UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Isopach Maps of Overburden on the Pittsburgh Coal Bed in Southwestern Pennsylvania and Northern West Virginia

Plate 1: Burgettstown, Carnegie, and Pittsburgh 15-minute quadrangles
Plate 2: Claysville, Amity, and Brownsville 15-minute quadrangles (2 sheets)
Plate 3: Rogersville, Waynesburg, and Masontown 15-minute quadrangles
Plate 4: Mannington, Blacksville, and Morgantown 15-minute quadrangles (2 sheets)
Plate 5: Clarksburg and Fairmont 15-minute quadrangles

Compiled by

Bion H. Kent

Open-File Report No. 74-132

This report is preliminary and has not been edited or reviewed for conformity with U.S. Geological Survey standards and nomenclature.

NOTES ON THE ISOPACH MAPS

Geology

The Upper Pennsylvanian Pittsburgh coal bed is the basal unit of a sequence of coal-bearing rocks deposited in a shallow structural depression in the Allegheny Plateau. The depression is known as the Dunkard basin of sedimentation; the present outcrop trace of Pittsburgh coal in southwestern Pennsylvania and northern West Virginia defines the northeastern limits of the basin (fig. 1), and sediments that filled the basin form the overburden on the Pittsburgh coal bed. In the vicinity of the depositional-axis of the basin (fig. 1) the Pittsburgh coal is buried to a maximum depth of about 1,500 feet (450 m) (pls. 3 and 4).

Rocks of the Allegheny Plateau have been broadly folded into northeast-trending anticlines and synclines. Within the area underlain by Pittsburgh coal (fig. 1), amplitudes of anticlines are on the order of 250 feet (75 m), and structural dips of beds on the flanks of the structures are on the order of 120 feet per mile.

The Allegheny Plateau has been a positive area since Mesozoic time; as a result, the plateau has been maturely dissected by rivers and streams and erosion and downcutting processes have removed much of the original overburden on the Pittsburgh coal bed. Since the Ice Age, for example, stream downcutting has been as much as 150 feet (45 m) in the region shown on figure 1. Topographic relief of the region is on the order of 400 feet (120 m) and hillside slopes of 20 degrees are not uncommon. Geologic structures have had little influence on the dendritic drainage pattern that developed.

Locally, the Pittsburgh coal bed is virtually flat lying, and variations in overburden thickness are primarily a function of topographic relief. Regionally, however, inclinations of the paleoslope of (Pittsburgh) coal deposition toward the depositional-axis effect a progressive increase in overburden thickness, and geologic structures which modified the paleoslope cause appreciable thinning, particularly in the crestal areas of anticlines beneath major valleys.

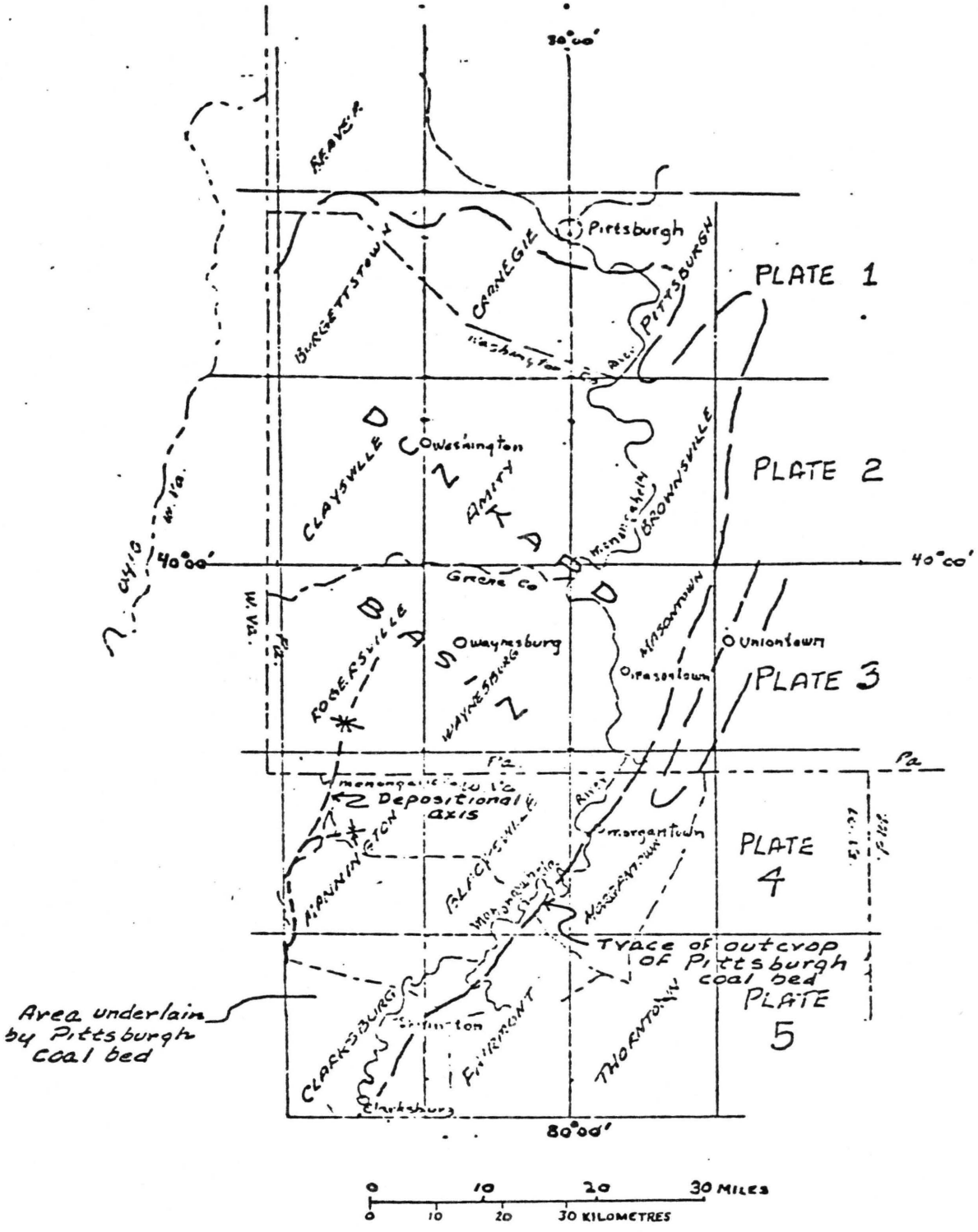


Figure 1: General index map of Pittsburgh coal bed, showing 15-minute quadrangles in southwestern Pennsylvania and northern West Virginia. The outcrop trace of the Pittsburgh coal bed defines the northeastern limits of the Dunkard basin.

Isopach map compilation

Thickness, in feet, of overburden on a designated key horizon such as the Pittsburgh coal bed is represented orthographically by the difference between topographic elevation and the structural elevation of the key horizon, with reference to a datum of mean sea level. The coal bed crops out at points where its structural elevation is equal to topographic elevation. These relations are shown diagrammatically on figure 2. Relations diagrammed on figure 2 were utilized in compiling the isopach maps, in the following way:

(1) The USGS 1:125,000-scale structure contour map drawn on the base of the Pittsburgh coal bed in southwestern Pennsylvania and northern West Virginia (contour interval, 20 feet; datum, mean sea level) was enlarged photographically to 1:62,500 scale and printed on translucent base.

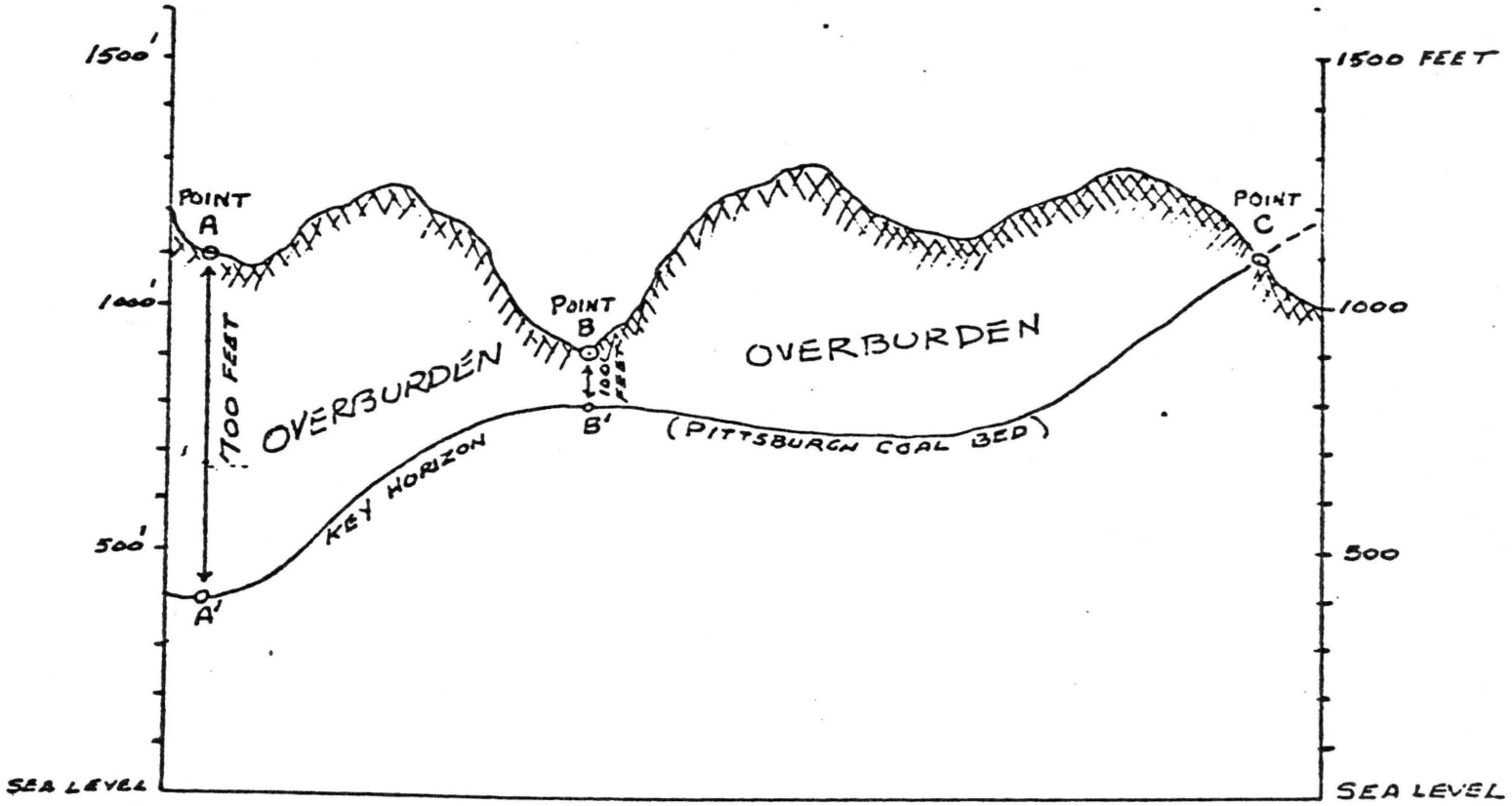
(2) USGS 1:62,500-scale topographic maps of 15-minute quadrangles in southwestern Pennsylvania and northern West Virginia (contour interval, 20 feet; datum, mean sea level) were photographed on translucent base:

(3) Corresponding areas covered by the structure contour map and the topographic map were registered on a light table, and selected isopachs of overburden thickness were drawn on a translucent overlay base.

(4) Overlay sheets of isopachs were then registered to, and overprinted photographically, in black, on topographic map bases printed in green.

(5) Ozalid copies of isopach map originals emphasize isopachs, but retain topography and culture.

It should be noted that 1:24,000-scale geologic maps in the USGS "Geologic quadrangle maps of the United States" series are available for many 7 1/2-minute quadrangles in southwestern Pennsylvania. These maps, on topographic map base, show 20-foot structure contours drawn on the base of the Pittsburgh coal bed; they would serve as compilation bases for preparing large-scale isopach maps of overburden in specific areas of interest.



REFERENCE POINT	ELEVATION (in feet, above sea level) TOPO.	KEY HORIZON	OVERBURDEN THICKNESS
A	1100	400 (A')	700 (A minus A')
B	900	800 (B')	100 (B minus B')
C	1100	1100	0 (outcrop)

Figure 2: Diagrammatic profile illustrating variations in overburden thickness on a key horizon such as the Pittsburgh coal bed

Specifications and comments

The 1:62,500-scale isopach map of overburden on the Pittsburgh coal bed covers an area of about 3,000 square miles (7,800 km²) in southwestern Pennslyvania and northern West Virginia; the mapped area is depicted on five plates (fig. 1). Contoured thicknesses of overburden are as follows: 0 (outcrop), 100, 200, 300, 400, 600, 800, 1,000, 1,200, and 1,400 feet.

As map originals of the 1:62,500-scale 15-minute quadrangle series of topographic maps were not available, it was necessary to photograph unstable paper print copies which exhibited some scale changes. This caused some errors in map joining, in compiling isopachs on the overlays, and in registering isopach overlays to topographic map bases. Also, in many places on the topographic maps the 20-foot contours were poorly defined and/or extremely close spaced, and adequate photographic resolution was difficult to obtain.

The isopach intervals selected are appropriate for the 1:62,500 scale chosen for mapping and for the sharp, appreciable relief indicated on the topographic maps; the selection was based on a compromise between wider spaced topographic contours associated with valley floors, extremely close spaced contours associated with valley walls and headland and inter-valley areas, and accurate representation of overburden thickness. In this respect, it is believed that the 0-to 600-foot thickness range is most critical and that range could be contoured with the least difficulty.

It will be noted that, as a practical matter, contoured thicknesses of overburden were computed to the base of the Pittsburgh coal bed; therefore, overburden thicknesses indicated are in error by an amount equal to the thickness of the coal bed itself. On average, the Pittsburgh coal bed is about 9 feet (3 m) thick; the coal bed commonly contains two benches of coal; and the lower, minable bench is about 7 feet (2 m) thick.

Suggested map uses

The overall utility of the isopach maps is enhanced considerably by coloring out contoured thickness values. Some suggested uses of the maps are as follows:

0-600 feet thickness range: Along the east and north side of the mapped area, there are many places where overburden on Pittsburgh coal is less than 200 feet (60 m) and the coal has been strip-mined in the past. In such places, a crude approximation of the volume of overburden on remaining Pittsburgh coal can be determined from the isopach maps, and field examination might indicate appreciable recoverable coal. In places where overburden thickness on the mined-out Pittsburgh coal bed is less than 400 feet (120 m), there is field evidence of surface subsidence...Underground mining problems, such as bad roof, water entering the mine, etc., are most prevalent in mine areas where overburden thickness is less than 600 feet.

600-1,000 feet thickness range: To date (1974), active underground mining of the Pittsburgh coal bed has been concentrated in the northern and eastern parts of the Dunkard basin (fig. 1) where overburden thicknesses are generally less than 1,000 feet (300 m). There is no conclusive evidence that overburden of 600-1,000 feet, in itself, is a factor in causing or promoting any specific underground mining problem.

1,000-1,400+ feet thickness range: This thickness range, associated with areas in the vicinity of the depositional-axis of the basin (fig. 1), is limited to the southwestern part of the mapped area. The Pittsburgh coal bed in most of those areas has not been mined; however, future mining will penetrate those areas and, should some new underground mining problems develop, the factor of overburden thickness should be evaluated at that time. Conceivably, problems associated with fracture conduits and geo-pressurized gas (methane) and water systems may develop.

EXPLANATION FOR PLATES 1 - 5

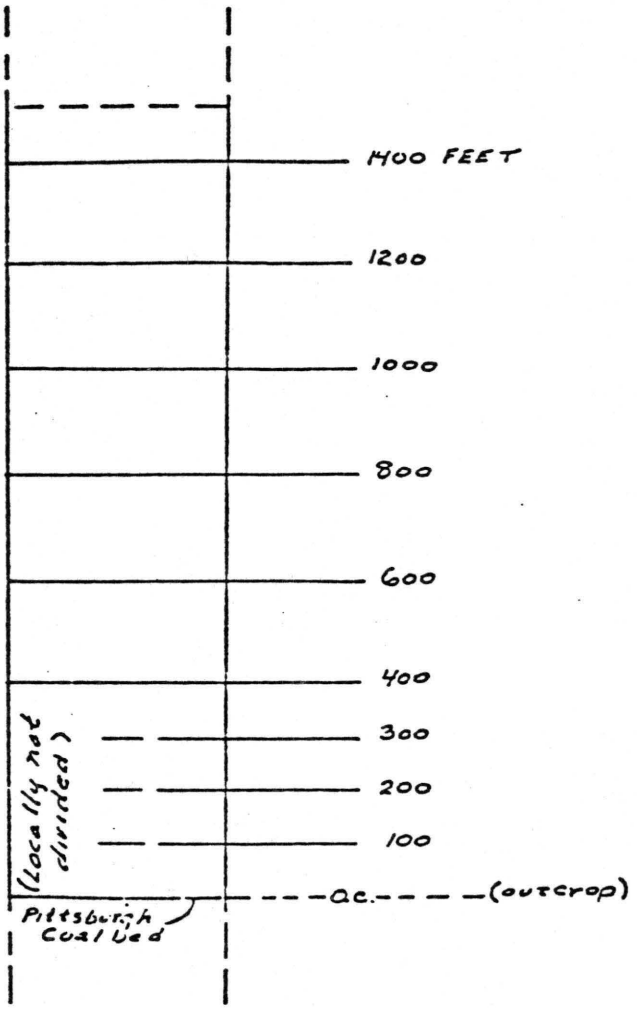
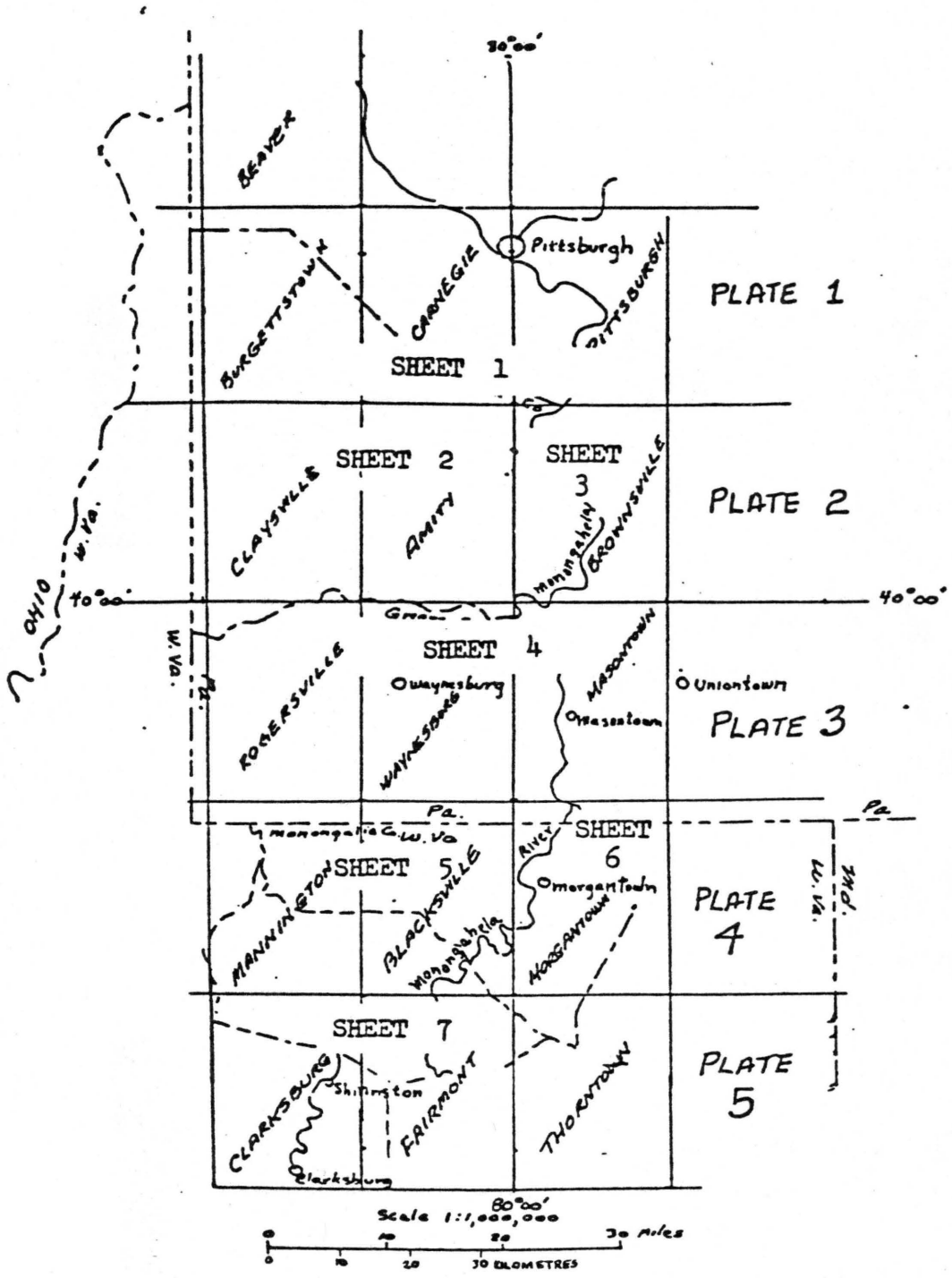


Diagram showing contoured thickness of overburden on the Pittsburgh coal bed, southwestern Pennsylvania and northern West Virginia.



Index map showing arrangement of isopach map-sheets (1-7) of overburden on the Pittsburgh coal bed, southwestern Pennsylvania and northern West Virginia