KGS KENTUCKY GEOLOGICAL SURVEY
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GEOLOGIC MAP SERIES 1
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GEOLOGIC MAP OF THE HARRODSBURG 30 x 60 MINUTE QUADRANGLE, CENTRAL KENTUCKY

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SYSTEM	SERIES	GROUP	FORMATION AND MEMBER	LITHOLOGY	THICKNESS IN METERS (FEET)
QUATERNARY	Holocene		Alluvium	Qal	0–27 (0–90)
QUATERNARY	Holocene		Colluvium and landslide deposits	Qcld	0–9 (0–30)
QUATERNARY	Pleistocene or Holocene		Terrace deposits	Qt	0–12 (0–40)
TERT. or QUAT.	Pliocene or Pleistocene		High-level fluvial deposits	QTf	0–27 (0–90)
TERT. or QUAT.	Pliocene or Pleistocene		Gravel and sand	QTg	0–12 (0–40)
	uncertain age		dolomite	dol	
PENNSYLVANIAN	Lower Pennsylvanian	Breathitt Group	Corbin Sandstone Member	₽gc	0–54 (0–180)
PENNSYLVANIAN	Lower Pennsylvanian	Breathitt Group	Grundy Formation	₽g	0–72 (0–240)
PENNSYLVANIAN	Lower Pennsylvanian	Breathitt Group	Alvy Creek Formation; Livingston Conglomerate Member	₽ac	0–32 (0–105)
MISSISSIPPIAN			Paragon Formation	Mp, ₽acl	0–33 (0–110)
MISSISSIPPIAN			Slade Formation: Poppin Rock Member, Maddox Branch Member, Ramey Creek Member, Tygarts Creek Member, Mill Knob Member, Warix Run Member, Ste. Genevieve Member, St. Louis Member	Msla	24–70 (80–230)
MISSISSIPPIAN			St. Louis Limestone	Msl	20+ (65+)
MISSISSIPPIAN			Salem and Warsaw Limestones; Renfro Member	Msw	16–20 (55–65)
MISSISSIPPIAN			Muldraugh Mbr.		
MISSISSIPPIAN			Borden Formation: Wildie Member, Halls Gap Member, Nada Member, Cowbell Member, Nancy Member, New Providence Shale Member	Mb	85–132 (280–435)
DEVONIAN	Mid. and Upper Dev.		New Albany Shale	MDna	12–46 (40–150)
DEVONIAN	Mid. and Upper Dev.		Boyle Dolomite	Db	0–11 (0–35)
SILURIAN	Lower and Middle Silurian		Crab Orchard Formation and Brassfield Dolomite: Crab Orchard Formation, Brassfield Dolomite	Scb	0–45 (0–150)
ORDOVICIAN	Upper Ordovician		Drakes Formation: Saluda Dolomite Member, Bardstown Member, Preachersville Member, Rowland Member	Od	0–49 (0–160)
ORDOVICIAN	Upper Ordovician		Ashlock Formation: Reba Member, Terrill Member, Grant Lake Member, Stingy Creek Member, Gilbert Member, Tate Member	Oa	12–45 (40–150)
ORDOVICIAN	Upper Ordovician		Calloway Creek Limestone	Occ	17–42 (55–140)
ORDOVICIAN	Upper Ordovician		Garrard Siltstone	Og	9–35 (30–115)
ORDOVICIAN	Upper Ordovician		Kope Formation	Ok	0–9 (0–30)
ORDOVICIAN	Upper Ordovician		Clays Ferry Formation	Ocf	24–73 (80–240)
ORDOVICIAN	Middle Ordovician	Lexington Limestone, Upper part	Tanglewood Limestone Mbr.	Olt	
ORDOVICIAN	Middle Ordovician	Lexington Limestone, Upper part	Millersburg, Strodes Creek, Devils Hollow Members; Tanglewood Limestone Mbr.	Olt	0–30 (0–100)
ORDOVICIAN	Middle Ordovician	Lexington Limestone, Upper part	Sulphur Well, Perryville Ls. Members	Olu	
ORDOVICIAN	Middle Ordovician	Lexington Limestone, Upper part	Tanglewood Limestone Mbr.	Olt	0–27 (0–90)
ORDOVICIAN	Middle Ordovician	Lexington Limestone, Upper part	Brannon Mbr.	Olb	0–9 (0–30)
ORDOVICIAN	Middle Ordovician	Lexington Limestone, Lower part	Tanglewood Limestone Mbr.	Olt	
ORDOVICIAN	Middle Ordovician	Lexington Limestone, Lower part	Grier Limestone, Logana, Curdsville Limestone Members	Ollr	36–59 (120–195)
ORDOVICIAN	Middle Ordovician	High Bridge Group	Tyrone Limestone and Oregon Formation: Tyrone Limestone, Oregon Formation	Oto	37 (120)
ORDOVICIAN	Middle Ordovician	High Bridge Group	Camp Nelson Limestone	Ocn	97+ (320+)

DESCRIPTION OF MAPPED UNITS

Qal ALLUVIUM—Silt, clay, sand, and gravel. Silt, partly clayey; clay, partly silty and sandy; sand, very fine- to coarse-grained, but mostly very fine to fine. Gravel composed of limestone, chert, dolomite, quartz, geodes, siltstone, quartzite, shale, and ironstone. Unit locally grades into unmapped colluvium.

Qcld COLLUVIUM AND LANDSLIDE DEPOSITS—Sand, gravel, and rubble. Consists of masses of shale and siltstone from Borden Formation, limestone blocks from Slade Formation, and sand, pebbles of quartz and chert, and blocks of conglomerate and sandstone from Grundy Formation. Mapped locally in southeastern part of quadrangle.

Qt TERRACE DEPOSITS—Clay, silt, sand, and gravel. Clay, silty to sandy; silt, clayey to sandy; sand, very fine- to coarse-grained, but mostly very fine to fine. Gravel composed of quartz, chert, geodes, siltstone, ironstone, and sandstone, with rare limestone and quartzite.

QTf HIGH-LEVEL FLUVIAL DEPOSITS—Sand, gravel, silt, and clay. Sand mainly very fine- to fine-grained, partly clayey and silty; silt, clayey; clay, silty. Gravel composed of quartz, chert, geodes, quartzite, sandstone, silicified fossils, siltstone, and ironstone. Deposits mainly occur on uplands along Kentucky River and its tributaries, and locally along Chaplin River.

QTg GRAVEL AND SAND—Unconsolidated conglomerate composed of quartz gravel in matrix of quartz sand and silt; scattered boulders and cobbles of conglomerate; few pebbles of sandstone; partly cemented with limonite and silica; partly crossbedded. Unit probably consists of letdown deposits derived from Pennsylvanian conglomerate (Rice, 1984).

dol DOLOMITE—Finely to coarsely crystalline dolomite similar to dolomite in formations of Ordovician, Silurian, and Devonian age. Occurs in several small grabens in northern part of quadrangle.

BREATHITT GROUP

₽gc CORBIN SANDSTONE MEMBER OF GRUNDY FORMATION—Sandstone, conglomerate, and siltstone. Sandstone is quartzose and crossbedded with common quartz pebbles. Forms steep cliffs in southeastern corner of quadrangle. Previously mapped as member of Lee Formation (Weir and others, 1971; Rice, 1972).

₽g GRUNDY FORMATION—Siltstone, shale, sandstone, and coal. Siltstone and shale, laminated, limonite-stained, and carbonaceous. Coals thin and unevenly distributed. Locally unconformable on Paragon and Slade Formations. Previously mapped in this area as Lee Formation (Greene, 1968; Weir and others, 1971; Rice, 1972), in adjacent areas as Breathitt Formation, and renamed Grundy Formation of the Breathitt Group by Chesnut (1992). As mapped here, may contain lenses of Bee Rock Formation at base.

₽ac ALVY CREEK FORMATION—Siltstone, shale, sandstone, and coal. Lithology similar to Grundy Formation above. Mapped unnamed coals now identified as Beaver Creek and Stearns No. 1 coal beds. Previously mapped as Lee Formation, renamed Alvy Creek Formation by Chesnut (1992). Unit thins to north and west, conformable on and intertongues with Livingston Conglomerate Member, locally unconformable with Paragon and Slade Formations.

₽acl ALVY CREEK FORMATION, LIVINGSTON CONGLOMERATE MEMBER—Sandstone and conglomerate. Sandstone is quartzose and crossbedded, with common quartz pebbles. Forms steep cliffs and occupies south-trending paleovalley cut more than 18 m into Slade Formation (Rice, 1984). Smaller quartz-pebble-bearing sandstones may occupy paleochannels outside of the main paleovalley, but are not mappable at the scale of this map and are included in the Grundy Formation.

Mp PARAGON FORMATION—Unit consists of rocks assigned to Pennington Formation during U.S. Geological Survey–Kentucky Geological Survey cooperative mapping project, 1960–78 (Ettensohn and others, 1984). Shale, siltstone, sandstone, limestone, dolomite, and coal. Shale, partly silty and sandy, sparsely fossiliferous; grades into and interlayered with siltstone. Sandstone, very fine- to medium-grained, sparsely fossiliferous; locally as much as 12 m thick at base of formation. Limestone, fine- to medium-grained, commonly fossiliferous. Dolomite, very finely crystalline, partly silty, unfossiliferous. Coal, several centimeters thick, locally at base of unit. Common erosional thinning and local removal of Paragon below pre-Breathitt unconformity.

Msla SLADE FORMATION—Unit includes rocks assigned to Newman Limestone and Renfro Member of Borden Formation during U.S. Geological Survey–Kentucky Geological Survey cooperative mapping project, 1960–78 (Ettensohn and others, 1984). Slade consists of nine members: in ascending order, the Renfro, St. Louis, Ste. Genevieve, Warix Run, Mill Knob, Tygarts Creek, Ramey Creek, Maddox Branch, and Poppin Rock Members. Limestone, dolomite, and shale. Limestone, micrograined to very coarse-grained, bioclastic, oolitic, peloidal; partly cherty, fossiliferous, argillaceous, brecciated, sandy. Dolomite, microcrystalline to very finely crystalline, silty, argillaceous; sparsely cherty and geodiferous; dominant lithology in basal 9–23 m. Shale, mainly in partings and interbeds; forms distinct unit, as much as 1.5 m thick, in upper part of formation. Common erosional thinning of Slade below pre-Breathitt unconformity.

Msl ST. LOUIS LIMESTONE—Limestone, fine- to medium-grained, argillaceous, cherty, fossiliferous, geodiferous. Mapped in southwestern part of quadrangle.

Msw SALEM AND WARSAW LIMESTONES—Limestone and sandstone. Limestone, coarse- to very coarse-grained, crinoidal, partly silicified, partly cherty, partly crossbedded. Sandstone, fine-grained, calcareous; about 1.5 m thick, occurring 1.5–2.5 m above base of unit. Mapped in southwestern part of quadrangle.

Mb BORDEN FORMATION—Unit consists of seven members: in ascending order, the New Providence Shale, Nancy, Cowbell, Halls Gap, Wildie, Nada, and Muldraugh Members. Former uppermost carbonate-rich Renfro Member of the siliciclastic-dominated Borden was reassigned to the overlying Slade Formation by Ettensohn and others (1984). Shale, siltstone, and limestone. Shale, clayey in basal part, grades upward into very silty shale and siltstone in middle and upper part; ironstone concretions; sparsely fossiliferous, with few lenses of fossiliferous limestone. Siltstone in part splits into southwest-plunging tongues. In southeastern part of quadrangle, uppermost Borden, 10–24 m thick, consists of shale, siltstone, and minor amounts of fossiliferous limestone; in southwestern part, geodiferous, cherty, dolomitic siltstone, 12–21 m thick, with minor limestone.

MDna NEW ALBANY SHALE—Shale and dolomite. Shale, carbon-rich, silty, fissile, pyritic; few interbeds of clayey shale in middle and upper parts. In lower part of unit, dolomite, very finely to finely crystalline, argillaceous, partly carbonaceous, partly intraclastic; interlayered with black shale; apparently included with Boyle Dolomite on several 7.5-minute geologic quadrangle maps. Basal contact conformable where unit overlies Boyle Dolomite; elsewhere base unconformable.

Db BOYLE DOLOMITE—Dolomite, limestone, and sandstone. Dolomite, very finely to moderately crystalline, commonly cherty, partly fossiliferous, silty and sandy at base. Limestone, very fine- to medium-grained, fossiliferous, partly dolomitic. Sandstone occurs locally at base, fine-grained, up to 1.8 m thick. Dolomite in basal New Albany Shale apparently included with Boyle Dolomite on several 7.5-minute geologic quadrangle maps. Unit pinches out locally. Base unconformable.

Scb CRAB ORCHARD FORMATION AND BRASSFIELD DOLOMITE—Mapping unit is composed of two formations: in ascending order, Brassfield Dolomite (0–7 m thick) and Crab Orchard Formation (0–41 m thick). Crab Orchard, in turn, consists of five members: in ascending order, the Plum Creek, Oldham, Lulbegrud Shale, Waco, and Estill Shale Members. Shale and dolomite. Shale, clayey, plastic, partly dolomitic, slightly silty, sparsely fossiliferous. Dolomite, very finely to moderately crystalline, silty, partly fossiliferous, partly vuggy petroliferous. Middle and upper parts of unit are mainly shale, with dolomite interbeds; dolomite dominant in lower part. Common erosional thinning and local removal of unit below pre-Boyle unconformity.

Od DRAKES FORMATION—Unit consists of two members: in ascending order, the Rowland and Preachersville Members. Mudstone, dolomite, and limestone. Mudstone, dolomitic, calcitic, rarely fossiliferous. Dolomite, finely crystalline, argillaceous, silty, partly fossiliferous; in part finely to coarsely crystalline; grades into and interbedded with mudstone. Limestone occurs locally in eastern part of quadrangle, in part fine- to coarse-grained, fossiliferous (Otter Creek coral bed); in part argillaceous. In southwestern part of quadrangle unit consists of three members: in ascending order, Rowland, Bardstown (limestone), and Saluda Dolomite (dolomite) Members. Local erosional thinning and removal of Drakes below pre-Boyle unconformity.

Oa ASHLOCK FORMATION—Unit consists of six members: in ascending order, the Tate, Gilbert, Stingy Creek, Grant Lake, Terrill, and Reba Members. Limestone, mudstone, dolomite, shale, and siltstone. Limestone, micrograined to coarse-grained, partly argillaceous, partly silty, sparsely cherty, abundantly to sparsely fossiliferous. Mudstone, dolomitic, argillaceous, partly silty, sparsely fossiliferous; intergrades with dolomite and dolomitic shale. Shale interlayered with limestone. Siltstone locally interlayered and intergrading with limestone. Unit partly grades into dolomite in some areas adjacent to faults. Local erosional thinning of Ashlock below pre-Boyle unconformity.

Occ CALLOWAY CREEK LIMESTONE—Limestone, shale, and siltstone. Limestone, very fine- to very coarse-grained, fossiliferous. Shale in partings and seams between limestone beds. Siltstone interlayered with limestone in lower part. Unit partly altered to dolomite along fault in northern part of quadrangle.

Og GARRARD SILTSTONE—Siltstone, shale, and limestone. Siltstone, quartzose, calcareous, sparsely fossiliferous, in planar to contorted beds. Shale, calcareous, silty, clayey, sparsely fossiliferous, interbedded with siltstone. Limestone, fine- to coarse-grained, fossiliferous, interlayered with siltstone. Unit partly altered to dolomite along fault in northern part of quadrangle.

Ok KOPE FORMATION—Shale, siltstone, and limestone. Shale, clayey, calcareous; with interbedded siltstone and limestone.

Ocf CLAYS FERRY FORMATION—Limestone, shale, and siltstone. Limestone, micrograined to very coarse-grained, partly argillaceous, commonly fossiliferous; interbedded with about equal amounts of calcareous, clayey shale. Siltstone, calcareous; interbedded with limestone and shale in upper part. Unit partly dolomitized along fault in northern part of quadrangle. Tongues of Clays Ferry shale and limestone occur locally in upper part of Lexington Limestone.

Olu UPPER PART OF LEXINGTON LIMESTONE—Unit consists of five members: in ascending order, Perryville Limestone, Sulphur Well, Devils Hollow, Strodes Creek, and Millersburg Members. Limestone and shale. Limestone, micrograined to coarse-grained, abundantly to sparsely fossiliferous, sparsely cherty; in part with partings and interbeds of shale. In parts of quadrangle, unit intertongues with and grades laterally into Tanglewood Limestone Member of Lexington Limestone, and intertongues with Clays Ferry Formation.

Olt TANGLEWOOD LIMESTONE MEMBER OF LEXINGTON LIMESTONE—Limestone and shale. Limestone, very fine- to very coarse-grained, bioclastic, commonly phosphatic, sparsely to abundantly fossiliferous, rarely cherty, partly crossbedded; rarely with shale partings. In parts of quadrangle, unit intertongues with and grades laterally into upper and lower parts of the Lexington, and intertongues with Clays Ferry Formation.

Olb BRANNON MEMBER OF LEXINGTON LIMESTONE—Limestone and shale. Limestone, micrograined to fine-grained, argillaceous, silty, partly cherty, sparsely fossiliferous; with interbedded shale. Bedding partly contorted. Unit pinches out in parts of quadrangle; locally intertongues with Tanglewood Limestone Member.

Ollr LOWER PART OF LEXINGTON LIMESTONE—Unit consists of three members: in ascending order, Curdsville Limestone, Logana, and Grier Limestone Members. Limestone and shale. Limestone, micrograined to very coarse-grained, fossiliferous, partly argillaceous, partly cherty; mainly irregular to nodular bedding, partly crossbedded, local contorted bedding; partly with interbedded shale. In parts of quadrangle, upper part of unit intertongues with Tanglewood Limestone Member.

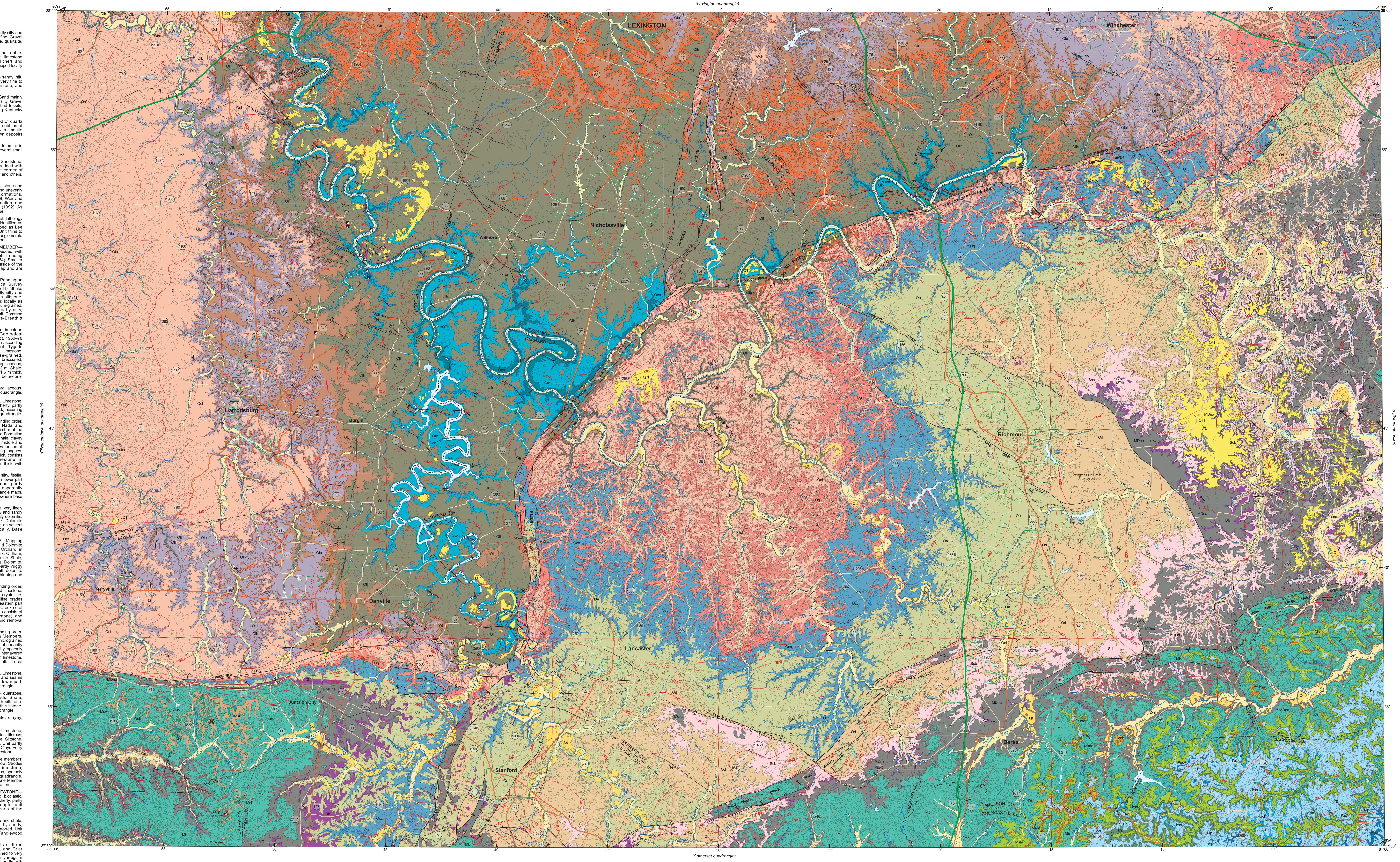
HIGH BRIDGE GROUP

Oto TYRONE LIMESTONE AND OREGON FORMATION—Mapping unit is composed of two formations: in ascending order, Oregon Formation (2–20 m thick) and Tyrone Limestone (17–35 m thick). Limestone, dolomite, shale, and bentonite. Tyrone Limestone consists of limestone, micrograined, partly cherty, sparsely fossiliferous; partly with scattered blebs and stringers of crystalline calcite; partly mottled with irregular bodies and seams of calcareous dolomite; few beds of pelletal and bioclastic limestone; with interbedded argillaceous limestone and shale in middle and upper parts. Bentonites at about 7 and 24 m below top of Tyrone and locally at top. Oregon Formation consists of dolomite, microcrystalline to moderately crystalline, calcareous, rarely fossiliferous; partly interbedded with limestone. In parts of quadrangle, lower part of Tyrone intertongues with upper part of Oregon.

Ocn CAMP NELSON LIMESTONE—Limestone, dolomite, and shale. Limestone, micrograined, mottled with irregular bodies of very finely to moderately crystalline, calcareous dolomite; with interbedded micrograined limestone containing scattered blebs and stringers of crystalline calcite; few interbeds of argillaceous limestone and calcareous shale, mainly in upper part. Base of formation not exposed.

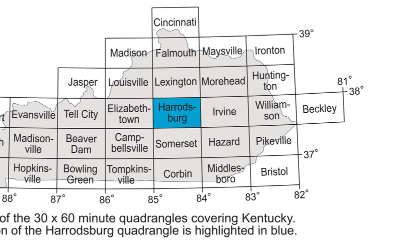
af ARTIFICIAL FILL—Compacted rock debris from highway or railroad construction, and mine tailings.

Revised July 2012



EXPLANATION

- Interstate highway or parkway
- U.S. highway
- State highway
- County boundary
- City boundary
- Railroad
- Normal fault (U, upthrown side; D, downthrown side)
- Reverse fault (R, upthrown side)
- Concealed fault
- Structure contour, feet
- Concealed contact
- Active stone quarry or mine
- Abandoned stone quarry or mine
- Abandoned sand, gravel, or clay pit
- Mineral vein
- Mineral prospect or outcrop
- Abandoned vein-mineral mine shaft



Locations of the 30 x 60 minute quadrangles covering Kentucky. The location of the Harrodsburg quadrangle is highlighted in blue.

SCALE 1:100 000

1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 KILOMETERS

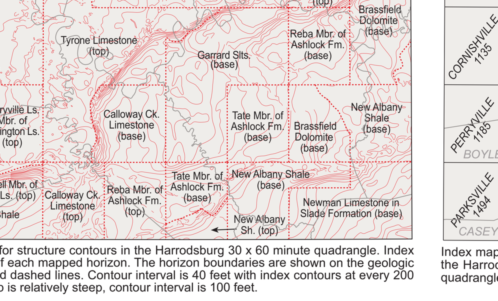
1 0 1 2 3 4 5 6 7 8 9 10 MILES

1000 0 5000 10 000 15 000 METERS

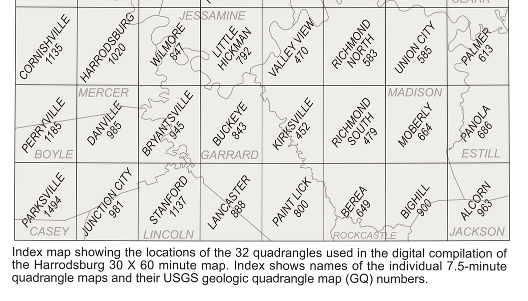
5000 0 10 000 20 000 30 000 40 000 50 000 FEET

universal transverse Mercator projection, zone 16: 1927 North American datum

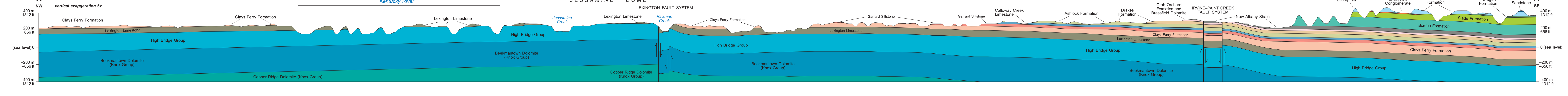
TOPOGRAPHIC CONTOUR INTERVAL 20 METERS



Location map for structure contours in the Harrodsburg 30 x 60 minute quadrangle. Index gives names of each mapped horizon. The horizon boundaries are shown on the geologic map as thin red dashed lines. Contour interval is 40 feet with index contours at every 200 feet. Where dip is relatively steep, contour interval is 100 feet.



Index map showing the locations of the 32 quadrangles used in the digital compilation of the Harrodsburg 30 X 60 minute map. Index shows names of the individual 7.5-minute quadrangle maps and their USGS geologic quadrangle map (GQ) numbers.



INTRODUCTION

This version of the geology of the Harrodsburg 30 x 60 minute quadrangle was digitally compiled mostly from U.S. Geological Survey 7.5-minute geologic quadrangle maps (GQ's), as cited in the references. The GQ's are products of a cooperative mapping project between the U.S. Geological Survey and the Kentucky Geological Survey from 1960 to 1978. Several regional studies on mapping and stratigraphy (e.g., Cressman, 1973; Ettensohn and others, 1984; Chesnut, 1992) have resulted in changes in the stratigraphic nomenclature and correlation. These changes are shown on this map, and were necessary for compilation of regional maps and for stratigraphic continuity between quadrangles. The 7.5-minute quadrangles that make up the Harrodsburg 30 x 60 minute quadrangle are shown in the index map.

PROCEDURE

The 7.5-minute quadrangle maps were digitally compiled using a semi-automated data-capture technique to convert hard-copy geologic maps into digital format. Compiling 7.5-minute maps into a 30 x 60 minute map required the resolution of significant problems, such as (1) correlating geologic formations across quadrangle boundaries, (2) resolving nonuniform structure-contour datums or intervals, and (3) resolving discrepancies in Quaternary alluvium boundaries and inferred contacts. The metadata portion of the digital file provides detailed information about the conversion process. Formation codes were assigned using the American Association of Petroleum Geologists' standard stratigraphic code (Cohee, 1967), which was modified by the Kentucky Geological Survey for state-specific use. Formations and formation boundaries were not mapped the same way on each of the 7.5-minute quadrangle maps, since they were compiled between 1960 and 1978. Resolution of the differences between quadrangles was necessary for topological analysis in a geographic information system (GIS) environment. In addition, numerous small members mapped on individual 7.5-minute quadrangle maps are too small to be mapped at a scale of 1:100,000 on a 30 x 60 minute quadrangle map. These problems were resolved by adhering to geologic, cartographic, and GIS standards appropriate for the scale of the map.

This map is a compilation of existing maps, and no additional geologic field work took place. When there were problems in stratigraphic correlation between quadrangles, the best current data available were used to resolve these differences.

GEOLOGIC SETTING AND STRUCTURAL GEOLOGY

The geology of the Harrodsburg 30 x 60 minute quadrangle mainly consists of flat-lying sedimentary rocks of Ordovician through Pennsylvanian age. These rocks extend across the north-trending Cincinnati Arch, a structural feature that extends from Ohio through Kentucky to Tennessee. The Jessamine Dome, a regional domal structure, lies along the Cincinnati Arch in central Kentucky. The apex of the Jessamine Dome occurs in the Harrodsburg quadrangle in southern Jessamine County.

The apex is reflected in the circular outcrop pattern of the Upper Ordovician units in the center of the map. Three major fault systems form the boundaries of the Jessamine Dome: (1) the Lexington Fault System, which bisects the quadrangle from north to south, (2) the Kentucky River Fault System, which trends north-northeast in the northeastern part of the quadrangle and represents the northern boundary of the Rome Trough, and (3) the Irvine–Paint Creek Fault System, which is oriented east-northeast across the southeastern part of the quadrangle. The western boundary of the Rome Trough terminates against the Lexington Fault System. Detailed investigations of the Jessamine Dome, Rome Trough, and Irvine–Paint Creek Fault System are by Anderson and others (1982), Harris and Drahovzal (1996), and Drahovzal and Noger (1995).

ECONOMIC AND ENGINEERING GEOLOGY

Limestone, vein minerals, oil, gas, clay, and coal are the principal mineral resources in the Harrodsburg 30 x 60 minute quadrangle. Limestone suitable for construction aggregate and agricultural products is being quarried from the Lexington Limestone in Boyle and Mercer Counties and mined from the High Bridge Group in Fayette, Jessamine, Garrard, and Madison Counties (Anderson and Dever, 1998). Numerous mineral veins occur in the Harrodsburg quadrangle, and many have been mined for barite, fluorite, calcite, and sphalerite (Anderson and others, 1982). Fluorite was mined at several sites near Mundys Landing in southern Woodford County and along Boone Creek at the Fayette–Clark County line during World War II. The Chinn calcite vein and other veins were mined for fluorite in Mercer County during this same period. A vein was mined for barite in Lincoln County in the 1960's, and another vein was mined for sphalerite at the Lexington Quarry Company in Jessamine County during the 1980's. These veins are usually north-trending, narrow, vertical, and extend for several thousand feet along strike. Several stratigraphic tests have been drilled in search of similar mineral occurrences and petroleum in the subsurface of the quadrangle. Traces of galena, sphalerite, fluorite, and barite mineralization have been noted at depth in the Knox Group, but these deposits are not economically mineable.

Several oil and gas fields have been discovered along the previously mentioned fault systems (Wilson and Sutton, 1976), and other anticlinal structures may play an important role in the accumulation of petroleum resources, particularly Cambrian natural gas. The following fields have produced oil from shallow reservoirs: Berea, Madison County; Brodhead, Rockcastle County; Cartersville, Garrard County; Lanhart, Jackson County; Junks, Estill County; Neals Creek and Jumbo Fields, Lincoln County. Cumulative production from the St. Peter Sandstone in the Trapp Gas Field, Clark County, is about 400 million cubic feet (MMcf). Several deep gas wells have been drilled in the Cambrian, and had shows of gas, but they were abandoned, because there is no pipeline to market the gas. For more information on the geology and production in these fields, see Roen and Walker (1996).

Some unnamed coal beds occur in the southeastern part of the quadrangle, but they are discontinuous and have not been extensively mined. Sand, gravel, and clay were also mined from the high-level fluvial and letdown deposits in the eastern and southwestern parts of the quadrangle, but most operations are currently inactive.

Clay from the Borden Formation could have commercial uses, although it is not currently mined. Analysis of samples from the southern part of the quadrangle indicates potential for industrial uses in the pottery, brick, and tile industry and for use as lightweight aggregate (McGrain and others, 1960). Siltstone and sandstone may also have use as flagstone and aggregate.

Slope instability in thick sequences of shales of the Borden Formation affects construction and engineering projects. Landslides or slumps could occur when developed slopes in the Borden are saturated with water.

HYDROGEOLOGY

The Harrodsburg quadrangle covers all of regions 5 and 6 and parts of regions 4 and 7 of the Kentucky River Basin watershed (Carey and others, 1994). The availability and quality of ground water in this area is discussed in Hall and Palmquist (1960), Palmquist and Hall (1960a,b), Carey (1992), Kipp (1997), and Currens and Ray (1998). Most ground water is obtained from wells less than 100 feet deep in shallow alluvial or bedrock regolith. Wells in alluvium near major streams may provide adequate water for farms or commercial operations. Shallow carbonate aquifers in the quadrangle are karstic. Ground water in karst aquifers occurs in solution-enlarged joints and bedding planes and in caves. These features provide a relatively small target for water-well drilling, so several dry holes may be drilled before a well producing an adequate supply for domestic use is found. Where favorably located, springs provide a more predictable supply. Water from all wells and springs in karst aquifers should be sanitized before being used for human consumption.

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