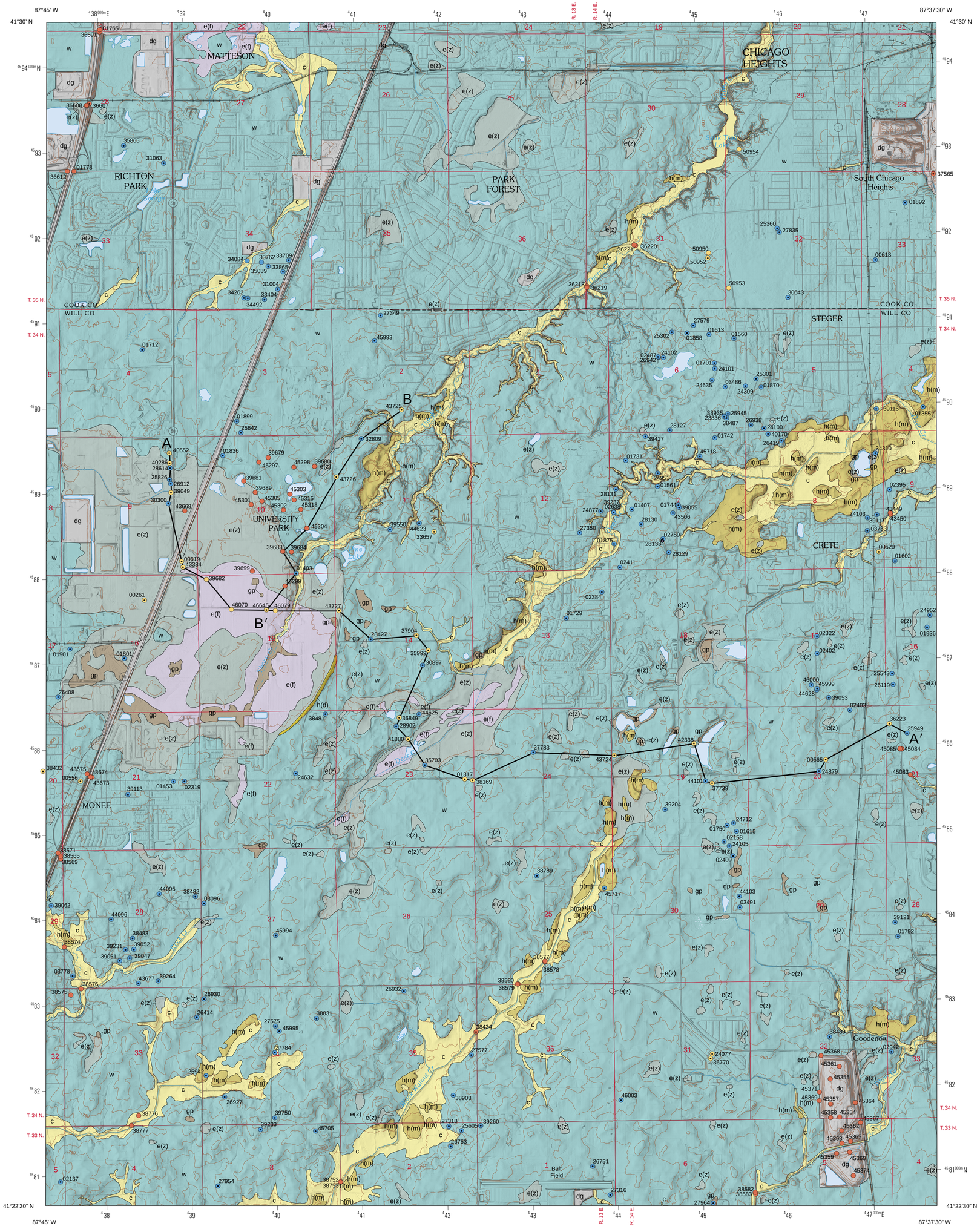
SURFICIAL GEOLOGY OF STEGER QUADRANGLE
WILL AND COOK COUNTIES, ILLINOIS

Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

Olivier J. Caron, B. Brandon Curry and David A. Grimley
2020

STATEMAP Steger-SG



QUATERNARY DEPOSITS

Description	Unit	Interpretation
HUDSON EPISODE (~14,700 years before present (B.P.) to today)[1]		
Diamicton, sand, gravel, silt, and peat; up to 10 feet thick	Disturbed ground: dg	**Disturbed land**; includes major highway embankments, and other construction areas
Peat, muck, organic silt and clay; interbedded with sand, silt, and clay in some places; up to about 10 feet thick	Grayslake Peat: gp	**Organic debris** deposited in depressions; intertongues with the Equality and Cahokia Formations
Sand, silt, and clay; stratified; locally containing beds of sand; generally less than 20 feet thick	Cahokia Formation: c	**Alluvium in floodplains and channels** of modern rivers and streams; alluvial fan deposits in some places
late WISCONSIN and HUDSON EPISODES (~17,600 years B.P. to today)[1]		
Sand, fine to medium, well-sorted, stratified, gravelly in places, silty in others, less than 45 feet thick	Henry Formation (Dolton facies): h(d)	**Littoral sands**; deposited in glacial Lake Pine Creek
Clay and silt; uniform and laminated; as much as 25 feet thick	Equality Formation (fine facies): e(f)	**Lake sediment** few deposits are slackwater; intertongues with alluvium of Cahokia Formation or Henry Formation. Unit e(f) is a fine-grained facies, deposited under quiet, typically off-shore conditions; unit e(z) is a coarser, lithologically heterogeneous facies that was deposited in higher-energy environments; large deposits make up glacial Lake Pine Creek on the east side of the map
Silt and clay with beds of fine to medium sand; uniform and laminated; as much as 30 feet thick	(silty facies): e(z)	
WISCONSIN EPISODE: Michigan Subepisode (~29,000–17,600 years B.P.)[1]		
Sand, typically with little gravel, interbedded with uncommon beds of silt or diamicton; less than 55 feet thick	Henry Formation (Mackinaw facies): h(m)	**Outwash**; deposited in glacial meltwater channels and in alluvial fans
Diamicton, loam to silty clay loam; uniform to vaguely stratified in places, gray (fresh) to brown, yellowish brown, and light gray (weathered); with lenses of sand and gravel; as much as 100 feet thick	Wadsworth Formation: w	**Till and debris flow deposits**; associated with the Tinley Moraine and Valparaiso Morainic System
Diamicton, loam and silt loam; gray, oxidizing to yellowish brown; includes layers of sand and gravel, silt, and silty clay; as much as 30 ft thick	Lemont Formation, Haeger Member (cross sections only): l-h	**Till and ice-marginal sediment**
Sand and gravel; yellowish brown; stratified in places; includes large boulders; as much as 50 ft thick	Beverly Tongue Henry Formation (cross sections only): h-b	**Proglacial outwash**; outwash deposited in glacial meltwater channels and in alluvial fans; underlies deposits of the Haeger Member
Diamicton; silty clay, silty clay loam, and clay; gray, oxidizing to yellowish brown; includes layers of sand and gravel, silt, and silty clay; as much as 30 ft thick	Yorkville Member Lemont Formation (cross sections only): l-y	**Till, debris flow deposits, and lake sediment**

PRE-QUATERNARY DEPOSITS

SILURIAN SYSTEM (440-410 million years B.P.)		
Dolomite, some shale	Bedrock (Silurian) (cross sections only): S	**Dolomitized carbonate bank deposits**

[1]The time periods for the Wisconsin Episode and the Hudson Episode are reported as calibrated radiocarbon years and can be directly compared to calendar years before 1950 (Stuiver et al. 2015).

Data Type

- Stratigraphic boring
- Water-well boring
- Engineering boring

S ⊙ 26211 — Labels indicate samples (s). Boring labels indicate the county number. Dot indicates boring is to bedrock.

Contact

A — A′ Line of cross section

Note: The county number is a portion of the 12-digit API number on file at the ISGS Geological Records Unit. Most well and boring records are available online from the ISGS Web site.

Base map compiled by Illinois State Geological Survey from digital data (2018 US Topo) provided by the United States Geological Survey. Shaded relief and contours derived from LiDAR elevation data provided by Will County (2014) and Cook County (2018).

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator
1,000-meter ticks: Universal Transverse Mercator grid system, zone 16

Recommended citation:
Caron, O.J., B.B. Curry, and D.A. Grimley, 2020, Surficial geology of Steger Quadrangle, Will and Cook Counties, Illinois: Illinois State Geological Survey, STATEMAP Steger-SG, 2 sheets, 1:24,000.

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 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1988

Geology based on field work by O. Caron, 2017-2018, D. Grimley and B. Curry 1999-2000.

Digital cartography by Deette Lund, Jennifer Carrell and Emily Bunse Illinois State Geological Survey.

This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program under StateMap award number G19AC00310, 2019, and Great Lakes Geologic Mapping Coalition award number G17AC0036, 2017. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

This map has not undergone the formal Illinois Geologic Quadrangle map review process. Whether or when this map will be formally reviewed and published depends on the resources and priorities of the ISGS.

The Illinois State Geological Survey and the University of Illinois make no guarantee, expressed or implied, regarding the correctness of the interpretations presented in this document and accept no liability for the consequences of decisions made by others on the basis of the information presented here. The geologic interpretations are based on data that may vary with respect to the accuracy of geographic location, the type and quantity of data available at each location, and the scientific and technical qualifications of the data sources. Maps or cross sections in this document are not meant to be enlarged.

ILLINOIS
Illinois State Geological Survey

Prairie Research Institute
Illinois State Geological Survey
615 East Peabody Drive
Champaign, Illinois 61820-6918
(217) 244-2414
http://www.isgs.illinois.edu

Great Lakes GEOLOGIC MAPPING COALITION

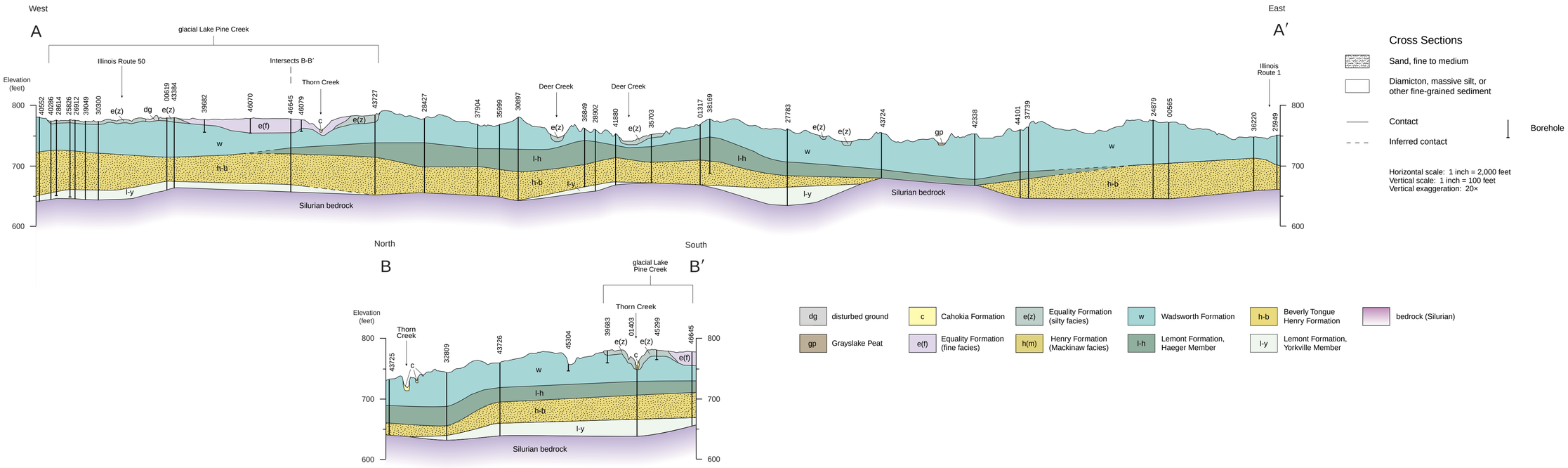
1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Tinley Park
2 Harvey
3 Calumet City
4 Frankfort
5 Dyer
6 Peotone
7 Beecher West
8 Beecher East

APPROXIMATE MEAN DECLINATION, 2019

ROAD CLASSIFICATION

Interstate Route — State Route
U.S. Route — Local road



Introduction

This surficial geologic map of the Steger 7.5' Quadrangle is part of a long-term geological mapping project (Caron and Curry 2019, Caron and Curry 2018, Caron 2017a, Caron 2017b, Caron 2016; Caron and Phillips 2015, Curry and Grimley 2001, Curry and Bruegger 2014) in Will and Cook counties. This map continues ISGS efforts in northeastern Illinois to map deposits at the land surface and in the subsurface down to bedrock to gain a better understanding of the complex geology left behind by repeated glaciations and associated flooding events. The Steger Quadrangle is located between the Tinley Moraine and the Valparaiso Morainic System, about 35 miles from the southern shore of Lake Michigan and the southern portion of the City of Chicago (Fig. 1). The largest communities in the area include the cities of Chicago Heights (29,571, United States Census Bureau 2018), Park Forest (21,429), Matteson (19,464), Richton Park (13,409), Steger (9,331), Crete (8,307), University Park (6,958), and Monee (5,122). Respectively, US-50 traverses the map and the Interstate-57 the north west edge of the study area.

Geologic Setting

The landscape was constructed during the last glaciation (Wisconsin Episode) between about 29,000 and 14,700 cal yr BP (Curry et al. 2014). Four moraines constitute the Valparaiso Morainic System: the Clarendon, Westmont, Wheaton, West Chicago, and Manhattan moraines (Fig. 1; Willman and Frye 1970). Shallow valleys trending northeast-southwest crosscut the moraines and were likely formed by subglacial meltwater channels that evolved near the ice margin during downwasting of the ice (Menzies 1995). The discontinuous Westmont Moraine is the oldest upland feature. Formed of diamicton of the Wadsworth Formation, the West Chicago moraine have been dissected by the Black Walnut Creek and by perched channels that were formed and abandoned during the last deglaciation. Bedrock, comprise of resistant Silurian sedimentary rocks, has low relief and gently dipping settings (Fig. 2).

Methods

Surficial Map

The surficial geology map is based primarily on interpretation of aerial imagery, lidar elevation data, boring records archived at the Illinois State Geological Survey (ISGS), hand auger descriptions, and the Will and Cook counties soils map (Hanson 2004). The soil survey map details soil parent materials in the upper five feet, which in Will and Cook counties are glacial and post-glacial deposits. Geologic contacts were verified at 32 sites by examining exposures along roads, creeks, and ditches, and by sampling with a hand auger. The subsurface data include detailed studies of 23 stratigraphic test holes including 5 stratigraphic test holes drilled by the ISGS, 182 water well logs, and 119 bridge and foundation (engineering) borings from the Will and Cook counties Highway Department. Positions of some map boundaries and descriptions of some units were modified based on geotechnical logs and test hole descriptions, from the field sites, and from other archival data. Locations of the water-well logs and geotechnical borings were confirmed by plat books of land ownership, aerial photography, tax records, and site visits. The records for all data sources are on file at the ISGS Geological Records Unit. We acquired a total of 932 feet of core at 15 locations using continuous wireline coring. The seven wireline core reached bedrock and the holes were logged with natural gamma-ray. Particle-size distributions were determined by laser diffraction on 8 samples from test holes. Finally, elemental analyses by Energy Dispersive XRF was performed on 38 samples from test holes. Sample testing was completed in Prairie Research Institute laboratories. The glacial stratigraphy of the Steger 7.5' Quadrangle is dominated by sorted deposits of the Mason Group and glacigenic diamicton of the Wedron Formation (Hansel and Johnson 1996; Fig. Stratigraphic framework). These units attain thicknesses of more than 150 feet (45.7 m) along the Westmont and Clarendon Moraines (Fig. 2 and cross sections A and B). Older units of the Wedron Group (Tiskilwa Formation and Batestown Member, Lemont Formation) are absent.

Bedrock Surface

Silurian-age rocks at the bedrock surface are composed of light gray, fine-grained limestone. Bedrock highlands mainly in the southwestern portion of the quadrangle ascend gently from about 600–640 feet mean sea level (MSL) to 700–745 MSL feet in the southwest (Fig. 3). Silurian rocks commonly exceed 250 feet in thickness. The surface elevations of water wells, engineering borings, stratigraphic borings, and gamma logs were interpolated from the Will and Cook Counties lidar using ESRI's ArcGIS software. Preliminary elevation contours were derived from a surface calculated by subtracting thickness of consolidated materials from the ground elevation. A smoother bedrock surface was created from the contours with ArcGIS' Topo-to-Raster interpolation method. Finally, the contours were adjusted to honor all of the data points on the final bedrock topography map.

Results

Glacial Sediments

The lowermost unit is the Yorkville Member (Lemont Formation; l-y), a gray, fine textured diamicton that contains lenses of gravel, sand, silt, and clay. It is typically 15 feet, but up to 20 feet thick. The Haeger Member (Lemont Formation, l-h) diamicton is yellowish brown, coarse-grained, friable and has a high dolomite content. This unit is greater than 30 feet thick in some places. Its extent and thickness are difficult to discern beneath the southwestern Lake Michigan area because of limited exposure, but the Haeger Member was clearly identified in the Steger Quadrangle. The Haeger Member is also associated with the underlying Beverly Tongue of the Henry Formation (h-b). The Beverly Tongue is regionally the thickest and most continuous subunit of the Henry Formation (as much as 70 feet thick). The fill along the Tinley Moraine contains a large proportion of sand and gravel of the Beverly Tongue. Locally, the lower part of the fill contains finer-grained material than the upper part. The sand and gravel is overlain by either diamictons of the Haeger Member of the Lemont Formation and by the Wadsworth Formation, the latter of which contains a high percentage of silt and clay (cross sections A and B). The uppermost diamicton unit has a heterogeneous lithology that is locally consistent with the Wadsworth Formation (w). The Wadsworth Formation is an extensive surficial clay-rich stratigraphic unit in northeastern Illinois. It is interpreted commonly as interstratified clayey till and lacustrine sediment (Hansel and Johnson 1996). In the Steger Quadrangle, this unit is greater than 60 feet thick (Fig. 4).

Postglacial Sediments

Deposits of silt and clay, peat, sandy gravel, and sand overlie the glacial units, filling the valleys throughout the mapped area as well as many low spots scattered across the uplands. Alluvium comprised of fine-grained floodplain and coarser-grained active channel deposits are undifferentiated within the Cahokia Formation (c). Bridge boring data indicate that the floodplain unit is generally <10 feet thick, and more typically 15 feet thick. The Grayslake Peat (gp) consists of peat, muck, organic silt and clay, and interbedded sand, and is less than 10 feet thick. The Grayslake Peat was deposited in depressions and at the toes of slopes.

Glacial Lake Pine Creek

The landscape was constructed during the Crown Point Phase (Wisconsin Episode) between about 18,500 and 16,500 cal yr BP. In this area, three moraines make up the Valparaiso Morainic System: the Westmont, Wheaton, and West Chicago Moraines (Willman and Frye 1970). Shallow valleys trending northeast crosscut the moraines and were likely formed by subglacial meltwater channels that evolved near the ice margin during downwasting of the ice (Menzies 1995; Curry and Grimley 2001). Much of the land surface of this area is characterized by glaciolacustrine sediments of the Equality Formation (Fig. 5) that were deposited in moraine-dammed lakes during glacial retreat. The lake deposits are generally less than 20 ft (6.1 m) thick. We recognize several mappable lake deposits that are not identified on the 1:500,000-scale Quaternary deposit map of Lineback (1979). One of the most prominent is glacial Lake Pine Creek (Fig. 5). A curvilinear beach ridge (Dolton Member of the Henry Formation) appears to be truncated by the Westmont Moraine near boring 121974372700 (API no.), suggesting that the Joliet sublobe readvanced across a narrow portion of the lake on the north and east. The beach ridge and other deposits indicate that the lake reached elevations of about 790 ft (240.8 m). Overflow erosion lowered the local base level (present-day Pine Creek) about 50 ft (15.2 m).

Cores

Two sediment cores (API nos. 121974468100 and 121974468200) sampled near the center of glacial Lake Pine Creek (Fig. 6a) revealed, from top to bottom, 0.0–2.3 ft Peoria Silt: Silty clay loam, black, soil structure, no geogenic features, leached of carbonate minerals.

2.3–6.7 ft Equality Formation: Silt loam, varicolored, deoxidized, weak geogenic features (stratification), weakly calcareous at top, grading to strongly calcareous at base.

6.7–22.4 ft Equality Formation: Rhythmites, including beds of silt loam (about 1 cm thick) and very fine sand (0.5–0.8 cm thick), gray, strongly calcareous, no biogenic carbonate, and rare plant macrofossils, including one section that yielded plant macrofossils from sediment core depths of 21.0 to 21.5 ft (6.4 to 6.6 m) in depth (Fig. 6b). These fossils yielded a radiocarbon age of 15,220 ± 60 ^{14}C yr BP, which calibrates to 18,490 ± 90 cal yr BP (Stuiver, et al 2015).

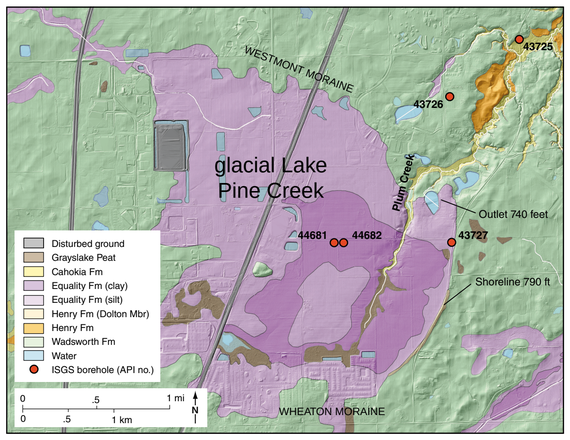


Figure 5 The University Park extent of glacial Lake Pine Creek at 790 ft (240.8m). The green geologic unit represents fine-grained till deposits of the Wadsworth Formation; pink represents fine-grained lacustrine sediments of the Equality Formation (silt and clay); orange represents outwash and shoreline deposits of the Henry Formation; yellow represents alluvial deposits of the Cahokia Formation; brown represents Grasylake Peat deposits; and gray represents disturbed ground. (after Caron and Curry 2016)

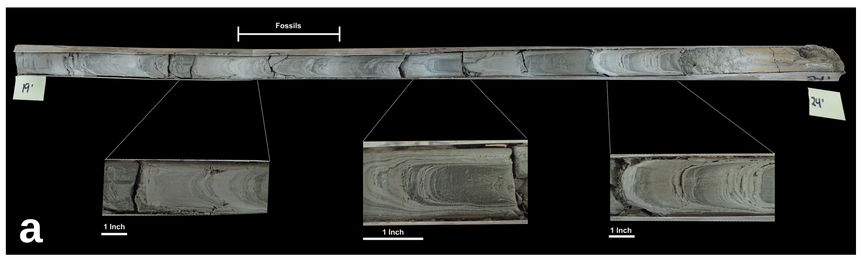


Figure 6 - a and b Photographs of split sediment core (**a**; API no. 121974468200) and (**b**) plant macrofossils recovered from 21.0 to 21.5 ft (6.4 to 6.6 m). The curving layers in the core were flat but deformed by the drilling process with the AMS PowerProbe sampling. The dimension of the square surrounding the fossils is 1.0 cm. (after Caron and Curry 2016)

Important Findings

- Three glacial diamicton units were identified: The Yorkville and Haeger Members of the Lemont Formation, and the Wadsworth Formation. The uppermost diamicton unit is the Wadsworth Formation which forms the Tinley Moraine and the Valparaiso Morainic System.
- Much of the land surface of this quadrangle is covered by glaciolacustrine sediments of the Equality Formation that were deposited in moraine-dammed lakes during glacial retreat. The lake deposits are generally less than 20 ft thick. The most prominent is glacial Lake Pine Creek (Willman 1971). The lake reaches 3.5 km long and 4 km wide.
- The Dolton Member of the Henry Formation has been identified at the glacial Lake Pine Creek. The beach ridge and other deposits indicate that the lake reached elevations of about 790 ft (240.8 m).
- Fossils and rare plant macrofossils from sediment core at glacial Lake Pine Creek yielded a radiocarbon age of 15,220 ± 60 14C yr BP, which calibrates to 18,490 ± 90 cal yr BP.
- The Beverly Tongue was consistently found across the Steger Quadrangle beneath the Haeger Member of the Lemont Formation.

Acknowledgements

We thank numerous local landowners, Forest Preserve District of Will County and municipalities for access to their property, data, and services. The ISGS Drill Team completed the test hole. We thank Deette Lund, Jennifer Carrell, and Emily Bunse for map production. This mapping was partly funded by the United States Geological Survey's STATEMAP program (award number G19AC00310) and Great Lakes Geologic Mapping Coalition (award number G17AC0036).

References

Caron, O.J., 2016, Surficial Geology of Mokena Quadrangle, Will and Cook Counties, Illinois. Illinois State Geological Survey, contract report. Two sheets. 1:24,000.

Caron, O.J., 2017a, Surficial Geology of Joliet Quadrangle, Will Counties, Illinois. Illinois State Geological Survey, contract report. Two sheets. 1:24,000.

Caron, O.J., 2017b, Surficial Geology of Romeoville Quadrangle, Will and Cook Counties, Illinois. Illinois State Geological Survey, contract report. Two sheets. 1:24,000.

Caron, O.J., and B.B. Curry, 2016, Guidebook: The Quaternary Geology of the Southern Chicago Metropolitan Area: The Chicago Outlet, Morainic Systems, Glacial Chronology, and Kankakee Torrent, NC-GSA 2016

Caron, O.J., and B.B. Curry, 2018, Surficial Geology of Tinley Park Quadrangle, Will and Cook Counties, Illinois. Illinois State Geological Survey, contract report. Two sheets. 1:24,000.

Caron, O.J. and B.B. Curry, 2019, Surficial geology of Palos Park Quadrangle, Cook County, Illinois: Illinois State Geological Survey, USGS-STATEMAP contract report, 2 sheets, 1:24,000.

Caron, O.J, and A.C. Phillips, 2015, Surficial Geology of Frankfort Quadrangle, Will and Cook Counties, Illinois, Illinois State Geological Survey, contract report. Two sheets. 1:24,000.

Curry, B.B., and A.R. Bruegger, 2014, Surficial Geology of Illiana Heights Quadrangle, Kankakee County, Illinois. Illinois State Geological Survey, contract report. Two sheets. 1:24,000.

Curry, B.B., E. Hajic, K. Befus, J. Clark, J. Carrell, and S. Brown, 2014, The Kankakee Torrent and other large meltwater flooding events during the last deglaciation, Illinois, USA: Quaternary Science Reviews, v. 90, p. 22–36.

Curry, B.B., and D.A. Grimley, 2001, Surficial Geology Map, Northern Beecher West and Southern Steger 7.5-minute Quadrangle, Will County, Illinois. Illinois State Geological Survey, Illinois Geological Quadrangle Map, IGQ Beecher West/Steger-SG. 1:24,000.

Hansel, A.K., and W.H. Johnson, 1996, Wedron and Mason Groups—Lithostratigraphic reclassification of deposits of the Wisconsin Episode, Lake Michigan Lobe area: Illinois State Geological Survey, Bulletin 104, 116 p.

Hanson, K.D, 2004, Soil Survey of Will County, Illinois. United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Illinois Agricultural Experiment Station. Champaign, Illinois.

Lineback, J.A., compiler, 1979, Quaternary deposits of Illinois: Illinois State Geological Survey, MISCMAPquat map, 1:500,000

Menzies, J., ed., 1995, Past glacial environments: Sediments, forms and techniques, in Glacial environments—Volume 2: Oxford, Butterworth-Heinemann, 598 p.

Stuiver, M., P.J. Reimer, and R.W. Reimer, 2015, CALIB radiocarbon calibration, version 7.1. http://calib.qub.ac.uk/calib/.

U.S. Census Bureau, 2018, Population Division, Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2018, accessed through https://www.census.gov/data/ on August 12, 2020.

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

Willman, H.B., 1971, Summary of the geology of the Chicago area, Illinois State Geological Survey Circular 460, 77 pp.

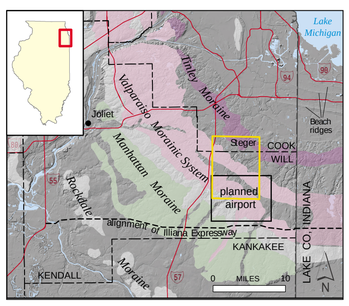


Figure 1 Location map for the Steger Quadrangle in northeastern Illinois. The area includes portions of the Valparaiso Morainic System, and the Tinley and Manhattan Moraines. Moraines modified from Willman and Frye (1970). Dashed lines show approved alignment of the Illiana Expressway corridor, and the black box shows the area of the proposed South Suburban Airport.

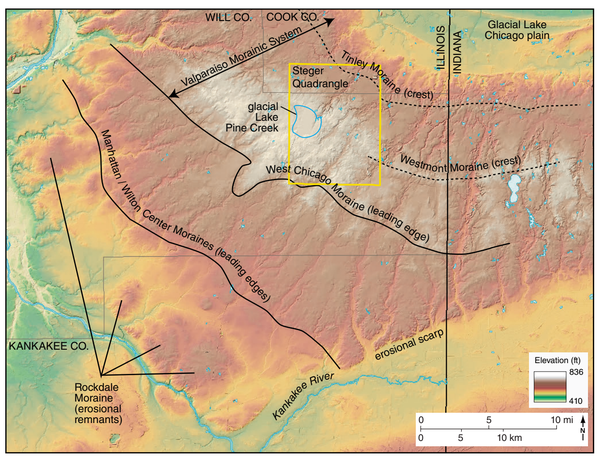


Figure 2 Shadeed relief map of a portion of northeastern Illinois showing part of the Kankakee River valley in Illinois, highlighting the erosional scarp obstensibly formed by the Kankakee Torrent. The leading edge of the West Chicago Moraine (of the Valparaiso Morainic System) and the Manhatten and Will Center Moraines are indicated. (after Caron and Curry 2016)

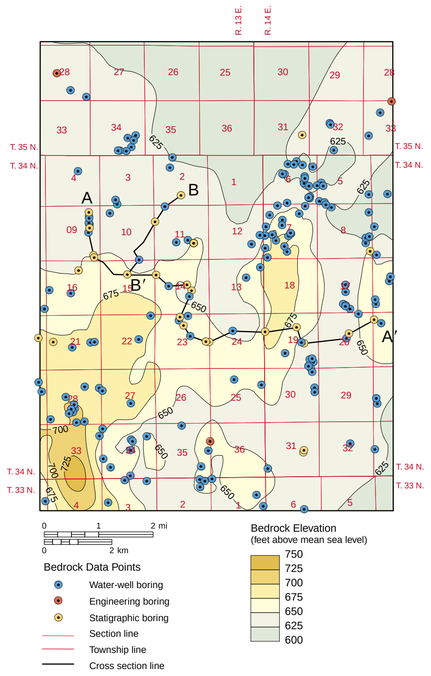


Figure 3 The generalized topography of the bedrock surface of the Steger Quadrangle. All data points on surficial geologic map were used to determine bedrock surface. Map scale is 1:100,000.

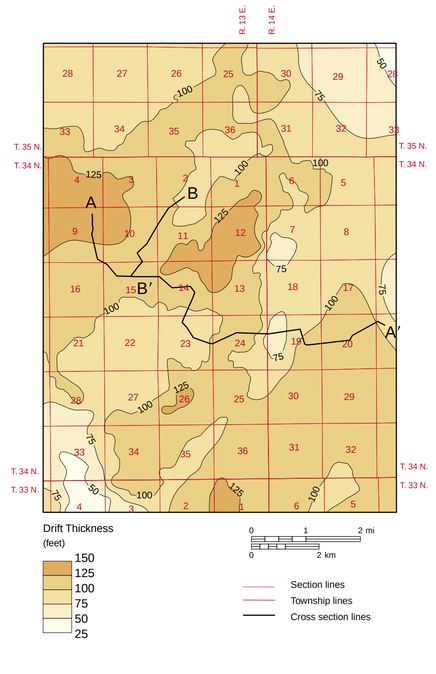


Figure 4 Drift thickness of the Steger Quadrangle. Drift includes all the unconsolidated sediments above bedrock (e.g., till, alluvium, outwash). Map scale is 1:100,000.