and Mahomet Bedrock Valleys (Herzog et al. 1994).

In general, the west wall of the MIV is steeper than the east wall, primarily because much of the modern western wall, particularly the middle portion, is a local high on the bedrock surface where numerous bedrock exposures occur up to 600 feet in elevation along the wall and along tributary valleys. The bedrock landform that is the western upland is relatively flat but slopes both northward and southward into the Princeton and Wyoming Bedrock Valleys. The east valley wall, which is known only from drill-hole data, is characterized by low erosional terraces. Several shallow, east-west valleys are incised into the eastern bedrock uplands.

This map covers nine 1:24,000-scale 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 bedrock topography maps produced by Horberg (1950, 1957) and Herzog et al. (1994). This present, more detailed map was an outgrowth of mapping for a proposed Illinois Department of Transportation highway improvement project along Illinois Route 29 on the west side of the Illinois River north of Chillicothe (Berg et al. 2002, 2003).

Methodology

Except for exposed bedrock along the western wall of the MIV, the bedrock throughout most of the study area is buried by glacial and post-glacial sediments. The bedrock elevation contours for the Princeton Bedrock Valley and for data-sparse areas along the western portion of the map were based on those of Herzog et al. (1994). For the remaining larger portion of the map, the elevation of the bedrock surface was determined by evaluating logs of borings and seismic profiles. A total of 1,124 elevation points were used from logs of water wells, engineering borings, and coal test borings. All data points are shown on the main map except for the Rome Quadrangle (fig. 1). The logs were supplemented with data from 21 Illinois State Geological Survey exploratory test borings and numerous field-described outcrops. These data are on file in the ISGS Geological Records Unit. Locations of borings were verified by matching property owners' names and addresses on drillers' logs to (1) county plat books showing land ownership, (2) observable houses on aerial photographs, or (3) name and address citations in phone books or by site visits. Locations were then plotted by hand and/or digitally on 1:24,000-scale topographic maps. A total of 483 boreholes reached the bedrock surface. Bottom elevations of many other borings ending in deposits above bedrock were used to "force down" bedrock surface contours, complementing nearby definitive elevation measurements.

In the northeastern portion of the map (see boxed area on map and Figure 2), seismic reflection profiles made along 5.15 miles of roads were used to redefine the geometry of the Ticona Bedrock Valley where it enters the Upper Illinois Bedrock Valley (Murphy 2005). Logs of nearby water wells were used as a basis for estimating seismic velocities of glacial-fluvial deposits, which allowed conversion of seismic travel times to estimated bedrock surface elevations. Ninety-six virtual boreholes, spaced about 300 feet apart, were developed; each provided a depth to bedrock that was inferred from the regional bedrock morphology and used to constrain the computer program that generated the map.

Along the 10-mile extent of the western bluff of the Illinois River Valley and in tributary valleys where bedrock is exposed, a digital elevation model (DEM) of the ground surface was used to partially define the elevation of the modeled bedrock surface. The DEM was complemented by field examination of numerous bedrock outcrops in the area. Elsewhere, the digital bedrock surface was created with the Topo to Raster tool in the Spatial Analyst extension of ArcGIS version 9.2 with a grid size of 30 m. In portions of the valley where data were too sparse for computer contouring to replicate channels, the valley bottom was interpreted by modeling the thickness of the sand and gravel unit (Henry Formation) overlying bedrock and then using the elevation of the bottom of that unit to define the bedrock valley shape.

Observations

The following observations of the bedrock topography of the MIV reflect the complex drainage history of the ancient Mississippi and modern Illinois Rivers, including erosion and sedimentation events, channel formation and widening, and the final diversion of the ancient Mississippi River to its present channel.

- The MIV has pre-glacial origins (Herzog et al. 1994) and was a drainageway for pre-Illinois episode meltwater. Throughout the Pleistocene and up to the time of its diversion, the ancient Mississippi River drained much of the midcontinent of North America through the present-day Illinois River valley to the Gulf of Mexico.
- New regional geologic mapping has provided sufficient new field observations and new data that better characterize erosion and deposition associated with glaciers repeatedly crossing the valley. The ancient Mississippi River had reoccupied the valley upon glacial retreat several times during the last several hundred thousand years until being blocked by a glacier that diverted it to its present Mississippi River course 20,780 ± 140 radiocarbon years before present (^{14}C yr BP) (McKay et al. 2008). Prior to 20,780 ^{14}C yr BP, the Princeton Bedrock Valley and the MIV constituted the ancient Mississippi River valley. This bedrock topography map reflects that complex history.
- Recent stratigraphic studies, including extensive field sampling and test drilling, reveal that the most extensive, oldest, and thickest deposits occur below land surface on uplands east of the Illinois River and west of the eastern bedrock valley wall (McKay and Berg 2008). The oldest OSL (optically stimulated luminescence) dates (185,000 to 190,000 years ago) in the region were obtained from early Illinois Episode fluvial quartz sand between elevations of 320 and 325 feet and below Illinois and Wisconsin Episode diamictons (NE¼ SE¼ NW¼, Sec. 4, T30N, R1W, Marshall Co.) within the thalweg of the MIV East Channel. The bedrock topography map also shows that the MIV East Channel overdeepened on the outside of two prominent meander bends. Stratigraphic data indicate that the MIV East Channel is the oldest part of the bedrock surface in this reach of the ancient Mississippi River. 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 Illinois, Sangamon, and Wisconsin Episode deposits indicate that the glaciers advanced and retreated across the valley several times, allowing the river to repeatedly occupy the valley after each retreat. Undulations of the bedrock valley floor, the width (up to 15 miles) of the bedrock valley, and its burial beneath the adjacent uplands reflect the complexity of erosion and sedimentation associated with these events. In general, this recent mapping infers that the ancient Mississippi River has gradually widened its valley, mainly by eroding its western bluff since the early part of the Illinois Episode. The swale between the bifurcating channels may have been functional during the Illinois Episode when meltwaters flowed down the Ancient Mississippi River Valley.
- Glacial and fluvial erosion along the western valley wall and into the tributaries has been ongoing at least since the early Illinois Episode. Illinois Episode diamictons and sand and gravel have infilled the bedrock valley beneath Rattlesnake Hollow (S½ Sec. 27, T12N, R9E, Marshall Co.) and are overlain by the Sangamon Geosol and Wisconsin Episode glacial and fluvial deposits.
- A prominent valley more than five miles long, just west of the Ticona Bedrock Valley, presumably could have carried overflow from the Ticona directly into the MIV during the Illiniois Episode.
- The MIV West Channel is occupied by deposits that probably post-date the last diversion, and the present Illinois River flows roughly above the MIV West channel.

Acknowledgments

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Base map compiled by 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, Richard C. Berg, C. Pius Weibel, and Andrew J. Stumpf, 2001–2007.

Digital cartography by Jennifer E. Carrell and Jane E.J. Domier, Illinois State Geological Survey.

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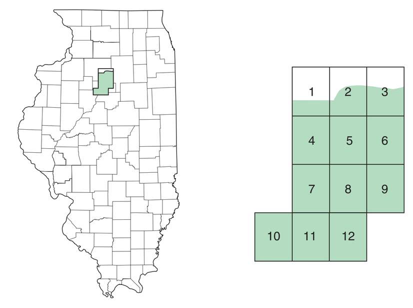

QUADRANGLES
1 Princeton South
2 DePue
3 Spring Valley
4 Putnam
5 Florid
6 McNabb
7 Lacon
8 Henry
9 Varna
10 Rome
11 Chillicothe
12 Washburn

2°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2009

ROAD CLASSIFICATION
- Interstate Route
- U.S. Route
- State Route