Bedrock Topography of Crystal Lake Quadrangle

McHenry and Kane Counties, Illinois

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

B. Brandon Curry
2005

Illinois Geologic Quadrangle Map
IGQ Crystal Lake-BT

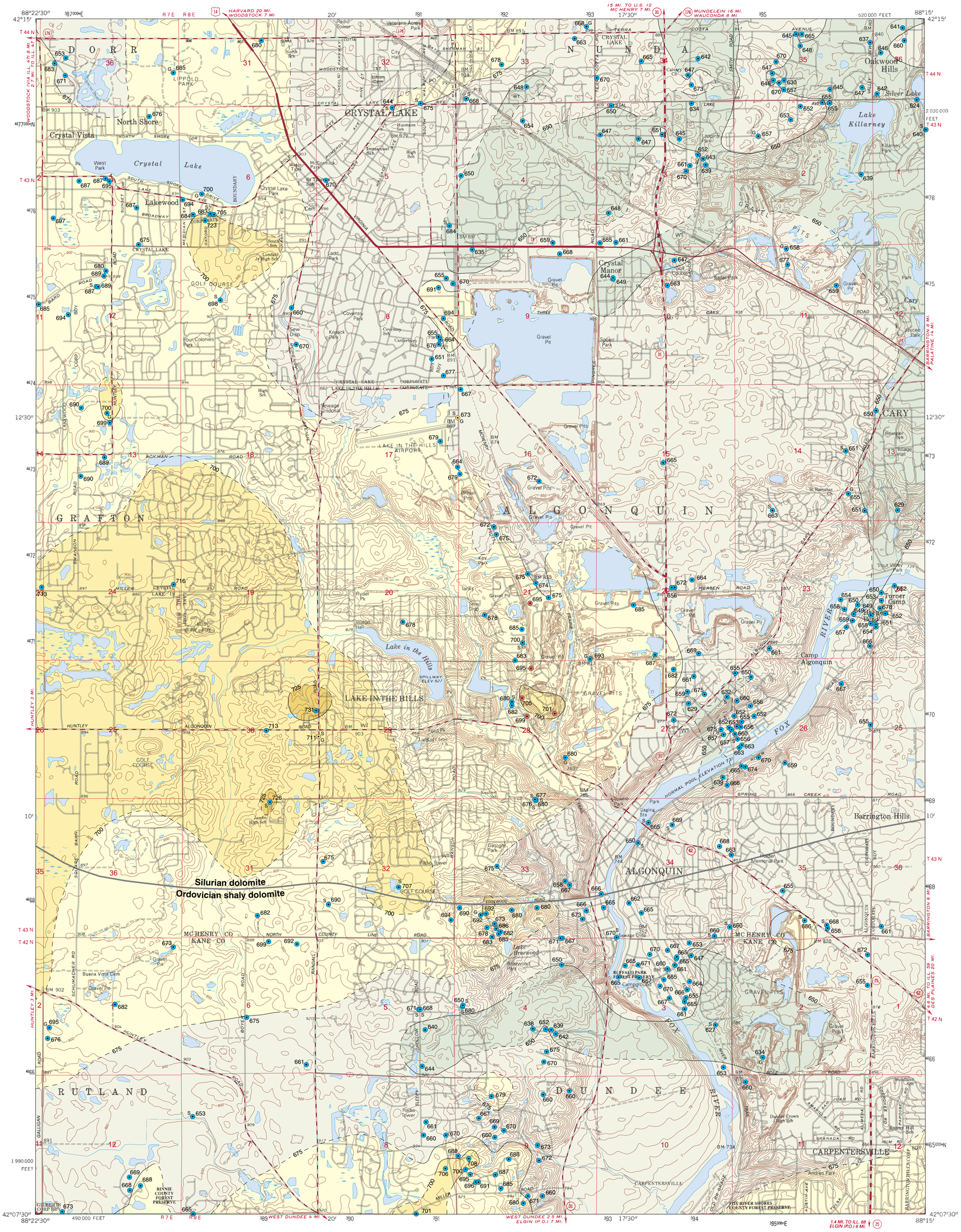

Figure 1 Regional bedrock topography (from Herzog et al. 1994). The discrepancies between this map and the new map on the left are due to the incorporation of new data and the inclusion of details that can be shown at a scale of 1:24,000.

Introduction

This bedrock surface topography map is useful for showing and predicting the elevation of sand and gravel aquifers located immediately above bedrock and in interconnected shallow bedrock aquifers tapped by private and municipal wells throughout the Crystal Lake Quadrangle.

Methods

Bedrock surface elevations were interpreted from the logs of water-well borings and engineering test borings that penetrate the bedrock surface (Curry 2005a). Bedrock surface elevations were calculated by subtracting the total thickness of unconsolidated materials penetrated by a well from the ground surface elevation. Land surface elevations, if not known, were estimated from 7.5-minute topographic maps with an accuracy of ±5 feet (U.S. Geological Survey 1999). The data were digitally contoured using the nearest neighbor gridding algorithm in Vertical Mapper Version 2.0 and then adjusted by hand, if necessary, to honor the data. Bedrock surface elevation data from a 1-mile-wide buffer around the Crystal Lake Quadrangle were included in the calculation but are not shown on the map. Contours are dashed where bedrock surface data points are separated by 2,000 feet or more (a distance of 1 inch on the map) or where the contour could be moved about 2,000 feet away from its present location and still be valid with the available information.

The quality of much of the data needed to compile this map is excellent, although the data points are not evenly distributed. Of the 421 data points used to make this map, 8 were of especially high quality because they were described by engineers and geologists. The remaining 413 records were from logs supplied by water-well drillers, including 11 confirmed by gamma-ray logs, and 37 logs with sample sets examined by Illinois State Geological Survey geologists. The location of each data point was verified in the field by an engineer or geologist. Sample sets consist of washed cuttings collected by the well driller at 5-foot intervals and at each significant change in lithology. The reliability of data derived from water-well logs was verified, in part, by similar bedrock surface elevations in residential subdivisions where the density of available data is great.

Regional Setting

The bedrock surface is a significant unconformity found throughout most of Illinois. Below this surface in northeastern Illinois, the bedrock is more than 400 million years old, and above the bedrock surface the sediment is less than about 500,000 years old. In many places the sediment is less than 25,000 years old (Curry et al. 1999). Most of the rock that occurs at and just below the bedrock surface was originally deposited as sediment in warm, tropical oceans; most of the sediment deposited above the bedrock surface was deposited by continental glaciers.

The bedrock surface in the Crystal Lake Quadrangle was eroded into the resistant Silurian dolomite and shaly Ordovician dolomite that underlie glacial drift and modern stream sediment. Drift thickness ranges from as little as 25 feet along the Fox River valley to more than 275 feet in uplands adjacent to that valley (Curry 2005b). Bedrock does not crop out in the quadrangle. Figure 1 shows the generalized topography of the bedrock surface of a portion of the northeastern Illinois region (Herzog et al. 1994). The bedrock topography of McHenry County (Curry et al. 1997) and Kane County (Vaiden and Curry 1990) has been mapped at larger scales (1:100,000 and 1:62,500, respectively). This 1:24,000-scale map of the Crystal Lake Quadrangle is more detailed than the countywide maps and includes revisions based on data from additional water-well and test-boring logs (Curry 2005a).

The topography of the bedrock surface probably was most influenced by glacial erosion and the torrents of meltwater that flowed from the glaciers, although erosion by early postglacial streams and rivers also was important. The best evidence for glacial erosion are the boulder-sized fragments of the underlying rock in the unsorted glacial sediment (diamicton). Additional evidence includes the polished and striated bedrock surfaces observed in many nearby quarries to the south within the Elgin Quadrangle.

Discussion

The large depression in the south-central part of the map between Algonquin and Carpentersville may be attributed to glacial erosion. An alternative explanation for this feature is that it may be connected with adjoining buried bedrock valley segments, either valley segments associated with the regional bedrock valley system of northeastern Illinois that once drained east to the Lake Michigan basin or with the St. Charles, Elgin, or Elburn Bedrock Valleys that once drained south and west to the Mississippi River (fig. 1). The orientation and location of the depressions or valleys also may be controlled by the density and orientation of joints and other discontinuities in the bedrock (Foote 1982, Bauer et al. 1988).

Studies of bedrock samples collected by water-well drillers and archived in the ISGS Geological Samples Library reveal that the northern two thirds of the Crystal Lake Quadrangle is underlain by hard Silurian dolomite, whereas the southern one third of the area is underlain by somewhat softer shaly Ordovician dolomite. Although not shown by the available data, it is likely that the bedrock surface slopes formed in Silurian dolomite bedrock are locally steeper than those formed in the softer shaly Ordovician dolomite. Bedrock valleys formed in the dolomite also are likely narrower than those formed in the shaly dolomite. These kinds of relationships between landforms and bedrock are observed in the driftless area of northwestern Illinois where the same bedrock units are at or near ground surface.

References

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Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. PLSS compiled in 1991. Hypsography compiled 1992. Transportation and hydrography updated from imagery dated 1999.

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

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SCALE 1:24 000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

BASE MAP CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Released by the authority of the State of Illinois: 2005

Geology based on field work by B. Curry, 1998–2001.

Digital cartography by M. Barrett and J. Domier, Illinois State Geological Survey.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

1905-2005 ISGS Illinois State Geological Survey

For more information contact:
Illinois State Geological Survey
615 East Peabody Drive
Champaign, Illinois 61820-6964
(217) 244-2414
http://www.isgs.uiuc.edu

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Woodstock
2 McHenry
3 Wauconda
4 Huntley
5 Barrington
6 Pingree Grove
7 Elgin
8 Streamwood

2 1/2° TRUE NORTH MAGNETIC NORTH

APPROXIMATE MEAN DECLINATION, 2005

ROAD CLASSIFICATION

Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
Interstate Route
U.S. Route
State Route

Bedrock Elevation
(feet above mean sea level)
750
725
700
675
650
625

Data Type

Stratigraphic boring
Water well
Engineering boring
SG Boring with samples (s) or geophysical log (g); dot indicates to bedrock
Bedrock surface contour located 2,000 feet or less from defining data
Bedrock surface contour located more than 2,000 feet from defining data

Note: Numeric labels indicate elevation above mean sea level.