Bedrock Topography of Renault Quadrangle
Monroe County, Illinois

Illinois Department of Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
William W. Shilts, Chief

Illinois Geologic Quadrangle Map
IGQ Renault-BT

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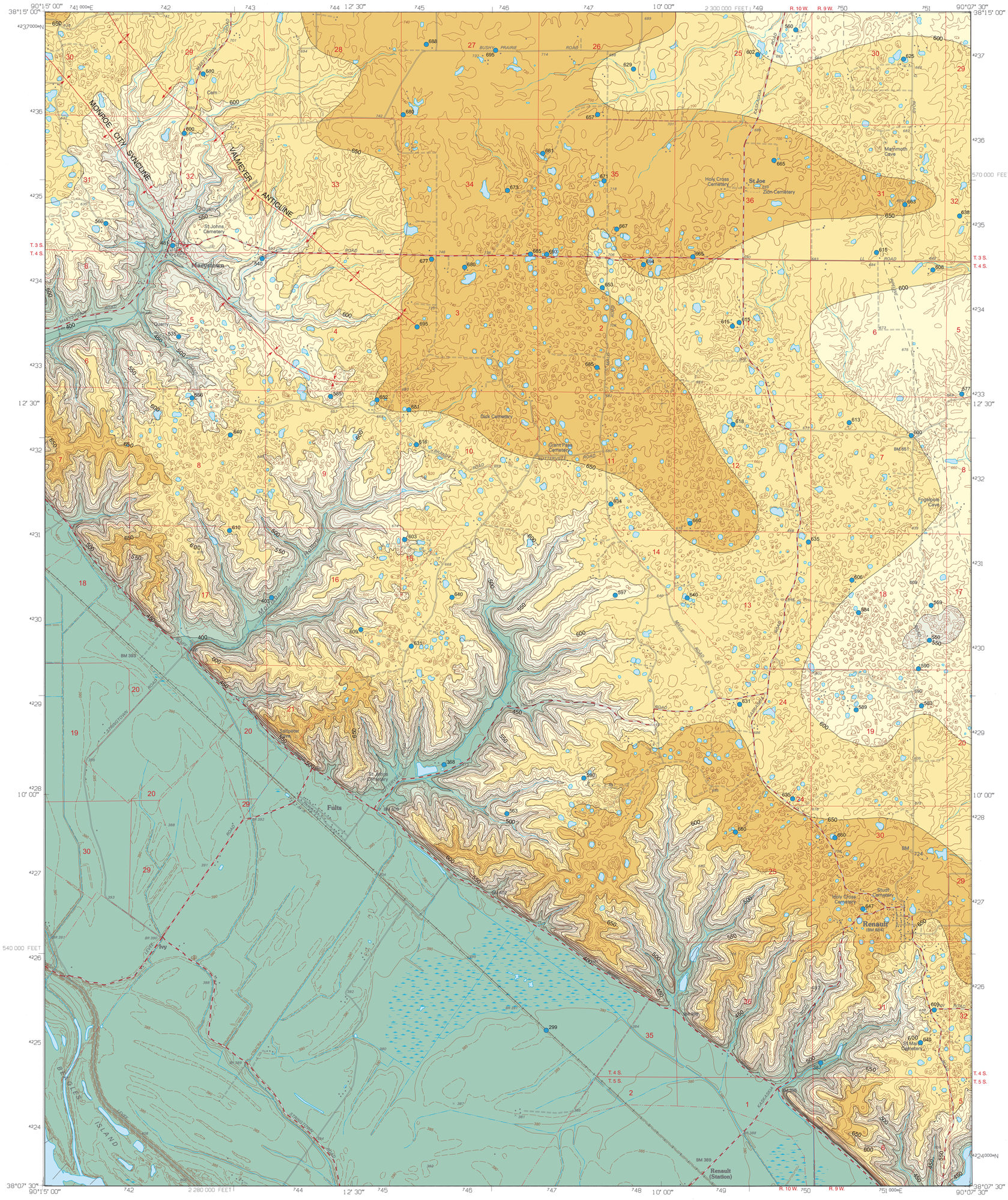
2008



Introduction

The bedrock topography of the Renault Quadrangle is part of a series of maps by the Illinois State Geological Survey (ISGS) that interpret (at a scale of 1:24,000) the geology within 7.5-minute quadrangles in the Metro East Illinois area of Greater St. Louis. Data collection and interpretation were funded by the ISGS.

The Renault Quadrangle is an area presently experiencing rapid population growth and urban and suburban development of primarily rural and agricultural land. Because of increasing environmental concerns with karst and associated groundwater contamination issues, it is important to document the bedrock topography for urban planning, land use planning, and water resource management.

The Renault Quadrangle lies within the southwestern Illinois sinkhole plain, which is within the Salem Plateau Section (Leighton et al. 1948). The karst topography that dominates the study area is the result of the soluble nature of the underlying bedrock. Mississippian-age carbonate bedrock, particularly St. Louis and Ste. Genevieve Limestones, contain solution-enlarged secondary fractures, and the area is characterized by cover-collapse sinkholes, caves, and large springs.

Map Use

This map is useful for delineating the locations of buried bedrock valleys and for defining flow patterns and recharge and discharge pathways of these aquifers. The map is essential for accurate assessment of the volume and distribution of economically significant shallow deposits of limestone and other construction stone. It is a useful predictive guide for drilling operations, construction and engineering projects, and geophysical surveys and as a base map from which geological units and bedrock structures can be delineated. This bedrock surface is the lower limiting surface that must be integrated into three-dimensional models of the overlying Quaternary sediments. Finally, this bedrock surface is the lower limiting surface that must be integrated into three-dimensional models of the overlying Quaternary sediments.

Mapping Methods

The bedrock topography was mapped using data from 75 well logs from the ISGS wells and borings database. Well locations were verified using plat books. Bedrock exposures were used to identify bedrock surface elevations; such exposures were usually associated with the bottom of sinkholes, cave entrances, springs, bluffs along major stream valleys, and stream bottoms. The data were plotted and contoured by hand; the resultant map was scanned into raster format and digitized using ESRI ArcMap software. Bedrock elevations were subtracted from standard 30-m digital elevation model data to be sure that the bedrock surface did not extend above the land surface. Because of the low data density, contour lines were not modified in the vicinity of sinkholes.

Bedrock Topography and Hydrogeology

The Renault Quadrangle is on the western margin of the Illinois Basin, and the bedrock dips gently to the east. Much of Monroe County and parts of St. Claire County to the north and Randolph County to the south are referred to as the sinkhole plain because of the area's high density of sinkholes. Approximately 10,000 sinkholes (with densities as high as 230 per square mile), numerous large springs, and the largest caves in the state are found in the Salem Plateau Section (Panno and Weibel 1996, Weibel and Panno 1997, Panno et al. 2004). Glacial drift thickness in this area is relatively thin and typically ranges from 0 to 30 feet (Herzog et al. 1994). Bedrock is covered by a layer of windblown loess that overlies Illinoian glacial deposits and pre-Illinois Episode residuum. This material, especially loess, is easily eroded and forms numerous cover-collapse sinkholes (sinkholes formed in sediment overlying creviced bedrock) and steep-sided gullies. Sinkholes have formed in about 30 feet of loess and glacial sediments over crevices in the bedrock surface that are 6 or more inches wide (Panno et al. 2008). Bedrock exposures in the quadrangle are most often associated with sinkholes, cave entrances, large springs, and along the bluffs overlooking the Mississippi River, large streams, and streambeds. Most sinkholes, caves, and large springs occur in the Mississippian-age St. Louis and Ste. Genevieve Limestones; these fairly soluble rocks are responsible for widespread karst terrain in southwestern Illinois (Weibel and Panno 1997), Kentucky, and Indiana.

The southwestern margin of the quadrangle is adjacent to the Mississippi River. Bedrock bluffs east of the American Bottoms rise sharply to the uplands to the northeast. The bedrock surface is the top of the lithified rock that underlies the Quaternary glacial and postglacial sediments. The bedrock in the Renault Quadrangle is Mississippian in age and consists predominantly of the St. Louis Limestone; minor outcrops of Salem Limestone occur along the Valmeyer Anticline and along the bluff of the Mississippi River valley. In addition, the Aux Vases Sandstone occurs along the topographically lower eastern edge of the quadrangle (unpublished mapping by J.A. Devera). The bedrock outcrops in numerous small exposures along the bluff and on the uplands along streams or within sinkholes. Sediment in the vicinity of the bluffs is often deeply dissected, exposing bedrock within dendritic stream channels. The sediment overlying the bedrock consists of Quaternary diamicton (a mixture of gravel, sand, silt, and clay), sand, gravel, and windblown silt (loess). Quaternary deposits range from 30 to 40 feet in thickness; loess deposits are usually thickest near the bluffs to the west and thinnest or absent within sinkholes. The largest sinkholes always contain exposures of bedrock.

The bedrock topography of the quadrangle is generally reflected in the surface topography. An upland plateau covers the northeastern two-thirds of the quadrangle, with a maximum elevation of more than 680 feet. Bedrock lies beneath the relatively thick fluvial sediments within the Mississippi River valley in the southwestern one-third, where bedrock surfaces probably drop below elevations of 280 feet. The upland plateau and the Mississippi River lowlands are separated by the northwest-trending, prominent, northeastern bluff of the Mississippi River valley, which has a relief of over 300 feet. The upland plateau is dissected by several relatively short tributary streams along the bluff that drain to the southwest to the Mississippi River. Most of the plateau is characterized by numerous sinkholes.

Two structural features in the northwestern quarter of the quadrangle are the Monroe City Syncline and the Valmeyer Anticline (Nelson 1995, unpublished mapping by J.A. Devera). These structures strike northwest, are essentially parallel, and show little effect on the bedrock topography; these structures are discussed in more detail in Panno et al. (2008). As noted earlier, the quadrangle lies within the sinkhole plain of southwestern Illinois (Panno et al. 1997, Weibel and Panno 1997). The karst topography that characterizes the region is the result of the soluble nature of the underlying bedrock (particularly the St. Louis and Ste. Genevieve Limestones) and the moderate amount of annual precipitation (40 inches per year) of the area. Sinkholes have formed in the approximately 30 feet of loess and glacial sediments over crevices in the bedrock surface that are 6 or more inches wide (Panno et al. 2008). At least two of the longest caves in the state, Illinois Caverns (Sec. 31, T3S, R9W) and Fogelpole Cave (Sec. 7, T4S, R9W), are located within the quadrangle. The results of a dye trace experiment in a large compound sinkhole in Sec. 18, T4S, R9W (unpublished report by T.P. Aley and C. Aley) suggest the presence of a third long cave within the quadrangle, the resurgence of which is Collier Spring (to the east). The Collier Spring groundwater basin and the adjacent Fogelpole Cave groundwater basin have a shared recharge area. A crescent-shaped, northeast-southwest–trending escarpment (visible on the sinkhole density map) separates the two groundwater basins and caves and appears to define the headwaters of the Fogelpole Cave groundwater basin boundaries (Panno et al. 2008).

References

Herzog, B.L., B.J. Stiff, C.A. Chenoweth, K.L. Warner, J.B. Sieverling, and C. Avery, 1994, Buried bedrock surface of Illinois: Illinois State Geological Survey, Illinois Map 5, 1:500,000.

Leighton, M.M., G.E. Ekblaw, and C.L. Horberg, 1948, Physiographic divisions of Illinois: Journal of Geology, v. 56: 16–33.

Nelson, W.J., 1995, Structural features in Illinois: Illinois State Geological Survey, Bulletin 100, 144 p.

Panno, S.V., J.C. Angel, D.O. Nelson, C.P. Weibel, and J.A. Devera, 2008, Sinkhole density of Renault Quadrangle, Monroe County, Illinois: Illinois State Geological Survey Illinois Geologic Quadrangle Map, IGQ Renault-SD, 1:24,000; report, 6 p.

Panno, S.V., S.E. Greenberg, C.P. Weibel, and P.K. Gillespie, 2004, Guide to the Illinois Caverns State Natural Area: Illinois State Geological Survey, GeoScience Education Series 19, 106 p.

Panno, S.V., and C.P. Weibel, 1996, Karst regions of Illinois: Illinois State Geological Survey, Open File Series 1997-2, 42 p.

Panno, S.V., C.P. Weibel, and W. Li, 1997, Karst regions of Illinois: Illinois State Geological Survey, Open File Series 1997-2, 42 p.

Weibel, C.P., and S.V. Panno, 1997, Karst terrains and carbonate rocks of Illinois, Illinois State Geological Survey, Illinois Map 8, 1:500,000.

Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. Topography compiled from imagery dated 1968. Revised and updated from imagery dated 1993. PLSS and survey control current as of 1970. Contours and elevations current as of 1968. Map edited 1996.

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 15

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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 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Released by the authority of the State of Illinois: 2008

Geology based on field work by the authors, 1997–1998.

Digital cartography by J. Domier, M. Widener, M. Bentley, and S. Radil, Illinois State Geological Survey.

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4		5
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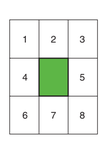
ADJOINING QUADRANGLES
1 Valmeyer
2 Waterloo
3 Paderborn
4 Selma
5 Ames
6 Danby, MO
7 Bloomsdale
8 Prairie du Rocher



APPROXIMATE MEAN DECLINATION, 2008

ROAD CLASSIFICATION

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

Bedrock Elevation
(feet above mean sea level)

700
650
600
550
500
450
400
350

Data Type

600 Water-well boring, bedrock elevation in feet above mean sea level
Syncline
Anticline

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