U.S. DEPARTMENT OF THE INTERIOR
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SCIENTIFIC INVESTIGATIONS MAP 2837
Version 1.0

SURFICIAL GEOLOGIC MAP OF THE GERMANTOWN QUADRANGLE, SHELBY COUNTY, TENNESSEE

By
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2004

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
SUPPLEMENTARY CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology mapped by Van Arsdale 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, basal point bar sands are overlain by alternating thin beds of sand and silt and capped by overbank clayey silt with beds having no apparent bedding. Bottom of basal sand not visible but floodplain borings indicate it is as much as 7 m thick, the overlying alternating sand and silt section is 1–2 m thick, and the top clayey silt unit is 1–4 m thick. Total alluvial thickness generally <10 m. This alluvium is restricted to the Wolf River floodplain (W.S. Parks, unpub. mapping, 1975; Broughton and others, 2001)

Alluvium (Holocene)—Reworked loess consisting of 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. Floodplain of Nonconnah Creek and tributaries to Wolf River and Nonconnah Creek consist of reworked loess. Channel beds 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

Gravel ("Lafayette Gravel" of Hilgard, 1892, early Pleistocene and Pliocene?)—Shown in cross section only. Highly oxidized, fine- to coarse-grained sand, chert gravel, and minor silt and clay; thickness 0–25 m. Thickness varies because upper and lower contacts are erosional. Color varies from strong brown (7.5YR 4/6) to red (2.5YR 4/6). Gravel is primarily medium pebbles that are subrounded to subangular (Autin and others, 1991). Vertical cylindrical structures that appear to be root casts or burrows are locally present. Upper part of unit exposed in some stream banks and in construction excavations

Claiborne Group (Eocene)

Upper part—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)

Lower part (Memphis Sand)—Shown in cross section only. Sand, silt, clay, and minor lignite. Consists of a thick body of sand containing clay lenses at various horizons. Sand is fine to very coarse. Upper part commonly contains lenses of fine sand, silt, and clay; lower part locally contains lenses of clay as thick as 16 m. The Memphis aquifer—the principal aquifer in the Memphis area—provides water for most domestic, commercial, industrial, and municipal supplies (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 Germantown quadrangle is one of several quadrangles that were mapped recently for these purposes (fig. 1).
Germantown 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 Germantown would be at risk (Hamilton and Johnston, 1990). The evidences suggestive of a seismic risk for the Germantown quadrangle are: (1) probable earthquake-induced liquefaction features (sand dikes) exist in Wolf River alluvium (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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