

SYSTEM	SERIES	GROUP	FORMATION	SYMBOL	SECTION	THICKNESS (IN FEET)	MINOR DIVISIONS	CHARACTER OF MINOR DIVISIONS	GENERAL CHARACTER OF FORMATIONS	TOPOGRAPHY	HYDROLOGY			
QUATERNARY	Pleistocene and Recent		Alluvium	Qal		0-60			Alluvium Silt, clay, and minor amounts of sand and gravel.	Alluvium Forms narrow flood plains and underlies terraces. At least one well-developed terrace is present along the principal streams of the region.	Alluvium Yields more than 100 gpd to most dug wells. Where sandy material is present and saturated thickness great enough, would yield more than 500 gpd to screened drilled wells.			
			PENNSYLVANIAN	Breathitt formation, post-Lee Pennsylvanian rocks	Pbt Pple	0-2500±	Magoffin beds ¹	Magoffin beds Limestone, fossiliferous, thin.	Breathitt formation or undifferentiated post-Lee Pennsylvanian rocks Siltstone, sandstone, and claystone, with lesser amounts of coal and clay. Very few limestones are present. Siltstones are gray, micaceous, and contain plant fragments. Some of the sandstones and claystones also contain fossil plants. Sandstones are gray and are characterized by an abundance of minerals of the clay-mica type and rock fragments. In the upper part of the formation the sandstones are feldspathic. Claystones are dark and light gray and contain ironstone at many places. Clays commonly underlie coal beds.	Breathitt formation or undifferentiated post-Lee Pennsylvanian rocks Underlies valleys and forms the hills of southeastern Whitley, Knox, Clay, Leslie, central and southeastern Owsley, and central Bell Counties. The topography is rugged, particularly in the southeastern part of the area. Sandstones form narrow valleys and cliffs or steep slopes on hillsides. Tops of hills and ridges commonly are capped by sandstone. Shales form wide valleys and moderate or gentle slopes on hills.	Breathitt formation or undifferentiated post-Lee Pennsylvanian rocks Along the western margin of the area, in the Cumberland Plateau section, yields more than 500 gpd to almost half the wells drilled in valley bottoms. Yields more than 100 gpd to more than half the wells on hillsides and about half the wells on hilltops. In southwestern Leslie and eastern Bell Counties yields more than 500 gpd to more than three-quarters of the wells drilled in valleys. Yields more than 500 gpd to about three-quarters of the wells on hillsides and more than 100 gpd to nearly all wells on hilltops. In the remainder of the area yields more than 500 gpd to almost half the wells on hillsides and smaller quantities of water to wells on hilltops. Yields water from sandstone, shale, and coal. Joints and openings along bedding planes supply most of the water to wells. Waters are highly variable in chemical character. May contain salty water at depths less than 100 feet below the principal valley bottoms in most of Clay and Owsley Counties, and in northwestern Leslie County.			
Corbin sandstone member	Corbin sandstone member Conglomeratic sandstone, pink, coarse-grained, friable, contains layers of thin-bedded hard sand. Weathers to rounded masses. Ranges in thickness from 0 to 200 feet.	Lee formation Two or three conglomeratic sandstones separated by claystones, siltstones, and a few thin coals. The sandstones are quartzose, massive, and crossbedded. Pebbles, in the conglomeratic phases of the sandstones, are quartz and may be distributed equally through the rock or concentrated in bands.					Lee formation Thick, resistant sandstones form the high ridges of Pine, Cumberland, and Rocky Face Mountains in Bell County, and underlie an extensive upland (Cumberland Plateau section) in McCreary, eastern Whitley, Laurel, southeastern Jackson, and northwestern Owsley Counties. Shaly facies of the Lee formation, cropping out in northwestern Laurel and Jackson Counties, form a highly dissected area of winding ridges and steep-sided hills.	Lee formation In northwestern Laurel, most of Jackson, and the western tip of Owsley County yields more than 100 gpd to about three-quarters of the wells drilled on hillsides and valley bottoms. Elsewhere in the Cumberland Plateau section yields more than 500 gpd to more than three-quarters of the wells drilled in valley bottoms. Yields more than 500 gpd to about three-quarters of the wells on hillsides and about half the wells on hilltops. In the Kanawha section yields more than 500 gpd to most wells drilled in valley bottoms. Yields more than 500 gpd to almost half the wells on hillsides, and more than 500 gpd to almost three-quarters of the wells on hilltops. In the Cumberland Mountain section yields more than 500 gpd to about three-quarters of the wells drilled in valley bottoms. Yields more than 500 gpd to about half the wells on hillsides. Yields smaller quantities of water to wells on hilltops. Some wells in Middlesboro flow. Sandstone is the principal aquifer, but shale yields water to some wells and coal to a few. Joints and openings along bedding planes, best developed in sandstone, supply most of the water to wells. Perched and semi-perched water tables are common in the western part of the area. Waters are generally soft or moderately hard and contain noticeable amounts of iron. Salty waters are known to be present at shallow depth in most of Clay, Owsley, and northwestern Leslie Counties.						
Rockcastle sandstone member	Rockcastle sandstone member Conglomeratic sandstone, coarse-grained, massive, cliff-forming. Ranges from 0 to 200 feet in thickness.													
Livingston conglomerate	Livingston conglomerate Sandstone, and conglomerate with well-rounded pebbles, poorly cemented; forms channel deposit.													
Pennington shale	Pennington shale Shale, reddish and greenish; contains minor amounts of limestone and sandstone.											Pennington shale Forms moderate slope beneath outcrops of the Lee formation along the northwestern face of Pine Mountain and western margin of the area.	Upper Mississippian rocks Yields more than 500 gpd to almost all the wells drilled in valley bottoms and to most wells drilled on hills. Yields little water where overlain by Pennsylvanian rocks. May yield as much as 400 gpm to wells at Pineville. Water is chiefly from solution cavities in limestone, but sandstone and shale yield water from fractures to a few wells. May contain salty water at shallow depth in a few places. Springs yield more than 20 gpm from solution cavities in limestone.	
Glen Dean limestone	Glen Dean limestone Limestone, dark- to bluish-gray, fine- to medium-grained, with shaly beds near top.	Warsaw limestone—Glen Dean limestone Forms steep slopes and cliffs along the northwest face of Pine Mountain in Bell County. Forms precipitous walls along streams in northwestern Jackson County and in the gorge of the Cumberland River in McCreary County. Forms cliffs on hillsides and underlies upland areas marked by solution features such as caves, sinks, and underground streams in western Rockcastle County.												
MISSISSIPPIAN	Upper Mississippian	Mu					Warsaw limestone	Warsaw limestone—limestones of early Chester age From top to bottom, consists of the following units: Limestone, whitish- to dark-gray, fine- to medium-grained, oolitic in places; contains green- to dark-gray shale, and shaly limestone in upper portion. Limestone, light-gray to whitish, fine-grained, oolitic, crossbedded; contains small amount of chert. Limestone, dark-gray to black, fine-grained, cherty; replaced in some areas by medium- to dark-gray geodiferous siltstone. Limestone, gray; contains beds of dark-gray to black shale, and light-brown, medium-grained sandstone. Limestone, light- to dark-gray, and light-brown medium-grained sandstone; replaced in some areas by medium- to dark-gray siltstone.				Warsaw limestone—Glen Dean limestone Forms steep slopes and cliffs along the northwest face of Pine Mountain in Bell County. Forms precipitous walls along streams in northwestern Jackson County and in the gorge of the Cumberland River in McCreary County. Forms cliffs on hillsides and underlies upland areas marked by solution features such as caves, sinks, and underground streams in western Rockcastle County.	Warsaw limestone—Glen Dean limestone Forms steep slopes and cliffs along the northwest face of Pine Mountain in Bell County. Forms precipitous walls along streams in northwestern Jackson County and in the gorge of the Cumberland River in McCreary County. Forms cliffs on hillsides and underlies upland areas marked by solution features such as caves, sinks, and underground streams in western Rockcastle County.	
							Borden group	Borden group Siltstone, containing beds of sandstone, claystone, and beds or lenses of limestone. Siltstones are dark, greenish, or yellowish gray to buff, and contain worm marks and <i>Zonitulus</i> . Sandstones are fine to very fine grained and micaceous. Variegated shaly claystones are prominent in the uppermost part of the formation. Carbonate concretions are common throughout the section, but bedded limestones are prevalent only in the upper part.						Borden group Yields more than 500 gpd to almost half the wells drilled in valley bottoms, and smaller quantities of water to wells on hills. Reported to yield as much as 55 gpm (gallons per minute). Shale is the most common aquifer. Sandstone yields water to some wells and limestone to a very few. Fractures chiefly supply water to wells. Commonly contains salty water at depths less than 100 feet below the level of the principal valley bottoms.
							Price and Maccrady formations	Price and Maccrady formations Shale, grayish green and red, interbedded with very fine-grained sandstone; grades downwards into reddish and greenish shale with limonite stringers.						Price and Maccrady formations Forms moderate slopes along the northwestern face of Pine Mountain in Bell County.
MISSISSIPPIAN	Lower Mississippian	MDu					Muldrough formation ⁴	151-465				Shale, grayish green and red, interbedded with very fine-grained sandstone; grades downwards into reddish and greenish shale with limonite stringers.	Price and Maccrady formations Forms moderate slopes along the northwestern face of Pine Mountain in Bell County.	
			Floyds Knob formation ⁴											
DEVONIAN		MDcl	Chattanooga shale	66-500±	Chattanooga shale Shale, black, fissile.	Chattanooga shale Forms wide valleys in which Copper Creek and Dix River in northwestern Rockcastle County flow, and moderate slopes at the base of Pine Mountain in Bell County.	Chattanooga shale In Rockcastle County yields more than 100 gpd (gallons per day) to most wells drilled in valley bottoms. Yields smaller quantities of water to wells on hillsides. Water is from fractures, and may be salty, sulfurous, or high in iron. On Pine Mountain yields little or no water to wells.							
			Duffin and Boyle limestones ⁶	0-12±	Duffin and Boyle limestones Limestone, brown, sandy, porous; contains small quartz pebbles.	Duffin and Boyle limestones Forms the valley bottoms of the lower part of Copper Creek and Dix River in northwestern Rockcastle County.	Duffin and Boyle limestones Yields small quantities of water to wells.							

¹ Of Murree (1931)
² Member, as used by Stockdale (1939)
³ Of Miller (1908)
⁴ As used by Stockdale (1939)
⁵ Of Stockdale (1939)
⁶ Of Foerste (1905, 1906); as used by Savage (1930)

GENERALIZED COLUMNAR SECTION IN BELL, CLAY, JACKSON, KNOX, LAUREL, LESLIE, MC CREARY, OWSLEY, ROCKCASTLE, AND WHITLEY COUNTIES, KENTUCKY

By
Chabot Kilburn, W. E. Price, Jr., and D. S. Mull