mont province, the Valley coalfields in the Valley and Ridge province, and the Southwest Virginia coalfield in the Appalachian Plateau province. All present production and most coal resources are within the Southwest field. Coal production in 1978 was 32,004,341 short tons of which 31% was by surface mining methods.

The Division of Mineral Resources is currently studying the geology of all of Virginia's coalfields, especially the Southwest field. For the past several years the Division has collected coal samples from the Southwest field to be analyzed by the U.S. Geological Survey and U.S. Bureau of Mines, with the results being entered into the National Coal Resources Data System. Mapping at a 1:24,000 scale is continuing on several quadrangles in the Southwest Virginia field and in parts of the Valley coalfields. The Division is compiling geologic data related to the methane potential of unminable coal beds, in cooperation with the Department of Mining and Minerals Engineering at Virginia Tech.

A mine inventory for all active coal mines in Virginia has been completed. This information will be used, along with other information gathered by the Division, to revise the coal resource estimates for Wise, Lee, Dickenson, and Scott Counties. The U.S. Geological Survey will concurrently revise the resource estimates for Buchanan, Tazewell, and Russell Counties.

Future work by the Division will include studies of mine-roof stability, hydrology, and geochemistry in the Southwest Virginia coalfield. In addition, we anticipate new mapping at 1:50,000 and 1:24,000 scales. Work is also planned in continuing existing sampling and mine inventory programs.

HOHN, MICHAEL ED., West Virginia Geol. and Econ. Survey, Morgantown, W. Va.

Elemental Abundances in Devonian Shales of Kentucky and West Virginia: Statistical Comparison and Depositional Environments

Stratigraphic and geographic controls on the distribution of major elements, minor elements, and minerals define depositional environments and provide a base line with which to compare local geochemical distributions in the detection of anomalies or trends related to gas production. Data consist of (1) cuttings from more than 30 wells in western and southern West Virginia, (2) similar analyses on samples collected from outcropping rocks of the Greenland Gap Group and Hampshire Formation in eastern West Virginia, and (3) outcropping black shales in eastern Kentucky.

Factor analyses revealed several groups of elements: a detrital association of aluminum, potassium, titanium, iron, and sodium; a carbonate association of magnesium and calcium; an association of sulfur, iron, and zinc; and an association of phosphorus and calcium. The carbonate association is observed in black shales of Kentucky; the association of calcium with phosphorus is observed in carbonate-poor clastics of West Virginia.

Within most West Virginia wells, such elements as potassium, silicon, and aluminum show gradual trends through the section, contrasting with abrupt changes in abundance exhibited by sulfur and titanium. Sulfur occurs in high percentages with black shales. In some wells, silicon has a higher abundance in black shales than in gray shales.

Trend surface analyses of data from western and southern West Virginia show that titanium peaks in easternmost wells, sulfur peaks in westernmost wells, and silicon peaks in easternmost and some westernmost wells. Observed trends agree with the accepted view of a prograding delta complex in Late Devonian time, but geographically local, time-restricted depositional processes influenced elemental percentages in subsets of wells and stratigraphic intervals. One example of such a process is possible deposition of clastics from a source west of the study area in West Virginia.

HOWER, JAMES C., and ZHICONG GONG, Inst. Mining and Minerals Research, Lexington, Ky.

Coal Rank in Part of Western Kentucky Coalfield

Coal rank (vitrinite maximum reflectance) has been determined for coals in the Henderson basin, Rough Creek fault complex, and Webster Syncline of the western Kentucky part of the Eastern Interior basin (Henderson, Union, and Webster Counties). The samples represent major coals (Western Kentucky No. 6, No. 9, No. 11) as well as minor coals from several bore holes.

The rank increases from high volatile C in the Henderson basin to high volatile B and A in the Webster Syncline to the south of the Rough Creek fault complex. The rank decreases to high volatile C to the south across the central faults in the Moorman Syncline. Coals in a bore hole in a graben of the Rough Creek complex (Bordley quadrangle, Union County) display a variable rank gradient. Rank increases from the hvC (0.56%R) of the top coal (youngest known Paleozoic coal in Kentucky) to hvA (0.88%R) of coals 400 m below (still several hundred meters above the WK No. 9 coal). The coal 15 m below the top coal, however, has a reflectance of 0.86%R. Hydrothermal metamorphism is suspected as the cause of the rank anomaly. The relatively high rank of coals in the Webster Syncline may have been influenced by the above event but in general the rank can be attributed to a higher paleogeothermal gradient in the syncline. The heat flow regime may have been influenced by the activity which produced the mineralization in the Fluorspar complex to the west. The fault zones to the north and south may have delineated the boundaries of the block subjected to higher heat flow.

JANKA, JOHN C., Inst. Gas Technology, Chicago, Ill., JOHN M. DENNISON, Univ. North Carolina, Chapel Hill, N.C., and R. DAVID MATTHEWS, Inst. Gas Technology, Chicago, Ill.

Devonian Oil Shale of Eastern United States

The Devonian oil shales of the eastern United States constitute one of the nation's major energy resources. The eastern Devonian oil shale resource is estimated to exceed 400 billion bbl of synthetic oil, if all surface and near-surface shales of ore quality were strip or deep mined for above-ground hydroretorting.

Work done at the Institute of Gas Technology since 1972 under the sponsorship of the American Gas Association, The Gas Research Institute, and the U.S. Department of Energy has shown that if retorted in hydrogen gas at temperatures of 500 to 730°C and pressures