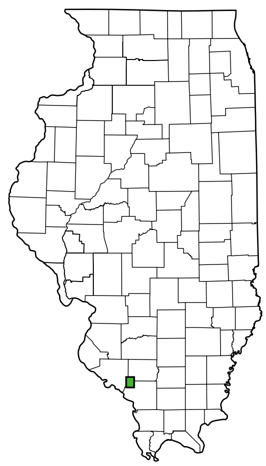
Illinois Geologic Quadrangle Map
IGQ Willisville-SG

Surficial Geology of Willisville Quadrangle

Jackson, Perry, and Randolph Counties, Illinois

W. John Nelson

2022



ILLINOIS
Illinois State Geological Survey
PRAIRIE RESEARCH INSTITUTE

615 East Peabody Drive
Champaign, Illinois 61820-6918
(217) 244-2414
http://www.isgs.illinois.edu

Introduction

This map is a companion to the bedrock geologic map of the Willisville Quadrangle (Nelson 2005). The investigation commenced with outcrop study, which entailed systematic exploration on foot, seeking exposures of earth materials in such places as ravines, steep slopes, stream banks, and artificial excavations. Extensive field notes of previous ISGS geologists also were consulted. Next, all available borehole records were examined, including those of water wells, oil and gas test holes, coal-test borings, and engineering boreholes. As data were compiled, interpretations were compared with those made by geologists working in adjacent quadrangles.

Stratigraphy

Cahokia Formation
The Cahokia Formation occurs along all streams in the Willisville Quadrangle but is shown on the map only where well-defined floodplains are developed. The formation consists of unlithified silt, clay, sand, gravel, and boulders. Exposures along stream banks are common but are small and uninformative. Better information is available from bridge borings conducted by the Illinois Department of Transportation (IDOT), particularly along Cox Creek and its tributaries. These records enable the limits of the underlying Equality Formation to be placed with a fair degree of confidence.

Equality Formation
The Equality Formation underlies the Cahokia Formation along the lower reaches of Brushy Fork and Cox Creek and their tributaries. No surface exposures are known within the map area, but logs of IDOT bridge borings enable approximate limits of the Cahokia to be mapped. The Equality is overall finer grained, is less strongly mottled, has a lower water content, and is stiffer (0.5 to 1.5 tons per square foot) than the Cahokia. These differences are consistent with those in the neighboring Welge Quadrangle (Nelson and Grimley 2010), where both surface exposures and IDOT drilling records are available. Moreover, the upper limit of the Equality occurs at elevations of 400 to 420 feet in both quadrangles.

Peoria and Roxana Silts
Composed of silt deposited by the wind (loess) and overprinted by soil development, the Peoria (younger) and Roxana Silts overlie the Glasford Formation throughout the quadrangle and rest directly on bedrock near the southwestern corner of the map area. As mapped by Fehrenbacher et al. (1986), the combined thickness of Peoria and Roxana is approximately 6 to 12 feet on uneroded, level to gently rolling uplands in the study area. Loess is thinner and locally absent on steeper slopes, where it has been eroded. The silts are completely absent only where the Cahokia and Equality Formations and bedrock are mapped and in areas that have been surface mined for coal, where the loesses have been mixed with older materials to a greater or lesser degree.

Glasford Formation
The Glasford Formation consists of pebbly silty clay loam, silty clay, and diamicton; fresh sediment is olive, brownish, and bluish gray; weathered sediment is strongly mottled in yellowish brown and yellowish orange in well-drained settings. In most exposures, the material is stiff silty clay to clayey silt with intermixed sand and 1 to 5% pebbles and larger rocks. Sand occurs as lenses and distorted layers and is generally yellowish orange. The sediment is otherwise not stratified or sorted. Well-rounded quartz pebbles dominate the gravel fraction, especially in the southern part of the quadrangle. Much of the quartz gravel is probably derived from the Lower Pennsylvanian Caseyville Formation, which underlies much of the southern area. Chert, sandstone, shale, coal, and other rock types make up the remainder of the gravel.

Cobbles and boulders (erratics) represent a great variety of rock types. Large blocks of pebbly sandstone and quartz-pebble conglomerate from the Caseyville Formation are plentiful in the southern part of the quadrangle where the Caseyville subcrops. The Middle Pennsylvanian Piasa Limestone, which lies at or near the bedrock surface in large areas of Perry County, also contributed many erratics as large as 2 feet thick and 10 feet across. This limestone is dense, dolomitic, and microgranular, weathering yellowish orange and bearing abundant large crinoid stems. Other erratics represent a large variety of rocks foreign to Illinois, including jasper, quartzite, schist, basalt, granite, and other coarse-grained igneous rocks. These are generally rounded (indicating stream transport prior to glaciation) and range up to about 3 feet in diameter.

Most Glasford till exposures are crisscrossed by joints or fractures that outline irregular polygons about 6 to 12 inches across. Joints are mineralized with iron oxide and stand out in relief. Locally, fractures show a preferred orientation.

The Sangamon Geosol is developed into the top of the Glasford Formation. Soil development is expressed as strongly weathered, leached sediment that is brightly mottled in red, orange, and yellowish brown. Crude columnar jointing, black iron–manganese stains, small slickensides, and cutans, or "clay skins," are present. The best Sangamon exposure seen during mapping was a large landslide scarp on the south side of the stream in the NW¼ NW¼ of sec. 24, T7S, R4W.

The Glasford is thinnest and locally absent along the ridge that extends from the southwest corner to the east-central part of the map area. The unit is thickest along buried valleys (indicated by contour lines on the map) and along the northwest flank of the ridge mentioned above. The maximum known thickness of the Glasford is 141 feet in a well in the center of the south half of sec. 24, T7S, R5W. The lower contact is unconformable.

Possibly present in the map area are deposits of coarse-grained stratified sediment (Pearl Formation) and finegrained stratified sediment (Teneriffe Silt), both of which would overlie the Glasford Formation and underlie the Sangamon Geosol. In addition, older Illinoian and pre-Illinoian deposits may underlie the Glasford Formation, particularly in buried valleys such as those near Cox Creek and Branch Creek. Such deposits may include the Petersburg Silt, the Griggs tongue of the Pearl Formation (both Illinoian), and pre-Illinoian till of the Banner Formation (David A. Grimley, written communication, 2018). Insufficient borehole data exist to identify any of these units.

Bedrock Topography

The elevation of the bedrock surface is shown on the map by red contour lines. This map is based on hundreds of outcrop observations combined with the logs of numerous boreholes, which are plotted on the map. Records of water wells, coal-test borings, and IDOT bridge borings provide useful information on depth to bedrock, but logs of oil-test holes generally do not.

Preglacial topography does not differ greatly from the present land surface and largely reflects the structure of the bedrock. A prominent ridge, with a crest above 600 feet, runs from the east-central edge of the map area to the southwest corner. This ridge corresponds with the Campbell Hill Anticline, an arch-like structure that brings sandstone of the Caseyville Formation (Lower Pennsylvanian) to the surface. This sandstone, composed of nearly pure quartz sand tightly cemented together, is more resistant to erosion than are the younger Pennsylvanian sandstone and shale that flank the anticline (Nelson 2005).

A lower bedrock ridge extends northwest from Campbell Hill toward Willisville, forming a drainage divide. Preglacial drainage east of the divide flowed into the ancestral Big Muddy River, whereas drainage west of the divide flowed northwest along the general course of present-day Cox Creek. The latter is the deepest bedrock valley in the area, being cut 100 to 140 feet below the present land surface in many places.

On the south, preglacial Little Kinkaid Creek lay close to the position of the modern stream. Another low divide running from Ava to Campbell Hill separates preglacial Little Kinkaid from Rocky Fork.

North of the Campbell Hill Anticline is a gently rolling till plain, only moderately dissected by modern streams. Valley slopes are moderate and thickly vegetated. Till outcrops are found only along stream banks.

Intricately dissected topography is found in thick Glasford Formation deposits at the headwaters of Cox Creek (secs. 19 and 20, T7S, R4W) and in the drainage of Little Kinkaid Creek. Steep hillsides are cut by a multitude of deep V-shaped ravines and gullies. Small creeks have narrow floodplains and meander tightly. Larger streams develop wider valleys, undercutting till bluffs and inducing landslides. Streams in the Cox Creek headwaters have recently been rejuvenated, incising gullies deeper than 10 feet into their floodplains. This erosion likely commenced when the land was cleared for agriculture.

Narrow, meandering gorges have been cut into sandstone at many places in the Willisville Quadrangle. The best examples are Rocky Fork at the east edge of the map (sec. 24, T7S, R4W) and along a western tributary of Little Kinkaid Creek in the NW¼ NW¼ NE¼ of sec. 33, T7S, R4W. These scenic little canyons are examples of superimposed drainage. After the glaciers receded, streams began to meander across the newly exposed, gently rolling till plain. As the streams cut downward, they encountered bedrock in places. Continued erosion produced vertical-walled gorges in sandstone because stream erosion is far more effective downward (in the stream bed) than laterally in competent materials. Similar incised meanders are common throughout southern Illinois near the glacial limit.

References

Fehrenbacher, J.B., I.J. Jansen, and K.R. Olson, 1986, Loess thickness and its effect on soils in Illinois: University of Illinois at Urbana-Champaign, College of Agriculture, Bulletin 782, 14 p., 2 pls.

Lineback, J.A. (compiler), 1979, Quaternary deposits of Illinois: Illinois State Geological Survey, 1 sheet, 1:500,000.

Myers, A.R., and C. Chenoweth, 2009, Directory of coal mines in Illinois, 7.5-minute quadrangle series, Willisville Quadrangle, Jackson, Perry, and Randolph Counties: Illinois State Geological Survey, 3 sheets, 1:24,000, 27-p. directory.

Nelson, W.J., 2005, Bedrock geology of Willisville Quadrangle, Jackson, Perry, and Randolph Counties: Illinois State Geological Survey, Illinois Preliminary Geologic Map, IPGM Willisville-BG, 2 sheets, 1:24,000.

Nelson, W.J., and D.A. Grimley, 2010, Surficial geology of Welge Quadrangle, Randolph and Jackson Counties, Illinois: Illinois State Geological Survey, Illinois Geologic Quadrangle Map, IGQ Welge-SG, 1:24,000, report, 6 p.

Shaw, E.W., and T.E. Savage, 1912, Murphysboro-Herrin folio: U.S. Geological Survey, Geologic Atlas of the United States Folio 185, 21 oversized pages, 1:62,500.

Stuiver, M., P.J. Reimer, and R.W. Reimer, 2020, CALIB 7.1 [web program], http://calib.org, accessed March 4, 2020.

Willman, H.B., and J.C. Frye, 1970, Pleistocene stratigraphy of Illinois: Illinois State Geological Survey, Bulletin 94, 204 p.