

- DESCRIPTION OF MAP UNITS**
- Qal** — Alluvium, modern (Holocene) — Silty clay and sandy silt with minor sand and sparse gravel; thickness 10 to 30 feet (3 to 10 m); found along banks of Ohio River and in floodplains along streams tributary to the Ohio River; deposited by modern historic stream processes; deposit is inset into adjacent map units; contact with adjacent units varies from sharp to poorly defined; mapped on the basis of topographic expression.
  - Qao** — Alluvium, natural levee deposits (Holocene) — Sand and silt; deposited in levee ridges or overwash deposits on floodplains of major rivers (Qafp) and on the Ohio River low-ohash terraces (Qot1); grades into adjacent floodplain deposits; typically sandier than adjacent floodplain deposits.
  - Qafp** — Alluvium, active floodplain (Holocene) — Sand, silt, fine gravel, and clay; surface mantled by silty clay and sandy silt; surface forms the lowest well-developed terrace along the Ohio River; 20 to 45 feet (10 to 15 m) thick; overlies sand and gravel deposits of older overwash deposits; contact is sharp, drawn at scarp of next higher terrace; estimated to range in age up to 6,500 years.
  - Qas** — Alluvium, sloughs (Holocene) — Organic-rich, black and gray clay silt, silty clay, and clay; found within low lying areas on floodplain (Qafp) and low-ohash terrace (Qot1); serve as poorly drained pathways to channel water off of the floodplain; areas that retain water year-round form bogs and cypress swamps.
  - Qot1** — Outwash, low terrace (Pleistocene-Holocene) — Fine to coarse sand and gravel, with local lenses of silt and clay; gravel includes chert, quartzite, sandstone, siltstone, igneous and metamorphic rocks, limestone, and coal; lithologically similar to adjacent outwash terraces (Qot2, Qot3); surface mantled with alluvial silt and sandy silt; 30 to 45 feet (10 to 15 m) thick; surface forms well-developed, low-relief terrace along Ohio River valley; deposited as glacial outwash reworked by post-glacial Ohio River; overlies older outwash deposits (Qot3); contact is sharp, drawn at scarp of next higher terrace or upland.
  - Qot2** — Outwash, intermediate terraces (Pleistocene) — Fine to coarse sand and gravel, with local lenses of silt and clay; gravel includes chert, quartzite, sandstone, siltstone, igneous and metamorphic rocks, limestone, and coal; lithologically similar to adjacent outwash terraces; surface mantled with eolian and alluvial silt and sandy silt; 30 to 45 feet (10 to 15 m) thick; surface forms well-developed, low-relief terrace along Ohio River valley; deposited as glacial outwash reworked by post-glacial Ohio River; overlies older outwash deposits (Qot3); contact is sharp, drawn at scarp of next higher terrace or upland.
  - Qol** — Loess (Pleistocene-Holocene) — (thicker than ~3 to 5 feet) Silt, clayey silt, and fine sand deposited by wind; typically massive; unit thickest (up to 40 feet) near Ohio River valley and thins gradually to the south; mantles bedrock upland; not mapped where locally found on lacustrine terrace (Ql) and high-ohash terraces (Qot3); estimated to range in age from 22,500 to 10,000 years old; locally includes thin layers of loess inferred to be older than 30,000 years.
  - Ql** — Lacustrine terrace (Pleistocene) — Clayey silt and silty clay; 20 to 45 feet (10 to 15 m) thick; thicker in tributary valleys; overlying complex deposits of sand, silt, clay and minor gravel; locally mantled by loess (Qol); not mapped; forms prominent low-relief terrace in tributary valleys and sheltered portions of Ohio River valley; deposited in lacustrine and slack-water environments associated with alteration of the Ohio River valley by glacial outwash and resulting impoundment of tributary valleys; underlying material is of apparent mixed fluvial and fluvio-lacustrine origin; contact with fluvial units is sharp, and drawn as scarp separating adjacent terraces; contact with eolian and upland units (Qol) is gradational and approximate, inferred by surface topography; estimated to range in age from 23,000 to 18,000 years old.
  - Qlm** — Marginal lacustrine deposits (Pleistocene) — Clayey silt, silt, and fine sand; thickness uncertain; surface forms moderate slope and beveled upland areas bordering lacustrine deposits (Ql); represents complex transition between lacustrine deposits and loess mantling upland; deposits include loess, loess-derived shewwash, colluvium, lacustrine silt and clay, and lacustrine shoreline deposits; contacts gradational and approximate, mapped on the basis of topographic expression.
  - Pz** — Bedrock, unroofed (Pennsylvanian) — Shale, sandstone, coal, and overlying regolith, comprising the core of the uplands in the study area; includes areas of loess thinner than 3 ft (1 m).

- Explanation**
- Bedrock elevation data
  - Surface observations
  - Concealed faults
  - 300 Bedrock surface contours

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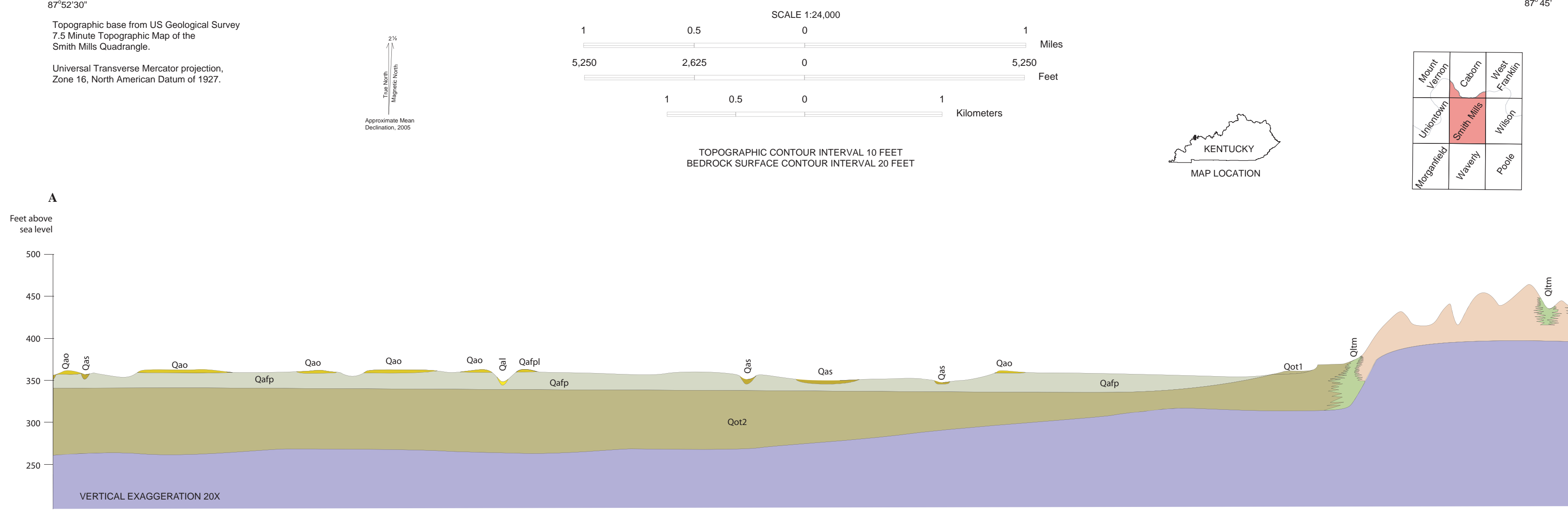
Field mapping was completed by Ronald C. Counts, June 2004 thru March 2006, with assistance from S. Wanger (Kentucky Geological Survey), W. Newell (U.S. Geological Survey), E. Kvalie (Indiana Geological Survey), and S. Aldridge (USDA-NRCS).

Subsurface information was compiled from databases and files at the Kentucky Geological Survey and from data contributed from the Kentucky Transportation Cabinet, the Indiana Geological Survey, and the U.S. Geological Survey.

**REFERENCES**  
Johnson, W.D., Jr., 1974, Geologic Map of the West Franklin, Caborn, and Mount Vernon quadrangles, Henderson and Union Counties, Kentucky; U.S. Geological Survey Geologic Quadrangle Map GQ-304, scale 1:24,000.  
Johnson, W.D., Jr., and Norris, R.L., 1974, Geologic Map of the Smith Mills Quadrangle, Henderson and Union Counties, Kentucky; U.S. Geological Survey Geologic Quadrangle Map GQ-332, scale 1:24,000.  
Ray, L.L., 1965, Geomorphology and Quaternary geology of the Owensboro quadrangle, Indiana and Kentucky; U.S. Geological Survey Professional Paper PP-488, 72 p.

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**QUATERNARY GEOLOGY OF THE SMITH MILLS AND CABORN QUADRANGLES,  
HENDERSON AND UNION COUNTIES, KENTUCKY**

By  
**Ronald C. Counts**  
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