Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

SURFICIAL GEOLOGY OF PALOS PARK QUADRANGLE
COOK COUNTY, ILLINOIS

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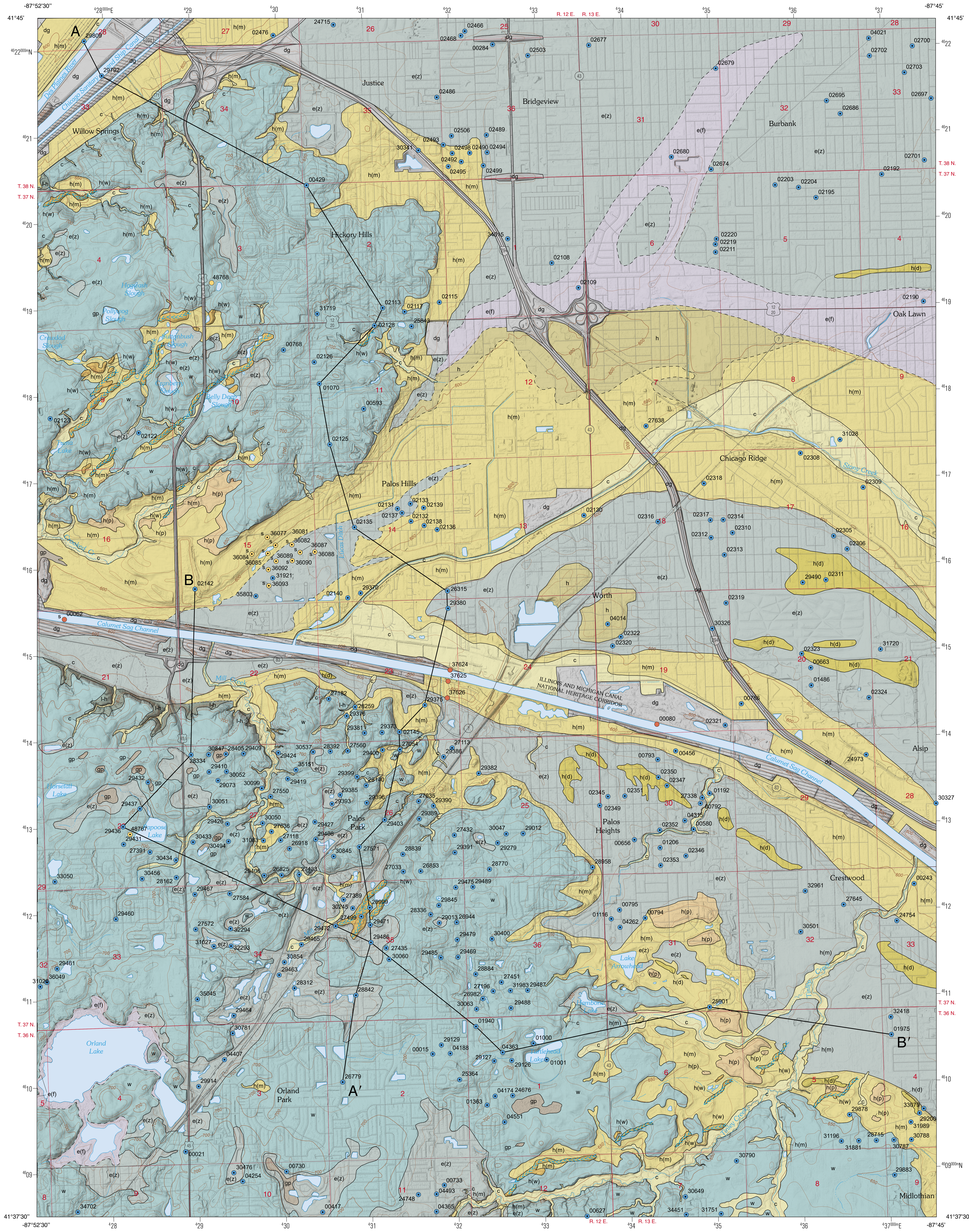
2019



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 former gravel pits and major areas of construction
Mucky sand, silt and clay ('natural materials') mixed with post settlement refuse, including industrial and sanitary sewage; as much as about 30 feet thick	Disturbed ground, dredge spoils (dg)	**Disturbed land**; dredge spoils from creation of canals
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 15 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 (~16,700 years before present (B.P.) to today)[1]		
Sand and gravel; as much as 35 feet thick	Henry Formation (h)	**Glaciofluvial sediment**
Sand, fine to medium, very well-sorted; crossbeds and horizontal stratification	Henry Formation (Parkland facies) (h(p))	**Sand Dunes**
Sand, fine to medium, well-sorted, less than 15 feet thick	Henry Formation (Dolton facies) (h(d))	**Littoral sands**; deposited in Lake Chicago
Clay and silt; uniform and laminated; as much as 20 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.
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 (~29,000–14,700 years B.P.)[1]		
Sand and gravel, less than 10 feet thick	Henry Formation (Wasco facies) (h(w))	**Eskers**
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; attaining about 100 feet maximum thickness	Lemont Formation, Haeger Member (l-h)	**Till and ice-marginal sediment**; including basal lacustrine and proglacial outwash, and overlying till and debris flow deposits

PRE-QUATERNARY DEPOSITS

SILURIAN SYSTEM (440-410 million years B.P.)

Description	Unit	Interpretation
Dolomite, less shale; upper 30 feet may include layers of diamicton about 1 to 3 inches thick along bedding planes, seperated by at least one foot of solid dolomite	Bedrock (Silurian) (cross sections only) (S)	**Dolomitized carbonate bank deposits** with layers of glacially injected diamicton along bedding planes near bedrock surface

[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
- Inferred contact
- Esker
- 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 derived from Cook County 2008 Lidar elevation data.

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

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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 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1988

Geology based on field work by O. Caron and B. Curry, 2018–2019.

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

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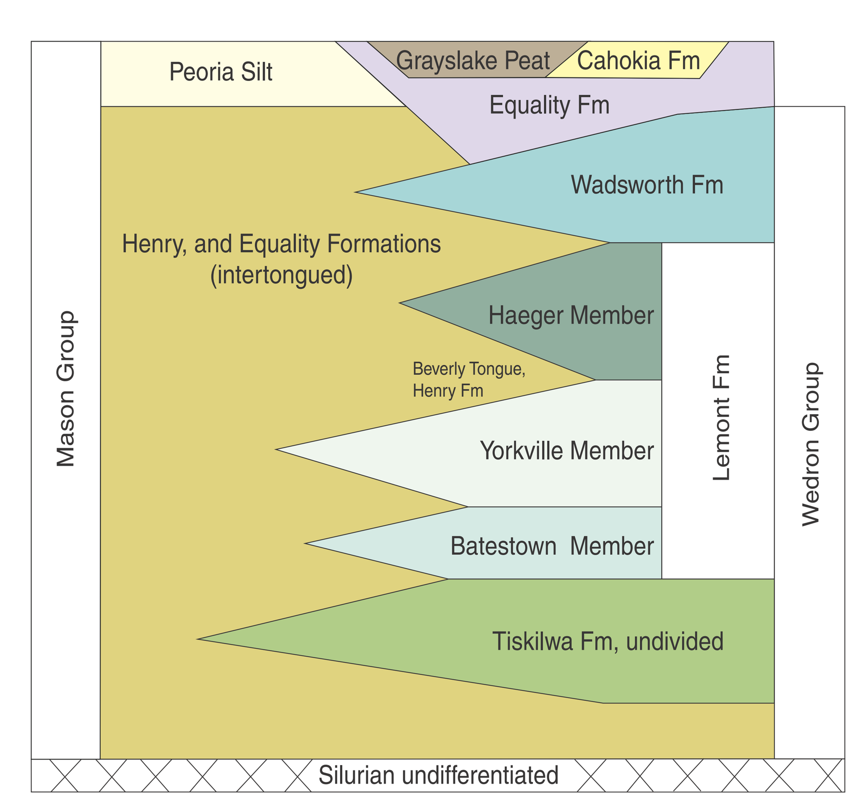
This map has not undergone the formal Illinois Geologic Quadrangle map review process. Whether or when this map will be formally reviewed and published depends on the resources and priorities of the ISGS.



Stratigraphic framework, schematic vertical and intertonguing relationships among the lithostratigraphic units of southern Cook County and environs (Caron and Curry 2016). The Batestown Member and the Tiskilwa Formation were not identified in the Palos Park 7.5' quadrangle.

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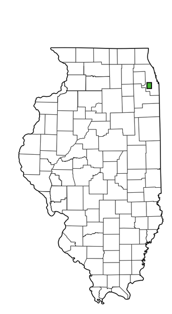


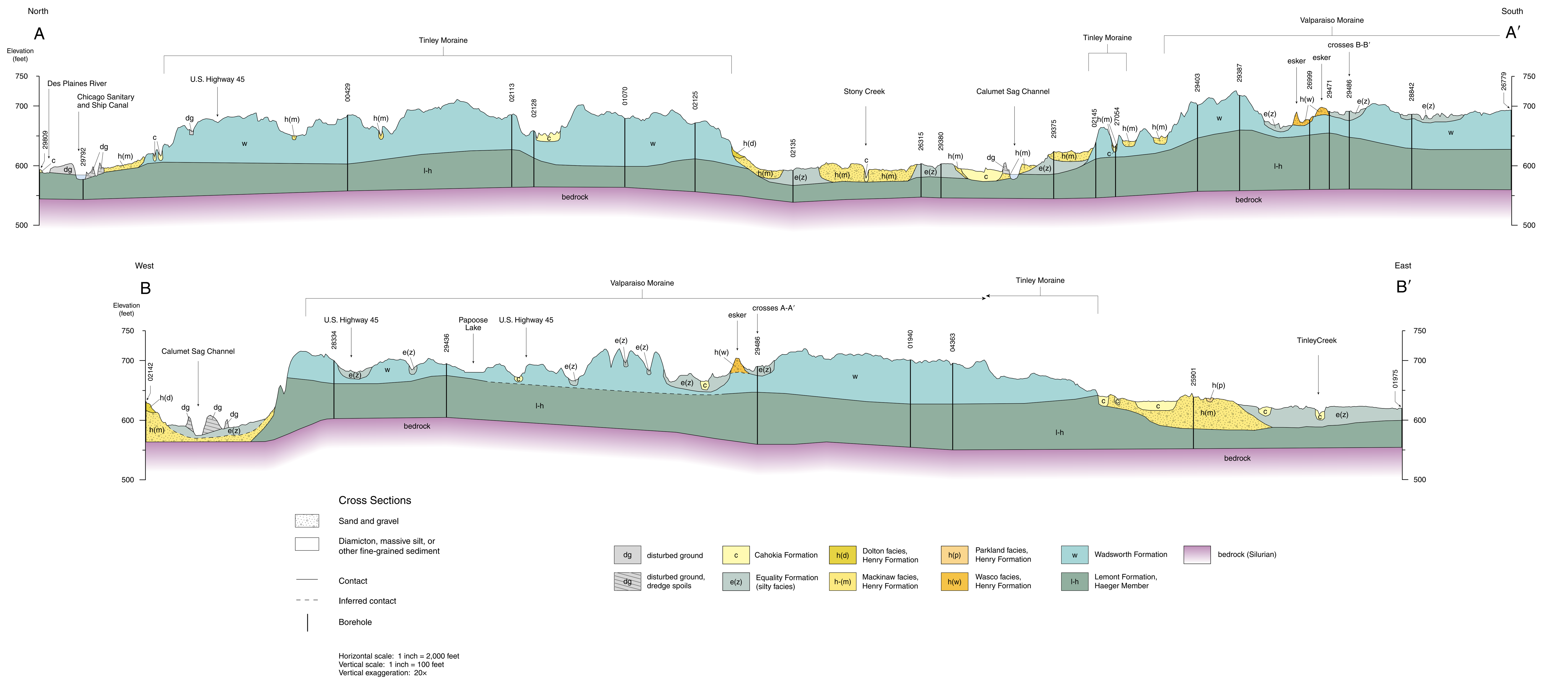
1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Hinsdale
2 Berwyn
3 Englewood
4 Sag Bridge
5 Blue Island
6 Mokena
7 Tinley Park
8 Harvey

4°
APPROXIMATE MEAN DECLINATION, 2019

ROAD CLASSIFICATION

- Interstate Route
- U.S. Route
- State Route
- Local road
- 4WD trail



Introduction

The surficial geologic map of the Palos Park 7.5' quadrangle is part of a long-term geological mapping project in Will and southern Cook counties (Curry and Grimley 2001, Curry and Bruegger 2014, Caron and Phillips 2015, Caron, 2016, Caron 2017, Caron and Curry 2018). 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 resulting from at least two glaciations and their associated flooding events. The Palos Park Quadrangle includes parts of the Valparaiso Morainic System, Tinley Moraine, Lake Chicago plain, and upper Chicago Outlet, about 15 miles from the southern shore of Lake Michigan. The largest communities partly or wholly within the mapping area include the cities of Orland Park (population 58,312; United States Census Bureau 2018), Burbank (28,534), Palos Hills (17,195), Bridgeview (16,187), Chicago Ridge (14,050), Hickory Hills (13,834), Justice (12,710), Crestwood (10,770), and, Willow Springs (5,668).

Geologic Setting

Major landscape elements on the Palos Park Quadrangle were formed during the latter phases of the last glaciation (Wisconsin Episode) and early to middle parts of the current interglaciation (Hudson Episode) between about 18,500 and 6,000 cal yr BP (Curry et al. 2018b; Hansel and Mickelson 1988) (Table 1). Within the quadrangle, the Westmont and Clarendon Moraines of the Valparaiso Morainic system form the oldest morainic topography in the southwestern part of the quadrangle. The moraines are typified by rolling hills and common kettles, many containing shallow lakes and wetlands. Examination of older topographic maps (Bretz, 1955) reveals that most lakes have been deepened through dredging of fringing peatlands, a practice carried out to this day in some places on the quadrangle by the Forest Preserves of Cook County. The Tinley Moraine is the youngest moraine on the Palos Park Quadrangle, and is notable for its lower, more subdued topography (Fig. 1; Willman and Frye 1970). Shallow valleys trending northeast-southwest crosscut the moraines and were

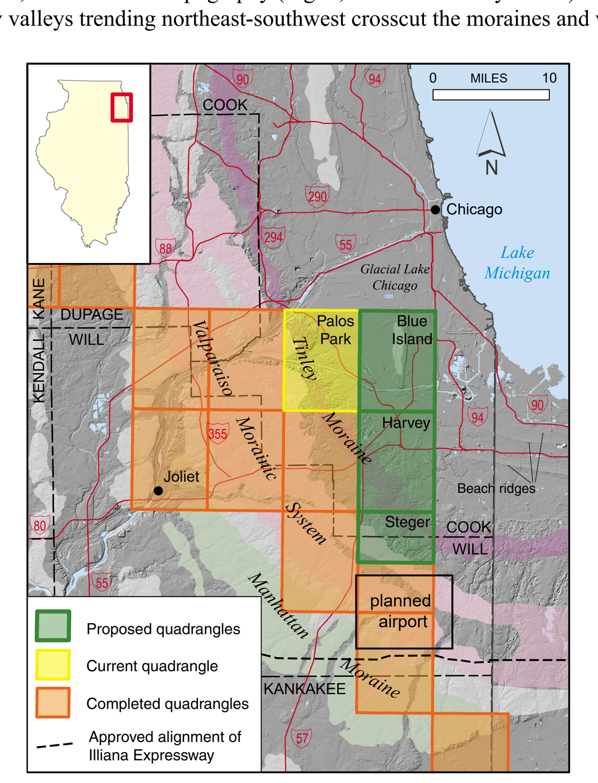


Figure 1 Location map for the Palos Park Quadrangle in northeastern Illinois. The area includes portions of the Valparaiso Morainic System and the Manhattan Moraine. Moraines modified from Willman and Frye (1970). Dashed lines show approved alignment of the Illiana Expressway corridor, and the black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

likely formed by channeled subglacial meltwater that evolved near the ice margin during downwasting of the ice (Menzies 1995). Later during deglaciation, subglacial drainage deposited long (1 km), sinuous eskers, composed of shallow sand and gravel. Bretz (1955) indicated that some eskers were graded to channel margins, which indicated that the Chicago Outlet had formed initially during late stage glaciation.

To the north and east, the morainic topography of the Tinley Moraine merges with the lake plain adjacent to Lake Michigan. The depositional history is complex, and includes two early phases, the Glenwood and Calumet phases (17.0–15.0 and 14.0–12.4 cal yr B.P.; Curry et al. 2018a) related to ancestral shorelines of Lake Chicago, a proglacial precursor of Lake Michigan. Lake Michigan later rose to the Toleston level between about 5,700–4,500 cal yr B.P. during the Nipissing Phase (Hansel and Mickelson 1988). During the Calumet Phase, Lake Chicago overflowed and deposited sandy terraces with surface elevations of about 625 ft above sea level (asl), eroding the linear scarp west of Moraine View Community College. Elsewhere, beaches and other features indicate evidence of the older Glenwood Phase occurs at elevations as high as 640 ft asl (Bretz 1951, 1955; Curry et al. 2018a). New radiocarbon ages and surface elevations of about 595 ft asl indicate the deepest (wide) channel on the lake plain occupied today by Stony Creek formed during the Nipissing Phase. Our new soil cores indicate the lake plain is underlain by fine sand, silt loam with much less peat and marl. Coarser sand and some gravel occur adjacent to the morainic uplands. Shallow bedrock is composed of resistant Silurian dolostone. The bedrock surface has low relief and dips gently northwestward. Bedrock is likely locally exposed along part of the Calumet Sag Channel. Dredge piles are prominent along the margins of this feature.

Methods

Surficial Map

The surficial geology map is based in part on interpretation of aerial imagery, lidar elevation data, boring records archived at the Illinois State Geological Survey (ISGS), hand auger descriptions, and soil survey maps of Cook county (Hanson 2004, Calsyn et al. 2012). The soil survey maps detail soil parent materials in the upper five feet, which locally are composed of glacial, post-glacial, and anthropogenic deposits. Geologic contacts were verified at 25 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 12 stratigraphic test holes drilled by the ISGS, 280 water well logs, and 5 bridge and foundation (engineering) borings from the highway departments of Cook county. For this project, two stratigraphic borings were completed and include continuous sediment cores, analysis of particle-size distribution (using a Malvern Mastersizer 3000), semi-quantitative mineralogy of the <2 µm fraction (X-ray diffraction methods; Hughes et al. 1994), and downhole natural gamma ray log. In addition, we sampled seven shallow borings using the ISGS PowerProbe. Soil core descriptions are on file at the ISGS Geological Records Unit.

Positions of some map boundaries and descriptions of some units were modified based on geotechnical logs and test-hole descriptions, and data from field studies and other archives. Locations of the water-well logs and geotechnical borings were confirmed by plat books of land ownership, aerial photography, tax records, and site visits.

Bedrock Surface

The database to obtain points forming the bedrock surface include drift thickness, and surface elevations of datum (water wells, engineering borings, etc.) interpolated from the state-wide coverage of lidar data using ESRI's ArcGIS software. A smoothed bedrock surface was created from the contours with ArcGIS' Topo-to-Raster interpolation method. Contours on the final bedrock topography map were adjusted to honor all of the data points (Fig. 2).

Results

Bedrock

Light gray, fine grained dolostone occurs at the bedrock surface. It is generally buried by glacial drift throughout the quadrangle, and in some places buried by thin alluvium (Fig. 3), or possibly exposed, along the Calumet Sag Channel. Bedrock highlands in the southeastern portion of the quadrangle descend gently from about 600–625 ft asl to 500–550 ft asl along the Calumet Sag Channel (Fig. 2).

Glacial Sediments

The glacial drift attains a maximum thickness of more than 160 ft (Fig. 3). The lowermost unit is the Beverly Tongue (Henry Formation) which is composed of laminated silt, silt loam, and very fine sand (lacustrine sediment) and fine sand (distal outwash). The Beverly unit is overlain by matrix-supported silt loam diamicton of the Haeger Member (Lemont Formation), interpreted as primarily till and flowed till (debris flows). The diamicton is matrix-supported, yellowish-brown, coarse-grained, friable, and has a relatively high dolomite content. As much as about 100 ft thick, the Beverly-Haeger sediment package is considered to be a glacigenic succession, reflecting changes in sedimentary environments as the Lake Michigan lobe approached and overrode the region. Deposits of the Beverly Tongue are generally not differentiated in second-tier data sources, such as water well logs, and are hence not identified on our cross sections. In engineering boring logs, Haeger diamicton is identified by its low moisture content, about 12 to 15%, and stratigraphic position. In our stratigraphic borings, natural gamma ray counts for sandy outwash, silty lacustrine sediment, and silt loam diamicton are from about 30 to 50, 40 to 55, and 40 to 50 counts per second, respectively.

The upper glacial unit is the Wadsworth Formation. Although its silt content is similar to that of the Haeger, the former contains less sand and more clay. Moisture contents, about 17 to 22%, are generally greater than those of the Haeger unit. Natural gamma ray values are greater as well, from about 70 to more than 100 counts per second. Textures include silt loam, silty clay loam, and loam. The Wadsworth in this area contains abundant shale clasts, inclusions and interbeds of fine, stratified sand and laminated silt loam. The heterogeneous lithology is consistent with other observations of the Wadsworth Formation in this region (i.e., Curry and Bruegger 2016). In the Palos Park Quadrangle, this unit is greater than 100 ft thick. The genesis of the Wadsworth Formation is interpreted as interstratified till and lacustrine sediment (Hansel and Johnson 1996). In many places, our sediment cores reveal subtle laminations in the diamicton matrix, supporting observations of enfolded sorted sediment into diamicton deposited at the glacier's base.

Several facies have been mapped of the surficial sand and gravel unit, the Henry Formation. The Wasco Member h(w) of the Henry Formation is the coarsest facies, consisting largely of gravelly sand, that occurs in long, gently sinuous ridges that we interpret to be eskers. The thickness of the sorted sediment was not determined. The other gravel-bearing facies, the Mackinaw h(m), is as much as 55 ft thick, forming terraces along Stony Creek, the Calumet Sag Channel, Mill Creek and Crooked Creek. The Mackinaw facies h(m) was mined extensively as an aggregate resource along the Cal Sag Channel. The Dolton facies h(d) represents littoral sand and gravelly sand less than 15 ft thick deposited by Lake Chicago. The elevation of most deposits indicates deposition during the Calumet Phase. The Parkland facies h(p) of the Henry Formation is well-sorted fine sand; we have mapped it in several areas where the lidar-assisted geomorphology indicates barchan dunes forms and a paleowind direction was west to east. The age of the dunes is not known.

We have differentiated a fine-grained facies of the Equality Formation (e-f), interpreted to be quiet-water lake sediment, from a lithologically variable facies (e-z) comprised of approximately equal amounts of silt/clay and sand/gravel, mostly sand. The latter facies was deposited under conditions of greater energy indicating currents or shallower water. The deposits of both facies are relatively thin (<30 ft thick) and discontinuous. We cannot account for the distribution of these facies where they are mapped on the Lake Michigan lake plain. In upland situations, the fine-grained facies of the Equality Formation occurs in valleys as slackwater deposits and in kettle basins. In these places, the unit is less than 20 ft thick. Alluvium comprised of fine-grained floodplain and coarser-grained channel facies are undifferentiated within the Cahokia Formation (c). Bridge boring data indicate that the floodplain facies is generally less than 15 ft thick. Grayslake Peat includes modern accumulations of peat in low wet areas on the floodplain of the tributaries. Peat is rarely more than 10 ft thick in this area.

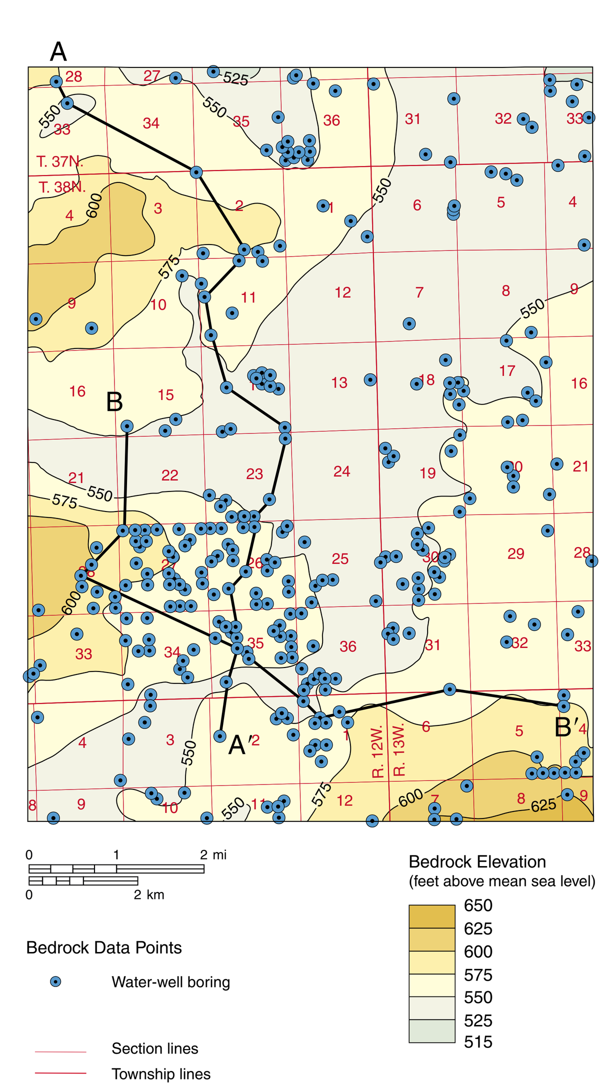


Figure 2 The generalized topography of the bedrock surface of the Palos Park Quadrangle. All data points on surficial geologic map were used to determine bedrock surface. Map scale is 1:100,000.

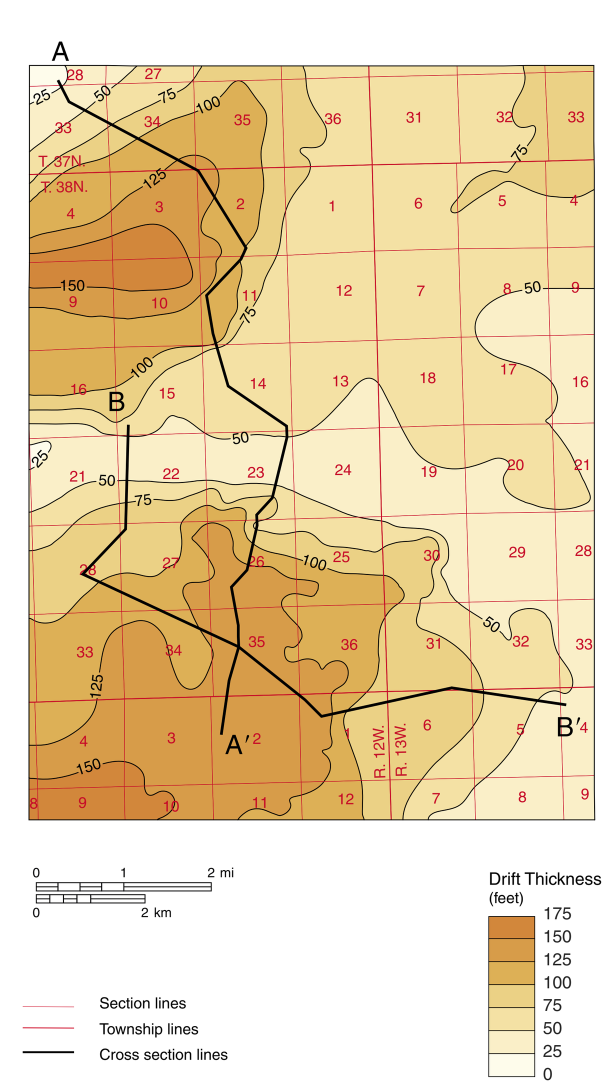


Figure 3 Drift thickness of the Palos Park Quadrangle. Drift includes all the unconsolidated sediments above bedrock (e.g., till, alluvium, outwash). Map scale is 1:100,000.

Important Findings

- Two glacial diamicton units were identified: The Haeger Member of the Lemont Formation, and the Wadsworth Formation. The uppermost diamicton unit, the Wadsworth Formation, forms the Tinley Moraine and the Valparaiso Morainic System. A well-defined sorted glacigenic succession occurs below Haeger diamicton, including thick, stratified medium sand (as much as 50 ft thick) and silty lacustrine sediment about 30 ft thick. This package of sorted sediment is known as the Beverly Tongue. This unit is included as part of the Haeger unit in cross section because it is not identified in the majority of our secondary data sources, such as water-well logs.
- Large areas of the land surface are covered by glaciolacustrine sediments of late-glacial Lake Chicago and its Holocene equivalent, Lake Michigan (Equality Formation). The dam for highest levels of these lakes was the configuration of alluvial channels and terraces at the confluence of the Calumet Sag Channel and Des Plaines River, also known as the Chicago Outlet (Hansel and Johnson 1996). The lake deposits in Palos Park Quadrangle are generally less than 30 ft thick.
- Shorelines associated with the early phase of glacial Lake Chicago (Henry Formation, Dolton facies) have been identified along the Calumet Sag Channel. We correlate beach deposit and terrace altitudes of about 625 ft (190 m) with the Calumet level, but note that most published elevations are 620 ft (188m). A wide channel, occupied by Stony Creek, and located in the central portion of the quadrangle, formed during the mid-Holocene Nipissing Phase. In most places, the altitude of the channel bottom is about 595 ft (181 m).
- Lidar DEMs facilitated mapping of several sinuous eskers in the study area. They are oriented ENE-WSW and as much as 1 km long. Although a few were identified by Bretz (1955), most have never been identified and mapped.

Acknowledgements

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