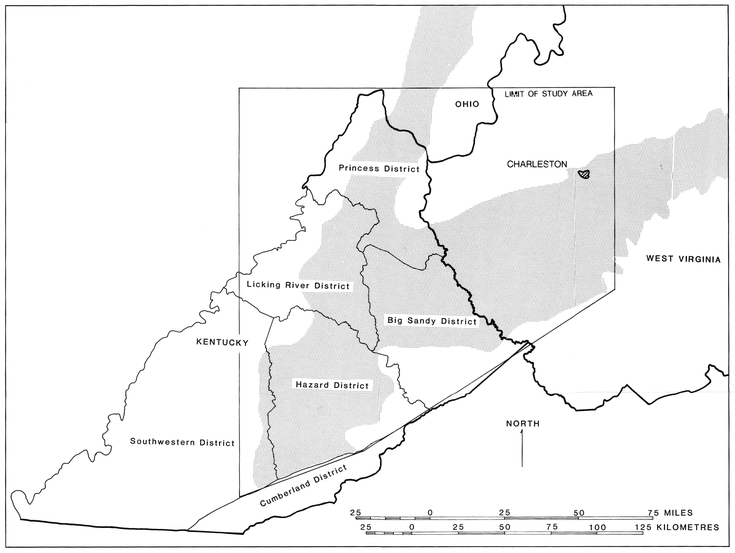
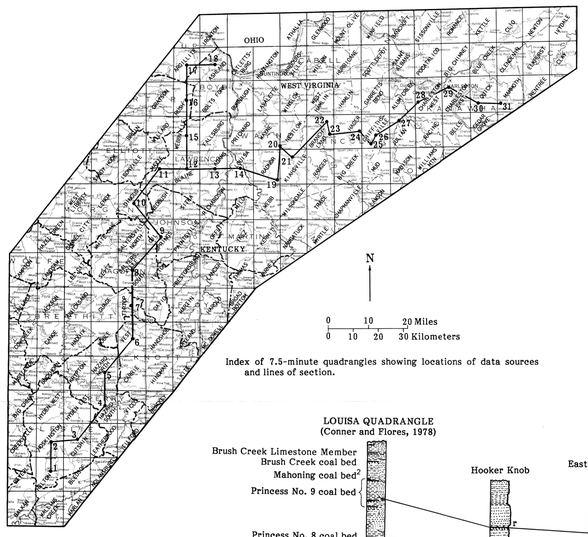
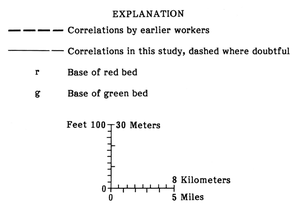
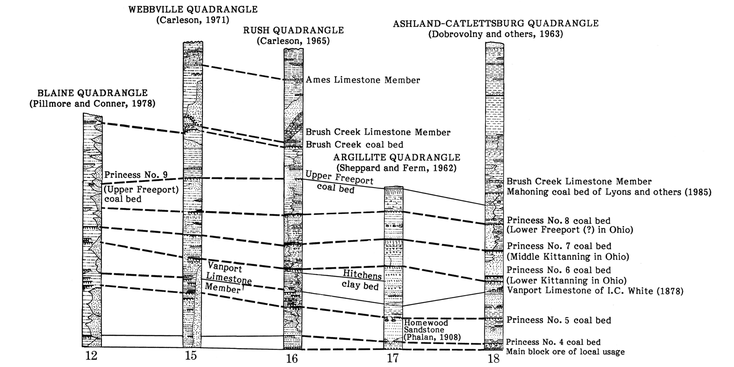


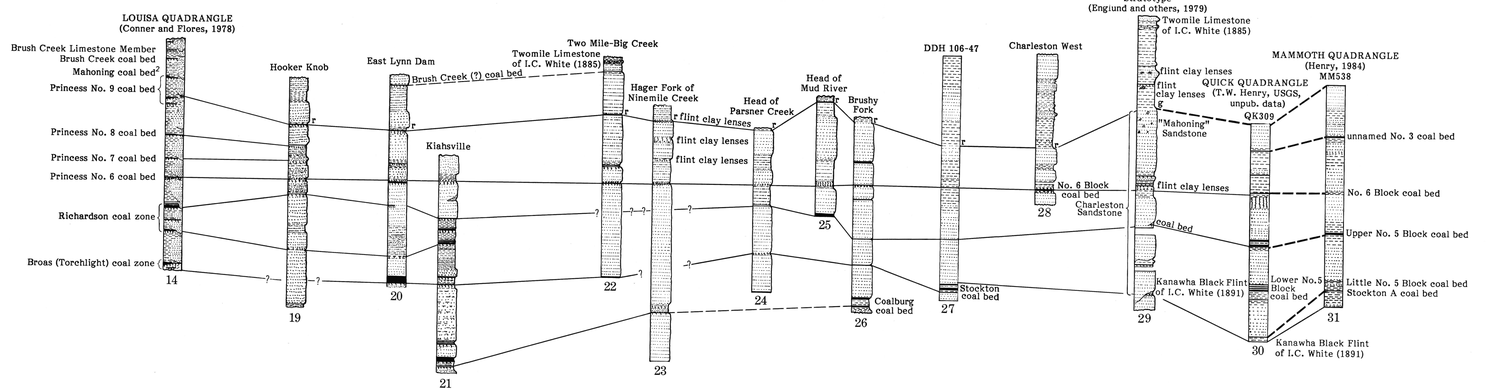
Figure 1.--Generalized area of outcrop of the Charleston Sandstone and equivalent strata in Kentucky and Ohio.

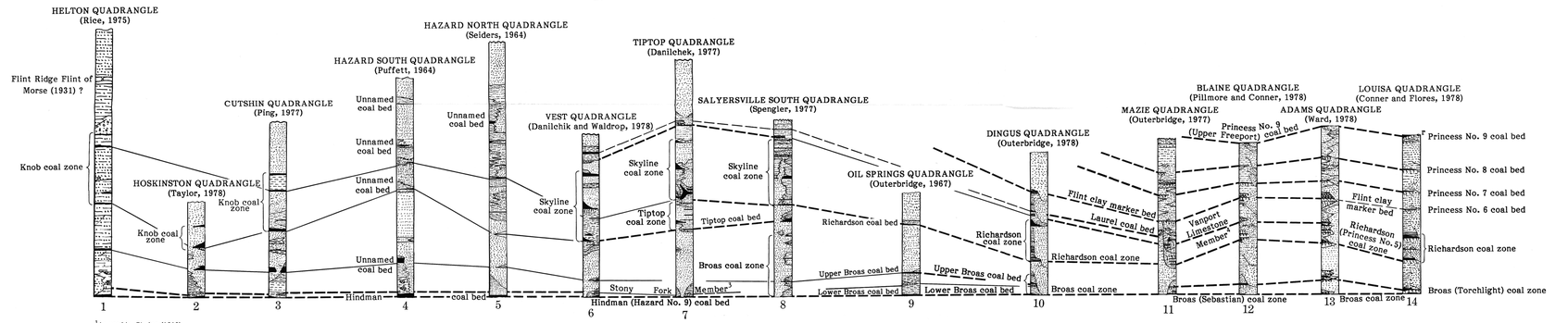


Index of 7.5-minute quadrangles showing locations of data sources and lines of section.









[1]As used by Phalen (1912)
[2]Of Lyons and others (1985)
[3]Lost Creek Limestone of Morse (1931)
[4]As used by Phalen (1912)

Figure 2.—Correlations of coal and other key beds in eastern Kentucky, western West Virginia, and southeastern Ohio.

Table 1.--*Upper Middle Pennsylvanian correlations in eastern Kentucky (modified from Rice and Smith (1980))*

SERIES	FORMATION	Princess District	Licking River District	Big Sandy District	Hazard District	Southwestern District
Middle Pennsylvanian	Breathitt	Princess No. 9 coal bed (Upper Freeport)[1]	(eroded)	(eroded)	(eroded)	(eroded)
		Princess No. 8 coal bed (Lower Freeport)[1]	Princess No. 8 coal bed			
		Princess No. 7 coal bed (Middle Kittanning)[1]	Princess No. 7 coal bed	Princess No. 7 (?) coal bed		
		Princess No. 6 coal bed (Lower Kittanning)[1]	Princess No. 6 coal bed	Princess No. 6 coal bed		
		Lower Kittanning clay	Lower Kittanning clay			
		Laurel coal bed	Laurel coal bed		Laurel (?) coal bed	
		Vanport Limestone Member[1]	Vanport Limestone Member[1] (Limekiln limestone[2] and chert)		Flint Ridge Flint[3]	Flint Ridge flint[5]
		Princess No. 5B coal bed Princess No. 5A coal bed Kilgore Flint[4] Princess No. 5 coal bed	Skyline, Princess No. 5, or Richardson coal zone	Richardson or Skyline coal zone	Skyline, Richardson, or Knob coal zone	Knob ? coal bed or Hazard No. 11 coal zone
			Tiptop coal bed	Tiptop or Lower Clarion coal bed	Tiptop or Hazard No. 10 (?) or Knob coal zone	Knob coal zone
		Princess No. 4, Upper Broas, or Torchlight coal bed	Upper Broas coal bed	Upper Broas and Broas coal beds	Hazard No. 10 coal bed (?)	Hazard No. 10 coal bed (?)
		Main Block ore[6]	Main Block ore		Stoney Fork Member	Stoney Fork Member
		Lower Broas coal bed	Hindman coal bed	Lower Broas and Broas coal beds	Hindman or Hazard No. 9 coal bed	Hindman or Hazard No. 9 coal bed

[1]As used by Phalen (1912)
[2]Of local usage (Johnston, 1962)
[3]Of Morse (1931) ? as used by Rice (1975)
[4]Of Cavaroc and Ferm (1968)
[6]The word "ore" reflects the use of siderite and clay ironstone as iron ore in the nineteenth and early twentieth century

Table 2.--*Coal and key bed correlations among Kentucky, West Virginia, and Ohio*

SYSTEM	SERIES	Stratigraphic Nomenclature Section	FORMATION	KENTUCKY Member and bed	FORMATION	WEST VIRGINIA Member and bed	GROUP	FORMATION	OHIO Member and bed
PENNSYLVANIAN	Upper Penn.		Conemaugh	Brush Creek Limestone Member	Conemaugh	Brush Creek Limestone Member	Conemaugh	Glenshaw	Brush Creek Limestone Member[4]
				Mahoning cb		Mahoning cb			Mahoning cb
	Middle Pennsylvanian			Princess No. 9 cb		Upper Freeport cb			Upper Freeport cb
				Princess No. 8 cb	Charleston Sandstone		Allegheny		Lower Freeport cb
				Princess No. 7 cb					Middle Kittanning cb
			Breathitt	Princess No. 6 cb Lower Kittanning clay Vanport Limestone Member[1] Upper Richardson cb		No. 6 Block cb Lower Kittanning clay Upper No. 5 Block cb			Lower Kittanning cb Lower Kittanning clay Vanport Limestone Member Clarion cb
				Richardson cb		Lower No. 5 Block cb		Pottsville	Brookville cb
				Upper Broas cb Stoney Fork Member Lower Broas cb	5	Stockton "A" cb Kanawha Black Flint[2] Stockton cb			Tionesta cb Upper Mercer Limestone[3] Bedford cb

[1]As used by Phalen (1912)
[2]Of I.C. White (1891)
[3]Of I.C. White (1879)
[4]Of I.C. White (1878)
[5]Kanawha Formation

DISCUSSION

Upper Middle Pennsylvanian rocks underlie a major part of western West Virginia, eastern Kentucky, and southern Ohio (fig. 1). Huddle and others (1963) divided eastern Kentucky into six coal reserve districts, five of which contain rocks of upper Middle Pennsylvanian age (table 1). Upper Middle Pennsylvanian rocks in West Virginia are included in the Charleston Sandstone of the proposed Pennsylvanian stratotype (Englund and others, 1979). Correlative beds in eastern Kentucky are included in the upper part of the Breathitt Formation (Rice and Smith, 1980) and in southern Ohio are included in the upper part of the Pottsville Group and all of the Allegheny Group (Collins, 1979). These upper Middle Pennsylvanian rocks are characterized by gray subgraywacke sandstone, siltstone, and shale. Redbeds may occur as low as the Princess No. 6 coal bed in Kentucky; they become common in younger strata and characterize the overlying Conemaugh Formation. Coal, refractory clay (flint clay), limestone, and clay ironstone are minor constituents of the upper Middle Pennsylvanian which have been or are of great economic importance. Coal is present in eight zones, refractory clay in one zone, limestone in one bed, and, formerly, iron ore in two beds. These commodities have been prospected and mined since the early 1800's.

In general, correlation of coal and other key beds in the tri-state area depends on demonstrated continuity. However, single beds do not persist across the entire region. The recognition of key beds and lithologic sequences is necessary to establish a stratigraphic framework over a large area. Key beds are widespread units of distinctive lithology. The most important are a) the Kanawha Black Flint of I.C. White (1891) (Upper Mercer Limestone of I.C. White, 1979), which marks the base of the Charleston Sandstone; b) the Vanport Limestone Member as used by Phalen (1912) (Breathitt and Allegheny Formations); c) the Lower Kittanning clay, a distinctive, locally flint, clay located between the Vanport Limestone Member and the Lower Kittanning coal zone, d) a black, locally flint, clay parting in the Lower Kittanning coal zone, and e) a distinctive grayish-purple to dusky-red sandy to flint clay-like bed at the top of the upper Middle Pennsylvanian sequence. Sandstone, in part conglomeratic, locally occupies thick sections of the upper Middle Pennsylvanian sequence. In addition, palynologic studies have established the correlation of certain coal zones in West Virginia and Kentucky (Kosanke, 1973, 1984).

Table 1 lists the most important names of late Middle Pennsylvanian-age beds used in eastern Kentucky. The coal bed names are those used in geologic quadrangle (GQ) maps of the region prepared between 1960 and 1978 as a result of the cooperative mapping program of the U.S. Geological Survey (USGS) and the Kentucky Geological Survey. These maps present brief descriptions of the local stratigraphy and identify many coal beds by both local and regional names. Generally, correlations of mapped coals and other key beds were made and discussed if adjacent or nearby quadrangles had already been mapped.

Figure 2 shows the most recent correlations of coal and other key beds in the upper Middle Pennsylvanian between the stratotype in West Virginia and Kentucky and through Kentucky into Ohio. Eighteen of the stratigraphic sections are composite sections compiled by the GQ authors (table 3). Correlations of beds in drill holes in the Quick and Mammoth quadrangles in West Virginia are by T.W. Henry (USGS, unpublished data) and Henry (1984), respectively. Each GQ map that included strata above the level of the Upper Mercer Limestone of I.C. White (1879) was used for stratigraphic information. Other sources of stratigraphic information for Kentucky include USGS Bulletins dealing with the stratigraphy of particular 7.5-minute quadrangles (Englund, 1955; Adkison, 1957; Welch, 1958; Bergin, 1962; Hayes and Connor, 1982), and Huddle and others (1963) for all of eastern Kentucky. Rice and Smith (1980) summarized the correlation of eastern Kentucky rocks in one convenient sheet. Huddle and Englund (1966) contains much useful information on the sandier facies of the upper Middle Pennsylvanian. The reports of Orton (1884), Stout (1916), Lamborn (1951), Denton and others (1961), Struble and others, (1971), and Collins (1979) contain stratigraphic data in Ohio that is required for any comparison with the section in Kentucky. For West Virginia, the county reports of Krebs and Teets (1913, 1914) provided clues to localities for measured sections between Kentucky and the stratotype section at Charleston. Campbell (1901) and Englund and others (1979) provided the stratigraphic framework in the Charleston area for correlations in the upper Middle Pennsylvanian rocks. Phalen's (1912) folio and Dobrovolny and others (1963) were most useful in correlating into Ohio and Connor and Flores (1978) provided a bridge into West Virginia. The palynologic studies of Kosanke (1973, 1984) corroborated some coal correlations and provided clues to others. All those sources together with appropriate field work helped establish correlations for the principal stratigraphic units of the upper Middle Pennsylvanian of the stratotype, eastern Kentucky, and southern Ohio (table 2). It is now possible to correlate beds in Kentucky and Ohio with strata in the Pennsylvanian stratotype in West Virginia.

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CORRELATION OF THE CHARLESTON SANDSTONE OF THE PROPOSED PENNSYLVANIAN STRATOTYPE WITH STRATA IN EASTERN KENTUCKY, WESTERN WEST VIRGINIA, AND SOUTHERN OHIO

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