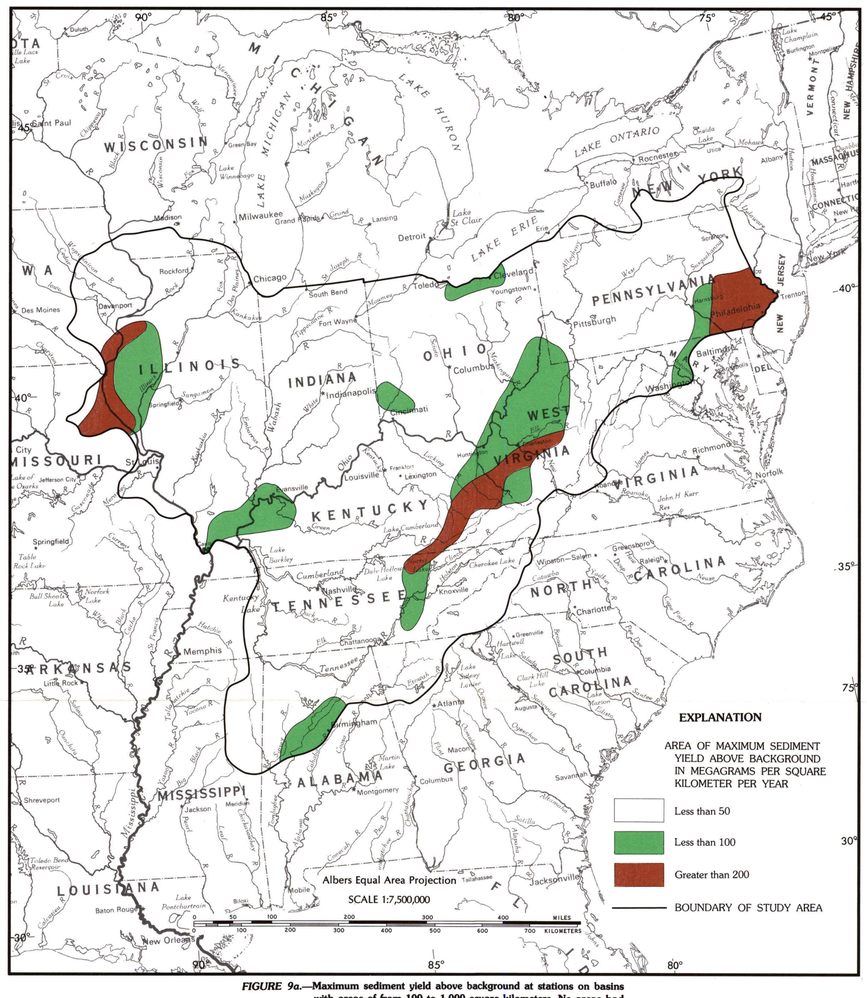

FIGURE 9a.—**Maximum sediment yield above background at stations on basins with areas of from 100 to 1,000 square kilometers. No areas had yields greater than or equal to 100 and less than 200 megagrams per square kilometer per year above background.**

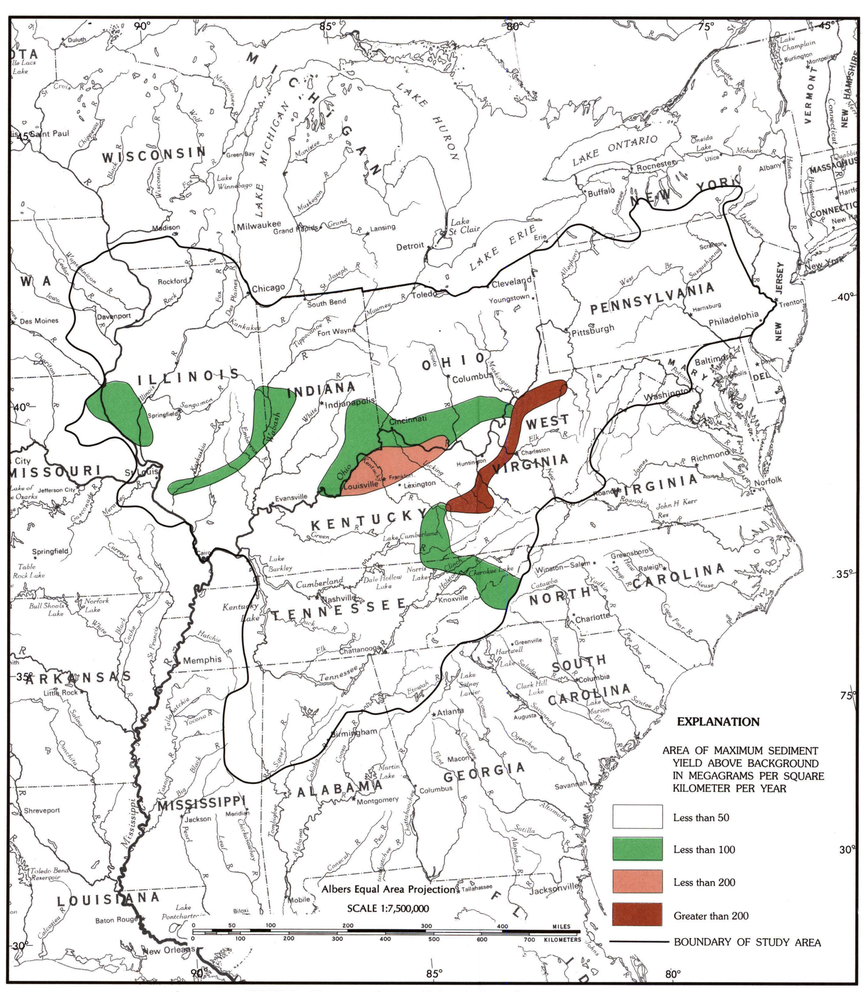

FIGURE 9b.—**Maximum sediment yield above background at stations on basins with areas of from 1,000 to 10,000 square kilometers.**

MAXIMUM SEDIMENT YIELDS ABOVE BACKGROUND

Maximum sediment yields above background vary from less than 50 to more than 200 (Mg/km²)/yr at stations on both smaller and larger basins (figs. 9a and 9b). For smaller basins (100 to 1,000 km²), the greatest values of maximum yield above background are found in southeastern Pennsylvania, western Illinois and adjacent parts of Iowa and Missouri, and in West Virginia and eastern Kentucky. The greatest values of maximum yield above background for larger basins (1,000 to 10,000 km²) also are in West Virginia and eastern Kentucky.

Maximum sediment yields above background identify areas where disturbance by human activities could possibly be an important influence on sediment yield. Large yields above background may indicate those areas in which disturbances by human activities, together with climatological factors and basin characteristics, are increasing the yields far above undisturbed levels. However, large yields above background may be due to the natural variation of yield among adjacent, undisturbed basins. Areas of significant disturbance by human activities may not be shown if background yields are far greater than undisturbed levels.

Large Sediment Yields Above Background in Southeastern Pennsylvania and in Western Illinois and the Adjacent Parts of Iowa and Missouri Reflect a Variety of Factors

In southeastern Pennsylvania, six stations on smaller basins show sediment yields greater than 200 (Mg/km²)/yr above background (fig. 9a); these large yields reflect both coal mining and other types of human activity. Four of these basins are mined for coal and located in the headwaters of the Schuylkill River Basin (see fig. 10a). Biesecker and others (1968) report that, prior to 1950, large yields from the headwaters of the Schuylkill River Basin were caused largely by waste discharges from coal-processing plants. Starting about 1950, actions were taken to reduce the sediment from waste streams reaching the Schuylkill River. The yields for these stations were measured during 1947–52 when controls were starting to be put into place; current yields are probably less. One of the unmined basins, Wissahickon Creek, was undergoing intense urbanization during the period of sampling (Biesecker and others, 1968). The other unmined basin, Pequea Creek, is largely agricultural (Lietman and others, 1983).

In western Illinois and the adjacent parts of Iowa and Missouri, sediment yields greater than 200 (Mg/km²)/yr above background are shown by five stations on smaller basins (fig. 9a). The présence of these five stations in or near the area with thick loess deposits (fig. 8) suggests that these large sediment yields above background are due at least partly to the presence of loess. Factors other than coal mining appear at least as important in determining sediment yields in the area; two of these five stations are on basins that are not mined for coal.

Large Sediment Yields Above Background in West Virginia and Eastern Kentucky Reflect Coal Mining and Topography

In West Virginia and eastern Kentucky, maximum sediment yields greater than 200 (Mg/km²)/yr above background reflect disturbances by coal mining (figs. 9a and 9b). All 17 of the stations that have these high yields are on basins that have been mined for coal; 10 of the stations are on smaller basins and 7 are on larger basins. The areas containing these stations coincide with the counties in which the mean annual coal production from surface mines is 2 million metric tons or more (figs. 10a and 10b).

Factors other than coal production from surface mines appear to be partly responsible for the stations in West Virginia and eastern Kentucky having large sediment yields. Counties with surface-mine coal production of at least 2 million metric tons per year are located in several areas other than in West Virginia and eastern Kentucky (figs. 10a and 10b). However, it is only in West Virginia and eastern Kentucky that large values of sediment yield above background measured on coal-mined basins correspond to counties with large coal production from surface mines.

Basin topography is one factor that controls sediment yield from mined basins; topography influences the type of mining technique used to extract the coal. The technique known as area mining is used where the land surface is flat or consists of gently rolling hills (fig. 11). In this type of mining, a trench is excavated down to the coal seam and the overburden is placed in a spoil pile in the adjacent, previously mined trench. The coal is then removed and the next parallel trench is cut. Almost all of the overburden remains within the trenches, and little is available to be carried away in surface runoff and streamflow.

Contour mining (fig. 12) is used in areas where the slopes are steeper. The mining operation follows the edge of the coal seam along the contours of hills. The overburden is removed, a bench created, and the coal mined as far back into the hill as economically practical; augering is employed in some cases. The overburden is either dumped down the slope or placed in a spoil pile at the edge of the bench. Regardless of the disposal method, material in the spoil pile is readily available for transport in surface runoff and streamflow.

The steeper topography of the basins in the eastern part of the study area is one reason why the yields from surface-mined basins in heavily mined counties in eastern Kentucky and West Virginia show large yields above background, and surface-mined basins in heavily mined counties in Illinois, Indiana, and western Kentucky do not (figs. 10a and 10b). The mean basin stream-channel gradient (one measure of topography) is less in basins in Illinois, Indiana, and western Kentucky than it is for basins in West Virginia and eastern Kentucky. The basins in Illinois, Indiana, and western Kentucky generally are flat, and most of the surface-mined coal in this area is extracted with area mining. Contour mining is used extensively in the steeper basins of West Virginia and eastern Kentucky. It is not clear why stations on heavily mined basins in Pennsylvania, Ohio, and Alabama do not have large yields above background in as much as contour mining also is used in these States.

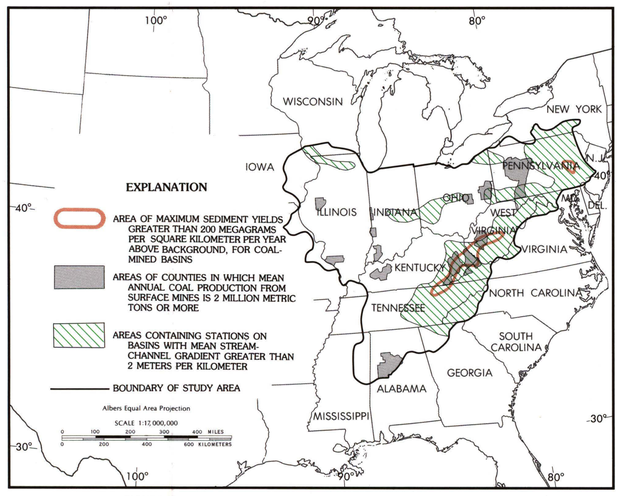

FIGURE 10a.—**Maximum sediment yields greater than 200 megagrams per square kilometer per year above background at stations on coal-mined basins; data are for stations on basins with areas of from 100 to 1,000 square kilometers. Counties in which mean annual coal production from surface mines is 2 million metric tons or more, and areas containing stations on basins with mean stream-channel gradient greater than 2 meters per kilometer also are shown.**

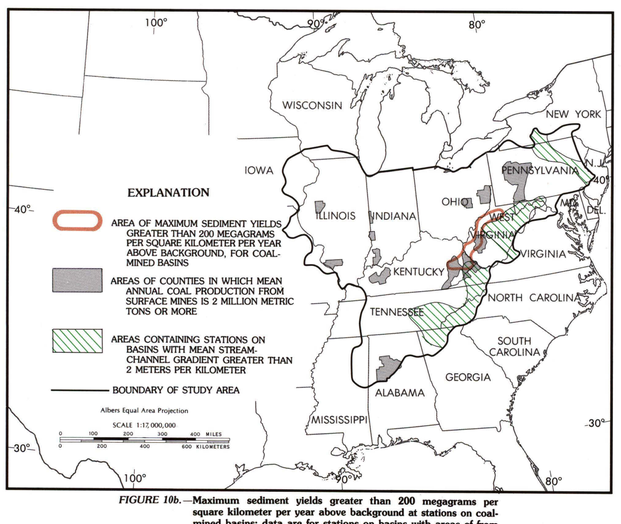

FIGURE 10b.—**Maximum sediment yields greater than 200 megagrams per square kilometer per year above background at stations on coal-mined basins; data are for stations on basins with areas of from 1,000 to 10,000 square kilometers. Counties in which mean annual coal production from surface mines is 2 million metric tons or more, and areas containing stations on basins with mean stream-channel gradient greater than 2 meters per kilometer also are shown**

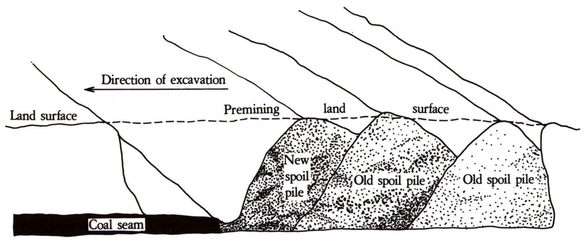

FIGURE 11.—**Typical area mining site**

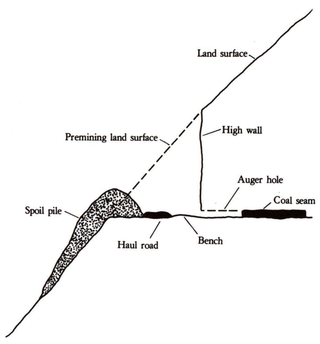

FIGURE 12.—**Typical contour-mining site (Gaydos and others, 1982).**

SUMMARY AND CONCLUSIONS

Mean annual suspended-sediment yields are shown at stations in and around the coal fields of the Eastern Coal Province and the eastern region of the Interior Coal Province. All stations are on smaller basins with areas of 100 to 1,000 km² or larger basins with areas of 1,000 to 10,000 km².

Background sediment yields vary from less than 25 (Mg/km²)/yr in the eastern part of the study area to more than 300 (Mg/km²)/yr in the west. Background yields less than 25 (Mg/km²)/yr in the eastern part of the study area approximate yields from undisturbed, forested basins. Background yields of more than 200 (Mg/km²)/yr in western Illinois and adjacent parts of Missouri and Iowa appear to reflect the presence of thick deposits of loess.

Sediment yields greater than 200 (Mg/km²)/yr above background in southeastern Pennsylvania and in western Illinois and adjacent Iowa and Missouri reflect a variety of factors. Large yields in southeastern Pennsylvania reflect coal mining and other human activities. The data suggest that the large yields in western Illinois and adjacent Iowa and Missouri are due partly to the thick deposits of loess in this area.

Large sediment yields above background in West Virginia and eastern Kentucky reflect coal production and topography. The areas containing stations that have sediment yields greater than 200 (Mg/km²)/yr above background correspond to the counties in which mean annual coal production from surface mines is at least 2 million metric tons. Contour mining, used extensively in West Virginia and eastern Kentucky because of the steep slopes, makes large amounts of material available for transport in surface runoff and streamflow.

Base from U.S. Geological Survey
National Atlas, 1970

AREAL VARIATION OF SUSPENDED-SEDIMENT YIELDS WITHIN AND ADJACENT TO THE COAL FIELDS OF THE EASTERN COAL PROVINCE AND THE EASTERN REGION OF THE INTERIOR COAL PROVINCE

By
R.E. Hickman

1990

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1990