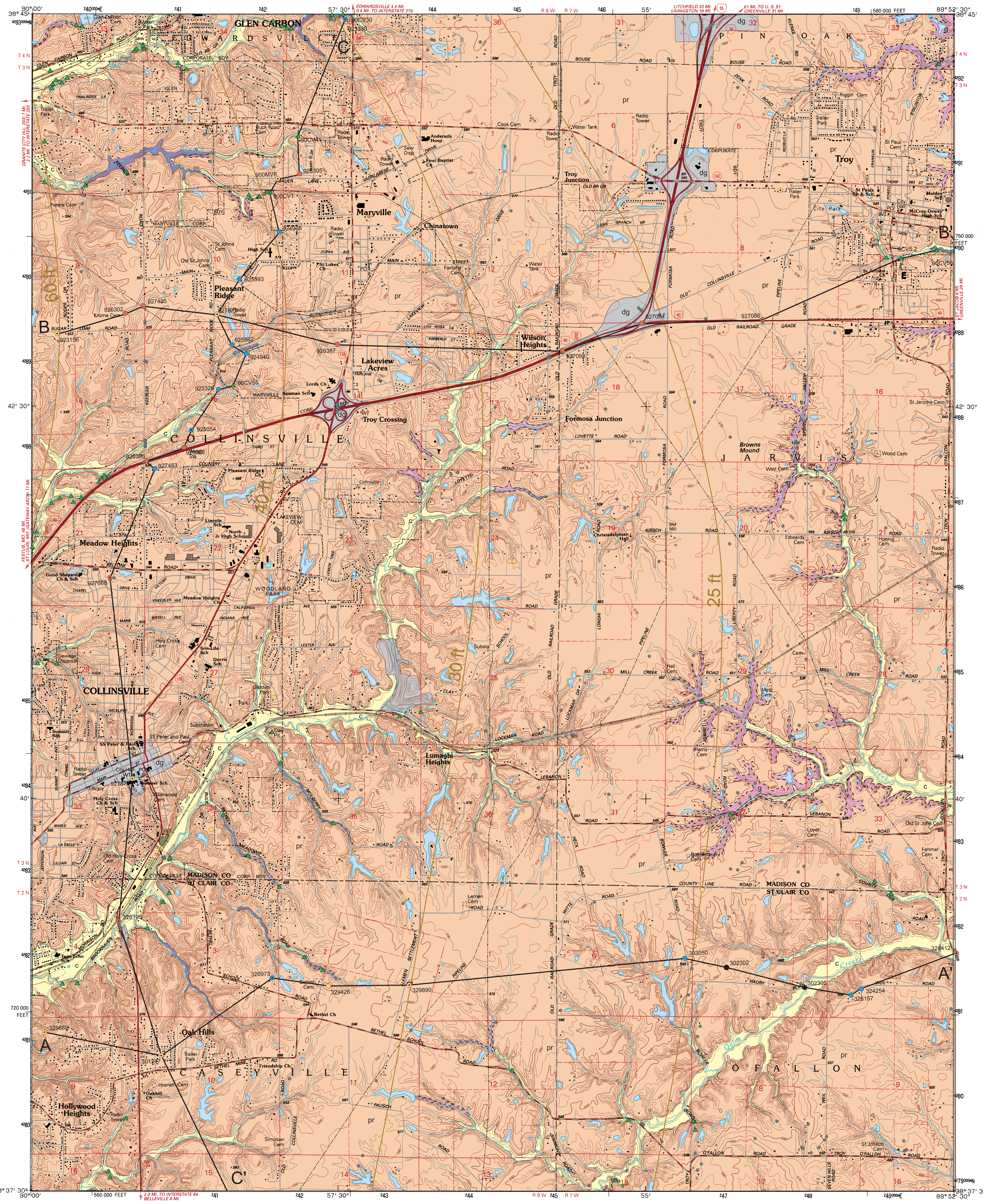
Department of Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
William W. Shilts, Chief

Surficial Geology of Collinsville Quadrangle
Madison and St. Clair Counties, Illinois

Illinois Preliminary Geologic Map
IPGM Collinsville-SG

Andrew C. Phillips
2004



MATERIAL PROPERTIES	UNIT	OCCURRENCE AND INTERPRETATION
HUDSON EPISODE (0 to ~12,000 years before present)		
Heterogeneous textures from silt to sand to rubble; up to 20 ft thick	**disturbed ground** dg	**Man-made materials** in road interchanges, landfills, urban areas, spoil piles, and borrow pits
Silt, silty clay loam, and silty clay; local sand and gravel; massive to well stratified; gray to brown; soft to moderately stiff; 5-25 ft thick	**Cahokia Formation** c	**Modern stream sediment** in creek floodplains and lower valley reaches; mainly redeposited loess eroded from the uplands, but intercalated with isolated sand and gravel bodies derived from surrounding till and bedrock; locally contains historical debris
WISCONSIN EPISODE (~12,000 TO 75,000 years before present)		
Silt to silt loam; massive to faintly stratified with dark organic layers; yellow brown to pinkish brown to gray; dolomitic, terrestrial gastropods common; weathered in upper 2 to 5 ft; 5-80 ft thick	**Peoria Silt and Roxana Silt** pr	**Wind-blown sediment** that blankets uplands, thins eastward. Deposited as loess deflated from Mississippi River floodplain; may include slope deposits; modern soil developed in surface; upper portion is Peoria Silt (tan to gray), lower portion is Roxana Silt (pink to tan-gray with higher clay content); sparse to abundant granules to pebbles in lowermost portions of the Roxana Silt interpreted as slope deposits on the Sangamon Geosol surface
Silt to clayey silt; massive to laminated; gray to brown; calcareous; contains sparse gravel clasts, aquatic gastropod and bivalve shells, and sparse to abundant wood; 20-30 ft thick	**Equality Formation** *cross sections only* e	**Lake sediment** in terraces that are blanketed by Peoria and/or Roxana Silt or buried by Cahokia Formation in creek valleys; deposited in tributary valleys of Mississippi River; much may be redeposited loess from surrounding uplands
ILLINOIS EPISODE (~130,000 to 200,000 years before present)		
silt to silt loam; massive; strong brown; weathered; less than 10 ft thick	**Teneriffe Silt** *cross sections only* t	**Wind-blown sediment** with a patchy distribution below Peoria and Roxana Silts and over Glasford Formation; contains well-expressed Sangamon Geosol; when < 5 ft thick, included in the Glasford Formation; loess deposited during waning of Illinois Episode Glaciation
Diamicton, loam to silt loam; massive but with lenses of stratified sand and gravel, clasts to pebble size, wood common; yellow brown to gray; weathered in upper few ft; 5-50 ft thick	**Glasford Formation** g	**Till**, deposited during advance of Illinois Episode glacier; pervasive below the Peoria and Roxana Silts; on bedrock where bedrock surface is relatively high; crops out along steep valley walls, and more commonly to the east where loess cover is relatively thin; lenses of glacial river sand and gravel facies are identified in cross sections by stipple; Sangamon Geosol up to 6 ft thick developed in upper portions; also includes thin occurrences of the overlying Teneriffe Silt
Silt, massive to laminated; laminated silt locally fossiliferous to organic and intercalated with isolated stratified sand and gravel facies; sharp contacts; brownish orange to gray, slightly weathered to unweathered; 5-30 ft thick	**Petersburg Silt** *cross sections only* pb	**River, lake, and wind-blown sediment**; below the Glasford Formation; mainly buried but exposed in few outcrops too small to map in northwest and southeast; loessial where massive, river or lake sediment where laminated; lake sediments deposited in tributary valleys of ancestral Mississippi River
PRE-ILLINOIS EPISODE (before ~200,000 years before present)		
Diamicton, silty clay loam, includes local bedrock (shale) fragments; strongly weathered (olive brown to yellowish brown) to unweathered (gray); 5-15 ft thick	**Omphghent member** (informal) Banner Formation *cross sections only* b-o	**Mainly till** deposited during advance of a pre-Illinois Episode glacier; found in boreholes penetrating buried valleys and in outcrop in northwestern creek valleys; Yarmouth Geosol developed in upper part; includes overlying silty clay with sparse pebbles (loess) with Yarmouth Geosol
Silt loam to silty clay loam; massive; yellow brown to strong brown, weathered; less than 20 ft thick	**Harkness Silt Member** Banner Formation *cross sections only* b-h	**Lake and wind-blown sediment** deposited in bedrock valleys, overlain by Banner Formation diamicton
Silty clay, stratified, and diamicton, silty clay loam and pebbly loam; includes shell and wood fragments; olive colors; leached to calcareous; less than 10 ft thick	**Canteen Creek member** (informal) Banner Formation *cross sections only* b-c	**River, slope and residual sediment;** below all other Quaternary units; weak paleosol developed in upper few feet
UNDIFFERENTIATED		
Silt, sand, silty to sandy diamicton	*cross sections only*	**Till, river, or wind-blown sediment**; in areas with sparse data or where boring and outcrop observations are not correlatable; may include Illinois Episode or pre-Illinois Episode deposits
PRE-QUATERNARY		
Pennsylvanian shale, siltstone, sandstone	**bedrock**	**Rock**; exposed in incised valley walls and along some creek bottoms

DATA POINTS

- Coal boring
- Geotechnical boring
- Outcrop
- Stratigraphic boring
- Water well boring
- Observation reaches bedrock
- G Natural gamma log available
- S Sample set available
- 924387 Points identified in cross sections
- 924387 ISGS County Number with abbreviated County Code
- 900CV1 Field note number
- Other boring with verified location

OTHER MAP SYMBOLS

- 25 ft — Maximum loess thickness contours (in feet, arbitrary increments)
- A A' — Line of cross section
- Higher confidence contact
- Lower confidence contact

Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. Topography compiled from aerial photographs taken 1986. Field checked 1988. Map edited 1991.

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator
10,000-foot ticks: Illinois State Plane Coordinate system, west zone (Transverse Mercator)
1,000-meter ticks: Universal Transverse Mercator grid, zone 16

Recommended citation:
Phillips, Andrew C., 2004, Surficial Geology of Collinsville Quadrangle, Madison and St. Clair Counties, Illinois: Illinois State Geological Survey, Illinois Preliminary Geologic Map, IPGM Collinsville-SG, 1:24,000.

SCALE 1:24 000
1 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

BASE MAP CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Released by the authority of the State of Illinois: 2004

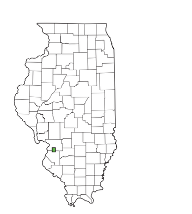
Geology based on fieldwork by A. Phillips, 1999-2000.

Digital cartography by A. Phillips and M. Barrett, Illinois State Geological Survey.

This research was supported in part by the Illinois Department of Natural Resources, Office of Water Resources Agreement S99-313, and by the U.S. Geological Survey, National Cooperative Geologic Mapping Program under USGS award number 00HQAG0151.

This Illinois Preliminary Geologic Map (IPGM) is a lightly edited product, subject to less scientific and cartographic review than our Illinois Geological Quadrangle (IGQ) series. It will not necessarily correspond to the format of IGQ series maps, or to those of other IPGM series maps. Whether or when this map will be upgraded depends on the resources and priorities of the ISGS.

For more information contact:
Illinois State Geological Survey
615 East Peabody Drive
Champaign Illinois 61820-6964
(217) 244-2414
http://www.isgs.uiuc.edu



ADJOINING QUADRANGLES

1	2	3
4		5
6	7	8

1 Wood River
2 Edwardsville
3 Marine
4 Monks Mound
5 St. Jacob
6 French Village
7 O'Fallon
8 Lebanon

MAGNETIC NORTH
TRUE NORTH
1/2°
APPROXIMATE MEAN DECLINATION, 2004

ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- Interstate Route
- U.S. Route
- State Route
- County Route

Purpose and Map Use. This map depicts geological materials found within 5 feet of the ground surface. Cross sections show the extent of these surficial units at greater depths, as well as the occurrence of buried units. The map and cross sections together show the essential distribution in three dimensions of geologic materials to bedrock. Previous investigations of the area have focused on individual outcrops (e.g., McKay 1986), have included only the upper portion of the sediment package (McKay 1977), or are at small scale (McKay et al., unpublished map). This project built upon the earlier work by adding many new observations of the surface and subsurface, incorporating them into a digital database, and interpreting them at large scale. Several bedrock valleys and their sedimentary fill were distinguished, and areas with relatively good and relatively poor geologic control were defined. Prediction of the occurrence of units far from the lines of cross section should be made with care. Additional studies are necessary if greater detail is desired. This product can be used for preliminary geologic assessments of construction siting issues, geologic hazards, groundwater resources, environmental protection, and other activities. The work is part of the ISGS Metro-East mapping program, intended to provide critical geologic data in this rapidly developing area. Mapping of this quadrangle was originally funded by the Office of Water Resources (Illinois Department of Natural Resources) for use in estimating landslide potential. Additional mapping was conducted under the U.S. Geological Survey STATEMAP program.

Preparation Procedures. A preliminary surface map was based upon soil series parent materials compiled from soils surveys (USDA 1999, 2001) and an unpublished stack unit map (McKay et al., unpublished). The preliminary map was modified with outcrop observations and interpretations of well data. Well data sources included stratigraphic borings acquired for this project, and geotechnical, water, and coal boring records stored in the ISGS Geological Records Unit. Some landforms were interpreted by airphoto analysis. Computer models were used to construct the bedrock surface and predict areas of outcrop of some map units. The quality of the geologic and locational descriptions of archived data varies considerably in detail and accuracy. Outcrops, ISGS boring descriptions, and geotechnical logs typically provided the most detail and could be located most accurately. Water-well descriptions provided by drillers were generally of low value because they distinguished few lithological boundaries, typically only the drift/bedrock interface, and tended to be cursorily located. A significant exception were descriptions provided by Kohnen Concrete Products, a water well drilling company, which were useful in distinguishing several units within the drift and could be accurately located. Positions of well and outcrop locations shown on the map are based upon the best available information for each point. Horizontal accuracy of points used in the cross sections varies from approximately 5 to 100 ft. Surficial contacts were correlated between observation points by interpreting landform-sediment relationships on topographic maps; contacts are dashed where not supplemented with nearby outcrop or borehole information. Buried unit boundaries are assumed to be well known within 1000 ft of each observation point. Boundaries extending further than that in the cross sections are dashed. Stratigraphic nomenclature follows Hansel and Johnson (1996) and Willman and Frye (1970), as appropriate.

Regional Setting. The Collinsville Quadrangle is in southwestern Illinois, about 15 miles east of St. Louis, Missouri. The uplands are a continuance of the Illinoian Till Plain landscape to the east, but are deeply incised by small streams, especially on the west towards the bluff line, which overlooks the extensive American Bottoms floodplain of the Mississippi River (Fig. 1). A narrow area of undissected uplands trends north to south across the map. This saddle divides streams flowing into the Mississippi Valley from streams flowing into the Silver Creek valley, a tributary of the Kaskaskia Valley, to the east. Stream valleys are steep-walled with narrow, flat bottoms. A curved ridge of glacial drift, part of a system of elongate ridges that trend northeast to southwest in southern Illinois, crosses the southeast corner of the quadrangle. The bedrock surface roughly parallels the land surface but has higher relief, and topographic highs and lows are not coincident (Fig. 2). Some modern streams coincide with bedrock valleys, but other bedrock valleys are buried by Quaternary sediment (cross sections, Figs. 2 and 3).

History. The Quaternary sediment overlying bedrock was deposited during at least three episodes of glaciation, intervening, relatively warm, interglacial episodes, and the postglacial episode during which people have significantly modified the landscape. Before the earliest known Quaternary glaciation, erosion had exposed much of the land surface to bedrock and created deep stream valleys (Fig. 2). During the pre-Illinois and the Illinois glacial episodes, glaciers flowed into the map region from the northeast. The glaciers sculpted the pre-existing landscape and left deposits of diamicton, a mixture of rocks, sand, silt, and clay deposited mainly from glacial ice. Sand and gravel were deposited from meltwater streams. The ridges of drift in the southeast were formed by the Illinoian glacier, through several possible modes of origin (Ball 1940; Heigold et al. 1985; Jacobs and Lineback 1969; Leighton 1959; Stiff 1996). Silt and clay were deposited in lakes that formed in valleys tributary to the Mississippi and Silver Creek valleys when they were flooded with glacial meltwater and meltwater sediment. Just after glaciation, silt was eroded by westerly winds off exposed sandy floodplains in the Mississippi Valley, and then deposited across the upland landscape as blankets of loess. Between glaciations, streams continued to erode some sediment out of their valleys, and soils developed on the fresh land surface.

During the last (Wisconsin Episode) glaciation, ice only advanced into the northeastern quadrant of Illinois, reaching about 80 miles to the northeast of Collinsville. Its main influence in this area was to discharge large volumes of sediment and water into the Mississippi and Kaskaskia Valleys. As during the earlier glaciations, filling of the trunk valleys caused lakes to form in tributary valleys, and a thick blanket of loess derived from floodplain sediments was deposited over the region. Postglacial river sediment is derived mainly from erosion of the loess-covered uplands, but erosion has also exposed older Quaternary sediments and bedrock. Clearing of forests during early European colonization and possibly earlier during Cahokia civilization (~900 – 1200 A.D.) led to extensive upland erosion and sediment accumulation in creek valleys. Relatively recent stream incision into these sediments and older deposits is attributed to large water discharges with relatively low sediment loads brought about by recent climate changes, landuse changes, or both.

Sediment Assemblages and Properties. Geologic materials found within the quadrangle are generally fine-grained, and may be difficult to distinguish from one another except through combinations of geotechnical and compositional properties and stratigraphic position (Table I).

Uplands. Most of the upland surface is covered by loess. Dashed brown lines on the map are contours of the maximum expected loess thickness on the uppermost uneroded portions of the uplands, and show how the package thins eastward exponentially. The Peoria Silt and the underlying Roxana Silt are not differentiated here, but the Roxana Silt may be exposed in eastern portions of the quadrangle where erosion has lowered the upland surface. Over bedrock highs, loess is typically underlain by dense, loamy diamicton intepreted to be till of the Glasford Formation, which in turn overlies bedrock. The texture of Glasford Formation diamicton fines slightly to the southwest. The upper few feet of the Glasford Formation is weathered to a reddish brown color with well-developed clay coatings along fractures and common iron-manganese concentrations (Fig. 4). These advanced B-horizon features are typical of the Sangamon Geosol. A prominent stone line may be present in the upper part, and the A-horizon is commonly missing.

Uplands – Buried Valleys. A variety of materials may be encountered in buried bedrock valleys. Below the Glasford Formation are found mainly silty sediments deposited from wind, rivers, lakes, and glaciers. Lake sediment of the Petersburg Silt is similar in lithology and origin to that the Equality Formation, but it tends to be stiffer and have a lower water content (Table I). The Banner Formation is comprised of till (Omphghent member, McKay 1986), lake sediments or loess (Harkness Silt Member), and river sediments (Canteen member). The Banner Formation is distinguished stratigraphically by a soil profile developed in the upper part. In this area, this Yarmouth Geosol exhibits more gleyed characteristics than the younger Sangamon Geosol (Fig. 4), and exhibits a thick, typically amalgamated, B-horizon when the profile is completely preserved (Grimley et al. 2002). McKay (1986) differentiated several pre-Illinoian loess and till units separated by paleosols, but these have been included here in the Omphghent and Harkness Silt members.

Modern Stream Valleys. South-facing walls of modern stream valleys tend to be gently sloping with thick accumulations of surficial slope sediment, whereas north-facing walls tend to be steeper, with outcrop of typically buried Quaternary sediments and bedrock. The asymmetry developed over thousands of years because small differences in insolation lead to slightly dryer, more variable climates on south-facing slopes than on north-facing slopes. The microclimatic differences in turn affect mechanisms and rates of mass wasting (Melton 1960; Dohrenwend 1978). The surficial deposit in the valleys is river sediment derived mainly from loess. The river sediment merges with slope sediment in the upper stream tributary reaches and along valley walls, and thickens downstream. In middle to lower reaches, many streams have eroded down to a resistant layer, either till or bedrock. In the lower reaches of larger streams, lake sediment of the Equality Formation or Petersburg Silt may be found below the Cahokia Formation (e.g., Canteen Creek, cross section C-C') or in terraces where it is covered by loess.

Geologic Hazards and Resources.
Mass Wasting. Mass wasting along steep valley walls is a significant geological hazard and has been identified as a major source of the sediment infilling wetlands in the American Bottoms west of the map area (Fig. 1). Slumps, rotational failures in sediment along a curved slipface, have been observed at many locations along creek cutbanks. The slumps occur within the loess or possibly along the Sangamon Geosol surface. A perceived increase in slump frequency over time has been attributed to increasing storm frequency and construction practices (Krumm, 1984; J. Harryman, NRCS, pers. com., 1999). Sierra and Straub (in review) found that slumping along stream banks commonly occurred during falling flood stage when high water levels supporting the base of slopes decreased.

Mines and Mine Subsidence. Much of the western and northeastern portions of the Collinsville Quadrangle are underlain by coal mine excavations (Chenoweth et al. 2000). Subsidence of these mines is a serious concern. One such event occurred behind Doris School, S27 T3N R8W (B. Bauer, ISGS, pers. com. 2002). Open pit mining occurred in Canteen Creek valley. The large area of made land north of Lumaghi Heights (S26 T3N R8W) is spoil from the Lumaghi mine that was reclaimed by IDNR in the 1980's.

Construction Materials Resources. Many active to intermittently active borrow pits developed in the loess occur across the Collinsville Quadrangle. The material is used locally for varied purposes from landscaping to fill. The Peoria Silt is more valuable than the Roxana Silt because the lower proportion of clay makes it drier and more friable. These properties make it desirable for landscaping because it is fertile and spreads easily. The Roxana Silt is used more frequently for fill.

Groundwater Resources. There are limited groundwater resources in the drift of the Collinsville Quadrangle. Many rural residences use large-diameter wells bored to the top of the Glasford Formation, which serves as an aquitard, but this technique has lost favor to deep drilling to bedrock. Most municipal supplies are now obtained from the thick sands and gravels in the American Bottoms. Contamination potential for the bedrock aquifers is low where loess and till deposits are thickest and moderate where surficial deposits are thin or bedrock crops out (Berg et al. 1984). In addition, the Sangamon Geosol provides a thick clay-rich horizon, up to 3 ft thick, that could substantially retard downward groundwater flow. By contrast, the many small lenses of sand in the upper part of the Glasford Formation may provide pathways for contaminants to underlying layers.

Acknowledgments. I thank the owners who graciously allowed access to outcrop and permitted drilling on their properties. Many field hands helped collect the field data and test samples, including Laura Swan and Andrew Parrish. Antigone Dixon-Warren collected several downhole natural gamma logs and Dave Grimley described split spoon samples for 927668 as they were obtained by contracting engineers. Field visits by Grimley, Leon Follmer, Brandon Curry, and Don Keefer led to valuable discussions. ISGS drillers Charles Dolan, Steve Wildman, and Jack Aud obtained most of the new borings. Jerry Berning, NRCS, provided unpublished field notes and helped with land owner relations. Portions of the mapping were funded by IDNR-OWR and USGS STATEMAP.

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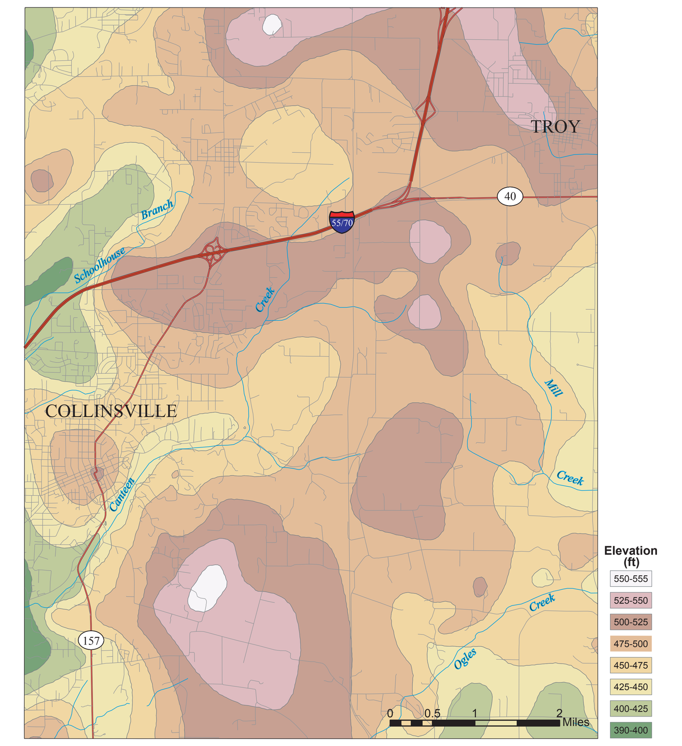

Figure 2. Although similar to the modern topography, the bedrock surface includes several valleys that are buried and filled with river, lake and glacial sediment (see cross sections). Where modern stream valleys overlie bedrock valleys, valley axes are not conicident.

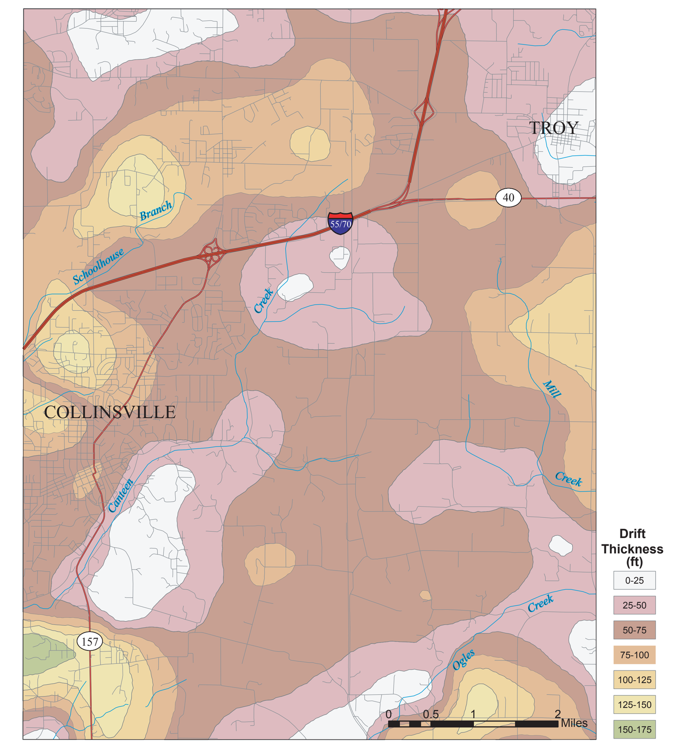

Figure 3. Drift is thickest in buried bedrock valleys (Fig. 2), and thinnest over bedrock highs and where erosion has removed the drift, particularly along north-facing stream valley walls.

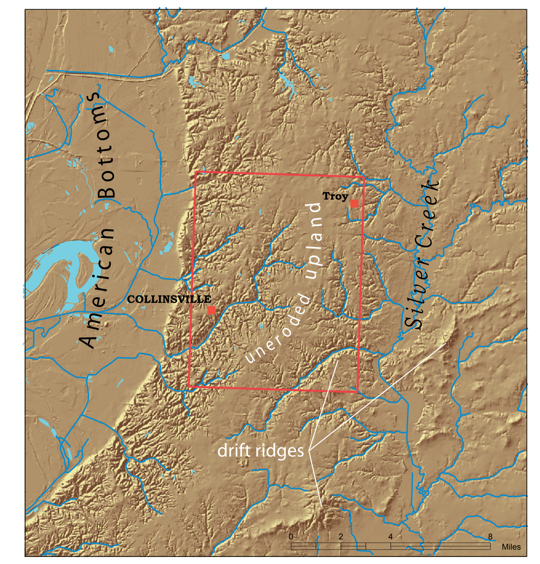

Figure 1. The Collinsville 7.5 minute quadrangle (red rectangle) lies just east of the bluff overlooking the wide Mississippi River floodplain named the American Bottoms. The uplands are a portion of the Illinoian Till Plain and are deeply dissected by small streams.

TABLE I. CHARACTERISTIC MATERIAL PROPERTIES

Stratum	Color	Texture	Composition	Strength (Qu*, tsf) average (range, n)	Water Content (%) average (range, n)
Cahokia Formation	brown to gray	gravel to clay, fining upwards	leached of carbonates	0.5 (0.32-0.62, 13)	27.3 (15-32, 15)
Peoria Silt	tan	silt, massive	dolomitic, abundant expandable clays	1.4 (0.3-3.3, 60)	26.5 (20-34, 19)
Roxana Silt	slightly pink to tan	silt, massive	abundant expandable clays and kaolinite	1.6 (0.5-3.2, 111)	26.4 (17-37, 36)
Equality Formation	gray, tan, slightly pink	silt, silty clay, clay, fine sand, massive to laminated	abundant expandable clays	0.71 (0.37-1.16, 35)	32.8 (28-41,34)
Teneriffe Silt	brown to olive gray	silt, massive	weathered	2.5 (1.8-3.1, 2)	24 (24-24, 2)
Glasford Formation	yellow brown to gray	loamy diamicton with sand and gravel lenses	dolomitic, 40-60% illite	3.4 (0.5-9.5, 240)	17.6 (9-30, 65)
Petersburg Silt	orange brown, tan, gray	silt, massive, thin bedded, laminated	dolomitic, 40-60% illite	3.6 (1.2->4.5, 6)	19.5 (16-24, 6)
Banner Formation	orange brown to gray	silty diamicton	calcitic, abundant expandable clays	3.0 (1.2->4.5, 6)	19.5 (17-21, 6)
Harkness Silt	gray brown to greenish gray	silt, massive to stratified	variable	3.7 (1.5->4.5, 6)	21.0 (18-24, 6)
Bedrock	gray, brown, black	shale, siltstone, limestone, coal	may be weathered	>5	high when weathered

Source: IDOT and other geotechnical reports within quadrangle, ISGS measurements
* includes both laboratory and hand penetrometer results

OTHER CROSS SECTION SYMBOLS

- Interfingering contact
- Weathered sediment
- Fine grained sediment, stratified
- Fine grained sediment, massive
- Coarse grained sediment, stratified
- Diamicton
- Boring into bedrock deeper than shown

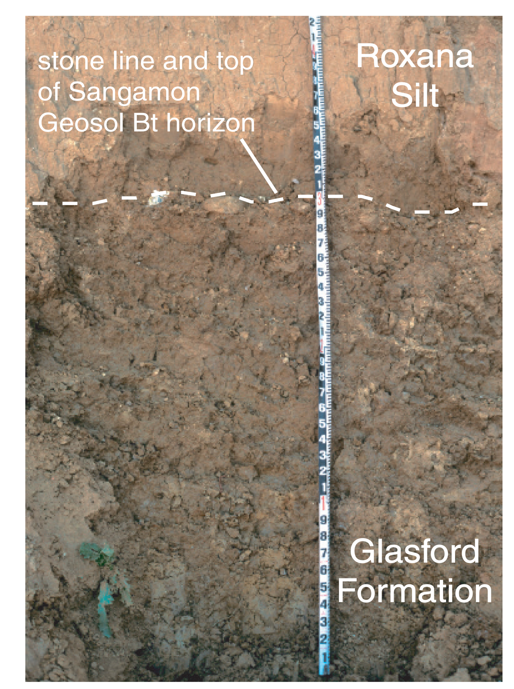

Figure 4. Contact between the Roxana Silt and the Glasford Formation. The contact is often distinguished by a thin layer of pebbles ("stone line") that was formed during development of the Sangamon Geosol. The staff gauge is marked in feet.