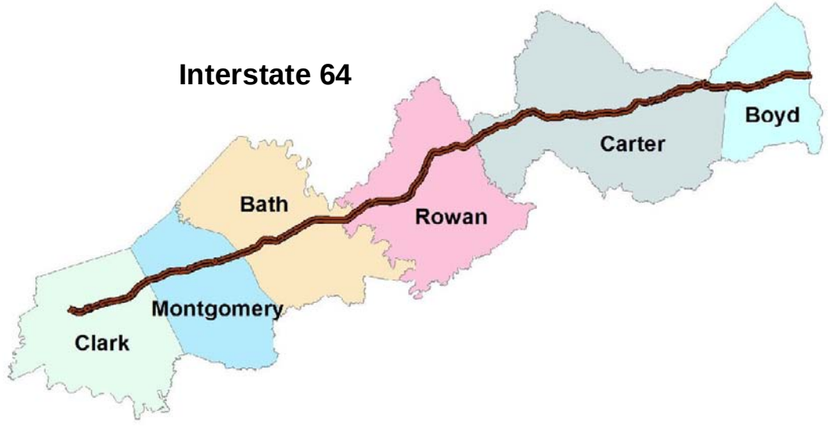
Geology Along Interstate 64: Winchester to Ashland

Daniel I. Carey, Martin C. Noger, Donald C. Haney, and Garland R. Dever Jr.

Sandstone in the Mississippian Farmers Member of the Borden Formation is exposed at several locations along Interstate 64. This is the well-known freestone or building stone used in the construction of many schools and other buildings in the area. Consistent thickness of individual layers characterizes this stone. Shale partings facilitate quarrying.



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UNIVERSITY OF KENTUCKY
Kentucky Geological Survey

Special Publication 12
Series XII, 2011

Terrain Along Interstate 64

While travelling along Interstate 64 from Winchester to Ashland, you will see a variety of terrain. Where natural landforms (lay of the land) differ significantly from one area to another, this generally indicates that each landform is underlain by a different type of rock. These different areas are known as physiographic regions. The major physiographic regions crossed by this stretch of Interstate 64 are the Inner Bluegrass, Bluegrass Hills, Outer Bluegrass, Knobs, Cumberland Escarpment/Mississippian Plateau, and Eastern Kentucky Coal Field. Figure 1 shows all physiographic regions in Kentucky, as well as the location this stretch of Interstate 64.

WARNING: Kentucky law prohibits vehicles from stopping on the shoulders of limited-access highways except in case of emergency --Title 603 KAR 5:025 Sec 4

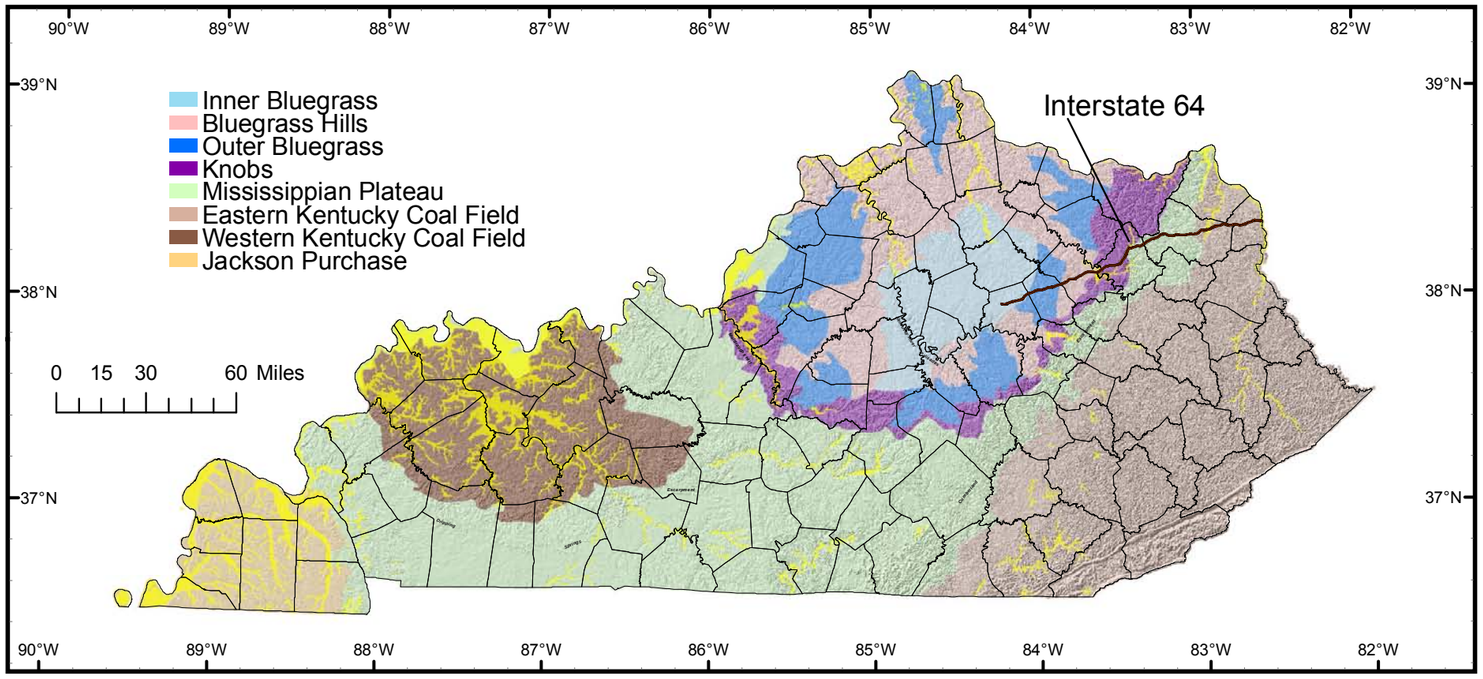

Figure 1. Physiographic regions in Kentucky and location of Interstate 64.

The Inner Bluegrass, extending to mile 99.3, is underlain by interbedded limestone, dolomite, and shale. The landscape is characterized by gently rolling terrain, sinkholes, rich soils, and Thoroughbred horse farms. Most of the rock exposures along Interstate 64 are covered with vegetation until near Winchester. The Bluegrass Hills, or Eden Shale Belt, lies between mile 99.3 and 106.7. The Clays Ferry Formation, with interbedded limestone and impervious and easily eroded shales, creates a hilly landscape. The rolling Outer Bluegrass begins at the eastern edge of the Bluegrass Hills and extends to mile 132.5.

Around mile 132.5, the landscape changes from a gently rolling upland to a belt of cone-shaped hills. This is the boundary of the Knobs Region with the Outer Bluegrass. The Knobs is a narrow belt of ridges and conical hills left behind by the eroding Mississippian rocks. These hills are generally separated by broad, shale-floored valleys underlain by siltstone and silty shale. The rocks are primarily from the Devonian and Silurian Periods.

Between mile 143.8 and 147.0, the landscape changes from the shale-floored valley of the Knobs Region to the narrow ridges capped by sandstone that characterize the Cumberland Escarpment/Mississippian Plateau. This region, in which limestone from the Slade Formation is quarried for use as crushed stone for road construction and concrete aggregate, extends to mile 161.5.

From mile 161.5 east lie the Pennsylvanian hills of the Eastern Kentucky Coal Field—a region of irregular, narrow-crested ridges and deep valleys with very little bottom land. This is one of the most important coal-producing regions in the world.

Roadlog and Strip Maps

Geologic units are shown approximately 0.5 mile on either side of the highway. Figure 2 shows the symbols used on all the strip maps. The construction of these continuous strip maps was facilitated by the availability of detailed 1:24,000-scale (1 inch on the map equals 24,000 inches or 2,000 feet on the ground) geologic data in digital form for the entire state; the digital data were converted from geologic quadrangle maps published by the U.S. Geological Survey in a joint project with the Kentucky Geological Survey from 1960 to 1978. Interstate 64's area is covered by 17 of these maps. Figure 3 shows the 7.5-minute quadrangles Interstate 64 passes through.

The roadlog covers the extent of Interstate 64 from Winchester, Ky., to the West Virginia border at the Big Sandy River. All descriptions of rock strata and geologic features are referenced to the highway mile markers that are located at 1-mile intervals along the shoulder of the highway. Mile-marker numbers are the same on both sides of the highway. Some of the roadcuts identified during a survey in the 1990's, particularly into shale, may now be revegetated. The descriptions were nonetheless retained in order to identify what now lies beneath the overgrowth.

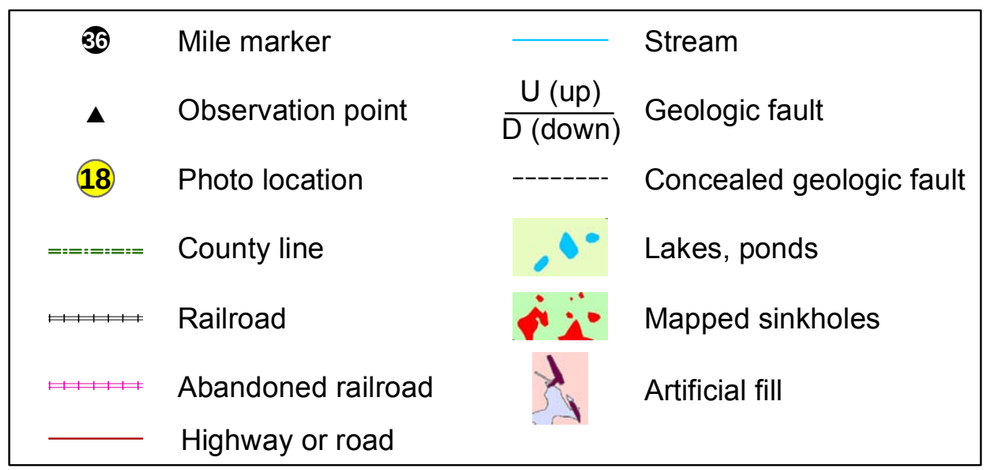

Figure 2. Symbols used on the strip maps.

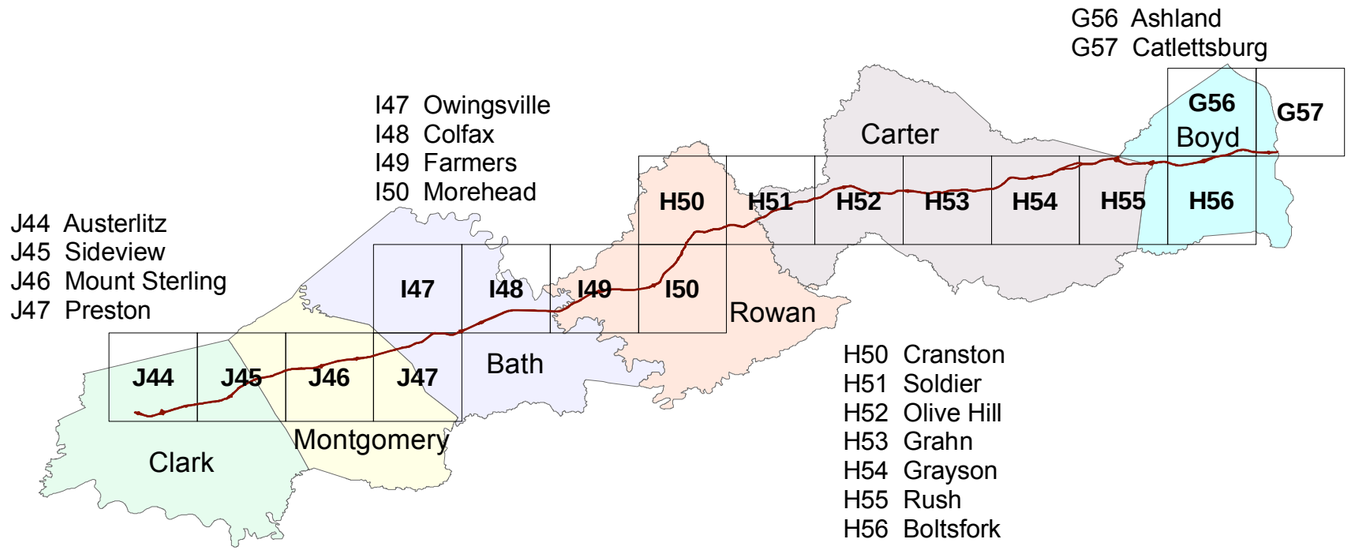

Figure 3. Interstate 64 passes through these 7.5-minute quadrangles.

Stratigraphy

A stratigraphic column (Fig. 4) is a generalized graphic representation of the rock layers present at the earth's surface. Figure 4 shows the rock units exposed along Interstate 64 from Winchester eastward, and indicates the units' geologic ages. To make it easier to study and describe these stratigraphic units, geologists have subdivided them into groups, formations, members, and beds. A group is a major stratigraphic unit containing two or more formations. A formation is a unit of rock that has characteristic and distinctive rock types and layering that are mappable. A member is a subdivision of a formation that is distinguishable from adjacent parts of the formation. A bed is a rock unit lower in rank than a member, which has a distinctive lithology (for example, a coal bed). The abbreviations used on geologic maps to designate specific rock units are indicated in parentheses after the unit name in Figure 4.

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Geologic Time Scale		Unit	Description
Present	Quaternary	Alluvium (Qal)	silt, clay, sand, and gravel
		Terrace deposits (QTt)	gravel, sand, silt, clay
2 million years ago		High-level fluvial deposits (QTf)	gravel, sand, silt, clay
300 million years ago	Pennsylvanian	Monongahela Formation and upper part, Conemaugh Formation (Pmc)	shale, siltstone, sandstone, minor coal
		Conemaugh Formation (Pc)	siltstone, sandstone, limestone reddish-green shale
		Princess Formation (Ppr)	sandstone, shale, siltstone, coal
		Princess No. 7 coal (P_7)	
		Princess No. 6 coal (P_6)	
		Princess No. 5 coal (P_5)	
		Middle part, Breathitt Group (Pbm)	shale, siltstone, sandstone, minor coal
		Four Corners Formation (Pfc)	sandstone, shale, siltstone, coal
		Hyden Formation (Ph)	sandstone, shale, siltstone, coal
		Fire Clay coal (fc)	
		Pikeville Formation (Ppk)	shale, siltstone, sandstone, minor coal
		Little Caney coal (lc)	
		Bruin coal (bu)	
		Grayson Sandstone Bed, Pikeville Formation (Pgr)	sandstone
		Pikeville and Grundy Formation, undifferentiated (Ppg)	shale, siltstone, sandstone, minor coal
		Grundy Formation (Pg)	sandstone, siltstone, shale, minor coal
		Unnamed sandstone bed in Grundy Formation (Pgs)	sandstone
		Unnamed sandstone bed in lower part, Breathitt Group (Pbls)	sandstone
		Corbin Sandstone Member, Grundy Formation (Plc)	sandstone
325 million years ago	Mississippian	Paragon Formation (Mp)	interbedded limestone and shale
		Paragon and Slade Formations, undifferentiated (Mpsl)	interbedded limestone and shale cherty limestone
		Carter Caves Sandstone (Mc)	sandstone
		Slade Formation (Msla)	cherty limestone
		Renfro Member, Slade Formation, and Nada Member, Borden Formation (Mbrn)	orange, weathering dolomite interbedded vari-colored shale and limestone
		Upper part, Borden Formation (Mbu)	interbedded limestone, siltstone, shale
340 million years ago	Mississippian	Nada Member, Borden Formation (Mbna)	interbedded vari-colored shale and limestone
		Cowbell Member, Borden Formation (Mbc)	siltstone and shale
		Nancy Member, Borden Formation (Mbn)	greenish-gray shale
		Farmers Member, Borden Formation (Mbf)	interbedded sandstone and shale
		Sunbury Shale, Berea Sandstone, and Bedford Shale, undivided (MDsb)	black, carbonaceous shale, sandstone, greenish--gray shale
		Sunbury Shale (Msu)	black, carbonaceous shale
		Bedford Shale (MDbd)	greenish-gray shale
360 million years ago	Devonian	New Albany Shale (MDna)	black, carbonaceous shale
		Ohio Shale (Do)	black, carbonaceous shale
		Boyle Dolomite (Db)	cherty dolomite
410 million years ago	Silurian	Estill Shale of Crab Orchard Group (Se)	green shale
		Alger Shale (Sa)	green and red shale
		Drowning Creek Formation (Sd)	cherty dolomite, contains glauconite; large crinoid stems near top
440 million years ago	Ordovician	Preachersville and Rowland Members, Drakes Formation (Odpr) Preachersville Member, Drakes Formation (Odp)	greenish-gray shale shaly dolomite
		Bull Fork Formation (Ob)	interbedded limestone and shale
		Sunset Member, Bull Fork Formation (Obs)	micrograined limestone
		Upper Ashlock Formation (Oau)	limestone and shale
		Grant Lake Member, Ashlock Formation (Oagl)	nodular-bedded limestone and shale
		Upper member, Grant Lake Limestone (Oglu) Grant Lake Limestone (Ogl)	nodular-bedded limestone and shale
		Tate Member, Ashlock Formation (Oat)	greenish-gray, silty limestone and shale
		Calloway Creek Limestone (Occ) Upper part, Calloway Creek Limestone (Occu) Lower part, Calloway Creek Limestone (Occl)	interbedded limestone and shale, limestone dominant
		Garrard Siltstone (Og)	calcareous siltstone; contains flow rolls
		Kope and Clays Ferry Formation (Okc)	interbedded shale and limestone
		Clays Ferry Formation (Ocf)	interbedded limestone and shale
480 million years ago		Upper part, Lexington Limestone (Olu)	nodular-bedded limestone and shale
		Tanglewood Limestone Member No. 4, Lexington Limestone (Olt4)	clastic limestone, commonly cross-bedded

Figure 4. Generalized stratigraphic column. Nearly 300 million years of the geologic record are absent in Kentucky, either from nondeposition or erosion, including the Tertiary, Cretaceous, Jurassic, Triassic, Permian, and part of the Pennsylvanian.

Geology Along Interstate 64: Winchester to Ashland: Mile 93.8–107.7

Mile 95.5: Upper part of the Lexington Limestone (Olu).

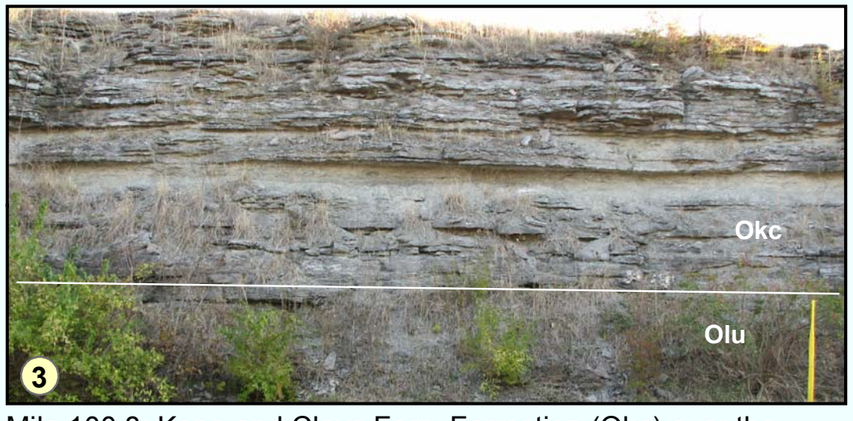
Mile 98.3, 99.6, 101.3, 102.0: Clays Ferry Formation (Ocf): interbedded limestone and shale. Contains distinctive brachiopod *(Sowerbyella)* in the lower part.

Hillsides on the shaly limestone units stripped of trees quickly begin a downhill slide under the forces of water and gravity and the actions of livestock.

Mile 104.0, 104.2: Calloway Creek Limestone (Occ) over Garrard Siltstone (Og).

Geologic Map Index

J44 Austerlitz
J45 Sideview
J46 Mount Sterling



Mile 100.8: Kope and Clays Ferry Formation (Okc) over the upper part of the Lexington Limestone (Olu).

The greater shale content in the Kope and Clays Ferry Formation (Okc) creates the more rugged terrain of the Bluegrass Hills Region that lies between mile 99 and 107.

Geology Along Interstate 64: Winchester to Ashland: Mile 107.7–121.1

Mile 108.0: Lower part of the Calloway Creek Limestone (Occl).

Mile 110.2, 111.0, 111.8: Greenish-gray silty limestone and shale of the Tate Member of the Ashlock Formation (Oat) over interbedded limestone and shale (limestone dominant) of the upper part of the Calloway Creek Limestone (Occu).

Mile 117.1: Fault in the Bull Fork Formation (Ob).

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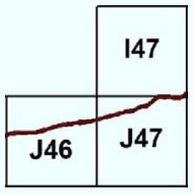


I47 Owingsville
J46 Mount Sterling
J47 Preston

Mile 119.4: Devonian Boyle Dolomite (Db), 400 million years old.

Mile 118.5: Sunset Member of the Bull Fork Formation (Obs) over the upper member of the Grant Lake Limestone (Oglu).

Mile 119.1, 120.8: Contact between, in descending order, greenish-gray (grassed) Alger Shale (Sa), gray fossiliferous dolomite interbedded with greenish-gray clay shale in the Drowning Creek Formation (Sd), and greenish-gray shale of the Preachersville Member of the Drakes Formation (Odp).

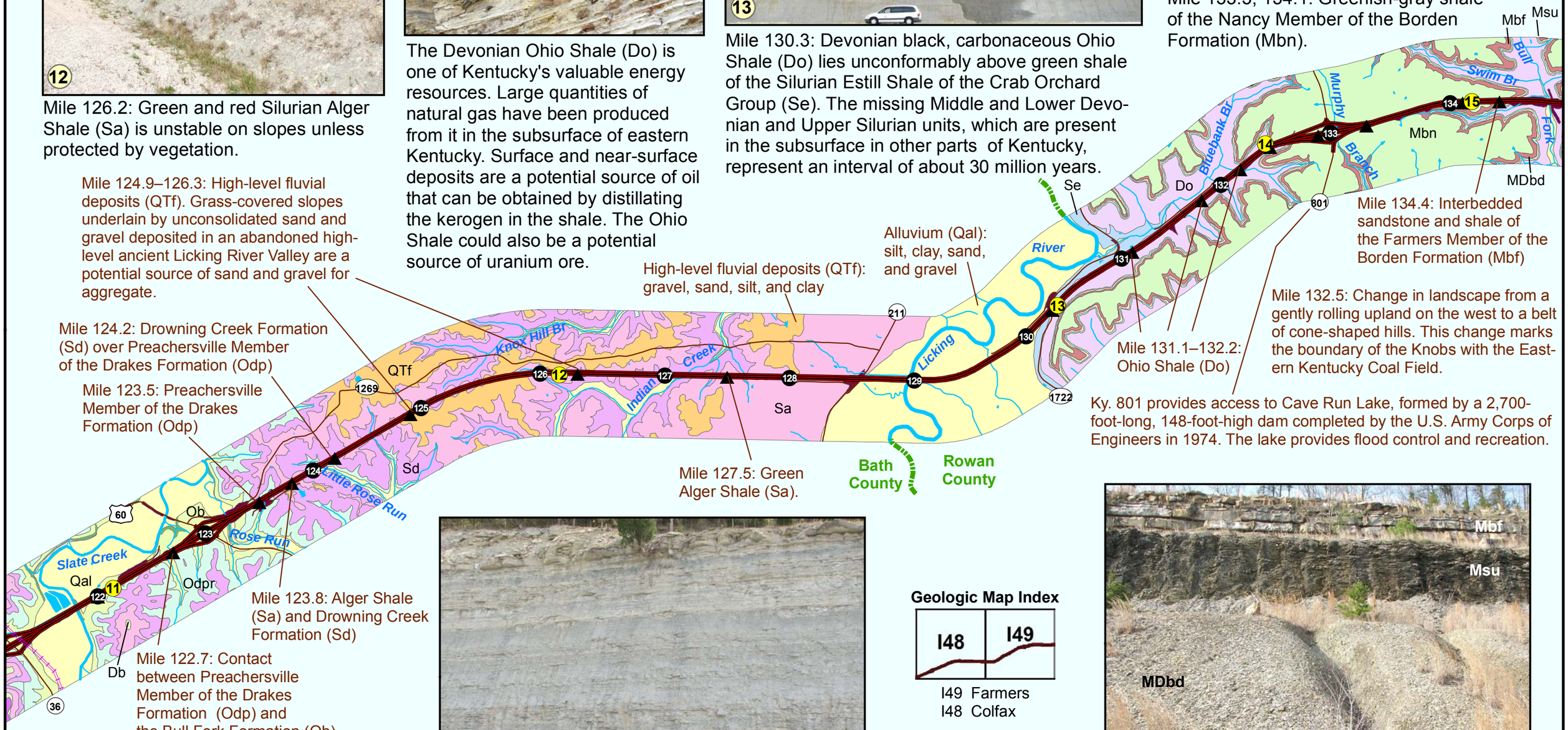
Geology Along Interstate 64: Winchester to Ashland: Mile 121.1–134.9

Mile 126.2: Green and red Silurian Alger Shale (Sa) is unstable on slopes unless protected by vegetation.

The Devonian Ohio Shale (Do) is one of Kentucky's valuable energy resources. Large quantities of natural gas have been produced from it in the subsurface of eastern Kentucky. Surface and near-surface deposits are a potential source of oil that can be obtained by distillating the kerogen in the shale. The Ohio Shale could also be a potential source of uranium ore.

Mile 130.3: Devonian black, carbonaceous Ohio Shale (Do) lies unconformably above green shale of the Silurian Estill Shale of the Crab Orchard Group (Se). The missing Middle and Lower Devonian and Upper Silurian units, which are present in the subsurface in other parts of Kentucky, represent an interval of about 30 million years.

Mile 133.3, 134.1: Greenish-gray shale of the Nancy Member of the Borden Formation (Mbn).



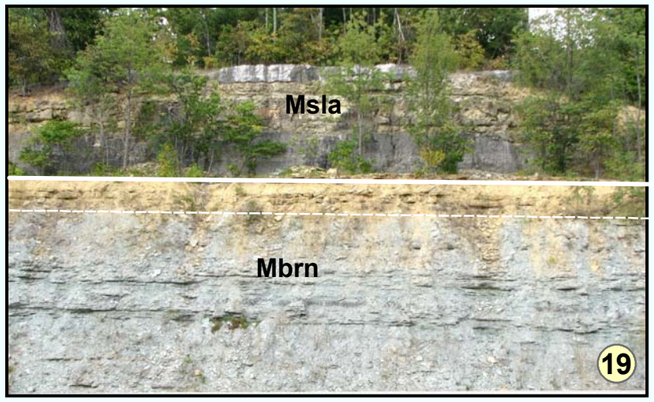
Mile 122.2: Greenish-gray shale and shaly dolomite of the Preachersville Member of the Drakes Formation (Odp).

Geologic Map Index

I49 Farmers
I48 Colfax

Mile 132.5–132.9: Contact between interbedded sandstone and shale of the Farmers Member of the Borden Formation (Mbf); black, carbonaceous Sunbury Shale (Msu); and greenish-gray Bedford Shale (MDbd).

Geology Along Interstate 64: Winchester to Ashland: Mile 134.9–151.6



Mile 146.0–146.4, 147.5: Cherty limestone of the Slade Formation (Msla), orange-weathering dolomite of the Renfro Member of the Slade Formation and interbedded varicolored shale and limestone of the Nada Member of the Borden Formation (Mbrn).

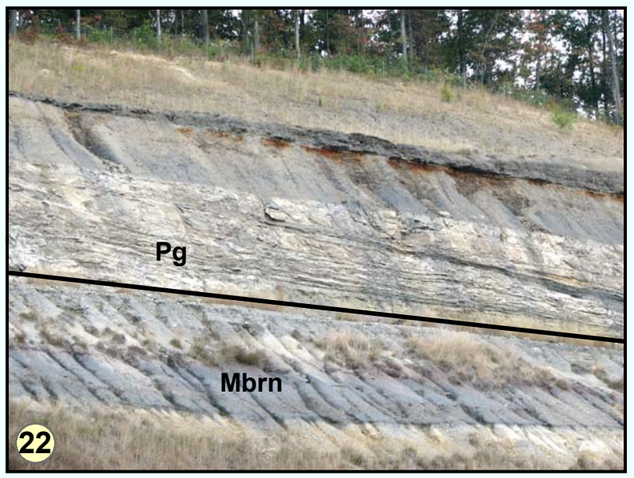
Mile 143.8–145.5: Siltstone and shale in the Cowbell Member of the Borden Formation (Mbc).

Mile 135.4: Greenish gray shale of the Nancy Member of the Borden Formation (Mbn) has potential for use in manufacturing drain and structural tiles; may contain ironstone concretions.

Mile 148.6: Shaly sandstone in the Grundy Formation (Pg).

Mile 147.0, 147.6: Mississippian Slade Formation (Msla). White limestone caps other limestone units.

Mile 138.8: Interbedded sandstone and shale of the Farmers Member of the Borden Formation (Mbf) is quarried as building stone.



Mile 151.0: Contact between Grundy Formation (Pg) and the Renfro Member of the Slade Formation and Nada Member of the Borden Formation (Mbrn).

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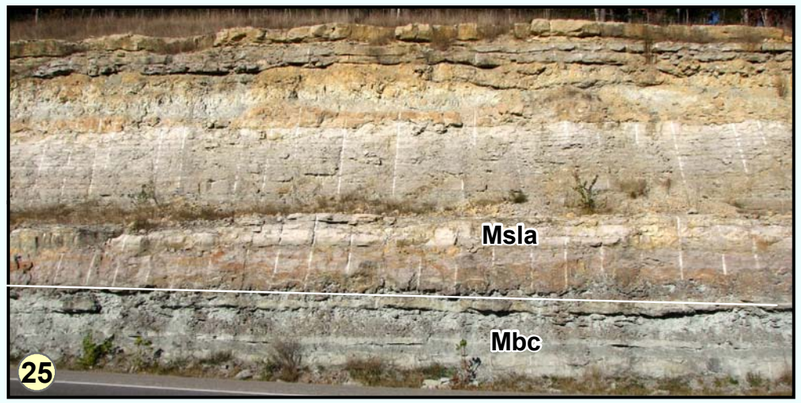
H50 Cranston
H51 Soldier
I49 Farmers
I50 Morehead

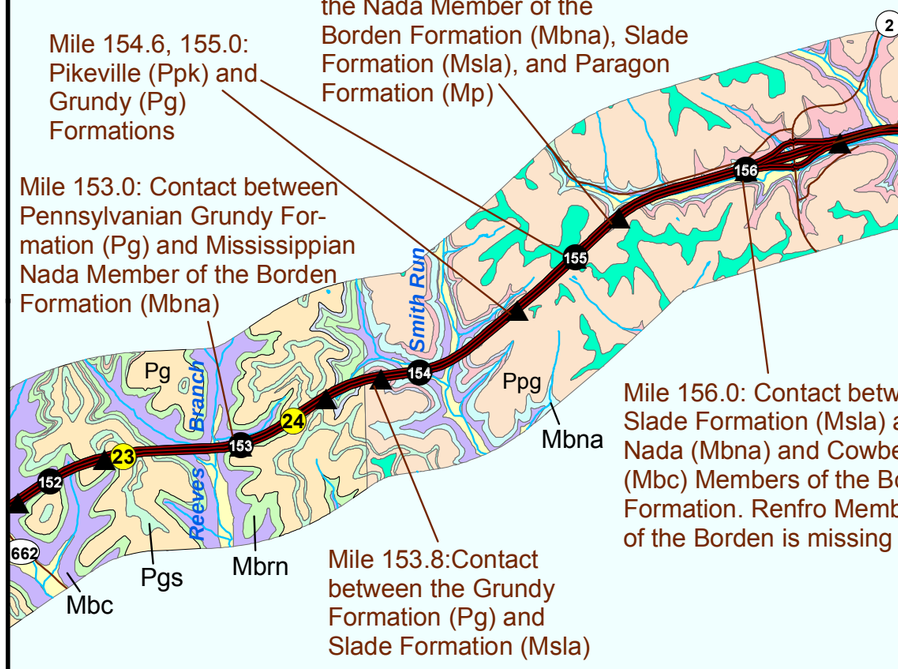
Geology Along Interstate 64: Winchester to Ashland: Mile 151.6–165.3

Mile 153.3: Sandstone over shale in the Pennsylvanian Grundy Formation (Pg).



Mile 157.4: Limestone and shale of the Slade Formation (Msla) over siltstone and shale of the Cowbell Member of the Borden Formation (Mbc).

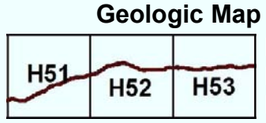
Mile 158.8: Limestone of the Mississippian Slade Formation (Msla).



Mile 152.3, 153.5: Dark-gray shale with sandstone lenses in the Pennsylvanian Grundy Formation (Pg).

Mile 161.5: Limestone of the Slade Formation (Msla) is quarried for use as crushed stone for road construction and concrete aggregate. Photo from the U.S. Department of Agriculture–Farm Services Administration, National Imagery Program (2004).

Geologic Map Index

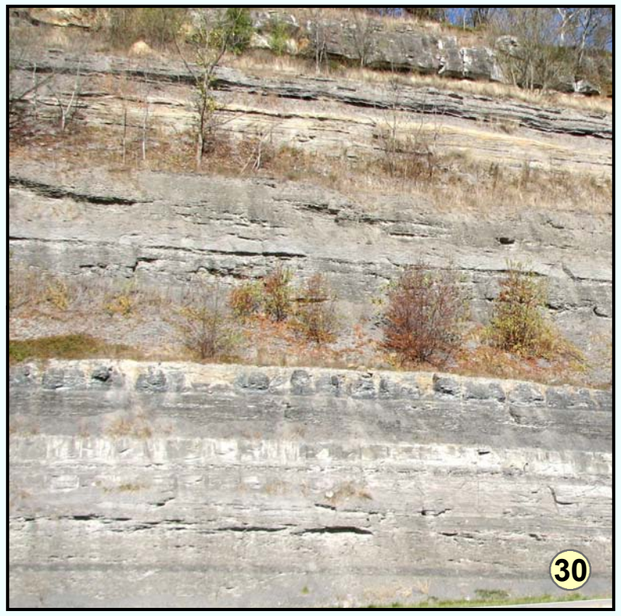


H51 Soldier
H52 Olive Hill
H53 Grahn

Mile 162.1: Shale layer in the Pennsylvanian Hyden Formation (Ph).

Carter Caves State Resort Park, a popular attraction in the steep Mississippian limestone valleys of tributaries of Tygarts Creek, is accessed from exit 161.

Geology Along Interstate 64: Winchester to Ashland: Mile 165.3–178.6



Mile 172.8: Middle part of Breathitt Group (Pbm). Sandstone, siltstone, shale, and coal.

Mile 174.8: Princess Formation (Ppr). Sandstone, siltstone, shale, and coal. Red seepage of iron oxide at thin coal seams.

Mile 176.4: Sandstone, siltstone, shale, Princess Nos. 5 (P_5) and 7 (P_7) coal beds of the Princess Formation (Ppr).

Miles 165.6–166.0: In ascending order, Grundy Formation (Pg), Grayson Sandstone Bed of Pikeville Formation (Pgr), Bruin coal bed (bu) and Little Caney coal bed (lc) of Pikeville Formation, Fire Clay coal bed (fc) of Hyden Formation (Ph).

Geologic Map Index

H53 Grahn
H54 Grayson
H55 Rush

Mile 174.4: Middle part of Breathitt Group (Pbm). Shale, largely carbonaceous, dark gray to black, with ironstone concretions.

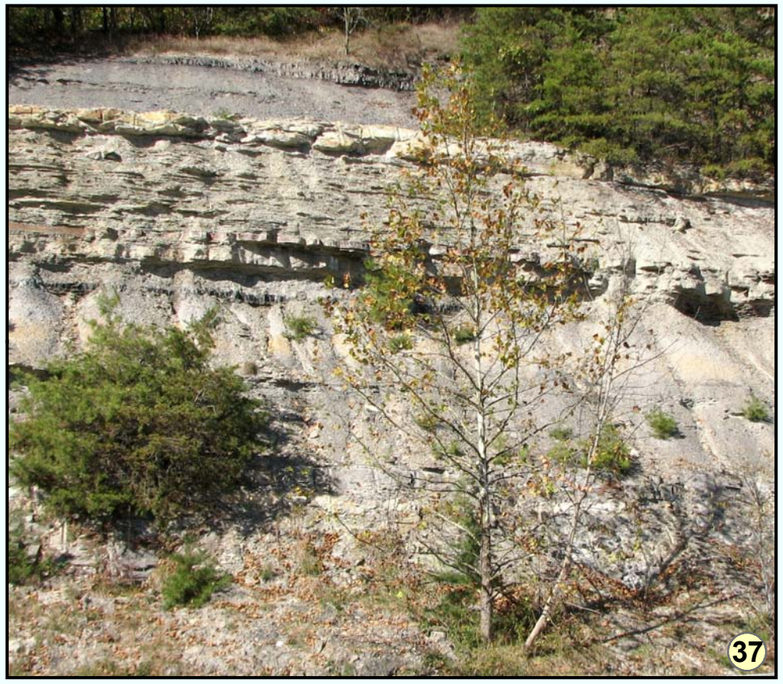
Mile 177: Reclaimed surface mine in the Princess Formation (Ppr); the Princess No. 5 coal (P_5) was mined. Photo from the U.S. Department of Agriculture–Farm Services Administration, National Aerial Imagery Program (2004).

Mile 166.0: Pikeville Formation (Ppk). Sandstone, shale, and coal.

The wide alluvium (Qal) of the Little Sandy River provides level land for communities, agriculture, and industry.

Mile 174.8: Princess Formation (Ppr) with Princess No. 5 coal bed (P_5).

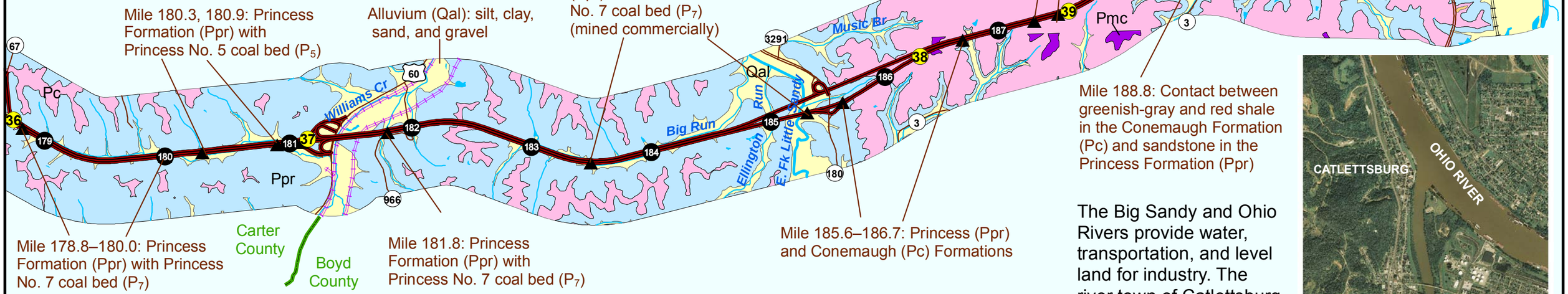
Geology Along Interstate 64: Winchester to Ashland: Mile 178.6–191.5



Mile 181.1: Princess Formation (Ppr) with Princess Nos. 5 (P_5), 6 (P_6), and 7 (P_7) coal beds.

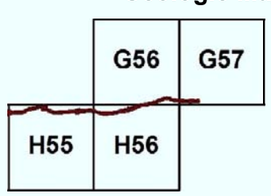
Mile 186.3: Conemaugh Formation (Pc): sandstone, siltstone, limestone.

Mile 187.6: Sandstone above thick shale bed in the Conemaugh Formation (Pc).



Mile 178.7: Princess Formation (Ppr): sandstone, siltstone, shale, with Princess No. 7 coal bed (P_7).

Geologic Map Index



G56 Ashland
G57 Catlettsburg
H55 Rush
H56 Bolts Fork/ Burnaugh

The Big Sandy and Ohio Rivers provide water, transportation, and level land for industry. The river town of Catlettsburg, at the confluence of the two rivers, was subject to flooding on a regular basis—estimated at every 18 months prior to 1937. During that year, a major flood convinced the town that a floodwall and levee system was necessary to protect the town. Aerial photos by the U.S. Department of Agriculture–Farm Services Administration, National Agricultural Imagery Program (2006).