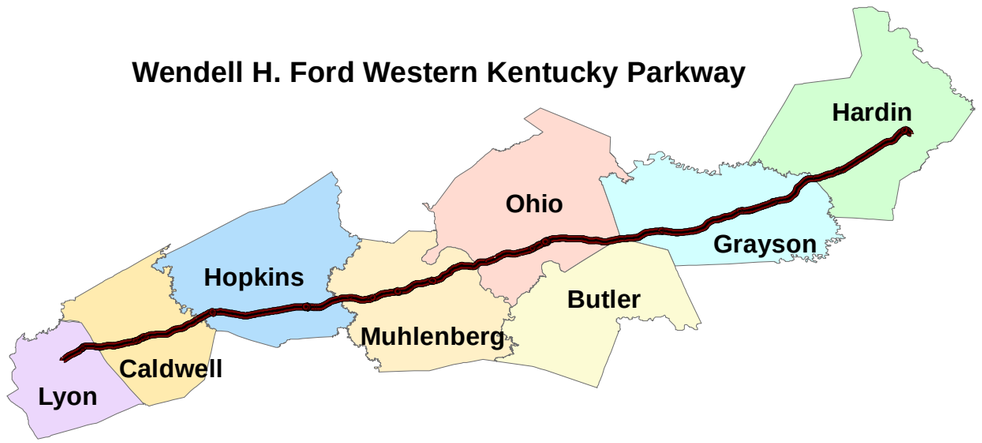
# Geology Along the Wendell H. Ford Western Kentucky Parkway

**Daniel I. Carey, Martin C. Noger, Donald C. Haney, and Stephen F. Greb**

The Caseyville Sandstone, seen here at Lake Malone in Muhlenberg County, lies along the Wendell H. Ford Western Kentucky Parkway and along the margin of the Western Kentucky Coal Field.




**Kentucky Geological Survey**
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# Terrain Along the Wendell H. Ford Western Kentucky Parkway

While travelling along the parkway, 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 the Western Kentucky Parkway are the Pennyroyal (Pennyrile), Clifty, and Western Kentucky Coal Field. Figure 1 shows all physiographic regions in Kentucky, as well as the location of the Western Kentucky Parkway.

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.

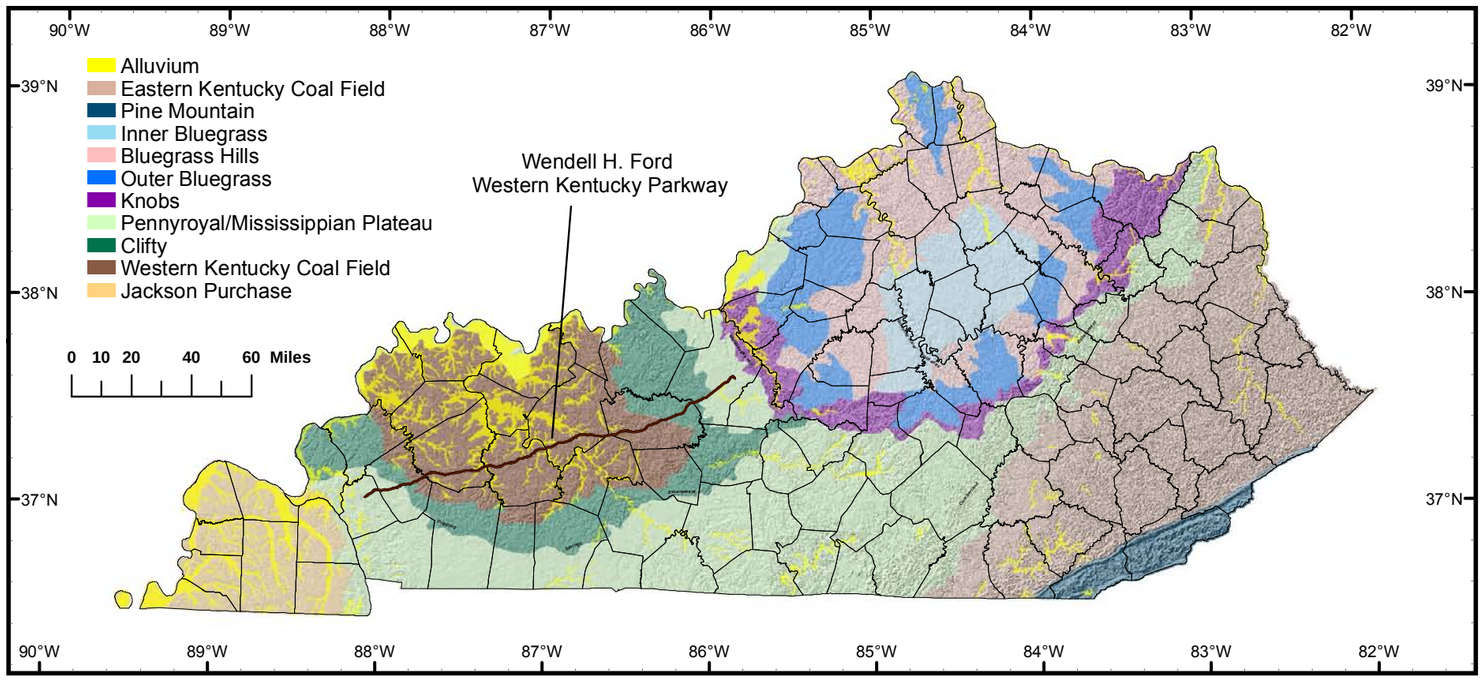


Figure 1. Physiographic regions in Kentucky and location of the Wendell H. Ford Western Kentucky Parkway.

The parkway begins in Lyon County at the junction with Interstate 24 near Lake Barkley. West of mile 15.0, the Pennyroyal Region is an upland underlain by limestone and characterized by complex underground drainage systems marked by sinkholes and caves; the limestone weathers to form thick, reddish residual soils. From mile 15.0 to 20.0, the landscape changes to narrow ridges and valleys underlain by an alternating sequence of resistant sandstones and less resistant shales and limestones: the Clifty Region.

From mile 20.0 to Leitchfield, the parkway crosses the Western Kentucky Coal Field, one of the most important coal producing areas in the world. The coal field is an upland of hills with low to moderate relief and wide, poorly drained valleys underlain by coal, shale, siltstone and sandstone.

From Leitchfield at mile 107.0 eastward to mile 122.0, the parkway reenters the Clifty Region. The route down the Dripping Springs Escarpment on the eastern edge of the Clifty leads back to the Pennyroyal Sinkhole Plain, formed by Mississippian limestones similar to those of the first 20 miles. This lower plateau extends to the end of the parkway.

## 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. The parkway's area is covered by 24 of these maps. Figure 3 shows the 7.5-minute quadrangles the parkway passes through.

The roadlog covers the entire extent of the Western Kentucky Parkway. 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.

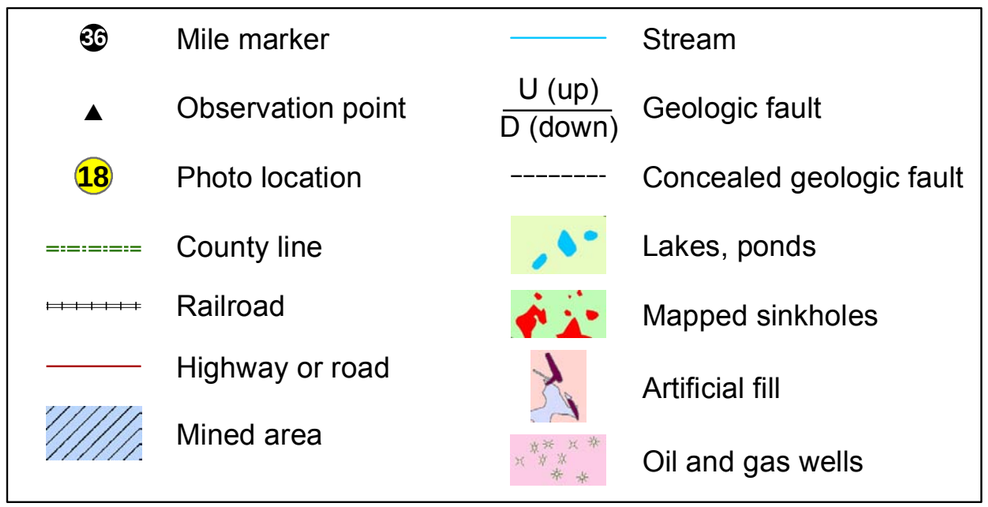


Figure 2. Symbols used on the strip maps.

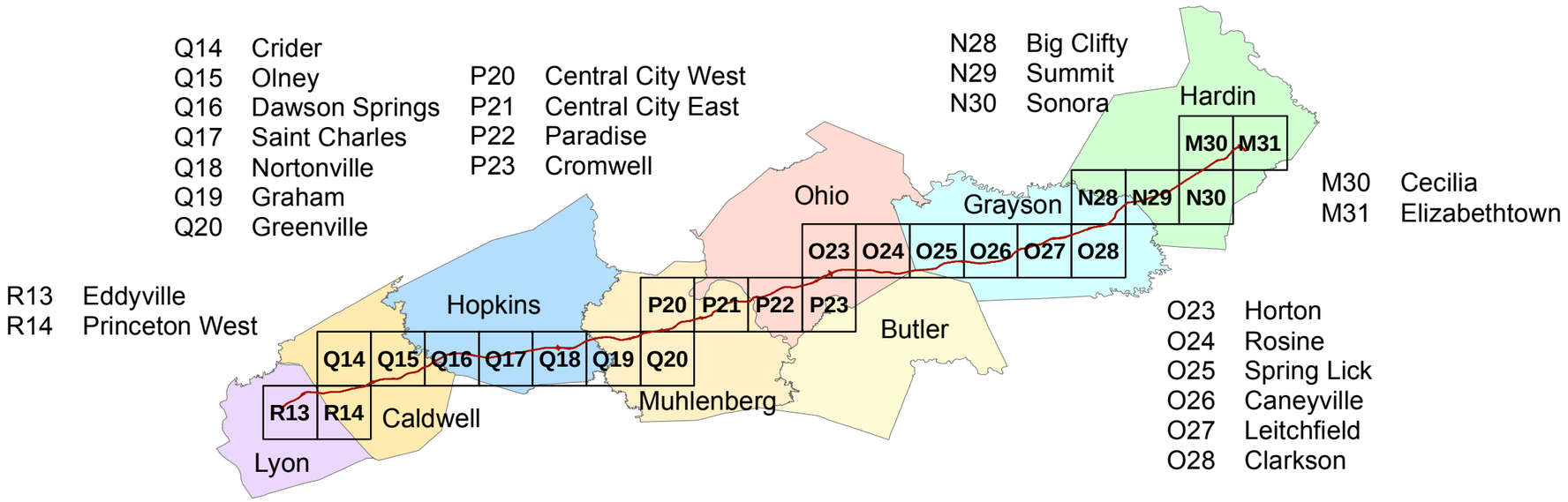


Figure 3. The Western Kentucky Parkway passes through these 7.5-minute quadrangles.

## 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 the Western Kentucky Parkway, 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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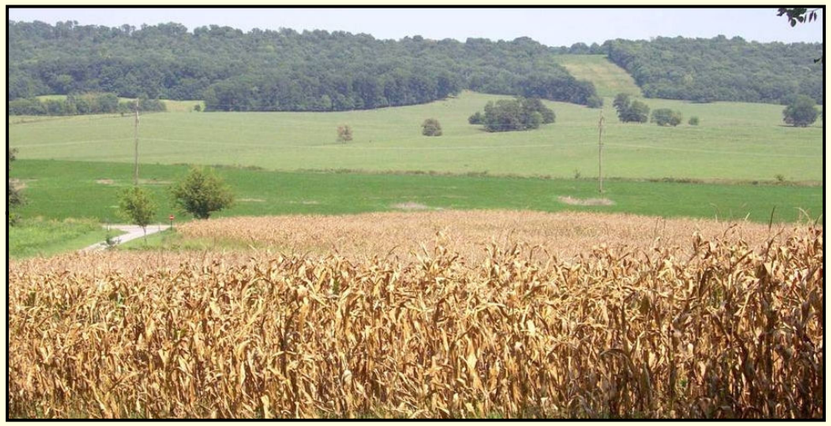
| Geologic Time Scale | Unit | Description |
|---|---|---|
| Present | | |
| Quaternary | Alluvium (Qal) | silt, clay, sand, and gravel |
| | Lacustrine and fluvial deposits (Qlf) | gravel, sand, silt, clay |
| | Tuscaloosa Formation (Kt) | gravel, sand, silt, clay |
| 2 million years ago | | |
| Pennsylvanian | Patoka Formation (Pp) | sandstone, shale, siltstone, coal, limestone |
| 300 million years ago | Shelburn Formation (Psh) | sandstone, shale, siltstone, coal, limestone |
| | Baker (W. Ky. No. 13) coal (13) | |
| | Paradise (W. Ky. No. 12) coal (12) | |
| | Carbondale Formation (Pc) | sandstone, shale, siltstone, coal, limestone |
| | Herrin (W. Ky. No. 11) coal (11) | |
| | Springfield (W. Ky. No. 9) coal (9) | |
| | W. Ky. No. 7 coal (7) | |
| | W. Ky. No. 6 coal (6) | |
| | Tradewater Formation (Pt) | sandstone, shale, siltstone, coal, limestone |
| | Mining City coal (mc) | |
| | Elm Lick coal (e) | |
| | W. Ky. No. 4 coal (4) | |
| | Tradewater and Caseyville Formations (Ptc) | conglomeratic sandstone, shale, siltstone, coal, limestone |
| | Caseyville Formation (Pca) | conglomeratic sandstone, shale, siltstone, coal, limestone |
| Mississippian | Kinkead Limestone, Degonia Sandstone, Clore Limestone (Mkc) | sandstone, siltstone, shale, limestone |
| 325 million years ago | Leitchfield Formation (Ml)/ Buffalo Wallow Formation (Mbw) — Palestine Sandstone (Mpt) | sandstone and minor shale |
| | Menard Limestone (Mme) | limestone and shale |
| | Waltersburg Sandstone and Vienna Limestone (Mwv) | sandstone, siltstone, shale, limestone |
| | Tar Springs Sandstone (Mts) | shale and sandstone |
| | Glen Dean Limestone (Mgd) | limestone and minor shale |
| | Hardinsburg Sandstone (Mh) | sandstone and minor shale |
| | Golconda Formation (Mgo) — Haney Limestone Member (Mgh) | limestone and minor shale |
| | Big Clifty Sandstone Member (Mgb) | sandstone and minor shale |
| | Beech Creek Limestone Member (Mgc) | limestone and minor shale |
| | Girkin Formation (Mg) | limestone, fine-grained |
| | Reelsville Limestone (Mr) | limestone and minor shale |
| | Sample Sandstone (Msa) | sandstone and minor shale |
| | Beaver Bend Limestone, Mooretown Formation, Paoli Limestone (Mbp) | limestone, fine-grained |
| | Cypress Sandstone (Mc) | sandstone and minor shale |
| | Paint Creek Limestone (Mpc) | limestone and shale |
| | Bethel Sandstone (Mbe) | sandstone and minor shale |
| 340 million years ago | | |
| Mississippian | Bethel Sandstone and Renault Limestone (Mbr) | sandstone, siltstone, shale, limestone |
| 355 million years ago | Renault Limestone (Mre) | limestone and minor shale |
| | Renault Limestone and Ste. Genevieve Limestone (Mrsg) | limestone and minor shale |
| | Ste. Genevieve Limestone (Msg) | limestone, fine-grained |
| | Ste. Genevieve Limestone and St. Louis Limestone, Upper Member (Mssu) | limestone, fine-grained |
| | Rosiclare Sandstone Member of the Ste. Genevieve Limestone (Msgr) | sandstone and minor shale |
| | St. Louis Limestone (Msl) | limestone, fine-grained |
| | St. Louis and Salem Limestones (Mss) | limestone, fine-grained |
| | Warsaw Limestone (Mw) | limestone, fine-grained |
| | Fort Payne Formation (Mfp) | siltstone and shale |

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 Periods.

# Geology Along the Wendell H. Ford Western Kentucky Parkway: Mile 0.0–13.0

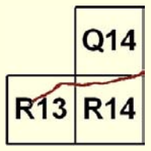


The topography of the Pennyroyal Region along this section of the parkway ranges from flat river valleys to narrow ridges, with elevations ranging from 380 to 710 feet. Photo by Glynn Beck, Kentucky Geological Survey.

Limestone is abundant in Caldwell County. The Princeton Quarry of the Rogers Group produces 800,000 tons of crushed stone each year from the Ste. Genevieve Limestone (Msg). The quarry, on the southeast side of Princeton off of Ky. 91, has been in operation since 1891. Photo by Glynn Beck, Kentucky Geological Survey.


Mile 10.9: Mississippian Ste. Genevieve Limestone (Msg) juts from the embankment like prehistoric beasts. Exposed rocks are rare at the beginning of the parkway.

**Geologic Map Index**




Q14 Crider
R13 Eddyville
R14 Princeton West




Tuscaloosa Formation (Kt) of Cretaceous age lies unconformably on St. Louis Limestone (Msl) of Mississippian age. Rocks of Jurassic, Triassic, Permian, Pennsylvanian, and Late Mississippian ages, representing an interval of about 250 million years, are missing.

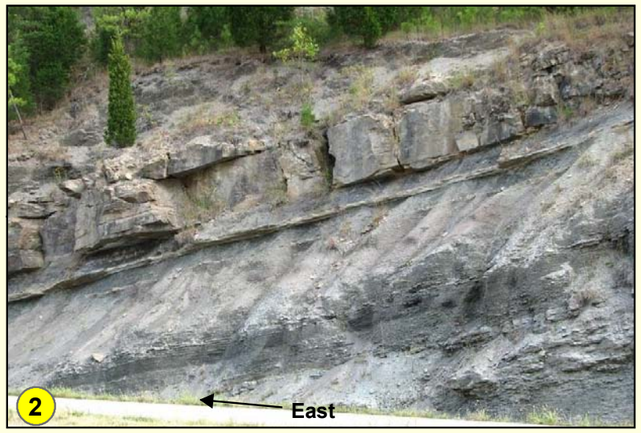


Sinkholes can present problems. The baseball field at Lee Jones Lyon County Recreational Park was moved because a sinkhole formed in the infield. Photo by Glynn Beck, Kentucky Geological Survey.




Karst is an irregular limestone region with sinkholes, underground streams, and caverns. Certain rock units have more sinkholes than others. The Ste. Genevieve (Msg) and St. Louis (Msl) Limestones form karst features. Fractures in the rock become enlarged when the rock dissolves, forming sinkholes and sinking streams. In karst areas, most rainfall sinks underground, resulting in fewer streams flowing on the surface than in nonkarst settings. Water flows underground through cracks, crevices, and caves, sometimes reemerging at karst windows, then sinks again to eventually discharge at a spring along a major stream or at the top of underlying impermeable rock. From Currens (2001).

# Geology Along the Wendell H. Ford Western Kentucky Parkway: Mile 13.0–26.6




Mile 15.3: Thick limestone overlying shale and thin limestone in the Golconda Formation (Mgo).


Mile 15.6: Sandy shale unit in the Glen Dean Limestone (Mgd).


A north-trending fault (not exposed) at about mile 15.0 causes the units to dip about 14° to the east. Dip diminishes to about 2° by mile 16.0. From Trace and Kehn (1968).

Mile 15.0: The landscape changes to the east from an upland of complex sinkholes and thick residual soils to narrow ridges and valleys underlain by an alternating sequence of resistant sandstones and less-resistant shales and limestones.

Mile 15.9–16.1: Contact between shaly limestone of the Glen Dean Limestone (Mgd) and fine-grained sandstone and shale of theTar Springs Sandstone (Mts). Units dip about 2° to the east. Minor fault about 100 feet east of mile 16.1 (Trace,1981).

Mile 17.3: Waltersburg Sandstone and Vienna Limestone (Mwv); shale, siltstone, sandstone, and limestone

Mile 21.9: Crabtree Fault

Mile 23.1: W. Ky. No. 4 coal, mined commercially

Mile 25.4: W. Ky. No. 6 coal, mined commercially

Mile 26.6: Sandstone




**Geologic Map Index**



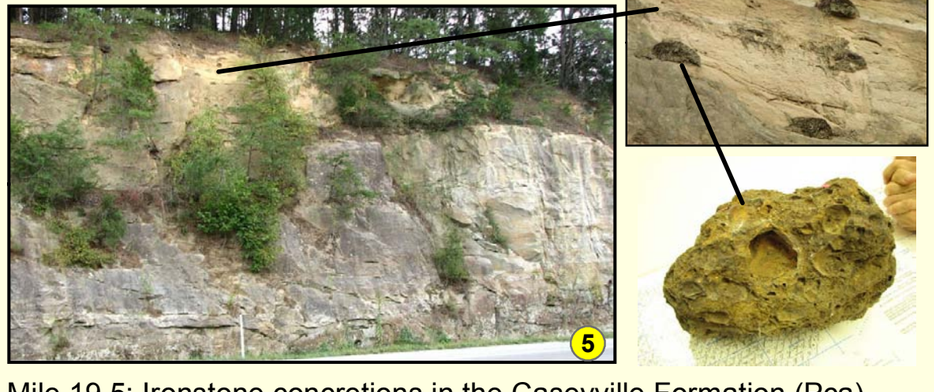

Q15 Olney
Q16 Dawson Springs



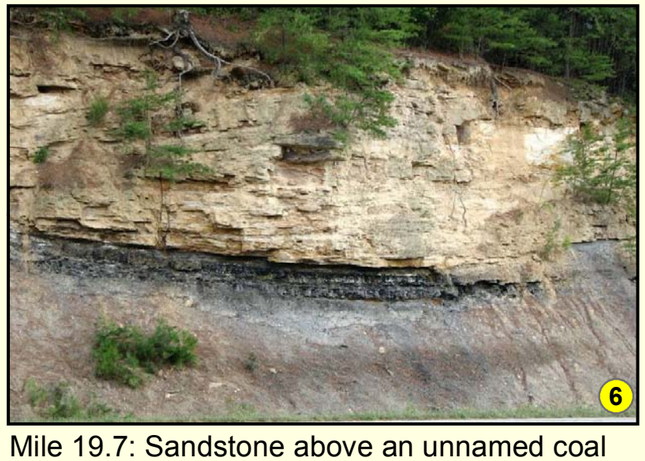

Mile 20.0: Gray shale in the Tradewater Formation (Pt). Shale is flaky (lower left photo) and often contains nodules of an iron carbonate called siderite (lower right photo).




Mile 18.2: Shaly limestone and shale in the Menard Limestone (Mme).



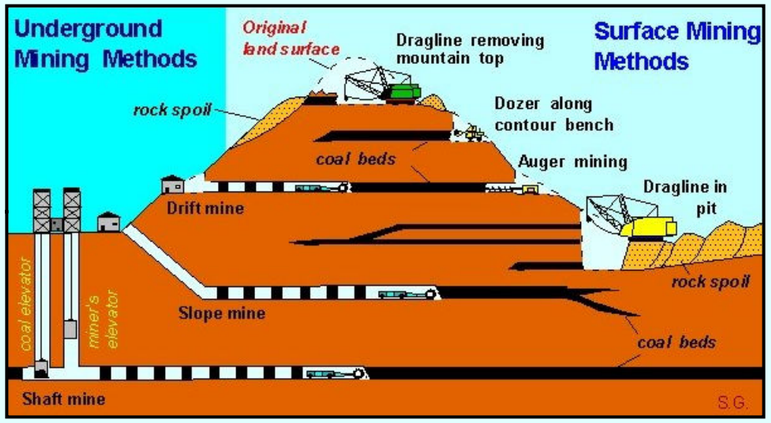

Mile 19.5: Ironstone concretions in the Caseyville Formation (Pca) resemble hornets' nests. Concretions form when groundwater dissolves iron compounds from the inner part of a block, then redeposits them as insoluble iron oxide in the outer parts, cementing grains in the original rock. Concretions may be released from surrounding softer rock through weathering.




Mile 19.7: Sandstone above an unnamed coal bed over shale in the Pennsylvanian Tradewater Formation (Pt).

# Geology Along the Wendell H. Ford Western Kentucky Parkway: Mile 26.7–39.5

Coal mining is a vital part of the Hopkins and Muhlenberg County economies. From 1866–2000, Hopkins County produced 782 million tons of coal: 475 million from underground mines and 307 million from surface mines. Combined production for Muhlenberg County since 1820 is more than 750 million tons. Photo by Glynn Beck, Kentucky Geological Survey.




The most common mining methods in western Kentucky are area (dragline or dozer), slope, and shaft. Both surface and underground mining has occurred in the area of the parkway. Illustration by Stephen Greb, Kentucky Geological Survey.

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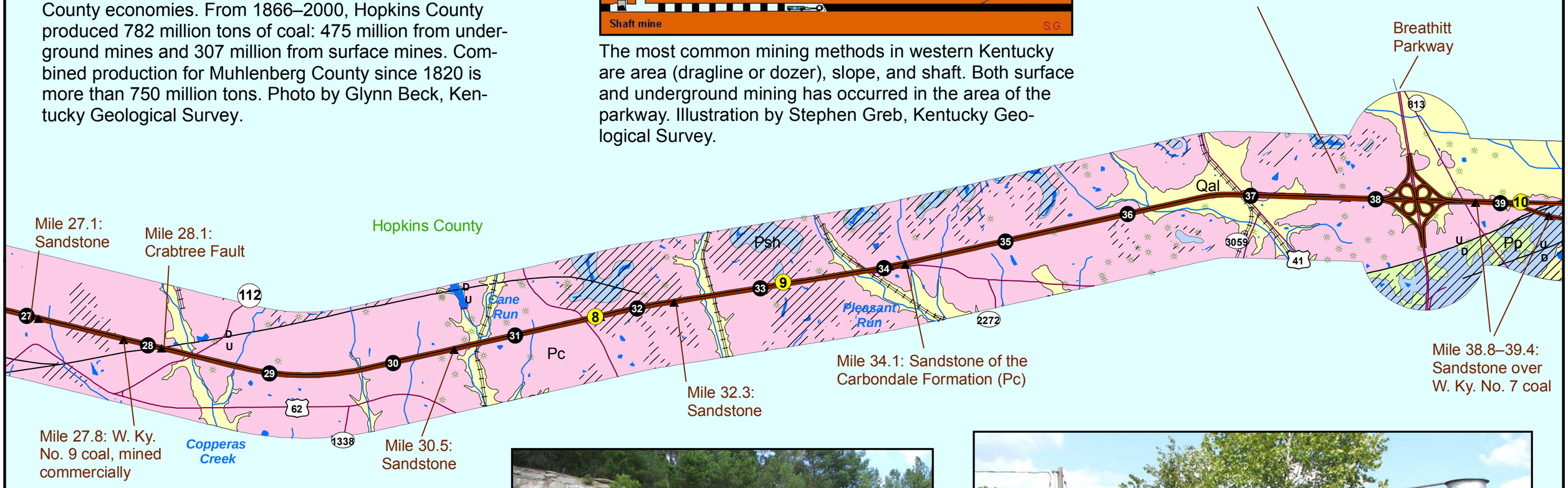
~~Q16~~ ~~Q17~~ ~~Q18~~

Q16 Dawson Springs
Q17 Saint Charles
Q18 Nortonville

Oil and gas are valuable energy resources in Kentucky. In the Morton Gap Field, oil is produced from sandstones in the Pennsylvanian Tradewater Formation (Pt) and the Mississippian Hardinsburg Sandstone (Mh), Paint Creek Limestone (Mpc), and Renault Limestone and Ste. Genevieve Limestone (Mrsg).




Mile 31.7: W. Ky. No. 7 coal, mined commercially.

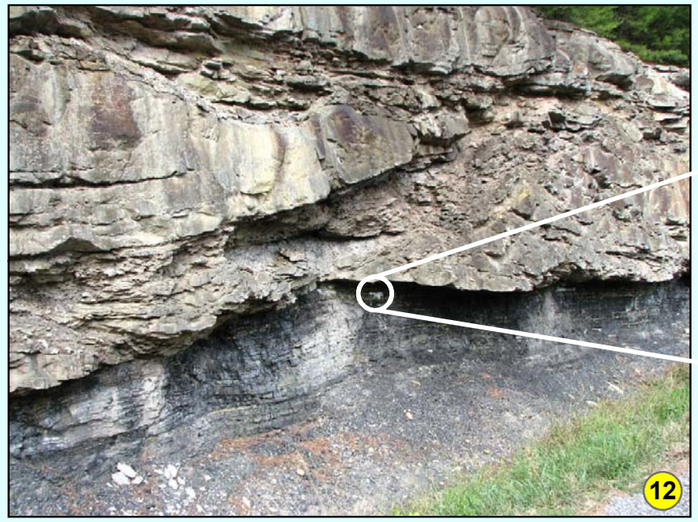
Mile 33.2: Pine trees cling to this vertical cliff, fed by water percolating down cracks in sandstone of the Carbondale Formation (Pc).

Mile 39.2: From 1919–2007, western Kentucky produced nearly 450 million barrels of oil and 200 billion cubic feet of natural gas. Peak oil production was 14 million barrels in 1964; production in 2007 was 1.1 million barrels. Peak gas production was 22.6 billion cubic feet in 1967; production in 2007 was 370 million cubic feet.

# Geology Along the Wendell H. Ford Western Kentucky Parkway: Mile 39.5–52.8

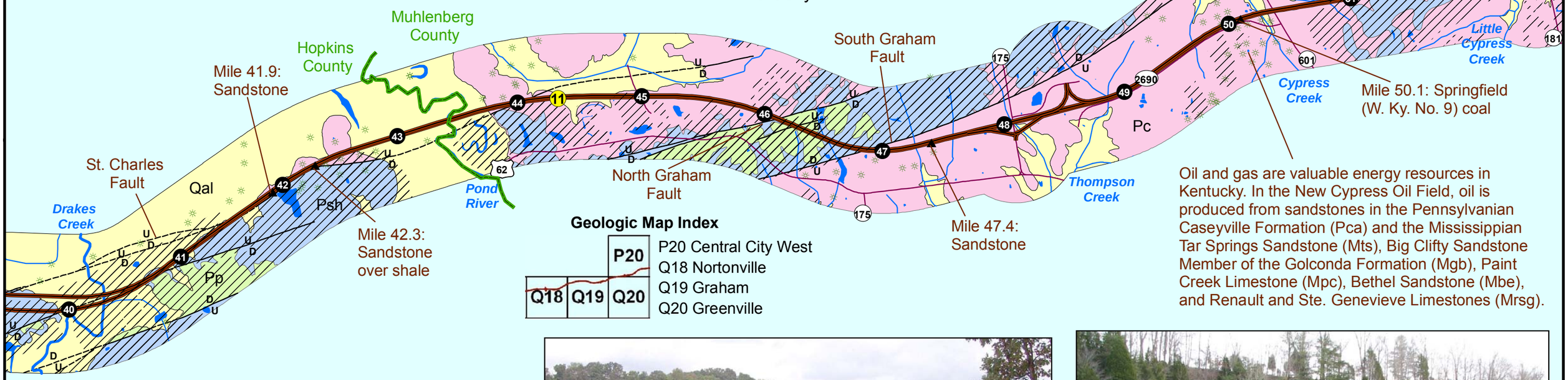


Soils from Pennsylvanian rocks provide the basis for a strong agricultural economy. In addition to corn, soybeans, and tobacco, nontraditional crops, such as green peppers (bottom), are increasingly grown for the commercial vegetable market. Photos by Glynn Beck, Kentucky Geological Survey.




Mile 51.3: Crossbedded sandstone deposited by an ancient river lies above the Paradise (W. Ky. No. 12) coal in the Shelburn Formation (Psh); mined commercially.

White and yellow sulfur precipitates from pyrite weathering in the coal.




**Geologic Map Index**

| | | |
|---|---|---|
| | P20 | P20 Central City West |
| Q18 | Q19 | Q20 Greenville |

Q18 Nortonville
Q19 Graham

Oil and gas are valuable energy resources in Kentucky. In the New Cypress Oil Field, oil is produced from sandstones in the Pennsylvanian Caseyville Formation (Pca) and the Mississippian Tar Springs Sandstone (Mts), Big Clifty Sandstone Member of the Golconda Formation (Mgb), Paint Creek Limestone (Mpc), Bethel Sandstone (Mbe), and Renault and Ste. Genevieve Limestones (Mrsg).


Mile 44.4: Swampy wetlands are remnants of past surface mining.

Constructed in the late 1950's, Lake Malone—about 15 miles south of the parkway via Ky. 181 or U.S. 431—covers 825 acres in southern Muhlenberg County, with branches in Todd and Logan Counties. The lake was made possible by local game and fishing clubs and is currently the only major recreational site in the three-county area. Photo by Glynn Beck, Kentucky Geological Survey.

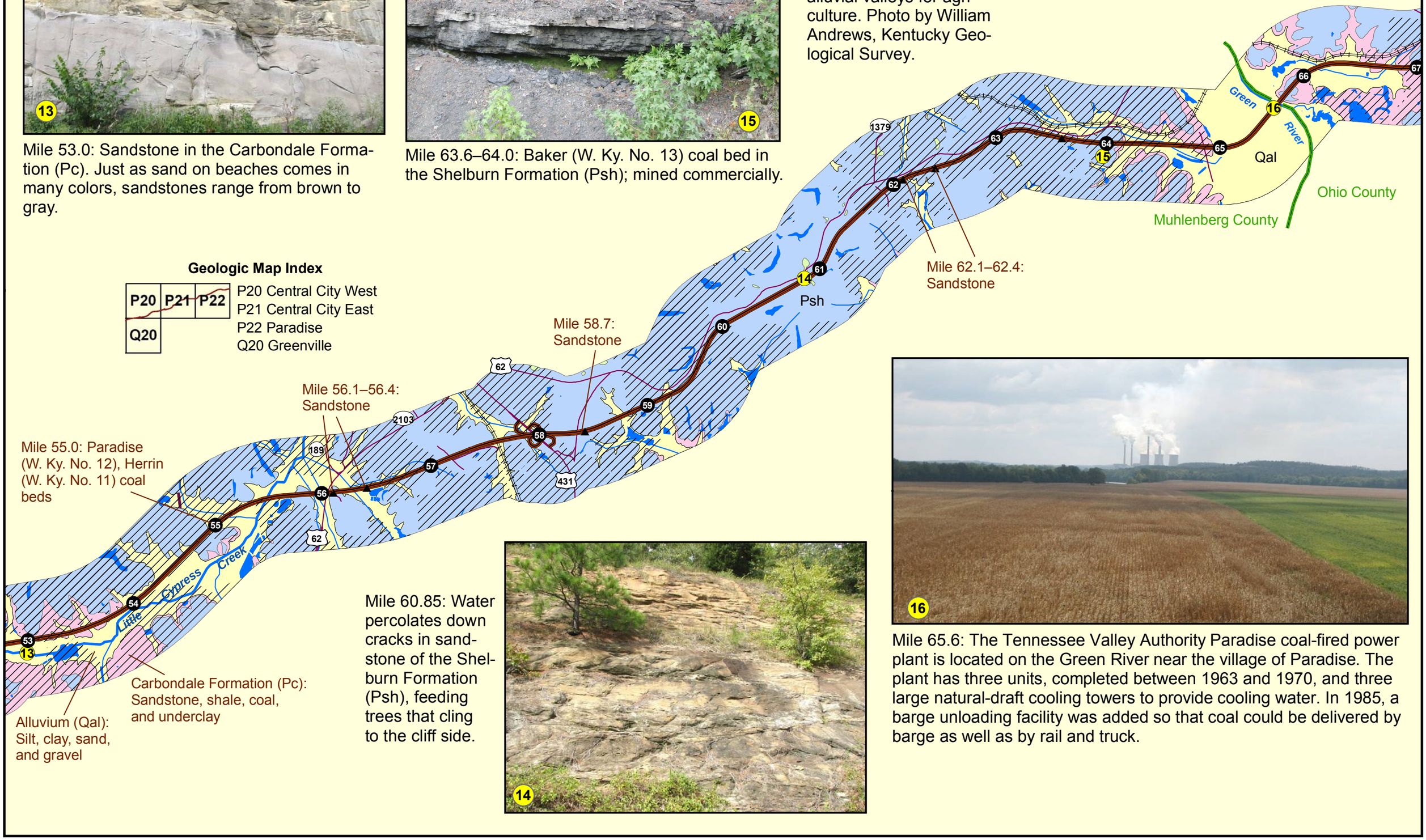
The fishing is good below the outlet spillway of Lake Malone in the Sandstone Hills area of southern Muhlenberg County. The lake is surrounded by 50-foot sandstone bluffs of the Caseyville Formation (Pca) and hardwood forests with hiking trails.

# Geology Along the Wendell H. Ford Western Kentucky Parkway: Mile 52.8–67.0


Mile 53.0: Sandstone in the Carbondale Formation (Pc). Just as sand on beaches comes in many colors, sandstones range from brown to gray.


Mile 63.6–64.0: Baker (W. Ky. No. 13) coal bed in the Shelburn Formation (Psh); mined commercially.

The 370-mile-long Green River, longest in Kentucky, begins in Lincoln County and drains more than 8,800 square miles before entering the Ohio River near Henderson. Along the way, it provides recreation and water supply, and irrigation water and wide alluvial valleys for agriculture. Photo by William Andrews, Kentucky Geological Survey.


Mile 60.85: Water percolates down cracks in sandstone of the Shelburn Formation (Psh), feeding trees that cling to the cliff side.



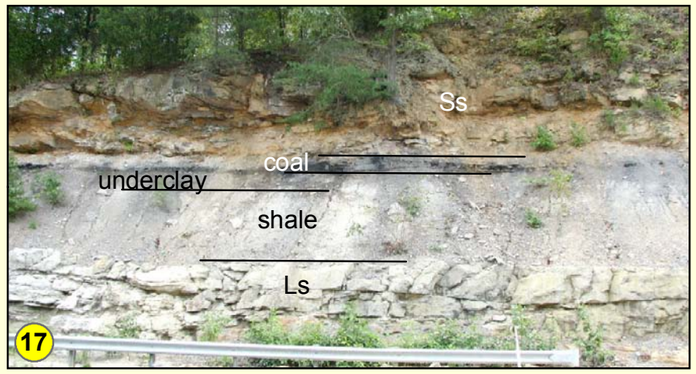




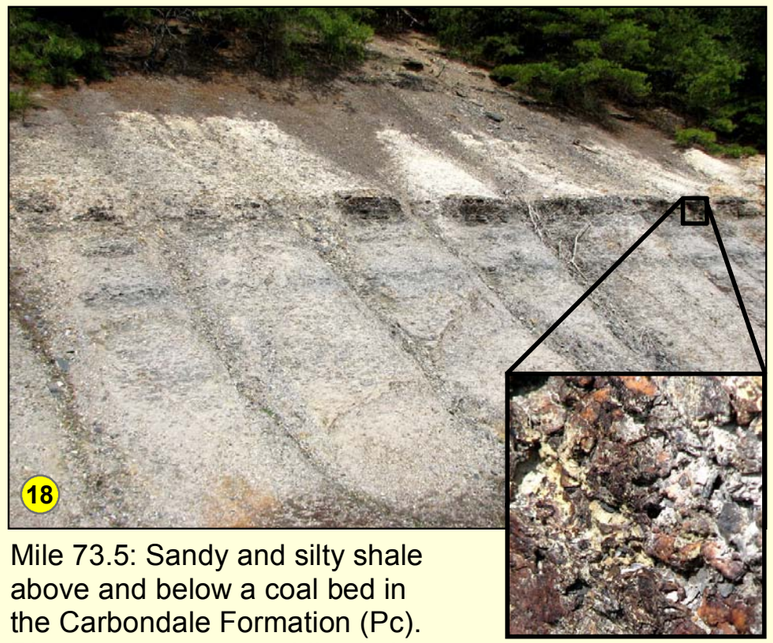
Mile 65.6: The Tennessee Valley Authority Paradise coal-fired power plant is located on the Green River near the village of Paradise. The plant has three units, completed between 1963 and 1970, and three large natural-draft cooling towers to provide cooling water. In 1985, a barge unloading facility was added so that coal could be delivered by barge as well as by rail and truck.

# Geology Along the Wendell H. Ford Western Kentucky Parkway: Mile 67.0–80.6






Mile 68.6: Shelburn Formation (Psh) contains sandstone, Baker (W. Ky. No. 13) coal, underclay, shale, and limestone.




Mile 73.5: Sandy and silty shale above and below a coal bed in the Carbondale Formation (Pc). Pines can grow on acidic shales. Iron precipitate creates a rusty patina (inset).


Mile 80.4: Sandstone, shale, siltstone, and coal in the slumping Pennsylvanian Tradewater and Caseyville Formations (Ptc). The apparent fault outlined in red is thought to be the result of slumping at some point during the deposition and compression of rock-forming sediments.

**Geologic Map Index**


O23 Horton
O24 Rosine
P22 Paradise
P23 Cromwell




Corn, soybeans, tobacco, livestock, chickens, and timber contribute to the economy of the Western Kentucky Coal Field. Economic diversification is also important to the region. A 1,100-acre industrial park, Bluegrass Crossings Business Centre, is located near exit 77. It is supported by Daviess, Hancock, McLean, Muhlenberg, and Ohio Counties.





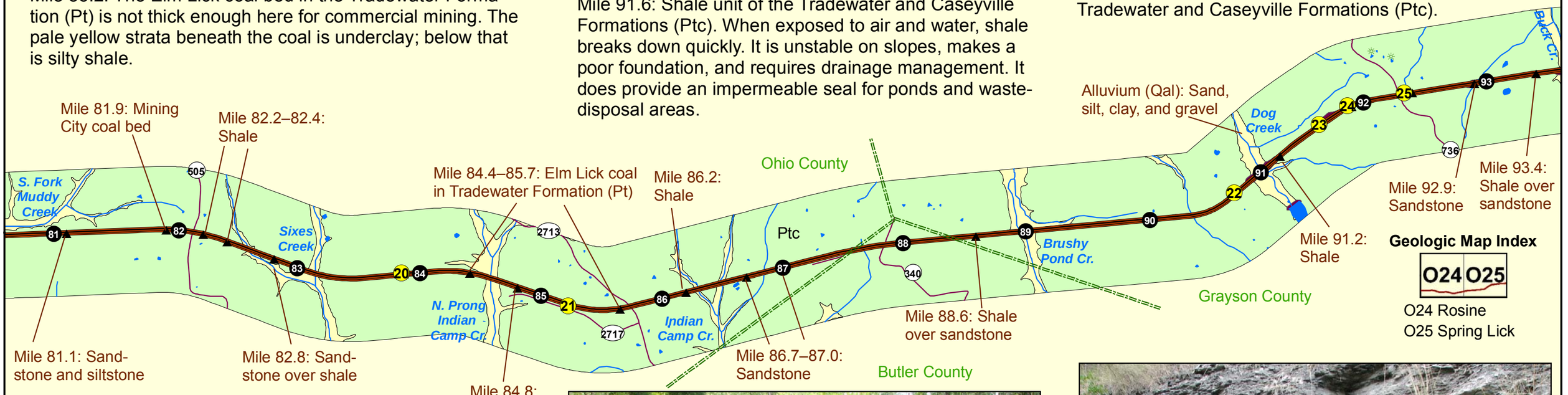
Coal mining continues to be a vital part of the Ohio County economy. Extensive surface and underground mining has occurred in southern Ohio County. The D.B. Wilson power plant (right) in Matanzas, about 8 miles north of the parkway, is one of 22 coal-fired electricity-generating plants in Kentucky. Photos by Glynn Beck, Kentucky Geological Survey.

# Geology Along the Wendell H. Ford Western Kentucky Parkway: Mile 80.6–93.6


Mile 85.2: The Elm Lick coal bed in the Tradewater Formation (Pt) is not thick enough here for commercial mining. The pale yellow strata beneath the coal is underclay; below that is silty shale.


Mile 91.6: Shale unit of the Tradewater and Caseyville Formations (Ptc). When exposed to air and water, shale breaks down quickly. It is unstable on slopes, makes a poor foundation, and requires drainage management. It does provide an impermeable seal for ponds and waste-disposal areas.


Mile 92.4: Sandstone over shale over siltstone in the Tradewater and Caseyville Formations (Ptc).

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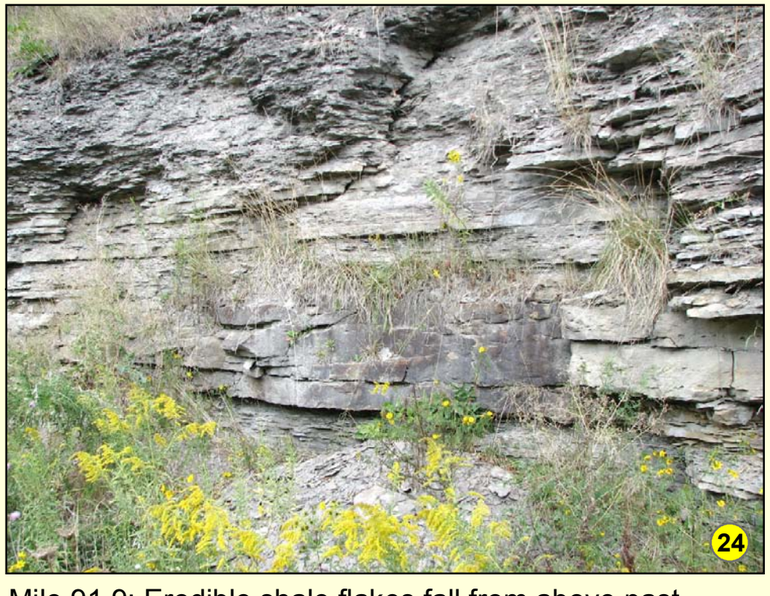
O24 Rosine
O25 Spring Lick


Mile 83.9: Pennsylvanian Tradewater and Caseyville Formations (Ptc) consist of sandstone over silty shale.


Mile 90.7: Shale in the Tradewater and Caseyville Formations (Ptc). A lens of siltstone in the flow path is more resistant to erosion than the shale.




Mile 91.9: Erodible shale flakes fall from above past erosion-resistant siltstone. Ponded water on the shale feeds plants.

# Geology Along the Wendell H. Ford Western Kentucky Parkway: Mile 93.6–107.2



Ragland Quarry, a mile west of Leitchfield off of Ky. 54, produces 300,000 tons of crushed stone, asphalt, and lime a year from the Glen Dean Limestone (Mgd) and Haney Limestone Member of the Golconda Formation (Mgh).


Mile 101.0: The Mississippian Kinkaid Limestone, Degonia Sandstone, and Clore Limestone (Mkc) overlies an unnamed coal bed and shale in the Buffalo Wallow Formation (Mbw).


Mile 105.4: Sandstone lies above shale in the Pennsylvanian Caseyville Formation (Pca); contains heavy oil.


Most ponds constructed on shale units, such as this one off of Ky. 2766 just south of the parkway, are successful.

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O25 Spring Lick
O26 Caneyville
O27 Leitchfield

Major tar sand resources are present in the Big Clifty Sandstone Member of the Golconda Formation (Mgb), Hardinsburg Sandstone (Mh), Tar Springs Sandstone (Mts), and Caseyville Formation (Pca) south of the parkway in Grayson, Butler, Edmonson, and Warren Counties. In-place resources are calculated to be in excess of 3 million barrels. Photo by Randy Bruner, Marathon Oil. Used with permission.


Mile 98.8: Sandstone, coal, siltstone, and shale in the Tradewater and Caseyville Formations (Ptc).


Mile 106.4: Interbedded limestone, shale, and siltstone in the Leitchfield Formation (Ml).

# Geology Along the Wendell H. Ford Western Kentucky Parkway: Mile 107.2–122.0


Mile 109.3: Big Clifty Sandstone Member of the Golconda Formation (Mgb). Rainwater percolates down cracks in the sandstone to feed evergreens clinging to the rock.

The low winter pool along Rough River Lake in Grayson County reveals the Big Clifty Sandstone Member of the Golconda Formation (Mgb) along the shore.

Mile 115.8: Haney Limestone Member of the Golconda Formation (Mgh).

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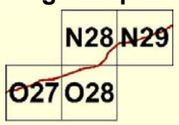


N28 Big Clifty
N29 Summit
O27 Leitchfield
O28 Clarkson





Mile 120.5–120.9: Big Clifty Sandstone Member of the Golconda Formation (Mgb). Vertical oil stains are evidence of heavy oil in the Big Clifty, which has been mined nearby for asphalt.




Mile 114.8, 115.2: Cedar trees grow where the top of coarse-grained limestone of the Haney Limestone Member of the Golconda Formation (Mgh) meets fine-grained sandstone of the bottom of the Hardinsburg Sandstone (Mh).


Mile 121.6: Beaver Bend Limestone, Mooretown Formation, and Paoli Limestone (Mbp).

# Geology Along the Wendell H. Ford Western Kentucky Parkway: Mile 122.0–136.8



Much of Hardin County obtains water from limestone springs. White Mills Spring, just south of the parkway on Ky. 84, provides water to the Hardin County Water District No. 2. Photo by Jack Stickney, Kentucky Rural Water Association. Used with permission.


Mile 128.4: Oolitic Ste. Genevieve Limestone (Msg).


Mile 124.5: Medium-grained, partly oolitic Ste. Genevieve Limestone (Msg) is mined for use as agricultural lime and construction aggregate.







Mile 128.4: Karst terrain characteristic of the eastern end of the parkway in Hardin County. The Mississippian Ste. Genevieve (Msg) and St. Louis (Msl) Limestones underlie a level to gently rolling landscape, dotted with sinkholes and laced with underground caves and flow channels.



A limestone quarry 1 mile north of the parkway off Ky. 222 produces construction aggregate and agricultural lime from the Ste. Genevieve (Msg) and St. Louis (Msl) Limestones. Photo by Jack Stickney, Kentucky Rural Water Association. Used with permission.

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M30 Cecilia
M31 Elizabethtown
N29 Summit
N30 Sonora