KENTUCKY GEOLOGICAL SURVEY
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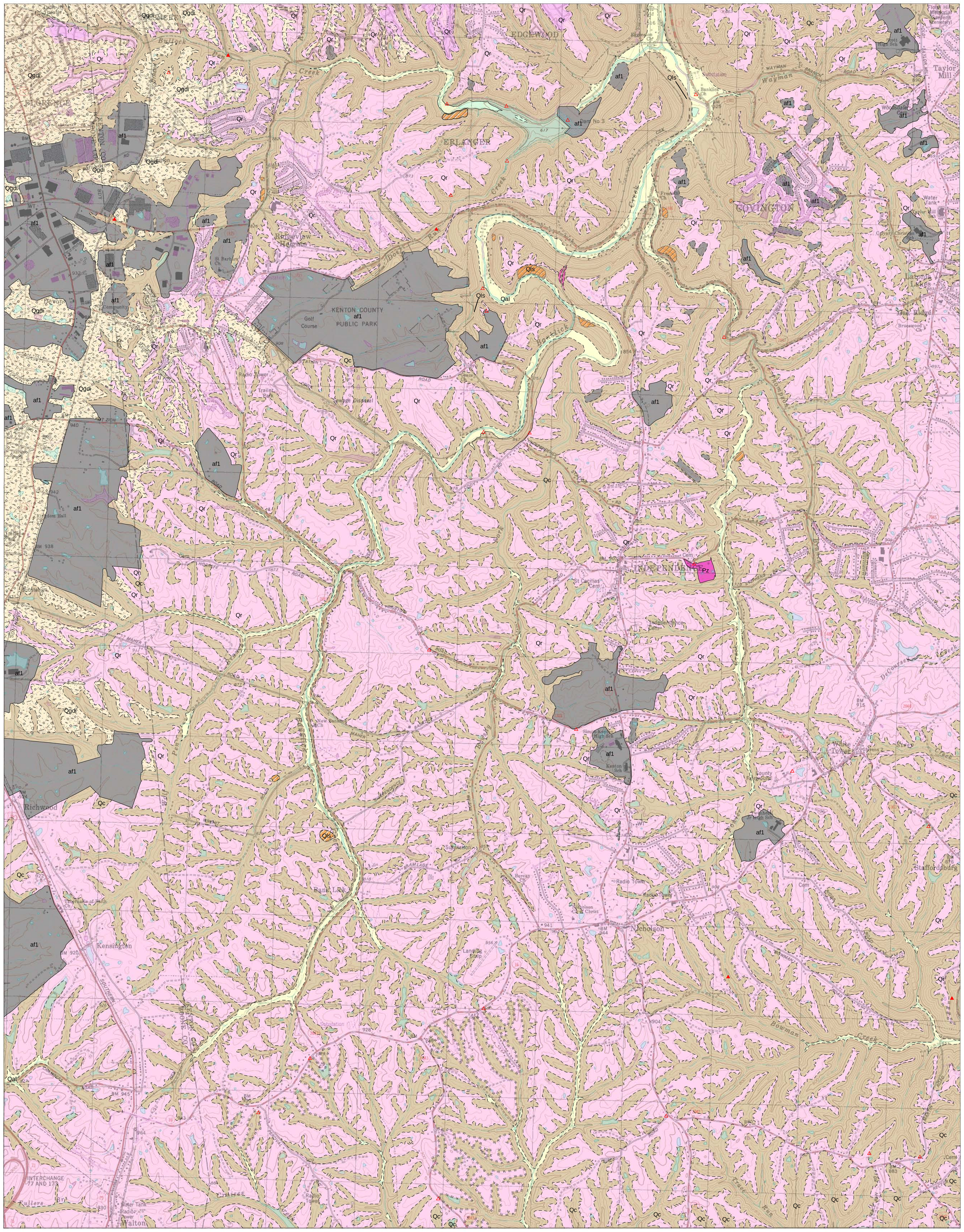
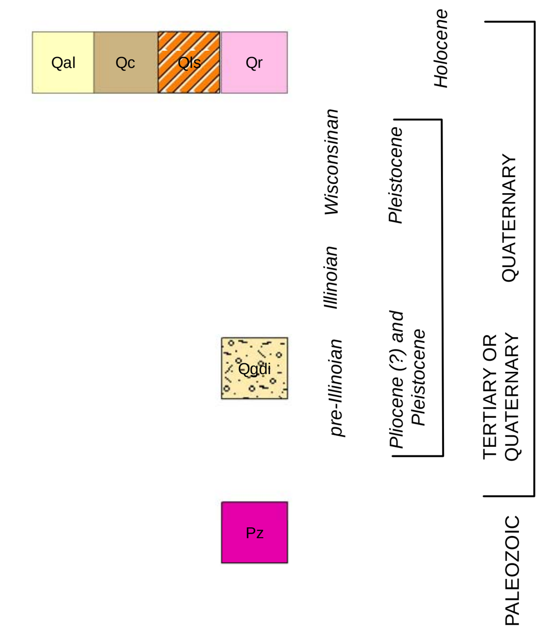
DRAFT GEOLOGIC QUADRANGLE
INDEPENDENCE QUADRANGLE, KY.

Series XII, 2012
GQ-785
Version 1.0

Contract Report 48



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 (Crawford, 2011).

Qal — Alluvium, modern tributary (Holocene)
Unconsolidated clay, silt, sand, gravel, and boulders deposited in modern stream channel tributaries of the Ohio River; occupies narrow valley bottoms and small floodplains. Grain size ranges from clay to limestone slabs of more than three feet in length. Streams draining areas from the northwestern quarter of the quad, have numerous igneous and metamorphic rocks in the beds of the streams. Deposits are generally less than 20 feet thick. Unit rests on Ordovician bedrock.

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 are 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 the colluvium is thin, soil horizons are mostly indistinguishable. Unit primarily derived from the bedrock of the Kope Formation and is the parent material of the USDA-NRCS Eden Soil Series (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 modified after Crawford (2011).

Qgdi — Glacial drift (Pleistocene)
Clay, silt, sand, and gravel: Finer fractions very poorly exposed, form deeply weathered, moderate-reddish-brown soil; locally leached; limonitic pellets present beneath leached zone. Gravel, generally redistributed by post-glacial streams, includes well-rounded pebbles, cobbles, and boulders of quartzite, sandstone, conglomerate, chert, and plutonic and metamorphic rocks to 2 feet in diameter; limestone fragments inconspicuous. Drift considered of pre-Illinoian ages by Leighton and Ray (1965). Unit present in northwest half of quadrangle and has been highly modified by industrialization. Description modified from Glacial drift (pre-Illinoian) of Geologic Map of the Independence quadrangle by Luft, S. (1969).

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

Pz — Bedrock (Paleozoic)
Shale and limestone; interbedded. Shaley bedrock along valley slopes and stream bottoms and more resistant limestone toward ridgetops. Only mapped as roadcuts and railroad cuts. Natural bedrock exposures at the tops of ridges or exposed in stream beds not mapped.

EXPLANATION

- Contact
- Gradational contact
- Gradational contact inferred
- ▲ Landform observation and soil sample
- △ Landform observation

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

Figure 2. Alluvium (Qal) along Bullock Penn Creek showing large imbricated slabs of limestone in a matrix of sand, silt, and clay at a pointbar of creek flowing into reservoir.

GEOLOGIC SUMMARY

GEOLOGIC SETTING

The Independence 7.5-min quadrangle is located in Boone and Kenton Counties, Kentucky in the Outer Bluegrass Region of the state. Ordovician bedrock geology in the quadrangle consists of, in ascending order, the Kope Formation, the Fairview Formation, the Bellevue Tongue of Grant Lake Limestone, and the Bull Fork Formation.. The Kope consists of approximately 75 percent shale and 25 percent limestone and is 230 to 250 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 90-120 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 6 to 20 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 105 ft thick and poorly exposed. All of the formations are fossiliferious. This map shows the distribution of surficial, engineering soils above bedrock and the relationship between surficial deposits and the underlying bedrock (Luft, 1969).

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 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 glacial drift (Qgdi), residual soil (Qr), colluvium (Qc), alluvim (Qal), 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.

Glacial deposits occur in the northwest quarter of the quad. The area is heavily industrialized making the locating of outcrops difficult. Mapping of the unit was based on previous work from the NRCS Soil Survey and from the presence of igneous and metamorphic rocks scattered through the area.

Most of the alluvial deposits (Qal) occupy the Banklick Watershed and parts of smaller tributary valleys. The glacial influence is supported by remnants being eroded by the drainages of the area and various igneous boulders. 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 modified after Crawford, (2011).

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 (Crawford, 2011).

REFERENCES CITED

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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.

MAP LOCATION

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

N

BURLINGTON	COVINGTON	NEWPORT
UNION	INDEPENDENCE	ALEXANDRIA
VERONA	WALTON	DE MOSSVILLE

7.5 MIN QUADRANGLE INDEX

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

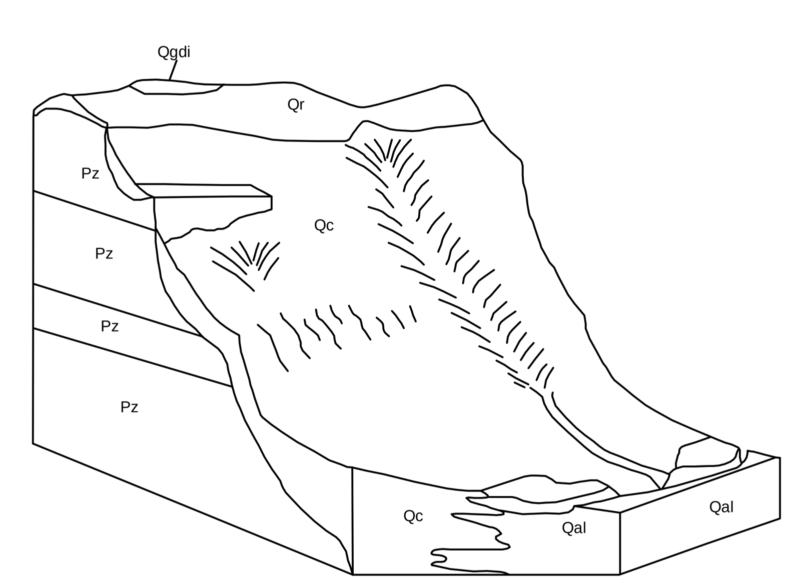

Figure 3. General diagrammatic model of the surficial deposits and geomorphology of the Independence quadrangle. Residual soil and colluvium mantle the hillsides and alluvium occupies the valleys. Glacial drift is present on the ridgetops in the northwest quadrant of the map. The green color represents Pz stratigraphy that contains more limestone and the purple more shale Modified from Wysocki and others, 2000 and Crawford 2011.

SURFICIAL GEOLOGIC MAP OF THE INDEPENDENCE QUADRANGLE, KENTUCKY

By
Max Hammond III

2012