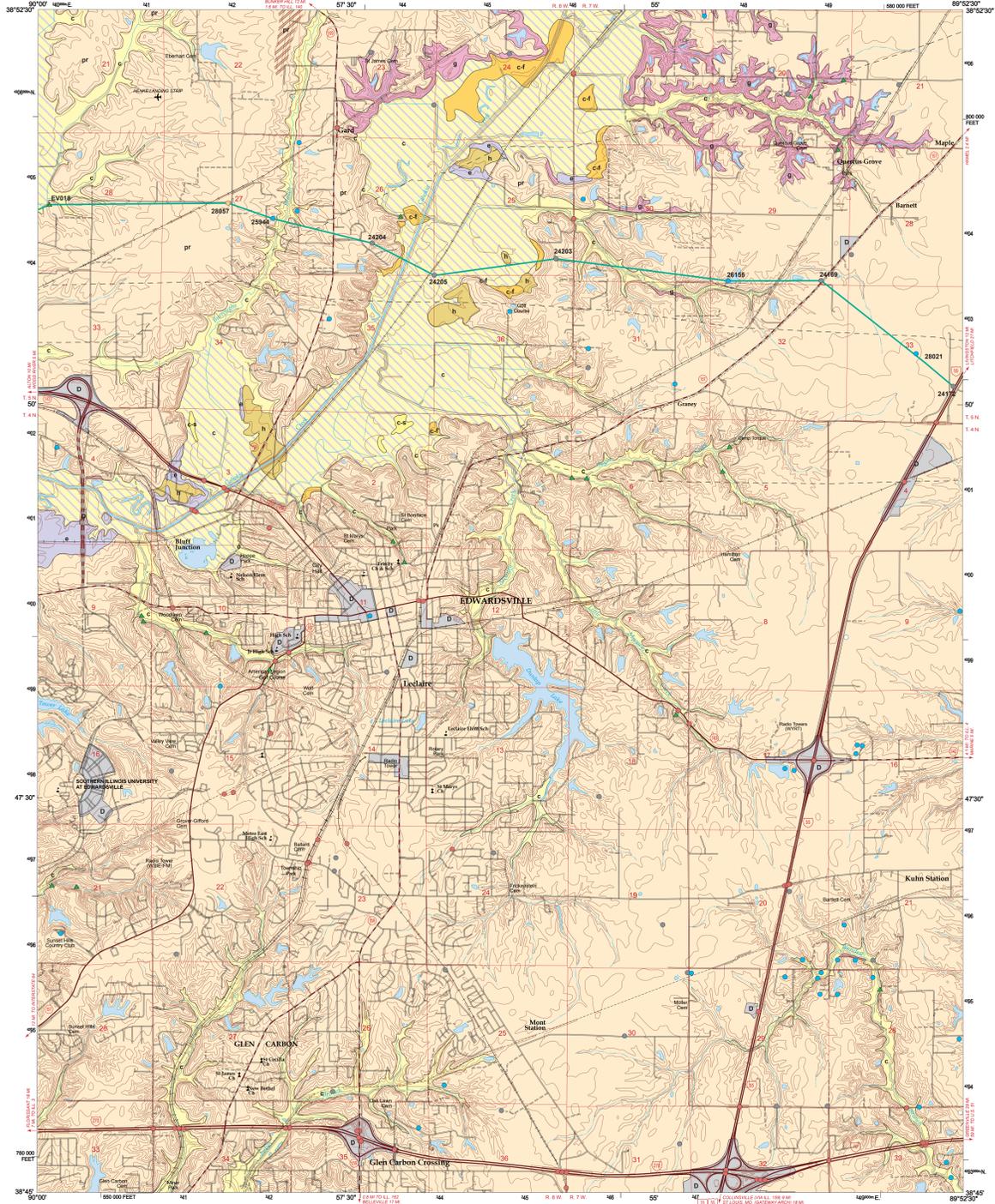


# SURFICIAL GEOLOGY OF EDWARDSVILLE QUADRANGLE

## MADISON COUNTY, ILLINOIS

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 2003



### QUATERNARY DEPOSITS

| Description  | Unit   | Interpretation/Occurrence   |
|--|--|---|
| <b>HUDSON EPISODE (~12,000 years before present (B.P.) to today)</b><br>heterogeneous textures from silt to sand to rubble; up to 20 ft thick  | Disturbed Ground<br>D  | Man-made materials in road interchanges, landfills, urban areas, spoil piles, and borrow pits   |
| silty clay to silt loam to sandy loam to fine sand; local sand and gravel lenses; gray to brown, massive to well stratified, leached, soft to moderately stiff; up to 30 feet thick  | Cahokia Formation (where sediment by Equality Fm.)<br>c                | river deposits in stream valley floodplains; contains significant redeposited loess; coarse grained in lower portions where sediment derived from till and buried river deposits; sandy to gravelly in upper reaches of smaller tributaries where incised into till                       |
| silt loam to sandy loam, stratified; gray to pale brown; up to 15 feet thick   | Cahokia Formation (fan facies)<br>c-f                                  | fans deposited from small tributary streams and slope wash; mainly redeposited loess; immediately underlain by clayey or sandy river sediments; occurs at foot of steep slopes and mouths of tributaries  |
| loam, sandy loam, to loamy sand; crudely to well stratified; up to 15 feet thick   | Cahokia Formation (sandy facies)<br>c-a                                | river sediment deposited in channels or natural levees; mapped in Cahokia Creek   |
| <b>WISCONSIN EPISODE (~75,000 - 12,000 years B.P.)</b><br>silty clay to silt loam to fine sand; gray to tan, massive to stratified, stiff, leached to calcareous; up to 25 feet thick  | Equality Formation<br>e  | lake deposits; buried below Cahokia Formation in the Cahokia, Mooney, and Indian Creek Valleys; also in discontinuous terraces along Cahokia Creek; deposited by backflooding of Mississippi River during glacial episodes; terraces include a cover of 3 to 6 feet of loess              |
| loam, sandy loam, to loamy sand; yellow brown; stratified; calcareous; thickness not known   | Henry Formation<br>h   | river sediment deposited during glacial episodes; in discontinuous terraces along Cahokia Creek, associated with silt of Equality Formation; buried by loess up to 3 ft thick   |
| silt to silt loam; yellow-brown to gray to pinkish brown, massive to blocky structure, friable, mainly leached but may be dolomitic; contains modern soil solum in upper 2 to 5 feet; up to 30 feet thick  | Peoria and Roxana Sills (disturbed where underlain by Pearl Fm.)<br>pe | loess, but including some slope deposits; upper and thicker portion is Peoria Silt (tan to gray); lower portion is Roxana Silt (pink to tan-gray) but may be surficial unit on eroded slopes to east; thickest on unroaded uplands in southwestern areas of quadrangle and fins eastwards |
| <b>ILLINOIS EPISODE (~200,000 - 130,000 years B.P.)</b><br>sandy loam to gravel; may be more clayey in upper few feet where it may contain a buried soil; leached to calcareous; up to 25 feet thick   | Pearl Formation (in cross sections only)<br>pe                         | outwash deposited by glacial meltwater streams; contains Sangamon Geosol in upper portions except where eroded; buried in Cahokia Creek valley fit and below loess in upland ridge  |
| pebbly loamy diamict; silt, sand and gravel lenses within or at the base of the unit; up to tens of feet wide and 20 feet thick; olive to gray, upper few feet is weathered brown, softer and more clay rich; lower portion is commonly more massive, stiff, and calcareous; up to 80 feet thick | Glasford Formation<br>g  | till and ice marginal sediment; weaker and more moist upper portion is basal or supraglacial till; lower portion is dense basal till; pervasive below Peoria and Roxana Sills and over all other Illinois and older formations; Sangamon Geosol developed in upper few feet               |
| silty clay loam, silt loam, clay loam diamict, with silt and silt beds; massive to laminated, grayish brown to dark grayish brown, sparse wood fragments, calcareous; up to 6 feet thick   | Petersburg Silt (in cross sections only)<br>pt                         | lake sediment, probably with lessial component; found in one borehole but may be more extensive   |
| <b>PRE-ILLINOIS (~500,000 years B.P.)</b><br>pebbly silty clay loam diamict; contains some sand lenses; brown, orange-brown or gray, rarely is olive or greenish; massive to weakly laminated, leached to calcareous; up to 90 feet thick  | Banner Formation, Omphgnet member (in cross sections only)<br>bo       | till and ice marginal sediment; Yarmouth Geosol may be developed in upper 10 feet but commonly truncated; sometimes is more clayey in lower portions  |
| silt, silt loam, clay, and very fine sand; laminated to massive; gray brown, gray, or pinkish; abundant fossils include gastropod shell and wood; calcareous; up to 40 feet thick  | Banner Formation, Harkness Silt Member (in cross sections only)<br>bh  | lake and river sediment deposited in deep bedrock valleys   |
| silty clay to silty clay loam, with fine sand to gravel near base of unit; weakly stratified to well stratified; olive gray to olive brown, leached; up to 25 feet thick   | Banner Formation, Canteen member (in cross sections only)<br>bc        | mainly fine-grained river and lake deposits; fines upwards; weak paleosol developed throughout; overlies bedrock  |
| <b>PALEOZOIC BEDROCK</b><br>predominantly shale, clay-rich, greenish-gray, laminated to bedded; noncalcareous, but may include limestone, siltstone or coal  | Near-surface bedrock<br>R  | mainly buried but crops out in lower Wendell Creek valley   |

### PURPOSE AND MAP USE

This map depicts geological materials found within 5 ft of the ground surface in the Edwarsville 7.5-minute quadrangle, Madison County, southwestern Illinois (Fig. 1). The cross-section shows the extent of these surficial units at greater depths, as well as the occurrence of buried units. The map and cross section together show the essential distribution in three dimensions of geologic materials above bedrock. Previous investigations of the area have been site-specific (e.g., Sierra and Straub, in review), or are at small scale (McKay et al., unpublished). This project built upon the earlier work by adding new observations of the surface and subsurface, incorporating them into a digital database, and interpreting them at large scale. The morphology of a major bedrock valley was refined (Fig. 2), the sedimentary fill of the bedrock and modern valleys 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 Euro-East mapping program, intended to provide critical geologic data in this rapidly developing area. Funding was provided by the U.S. Geological Survey STATEMAP program.

### PREPARATION PROCEDURES

A preliminary surface map was based upon soil series parent materials compiled from soils surveys (NRCS 2002) and an unpublished stacked 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, geotechnical, water, and coal boring records stored in the ISGS Geologic Records Unit. Some landforms were interpreted by airphoto analysis. Computer models were used to construct the bedrock. The quality of the geologic and locational descriptions of archived data varies considerably in detail and accuracy. Outcrops described in this study provide critical two-dimensional perspectives of map unit variability and contact characteristics, but exposures are limited to near-surface units. ISGS boring descriptions and geotechnical logs typically provided the most detail and could be located most accurately. A set of coal borings with gamma logs were rare data that allowed identification of deeply buried units in the northern portion of the quadrangle. 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. 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. 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 Edwarsville 7.5-minute quadrangle occurs just east of bluffs overlooking the Mississippi River floodplain (Fig. 1). The uplands are a marginal portion of the Illinoian Till Plain. At its maximum extent, the Illinoian glacier crossed the Mississippi Valley and terminated near St. Louis, Missouri. The larger north to south trending stream valleys were conduits of meltwater from the Illinoian glacier. Cahokia Creek was a major conduit. The landscape of the Edwarsville quadrangle can be divided geomorphically into river valleys, including terraces and fans on valley sidewalls, and uplands. Sediment assemblages within these landforms are distinct. The subsurface Quaternary geology is made more complicated by buried landforms such as bedrock valleys (Fig. 2). 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 a deep stream valley trending ENW-W across the northern half of the quadrangle. During the pre-Illinoian and the Illinoian glacial episodes, glaciers flowed into the region from the northeast. The glaciers sculpted the pre-existing landscape and left deposits of diamict (a mixture of rocks, sand, silt, and clay) deposited mainly as till. Silt, sand and gravel were deposited from meltwater streams. 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 off 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 north of Edwarsville. Its main influence in this area was to discharge large volumes of sediment and water into the Mississippi. The filling of the Mississippi Valley caused lakes to form in tributary valleys such as Cahokia Creek. Remnants of the sediments deposited in these lakes occur in small terraces along valley walls. In addition, thick blankets of loess derived from extensive outwash plain sediments were deposited over the region by westerly winds. 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 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 initially low sediment loads brought about by recent climate changes, land-use 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 1).

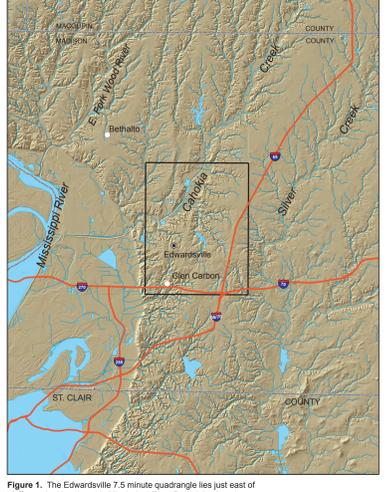


Figure 1. The Edwarsville 7.5-minute quadrangle lies just east of bluffs overlooking the wide Mississippi River floodplain (American Bottoms). The upland surface is a marginal portion of the Illinoian Till Plain and is deeply dissected by small streams. Cahokia Creek was a meltwater channel for the Illinoian glacier. This map depicts the three-dimensional landscape with a simulated light source from the northwest.

### Uplands

Most of the upland surface is blanketed by loess. The Peoria Silt and the underlying Roxana Silt are not differentiated here because their geotechnical properties are very similar (Table 1), but they have been studied extensively by McKay (1979), Wang et al. (2000), and others. The loess package is thick (approximately 30 ft) on the west towards its source area and thins to about 20 ft on eroded uplands in the east. There is sufficient erosion along valley slopes in the north that the underlying diamict is mapped. Exposures also occur on steep valley walls across the quadrangle, but they are so small in extent to show on this map. This diamict is till and classified in the Glasford Formation. It is pervasive under the uplands and overlies all Quaternary units or rests directly on bedrock over bedrock highs (Fig. 2). The till is sandy, very stiff, and has low water content (Table 1). It may contain thin lenses of sand and gravel. Up to 10 ft of sand and gravel are consistently described at the base of the unit in boring records, but this has not yet been described in stratigraphic borings. Relatively higher water contents, more variable strengths, and more frequent sand and gravel lenses in the upper portions of the unit are interpreted to be effects of till deposition from shallow subglacial or supraglacial positions. By contrast, the more uniform, stiffer, and dryer till in the lower portion of the unit is interpreted to have been compressed by the great weight of the ice sheet during subglacial deposition. The upper 3-10 ft of the unit contains the weathering profile of the Sangamon Geosol, and interglacial paleosols. This portion is leached, oxidized, and features roots, strong soil structure, and extensive clay accumulations along fractures and pores. Relatively high water contents and lower strengths can be attributed to the weathering, in particular the clay content.

### Stream Valleys

The one of the thickest regional occurrences of Harkness Silt was described in borehole 28057 (cross section A-A'). The Harkness Silt is distinguished stratigraphically by the weathering profile of an interglacial soil (Yarmouth Geosol) developed in the upper part, although it was typically truncated by the Illinoian ice. The Omphgnet member diamict is till that can be distinguished from the Glasford Formation by higher water contents and finer textures (Table 1). In addition, gamma log signatures tend to have lower variability. The Omphgnet member is distinctly thinner to the west of Cahokia Creek than to east (cross section A-A'), but the origin is not clear. The one of the thickest regional occurrences of Harkness Silt was described in borehole 28057 (cross section A-A'). The deposition of well-laminated silts and clays and common aquatic fossils are interpreted to be mainly lake deposits. A weak paleosol, more variable, and somewhat coarser texture distinguishes the Canteen member from the Harkness Silt. This unit has been found in boreholes penetrating buried bedrock valleys from northern St. Clair to northern Madison Counties (Fig. 1).

The distribution of sediments that fill the Cahokia Creek valley and its tributaries reflects a complex history of erosion and deposition. The position of modern valley is not directly related to the underlying bedrock valley because of repeated filling and erosion over the Quaternary. However, the valley was a major meltwater outlet for the Illinoian glacier. The wide valley probably reflects preferential sediment accumulation upstream of the valley restriction near Edwarsville. The surface deposit (Cahokia Formation) is up to 30 ft thick. It is generally fine grained but varies from silty clay deposited in bank environments and abandoned meanders, to loamy silt of sand to gravel that was concentrated by river processes from older deposits as occur at the base of the unit. Much of the Cahokia Formation was derived from loess, but locally includes sediment from till. Small tributary streams are incised into upland sediments. In lower reaches, the texture and thickness of the Cahokia Formation grades into the main valley fill. In upper reaches, stream channels may exhibit high-frequency meandering (e.g., Sugar Creek near Camp Togaue, Jerusalem Creek near Quercus Grove) caused by incision into till or bedrock that is relatively resistant to erosion. Cahokia Formation sediment there may comprise coarse sand to cobbles derived from the till and is only transported during high flood flows. In upper Sugar Creek, alternating cobble gravel bars up to 4 ft thick and underlain by till were found. Siltly fan deposits (Cahokia Formation - fan facies) were mapped on footslopes below steeply sloping areas and at the confluence of some tributary valleys. Modern soils are well developed in the fan facies and are better drained than tributary facies of the Cahokia Formation because they are slightly higher than the surrounding floodplain. The fans were deposited by streams or slope processes. Several terraces comprised of mainly Equality and Henry Formations are shown on the map along the walls of Cahokia Creek. Surface elevations are 460-470 ft above sea level. Below 2-10 ft of loess are stratified silts, silty clays, and fine sands. Soils developed into the terraces exhibit well-developed B horizons and sometimes H horizons. The sediments were interpreted to have been deposited in slackwater lakes (Equality Formation) and associated river or deltaic environments (Henry Formation) during the early Wisconsin Episode. Sediments of the Equality Formation typically have low strength and high water contents (Table 1). They are also found buried below the Cahokia Formation in Cahokia Creek and Mooney Creek, although the top of the Equality Formation is always below 480 ft (Cross section A-A'). Stratified sands and gravels of the Pearl Formation are found in boreholes throughout Cahokia Creek. Although usually distinguishable solely by texture, some records indicate the weathering profile of the Sangamon Geosol in the upper few feet. The Pearl Formation was deposited by meltwater of the Illinoian glacier. Below the Pearl Formation lies till of the Glasford Formation or bedrock.

### 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. Harriman, 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 area under Edwarsville and Glen Carbon is underlain by coal mine excavations (Chenoweth and Barrett, 2001). The mines are now inactive. Mine subsidence is a serious concern for planners and developers (Trewoy and Hindman 1991).

**Groundwater Resources.** There are limited groundwater resources in the drift of Edwarsville quadrangle. Many rural residences use large-diameter wells bored to the top of the Glasford Formation, which serves as an aquifer. Pearl Formation sediments buried in Cahokia Creek valley are exploited upstream in Madison County, but not within this quadrangle. 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 thick and moderate where surficial deposits are thin or bedrock crops out (Frye 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.

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### TABLE 1. CHARACTERISTIC MATERIAL PROPERTIES

| Stratum            | Color                               | Texture  | Composition                                   | Strength (Qu <sub>c</sub> , left average (range), right) | Water Content (%) average (range, n) |
|--------------------|-------------------------------------|--|---|--|--------------------------------------|
| Cahokia Formation  | brown to gray                       | gravelly sand to silty clay; fining upwards                      | leached of carbonates                         | 0.5 (0.32-0.62, 13)                                      | 27.3 (15-32, 15)                     |
| Peoria Silt        | tan                                 | silt to silt loam, massive                                       | abundant dolomitic, abundant expandable clays | 1.4 (0.3-3.3, 60)  | 26.5 (20-34, 19)                     |
| Roxana Silt        | slightly pink to tan                | silt to silt loam, massive                                       | abundant dolomitic, abundant expandable clays | 1.6 (0.5-3.2, 111)                                       | 26.4 (17-37, 38)                     |
| Equality Formation | gray, tan, slightly pink            | clay, silty clay, silt loam, fine sand, massive to laminated     | abundant expandable clays                     | 0.71 (0.37-1.16, 35)                                     | 32.8 (28-41, 34)                     |
| Glasford Formation | yellow brown to gray                | loamy diamict with sand and gravel lenses                        | dolomitic, 40-60% silt                        | 3.4 (0.5-5.5, 240)                                       | 17.6 (9-30, 65)                      |
| Petersburg Silt    | grayish brown to dark grayish brown | silt, massive to laminated                                       | dolomitic, 40-60% silt, fossiliferous         | 3.6 (1.2-4.5, 5)   | 19.5 (16-24, 6)                      |
| Omphgnet member    | orange brown, brown, to gray        | silty clay loam diamict  | calcareous, abundant expandable clays         | 3.0 (1.2-4.5, 6)   | 19.5 (17-21, 6)                      |
| Harkness Silt      | gray brown to olive gray            | silt, silty clay, clay and very fine sand, massive to stratified | variable                                      | 3.7 (1.5-4.5, 5)   | 21.0 (18-24, 6)                      |
| Canteen member     | olive brown to olive gray           | silty clay to silty clay loam, laminated                         | leached of carbonates                         | ---  | ---                                  |
| Bedrock            | gray, brown, black                  | shale, siltstone, limestone, coal                                | may be weathered                              | >5   | high when weathered                  |

Source: IGOT and other geotechnical reports with quadrangle. Includes both laboratory and hand penetrometer results.

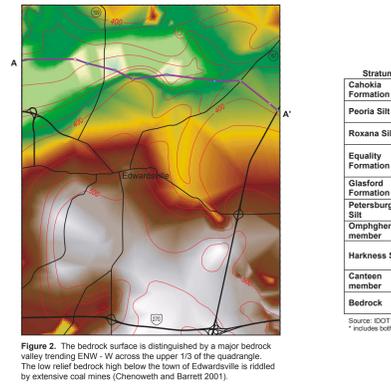


Figure 2. The bedrock surface is distinguished by a major bedrock valley trending ENW-W across the upper 1/3 of the quadrangle. The low relief bedrock high below the town of Edwarsville is reddened by extensive coal mines (Chenoweth and Barrett, 2001).

Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. Topography compiled from imagery dated 1986. Transportation updated 1998. Hydrography updated 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

SCALE 1:24,000  
 0 1000 2000 3000 4000 5000 6000 7000 FEET  
 0 1 2 3 4 5 6 KILOMETER

Geology based on fieldwork by Andrew C. Phillips, 2002-2003.  
 Digital cartography by Melvyn E. Barrett, Illinois State Geological Survey.

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ADJOINING QUADRANGLES

|   |   |   |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 |   |

APPROXIMATE MEAN DECLINATION, 1991

ROAD CLASSIFICATION

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