KENTUCKY GEOLOGICAL SURVEY
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DRAFT GEOLOGIC QUADRANGLE
ALEXANDRIA QUADRANGLE, KY.
Series XII, 2012
GQ-926
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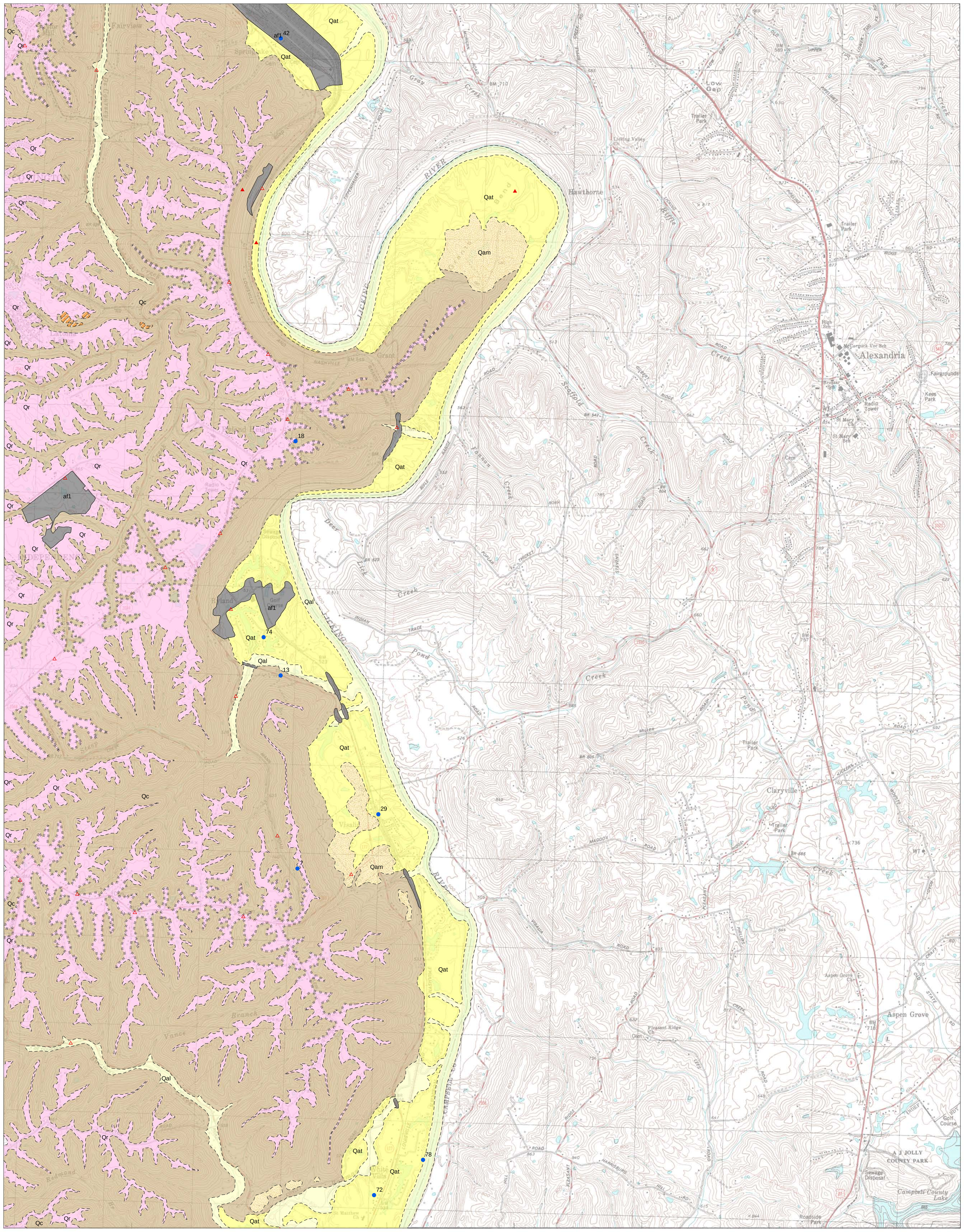
Contract Report 47



NAD 1983, Kentucky State Plane Single Zone, feet projection

Topographic base from the Kentucky Geography Network, Kentucky Raster Graphics (KRGs). ftp://ftp.kymartian.ky.gov/krg/

Original coordinate system UTM, zone 16, NAD 1927

N

SCALE 1:24,000

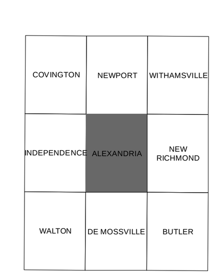
5,100 2,550 0 5,100 10,200 Feet

0.5 0.25 0 0.5 1 Miles

0.5 0.25 0 0.5 1 Kilometers

CONTOUR INTERVAL 20 FEET

MAP LOCATION



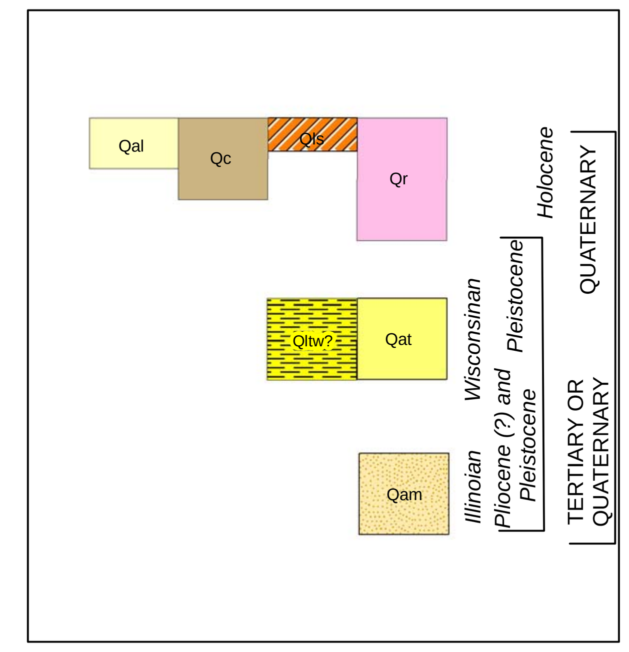
7.5 MIN QUADRANGLE INDEX

SURFICIAL GEOLOGIC MAP OF PART OF THE ALEXANDRIA QUADRANGLE, KENTUCKY

By
Max Hammond III

2012

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qls — **Landslide deposits (Holocene)**
Unconsolidated, complex deposits of colluvial soil and weathered rock derived from gravity-related processes including slumps, translational slides, earthflows, and creep. Processes can occur where water contributes to a plane of weakness within colluvial slopes or along stream banks; commonly at the soil-bedrock interface. Large amounts of water, especially after large storm events, increases the soil's pore water pressure adding to the load on the slope. Slope disturbance or modification in addition to natural erosion also contributes to landslides. Slide ages range from active to historic non-active. Unit mapped from 1-meter resolution LiDAR data. Description from Crawford, (2011).

Qal — **Alluvium, modern tributary (Holocene)**
Unconsolidated silt, gravel, clay and sand deposited in modern river channel and tributaries of the Licking River. Deposits are generally less than 20 feet thick. Unit rests on lacustrine deposits or Ordovician bedrock. Description modified from Crawford, (2011).

Qc — **Colluvium (Holocene)**
Unconsolidated, heterogeneous deposit covering hillsides and shoulders of ridges. Generally steeper than 10 degrees and dominantly ranges from 10 to 40 degrees. Grain size ranges from fine silty-clay loam to silt, flaggy limestone and shale fragments present. Thickness of colluvial soils ranges, but is typically thicker at the toe of the slope. Clayey (predominantly illite) parts can become sticky and plastic when wet. Areas where thin, soil horizons are indistinguishable. Unit primarily derived from the bedrock of the Kope Formation and is the parent material of the USDA-NRCS Eden Soil Series. Description from Crawford, (2011).

Qr — **Residual soil (Holocene-Pleistocene)**
Unconsolidated silt to silty-clay loam derived from weathering of underlying bedrock; primarily occurs on ridgetops and slope shoulders. Slopes generally are less than 12 degrees. In some areas unit is mixed with overlying loess. Blocky to fine-granular structure, stiff. These soils formed from limestone bedrock residuum interbedded with shale and primarily is the parent material of the USDA-NRCS Faywood and Nicholson Soil Series. Description from Crawford, (2011).

Qat — **Terrace Deposits (Pleistocene and Holocene)**
Silty clay, minor sand, and gravel. Sand composed of fine to medium quarts grains. Gravel is less than 3 inches in diameter and is composed of limestone, siltstone, white quartz, and brown chert. Terrace banks are commonly steep and gullied. Unit forms extensive high terraces at about 540 feet altitude; unit is also underlain by lacustrine clays of Pleistocene Licking River Lakes. Description is modified from Crawford, (2011).

Qam — **Alluvium of Valley Sides, Meander Cores, and Abandoned Channels (Pleistocene)**
Clay, silt, sand, and gravel, light-brown to moderate-yellowish brown. Gravel consist of rounded white and colorless quartz pebbles, and some siltstone generally less than 1.5 inches but up to 5 inches in diameter. Mostly exposed along flanks and at crest of meander cores in present valley of Licking River at altitudes between 620 and 540 feet. Description from Gibbons, (2011).

af1 — **Artificial fill, engineered fill (Modern)**
Material designed and deposited for construction of roads, railroads, buildings and engineered structures. Map units are delineated only when they are large enough to be shown as polygons at the scale of 1:24000.

Qltw? — **Lacustrine deposits (Pleistocene)**
Clay, silt, and sand deposits. Unit is not present at surface but is derived from water well data. Unit is 50+ ft thick in some locations as shown by the bedrock depth of over 70 ft from some of the water wells on this part of the quadrangle. The blue clays shown in the water well data suggest a lacustrine deposit as well. Age is not certain but is most likely from the Wisconian Age from the damning of the Ancestral Licking River Valley.

EXPLANATION

- Contact
- Gradational contact
- Gradational contact inferred
- 23 — KGS database, number indicates depth to bedrock in feet
- Landform observation
- Landform observation and soil sample

Figure 1. Active landslide along a cutbank of Bowman Creek, showing colluvium (Qc) moving downslope. The Kope Formation is exposed beneath the colluvium.

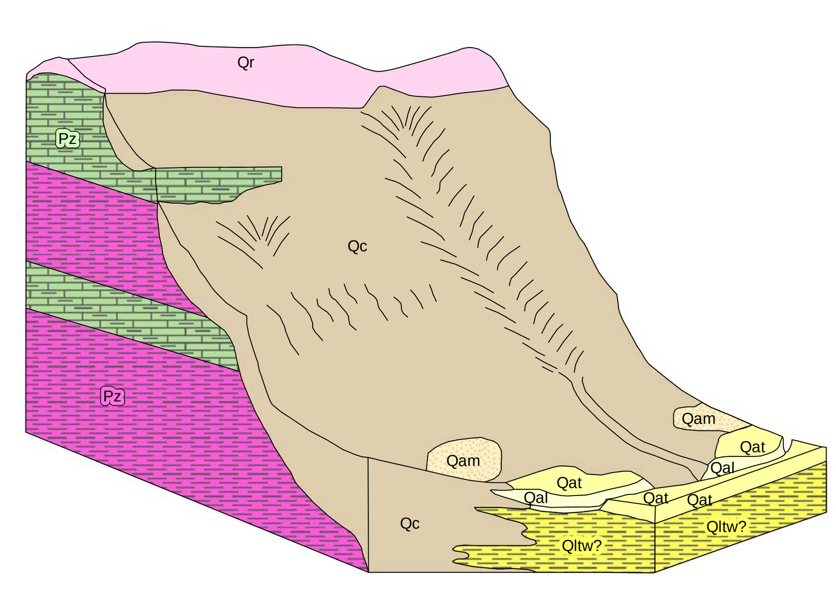


Figure 2. General diagrammatic model of the surficial deposits and geomorphology of part of the Alexandria quadrangle. Residual soil and colluvium mantle the hillsides and glacial lacustrine?, alluvium, and terrace deposits occupy the valleys. The green color Pz represents stratigraphy that contains more limestone and the purple more shale Modified from Wysocki and others, 2000 and Crawford, 2011.

GEOLOGIC SUMMARY

GEOLOGIC SETTING

The Alexandria 7.5-min quadrangle is located in Campbell and Kenton Counties, Kentucky in the Outer Bluegrass Region of the state. Ordovician bedrock geology in the quadrangle consists of, in ascending order, the Point Pleasant, the Kope Formation, the Fairview Formation, the Bellevue Tongue of Grant Lake Limestone, and the Bull Fork Formation. The Point Pleasant consists of approximately 45 to 65 percent limestone, with the rest being shale, poorly exposed and base is not present in the quad. The Kope consists of approximately 75 percent shale and 25 percent limestone and is 170 to 245 ft thick, primarily cropping out along stream valleys, the lower parts of hills, and along railroad and highway cuts. The Fairview is interbedded limestone and shale with 45 to 65 percent being limestone and is 95-130 ft thick, that occurs as a more resistant rock on hills and ridgetops. The Bellevue Tongue of the Grant Lake Limestone is a shelly rubbly weathering limestone that has very thin discontinuous shale parting, it is 10 to 15 ft thick and is non-resistant and poorly exposed. The Bull Fork Formation is made up of interbedded limestone and shale, with more than 50 percent being limestone, it is approximately 50+ ft thick and poorly exposed. All of the formations are fossiliferious (Gibbons, 1971). This map shows the distribution of surficial, engineering soils above bedrock and the relationship between surficial deposits and the underlying bedrock.

GEOMORPHOLOGY AND SURFICIAL DEPOSITS

The units described on this map reflect natural processes collectively operating as a dynamic geomorphic system (Newell, 1978). The primary mechanisms of sediment transport and deposition in this area are flowing water (alluvial and glacial processes) and gravity/mass-movement (colluvial processes), which are complexly interrelated. The map units in this area have been delineated based on the primary process generating the deposit or material. Soil survey maps and existing bedrock geologic maps served as the initial guide to mapping and these areas were modified through field identification, geomorphic setting, and well data. Delineation and identification of all maps units is restricted by the map scale of 1:24,000.

This map shows the distribution of surficial deoposits of residual soil (Qr), colluvium (Qc), alluvim (Qal), terrace deposits (Qat), landslide deposits (Qls), and artificial/engineered fill (af1). The distributions of these deposits are based on field observation, Natural Resource Conservation Service soil data, high resolution elevation data (LiDAR) and the geologic quadrangle of Independence.

Most of the alluvial deposits (Qal) occupy the Licking River Valley and parts of smaller tributary valleys. The glacial influence is supported by water well data of blue clay beneath the terrace deposits (Qat) of the Licking River Valley, descriptions and data is from the water well data and suggests the these lacustrine deposits (Qltw?) are more than 50 ft. thick. Residual soil (Qr) mapped primarily occurs on ridges and hilltops. This soil locally includes loess that overlies or is mixed with the residuum. The Kope shale weathers easily, slumping and producing colluvial soils (Qc) of variable thickness. Composition of the colluvium ranges from clayey (predominantly illite) and silty to coarse with abundant limestone slabs.

HAZARDS

Landslides have been a problem in the northern Kentucky area for decades. The natural geology and topography of many parts of northern Kentucky are susceptible to landslides. Just across the Ohio River in Cincinnati, where the geology and slopes are similar, more money is spent per capita to repair landslides than in any other city in the United States (Crawford, 2011). Landslides typically occur on steep slopes in the colluvium or along the colluvial-bedrock contact. Other surficial deposits in the area are prone to landslides as well. Pleistocene glaciation in the region produced soft clayey lake deposits, outwash, glacial drift, and other fluvial deposits that fail and can damage roads or other infrastructure. Artificial fill, particularly above and below roadways, is also susceptible to landslides (Crawford, 2011).

The most common types of landslides are small, thin translational slides and thick rotational slumps on steeper slopes. Less frequent block slides occur in unconsolidated glacial deposits. In a translational slide, thin layers of colluvium move downslope along the underlying bedrock contact. Rotational slides typically occur within thicker colluvial slopes, artificial fill, and lake deposits where scarps and slide boundaries are more evident but the failure plane is more difficult to identify. Shaley colluvium associated with the Kope Formation slumps easily and is susceptible to movement when not properly drained or the slope is steepened. Areas within existing landslides generally seem to be more susceptible to further slope movement than colluvial slopes that have no disturbance (Agnello, 2009). Landslide movement in colluvium is most common during the spring and winter when there typically is a higher level of precipitation (Agnello, 2009). Many landslides are associated with some type of human disturbance, such as improper drainage or steepening the slope to build a road, home, or other structure. Description from Hazards of the Surficial Geologic Map of the New Richmond quadrangle by Crawford, M.M. (2011).

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DISCLAIMER

ACKNOWLEDGMENTS

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Field mapping was completed by Maxwell L. Hammond III from July 2011 to July 2012. Subsurface information was compiled from data on file at the Kentucky Geological Survey.