

Carboniferous Stratigraphy in the Vicinity of the Daniel Boone National Forest

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Introduction

Middle Carboniferous strata on the western margin of the Eastern Kentucky Coal Field crop out along a north-northeast-trending belt sometimes referred to as the western belt of outcrop of the central Carboniferous Basin. This belt also coincides with the Daniel Boone National Forest. These rocks are important because they contain coal, oil, and groundwater, and helped create the ruggedly beautiful canyons, rapids, falls, and arches in the national forest and nearby state parks. This report describes the general stratigraphy of these Carboniferous rocks, and is designed to assist stratigraphers, coal geologists, forest managers, science educators, and geology students.

Two cross sections were constructed using two different types of information. Information for the western cross section (A-A') came from outcrop descriptions (measured sections) and geologic maps, and was supplemented with sparse subsurface data (borehole descriptions and drillers' logs and geophysical logs from oil and gas wells). The eastern cross section (B-B') was designed to make the best use of subsurface data such as the numerous records from oil and gas wells that penetrated the middle Carboniferous rocks at depth, few outcrop data were available for the eastern section. Sea level was the datum for both cross sections.

Because of the rugged topography and the forest cover, much of the study area is difficult to access. Cross sections of some important outcrops in state parks and other scenic areas are shown in insets. The locations of these outcrops are shown on the cross sections and on the location map.

Stratigraphy

Stratigraphic nomenclature for the Carboniferous and Upper Devonian strata follows that formalized by Chesnut (1992b). For more detailed descriptions, consult 7.5-minute geologic quadrangle maps published jointly by the U.S. Geological Survey and the Kentucky Geological Survey. The particular quadrangle that covers a particular segment of each cross section is indicated at the top of the section. County names are shown below quadrangle names. Geologic quadrangle maps may be purchased at the Kentucky Geological Survey.

Chattanooga and Ohio Shales

The Chattanooga and Ohio Shales consist largely of Upper Devonian and Lower Mississippian black shales. The term "Chattanooga Shale" is used in southern Kentucky and is equivalent to the Sunbury Shale, Berea Sandstone, Bedford Shale, and Ohio Shale in northeastern Kentucky. The Sunbury, Berea, and Bedford become too thin to recognize in outcrops to the south. The gamma-ray signatures of these units are distinctive on oil and gas geophysical logs and scintillometer readings from the study area, however. These strata thicken to the north, where intervening gray shales and sandstones also become thicker and more common. The lowest gray shale in the study area is the "Upper Olenian Shale." Overlying the Upper Olenian is the Ohio Shale. In northern parts of the study area, the Ohio is divided into several shale units, which are, in ascending order, the Lower Huron (black shale), Middle Huron (gray shale), Upper Huron (black shale), Three Lick Beds (series of thin gray shales), and the Cleveland Shale (black shale). The Upper Olenian and Ohio Shales are Upper Devonian. Overlying the Ohio Shale are the Upper Devonian gray Bedford Shale and Berea Sandstone. The Lower Mississippian Sunbury Shale, a black shale, overlies the Berea and Bedford.

The black shales were probably deposited at the bottom of fairly deep dysaerobic (low oxygen content) seas. Gray shales represent deposition of siliciclastics in more oxygenated bottom conditions.

The Ohio and Chattanooga Shales have been evaluated for use as an oil shale. This unit is the source rock for most of the oil found in eastern Kentucky, and is the largest producer of gas in that region.

Borden Formation

The Lower Mississippian Borden Formation consists of shales, siltstones, and sandstones. The Borden thickens to the northeast and thins to almost zero thickness in the southernmost part of the study area. The Borden has been divided into several members, which are not shown here. See Sable and Dever (1990) for a more detailed discussion of Borden stratigraphy.

The Borden siliciclastics were deposited as a subaqueous delta that prograded to the southwest in marine seas. Environments represented by members of the Borden include distal and proximal prodelta, delta front, and delta top.

The shales of the Borden have been used to make tile and brick products. Freestone was quarried from some of the siltstone and sandstone beds in northern Kentucky. Sandstones in the Borden are reservoirs for oil and gas in some parts of eastern Kentucky.

Fort Payne Formation

The Lower Mississippian Fort Payne Formation is composed of siliceous limestone and dolomitic siltstone and shale. It occurs only in the southern part of the study area, where its thickness is indirectly proportional to the thickness of the underlying Borden Formation. Thin lateral equivalents of the Fort Payne

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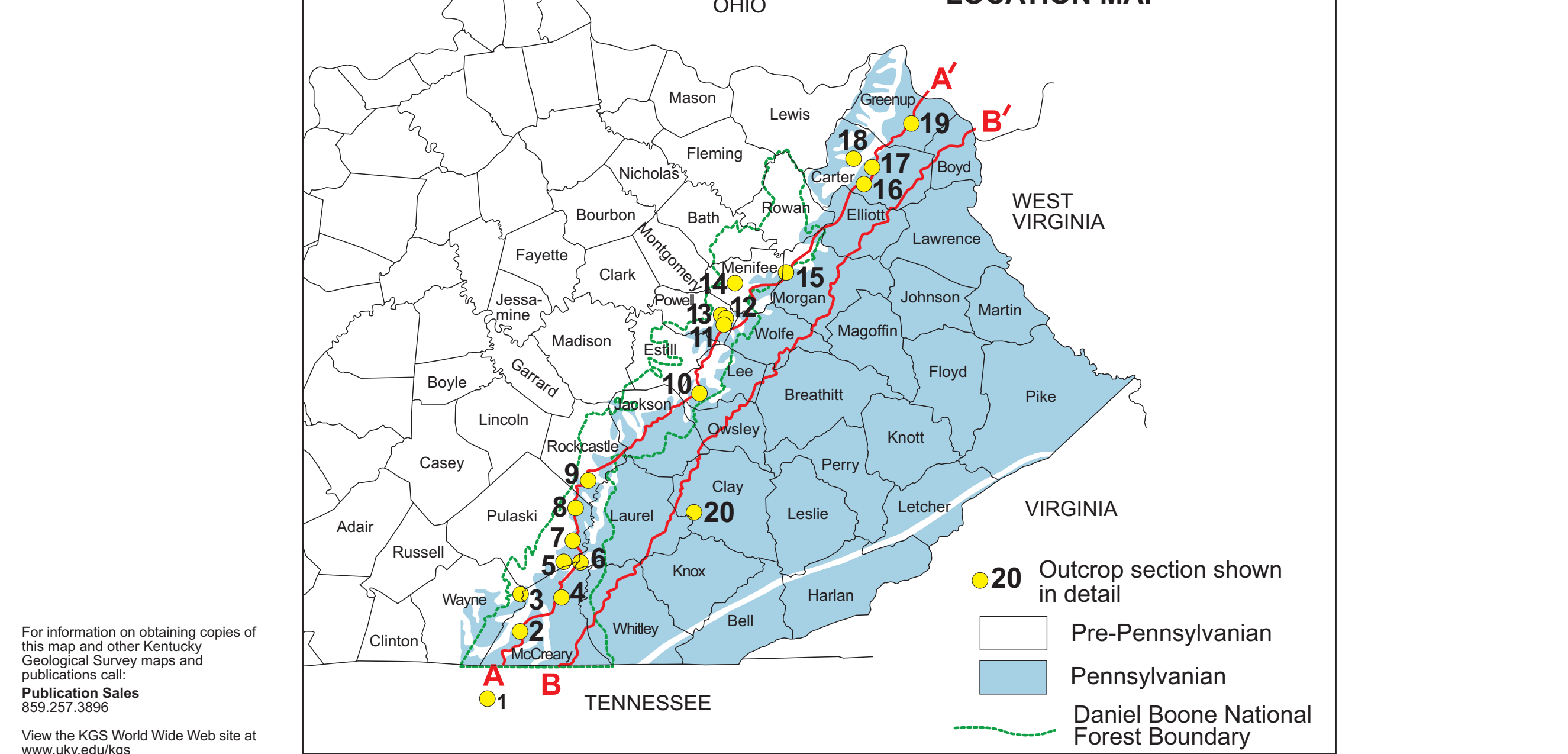
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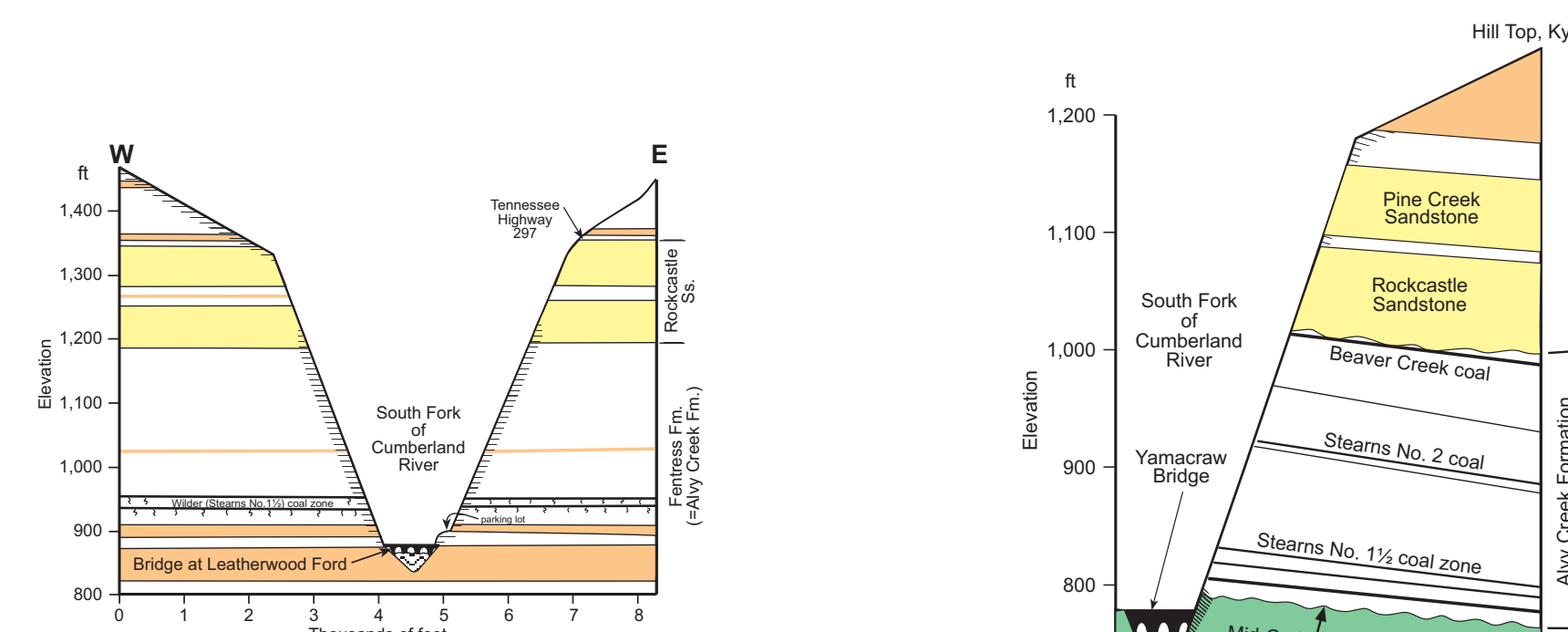
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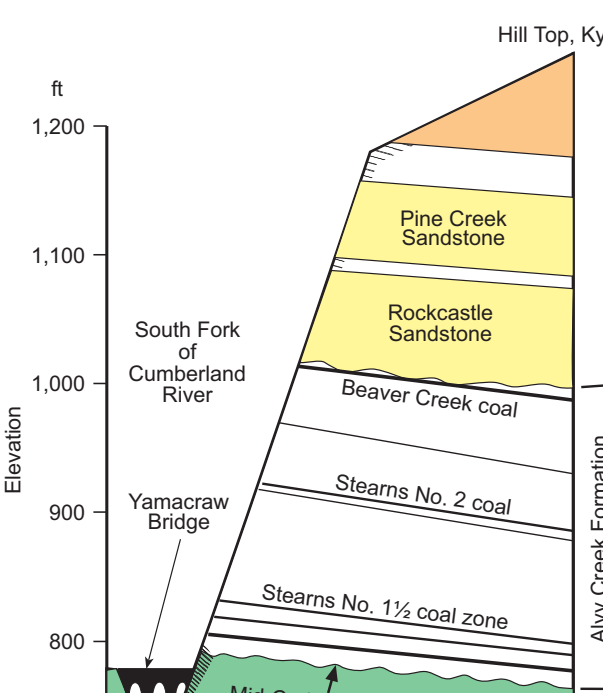
LOCATION MAP



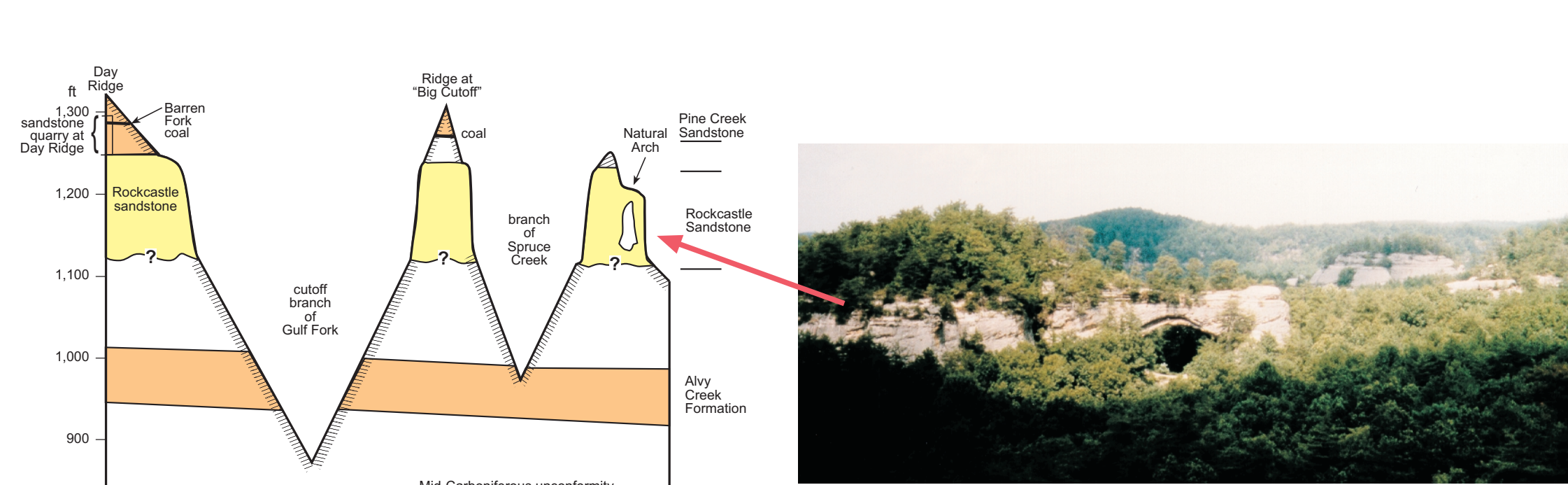
For information on obtaining copies of this map and other Kentucky Geological Survey maps and publications call: Publication Sales 635-2532. View the KGS World Wide Web site at www.uky.edu/kgs



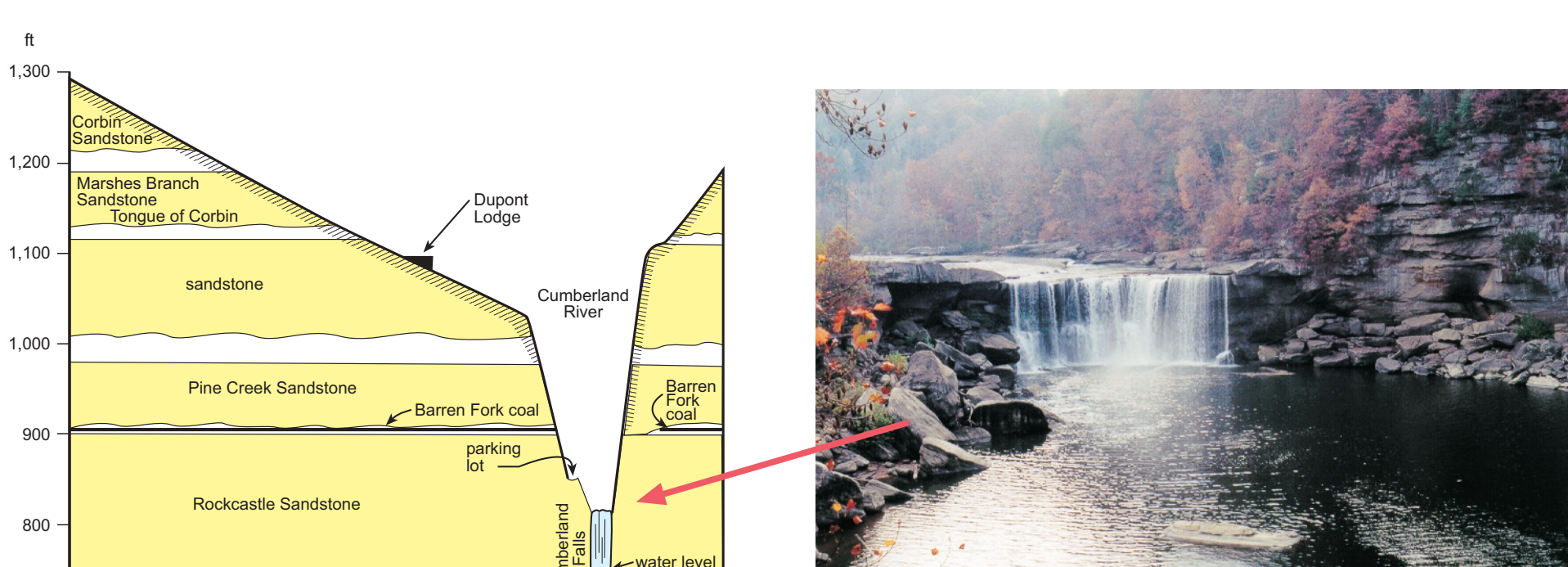
Outcrop 1. Leatherwood Ford, Big South Fork of the Cumberland National Recreation Area, Tennessee 297, Honey Creek 7.5-minute quadrangle, Scott County, Tenn. This outcrop is not on the cross section.



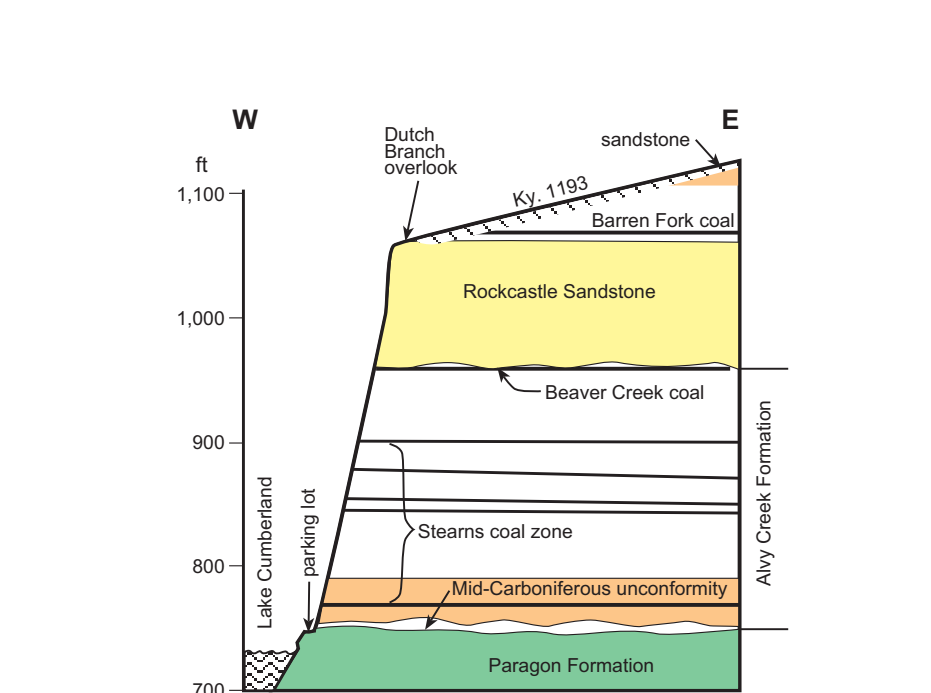
Outcrop 2. Yamacraw Bridge to Hill Top, Kentucky Kentucky 92, Breathitt 7.5-minute quadrangle, McCreary County, Ky. This outcrop is not on the cross section.



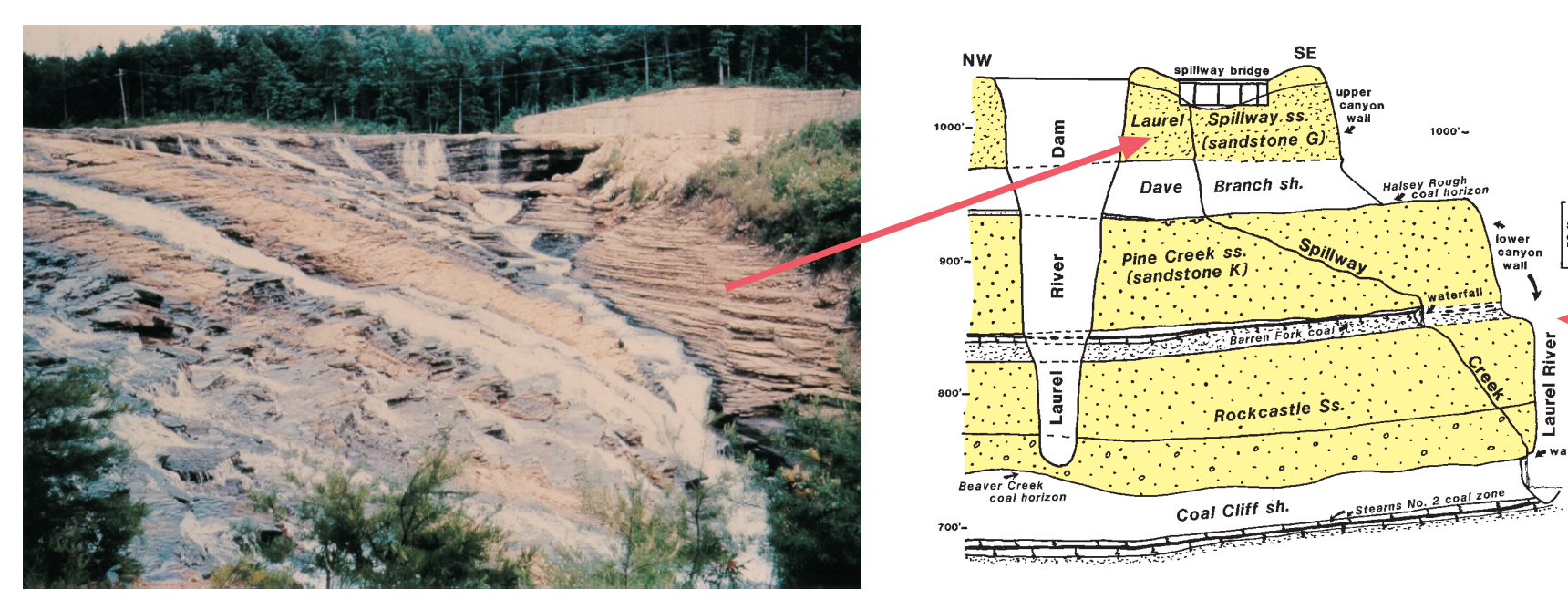
Outcrop 3. Day Ridge, Natural Arch Scenic Area, Nevelsville 7.5-minute quadrangle, McCreary County, Ky. This outcrop is not on the cross section.



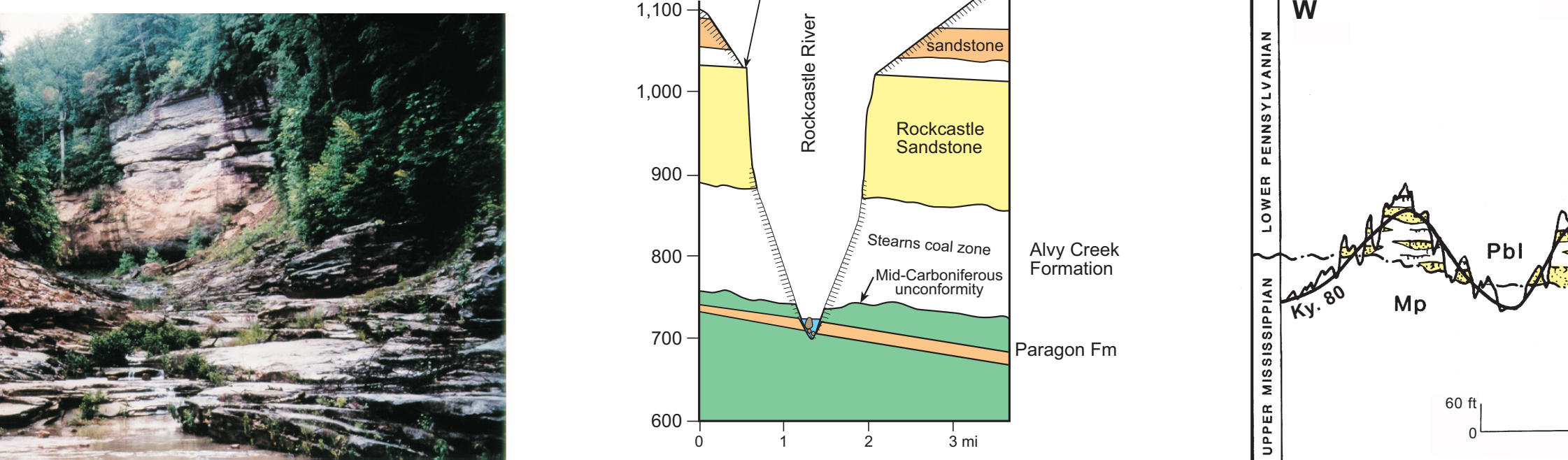
Outcrop 4. Cumberland Falls State Resort Park, Cumberland Falls 7.5-minute quadrangle, McCreary and Whitley Counties, Ky.



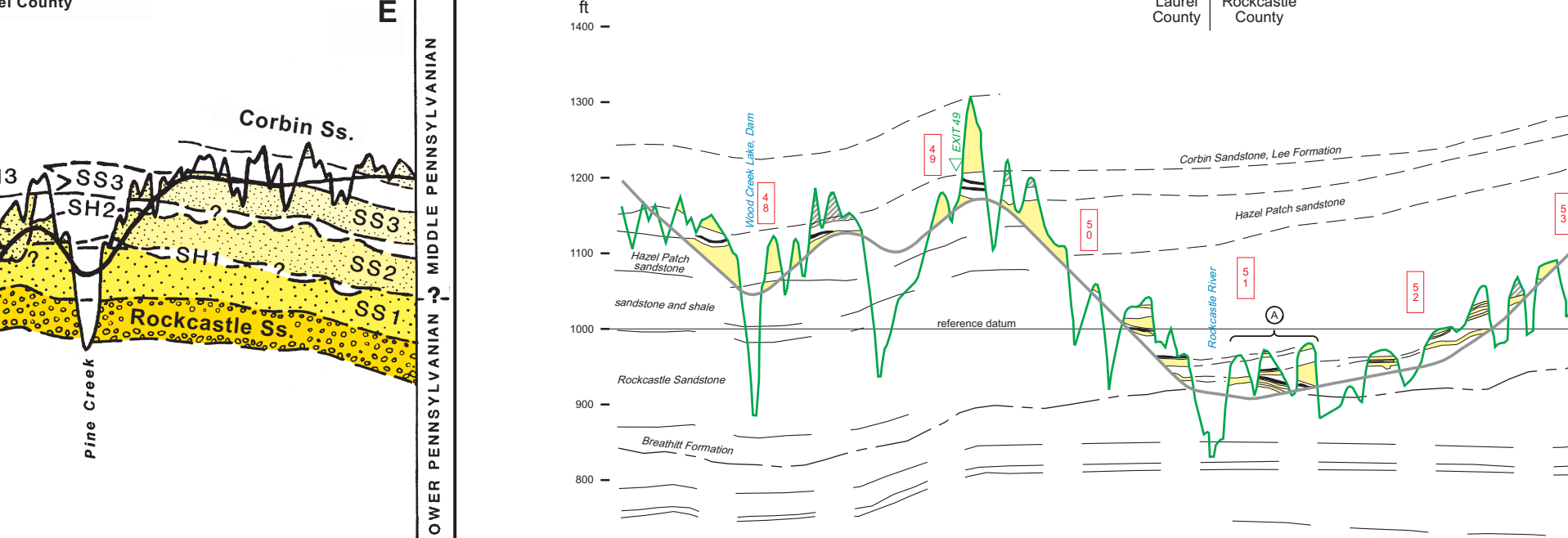
Outcrop 5. London Boat Dock section, Transsect along Kentucky 1193, Sawyer 7.5-minute quadrangle, Laurel County, Ky. This outcrop is not on the cross section.



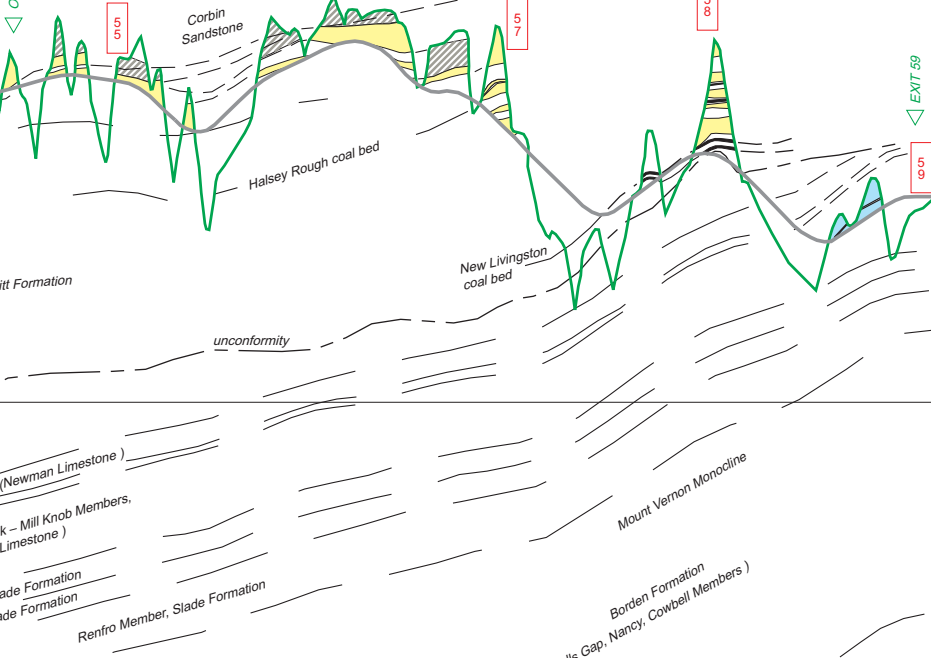
Outcrop 6. Laurel River Lake Dam site, Sawyer 7.5-minute quadrangle, Laurel and Whitley Counties, Ky. For more detailed descriptions, see Greb and Chesnut (1989a).



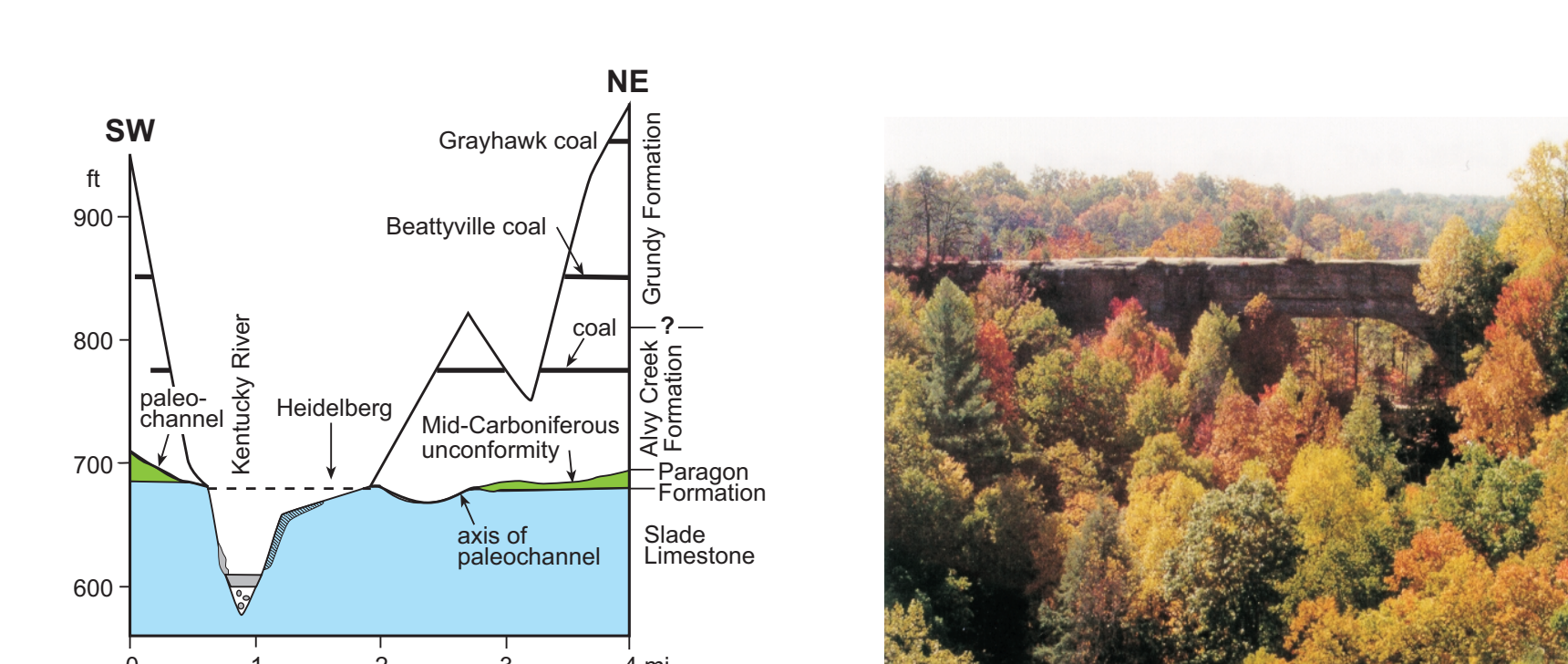
Outcrop 7. The Narrows of the Rockcastle River, Bee Rock Recreational Area, Ano 7.5-minute quadrangle, Laurel and Pulaski Counties, Ky.



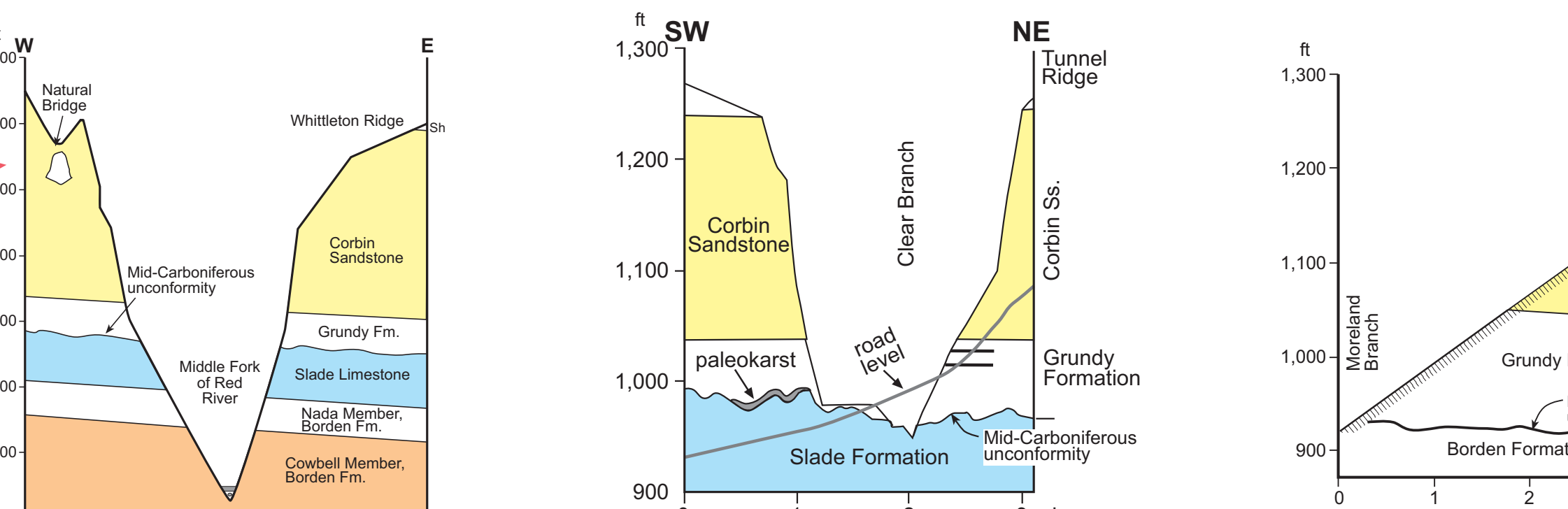
Outcrop 8. Billows area, Cross section along Ky. 80, Billows 7.5-minute quadrangle, Laurel and Pulaski Counties, Ky. For more detailed descriptions, see Greb and Chesnut (1989a, b) and Dever and others (1990).



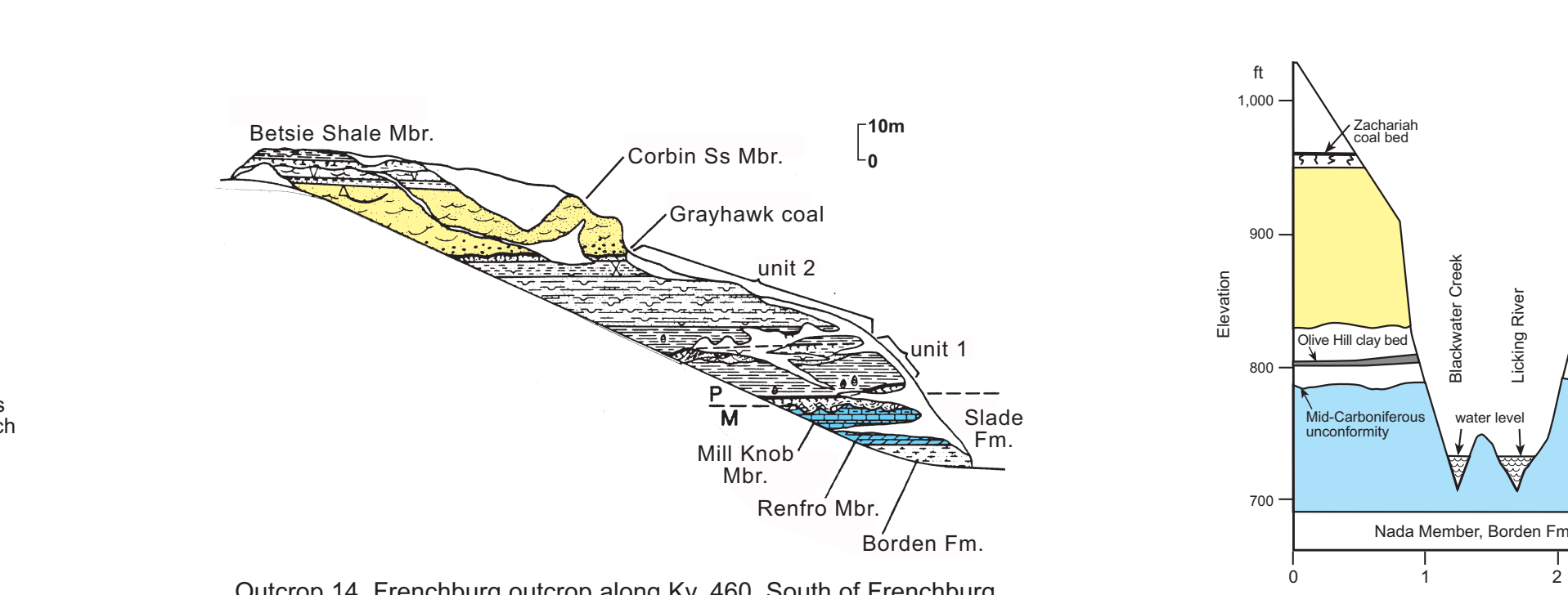
Outcrop 9. Series of roadcuts along Interstate 75, Bernstadt, Livingston, and Mount Vernon 7.5-minute quadrangles, Laurel and Rockcastle Counties, Ky. From Chesnut (1992a). For more detailed description, see Cobb and others (1981, step 1).



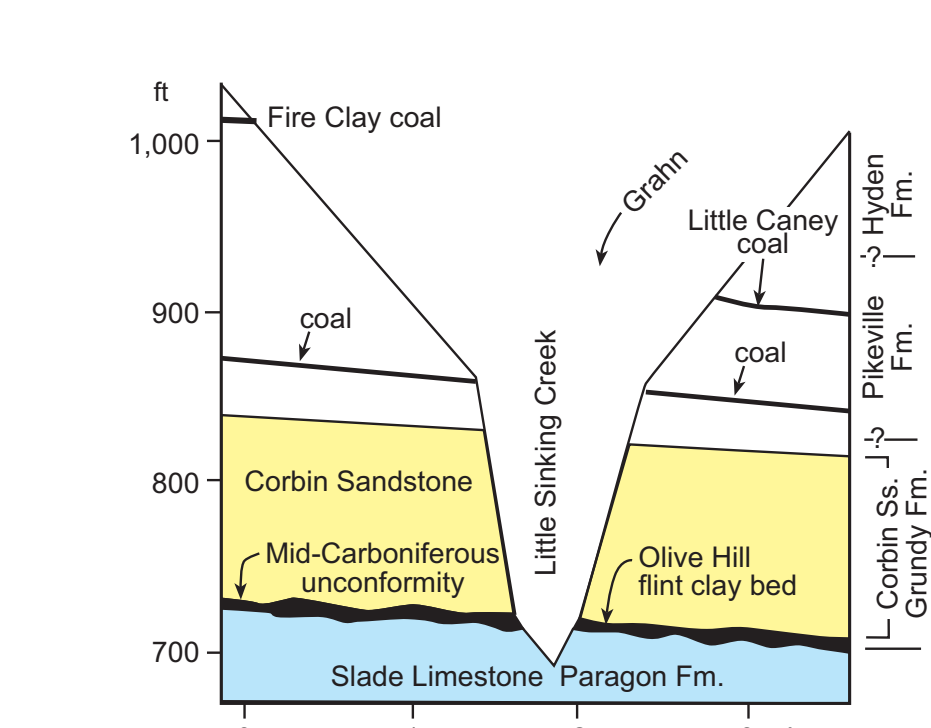
Outcrop 10. Paloochamnel at Mid-Carboniferous unconformity, Heidelberg 7.5-minute quadrangle, Lee County, Ky.



Outcrop 11. Natural Bridge State Resort Park, Slade 7.5-minute quadrangle, Powell County, Ky.

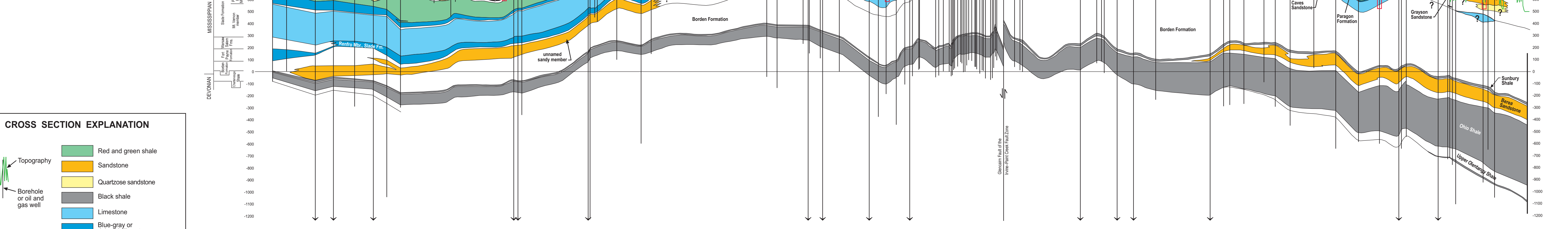


Outcrop 12. Mountain Parkway at Tunnel Ridge, Slade 7.5-minute quadrangle, Powell County, Ky. This outcrop is not on the cross section.

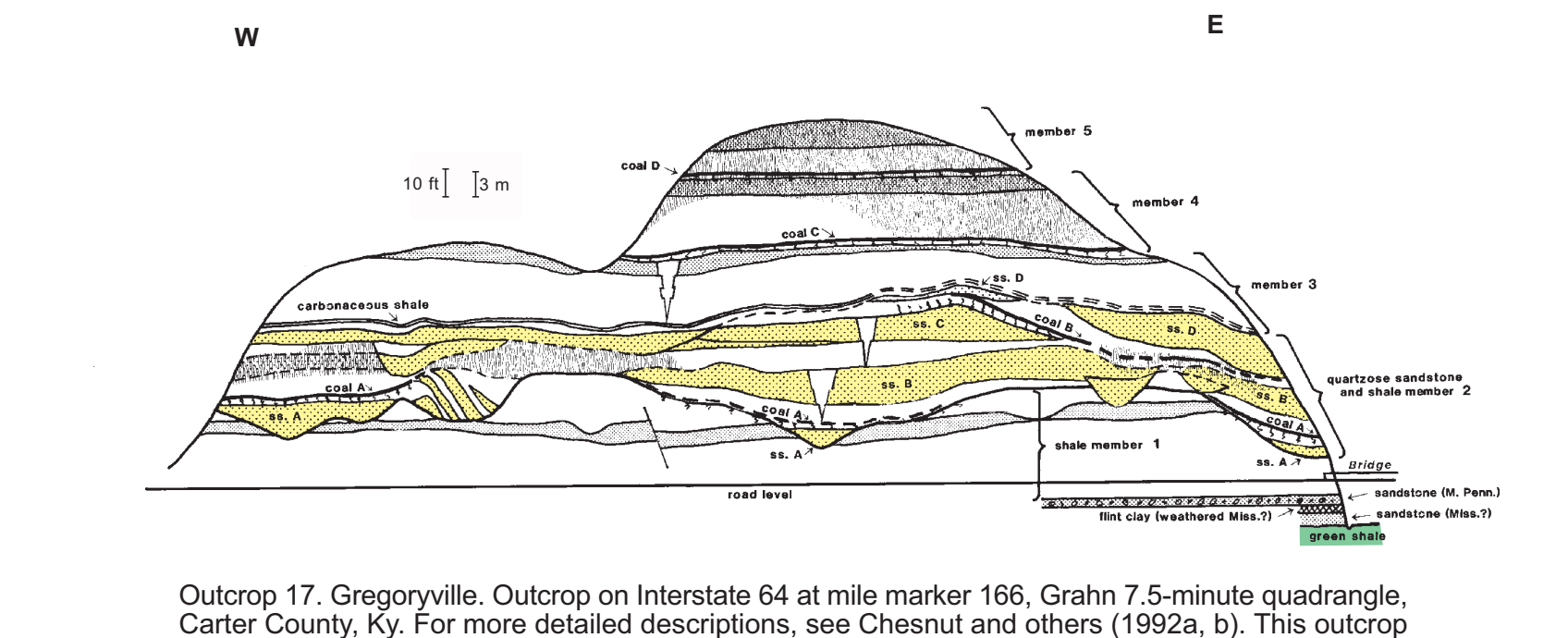
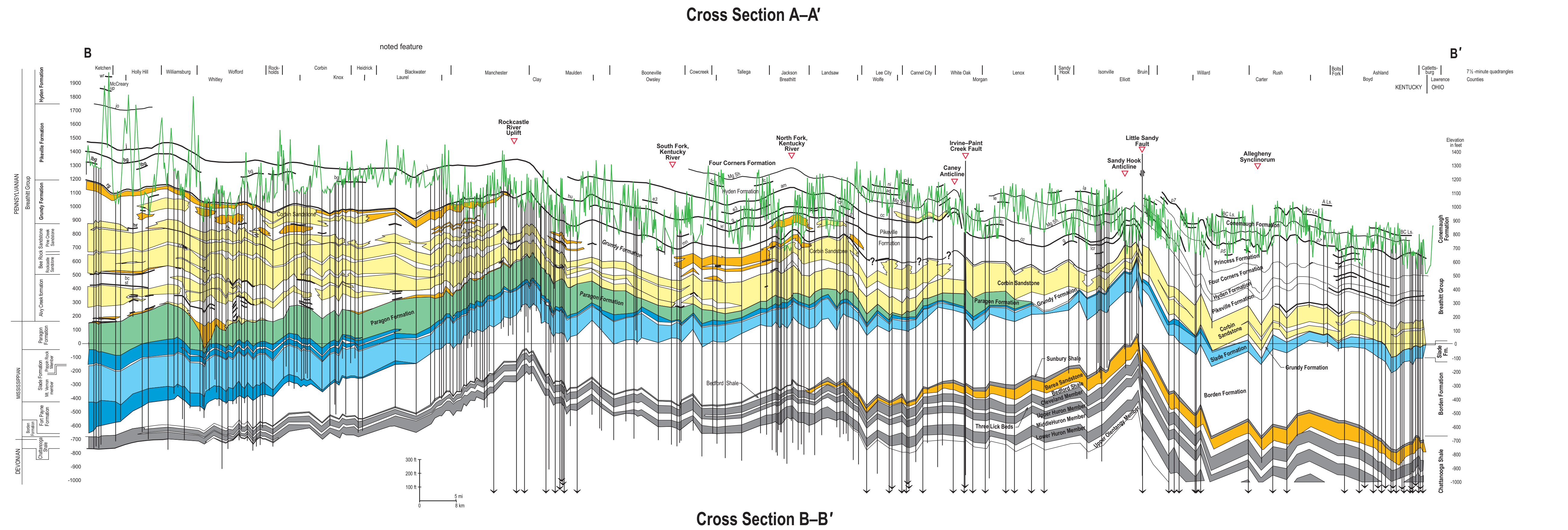
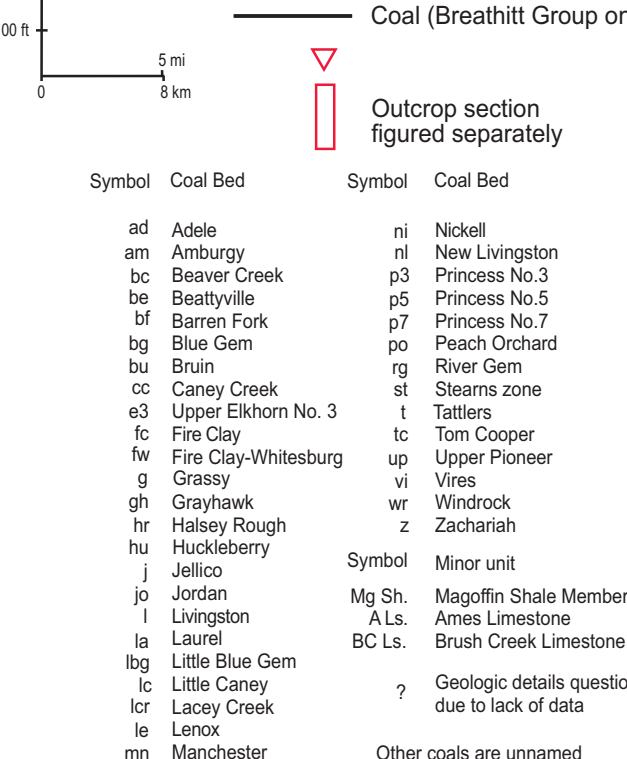


Outcrop 13. Nada Tunnel, Red River Gorge, Slade 7.5-minute quadrangle, Powell County, Ky. This outcrop is not on the cross section.

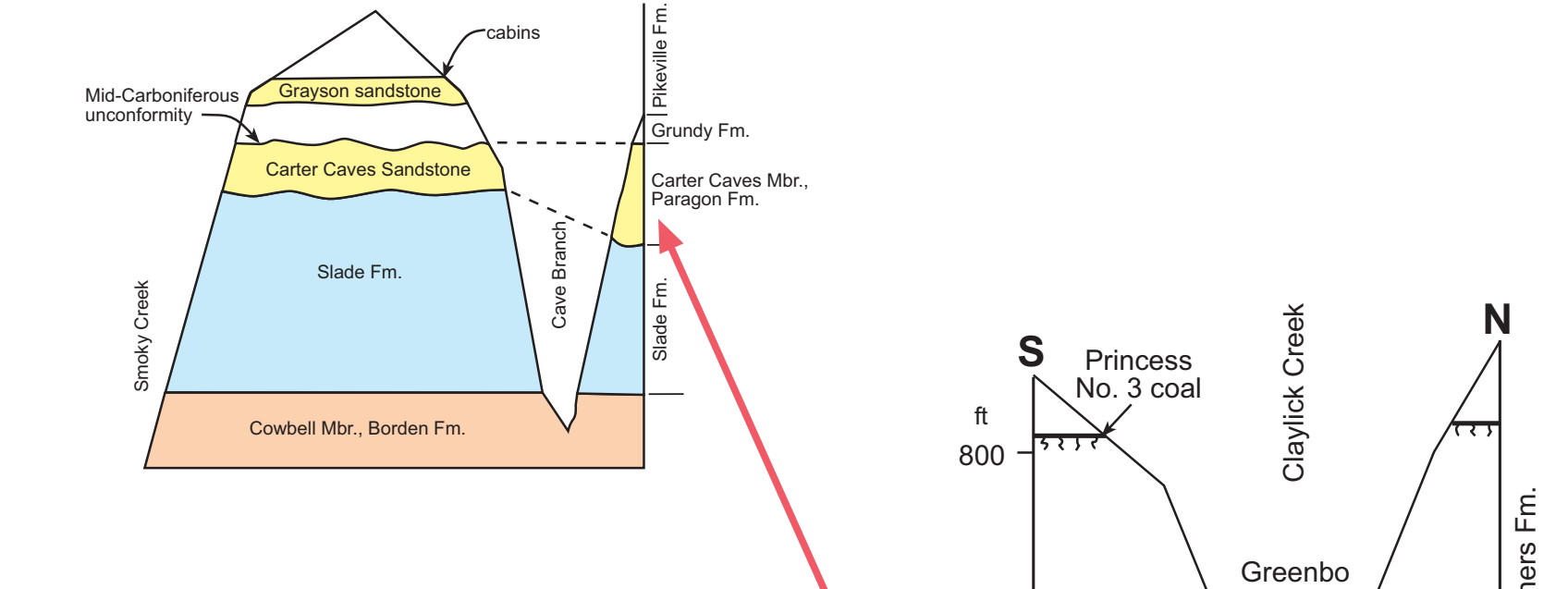
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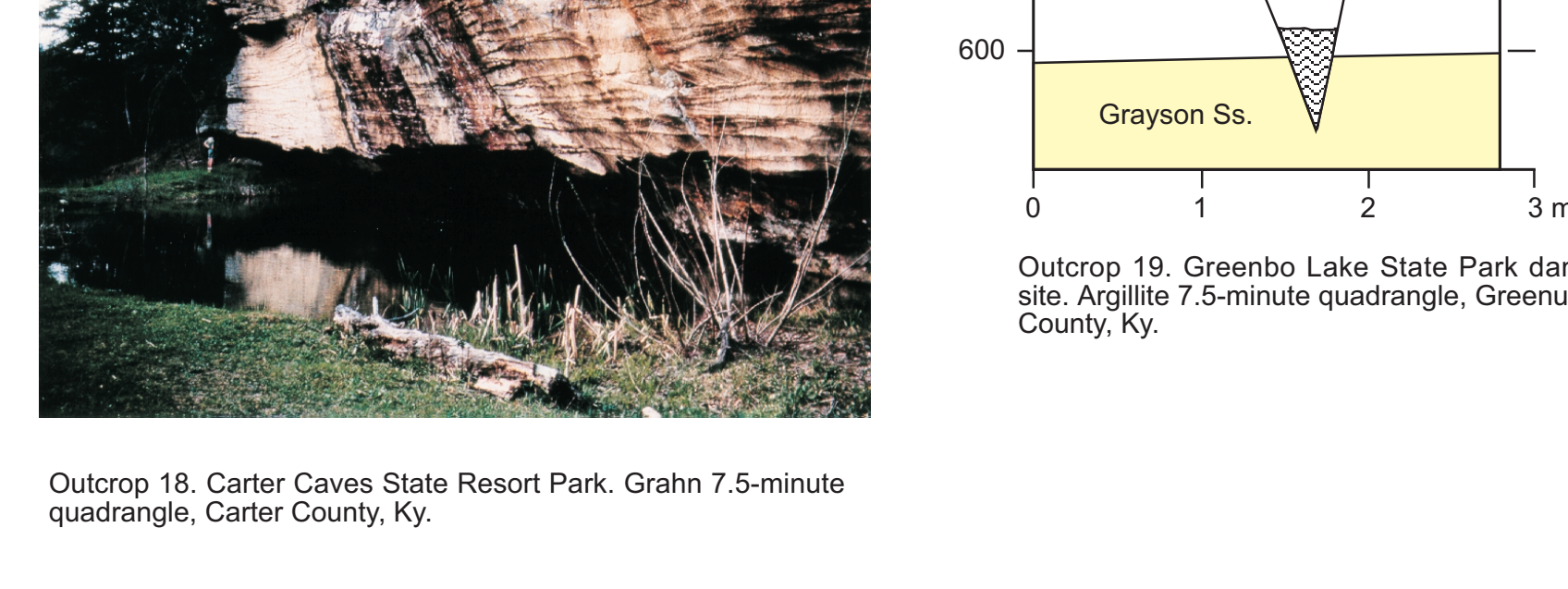
CROSS SECTION EXPLANATION



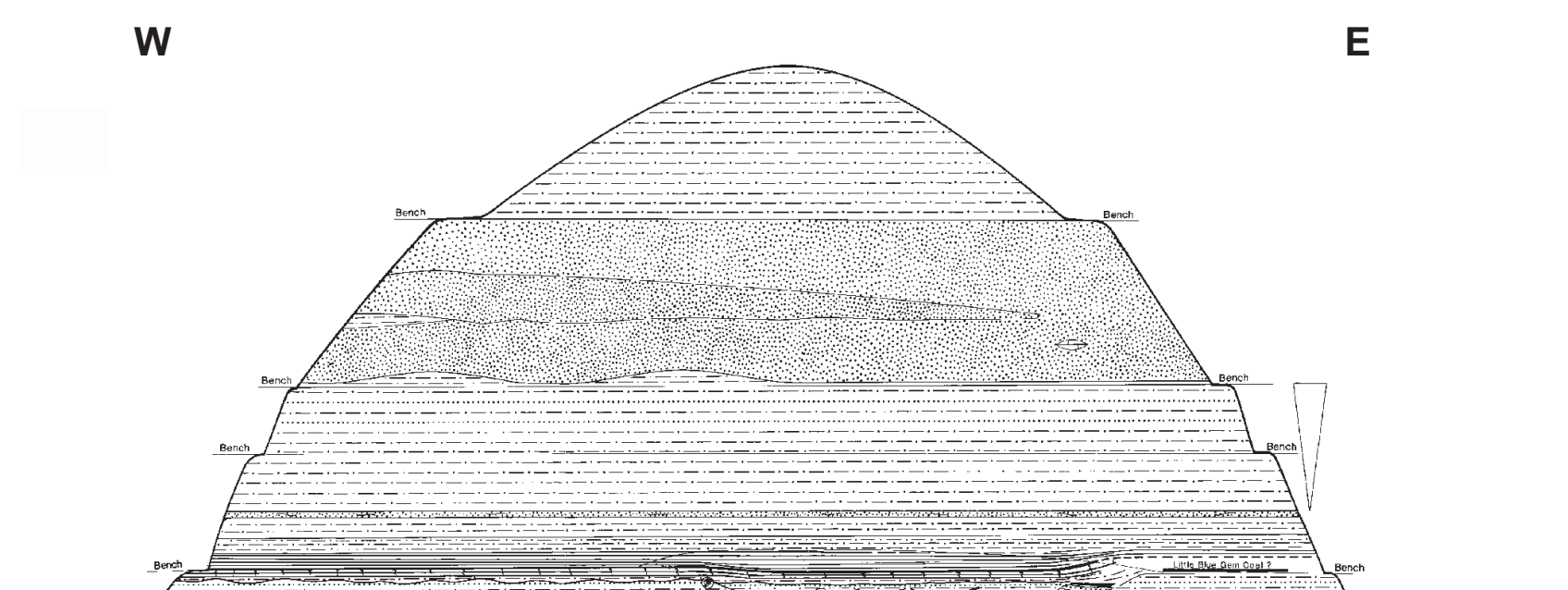
Outcrop 14. Firenburg outcrop along Ky. 480, South of Firenburg, Scranton 7.5-minute quadrangle, Menifee County, Ky. For more detailed description, see Greb and others (1992). This outcrop is not on the cross section.



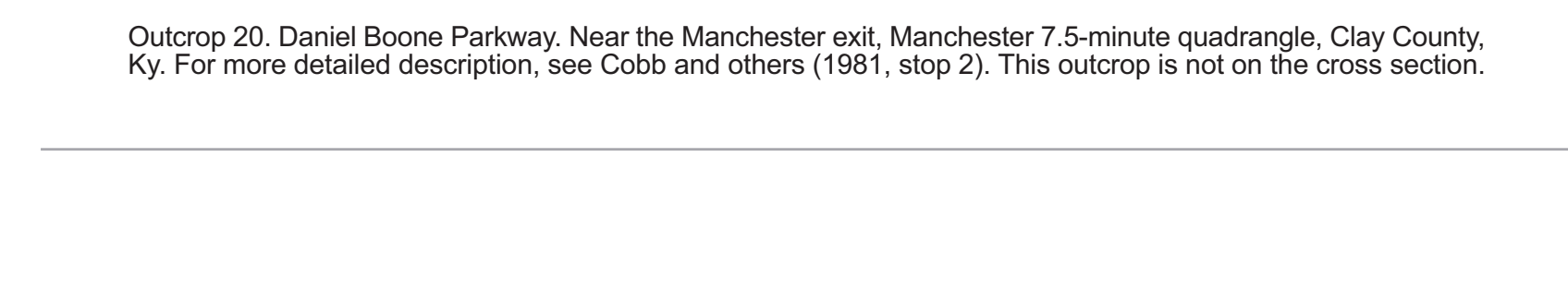
Outcrop 15. Cave Run Lake, Confluence of Blackwater Creek and Licking River, Ezel 7.5-minute quadrangle, Morgan County, Ky.



Outcrop 16. Greenbush 7.5-minute quadrangle, Carter County, Ky. For more detailed description, see Chesnut and others (1992c). This outcrop is not on the cross section.



Outcrop 17. Gregoryville, Outcrop on Interstate 64 at mile marker 166, Grahn 7.5-minute quadrangle, Carter County, Ky. For more detailed descriptions, see Chesnut and others (1992a, b). This outcrop is not on the cross section.



Outcrop 18. Carter Caves State Resort Park, Grahn 7.5-minute quadrangle, Carter County, Ky.

Outcrop 19. Greenbo Lake State Park dam site, Argillite 7.5-minute quadrangle, Greenup County, Ky.

Outcrop 20. Daniel Boone Parkway, Near the Manchester exit, Manchester 7.5-minute quadrangle, Clay County, Ky. For more detailed description, see Cobb and others (1981, step 2). This outcrop is not on the cross section.