Department of Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
Illinois Geologic Quadrangle Map: IGQ Grafton-SG
William W. Shilts, Chief
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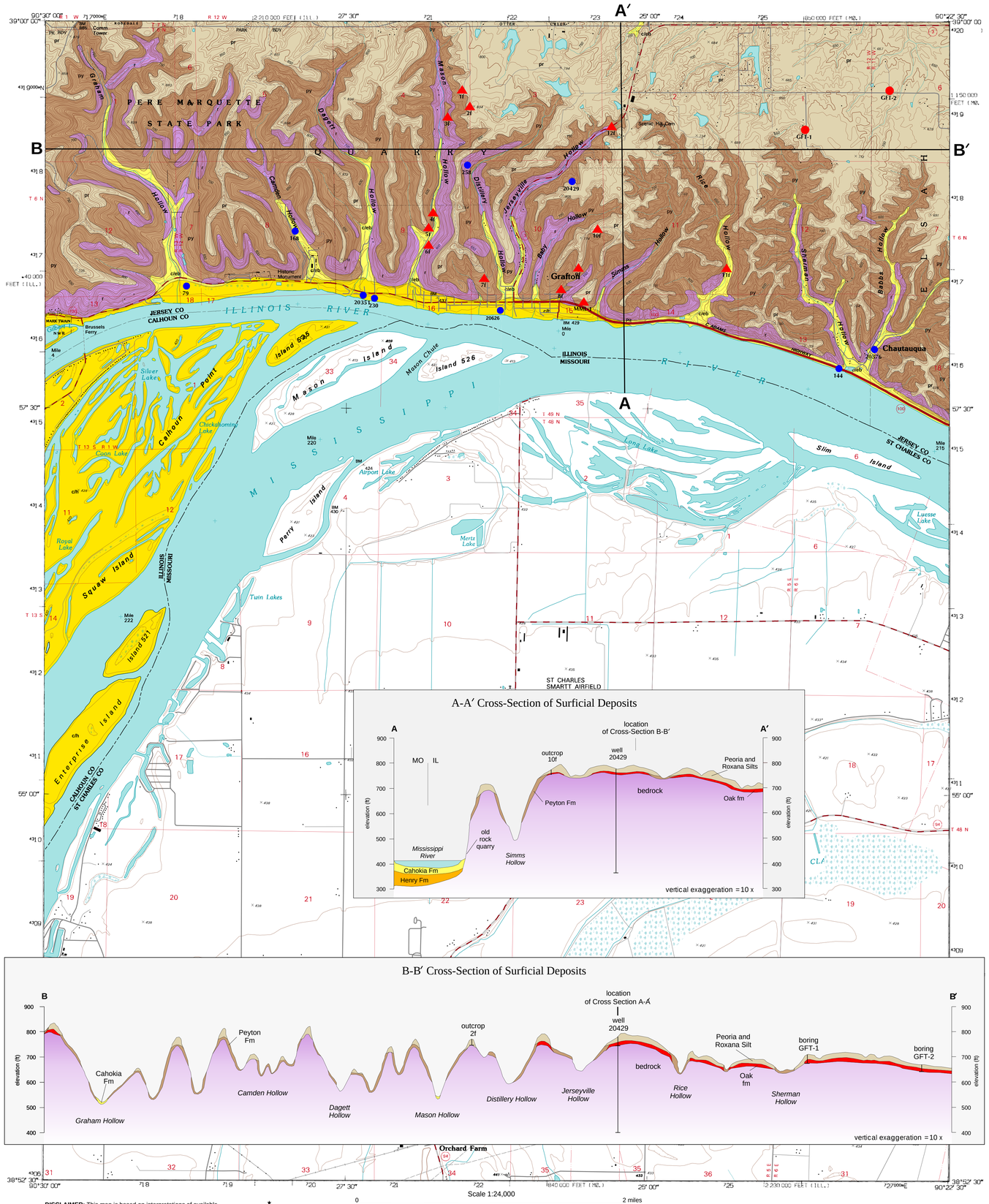
SURFICIAL GEOLOGY MAP

Grafton Quadrangle (Illinois Portion), Jersey and Calhoun Counties, Illinois

David A. Grimley



Scale 1:24,000

0 2 miles
0 2 kilometers
0 2000 feet

CONTOUR INTERVAL 10 FEET

Base map compiled at the Illinois State Geological Survey (ISGS)
from digital line data (1990) provided by the U.S. Geological Survey and the ISGS
1927 North American Datum
Universal Transverse Mercator grid, Zone 16

UTM GRID AND 1995 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

DISCLAIMER: This map is based on interpretations of available data obtained from a variety of sources. Some water well locations are not precisely verified and interpretations based upon them are not guaranteed by the ISGS. This map was prepared as part of a project for geologic mapping, resource evaluation, and planning, and does not replace the need for detailed site-specific studies. Public Land Survey township lines in this part of the state do not run true north-south or east-west.

Acknowledgments
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1 Nutwood
2 Otterville
3 Jerseyville South
4 Brussels
5 Elsah
6 Kampsville
7 St. Charles
8 Florissant

ADJOINING 7.5-MINUTE QUADRANGLES

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QUATERNARY DEPOSITS

Hudson Episode (0 to about 10,000 years before present [B.P.])

c/eb **Cahokia Formation, overlying either Equality Formation or bedrock** Alluvium (river sediment) ranges from silt to coarse sand and gravel; silty deposits are derived from loess (wind-deposited silt) and tend to occur in the headwaters of creeks. Gravelly alluvium (<15 ft thick) is common where alluvium rests directly on bedrock, as it does in the channels of many southflowing tributaries to the Mississippi River. Some areas underlying Illinois route 100 near the bluffs have been disturbed and are underlain by sand and gravel fill up to 20 feet thick.

In isolated areas, the Equality Formation underlies the Cahokia Formation in tributary valleys at elevations of 500 feet or lower. The Equality Formation consists of Wisconsin Episode slackwater lake deposits, which are crudely stratified silty clay, silt, and clay, often grey to yellow grey. The formation's occurrence is limited because of postglacial fluvial erosion; where it was found in Mason Hollow (site 4f), only a 5-foot thickness was exposed. A radiocarbon age of 19,370 ± 200 (ISGS3582) was determined on a sample of spruce wood collected from this site at an elevation of 490 feet.

c/h **Cahokia Formation overlying Henry Formation** Alluvium, ranging from clay and silt to medium sand, occurs in the Illinois Mississippi Valley. The Cahokia Formation in these main valleys ranges from about 15 to 40 feet thick; generally the upper 5 to 30 feet is silt and clay. Henry Formation sand and gravel underlies the Cahokia Formation, with the total thickness of both units ranging from about 40 to 100 feet (see cross section A–A′)

py **Peyton Formation** Colluvium (sediment moved downslope by gravity) originated as a relatively unsorted mixture of loess, residuum (bedrock soils), and bedrock. Silt, pebbly silt, and/or pebbly clay, ranging from yellow–brown to reddish brown, can be commonly found on the sides or at the foot of steep slopes. The bulk of this unit is redeposited or eroded loess. Some portions of the colluvium may have been deposited earlier in the Quaternary, prior to or concurrent with loess deposition. The formation ranges from 0 to 20 feet thick.

Wisconsin Episode (about 10,000 to 75,000 years B.P.)

h **Henry Formation (shown in cross sections only)** This sand and gravel outwash deposited in the Mississippi River Valley is related to advances of upper midwestern glaciers that did not reach the study area. Water well records indicate that this unit ranges from 20 to 90 feet thick in the Illinois and Mississippi Valleys and underneath the Mississippi River. Deposits are thinnest along the narrow floodplain parallel to the bluffs and thicken away from the valley edges, for example, underneath the river and islands in Calhoun County, such as Calhoun Point. Henry Formation is overlain by about 10 to 40 feet of Hudson Episode alluvial clay, silt, and sand (Cahokia Formation).

pr **Peoria and Roxana Silts, undifferentiated** Loess (silt or silt loam texture) is underlain by residuum, colluvium, and/or bedrock. The Peoria Silt, yellow–brown to grey, constitutes two–thirds of this unit's thickness in uneroded areas. The Roxana Silt, pinkish brown to brown–grey, constitutes approximately the lower one–third of the unit. Loess thickness on relatively flat, uneroded uplands ranges from 15 feet in the northeastern portions of the quadrangle to a maximum of about 40 feet in isolated uplands near the Mississippi Valley bluffs. Areas of severely eroded and redeposited loess on steep slopes are mapped as Peyton Formation.

TERTIARY / QUATERNARY DEPOSITS

o **Oak formation (shown in cross sections only)** Deposits of residual clay, cherty clay, silty clay, and silty clay loam are red to yellow–brown, and have grey mottles at some sites. Rare erratics are present within the clay at some localities. This unit was formed by chemical dissolution of carbonate bedrock, primarily during the Tertiary (Willman et al. 1989), with some admixed Quaternary loess, dust, and perhaps thin till deposits, which have been subsequently severely eroded and weathered. The unit as a whole is a residual soil and paleosol complex. The Sangamon Geosol (last interglacial soil) bounds the top of the Oak formation and separates it from the Wisconsin Episode loess deposits above. The Oak formation was originally defined by Nelson et al.(1991).

PALEOZOIC BEDROCK

r **Bedrock exposures or bedrock within 5 to 10 feet of land surface** Typical rocks are flatlying limestone, dolomite, shale, and siltstone; some rocks are faulted or slightly tilted. Also included are some talus–covered bedrock slopes at the base of the bluffs of the Mississippi Valley. Limestone and shale are common Mississippian rocks, the youngest and uppermost rocks. Devonian rocks are thin sandy limestones. Silurian rocks are dominantly thick, massive dolomite. Ordovician rocks, exposed at the lowest elevations, are calcareous siltstones to shale (Denny and Devera, *Bedrock Geology Map of the Grafton 7.5-Minute Quadrangle*, in progress).

2f outcrops examined
GFT-1 stratigraphic test cores
144 water wells and engineering borings
(county numbers on file in the ISGS Geological Records Unit)

View of the Illinois River and its floodplain from the bluffs of Pere Marquette State Park. Glacial outwash deposits, deposited on this vast floodplain during the Wisconsin Episode, were windswept into thick dust clouds. Repeated settling of windblown silts resulted in thick loess deposits on uplands of this area. This photo was taken a couple of miles west of this quadrangle; river levels were normal when the photo was taken. [Photo by Joel M. Dexter, 1991]

Steep vertical bluffs of Paleozoic bedrock along the Mississippi River in the Grafton Quadrangle. This photo was taken 1 mile or so east of downtown Grafton along Illinois route 100. White to grey limestone bluffs such as these are common along the river in areas between Grafton and Alton, Illinois. [Photo by Joel M. Dexter, 1997]

Quaternary Geology

The Grafton Quadrangle in southwestern Illinois, about 20 miles north-northwest of St. Louis, is near the terminus of midcontinental glaciation. This interpretation is suggested by the presence of scattered glacial erratics, primarily in the central and eastern portions of the quadrangle (see also, Rubey 1952). However, till was not definitely identified in drill holes or outcrops. Thus, pre–Illinois and Illinois Episode ice advances from the east and northeast (McKay 1979) likely deposited a thin layer of till, which was later eroded. It is unlikely that thinning glacial ice over-topped the highest bedrock hills to the west. Rather, glacial ice was probably diverted southward into the many hollows and toward the Mississippi River Valley. Scattered erratics in stream alluvium, colluvium, and residuum, are evidence of middle Quaternary glaciation, and are more common in the eastern portion of this quadrangle.

Extensive erosion, in addition to soil formation, likely occurred during the Yarmouth and Sangamon Episodes (interglacials), when patchy till deposits were weathered and reworked by stream and slope processes. Thick terra rosa soils (red bedrock residuum) mapped as Oak formation (Nelson et al. 1991) were formed by in–situ weathering of carbonate bedrock, common to upland areas of this quadrangle. The Oak formation, previously called the geest, formed predominantly during the Tertiary and early Quaternary, as interpreted from stratigraphic and mineralogical studies in the Driftless Area of northwestern Illinois (Willman et al. 1989). The Oak formation, which can include pre–Wisconsin Episode Quaternary paleosols that formed in loess, may be up to 20 feet thick on the flattest uplands.

Outwash and loess deposits in the Grafton Quadrangle are the indirect result of the Wisconsin Episode glaciation, which occurred in northeastern Illinois and the upper Mississippi River drainage basin. As much as 70 feet of Henry Formation sand and gravel, overlain by 20 to 30 feet of postglacial alluvium (Cahokia Formation), was deposited in the Illinois portion of the Illinois–Mississippi Valley during the Wisconsin Episode. Coarse–grained, valley–train sediment grades into silty lacustrine sediment (Equality Formation) in valleys tributary to the Mississippi and Illinois Rivers. The formation of slackwater lakes occurred as a result of aggradation to the 500-foot elevation in the main valley. It is likely that most of these lacustrine silts were subsequently eroded along the steep ravines. In tributaries to the Illinois and Mississippi Rivers, the Cahokia Formation overlies these slackwater deposits or directly overlies bedrock. In many of the hollows, the Cahokia Formation is gravelly because of its inclusion of local bedrock fragments.

Loess deposits, swept by westerly winds, from the Mississippi and Missouri River Valleys up to the bluffs, may be up to 40 feet thick on adjacent, uneroded uplands. The loess thins, however, to about 15 feet in northeastern portions of the quadrangle. Most loess is Peoria and Roxana Silt, although some Illinois and pre–Illinois loess (both in the Oak formation) may be preserved on some uplands, particularly in western portions of the quadrangle. Colluviated loess mixed with local bedrock fragments and bedrock residuum (Peyton Formation) is common along the steep slopes of ravines and hollows. Erratics are scattered within this colluvium, directly above bedrock or residuum.

Material Resources and Environmental Hazards

Groundwater
Most groundwater supplies on the uplands are from fractured carbonate bedrock. Although karst topography is not evident at the surface, some of the bedrock (particularly the Burlington Limestone) can be cavernous. In areas of thin loess and residuum, the karst aquifers are highly susceptible to contamination due to conduit flow. Henry Formation sand and gravel and Cahokia Formation sand in the Illinois and Mississippi river floodplains constitute the most significant Quaternary aquifer in the quadrangle. The potential for contamination of this groundwater resource is high because of the relatively thin covering of silt and clay (approximately 5 to 30 feet).

Sand and Gravel
These deposits, which mostly lie below the water table, are a potential source of construction materials. Dredging for sand in the Mississippi River channel is occurring, as of 1997, in the Alton area, several miles downstream from Grafton. The sand, primarily siphoned from the upper 15 feet of channel sediment, is used for asphalt and mortar. Gravel content is low, somewhat limiting the use of these sediments by the construction industry (Goldman 1994). Well logs for the floodplain west of Grafton indicate that usable river sands may be buried by as much as 30 feet of silt and clay.

Mass Wasting
Undercutting and slumping of thick loess deposits, Maquoketa Group shales, and the Hannibal Shale along bluff edges are a potential hazard (Killey et al. 1985). A large slump block of Silurian dolomite, underlain by Maquoketa Group shale, pulled away from and rotated back towards the joint-faced cliff along the bluffs just east of Graham Hollow. The movement was probably due to lubrication of the shale (Collinson et al., 1954). Other slumps involving Mississippian bedrock have been noted 1 or 2 miles east of Grafton (Killey et al. 1985).

Soil Erosion
Steep slopes along ravines and along the bluffs are subject to severe soil erosion due to the nature of loessial soils. Areas mapped as Peoria and Roxana Silt and Peyton Formation have loose, windblown, near-surface silt deposits that are soft and weakly cohesive, and thus have a low shear resistance. These loess deposits (and redeposited loess) are easily eroded by running water during heavy rainfalls. Runoff during rain storms can quickly erode into and enlarge rills and gullies, thereby accelerating the process of erosion, as water is channeled into the growing drainage system.

Flooding
Severe flooding occurs periodically in the Grafton area and west to Pere Marquette State Park. During the flood of 1993 (Chrzastowski et al. 1994), the Illinois–Mississippi River rose to an elevation of 442 feet, inundating much of the town of Grafton and leaving behind a thin layer of clay on the floodplain. A new community of homes, available to residents of Grafton, is currently being constructed on uplands about 1 mile north of the town.

Mapping Techniques

This surficial geology map is based in part upon the Jersey County soil survey (Fehrenbacher and Downey 1966); but it was considerably modified based upon field observations and drilling operations performed as part of this STATEMAP project. Well log data, records of the Illinois Department of Transportation, and other engineering-boring data, on file at the Illinois State Geological Survey, were used to aid in mapping and especially in drafting the two cross sections.

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Aerial view of major flooding of the Illinois–Mississippi Rivers in downtown Grafton. This photo was taken on August 6, 1993, during peak flooding along the rivers. Similar flooding occurred during the Wisconsin Episode, the last midcontinental glaciation, when floodwaters reached an elevation of almost 500 feet, at least 50 feet higher than this great flood. [Photo by Joel M. Dexter, 1993]

Evidence of flooding in downtown Grafton, built in the floodplain of the Illinois–Mississippi Rivers. This photo was taken on September 8, 1993, one month after the peak floods of that summer. A flood-level line is visible a few feet above the door to the building. Brown mud, carried in suspension by the rivers, discolored part of the building while it was underwater. Boats cruised down Illinois route 100 in downtown Grafton during peak flood levels *[see photo above]*, when the water was up to about the 442-foot elevation. [Photo by David A. Grimley, 1993]