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Correlation chart of named coal beds, coal zones, key beds, and other selected rock stratigraphic units of Pennsylvanian age by coal reserve districts and subdistricts. Sandstone members, shown by pattern, are identified by formation where required for clarity. Marine units are shown by vertical hatching. In the overlap zone of the Lee, Breathitt, and Breckinridge Formations, marine units are assigned to the Breathitt Formation. Unrelated strata are left blank. Sandstone members are shown in their general stratigraphic positions and may not be equivalent in age to adjacent stratigraphic units. The Pennsylvanian age (mostly Mississippian age) locally may contain a top thin shale sequences of Pennsylvanian age (not shown) in the Upper Cumberland River district (see text). Chart is modified from Rice and Smith (1980). Names of sandstone units on the chart and characterization of coals as beds or zones generally follow the usage of the GQ-map reports for given coal districts.

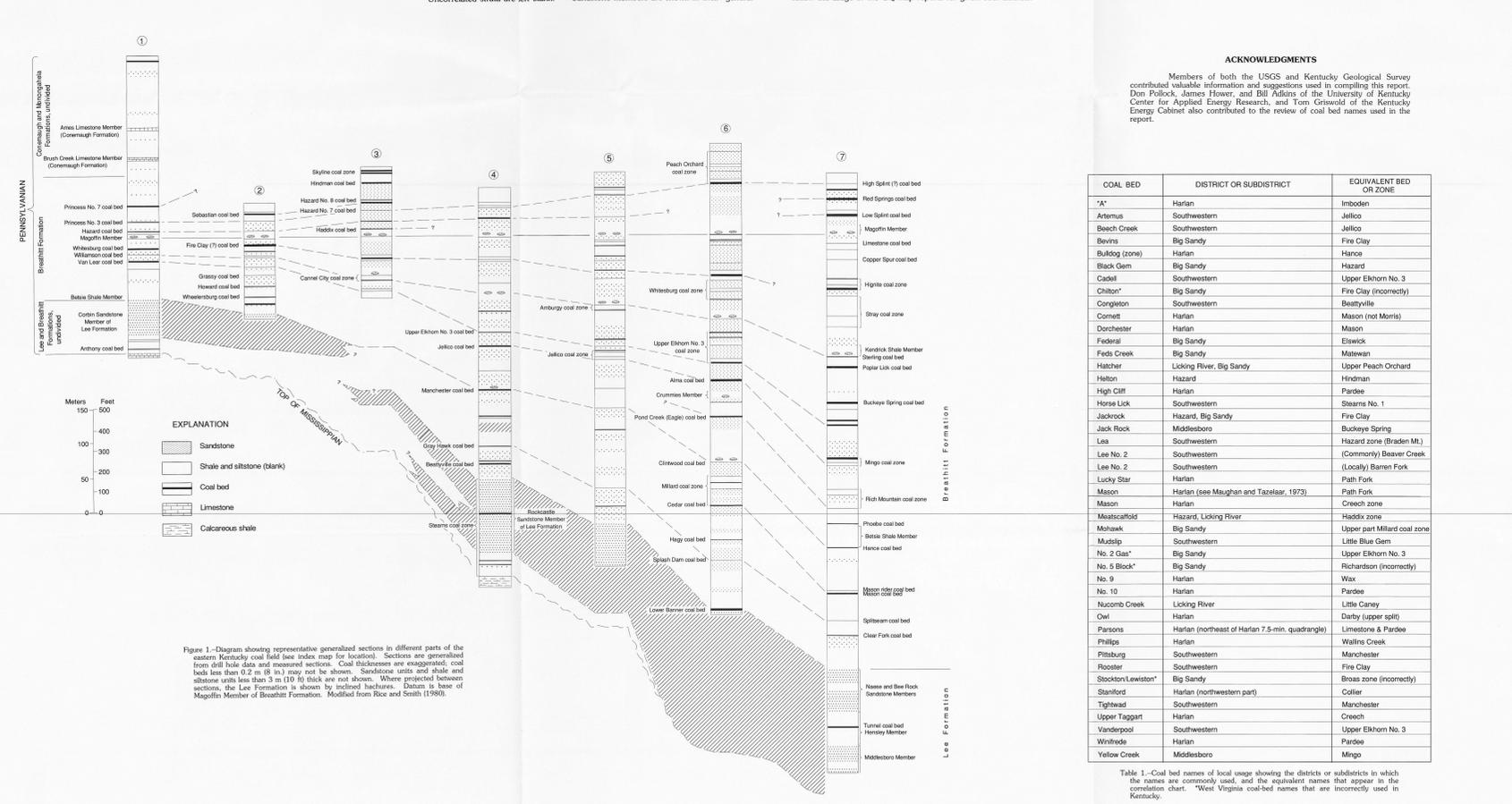


Figure 1.—Diagram showing representative generalized sections in different parts of the eastern Kentucky coal field (see index map for location). Sections are generalized from drill hole logs and stratigraphic sections. Coal thicknesses are exaggerated; coal beds less than 0.2 m (8 in.) may not be shown. Sandstone units and shale and siltstone units less than 3 m (10 ft) thick are not shown. Where geologic sections are shown, the Lee Formation is shown by vertical hatching. Datum is base of Magoffin Member of Breathitt Formation. Modified from Rice and Smith (1980).

1 Coal bed names of local usage showing the districts or subdistricts in which the names are commonly used, and the equivalent names that appear in the correlation chart. \*West Virginia coal-bed names that are incorrectly used in Kentucky.

REVISED CORRELATION CHART OF COAL BEDS, COAL ZONES, AND KEY STRATIGRAPHIC UNITS IN THE PENNSYLVANIAN ROCKS OF EASTERN KENTUCKY

By  
Charles L. Rice<sup>1</sup> and John K. Hielt<sup>2</sup>  
1994



Index map showing coal reserve districts and subdistricts of the eastern Kentucky coal field. Numbers indicate locations of measured sections and drill hole sections shown in figure 1.

**INTRODUCTION**

This report revises Miscellaneous Field Studies Map MF-1188 (Rice and Smith, 1980). Major revisions to the original correlation chart include formal naming of key marine units in Kentucky and replacement of informally named marine units incorrectly projected into Kentucky from adjacent states. Also included in the report is the proper correlation of some regionally recognized coal bed names that have been incorrectly projected into Kentucky, particularly from Ohio and West Virginia. Besides these additions and corrections, minor changes have been made to the correlation chart, all of which are discussed below in detail.

The Pennsylvanian rocks of the eastern Kentucky coal field underlie an area of about 27,000 square kilometers (see index map). Largely because of the size and stratigraphic complexity of the area, Huddle and others (1963, p. 31) produced the coal field into six reserve districts. Over the years, these district and county lines as well as geologic features, drainage areas, and coal producing areas. This division is followed herein because, in general, each of the districts has a characteristic stratigraphic nomenclature, particularly with regard to coal bed names. The six districts are the Princess, Licking River, Big Sandy, Hazard, Southwestern, and Upper Cumberland River; the Upper Cumberland River district is divided into the Middleboro and Harlan subdistricts.

The correlation chart lists most of the stratigraphic units in the eastern Kentucky coal field as used in eastern Kentucky, and is especially principally with coal bed names used in publications since about 1950, and concerned all the names of coal beds for which resources and reserves have been calculated. It constitutes only a small percentage of the total Pennsylvanian rock sequence, but is present in as many as 26 marine coal zones that have been projected and mined extensively in all parts of the coal field since the early 1900's. Coal names listed in this chart represent coal beds that have been mined commercially or used locally by residents of the area. Not every coal bed listed under a district in the chart is found in all parts of that district, nor has every coal bed been given a name. For the sake of accuracy, coal beds commonly identified as a "ride" coal bed (commonly a minor coal bed or split above the main bed) or as a "marker" coal bed (a minor coal bed that has been projected into the chart because they do not contribute to the overall stratigraphic framework of the coal field).

Most of the stratigraphic units listed in the correlation chart are defined and described in detail in the almost 200 geologic reports of the Geologic Survey of the U.S. Geological Survey. In 1963, 1964, and 1965, descriptive lithology and local stratigraphy and identify many coal beds by both local and regional names. Other geologic reports of significance are in eastern Kentucky in the construction of the chart include USGS bulletins dealing with the correlation of single 7.5-minute quadrangles (England, 1965; Addison, 1967; Welch, 1968; Bergin, 1968). The coal resources of eastern Kentucky as a whole have been described by Huddle and others (1963) and detailed reports on the stratigraphy and coal resources of significant areas in eastern Kentucky have been made by Huddle and England (1966) and England (1968).

An additional source of stratigraphic information is the SEAMS database, which is jointly sponsored by the University of Kentucky Center for Applied Energy Research, the Kentucky Geological Survey, and the Kentucky Department of Mines and Minerals. The SEAMS database identifies the stratigraphic position and location of all coal beds in the eastern and western Kentucky coal fields as well as those of bounding areas in adjacent states. The database includes references to all coal-bed names used in Kentucky, especially those shown on coal company mine maps. Local names of coal beds in the database file are not generally used in publications as listed in table 1 together with their regional equivalents.

**GEOLOGIC SETTING**

The Pennsylvanian rocks of the central Appalachian basin were deposited in a foreland basin whose axis lay parallel to and northwest of the Appalachian Mountains. The Pennsylvanian rocks in the eastern Kentucky coal field are divided into the formations. In ascending order, they are the Lennox, Middleboro, and Early Pennsylvanian age, the Breathitt Formation of Late Mississippian to Middle Pennsylvanian age, the Lee Formation of Early and Middle Pennsylvanian age, and the Cornsawhatch and Monongahela Formations of Late Pennsylvanian age (see correlation chart). Where a thin Pennsylvanian shale sequence (not shown) in the correlation chart above the Mississippian-Pennsylvanian unconformity locally underlies massive Pennsylvanian sandstones of the Lee Formation in the Upper Cumberland River district, the sequence has been mapped at the top of and as part of the Breathitt Formation. The Lee Formation is mostly a pebbly quartzite sandstone (greater than 90 percent quartz) that intertongues with and locally grades into the Breathitt Formation. However, the oldest member of the Lee Formation is the Pinacle Overlook Member, which lies within the Breathitt Formation as shown on the chart. The Breathitt Formation, characterized by subgraywacke, gray shale, and gray siltstone, grades into the overlying red and green shale and subgraywacke of the Cornsawhatch and Monongahela Formations (identified) in northeastern Kentucky.

The Breathitt was mapped on many GQ map reports in the Upper Cumberland River district as a group of five formations, in ascending order, they are the Harlan, Manco, Catron, Higley, and Byron Formations. Because these latter formations were not mapped consistently in the GQ's across the Cumberland River district (Rice, 1984a; McDowell and others, 1985), they have been abandoned (see Rice, Hielt, and Koomin, 1994). Thus, the Breathitt Group of England and Ebers (1965, p. 31) has been replaced on the Breathitt Formation, which includes all strata younger than the Lee Formation in the Upper Cumberland River district. These formations should not affect the correlation of coal beds and key beds or the status of members previously identified in these strata.

Key marine beds, key coal beds, and widely distributed sandstone members together constitute the stratigraphic framework which locally imports the regional stratigraphic framework. The regional stratigraphic framework is the basis for the correlation chart. Because many of the marine units resemble one another and coal beds generally can not be distinguished from each other, the correlation of key beds in eastern Kentucky depends mostly on a continuity demonstrated by detailed mapping. However, because individual coal beds do not persist across the entire coal field, the recognition of local key beds and sequences of key beds is necessary to establish a stratigraphic framework to which coal beds can be referred for purposes of correlation. In addition, some common marine units of wide extent—the most important are the Kendrick Shale, Magoffin, and Stone's Member of the Breathitt Formation. These stratigraphic units are shown stream level over much of the coal field, and their continuity has been demonstrated by mapping.

Blood drainage divides between major rivers in eastern Kentucky make correlation of concealed beds below the Tom Cooper coal bed and its equivalents difficult. However, as a result of regional stratigraphic studies, two important datums have been established in the lower part of the section. First, the Betsie Shale Member of the Breathitt Formation has been identified and named (see Rice and others, 1987) based on geophysical logs from coal and gas test holes. These logs show that the Betsie, with about 46 m (150 ft) thickness, has a relatively thin basal shale that reflects the gamma-ray curve as much as 100 American Petroleum Institute (API) units beyond the gray shale base line. The Betsie is thus an invaluable stratigraphic marker bed in strata that are below stream level across much of eastern Kentucky (see fig. 1). The Betsie is a marine unit that is equivalent to the Eagle shale and limestone of White (1891) but generally has been misidentified as the Carnation limestone of White (1885) in Kentucky and adjacent areas. The second important datum is the Gray Hawk coal bed and equivalent beds in eastern Kentucky that paleontological studies have shown contain the stratigraphically highest observed occurrences of the miocene *Schizophoria zana* of Mississippi to Middle Pennsylvanian age (see text). Robert Koenigsberg (1979, section 4) has identified the Betsie Shale Member as a datum for correlation in the central Appalachian basin. U.S. Geological Survey Miscellaneous Field Studies Map MF-1188 (Rice and Smith, 1980) is a datum for correlation in the central Appalachian basin. U.S. Geological Survey Miscellaneous Field Studies Map MF-1188 (Rice and Smith, 1980) is a datum for correlation in the central Appalachian basin. U.S. Geological Survey Miscellaneous Field Studies Map MF-1188 (Rice and Smith, 1980) is a datum for correlation in the central Appalachian basin.

**STRATIGRAPHY**

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