Cores from more than 75 near-outcrop localities in Kentucky have been studied to determine the thickness and extent of shale containing more than 8% organic carbon by weight. Detailed microstratigraphy of the Upper Devonian sequence is made possible by the completeness of cores, the spacing of holes, and the recognition of key lithostratigraphic and biostratigraphic markers associated with radioactivity profiles of the sequence.

Episodic and localized subsidence of the arch along the west flank of the Appalachian basin is demonstrated by erratic thickness changes in the lowermost units of the Ohio Shale. These units include equivalents of the Blocher, Morgan Trail, and Camp Run Members of the New Albany Shale to the west. The syndepositional movement appears to have been most intense along the Irvine-Paint Creek and Kentucky River fault zones. These zones also had an influence on the preserved distribution of the Silurian and Middle Devonian units immediately underlying the shale.

Earlier studies indicated that most formal members of the New Albany Shale of the Illinois basin diminish or disappear where traced across the Cincinnati arch eastward into the lower part of the Ohio Shale. This study documents the details.

KORNFELD, I. E., Texaco, Inc., New Orleans, LA, and ROBERT E. WEEMS,* U.S. Geol. Survey, Reston, VA

Depositional Environments and Sedimentology of Vinita Beds, Richmond Basin, Virginia

The Carnian (middle to late Middle Triassic) Richmond basin of northeast Virginia is the oldest of the exposed Newark rift basins of the eastern seaboard. These basins formed during the Mesozoic divergence of the continents. As presently defined, the Richmond basin is a large synclinal feature measuring 32 mi (53 km) long by 8 mi (13 km) wide, and is located west of Richmond and east of Amelia, Virginia. Sediments of the Richmond basin have been assigned to the Richmond group and have been stratigraphically subdivided into the following informal units, lowest to highest: coarse boulder breccias, coal measures, Vinita beds, and Otterdale Sandstone.

The Vinita beds are composed of arkosic sandstones, shales, siltstones, and minor amounts of coal, and are mineralogically immature. They are composed of angular to subrounded rock fragments, quartz, and feldspars, and are highly micaceous and kaolinitic. In places, feldspars make up as much as 50% of the rock. Sandstones and conglomerates are crossbedded and channeled, and shales and siltstones are thinly laminated. The Vinita beds are rich in fossil fish, branchiopods, and plant fragments. These rocks were deposited in braided streams as well as in paludal and possible lacustrine environments in a humid, heavily vegetated setting. Hydrocarbon shows reported in the basin occurred in the lower Vinita beds.

KOTRA, R. K., P. G. HATCHER, E. C. SPIKER, L. A. ROMANKIW, and R. M. GOTTFRIED, U.S. Geol. Survey, Reston, VA, and L. M. PRATT and A. K. VULETICH, U.S. Geol. Survey, Denver, CO

Organic Geochemical Investigations of Eastern U.S. Early Mesozoic Basins

Shales rich in organic matter and coalified plant fragments (phytoclasts) in the early Mesozoic basins of the Newark Supergroup of the eastern United States are the topic of a current multidisciplinary study to understand their burial history, their role in ore-forming processes, and their hydrocarbon potential. Samples from the Hartford, Newark, Culpeper, Richmond, Taylorsville, and Deep River basins were analyzed using elemental analysis, nuclear magnetic resonance spectroscopy (NMR), Rock-Eval pyrolysis, stable isotope mass spectrometry, pyrolysis-gas chromatography, and gas chromatography-mass spectrometry.

The composition of the preserved organic matter in these samples is highly variable. Most sedimentary rocks of Triassic to Jurassic age in the Hartford, Newark, Culpeper, Richmond, and Deep River basins are in a catagenetic stage of thermal alteration. Samples from the Lower Jurassic Towaco Formation of the Newark basin are the least thermally altered samples analyzed and are apparently at a late diagenetic stage. Most of the older Triassic samples and a few of the latest Triassic to Jurassic samples, however, are highly thermally altered. Phytoclasts from the Lower Jurassic Feltville and Portland Formations, from the Newark and Hartford basins, respectively, are essentially aromatic; however, phenolic groups were observed in the NMR spectra.

The initial organic geochemical results imply that the organic matter basically exists in two populations, one with a low to medium rank or level of maturation and the other representing a much higher maturation level. No gradual change in maturation from one rock unit to the next was observed for the samples analyzed, and the distribution of maturities apparently is neither stratigraphically nor temporally controlled. The presence of phenolic groups in the phytoclasts from the Feltville and Portland Formations suggests that carbonization rather than coalification processes may have occurred.

LEMON, JOSEPH P., Columbia Gas Transmission Corp., Charleston, WV, and JOHN B. CURTIS, Columbia Gas System Service Corp., Columbus, OH

Interpretation of Natural Controls on Devonian Shale Gas Production from Seismic Data

Columbia Gas and the Gas Research Institute are studying a set of Devonian shale gas wells in southwestern West Virginia to determine the geologic controls on shale gas production. Approximately 25 line-mi of Vibroseis seismic data were recorded to (1) evaluate the regional geologic setting and structural style of the area; (2) evaluate relationships among the regional geology, a high producing shale gas area, and a postulated fault zone; (3) evaluate the local geologic setting of three study wells; and (4) attempt to recognize stratigraphic controls on shale gas production.

Several initial conclusions concerning production controls have been reached. (1) Basement faulting extended up through the shale section, and resultant fracturing influenced gas production in the northern area of the seismic survey. (2) Reflection patterns in the shale contain information on the lithologic character of the shale. Local lenses of silt or sandy shale are probably present within the more fine-grained shale section. These lenses may be geologic features with increased permeability. (3) Areas of dimmed reflection energy on seismic lines correlate with areas of high gas reserves, suggesting that these areas are fractured shale.

Information from the seismic survey is being integrated with core, log, and well-test data to understand the active controls on shale gas production in the study area.

LENTZ, LEONARD J., and VICTOR V. CAVAROC, North Carolina State Univ., Raleigh, NC

Coal Occurrence in Progradational Deltaic Sequence, Raleigh County, West Virginia

Surface outcrops and data from 75 core holes were used to study the Pennsylvanian Kanawha Formation in a 100 mi^2 area of western Raleigh County, West Virginia. The interval consists of approximately 1,400 ft of prograding alluvial-deltaic deposits and includes 22 coal seams.

The interval developed across drowned orthoquartzite coastal sandstones (Nutall) that mark the approximate top of the New River Formation. Its lower portion (Douglas to Eagle coals) is a generally coarsening-upward, prodelta/distal-deltaic succession of units dominated by dark shale and containing brackish-marine intercalations that extend across most of the area. Coals are widespread but commonly thin (about 1 ft), and the rate of lateral change is low. The top of this lower section is capped by outer deltaic sandstones (Eagle coals).

The upper portion of the Kanawha Formation is dominated by outer deltaic strata (to Hernshaw coal) grading upward to inner (Stockton coal) deltaic sandstones. Brackish-marine intercalations associated with autocyclic shifting of detrital lobes are restricted in areal extent. The outer deltaic coal beds are thick (up to about 6 ft) and laterally uniform; succeeding inner deltaic coals are thinner (less than 3-4 ft) and are variable laterally.

Deltaic deposits grade upward into lower alluvial plain strata of the Allegheny Formation near the ridge crests. Associated coals locally may be thick (up to 6 ft), but abrupt changes in thickness and shale partings are typical.