U.S. DEPARTMENT OF THE INTERIOR
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SCIENTIFIC INVESTIGATIONS MAP 2839
Version 1.0

SURFICIAL GEOLOGIC MAP OF THE NORTHEAST MEMPHIS QUADRANGLE, SHELBY COUNTY, TENNESSEE

By
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Base from U.S. Geological Survey 1997
1927 North American Datum (NAD 27)
Projection and 1,000-meter grid: Transverse Mercator, zone 16
10,000-foot ticks: Tennessee Coordinate System

SCALE 1:24 000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology mapped by Cox in 2002
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DESCRIPTION OF MAP UNITS

Artificial fill (Holocene)—Brown (10YR 6/2) mostly silt, sand, and chert gravel; locally derived from loess, alluvium, and map unit QTg. Fill occurs along roadways and reclaimed sand and gravel quarries, and as building pads. Thickness generally 1–2 m, but 20±10 m in reclaimed quarries and some bridge approaches

Alluvium (Holocene)—White (10YR 8/2) sand, brown (10YR 6/2) clayey silt, and minor tan (10YR 7/4) gravel. Sand is very fine grained to coarse-grained quartz with chert. Thick-bedded (0.5–1.5 m), basal point bar sands are overlain by alternating thin beds of sand and silt (<0.5 m thick) and capped by overbank clayey silt (beds <1 cm thick to having no apparent bedding). Bottom of basal sand not visible but floodplain borings indicate it is as much as 10 m thick, the overlying alternating sand and silt section is 1–2 m thick, and the top clayey silt unit is 3–5 m thick. Total alluvial thickness generally <16 m. This alluvium is restricted to the Wolf River floodplain

Alluvium (Holocene)—Brown (10YR 6/2) silt and minor mixed sand and clay. Silt beds are thin to massive; total thickness of silt floodplains <6 m. Dispersed sand is very fine to very coarse grained quartz and minor chert. Floodplains of tributaries to Wolf River consist of reworked loess. Tributary channels are floored in map unit QTg or the Claiborne Group, or are covered with thin sand and gravel bars

Loess (late Pleistocene)—Brown (10YR 6/6) and light-brown (10YR 7/4) silt with <10 percent sand and <10 percent clay (Spann, 1998). Regionally, loess is predominantly quartz with minor amounts of plagioclase, orthoclase, and dolomite (Gelderloos, 1996). Borings reveal loess is 2–20 m thick. In excavations, loess maintains vertical faces, and slopes develop closely spaced rills

Terrace deposit (late Pleistocene)—White (oxidized orange), dense, crossbedded, medium-grained sand capped by loess silt (Saucier, 1987)

Gravel ("Lafayette Gravel" of Hilgard, 1892, early Pleistocene and Pliocene?)—Shown in cross section only. Red (10R 5/4) sand and gravel. Sand consists of fine- to coarse-grained quartz and chert. Gravel clasts are subrounded to subangular chert pebbles.

Bore-hole data reveal that the gravel varies in thickness from 2 to 25 m. Sand and gravel lenses thicken and thin laterally. Upper and lower contacts of the gravel are erosional as reflected in rip-up clasts of the underlying upper part of the Eocene Claiborne Group in base of gravel, and irregular topography of gravel's upper contact with overlying loess. The gravel is a high-level, ancestral Mississippi River deposit

Claiborne Group, upper part (Eocene)—Shown in cross section only. Clay, silt, and sand. Generally consists of clay and silt, but locally may consist predominantly of fine sand (Kingsbury and Parks, 1993)

Contact—Relatively certain

Drill-hole locality and identification number

INTRODUCTION

The map locates surficial deposits and materials. Mapping them is the first step to assessing the likelihood that they could behave as a viscous liquid (liquefy) and (or) slump during strong earthquakes. This likelihood depends partly on the physical characteristics of the surficial deposits (Youd, 1991; Hwang and others, 2000), which are described here. Other possible uses of the map include land-use planning, zoning, education, and locating aggregate resources. The Northeast Memphis quadrangle is one of several quadrangles that were mapped recently for these purposes (fig. 1).

The City of Memphis lies within the upper Mississippi embayment, which is seismically active (Schweig and Van Arsdale, 1996) and near the New Madrid Seismic Zone (NMSZ) (fig. 2). Proximity to the NMSZ raises concerns that if earthquakes as strong as those that occurred near New Madrid, Mo., in 1811–1812 were to occur again, life and infrastructure in Memphis would be at risk (Hamilton and Johnston, 1990). The evidences suggestive of a seismic risk for the Northeast Memphis quadrangle are: (1) probable earthquake-induced liquefaction features (sand dikes) exist in Wolf River alluvium inside Memphis city limits (Broughton and others, 2001), (2) severe damage in the area of present-day Memphis was caused by an 1843 earthquake in the NMSZ, near Marked Tree, Ark. (Stover and Coffman, 1993), and (3) in the mid-continent, earthquake energy waves travel long distances outward from their source, compared to distances of wave transmission from earthquakes of comparable magnitude in California (Johnston and Kanter, 1990; Tuttle and Schweig, 1996).

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Figure 1. Locations of quadrangles for which the geology has been mapped recently as part of the National Earthquake Hazards Reduction Program of the USGS.

Figure 2. New Madrid and Wabash Valley seismic zones, showing earthquakes as circles. Red, earthquakes that occurred from 1976 to 2002 with magnitudes >2.5, located using modern instruments (University of Memphis). Green, earthquakes that occurred prior to 1974. Larger circle represents larger earthquake. Modified from Gomberg and Schweig (2002).

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