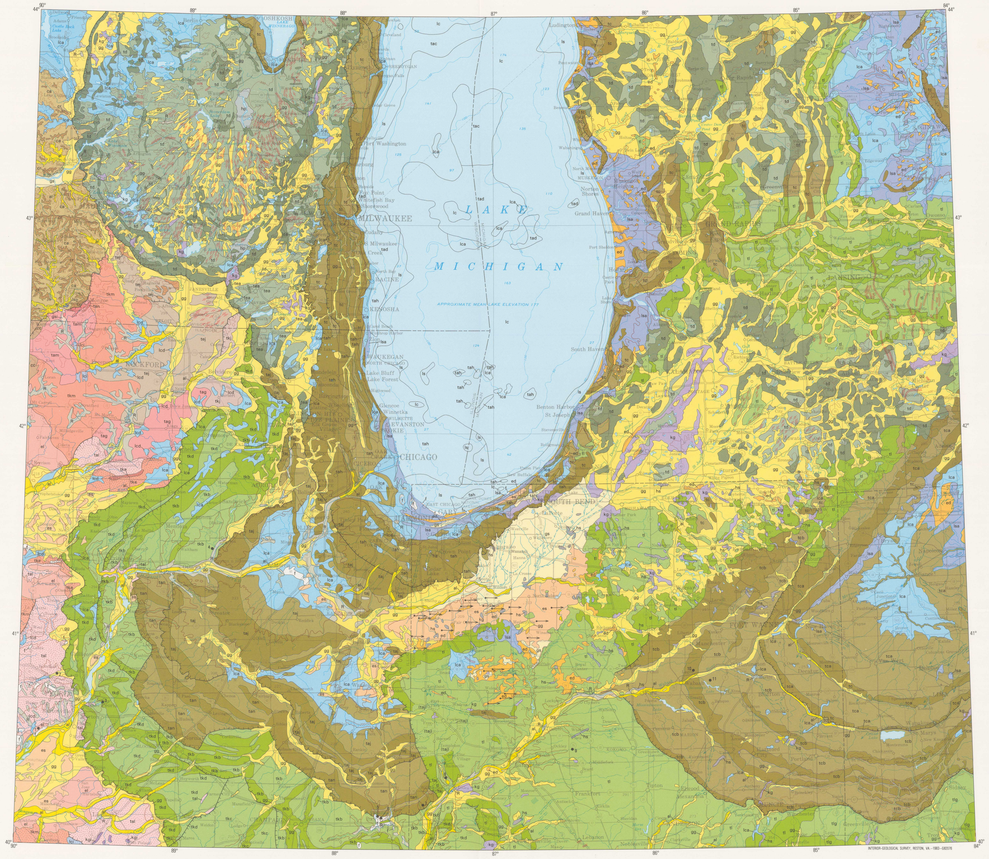
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

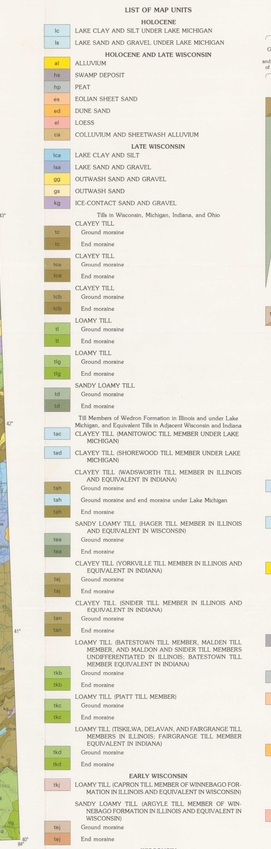
PREPARED IN COOPERATION WITH THE
ILLINOIS STATE GEOLOGICAL SURVEY, INDIANA GEOLOGICAL SURVEY
DEPARTMENT OF GEOLOGY AND GEOPHYSICS, UNIVERSITY OF WISCONSIN
DEPARTMENT OF GEOLOGICAL SCIENCES, UNIVERSITY OF MICHIGAN AND THE
DEPARTMENT OF GEOLOGY AND MINERALOGY, OHIO STATE UNIVERSITY

QUATERNARY GEOLOGIC ATLAS OF THE UNITED STATES
MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-1420 (NK-16)

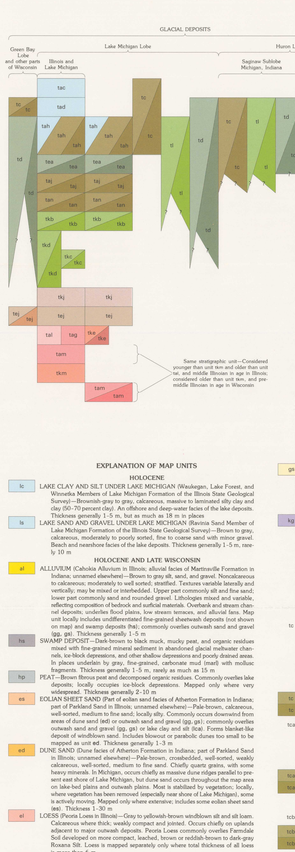


INDEX TO INTERNATIONAL MAP OF THE WORLD 1:1,000,000 TOPOGRAPHIC SERIES

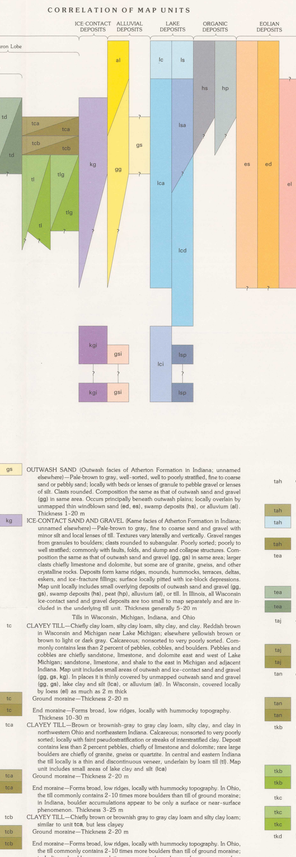
Showing location of the Quaternary Geologic Map of the Chicago 4° x 6° Quadrangle in red (U.S. Geological Survey, Miscellaneous Investigations Series, Map I-1420 (NK-16)) and other published maps in the Quaternary Geologic Atlas of the United States in yellow.



LOESS DISTRIBUTION AND THICKNESS, IN METERS



CORRELATION OF MAP UNITS



QUATERNARY GEOLOGIC MAP OF THE CHICAGO 4° x 6° QUADRANGLE, UNITED STATES

State compilations by
Jerry A. Lineback, Ned K. Bleuer, David M. Mickelson, William R. Farrand, and Richard P. Goldthwait

Edited and integrated by
Gerald M. Richmond and David S. Fullerton

1983

QUATERNARY GEOLOGIC ATLAS OF THE UNITED STATES

LIST OF MAP UNITS

HOLOCENE

lc	LAKE CLAY AND SILT UNDER LAKE MICHIGAN
ls	LAKE SAND AND GRAVEL UNDER LAKE MICHIGAN

HOLOCENE AND LATE WISCONSIN

al	ALLUVIUM
hg	SWAMP DEPOSIT
hp	PEAT
es	EOLIAN SHEET SAND
ed	DUNE SAND
el	LOESS
ca	COLLUVIUM AND SHEETWASH ALLUVIUM

LATE WISCONSIN

lca	LAKE CLAY AND SILT
lsa	LAKE SAND AND GRAVEL
gg	OUTWASH SAND AND GRAVEL
gs	OUTWASH SAND
kg	ICE-CONTACT SAND AND GRAVEL

Tills in Wisconsin, Michigan, Indiana, and Ohio

tc	CLAYEY TILL: Ground moraine
tcu	End moraine
tcl	CLAYEY TILL: Ground moraine
tcm	End moraine
tcb	CLAYEY TILL: Ground moraine
tcs	End moraine
tl	LOAMY TILL: Ground moraine
tlu	End moraine
tlg	LOAMY TILL: Ground moraine
tlm	End moraine
td	SANDY LOAMY TILL: Ground moraine
tdm	End moraine

Till Member of Wedron Formation in Illinois and under Lake Michigan, and Equivalent Tills in Adjacent Wisconsin and Indiana

tac	CLAYEY TILL (MANTOWOC TILL MEMBER UNDER LAKE MICHIGAN)
tad	CLAYEY TILL (SHOREWOOD TILL MEMBER UNDER LAKE MICHIGAN)
tadu	CLAYEY TILL (WADSWORTH TILL MEMBER IN ILLINOIS AND EQUIVALENT IN INDIANA)
tadm	Ground moraine
tah	Ground moraine and end moraine under Lake Michigan
tam	End moraine
tea	SANDY LOAMY TILL (HAGER TILL MEMBER IN ILLINOIS AND EQUIVALENT IN WISCONSIN)
teau	Ground moraine
tearm	Ground moraine
tey	CLAYEY TILL (YORKVILLE TILL MEMBER IN ILLINOIS AND EQUIVALENT IN INDIANA)
teyu	Ground moraine
teym	End moraine
tes	CLAYEY TILL (SNIDER TILL MEMBER IN ILLINOIS AND EQUIVALENT IN INDIANA)
tesu	Ground moraine
tesm	End moraine
tbt	LOAMY TILL (BATESTOWN TILL MEMBER, MALDEN TILL MEMBER, AND MALDON AND SNIDER TILL MEMBERS UNDIFFERENTIATED IN ILLINOIS; BATESTOWN TILL MEMBER EQUIVALENT IN INDIANA)
tbtu	Ground moraine
tbtm	End moraine
tkb	LOAMY TILL (PIATT TILL MEMBER)
tkbu	Ground moraine
tkbm	End moraine
tf	CLAYEY TILL (TISKILWA, DELAVAN, AND FAIRGRANGE TILL MEMBERS IN ILLINOIS; FAIRGRANGE TILL MEMBER EQUIVALENT IN INDIANA)
tfu	Ground moraine
tfm	End moraine

EARLY WISCONSIN

tk	LOAMY TILL (CAPROL TILL MEMBER OF WINNEBAGO FORMATION IN ILLINOIS AND EQUIVALENT IN WISCONSIN)
tej	SANDY LOAMY TILL (ARGYLE TILL MEMBER OF WINNEBAGO FORMATION IN ILLINOIS AND EQUIVALENT IN WISCONSIN)
teju	Ground moraine
tejm	End moraine

WISCONSIN

lcd	LAKE SILT AND CLAY

ILLINOIAN

lci	LAKE SILT AND CLAY
lsc	LAKE SAND AND SILT
gsi	OUTWASH SILT, SAND, AND GRAVEL
kgi	ICE-CONTACT SAND AND GRAVEL
tai	CLAYEY TILL (RADNOR AND STERLING TILL MEMBERS OF GLASFORD FORMATION IN ILLINOIS)
tgi	CLAYEY TILL (ESMOND TILL MEMBER OF GLASFORD FORMATION IN ILLINOIS)
tlci	CLAYEY TILL (LEE CENTER TILL MEMBER OF GLASFORD FORMATION IN ILLINOIS)
tkui	Ground moraine
tkmi	End moraine
tlcl	LOAMY TILL (OGLE, HULICK, AND VANDALIA TILL MEMBERS OF GLASFORD FORMATION IN ILLINOIS; OGLE TILL MEMBER EQUIVALENT IN WISCONSIN)
tlcu	CLAYEY TILL (WINSLOW TILL MEMBER OF GLASFORD FORMATION IN ILLINOIS AND EQUIVALENT IN WISCONSIN)
tlcm	Ground moraine
tlcm	End moraine
co	COLLUVIUM

QUATERNARY

co	COLLUVIUM

PRE-QUATERNARY

R	BEDROCK

NOTE: This map is the product of interorganizational collaboration. Following a regional meeting of State compilers with the coordinator to establish map units and related matters, Quaternary maps and map explanations of the parts of States included in the quadrangle were prepared by each of the compilers. These were then integrated and locally supplemented by the editors to produce this quadrangle map and map explanation. Associated diagrams were prepared by the editors. Significant geologic problems requiring changes in the map or addition of information were resolved at meetings with the compilers, who reviewed the map prior to its submittal for publication. Other reviewers, to whom the editors are indebted, were W. Hilton Johnson, University of Illinois, and Harold E. Malde, U.S. Geological Survey.

RELATIONSHIPS OF LATE WISCONSIN GLACIAL LOBES, SUBLOBES AND ADVANCES WITHIN LOBES AND SUBLOBES

Numbers indicate relative ages of surface tills in respective lobes and sublobes (oldest to youngest) in this quadrangle. Hachures indicate readvance limits shown on Quaternary geologic map. Arrows indicate generalized ice flow within lobes and sublobes.

RESPONSIBILITY FOR STATE COMPILATIONS

(1) ILLINOIS STATE GEOLOGICAL SURVEY
(2) INDIANA GEOLOGICAL SURVEY
(3) DEPARTMENT OF GEOLOGY AND GEOPHYSICS, UNIVERSITY OF WISCONSIN
(4) DEPARTMENT OF GEOLOGICAL SCIENCES, UNIVERSITY OF MICHIGAN
(5) DEPARTMENT OF GEOLOGY AND MINERALOGY, OHIO STATE UNIVERSITY

EXPLANATION OF MAP UNITS

HOLOCENE

lc LAKE CLAY AND SILT UNDER LAKE MICHIGAN (Waukegan, Lake Forest, and Winnetka Members of Lake Michigan Formation of the Illinois State Geological Survey)—Brownish-gray to gray, calcareous, massive to laminated clay and silty clay (50–70 percent clay). An offshore and deep-water facies of the lake deposits. Thickness generally 1–5 m, but as much as 18 m in places

ls LAKE SAND AND GRAVEL UNDER LAKE MICHIGAN (Ravinia Sand Member of Lake Michigan Formation of the Illinois State Geological Survey)—Brownish-gray calcareous, moderately to poorly sorted, fine to coarse sand with minor gravel. Beach and nearshore facies of the lake deposits. Thickness generally 1–5 m, rarely 10 m

HOLOCENE AND LATE WISCONSIN

al ALLUVIUM (Cahokia Alluvium in Illinois; alluvial facies of Martinsville Formation in Indiana; unnamed elsewhere)—Brown to gray silt, sand, and gravel. Noncalcareous to calcareous; moderately to well sorted; stratified. Textures random in detail and vertically; may be mixed or interbedded. Upper part commonly silt and fine sand; lower part commonly sand and rounded gravel. Lithologies mixed and variable, reflecting composition of bedrock and surficial materials. Overbank and stream channel deposits; underlies flood plains, low stream terraces, and alluvial fans. Map unit locally includes undifferentiated fine-grained sheetwash deposits (not shown on map) and swamp deposits (hg); commonly overlies outwash sand and gravel (gg, gs). Thickness generally 1–5 m

hg SWAMP DEPOSIT—Dark-brown to black muck, mucky peat, and organic residues mixed with fine-grained mineral sediment in abandoned glacial meltwater channels, ice-block depressions, and other shallow depressions and poorly drained areas. In places underlain by gray, fine-grained, carbonate mud (marl) with mollusc fragments. Thickness generally 1–5 m, rarely as much as 15 m

hp PEAT—Brown fibrous peat and decomposed organic residues. Commonly overlies lake deposits; locally occupies ice-block depressions. Mapped only where very widespread. Thickness generally 2–10 m

es EOLIAN SHEET SAND (Part of eolian sand facies of Atherton Formation in Indiana; part of Parkland Sand in Illinois; unnamed elsewhere)—Pale-brown, calcareous, well-sorted, medium to fine sand; locally silty. Commonly occurs downwind from areas of dune sand (ed) or outwash sand and gravel (gg, gs); commonly overlies outwash sand and gravel (gg, gs) or lake clay and silt (lca). Forms blanket-like deposit of windblown sand. Includes bioturbated or parabolic dunes too small to be mapped as unit ed. Thickness generally 1–3 m

ed DUNE SAND (Dune facies of Atherton Formation in Indiana; part of Parkland Sand in Illinois; unnamed elsewhere)—Pale-brown, crossbedded, well-sorted, weakly calcareous, well-sorted, medium to fine sand. Chiefly quartz grains, with some heavy minerals. In Michigan, occurs chiefly as massive dune ridges parallel to present east shore of Lake Michigan; but dune sand occurs throughout the map area on lake-bed plains and outwash plains. Most is stabilized by vegetation; locally, where vegetation has been removed (especially near shore of Lake Michigan), some is actively moving. Mapped only where extensive; includes some eolian sheet sand (es). Thickness 1–30 m

el LOESS (Peoria Loess in Illinois)—Gray to yellowish-brown windblown silt and silt loam. Calcareous where thick; weakly compact and jointed. Occurs chiefly on upland; adjacent to major outwash deposits. Peoria Loess commonly overlies Farmdale Soil developed on more compact, leached, brown or reddish-brown to dark-gray Roxana Silt. Loess is mapped separately only where total thickness of all loess units is 1 m or more

ca COLLUVIUM AND SHEETWASH ALLUVIUM—Colluvium—Brown or reddish-brown, noncalcareous to weakly calcareous, nonsorted, nonstratified to faintly stratified, sandy to silty clay containing angular to subangular clasts of sandstone, dolomite, limestone and chert. Deposits of colluvium are chiefly on valley sides and are separated by scattered, numerous, or extensive outcrops of sandstone, dolomite, and limestone
Sheetwash alluvium—Brown to reddish-brown, noncalcareous to weakly calcareous, poorly sorted to well-sorted sand, silt, and clay containing local layers of subangular to subrounded boulders of sandstone, dolomite, limestone, and chert
Sheetwash alluvium is chiefly on lower slopes of valley sides and on valley floors. The colluvium and sheetwash alluvium cannot be distinguished separately at the scale of this map. Both deposits are 1–3 m thick, and commonly are covered locally by unmapped loess (el) or windblown sand (es)

LATE WISCONSIN

lca LAKE CLAY and SILT (Part of Carmi Member of Equality Formation in Illinois; lacustrine facies of Atherton Formation in Indiana; unnamed elsewhere)—Yellowish-brown to brown or bluish-gray to gray clay and silt. Well bedded; soft; commonly thinly laminated; locally varved. Most deposits are calcareous, but some are noncalcareous. Commonly overlies glacial lakes; some are in small, separate lake basins; a few are in deep-water valleys tributary to major outwash valleys. Thickness and discontinuous in some areas. Deposits include some undifferentiated area of lake sand and gravel (lsa) and wave-washed or current-winnowed silt, sand, and gravel by unmapped Richland Loess in Illinois; thin eolian sand (es); swamp deposits (hg), or alluvium (al). Thickness generally 1–30 m
Included in this unit are deposits under Lake Michigan, consisting of reddish-gray to reddish-brown clay (Sheboygan and South Haven Members of Lake Michigan Formation of the Illinois State Geological Survey). Clay is confined to deep-water areas and generally is 10–15 m thick

lsa LAKE SAND AND GRAVEL (Lacustrine facies of Atherton Formation in Indiana; Dolton Member of Equality Formation in Illinois; unnamed elsewhere)—Pale-brown to gray, well-sorted to poorly sorted, locally forest-bedded or crossbedded, fine to coarse sand or silty sand; locally silty and with minor gravel. Sand commonly contains beds or lenses of rounded gravel; beaches and offshore bars locally are gravelly. Clasts chiefly dolomite, limestone, and sandstone in Wisconsin; limestone and dolomite in Illinois and Ohio; limestone, dolomite, and shale in Indiana; and sandstone, limestone, and shale in Michigan. Occurs as beach ridges, offshore bars, spits, and deltas; all locally forested bedded, and other nearshore or shallow-water deposits of former glacial lakes; in Ohio, beach ridges and bars are shown by symbol where narrow. Beach ridges and offshore bars are generally 1–5 m thick (lsa); in places sand and gravel are covered by unmapped thin windblown sand (es), etc. Thickness 1–30 m

gg OUTWASH SAND AND GRAVEL (Batavia and Mackinaw Members of Henry Formation in Illinois; outwash facies of Atherton Formation in Indiana; unnamed elsewhere)—Pale-brown to gray, fine to coarse sand or pebbly sand alternating with layers or beds of granule to cobble gravel and minor beds of silt; locally boulders. Clasts rounded. Textures variable laterally and vertically; interlayered thick and thin beds; commonly well sorted within beds and poorly to well stratified, locally crossbedded. Clasts chiefly dolomite, limestone, and sandstone in Wisconsin; sandstone, limestone, and shale in Michigan; limestone and dolomite in Ohio and Indiana, but shale is abundant in western Indiana. Deposits form dense, texture, outwash plains, valley trains, outwash aprons, and stream-channel fills. Surfaces locally pitted by ice-block depressions. The deposits commonly are covered by unmapped thin loess or windblown sand (el, es, ed) and locally by swamp deposits (hg), peat (hp), or alluvium (al). Thickness 1–20 m

gs OUTWASH SAND (Outwash facies of Atherton Formation in Indiana; unnamed elsewhere)—Pale-brown to gray, well-sorted, well to poorly stratified, fine to coarse sand or pebbly sand; locally with thin beds of silt. Clasts of Darwin Stratum of Stanley Bulletin 29, of gravel size. Clasts rounded. Composition the same as that of outwash sand and gravel (gg) in same area. Occurs principally beneath outwash plains; locally overlain by unmapped thin windblown sand (ed, es), swamp deposits (hg), or alluvium (al). Thickness 1–20 m

kg ICE-CONTACT SAND AND GRAVEL (Kame facies of Atherton Formation in Indiana; unnamed elsewhere)—Pale-brown to gray, fine to coarse sand and gravel with minor silt and local lenses of till. Textures very laterally and vertically. Gravel ranges from granules to boulders; clasts rounded to subangular. Poorly sorted; poorly to well stratified; commonly with faults, folds, and slump and collapse structures. Composition the same as that of outwash sand and gravel (gg, gs) in same area. Larger clasts chiefly limestone and dolomite, but some are of granite, gneiss, and other crystalline rocks. Deposits form kame ridges, mounds, hummocks, terraces, deltas, eskers, and ice-fracture fillings; surface locally pitted with ice-block depressions. Map unit locally includes small overlying deposits of outwash sand and gravel (gg, gs), swamp deposits (hg), peat (hp), alluvium (al), or till. In Illinois, all Wisconsin ice-contact sand and gravel deposits are mapped with unit kg, generally and are included in the underlying till unit. Thickness generally 5–20 m

Tills in Wisconsin, Michigan, Indiana, and Ohio

tc CLAYEY TILL—Chiefly clay loam, silty clay loam, or silty clay. Reddish brown in Wisconsin and Michigan near Lake Michigan; elsewhere yellowish brown or brown to light or dark gray. Calcareous; nonsorted to very poorly sorted. Commonly contains less than 2 percent of pebbles, cobbles, and boulders. Pebbles and cobbles are chiefly sandstone, limestone, and dolomite east and west of Lake Michigan; sandstone, limestone, and shale to the east in Michigan and adjacent Indiana. Map unit includes small areas of ice-contact sand and gravel (gg, gs, kg). In places it is thinly covered by unmapped outwash sand and gravel (gg, gs), lake clay and silt (lca), or alluvium (al). In Wisconsin, covered locally by loess (el) as much as 2 m thick
Ground moraine—Thickness 2–20 m
End moraine—Forms broad, low ridges, locally with hummocky topography. Thickness 10–30 m

tca CLAYEY TILL—Brown or brownish-gray to gray clay loam, silty clay, and clay in northwestern Ohio and northeastern Indiana. Calcareous; nonsorted to very poorly sorted; locally with faint parabedding or streaks of intermediate clay. Deposit contains less than 2 percent pebbles, chiefly of limestone and dolomite; rare large boulders are chiefly of granite, gneiss or quartzite. In central and eastern Indiana the till locally is a thin and discontinuous veneer, underlain by loam till (tl). Map unit includes small areas of lake clay and silt (lca)
Ground moraine—Thickness 2–20 m
End moraine—Forms broad, low ridges, locally with hummocky topography. In Ohio, the till commonly contains 2–10 times more boulders than till of ground moraine; in Indiana, boulder accumulations appear to be only a surface or near-surface phenomenon. Thickness 5–35 m

tcb CLAYEY TILL—Chiefly brown or brownish gray to gray clay loam and silty clay loam; similar to until tcm, but less clayey
Ground moraine—Thickness 2–20 m
End moraine—Forms broad, low ridges, locally with hummocky topography. In Ohio, the till commonly contains 2–10 times more boulders than till of ground moraine; in Indiana, boulder accumulations appear to be only a surface or near-surface phenomenon. Thickness 5–35 m

tl CLAYEY TILL (Tradelage Formation in Indiana; unnamed till in Michigan)—Yellowish-brown or brown to light- or dark-gray, silty loam, silty clay loam, and silty clay loam; locally reddish brown in Michigan. Calcareous; nonsorted to very poorly sorted. Generally pebbly; pebbles, cobbles, and small boulders are chiefly limestone and dolomite; large boulders are chiefly igneous and metamorphic rocks and quartzite. In Indiana, abundance of garnet and high magnetic susceptibility distinguish till that was transported from north-northeast by Huron glacial lobe. Map unit includes small areas of clayey till (tc), loam till (tl), sandy till (td), and outwash or ice-contact sand and gravel (gg, gs, kg). Commonly, but not everywhere, covered by loess (el) less than a 1 m thick
Ground moraine—Thickness 2–30 m
End moraine—Forms broad, low ridges, commonly with hummocky topography. In Ohio, pebbles, cobbles, and boulders are more abundant than till of ground moraine; in Indiana boulder accumulations appear to be only a surface or near-surface phenomenon. Thickness 5–35 m

tlg CLAYEY TILL—Yellowish-brown or brown to light- or dark-gray loam and silt loam; in Ohio, also silty clay loam and clay loam. Calcareous; nonsorted to very poorly sorted. Commonly pebbly; pebbles, cobbles, and small boulders are chiefly limestone and dolomite; large boulders are chiefly granite and gneiss. Unit includes small areas of clayey till, sandy loamy till, and outwash and ice-contact sand and gravel (gg, kg). Commonly covered by loess (el) as much as 1 m thick
Ground moraine—Thickness 2–30 m
End moraine—Forms broad, low ridges with hummocky topography. Pebbles, cobbles and boulders are much more abundant than till of ground moraine; 2–100 x more abundant in Ohio; boulder accumulations appear to be only a surface or near-surface phenomenon. Thickness 5–35 m

td SANDY LOAMY TILL—Chiefly yellowish brown to light or dark gray sandy clay loam, sandy loam, and loamy sand; locally reddish brown. Calcareous; nonsorted to poorly sorted. Pebbles, cobbles, and small boulders are chiefly dolomite, limestone, and sandstone in Wisconsin, and sandstone, limestone, and shale in Michigan; large boulders are chiefly crystalline igneous and metamorphic rocks, quartzite, and dolomite. The deposits locally resemble outwash sand and gravel (gg), owing to an abundance of well-rounded clasts; they are nonstratified and include lenses of nonsorted clayey or silty till. Locally covered by loess (el) as much as 2 m thick
Ground moraine—Thickness 2–30 m
End moraine—Somewhat more bouldery than ground moraine, and locally contains included masses of ice-contact sand and gravel (kg); otherwise, till is similar to that of ground moraine. Thickness 5–35 m

Till Members of Wedron Formation in Illinois and Under Lake Michigan, and Equivalent Tills in Adjacent Wisconsin and Indiana

Mostly till with associated lenses and beds of sand, gravel, and silt. Includes small unmapped deposits of outwash sand and gravel (gg), ice-contact deposits (kg), peat (hp), and alluvium (al). All members may have a cover of unmapped loess (Richland Loess in Illinois) as much as 6 m thick. Total thickness of Wedron Formation averages about 20 m; maximum thickness may exceed 100 m

tac CLAYEY TILL (Manitowoc Till Member under Lake Michigan)—Brown to reddish-brown clay; intermediate lithic content; calcareous. Ground moraine and end moraine not differentiated. Maximum thickness may exceed 20 m

tad CLAYEY TILL (Shorewood Till Member under Lake Michigan)—Pinkish-gray, brownish-gray, or reddish-gray clay; lithic and dolomitic. Ground moraine and end moraine not differentiated. Maximum thickness greater than 25 m in unmapped submerged end moraine

tah CLAYEY TILL (Wadsworth Till Member in Illinois and its equivalent in Indiana)—Gray clay to silty clay loam; lithic and dolomitic; nonsorted to very poorly sorted. Clasts are chiefly pebbles and cobbles, dominantly of dolomite, and fragments of black shale. Clasts decrease in abundance toward Lake Michigan
Ground moraine—Commonly 2–15 m thick
Ground moraine and end moraine under Lake Michigan—Maximum thickness may exceed 18 m in submerged end moraine but till is thin or absent over bedrock highs and in center of lake basin
End moraine—Forms hummocky to smooth ridges. Thickness generally 10–25 m

tea SANDY LOAMY TILL (Haeger Till Member in Illinois and its equivalent in Wisconsin)—Chiefly gray to brown gravelly, sandy loam. Lithic and dolomitic; nonsorted to poorly sorted. Commonly a thin deposit, overlying and interbedded with thick outwash sand and gravel that are included in the member. Pinches out southward in northwestern Illinois, where it is overlapped by the Wadsworth Till Member
Ground moraine—Thickness generally 3–6 m. Thickness of Haeger Till Member, including underlying and interbedded sand and gravel, averages 20 m
End moraine—Thickness generally 6–10 m, including underlying and interbedded sand and gravel; locally 20 m

tey CLAYEY TILL (Yorkville Till Member in Illinois and its equivalent in Indiana)—Gray or greenish-gray clay to silty clay loam. Illitic and dolomitic; nonsorted to very poorly sorted. Contains abundant small pebbles, chiefly of dolomite, and fragments of black shale. Overlain in many places by lake clay and silt (lca), included in map unit
Ground moraine—Thickness 2–15 m
End moraine—Thickness 10–30 m

tes CLAYEY TILL (Snider Till Member in Illinois and its equivalent in Indiana)—Gray to olive-gray clay to silty clay loam. Illitic and dolomitic; nonsorted to very poorly sorted; coarse, blocky structure. Clasts are predominantly pebbles, chiefly of dolomite, and fragments of black shale
Ground moraine—Thickness averages 6 m
End moraine—Thickness about 15 m

tbt LOAMY TILL (Batestown Till Member, Malden Till Member, and Malden and Snider Till Members undifferentiated in Illinois; Batestown Till Member equivalent in Indiana)—Olive-brown to gray clay loam and silty clay loam. Illitic, dolomitic, nonsorted to very poorly sorted. Batestown Till Member in east-central Illinois; Malden Till Member in north-central Illinois; undifferentiated Malden and Snider Till Members north of Illinois River in Illinois
Ground moraine—Thickness averages 6 m

tkb LOAMY TILL (Batestown Till Member, Malden Till Member, and Malden and Snider Till Members undifferentiated in Illinois; Batestown Till Member equivalent in Indiana)—Olive-brown to gray clay loam and silty clay loam. Illitic, dolomitic, nonsorted to very poorly sorted. Batestown Till Member in east-central Illinois; Malden Till Member in north-central Illinois; undifferentiated Malden and Snider Till Members north of Illinois River in Illinois
Ground moraine—Thickness averages 6 m

tk LOAMY TILL (Capron Till Member in Illinois and equivalent till in Wisconsin)—Sandy clay loam to upper part to clay loam in lower part. Pink; intermediate lithic; dolomitic; nonsorted to very poorly sorted. Commonly thin and discontinuous; map unit includes areas of bedrock, especially in Wisconsin. Mapped only in northeastern Illinois and adjacent Wisconsin. Thickness ranges from a veneer to as much as 8 m

tej SANDY LOAMY TILL (Argyle Till Member in Illinois and equivalent till in Wisconsin)—Pink sandy loam and loam; gravelly in places. Intermediate lithic; dolomitic; nonsorted to poorly sorted; locally compacted. Pebbles and cobbles, chiefly of dolomite, abundant locally. Commonly thin and discontinuous; map unit includes small areas of till of similar composition and of bedrock
Ground moraine—Thickness ranges from a veneer to 10 m

tf CLAYEY TILL (Tiskilwa Till Member, Delavan Till Member, and Fairgrange Till Members in Illinois; Fairgrange Till Member in Indiana)—Brown or reddish-brown clay loam, silty clay loam, and clay. Calcareous; nonsorted to very poorly sorted. Commonly contains 2–10 times more boulders than till of ground moraine; 100 x more abundant in Ohio; boulder accumulations appear to be only a surface or near-surface phenomenon. Thickness 5–35 m

tcl LAKE SILT AND CLAY—(Part of Carmi Member of Equality Formation in Illinois)—Yellowish-brown to brown or bluish-gray to gray clay and silt. Well bedded; commonly thinly laminated; locally varved. Most deposits are calcareous, but some are noncalcareous. Commonly overlies glacial lakes; some are in small, separate lake basins; a few are in deep-water valleys tributary to major outwash valleys. Thickness and discontinuous in some areas. Deposits include some undifferentiated area of lake sand and gravel (lsa) and wave-washed or current-winnowed silt, sand, and gravel by unmapped Richland Loess in Illinois; thin eolian sand (es); swamp deposits (hg), or alluvium (al). Thickness generally 1–30 m

tkd Ground moraine—Thickness generally 1–30 m

tkm End moraine—Commonly overlies older moraines or ridges. Thickness about 6 m

tlcl LOAMY TILL (Tiskilwa, Delavan, and Fairgrange Till Members in Illinois and Fairgrange Till Member equivalent in Indiana)—Pink, pinkish-gray, gray, brown, and reddish-brown clay loam, silty clay loam, and loam. Pink; pinkish gray, gray, brown and reddish brown; lithic to intermediate lithic; and dolomitic; nonsorted to poorly sorted. Tiskilwa Till Member in northern Illinois; Delavan Till Member in central Illinois; Fairgrange Till Member in east-central Illinois. Map unit includes yellowish-gray to pinkish-gray sandy alluvium. Depth to a small area in northeastern Illinois
Ground moraine—Thickness averages 10 m, but may be as much as 30 m in places

tlcu End moraine—Thickness locally 30–100 m

EARLY WISCONSIN

Till Members of Winnebago Formation in Illinois and Equivalent Tills in Adjacent Wisconsin

Till with interbedded silt, peat, and gravel; present at the surface only in northwestern Illinois and southeastern Wisconsin; separated from Wedron Formation by the Robein Silt and the Morton Loess. Commonly covered by unmapped loess (el) as much as 6 m thick. Thickness of Winnebago Formation is variable, and it is commonly thin and discontinuous. Maximum thickness may be more than 10 m

tkj LOAMY TILL (Capron Till Member in Illinois and equivalent till in Wisconsin)—Sandy clay loam in upper part to clay loam in lower part. Pink; intermediate lithic; dolomitic; nonsorted to very poorly sorted. Commonly thin and discontinuous; map unit includes areas of bedrock, especially in Wisconsin. Mapped only in northeastern Illinois and adjacent Wisconsin. Thickness ranges from a veneer to as much as 8 m

tej SANDY LOAMY TILL (Argyle Till Member in Illinois and equivalent till in Wisconsin)—Pink sandy loam and loam; gravelly in places. Intermediate lithic; dolomitic; nonsorted to poorly sorted; locally compacted. Pebbles and cobbles, chiefly of dolomite, abundant locally. Commonly thin and discontinuous; map unit includes small areas of till of similar composition and of bedrock
Ground moraine—Thickness ranges from a veneer to 10 m

tgi CLAYEY TILL (Esmond Till Member of Glasford Formation in Illinois)—Clay loam to silty clay loam; calcareous; nonsorted to very poorly sorted. Commonly thin and discontinuous; map unit includes small areas of bedrock, especially in Wisconsin. Mapped only in northwestern Illinois. Thickness commonly less than 5 m

tai CLAYEY TILL (Radnor and Sterling Till Members of Glasford Formation in Illinois)—Yellowish brown or brown to dark-gray clay loam, silty clay loam, and loam. Illitic and dolomitic; commonly interbedded with sand and silt. Compact; locally massive and jointed. Radnor Till Member is in central and western Illinois, and Sterling Till Member is in northwestern Illinois. Distribution of loess cover more than 2 m thick shown by pattern. Thickness of till commonly less than 6 m in northwestern Illinois; may exceed 15 m elsewhere

tag CLAYEY TILL (Edmond Till Member of Glasford Formation in Illinois)—Clay loam in upper part, clay in lower part; gray; illitic and dolomitic; nonsorted to very poorly sorted; thin and discontinuous. Mapped only in northwestern Illinois. Lacks distinctive end moraine topography. Map unit includes areas of older drift and bedrock. Mapped only in northwestern Illinois. Thickness commonly less than 5 m

tlcu LOAMY TILL (Lee Center Till Member of Glasford Formation in Illinois)—Gray to brownish-gray clay loam. Illitic and dolomitic; nonsorted to very poorly sorted. Commonly thin and discontinuous; map unit includes areas of older drift and bedrock. Mapped only in northwestern Illinois. Distribution of loess cover more than 2 m thick shown by pattern
Ground moraine—Thickness commonly less than 6 m
End moraine—Thickness 6–10 m

tlcm LOAMY TILL (Ogle, Hulick, and Vandalia Till Members of Glasford Formation in Illinois and Ogle Till Member equivalent in Wisconsin)—Yellowish-brown, reddish-brown, brownish-gray, or gray loam, silt loam, and clay loam. Illitic to intermediate lithic; dolomitic. Nonsorted to poorly sorted; locally interbedded with sand and gravel. Compact to moderately compact; locally jointed. The Ogle Till Member in northwestern Illinois and the equivalent till in southeastern Wisconsin have been extensively eroded; throughout the quadrangle the map unit includes many small areas of bedrock. Commonly thin till is covered by as much as 2 m of loess; locally, in southwest part of quadrangle, by as much as 5 m. Distribution of loess cover more than 2 m thick shown by pattern. In Illinois, the Ogle Till Member is inferred to be older than the Winslow Till Member (tlcu); in Wisconsin, the equivalent till is inferred to be younger than the Winslow Till Member. Till thickness commonly is less than 6 m in Illinois and less than 2 m in Wisconsin; in west-central and central Illinois the average thickness of till (Hulick and Vandalia Till Members) is 15 m

tlcu CLAYEY TILL (Winslow Till Member of Glasford Formation in Illinois and its equivalent in Wisconsin)—Yellowish-brown to gray or dark-gray clay loam, silty clay loam, and silty clay. Intermediate lithic; dolomitic; nonsorted to very poorly sorted; pebbles and cobbles uncommon. Till commonly is covered by as much as 2 m of unmapped loess (el). Mapped areas include many small bedrock outcrops. In Illinois, the Winslow Till Member is inferred to be younger than the Ogle Till Member (tlcm); in Wisconsin, the equivalent till is inferred to be older than the Ogle Till Member

tarm Ground moraine—Thin and discontinuous. Thickness commonly less than 5 m in Illinois and less than 2 m in Wisconsin, but may exceed 20 m in buried valleys

tam End moraine—Occurs only in Wisconsin. Forms broad, deeply eroded ridges; includes some unmapped ice-contact sand and gravel. Thickness locally as much as 20 m

PLEISTOCENE

co COLLUVIUM—Red, reddish-brown, or brown, noncalcareous to weakly calcareous clay, sandy clay, and clayey sand. Poorly sorted to well sorted; massive to well stratified; clast-free to chaotic boulder rubble. Much of the colluvium is clayey residuum that moved downslope by solifluction and creep. Chert fragments in clayey colluvium commonly occur in lenses, layers, co-pebble bands parallel to slopes. Discontinuous, generally thin, patches of fissile, blocky, or stiff structureless residual clay with scattered chert fragments underlie the colluvium and overlie dolomite and limestone bedrock locally. Where derived chiefly from sandstone and quartzite bedrock, the colluvium is sandy clay or clayey sand, with angular to subangular boulders, cobbles, and pebbles of sandstone and quartzite. Locally, stratified blocks, block streams, and talus are composed of boulders and cobbles of chert, sandstone, quartzite, dolomite, and limestone. Colluvium occ