

**QUATERNARY GEOLOGIC ATLAS OF THE UNITED STATES
MISCELLANEOUS INVESTIGATIONS SERIES MAP I-1420 (NK-16)
CHICAGO 4° x 6° QUADRANGLE**

**Edited and integrated by
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The Quaternary Geologic Map of the Chicago 4° x 6° Quadrangle was mapped as part of the Quaternary Geologic Atlas of the United States. The atlas was begun as an effort to depict the areal distribution of surficial geologic deposits and other materials that accumulated or formed during the past 2+ million years, the period that includes all activities of the human species. These materials are at the surface of the earth. They make up the "ground" on which we walk, the "dirt" in which we dig foundations, and the "soil" in which we grow crops. Most of our human activity is related in one way or another to these surface materials that are referred to collectively by many geologists as regolith, the mantle of fragmental and generally unconsolidated material that overlies the bedrock foundation of the continent. The maps were compiled at 1:1,000,000 scale.

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. The map includes illustrations for:

- 1) INDEX MAP TO INTERNATIONAL MAP OF THE WORLD 1:1,000,000 TOPOGRAPHIC SERIES
- 2) LOESS DISTRIBUTION AND THICKNESS IN METERS
- 3) RELATIONSHIPS OF LATE WISCONSIN GLACIAL LOBES, SUBLOBES, AND ADVANCES WITHIN LOBES AND SUBLOBES
- 4) RESPONSIBILITY FOR STATE COMPILATIONS

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 silty clay and 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)—Brown to 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 variable laterally 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 (**hs**); commonly overlies outwash sand and gravel (**gg**, **gs**). Thickness generally 1-5 m
- hs 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 blowout 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 uplands 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 is more than 6 m
- ca COLLUVIUM AND SHEETWASH ALLUVIUM¹
- 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 to pebbles 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 underlie extensive, flat, low-lying areas formerly occupied by glacial lakes; some are in small, separate lake basins; a few are in slack-water valleys tributary to major river valleys. Thin and discontinuous in some areas. Deposits include some undifferentiated area of lake sand and gravel (**lsa**) and wave-washed or current-scoured till. Commonly covered by unmapped Richland Loess in Illinois, thin eolian sand (**es**), swamp deposits (**hs**), or alluvium (**al**). Thickness generally 1-10 m
- Included in this unit are deposits under Lake Michigan, consisting of reddish-gray to reddish-brown clay (Sheboygan and South Haven Members of the 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 foreset-bedded or crossbedded, fine to coarse sand or pebbly sand 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 foreset bedded, and other nearshore or shallow-water deposits of former glacial lakes; in Ohio, beach ridges and bars are shown by symbol where narrow. Mapped areas locally include some lake clay and silt (**lca**). In places sand and gravel are covered by unmapped thin. windblown sand (**ed, es**). 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 bouldery. 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 deltas, terraces, outwash plains, valley trains, outwash fans, and meltwater channel fills. Surfaces locally pitted by ice-block depressions. The deposits commonly are covered by unmapped thin loess or windblown sand (**ed, es**), and locally by swamp deposits (**hs**), 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 beds or lenses of granule to pebble gravel or lenses of silt. 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 (**hs**), 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 vary 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 (**hs**), peat (**hp**), alluvium (**al**), or till. In Illinois, all Wisconsin ice-contact sand and gravel deposits are too small to map separately 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, silty clay, and 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 outwash and 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
- tc Ground moraine—Thickness 2-20 m
- tc 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 pseudostratification or streaks of interstratified 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**)
- tca Ground moraine—Thickness 2-20 m
- tca 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 3-25 m
- tcb CLAYEY TILL—Chiefly brown or brownish gray to gray clay loam and silty clay loam; similar to unit **tca**, but less clayey
- tcb Ground moraine—Thickness 2-20 m
- tcb 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 3-25 m
- tl LOAMY TILL (Trafalgar Formation in Indiana; unnamed till in Michigan)—Yellowish-brown or brown to light- or dark-gray loam, silt loam, silty clay loam, and 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 indicate till was transported from north-northeast by Huron glacial lobe. Map unit includes small areas of clayey till (**tc**, **tcb**), sandy loamy till (**td**), and outwash or ice-contact sand and gravel (**gg**, **gs**, **kg**). Commonly, but not everywhere, covered by loess (**el**) as much as 1 m thick
- tl Ground moraine—Thickness 2-30 m
- tl End moraine—Forms broad, low ridges, commonly with hummocky topography. In Ohio, pebbles, cobbles, and boulders are much more abundant than in till of ground moraine; in Indiana boulder accumulations appear to be only a surface or near-surface phenomenon. Thickness 5-35 m

- tlg LOAMY 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
- tlg Ground moraine—Thickness 2-30 m
- tlg End moraine—Forms broad, low ridges with hummocky topography. Pebbles, cobbles and boulders are much more abundant than in till of ground moraine (2-100 x more abundant in Ohio); boulder accumulations appear to be only a surface or near-surface phenomenon in Indiana. 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
- td Ground moraine—Thickness 2-30 m
- td 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 Till 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 illite content; dolomitic. 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; illitic 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. Illitic 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
- tah Ground moraine—Commonly 2-15 m thick
- tah 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
- tah 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. Illitic 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
- tea Ground moraine—Thickness generally 3-6 m. Thickness of Haeger Till Member, including underlying and interbedded sand and gravel, averages 20 m
- tea End moraine—Thickness generally 6-10 m, including underlying and interbedded sand and gravel; locally 20 m
- taj 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 (**Ica**), included in map unit
- taj Ground moraine—Thickness 2-15 m
- taj End moraine—Thickness 10-30 m
- tan 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
- tan Ground moraine—Thickness averages 6 m
- tan End moraine—Thickness about 15 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; non-sorted 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
- tkb Ground moraine—Thickness averages 6 m
- tkb End moraine—Thickness as much as 15 m, but commonly thinner where till overlies older moraines or ridges
- tkc LOAMY TILL (Piatt Till Member)—Olive-brown to gray loam to silty clay loam. Illitic, dolomitic; nonsorted to poorly sorted. Mapped only in east-central Illinois
- tkc Ground moraine—Thickness 1-6 m
- tkc End moraine—Commonly overlies older moraines or ridges. Thickness about 6 m
- tkd 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. Illitic to intermediate illitic, 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 ablation drift in a small area in northeastern Illinois
- tkd Ground moraine—Thickness averages 10 m, but may be as much as 30 m in places
- tkd 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 illite; 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 illite; dolomitic; nonsorted to poorly sorted; loosely compacted. Pebbles and cobbles, dominantly of dolomite, abundant locally. Commonly thin and discontinuous; map unit includes small areas of older till of similar composition and of bedrock
- tej Ground Moraine—Thickness ranges from a veneer to 10 m
- tej End moraine—Mapped only in Wisconsin; characterized by distinct ridge topography with drumlinoid forms oriented northeast-southwest. End moraine includes some ice-contact sand and gravel. Thickness 10 to 20 m

WISCONSIN

- lcd LAKE SILT AND CLAY—(Part of Carmi Member of Equality Formation in Illinois) Yellowish-brown to brown or bluish-gray to gray silt and clay. Well bedded; commonly with minor fine sand. Commonly thinly laminated; locally varved. Most deposits are in basins formerly occupied by glacial lakes or in slack-water valleys tributary to major river valleys. Thin and discontinuous in some areas; locally greatly dissected. Commonly covered by unmapped thin eolian sand (**es**), loess (**el**), swamp deposits (**hs**), or alluvium (**al**). Thickness generally 1-6 m; locally more than 15 m

ILLINOIAN

- lci LAKE SILT AND CLAY (Teneriffe Silt in Illinois)—Yellowish-brown or brown to gray, massive silt and clayey silt with beds of sand and clay. Generally leached; calcareous in lower part only where thick. Map unit locally includes some outwash silt, sand, and gravel (**gsi**), windblown sand (**es**), and undescribed sheetwash alluvium. Sangamon Soil is developed in upper part of the unit. Commonly covered by loess (Peoria Loess and Roxana Silt) as much as 6 m thick. Distribution of loess more than 2 m thick shown by pattern. Thickness of silt and clay less than 1 m to 10 m

- lsp LAKE SAND AND SILT—Brown to reddish brown; poorly sorted; stratified. Underlies low terrace remnants bordering flood plains. Mapped only in southwestern Wisconsin. Locally covered by as much as 2 m of loess (**el**) or by alluvium (**al**) or undescribed colluvium. Probably deposited contemporaneously with glaciation. Thickness 0.5 to 4 m
- gsi OUTWASH SILT, SAND, AND GRAVEL (Pearl Formation in Illinois)—Chiefly yellowish brown to gray silt and pebbly sand. Generally more oxidized and more cemented than younger outwash sand and gravel (**gg**). Composition and bedding similar to that of unit **gg** in same area. Locally includes ice-contact sand and gravel (**kgi**). Commonly forms terrace remnants and outwash plains. Sangamon Soil is developed in upper part of unit. Commonly covered by as much as 6 m of loess (Peoria Loess and Roxana Silt). Distribution of loess more than 2 m thick shown by pattern. Thickness of outwash generally less than 12 m, but in major valleys may be much thicker
- ksi ICE-CONTACT SAND AND GRAVEL (Hagarstown Member of Glasford Formation in Illinois)—Chiefly well sorted, bedded sand and gravel. Unit includes some gravelly till. Occurs as kames, eskers, and crevasse fillings. Overlies till of Glasford Formation. Sangamon Soil is developed in upper part of the unit. Generally covered by as much as 6 m of loess (Peoria Loess and Roxana Silt). Distribution of loess more than 2 m thick shown by pattern. Thickness of sand and gravel probably greater than 30 m in some ridges

Till Members of Glasford Formation in Illinois and equivalent units in adjacent Wisconsin

All till units locally are covered by small unmapped deposits of outwash silt, sand, and gravel (**gsi**, **gg**), lake silt and clay (**lci**, **lcd**, **lca**); windblown sand (**es**), alluvium (**at**), or younger till, and commonly are covered by as much as 6 m of loess (Peoria Loess and Roxana Silt in Illinois). Sangamon Soil locally is developed in upper part of each till member. Average thickness of Glasford Formation is about 15 m; maximum thickness is probably greater than 30 m

- tal 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 (Esmond 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
- tke 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

- tkc Ground moraine—Thickness commonly less than 6 m
- tkc End moraine—Thickness 6-10 m
- tkm 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 illitic; 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 the 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 (**tam**); 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
- tam 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 illite; 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 (**tkm**); in Wisconsin, the equivalent till is inferred to be older than the Ogle Till Member
- tam 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

- cr COLLUVIUM¹—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, or 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 block fields, block streams, and talus are composed of boulders and cobbles of chert, sandstone, quartzite, dolomite, and limestone. Colluvium, occurs on nearly all upland slopes steeper than 3-5°. It commonly contains admixed clay derived from a cover of unmapped loess as much as 4 m thick. Locally the colluvium and unmapped loess are covered by unmapped eolian sand as much as 5 m thick. The colluvium in general is 0.5-2 m thick

QUATERNARY

- cc COLLUVIUM¹ (Mapped only in Illinois; equivalent to map units **cr** and **ca** elsewhere)—
Brown or reddish-brown, noncalcareous to weakly calcareous clay to sandy clay. Nonsorted; nonstratified to faintly stratified. Commonly contains angular to subangular clasts of dolomite and chert. Thin and discontinuous, with abundant or extensive bedrock outcrops. Occurs chiefly at bases of slopes steeper than 3-5°. Colluvium commonly contains admixed clay derived from unmapped loess that locally mantles it. Both the colluvium and unmapped loess in turn are covered locally by unmapped eolian sand as much as 5 m thick. Thickness of colluviurn generally 0.5-2 m

PRE-QUATERNARY

R BEDROCK

¹*For purposes of this map, colluvium is a general term for material transported and deposited by masswasting processes, chiefly solifluction and creep. Sheetwash alluvium is material transported and deposited by running water, chiefly by sheetflow or rill wash. Residuum is material derived in place by solution and decomposition of bedrock, with no appreciable lateral transport.*

NOTE: All units listed as EARLY WISCONSIN on the original map are presently recognized as being ILLINOIAN. Unit **lcd** listed as WISCONSIN is probably ILLINOIAN and may be the same map unit as **lci**.

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LOCATION OF IMPORTANT STRATIGRAPHIC SECTIONS

- 1 Tindall School Section, Illinois--Type section for Banner and Glasford Formations and Peoria Loess; paratype section for Illinoian Stage and holostratotype section for Kansan Stage of Illinois State Geological Survey (Willman and Frye, 1970; Follmer and other, 1979)
- 2 Jubilee College Section, Illinois--Type section for Radnor Till Member of Glasford Formation; type section for Jubileean and Monican Substage of Illinoian Stage of Illinois State Geological Survey (Willman and Frye, 1970; Follmer and others, 1979)
- 3 Farm Creek Section, Illinois--Type section for Robein Silt and Farmdale Soil; type section for Farmdalian Substage of the Wisconsinan Stage of Illinois State Geological Survey; hypostratotype for Sangamon Soil (Willman and Frye, 1970; Follmer, 1978; Follmer and others, 1979)
- 4 Wedron Section, Illinois--Type section for Wedron and Peddicord Formations (Willman and Frye, 1970; Willman and others, 1971)
- 5 Emerald Pond Section, Illinois--Type section for Glenburn, Batestown, and Snider Till Members of Wedron Formation (Johnson and others, 1971; Johnson and others, 1972)
- 6 Harmattan Strip Mine, Illinois--Type section for Hegeler Till Member, Harmattan Till Member, and Belgium Member of Banner Formation (Johnson, 1971; Johnson and others, 1971; Johnson and others, 1972)
- 7 Opossum Run Section, Indiana--Snider, Batestown, and Fairgrange Till Members of Lake Michigan lobe Wedron Formation overlies Illinoian Vandalia Till Member of Glasford Formation, "Kansan" Hillery and Harmattan Till Members of Banner Formation, and an older "Nebraskan" (?) till (N. K. Bleuer, unpub. data)
- 8 Lovers Leap Section, Indiana--Huron lobe till of Trafalgar Formation overlies Lake Michigan lobe Snider and Fairgrange Till Members of Wedron Formation (Bleuer, 1975)
- 9 Adams Mill Section, Indiana--Huron lobe till of Trafalgar Formation overlies involuted muck, a buried soil, sand, two Illinoian tills, and a pre-Illinoian (?) till (N. K. Bleuer, unpub. data)
- 10 Lagro Section, Indiana--Type section for Lagro Formation (Wayne, 1963)
- 11 New Holland Section, Indiana--Type section for New Holland Till Member of Lagro Formation (Wayne, 1963)