

Five sources were used in the preparation of this map and are illustrated in Figure 1. Data from drilling records filed with the Kentucky Geological Survey were locally augmented by examination both of drillhole cuttings and of several diamond-drill corehole records. The density of drillhole data used in this study is shown in Figure 2.

Southeast of Pine Mountain, within the Cumberland overthrust block, the base of the Pennsylvanian was drawn by projection downward from the base of the Island or Hingo coal bed; the interval between horizons was determined by the construction of an isopach map using outcrop data and the few available drill records. Structure on the base of the Harlan coal bed east of the Rocky Face fault was determined by Frowlich (1977, pl. 3); structure on the base of the Hingo coal bed west of the fault is from published geologic quadrangle maps. In northeastern Kentucky, because the Olive Hill clay bed lies on or very near the base of the Pennsylvanian, the structure-contour map drawn on this unit by Hosterman (1963) was adopted for this report.

The Mississippian-Pennsylvanian boundary is generally interpreted to be an unconformity throughout much of eastern Kentucky northwest of the Cumberland overthrust block. Relief of the unconformity is least near Pine Mountain, and it increases northwestward to the western edge of the Pennsylvanian outcrop area, where it is as much as 200 feet in channels incised into the Mississippian rocks; one such channel runs from southern Madison County to the north edge of Laurel County (Watt, 1977) and is well exposed in the Livingston quadrangle (Brown and Conkling, 1974). In the Cumberland overthrust block, the systematic boundary is exposed along Pine Mountain and occurs either at the base of the lowermost channel-fill sandstone of the Lee Formation or within a continuous sequence of clastic rock as much as 75 feet below the Lee. In the upper part of the Pennington Formation.

In most of southeastern Kentucky the Mississippian-Pennsylvanian boundary is between the underlying, mostly marine Pennington Formation and the overlying, mostly continental Lee and Breathitt Formations. The red and (or) green shales and the limestones of the upper part of the Pennington characterize the Mississippian rocks. Pennington rocks are characterized by the limestones, commonly pebbly, quartzose sandstones of the Lee Formation and by the carbonaceous shales of the Breathitt Formation. In drillers' logs, red shale is generally noted as "red rock"; Lee-type sandstones, due to the characteristic presence of salt water, is referred to as "salt sand" (drillers may recognize as many as three salt sands); and the sandstones within the Pennington are called "mass sands." The term "lime" in the drillers' records is not a reliable indication of limestone, because it is sometimes applied to sandstone if the drilling properties are similar to that of limestone.

Over much of southeastern Kentucky the uppermost recorded red shale was chosen as the top of the Mississippian section (fig. 3); in most areas this is checked both by the logged presence of a salt sand (or inferred Lee sandstone, or coal) within 50 feet above the red shale, and by measurement of the interval to the top of the main body of Pennsylvanian (called "big lime" by drillers) of Mississippian age. In the northern and northwestern part of the area, the Pennington thin, and the unconformity occurs on units from Breathitt to Pennington age. Where the Mississippian-Pennsylvanian boundary has been placed mostly at the top of the uppermost logged limestone locally in the northernmost part of the area, the unconformity lies below the Hemen limestone, and the boundary is placed at the uppermost logged red or green shale of the Breathitt Formation. The contours are generalized and are probably accurate only within 100 feet.

Within the Cumberland Mountain fault block, the lowermost beds of the Lee Formation intertongue with and grade laterally into the uppermost beds of the Pennington Formation (Englund, 1964). However, for map purposes, the top of the Mississippian was considered to be at the top of the Pennington Formation as mapped along Pine and Cumberland Mountains and to be at the uppermost red shale or lime beds as recorded in drill logs or samples; sparse data and lack of precision in locating the systematic boundary within the Pennington preclude an accuracy of less than 200 feet.

REFERENCES CITED

- Brown, W. R., and Conkling, R. J., 1974 [1975], Geologic map of the Livingston quadrangle, southeastern Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1179.
- Englund, R. J., 1964, Stratigraphy of the Lee Formation in the Cumberland Mountains of southeastern Kentucky, in Geological Survey Research 1964: U.S. Geological Survey Professional Paper 501-B, p. B30-B38.
- Frowlich, A. J., 1977, Preliminary report of the oil and gas possibilities between Pine and Cumberland Mountains, southeastern Kentucky: Kentucky Geological Survey, Series 10, Report of Investigations 34, 12 p.
- Hosterman, W. A., 1963, Structure-contour map of the Olive Hill clay bed in northeastern Kentucky: U.S. Geological Survey Mineral Investigations Field Studies Map MF-241.
- Watt, J. B., 1977, Sedimentary aspects of the Livingston Coalfield—northeastern Kentucky: Lexington, Ky., University of Kentucky, unpublished Master's thesis, 63 p.

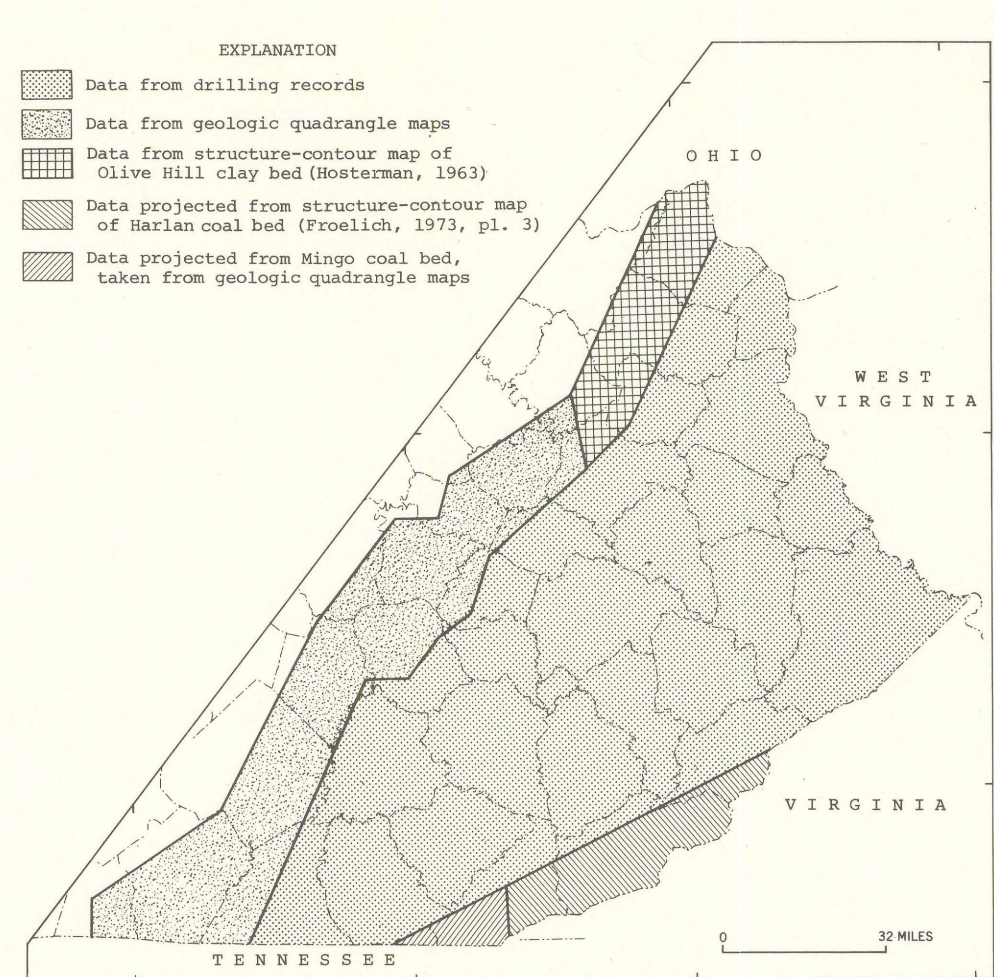


Figure 1.—Map showing sources of data.

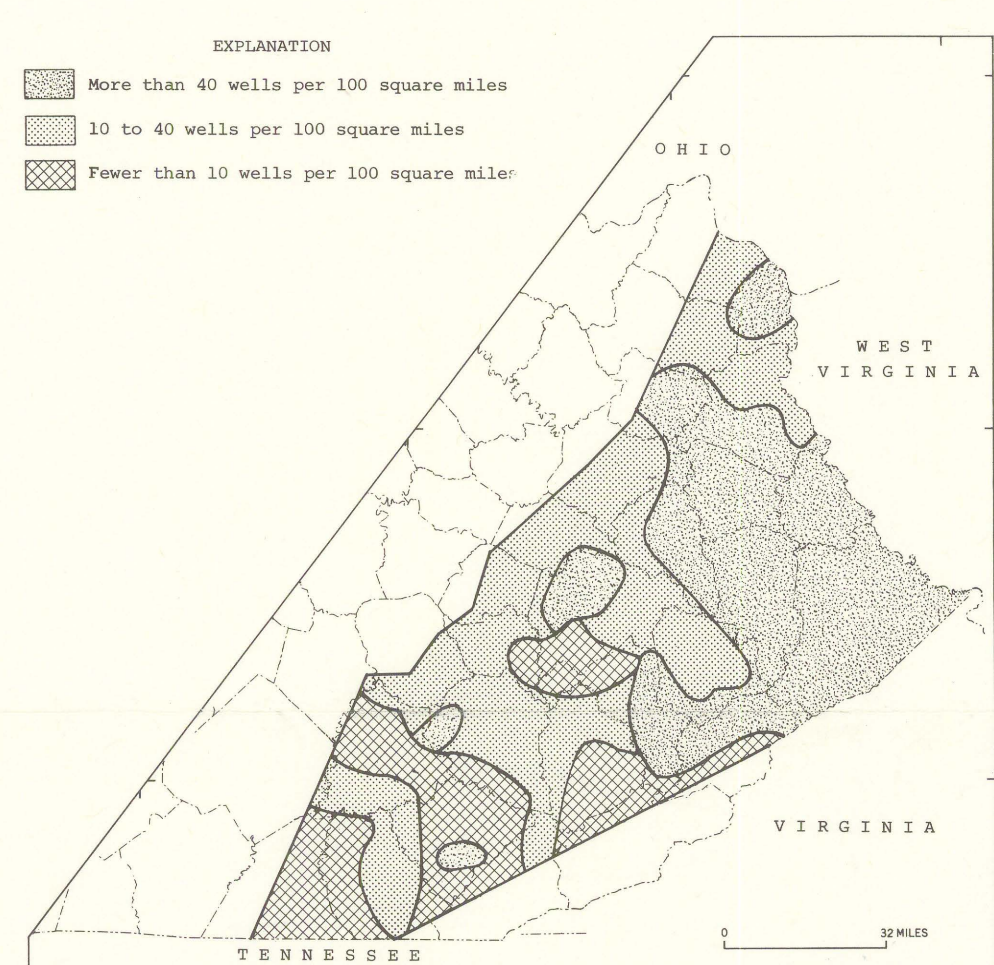


Figure 2.—Map showing density of drillhole data used in study.

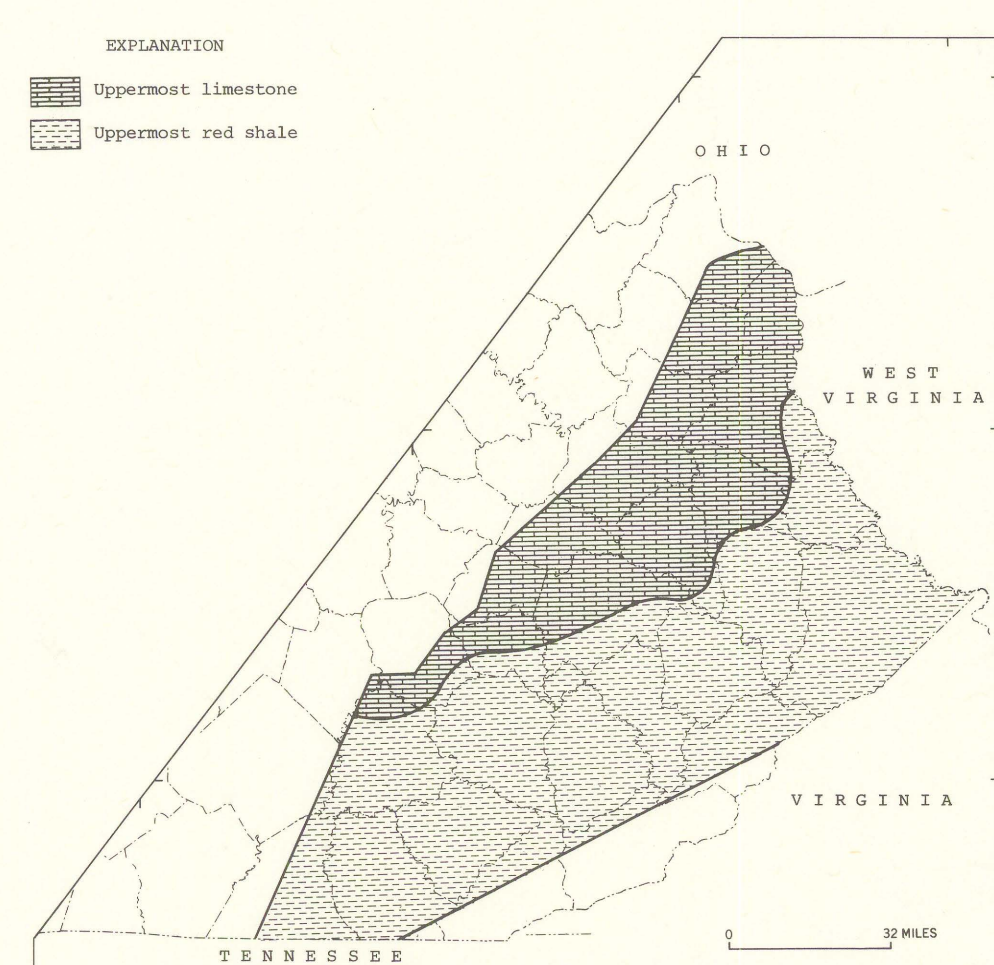
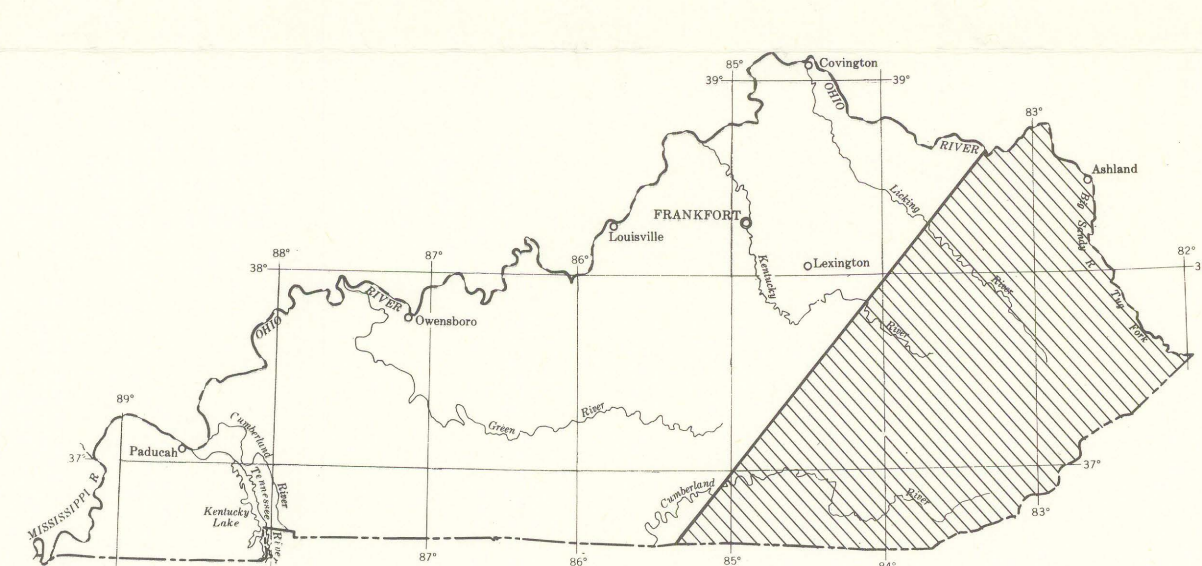


Figure 3.—Map showing distribution of criteria for determination of top of Mississippian strata.



INDEX MAP SHOWING STUDY AREA

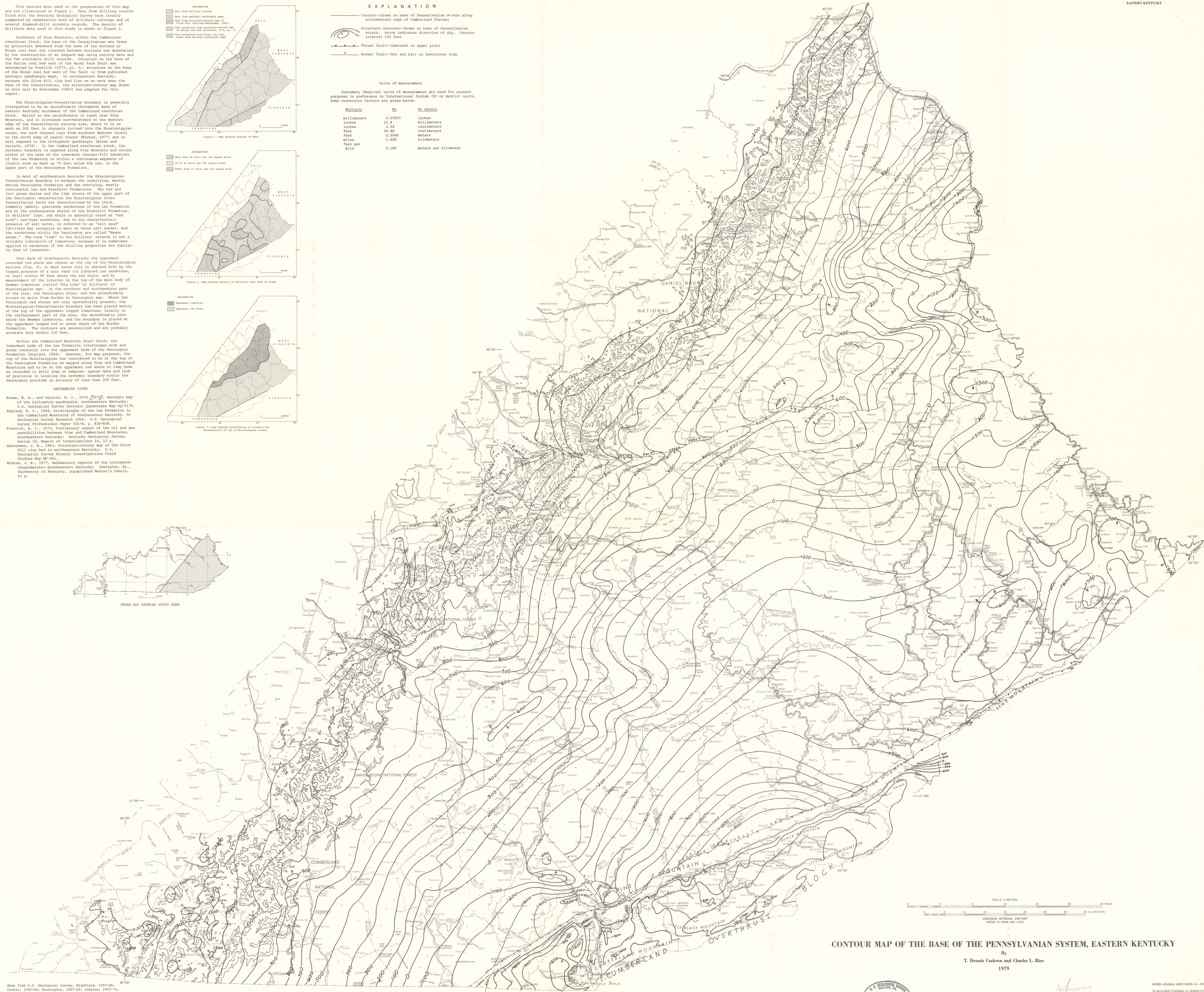
EXPLANATION

- Contour—Drawn on base of Pennsylvanian strata along southwestern edge of Cumberland Plateau
- Structure contours—Drawn on base of Pennsylvanian strata. Arrow indicates direction of dip. Contour interval 100 feet
- Thrust fault—Sawtooth on upper plate
- Normal fault—Bar and ball on downthrow side

Units of measurement

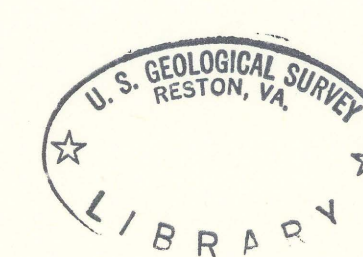
Customary (English) units of measurement are used for present purposes in preference to International System (SI or metric) units. Some conversion factors are given below:

Multiply	By	To obtain
millimeters	0.09357	inches
inches	25.4	millimeters
inches	2.54	centimeters
feet	30.48	centimeters
feet	0.3048	meters
miles	1.609	kilometers
feet per mile	0.169	meters per kilometer



CONTOUR MAP OF THE BASE OF THE PENNSYLVANIAN SYSTEM, EASTERN KENTUCKY

T. Dennis Cooken and Charles L. Rice
1979



Base from U.S. Geological Survey, Bluefield, 1957-60; Corbin, 1956-65; Huntington, 1957-66; Jenkins, 1957-72; Johnson City, 1957-66; Winchester, 1957-67.

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