SURFICIAL GEOLOGY OF DYER QUADRANGLE
COOK AND WILL COUNTIES, ILLINOIS AND LAKE COUNTY, INDIANA

Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

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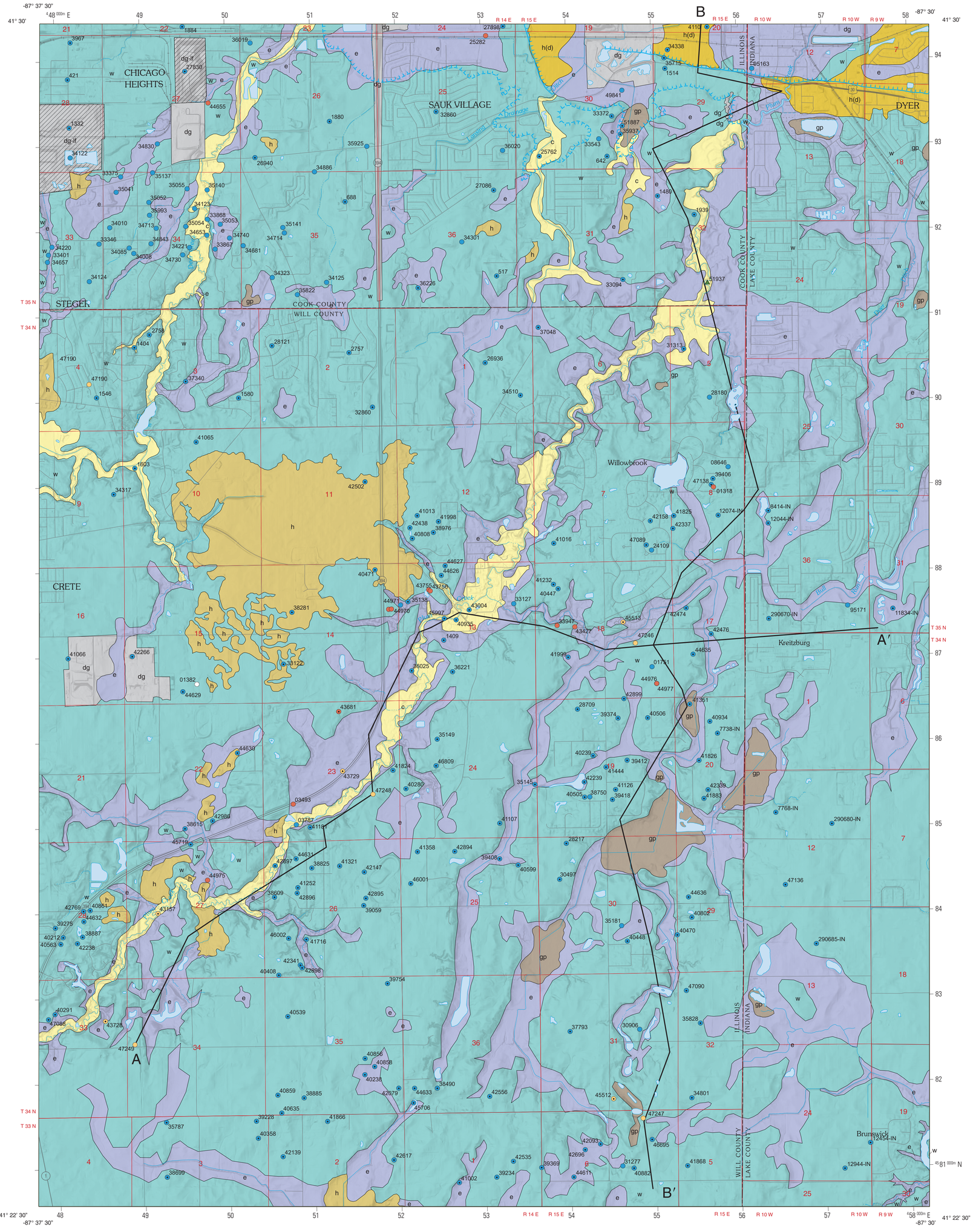
2022

STATEMAP Dyer-SG



QUATERNARY DEPOSITS

Description	Unit	Interpretation
HUDSON EPISODE (~14,700 years before present [B.P.] to today)[1]		
Silty clay loam and silt loam diamicton	Disturbed Ground: dg	**Redistributed land**
Municipal waste	dg-lf	**Landfill**
Peat, muck, organic silt and clay; as much as 15 ft thick	Grayslake Peat: gp	**Organic matter** accumulated in depressions on moraines and along drainageways
Sand, silt, clay, peat, basal gravelly sand in places; as much as 20 ft thick in Plum Creek	Cahokia Formation: c	**Alluvium** in the channels of Plum Creek and other drainageways
Late WISCONSIN EPISODE and HUDSON EPISODES (~17,600 years B.P. to today)[1]		
Sand, silty fine to medium, to sandy loam, with basal cobble gravel beds; stratified; up to 30 ft thick	Henry Formation: h	**Glacifluvial and glaciolacustrine deposits,** locally intercalated with silty lake sediment and grading to post-glacial alluvium
Sand, well sorted, with local gravel; stratified; typically less than 10 ft thick	Henry Formation (Dolton facies): h(d)	**Littoral sand** deposited in Pleistocene Lake Chicago at the Glenwood level (Bretz, 1939)
Clay and silt; uniform and laminated; in places with laminae of silty fine sand, beds of sand and gravel, and silty diamicton; as much as 60 ft thick	Equality Formation: e	**Lake sediment** of late Pleistocene Lake Chicago; also lake sediment filling glacial valleys and post glacial depressions
WISCONSIN EPISODE: Michigan Subepisode (~29,000–14,700 years B.P.)[1]		
Silty clay loam and silty clay diamicton; stiff to very stiff; typically about 30 to 40 ft thick	Wadsworth Formation: w	**Till and ice-marginal sediment**
Silty sand, medium to coarse, gravelly in places, as much as 60 ft thick	Beverly Tongue, Henry Formation [Cross Sections only]: h-b	**Glacifluvial deposits**
Silty clay loam diamicton; hard; with interbeds of sand and gravel, and silty lacustrine deposits; as much as 60 ft thick	Yorkville Member, Lemont Formation [Cross Sections only]: l-y	**Till and ice-marginal sediment**

PRE-QUATERNARY DEPOSITS

SILURIAN SYSTEM (440-410 million years B.P.)		
Dolomite with local shale	Silurian Bedrock [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
- Other Boring
- Outcrop

26211 Boring labels indicate the county number. Dot indicates boring is to bedrock.

- Contact
- Inferred contact
- paleoshorelines of Lake Chicago as mapped by (Bretz 1939) triangles point offshore.
- Approximate paleoshorelines of Lake Chicago

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.

Bretz, J.H., 1939, Surficial Geology of the Dyer Quadrangle, maps no. 24 *in* Bretz, J.H., 1943, Chicago area geologic maps: Illinois State Geological Survey, Bulletin 65 maps, 24 sheets, 1:24,000.

Base map compiled by Illinois State Geological Survey from digital data (2019 US Topo) provided by the United States Geological Survey. Shaded relief derived from lidar elevation data from Cook (2017) and Will (2021) county collections provided through ILHMP and the USGS 3DEP (2017) collection.

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

BASE MAP CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1988

Geology based on field work by B. Curry, 2011–2022; A. Bruegger, 2015–2016; O. Caron (2011-2015), N. Healy, 2022; and S. Dendy, 2022

Digital cartography by Katie Mandera, Deette 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.

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.

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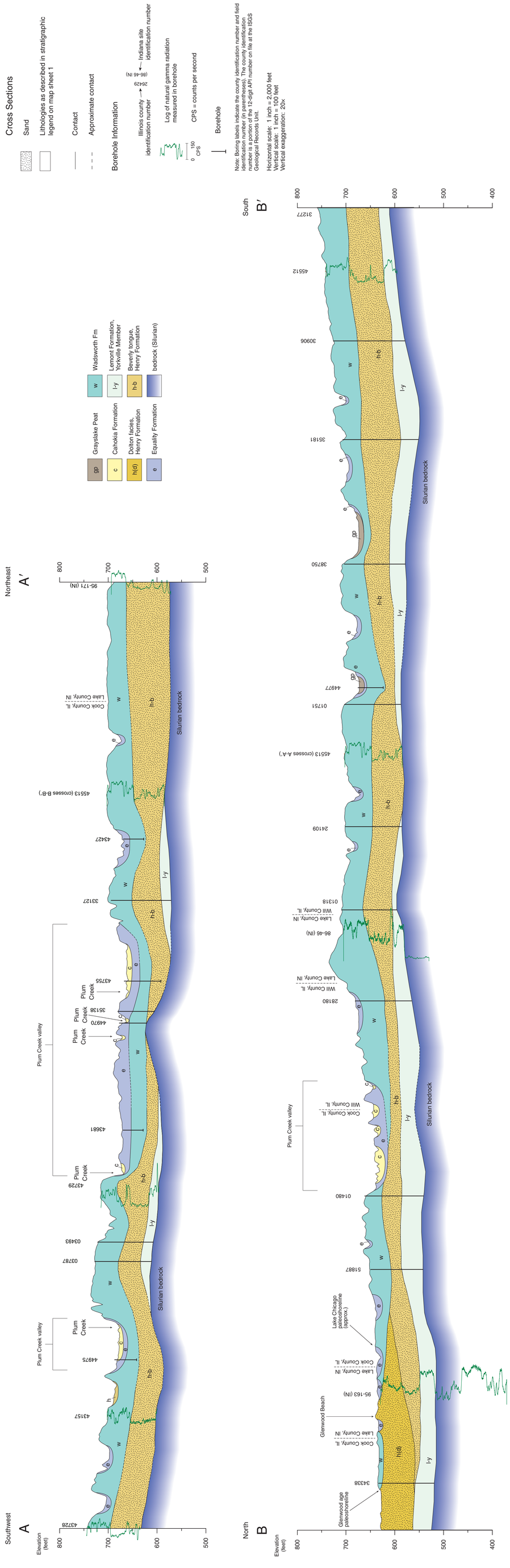
1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Harvey
2 Calumet City
3 Highland
4 Steger
5 Saint John
6 Beecher West
7 Beecher East
8 Lowell

APPROXIMATE MEAN DECLINATION, 2022

ROAD CLASSIFICATION

- U.S. Route
- State Route
- Local road



STATEMAP Dyer-SG Sheet 2 of 3

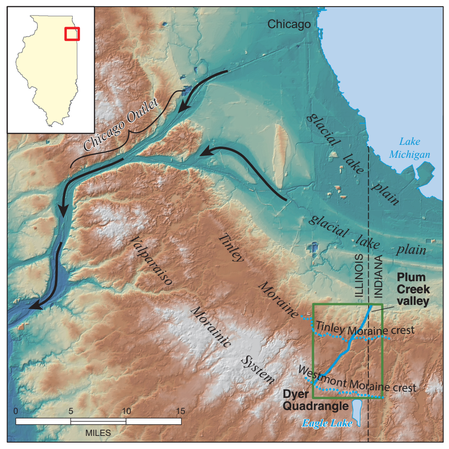


Figure 1 Location of the Dyer Quadrangle in northeastern Illinois and northwestern Indiana. Major landscape elements are indicated including the valley of Plum Creek, and the approximate locations of the crests of the Tinley Moraine and Westmont Moraine (of the Valparaiso Morainic System).

Figure 2 Outcrops of the Equality Formation along Plum Creek (outcrop, no. 51935 on map) showing a dark buried soil sandwiched by fossiliferous lacustrine sediment above and below. The soil includes fossils of wood, seeds, and charcoal that collectively date between 9,060 to 9,750 calibrated years (Table 1, [sheet 3]). The tape measure is approximately 3 feet long.

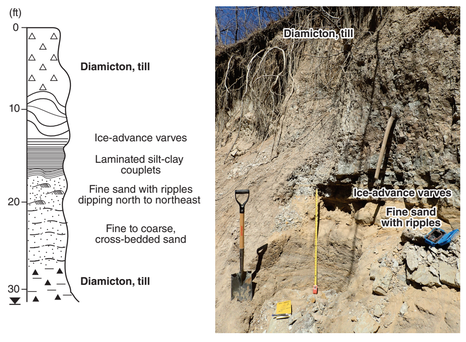


Figure 3 Outcrop of proglacial sand and silt associated with the Tinley Moraine exposed along Plum Creek (outcrop, no. 51937 on map) near the Cook and Will County boundary. Silt loam diamicton (till) of the Wadsworth Formation occurs above and below the sorted sediment. The tape measure is approximately 3 feet long in the lower photo. From Caron and Curry, 2016.

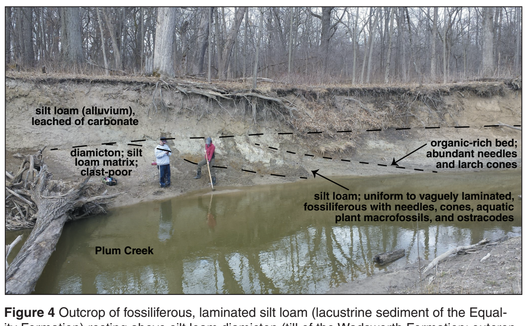


Figure 4 Outcrop of fossiliferous, laminated silt loam (lacustrine sediment of the Equality Formation) resting above silt loam diamicton (till of the Wadsworth Formation; outcrop no. 51925 on map). Fossils include ostracodes, gastropods, pelecypods, bryophytes (moss), and cones (larch). Wood and needles samples date at 16,580 and 15,600 calibrated years, respectively (Table 1, [sheet 3]). The glacial lake sediment and till are truncated and covered by alluvium of the Cahokia Formation.

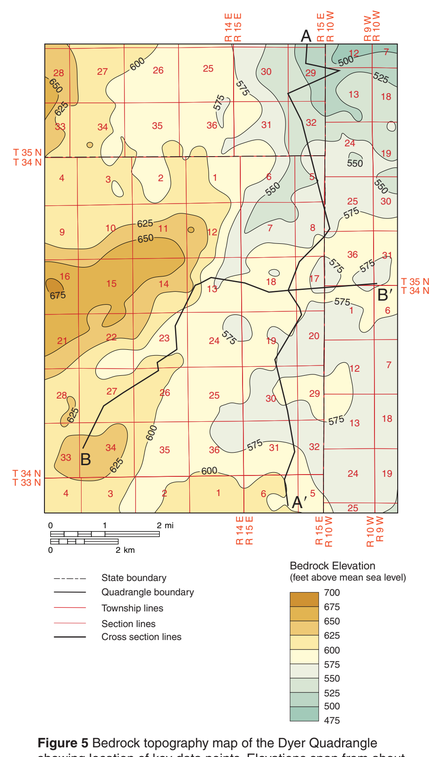


Figure 5 Bedrock topography map of the Dyer Quadrangle showing location of key data points. Elevations span from about 495 to 675 ft above sea level. (1:100,000 scale)

Introduction

The Dyer Quadrangle covers parts of three counties across Indiana and Illinois, including Lake County (IN) and Cook and Will counties (IL). The largest city is Dyer, Indiana, with a population in 2020 of 15,900 people. Other communities on the quadrangle include Sauk Village, Steger, and Crete, Illinois, with populations of 10,390, 9,290, and 8,060, respectively. The most prominent landforms include the valley of Plum Creek (which sports several forest preserves run by the Forest Preserves of Cook and Will counties), the Tinley Moraine, and Westmont Moraine of the Valparaiso Morainic System (Fig. 1). A subdued feature is the Glenwood lagoon, a backwater region of Glacial Lake Chicago behind its highest and oldest beach ridges that formed during its inception during the Glenwood Phase (The Glenwood and Dyer beaches).

Previous Investigations

The northern part of the Dyer Quadrangle that is part of Cook County and adjacent Lake County in Indiana was mapped by J. Harlen Bretz (1939) as "Chicago Areal Geologic Map(s) no. 24", the last in the series. Much is revealed on this small sub-map, including the Tinley Moraine, Glenwood Shoreline, and oldest shorelines of Lake Chicago. Although Bretz contributed much to the understanding of the geology of the area, it is unfortunate his Bulletin 65 on the geology of the Chicago region was released as Part I in 1939 and Part II in 1955. In the time between these publication dates, Bretz also published influential journal articles on lake levels and lake history; this period was an especially fertile time in the advancement of concepts of isostasy and revision of the elevation and timing of overflow sills.

Bretz described interesting exposures along Plum Creek in 1955 that were the result of headward erosion caused by the construction of Hart Ditch across the Glenwood Phase Dyer Beach, including accounts of deer antler and mammoth tooth fossils in context with deposits of marl and fossiliferous lake sediment attributed to Lake Chicago. Prior to the ditching, Plum Creek flowed into a swamp formed between behind the Dyer Beach and Tinley Moraine. Drainage eventually exited where Calumet Beach had been overtopped and eroded in the Village of Glenwood (on the Calumet City Quadrangle; Curry et al. 2021). With the new ditch in place, headward erosion resulted in the stream cuts photographed and sketched by Bretz (1955). Today, the soft material is susceptible to slumping and is overgrown in most places. A few excellent exposures are revealed from time to time (Figs. 2, 3 and 4).

Bretz's narrative led us to this area in hopes of elucidating the ice-age history through radiocarbon dating. Bruegger (2016) explored the Forest Preserve of Plum Creek (Cook County) by taking several shallow cores with the ISGS PowerProbe and sampling a cut bank (Figure 4). Our field research reexplored many of the cut banks along Plum Creek. Table 1 [sheet 3] lists radiocarbon ages resulting from this and other research in the region pertaining to the level of Lake Michigan and its precursor, Lake Chicago.

Landscape Sediment Assemblages

The landscape of the Dyer Quadrangle is characterized by a gently rolling till upland cut by a network of linear valley segments with a dominant grain of about 30°. The valleys have flat bottoms from a few tens of feet to more than one mile across. The till upland ends abruptly on the northern side of the quadrangle where it was truncated by Glacial Lake Chicago. Short sand-capped ridges demarcate ancient beaches named the Glenwood and Dyer beaches by Bretz (1939). Upslope of those beach ridges, the Glenwood lagoon extends up lower Plum Creek, the major drainage of the map area.

The northern edge of the till upland on the Dyer Quadrangle is formed by the Tinley Moraine. The crest of the moraine is subdued, but visible on detailed hillshade maps of LiDAR data (Fig. 1; Caron and Curry 2016). The Valparaiso Morainic Complex forms the remainder of the till upland. Only the crest of the Westmont Moraine is mappable as it crosses the southwestern part of the map. Its southern boundary is demarcated by an east-to-west linear segment of Trim Creek which issues from the basin of Eagle Lake, a large hydrologically open depression (Curry et al. 2018) that occurs on the Beecher East 7.5-minute Quadrangle to the south of the Dyer Quadrangle (Fig.1).

The till upland is formed of 30 to 50 feet of the Wadsworth Formation. Composed of gray silt loam to silty clay loam diamicton, the moisture content varies from 15 to 17%. In detail, the unit typically has layers from 5 to 10 feet thick or more with uniform diamicton intercalated with thin beds to seams of sand or sand and gravel. In most places the diamicton is uniform, but it may be vaguely stratified in places. In some areas, the uppermost eight feet or so is laminated, with evidence of layering heightened by preferential oxidation of relatively coarser material, typically very fine sand or silt. Wet sieving ten samples of this material recovered no fossils.

Logs of structural borings done for highway departments reveal complex valley fills that include lacustrine sediment and peat. The largest feature of this sort in the region, Eagle Lake, was explored by several borings that reveal more than 60 feet of fossiliferous material dating from about 16,000 calibrated years to the present (Curry et al., 2018). The large peat bogs on the Dyer Quadrangle are genetically related to the Eagle Lake fill but are not likely as thick; our borings, taken on the margins of the bogs, suggest a thickness of no more than 30 feet.

Narrower stretches of the valleys have been ditched, and in most places where there are structural borings, reveal at least 10 feet of sorted sediment that we have mapped as the Equality Formation. In most areas, the soils maps indicate valley bottoms and sides have parent materials of till, indicating lateral erosion (planation) by streams, with material transported along and out of the valleys. The combination of strath (erosional) and aggradation (lake deposits) elements point to a polygenetic terrace origin.

Terraces along Plum Creek are fascinatingly complex, and include facies of the Equality Formation: wood, larch cone, and ostracode-bearing silt (Caron and Curry, 2016) as well as snail-shell, wood, and ostracode-bearing silt loam diamicton. These fossiliferous units pinch out laterally leaving patches of barren diamicton of the Wadsworth Formation. We have mapped these areas as all Equality Formation but recognize the patchy occurrence of windows of Wadsworth Formation at ground surface. Due to lowering of base level of lower Plum Creek by the Hart Ditch across the Glenwood shorelines, surfaces that were once frequently inundated by flooding have been modified by creation of small mounds and fewer sub-linear basins. Most of these are too small to show at our scale of 1:24,000, but they are common in some parks.

Bedrock Topography

The ANUDEM routine, v. 5.3 (see Hutchinson 2011), implemented as Topo to Raster in ArcGIS v. 10.8.1 was used on a subset of about 330 records to generate bedrock surface map (Figure 5). Contours were smoothed and adjusted to honor the data. The surface may be characterized as upland dissected by a valley that deepens to the north and east. Relief of the buried bedrock is about 180 feet, ranging from about 495 to 675 feet above sea level.

Major Geologic Units

The Yorkville Member of the Lemont Formation is found deep in the subsurface, and its characteristics were documented in our five exploratory stratigraphic borings. The natural gamma-ray logs indicate that the unit is sedimentologically complex, including layers fine-grained lake sediment, poorly-sorted gravelly sand, and silty diamicton. Its physical, mineralogical, and chemical character is nearly identical to the Wadsworth Formation (Table 2 [sheet 3]). We interpret the complex array of sediment types to deposition related to the advancing and overriding Lake Michigan lobe in proglacial and subglacial environments.

The Beverly Tongue of the Henry Formation also occurs only in the subsurface, but is the thickest and most widespread unit in the subsurface of the Dyer Quadrangle. The unit is composed of sand with occasional beds of gravelly sand, and laminated silt loam. The coarser, poorly sorted facies of this unit allows differentiation with the finer-grained littoral Dolton facies of the Henry Formation.

The Wadsworth Formation is composed of chiefly matrix-supported diamicton with silt loam texture. The gravelly clasts are composed chiefly of local dolomite and shale. In many places, the diamicton is vaguely to strongly stratified imparted by contrasting grain-size, namely subtle changes among laminae to thin beds of silt, silt loam, and silty clay loam, with less frequent beds of very fine, fine, to medium sand. This fabric has allowed rapid oxidation of the entirety of the unit to depths of about 20 feet, and along subvertical joints and discontinuities to depths of more than 40 feet. Heterogenous sediment character of this type are reflected by the variability of the natural gamma-ray logs and is observed to be thickest and most more prevalent near the base of the unit.

Surficial deposits of lake sediment (Equality Formation) and alluvium (Cahokia Formation) are less than 10 feet thick. Due to their lithologic variability and weathered condition, they were not examined in detail in this investigation. Both units include beds of soft, weathered sand and gravelly sand that readily slump along creeks.

Regional Correlation

All stratigraphic units names change across the state line between Illinois and Indiana (Table 3 [sheet 3]), but there is likely little significant change in their lithology or age. Natural gamma-ray and lithologic logs from water well drillers were utilized to correlate units across state lines. We do not expect that the physical properties will change markedly going from west to east, but there may be subtle changes in the ratio of shale-to-dolomite clast content as younger, shalier Devonian units become more prevalent in the subsurface heading eastward.

Interpretation of Radiocarbon Ages

Twenty radiocarbon ages have been determined from samples coming from the Dyer Quadrangle (Table 1 [sheet 3]). These ages have been may be divided into the diachronic Glenwood Phase I (17.2 – 16.5 cal ka), Crown Point Phase (17.2 – 16.9 cal ka), Glenwood II (16.1 – 14.2 cal ka), Chippewa Low (9.7 – 9.1 cal ka), and post-Nipissing (2.8 cal ka). The proximity of post-glacial and lacustrine environments during the earliest deglaciation has resulted in overlapping age ranges of the Crown Point and Glenwood phases.

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Table 1 List of radiocarbon ages from samples recently assayed from the southwestern Lake Michigan coastline and environs.

Lab	Number	API	County	State	Quadrangle	Boring ID, depth (ft)	Material assayed	Latitude	Longitude	^{14}C yr B.P.	±	δ13C (‰)	Source(s)	cal yr BP	sig-1 min	sig-1 max	Intercepts	Lithostratigraphy
UCIAMS	252689	120315179000	Cook	IL	Blue Island	BLI P11, 10.5-11.0	rootlets	41.726648	-87.687393	1,695	15	-24.2	unpublished	1580	1540	1680	2	Equality Fm
UCIAMS	266806	120315193400	Cook	IL	Dyer	PC-22c (core), 3.0	charcoal	41.489144	-87.525991	2,660	15	-27.1	unpublished	2760	2750	2770	1	Equality Fm
ISGS	A4295	121974608500	Will	IL	Beecher East	BEEC 17-7 Bultema Farm, 1.8-2.0	sedge	41.358473	-87.543836	2,975	20	-11.6	Curry et al. 2018 a, b	3150	3030	3210	4	Equality Fm
ISGS	A4218	121974608500	Will	IL	Beecher East	BEEC 17-7 Bultema Farm, 9.2-9.6	sedge	41.358473	-87.543836	3,180	20	ND	Curry et al. 2018 a, b	3410	3380	3450	2	Equality Fm
UCIAMS	252675	120315177300	Cook	IL	Calumet City	CC-21-05, 14.5	Pleurocera shells	41.593564	-87.549307	3,650	15	-8.7	unpublished	3970	3920	4060	3	Equality Fm
UCIAMS	252676	120315177300	Cook	IL	Calumet City	CC-21-05, 58.6	Pleurocera shells	41.593564	-87.549307	3,775	15	-8.4	unpublished	4140	4090	4220	3	Equality Fm
UCIAMS	256914	120314884800	Cook	IL	Lake Calumet	CALU-18-03, 6.5-6.7	Pleurocera shells	41.62612	-87.559538	4,045	15	0.6	unpublished	4480	4450	4570	3	Equality Fm
ISGS	A4217	121974608500	Will	IL	Beecher East	BEEC 17-7 Bultema Farm, 29.1-29.5	sedge	41.358473	-87.543836	4,765	20	ND	Curry et al. 2018 a, b	5530	5580	5480	3	Equality Fm
UCIAMS	142914	120313649300	Cook	IL	Palos Park	MVCC-2, 6.1	bulrush seeds	41.692813	-87.843168	5,150	20	ND	unpublished	5920	5900	5930	1	Equality Fm
UCIAMS	256890	120314884800	Cook	IL	Lake Calumet	CALU-18-03, 6.15-6.25	insect nest	41.62612	-87.559538	5,170	45	ND	unpublished	5930	5900	5990	2	Equality Fm
UCIAMS	256896	120313649500	Cook	IL	Palos Park	MVCC-3, 12.0	bulrush seeds	41.690295	-87.842769	5,200	15	-25.4	unpublished	5960	5930	5990	2	Equality Fm
UCIAMS	142913	120313649200	Cook	IL	Palos Park	MVCC-1, 26.0-26.3	wood	41.689428	-87.844878	5,230	20	ND	unpublished	5970	5940	6000	2	Equality Fm
UCIAMS	142915	120313649300	Cook	IL	Palos Park	MVCC-2, 6.2	bulrush seeds	41.692813	-87.843168	5,480	20	ND	unpublished	6290	6280	6300	1	Equality Fm
UCIAMS	142912	120313649200	Cook	IL	Palos Park	MVCC-1, 24.6-24.9	wood	41.689428	-87.844878	5,505	25	ND	unpublished	6300	6280	6310	1	Equality Fm
UCIAMS	142916	120313649300	Cook	IL	Palos Park	MVCC-2, 6.2	wood	41.692813	-87.843168	5,620	20	ND	unpublished	6390	6320	6440	3	Equality Fm
ISGS	A4375	121974608500	Will	IL	Beecher East	BEEC 17-7, 38.5-39.0	sedge	41.358473	-87.543836	5,650	25	ND	Curry et al. 2018 a, b	6430	6400	6480	2	Equality Fm
UCIAMS	256897	120313649500	Cook	IL	Palos Park	MVCC-3, 12.5-13.0	insect nest; sedge	41.690295	-87.842769	5,880	15	-26.6	unpublished	6700	6670	6730	2	Equality Fm
UCIAMS	256895	120313649200	Cook	IL	Palos Park	MVCC-1, 25.0-25.2	wood	41.689428	-87.844878	5,935	15	-26.5	unpublished	6760	6740	6790	2	Equality Fm
ISGS	A4376	121974608500	Will	IL	Beecher East	BEEC 17-7, 43.5-44.0	sedge	41.358473	-87.543836	7,960	30	ND	Curry et al. 2018 a, b	8840	8660	8980	7	Equality Fm
UCIAMS	266803	120315193500	Cook	IL	Dyer	PC-22 (outcrop), 8.0-9.0	macros	41.489264	-87.525991	8,125	20	-28.6	unpublished	9060	9010	9090	2	Equality Fm
UCIAMS	266804	120315193500	Cook	IL	Dyer	PC-22 (outcrop), 8.0-9.0	charcoal	41.489264	-87.525991	8,230	20	-25.8	unpublished	9200	9130	9270	3	Equality Fm
ISGS	2095	none	Cook	IL	none	Olsen Forest bed	wood (ash)	41.817	-87.3	8,320	70		Chrzastowski et al. 1991	9320	9150	9450	2	Equality Fm
ISGS	2096	none	Cook	IL	none	Olsen Forest bed	wood (oak)	41.817	-87.3	8,320	70		Chrzastowski et al. 1991	9320	9150	9450	2	Equality Fm
UCIAMS	266802	120315193500	Cook	IL	Dyer	PC-22 (outcrop), 8.0-9.0	light wood	41.489264	-87.525991	8,740	80	ND	unpublished	9750	9560	9890	2	Equality Fm
UCIAMS	248763	120314884800	Cook	IL	Lake Calumet	CALU 18-03, 6.25	needles	41.62612	-87.559538	8,995	25	-26.0	unpublished	10200	10180	10220	1	Equality Fm
ISGS	A4374	121974608500	Will	IL	Beecher East	BEEC 17-7, 48.5-49.0	sedge	41.358473	-87.543836	9,620	40	ND	Curry et al. 2018 a, b	10950	10810	11150	5	Equality Fm
UCIAMS	142917	120313649300	Cook	IL	Palos Park	MVCC-2, basal marl	wood	41.692813	-87.843168	9,915	30	ND	unpublished	11310	11250	11390	2	Equality Fm
UCIAMS	248761	120315177000	Cook	IL	Calumet City	CC-21-02, 10.0	needles	41.564066	-87.533718	10,675	25	-26.8	unpublished	12710	12690	12720	1	Equality Fm
UCIAMS	252685	120315177000	Cook	IL	Calumet City	CC-21-02, 10.0	seeds, bulrush	41.564066	-87.533718	11,030	25	-25.1	unpublished	12970	1290	13050	2	Equality Fm
UCIAMS	256893	120315177000	Cook	IL	Calumet City	CC-21-02, 10.0	moss	41.564066	-87.533718	11,130	30	-31.2	unpublished	13080	13010	13100	2	Equality Fm
ISGS	A4219	121974608500	Will	IL	Beecher East	BEEC 17-7, 52.8-53.0	needles, macros	41.358473	-87.543836	11,370	35	ND	Curry et al. 2018 a, b	13250	13190	13300	2	Equality Fm
UCIAMS	248760	120315177000	Cook	IL	Calumet City	CC-21-02, 10.0	wood	41.564066	-87.533718	11,430	25	-26.4	unpublished	13300	13250	13330	2	Equality Fm
UCIAMS	256892	120315177000	Cook	IL	Calumet City	CC-21-02, 10.0	cones	41.564066	-87.533718	11,480	25	-26.3	unpublished	13360	13310	13410	2	Equality Fm
UCIAMS	248762	120315177000	Cook	IL	Calumet City	CC-21-02, 10.0	*Naja* seeds (aquatic)	41.564066	-87.533718	11,495	25	-16.0	unpublished	13370	13320	13410	2	Equality Fm
UCIAMS	252684	120315177000	Cook	IL	Calumet City	CC-21-02, 10.0	charcoal	41.564066	-87.533718	11,765	30	-24.2	unpublished	13610	13520	13740	4	Equality Fm
ISGS	A4297	121974608500	Will	IL	Beecher East	BEEC 17-7, 54.0-54.5	needles	41.358473	-87.543836	12,225	40	–25.6	Curry et al. 2018 a, b	14130	14070	14170	1	Equality Fm
UCIAMS	266805	120315193500	Cook	IL	Dyer	PC-22 (outcrop), 9.0-10.0	wood, macros	41.489264	-87.525991	12,330	60	ND	unpublished	14350	14150	14790	2	Equality Fm
UCIAMS	252686	120315179000	Cook	IL	Blue Island	BLI P11, 4.0-4.2	needles	41.726648	-87.687393	12,535	30	-28.1	unpublished	14900	14640	15000	2	Equality Fm
UCIAMS	252687	120315179000	Cook	IL	Blue Island	BLI P11, 9.8-10.0	needles	41.726648	-87.687393	12,560	35	-28.0	unpublished	14950	14870	15050	1	Equality Fm
UCIAMS	266813	120315193500	Cook	IL	Dyer	PC-22 (outcrop), 9.0-10.0	shell	41.489264	-87.526203	12,610	25	-5.9	unpublished	15030	14980	15090	1	Equality Fm
UCIAMS	252688	120315179000	Cook	IL	Blue Island	BLI P11, 10.0-10.2	wood	41.726648	-87.687393	12,705	30	-29.6	unpublished	15150	15090	15220	1	Equality Fm
UCIAMS	159243	120315192500	Cook	IL	Dyer	DYER 2, 0.7-1.4	needle	41.478459	-87.532544	13,065	45	ND	Bruegger 2016	15660	15590	15740	1	Equality Fm
UCIAMS	159241	120315192900	Cook	IL	Dyer	PC-5, 5.45-5.65	needle	41.493094	-87.541728	13,150	45	ND	Bruegger 2016	15770	15690	15850	1	Equality Fm
UCIAMS	159244	120315192500	Cook	IL	Dyer	DYER 2, 3.0-3.1	needle	41.478459	-87.532544	13,355	50	ND	Bruegger 2016	16070	15980	16170	1	Equality Fm
ISGS	1378	none		MI		outcrop	wood			13,470	130		Monaghan and Hansel 1990	16230	16020	16420	1	Equality Fm
ISGS	A4216	121974608500	Will	IL	Beecher East	BEEC 17-7, 59.7-59.9	*Dryas* leaves, stems	41.358473	-87.543836	13,500	35	–26.2	Curry et al. 2018 a, b	16280	16210	16340	1	Equality Fm
UCIAMS	159242	120315192900	Cook	IL	Dyer	PC-5, 6.55-6.75	needle	41.493094	-87.541728	13,675	45	ND	Bruegger 2016	16530	16430	16610	1	Equality Fm
ISGS	7087	120315192500	Cook	IL	Dyer	Dyer 2, 3.2-3.25	wood	41.476658	-87.533155	13,700	80	-24.6	Bruegger 2016	16580	16410	16710	1	Equality Fm
UCIAMS	159238	120315192800	Cook	IL	Dyer	PC-4, 9.3-9.5	needle	41.490438	-87.534164	13,790	50	ND	unpublished	16730	16570	17060	1	Equality Fm
ISGS	1549	120312729000	Cook	IL	Dyer	Lynwood Reservoir, 15.0	cones	41.504167	-87.541667	13,870	170	-24.8	Hansel and Mickelson 1988	16820	16570	17060	1	Dolton facies, Henry Fm
UCIAMS	63076	none	Lake	IL	Wadsworth	Wadsworth Village Hall, 16.5	*Dryas* leaves, stems	42.427882	-87.907156	13,910	35	ND	Curry and Petras 2011	16930	16870	17020	1	Equality Fm
UCIAMS	159240	120315192800	Cook	IL	Dyer	PC-4, 13.0-13.6	rootlets	41.490438	-87.534164	14,050	45	-26.4	Bruegger 2016	17090	17010	17250	2	Equality Fm
UCIAMS	159235	120315192700	Cook	IL	Dyer	PC-2, 12.0-12.4	rootlets	41.490438	-87.534164	14,075	50	-25.7	Bruegger 2016	17140	17040	17280	2	Equality Fm
UCIAMS	159237	120315192700	Cook	IL	Dyer	PC-2, 12.0-12.8	rootlets	41.490438	-87.534164	14,085	45	-25.6	Bruegger 2016	17160	17050	17280	2	Equality Fm
ISGS	1570	120312729000	Cook	IL	Dyer	Lynwood Reservoir, 15.0	driftwood	41.504167	-87.541667	14,100	640	-25.8	Hansel and Mickelson 1988	17080	16290	18020	1	Dolton facies, Henry Fm
UCIAMS	159236	120315192700	Cook	IL	Dyer	PC-2, 12.4-12.8	rootlets	41.490438	-87.534164	14,115	50	-25.8	Bruegger 2016	17190	17280	17080	2	Equality Fm
UCIAMS	159239	120315192800	Cook	IL	Dyer	PC-4, 9.8-10.4	needle	41.490438	-87.534164	14,140	50	-26.8	Bruegger 2016	17200	17100	17280	1	Equality Fm
UCIAMS	256889	120314884800	Cook	IL	Lake Calumet	CALU-18-03, 6.5-6.7	wood	41.62612	-87.559538	41,200	1900	-28.1	unpublished	44290	42790	45440	1	Equality Fm
UCIAMS	256891	120315177000	Cook	IL	Calumet City	CC-21-02, 10.0	coal	41.564066	-87.533718	>51,700	ND	-24.4	unpublished	ND	ND	ND	ND	Equality Fm

unpublished citations by quadrangle: Dyer (Curry et al. 2022[this map]); Blue Island (Phillips et al. 2021); Calumet City (Curry et al. 2021), Lake Calumet (in progress); Beecher East [Eagle Lake core] (Curry et al. 2018 a,b); Palos Park (Caron and Curry 2016)
= important legacy ages

Table 2 Summary of physical, mineralogical, and chemical data per stratigraphic unit.

Stratigraphic unit		Depth (ft)	X-ray diffraction of oriented slides (< 2 um fraction)							CIE (1978) color spectroscopy				Particle Size Distribution							Moisture
			Clay Mineralogy (%)				Count per second (CPS)							total sample	< 2 mm fraction			diameter (mm)			
			smectite	illite	kaolinite	chlorite	calcite	dolomite	Total	L	a*	b*	M	% gravel	% sand	% silt	% clay (<2µm)	Dx 10	Dx 50	Dx 90	Content
Wadsworth Formation	average	27.5	2.4%	75.0%	5.8%	16.8%	104	194	778	66.4	2.5	12.4	0.4	4.0	16.7	66.7	16.6	1.6	16.3	119.5	15.2
	std dev	14.8	1.4%	4.0%	1.5%	3.9%	58	90	192	1.9	1.4	4.2	0.1	9.6	14.1	10.4	4.9	1.4	38.9	104.6	2.1
	count	45	36	36	36	36	27	27	27	27	27	27	27	46	46	46	46	46	46	46	37
Henry Formation, Beverly Tongue	average	97.1	2.1%	73.3%	7.7%	16.9%	94	168	939	67.6	0.9	9.1	0.3	7.0	61.2	33.7	5.1	29.6	122.1	265.0	10.5
	std dev	23.0	1.2%	7.0%	2.3%	5.9%	61	89	746	7.7	1.7	2.0	0.1	18.8	34.0	28.9	6.1	32.8	87.5	242.6	0.3
	count	8(16)	8	8	8	8	16	16	16	16	16	16	16	40	40	40	40	40	40	40	4
Yorkville Member, Lemont Formation	average	115.9	1.8%	71.6%	7.1%	19.4%	94	254	612	65.4	1.3	8.7	0.3	6.4	7.9	75.0	17.1	1.3	7.6	46.2	ND
	std dev	16.2	0.4%	3.9%	1.0%	3.6%	39	120	202	2.7	0.1	1.1	0.0	12.9	3.1	4.7	4.9	0.3	2.5	26.3	ND
	count	7	7	7	7	7	5	5	5	5	5	5	5	6	6	6	6	6	6	6	ND

Stratigraphic unit		Oxides (mass per cent)											Elements (mg/kg or ppm)															
		Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	K_2O	CaO	TiO_2	MnO	Fe_2O_3	Cl	V	Cr	Ni	Cu	Zn	Ga	As	Br	Rb	Sr	Y	Nb	Ba	Pb	Th
Wadsworth Formation	average	1.0	4.8	12.9	62.6	0.1	0.6	3.5	8.8	0.7	0.1	4.6	184.9	173.9	75.7	52.7	46.7	82.6	20.9	11.9	3.5	128.2	143.2	30.5	16.5	372.6	26.8	16.8
	std dev	0.1	0.7	1.4	2.3	0.0	0.6	0.4	2.7	0.1	0.0	0.5	39.1	47.2	20.8	7.1	6.6	11.7	3.1	2.6	0.8	23.0	21.8	2.7	3.7	33.4	3.1	2.1
	count	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42
Henry Formation, Beverly Tongue	average	1.1	3.9	9.8	68.1	0.1	1.1	2.8	8.9	0.5	0.1	3.4	229.3	106.4	106.6	39.8	36.9	66.0	16.8	9.9	3.8	98.3	167.1	27.5	15.5	354.9	22.8	14.6
	std dev	0.3	1.5	3.5	9.2	0.0	0.8	0.9	3.7	0.3	0.0	1.9	82.5	64.6	55.4	21.1	15.2	25.9	5.9	6.3	1.1	41.2	47.8	12.4	4.7	82.7	8.3	2.9
	count	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Yorkville Member, Lemont Formation	average	0.9	5.2	12.7	60.0	0.1	1.4	3.6	10.1	0.8	0.1	5.1	182.2	148.0	72.4	61.2	50.2	88.0	21.2	15.3	4.1	133.9	154.2	32.3	16.8	353.0	29.7	18.0
	std dev	0.1	0.8	1.7	2.0	0.0	0.7	0.5	2.9	0.1	0.0	0.6	47.4	33.4	17.1	5.1	4.3	5.6	3.7	2.2	0.7	31.1	8.5	2.2	3.9	40.0	3.7	2.1
	count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

ND = not determined
Commission Internationale de l'Eclairage (CIE), 1978. Recommendations on Uniform Color Spaces, Color Difference and Psychometric Color Terms. Paris, CIE, Colorimetry, publication 15, supplement 2, 21 pp

Table 3 Comparison of the lithostratigraphic units used in this region, informal units mapped in northern Lake County, Indiana, and formal state-wide units in Indiana.

Illinois State Geological Survey lithostratigraphy (modified from Hansel and Johnson 1996)	Northern Lake County, Indiana (Brown and Thompson 2005)	Indiana Pleistocene stratigraphy (statewide; Wayne 1960)
Equality Formation, Lake Michigan Member		
Grayslake Peat Cahokia Formation	Toleston lagoon, Calumet lagoon, Glenwood spit platform and swales	Martinsville Formation
Henry Formation, Parkland facies (dune) Henry Formation, Dolton facies (nearshore)	Toleston strandplain, Toleston transgressive nearshore and fluvial, Calumet nearshore, Calumet dunes, Glenwood spit	Atherton Formation
Equality Formation		
Henry Formation, undivided		
Wadsworth Formation	fine-grained diamicton (a)	Lagro Formation (Wedron Formation of Gray, 1990)
Lemont Formation, Haeger Member	fine-grained diamicton (b)	
Henry Formation, Beverly Tongue	Proximal subaqueous fan	
Lemont Formation, Yorkville Member		