

**SELECTED FEATURES OF KENTUCKY GEOLOGY  
FROM LEXINGTON TO PINEVILLE**

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## GEOLOGY FROM LEXINGTON TO PINEVILLE

Kentucky has been disturbed by two major catastrophic events. The major portion of the state was upheaved to what is referred to as the Cincinnati Anticline, and erosion has resulted in forming of several physiographic regions, four of which will be traversed on this trip--namely, the Inner Blue Grass region, the Outer Blue Grass region, the Knobs, and the Eastern Coal Fields. The second major catastrophic event was the Appalachian folding, of which the Pine Mountain Overthrust and its faulting affects the southeastern Kentucky area.

The Inner Blue Grass region contains the lowest exposed geologic formation in Kentucky which is the Middle Ordovician exposed in the bluffs of the Kentucky River at Clays Ferry. The limestones of the Middle Ordovician are major sources of the quarry industry, which provides aggregates for the concrete and roadbuilding industries. Rocks of Upper Ordovician, Silurian, and Devonian ages, are exposed in the Outer Blue Grass. The transition from the Outer Blue Grass into the Knobs region can be recognized by a strata of black shale having considerable thickness.

The Knobs region is a ring of hills, mainly exposing Mississippian age materials. This ring is a relatively narrow band compared to the other three major regions.

The Eastern Coal Field is of the Pennsylvanian era and contains numerous coal seams varying widely in thickness. Most of these coal beds have been commercially exploited by tunneling and strip mining methods. Evidence of old strip mining activities can be seen on the upper slopes of the hills starting midway between London and Barbourville. The strip mining activities become more prominent nearer Pineville.

Included herein is a continuous road log of exposed geologic formations visible in roadway cuts and outcrops. Distinctive formations are located by the distance in miles from the starting point. An overall, brief, stratigraphic outline is presented to show the general geological relationships and a detailed columnar section of each of the major physiographic regions is shown.

Stratigraphic Outline of Exposed Formations  
From Lexington to Pineville

System	Series	Group	Formation	Member	Description	Formation Observed at Mileage	
Pennsylvanian (Carboniferous)		Breathitt	Catron		Shale, sandstone, and coal	(?)	
			Mingo		Shale, sandstone, siltstone, underclay, and coal	112.75 (?)	
			Hance		Shale, sandstone, siltstone, underclay, and coal	72.80	
			Lee	D C B A	Sandstone and shale Sandstone Shale, underclay and siltstone Sandstone	112.75 (?) 112.75 (?) 47.40	
Mississippian (Carboniferous)	Upper		Newman	Upper Ste. Genevieve St. Louis	Limestone and shale Limestone Limestone	40.40 38.40 35.70	
			Borden	Upper Nancy (?)	Shale and limestone	33.30	
Devonian	Middle & Upper Devonian and Lower Missis- sippian		New Albany Shale		Shale	30.55	
	Middle		Boyle Dolomite		Dolomite	28.50	
Silurian	Lower		Crab Orchard Brassfield		Mudstone and dolomite Dolomite and mudstone	28.50 27.00	
Ordovician	Upper		Drake's		Mudstone, dolomite, and limestone	13.75	
			Ashlock	Upper	Reba	Limestone	14.30
					Terrill	Limestone	14.30
					Grant Lake	Limestone and shale	11.25
			Lower	Tate	Mudstone and limestone	10.45	
				Calloway Garrard		Limestone, shale, and siltstone Siltstone and minor limestone	8.80 8.60
	Middle and Upper		Clays Ferry Lexington	Tanglewood Brannon	Shale, limestone, and siltstone Limestone and shale Limestone and shale	7.30 7.30 7.30	
	Middle	High Bridge		Tyrone Oregon Camp Nelson	Limestone Dolomite Limestone and dolomite	5.50 6.10 6.25	
	Cambrian	(Not Exposed)					

## GEOLOGICAL ROAD LOG

### Lexington - Pineville

Mileage From Check Points	Trip Mileage	
0.0	0.0	Athens - Boonesboro Overpass - Intersection of KY 418 and I-75 Entrance Ramp.
0.9	0.9	Fault is visible in the cut on the right. This is the South fault of 0.1 mile wide graben. North fault is not visible.
5.4	5.4	South portion of Elk Creek graben is visible in cut to the left (This is a small graben within a larger graben). The visible portion of the graben is 0.05 miles wide of a 0.22-mile wide graben.
5.5	5.5	Tyrone limestone is exposed in the cut on the left. Leave I 75 and proceed south on US 25.
5.7	5.7	Intersection of US 25, 421 and I 75 exit ramp.
6.1	6.1	Oregon Formation underlying Tyrone Limestone is exposed on the left.
6.25	6.25	Begin exposures of Camp Nelson Formation (limestone and dolomite).
6.3	6.3	Kentucky River Fault Zone is visible in bluff to the right across the river.
6.45	6.45	Kentucky River Fault Zone is visible to the left.
6.5	6.5	Beneath I 75 bridges, Camp Nelson Formation is exposed in cut on the left. Bridge piers are located on fault zone.
6.7	6.7	South fault face of a narrow graben is exposed in the cut to the left.
6.8	6.8	Kentucky River
6.9	6.9	Kentucky River fault zone is exposed in the cut to the left.
7.3	7.3	Clays Ferry Formation is exposed in the cut to the left. It overlies the Tanglewood and Brannon members of the Lexington Formation.
8.45	8.45	Mileage Check - Intersection of Old US 25 and US 421. Proceed to I 75.
0.15	8.6	Garrard Siltstone is visible in the cut to the right.
0.35	8.8	Calloway Creek limestone is exposed in the cut on the right. It overlies the Garrard siltstone. Next 1.65 miles is through exposures of Calloway Creek limestone.
2.0	10.45	Tate member of the Ashlock Formation is exposed.
2.65	11.1	Bridge overpass - Boonesboro Road.
2.8	11.25	Grant Lake member of the Ashlock Formation is exposed in the cut on the left. For the next 0.85 miles, Tate and Grant Lake members are visible.
5.3	13.75	Drakes Formation is exposed.
5.85	14.3	Drakes Formation over Reba and Terrill members of the Ashlock Formation is visible.
6.55	15.0	Exposures of the Terrill member over the Grant Lake member of the Ashlock Formation are visible. In the next 2.9 miles, various members of the Ashlock Formation are exposed.
7.65	16.1	Mileage Check - Interchange of US 25, US 421 and I 75.
1.8	17.9	In cut sections, massive limestones of the Calloway Creek Formation are exposed. For the next 4 miles, cuts expose Calloway Creek limestone overlain with the lower Ashlock Formation in many locations.
2.7	18.8	Mileage Check - Intersection of KY 876
0.6	19.4	Exposure of Calloway Creek limestone overlain with the lower Ashlock Formation in the cut.
3.5	22.3	Lower Ashlock Formation (probably Tate member) exposed in the cut. For next 2.9

miles, cuts expose lower Ashlock Formation.

4.8	23.6	Mileage check - I 75 Rest Area.
1.6	25.2	At South side of Silver Creek, Calloway Creek limestone formation is visible in cut.
2.0	25.6	Ashlock Formation
2.95	26.55	Upper Ashlock Formation is exposed.
3.4	27.0	Brassfield dolomite is exposed.
4.1	27.7	View of the Knobs physiographic region.
4.9	28.5	Exposure of the Boyle dolomite over the Crab Orchard (shale) formation.
6.95	30.55	New Albany shale over the Boyle dolomite is exposed in the KY 21 interchange cut. New Albany shale exposed in cuts for approximately the next mile.
7.2	30.8	Mileage Check - KY 21 Interchange
1.8	32.6	Nancy member of the Borden Formation visible in the cut.
2.5	33.3	Exposure of the Borden Formation overlying the New Albany Formation in the cut.
4.9	35.7	Exposed in large cut are upper Borden members overlain by Newman (limestone) Formation.
7.3	38.1	Mileage Check - Intersection of US 25. Exposures of the upper Borden members.
0.3	38.4	St. Genevieve overlying St. Louis limestone visible in the cut. Next 1.5 miles exposes the Newman Formation.
2.3	40.4	For the next 5.5 miles, massive limestones of the upper Newman Formation are exposed in cuts. Sandstones of the Lee Formation are occasionally visible at the tops of cuts.
9.3	47.4	Limestone quarry on the right. Upper member and St. Genevieve limestone member of the Newman Formation are exposed. Tops of hills in distance are sandstone caps of the Lee Formation.
9.6	47.7	Mileage Check - End I 75 and begin US 25.
1.25	48.95	Reelsville-Beech Creek within upper member of Newman (limestone) Formation in cut at top of hill.
2.35	50.05	Limestones of upper member of Newman Formation.
3.9	51.6	Lee No. 1 coal in the lower Lee Formation in cuts at top of hill.
5.65	53.35	Top of upper member of Newman Formation in cuts at bottom of hill.
6.05	53.75	Mississippian(Upper Member) - Pennsylvanian (Lee Formation) contact in roadcut on right.
6.3	54.0	Lee No. 1 (?) coal seam in cut at top of hill north of Livingston.
6.9	54.6	Livingston north Corporate Limits. Abandoned stripping operation on the left.
7.75	55.45	Pennsylvanian Channel cutting down into upper member of the Newman Formation at the south edge of Livingston.
8.35	56.05	Top of upper member (limestone) of the Newman Formation.
8.65	56.35	Sandstone and shale channel fill of Pennsylvanian Age cutting sharply into the upper member of the Newman Formation for the next 0.7 miles. At the north end of this exposure, blocks of limestone of the upper member are present in the conglomerate.
10.35	58.05	Thin, impure limestones and shales of the upper member of the Newman Formation in long cut on the right.
11.05	58.75	Red and Green shales of the top of the upper member of the Newman Formation (uppermost Mississippian) in cuts on the right.

11.4	59.10	The section exposed here is near the base of the Lee Formation. The massive sandstone, about 12 feet thick, on the left side of the roadcut occupies a channel cut in thin-bedded shales and siltstones. South of this, with a fault contact, is an underclay-type shale which was deformed by penecontemporaneous slumping. The shale is overlain by thin-bedded, very fine grained sandstone and siltstone which grades southward into silty shales by lateral gradation and interfingering. This point is near the western edge of the Rockcastle River uplift. This is the largest structural feature between the Pine Mountain overthrust and the Cincinnati arch. It roughly parallels the axis of the Appalachian folding and may represent its termination. About 20 miles to the east of here, sub-surface records indicate a noticeable thinning of the Devonian and Silurian limestone section over the uplift.
12.15	59.85	Mileage Check - Rockcastle River. Lee Sandstones and shales well exposed in cuts for next 3 miles.
0.55	60.4	Sandstone of the Lee Formation exposed in the cut.
1.9	61.75	Bluffs of Lee sandstone may be seen in the valley walls on either side of the highway for the next mile. The road is on top of the Lee.
2.1	61.95	Dark shales of the Lee Formation in the cut.
6.4	66.25	Mileage Check - I 75 under construction.
2.05	68.3	Abandoned stripping operations on both sides of the road.
3.45	69.7	Abandoned stripping operations on left of the road.
6.55	72.8	Mileage Check - Intersection of KY 229. Proceed south on KY 229. Sandstones and shales of the Hance Formation of the Breathitt Group are exposed in cuts for the next 21.3 miles.
14.1	86.9	Old strip mining operations, which are difficult to see, are located on the hills.
21.3	94.1	Mileage Check - Junction US 25 E. Continue south on US 25E for the next 20.5 miles to Pineville, the geologic setting consists of sandstones, shales, and coal beds of the lower Hance Formation of the Breathitt group and upper Lee Formation. Proceeding southeasterly, the Lee Formation is more prominent.
14.15	108.25	Mileage Check - Cumberland River
1.5	109.75	Strip mining operation and KU Coal Burning Power Plant on the left.
4.5	112.75	Sandstone (Member C) over interbedded shale and sandstone (Member B) of the Lee Formation.
6.35	114.6	Cedar Street, first traffic light entering Pineville.
7.05	115.3	Pine Mountain thrust fault visible in distance on the left.
7.65	115.9	Junction US 119.

Columnar Section - Lexington to I 75-US 25 and 421  
Interchange South of Kentucky River

System	Series	Group, Formation Member, and Bed	Thickness (feet)	Description	
Ordovician	Middle and Upper Ordovician	Clays Ferry Formation	125-190	Interbedded clay shale, limestone and siltstone: Clay shale, medium-dark-olive-gray, weathers yellowish-gray as planar interbeds 0.1 to 1.0 foot thick. Limestone, medium-gray to dark-gray in very thin to thin tabular beds intercalated with shale and sandstone. Siltstones, medium-greenish-gray in very thin beds.	
		Lexington Limestone	Tanglewood Limestone Member	30-50	Limestone, medium-light-gray to medium-brownish-gray in very thin to thin even beds, crossbedded in part, irregularly bedded in part.
			Brannon Member	10-31	Limestone and clay shale: Limestone, medium-gray to light-brownish-gray in very thin to thin tabular beds. Clay shale, medium-gray to medium-brownish-gray as interbeds; generally makes up less than one-third of unit. Unit is thickest at Clays Ferry.
	Middle Ordovician	High Bridge Group	Tyrone Limestone	55-90	Limestone, light-brownish-gray to light-yellowish-gray in thin to thick even beds. Some thin dolomite beds interlaced.
			Oregon Formation	30-65	Calcareous dolomite, brownish-orange to brownish-yellow generally occurs in thick, even-surfaced beds and bedding sets some of which show lamination when weathered. In most areas the Oregon consists of a basal unit of thick, blocky bedded dolomite, 25 to 35 feet thick.
			Camp Nelson Limestone	165 +	Limestone and Dolomite: Limestone, light-brownish-gray. Dolomite, brownish-yellow. Base of unit not exposed. This unit is the oldest exposed in Kentucky. 3200-foot well near Nicholasville penetrated 2880 feet to the base of the Knox Dolomite (lower Ordovician) and then 320 feet into sandstone and shale referred to as the Cambrian Nolichucky Formation.

Columnar Section - I 75-US 25-421 Interchange South of Kentucky River To  
3.4 Miles South of I 75 Rest Area

System	Series	Group, Formation, Member, and Bed	Thickness (feet)	Description	
Ordovician	Upper Ordovician Ashlock Formation	Drake's Formation	125-130	Dolomite and Mudstone: Dolomite, grayish-green, pale-green, and greenish-gray, fine-grained, muddy; grades into and is interbedded with dolomitic mudstone having same colors. Laminated to thin bedded.	
		Upper Ashlock	Reba Member	15-20	Limestone in two units. Limestone, light-gray to medium-gray. Upper unit: weathers medium-gray to dark-gray, grayish-brown, and grayish-green; poorly and unevenly bedded. Lower unit: thin and even-bedded with a few wavy beds.
			Terrill Member	6-12	Dolomite and shale: unit moderate-grayish green, light-olive-gray, and light-greenish-gray, thin bedded. Dolomite is very argillaceous and silty. Shale is very dolomitic.
		Lower Ashlock	Grant Lake Member	75-80	Limestone and shale in two units. Upper unit: Limestone and shale. Limestone, medium-light-gray to medium-gray; mostly in uneven beds 0.2 to 0.3 foot thick, interbedded with thin beds of gray shale. Lower unit: Limestone, greenish-gray, thin bedded, numerous shaly partings.
			Tate Member	35	Limestone, medium-greenish-gray to pale-greenish-gray and grayish-green, thin bedded, and silty.
		Calloway Creek Limestone	100-125	Limestone, shale, and siltstone: Limestone, medium-light-gray to medium-dark-gray, unevenly bedded. Shale, light-gray to greenish-gray. Siltstone, greenish-gray; weathers dark-yellowish-brown.	
		Garrard Siltstone	30-80	Siltstone, light-greenish-gray, calcareous; weathers pale-yellowish-brown, dark-yellowish-brown, and dusky-yellowish-brown.	



Columnar Section - 3.4 miles South of I 75 Rest Area To  
I 75 - US 25 Interchange SE of Mt. Vernon

System	Series	Group, Formation, Member, and Bed	Thickness (feet)	Description	
Mississippian		Newman Limestone	upper member top beds	0-170	Limestone and Shale: limestone, gray to yellowish-gray, finely to coarsely crystalline, interbedded with green shale.
			upper member lower beds		Limestone, gray, oolitic and medium-crystalline, locally crossbedded, indistinctly bedded elsewhere.
			St. Genevieve Limestone Member	40-80	Limestone, gray, oolitic, contains sparse grains of chert and quartz, locally upper 1 foot of limestone brecciated. Base unconformable on underlying unit.
			St. Louis Limestone Member	15-80	Limestone, gray, very fine to medium-crystalline in thin to thick beds with undulatory partings of green shale; contains chert nodules in upper part. Intertongues with argillaceous limestone and dolomite of underlying formation locally.
		Borden Formation upper Borden members	Renfro Member	50-90	Limestone and Shale: limestone, dolomitic, argillaceous, probably gray where fresh, almost everywhere deeply weathered to pale orange and orangish-pink; in thick beds with greenish-gray shale partings. Shale, greenish-gray, silty; thins eastward.
			Wildie Member	15-25	Shale and interbedded siltstone and sandstone: Shale, clayey to silty, greenish-gray, locally mottled purple. Siltstone and very fine grained. Sandstone, grayish-green, laminated.
			Halls Gap Member	10-60	Siltstone and silty to clayey shale, yellowish-gray, greenish-gray, and bluish-gray, indistinctly bedded.
		Mid. & Upr. Devonian & Lower Mississippian	Nancy Member	200-235	Shale, clayey to silty, olive-gray and greenish-gray to bluish-gray. Basal contact sharp.
			New Albany Shale	80-110	Shale, black; weathers brownish-black to yellowish-brown; carbonaceous; sparse finely crystalline pyrite; locally small concretions of calcitic and iron-rich or phosphatic material; a few seams 1 to 2 inches thick, of yellow-green shale present locally; thinly laminated; forms slope; outcrop yields abundant thin chips and plates. Basal contact sharp.
			Boyle Dolomite	0-15	Dolomite and dolomitic limestone, light-gray to dark-gray and pale-yellowish-brown; mostly weathers yellowish-brown and grayish-orange; stained dark-yellowish-brown by limonite; very fine grained; in irregular beds 1 to 5 feet thick. Forms ledge on slopes, caps many hilltops and underlies extensive flats.
Silurian	Middle Silurian	Crab Orchard Formation	5-35	Mudstone and dolomite: Mudstone (80 percent), grayish-yellow and grayish-green; mostly weathered to fluffy light-yellowish-gray soil; slightly silty; in part laminated; poorly exposed. Dolomite (20 percent, chiefly medium-light-gray, yellowish-gray, and light-olive-gray; fine grained; in even beds a few inches to about 2 feet thick.	
	Lower Silurian	Brassfield Formation	10-18	Dolomite and Mudstone: dolomite (95 percent), chiefly light-olive-gray, light-gray and light-brownish-gray; in places stained dark-gray; fine to medium grained: in irregular beds 1 to 12 inches thick. Mudstone, limy, pale-greenish-yellow; as parting and seams less than 2 inches thick between limestone beds.	

Columnar Section - I 75 - US 25 Interchange  
SE of Mount Vernon to Pineville

System	Series	Group, Formation, Member, and Bed	Thickness (feet)	Description
Pennsylvanian (Carboniferous)		Catron (Wallins Creek Coal bed)	75	Medium-gray shale; light-gray, fine to medium-grained micaceous sandstone in middle part; and coal.
		Mingo and Hance Formations	900	Shale, silty shale, sandstone, siltstone, underclay, and coal: Medium-gray to dark-gray shale and silty shale interbedded with light-gray, mostly very fine to fine-grained, micaceous, thin-bedded to massive, sandstone. Few beds of medium-gray argillaceous siltstone; medium-gray clayey to silty underclay; and coal. Contains several commercial coal beds which may be as thick as 12 feet.
	Breathitt Group	Lee	490-530	Alternating layers of medium-gray to light-gray shale; white to very light-gray sandstone; underclay; and commercial coal. Contains three coal beds ranging in thickness from 0 to about 8 feet.