The synclines contain a nearly continuous sedimentary sequence, whereas the anticlines have the uppermost Otterdale Sandstone facies as a blanket deposit over their truncated tips and steeply dipping Vinita beds below the unconformity on their flanks. Extensional events followed the main phase of folding and pulled the limbs of the anticlines apart, causing normal listric faults to form and blocks of Vinita beds to separate into North Sea-type fault-block structure.

Based on maturation and porosity trends with depth, at least 7,000 ft of overburden have apparently been removed from the basins. Either the structural style changed dramatically from listric faults to horst and graben mechanics, thereby dropping the Richmond-Taylorsville sequences below the present erosional level, or an enormous gravity slide from the east covered the basins, and erosion has created windows through this detached Paleozoic thrust sheet into a much larger Triassic rift system below it.

COUSMINER, HAROLD L., WILLIAM E. STEINKRAUS, and RAYMOND E. HALL, U.S. Dept. Interior, Minerals Management Service, Vienna, VA

Mesozoic Biostratigraphic Framework of U.S. Atlantic Outer Continental Shelf

The geologic age of the first marine sediments deposited in the North Atlantic basin is of basic importance in reconstructing the basin's early geologic history. Thus, although the oldest dated marine sediments penetrated on the U.S. North Atlantic margin by DSDP wells are of Callovian age (Blake-Bahama basin), both the Georges Bank and Baltimore Canyon basins include much older Jurassic strata of Bajocian-Bathonian age, as well as an Upper Triassic section. Microplankton provide the basis for a Mesozoic biostratigraphic framework of three basins where drilling has occurred on the U.S. Atlantic outer continental shelf. Studies of closely sampled subsea sections from multiple wells drilled on the Georges Bank basin, the Baltimore Canyon Trough, and the Southeast Georgia embayment, make dating possible by standard age and subage equivalents ranging from Middle Jurassic (Bajocian) to Maestrichtian (Late Cretaceous). This age sequence is documented by dinoflagellate range tops recorded in the offshore Canadian Grand Banks and Scotian Shelf, as well as by reference to ammonite-controlled type localities in northwestern Europe. The age of this sequence is supported from the Callovian to the top of the Maestrichtian by calcareous nannofossils. Additional biostratigraphic markers include a few benthonic and planktonic foraminifers and spores and pollen of age-guide value. The post-Middle Jurassic section in the Baltimore Canyon Trough averages over twice the thickness of the equivalent section in the Georges Bank basin, so that the base of the Middle Jurassic marine section has not been penetrated in the Mid-Atlantic. Georges Bank also has an Upper Triassic section.

DELLAGIARINO, GEORGE, and EDWARD RUIZ, U.S. Dept. Interior, Minerals Management Service, Reston, VA

Geologic Evaluation of Leasing on Atlantic Outer Continental Shelf

To date, 9,160 tracts, totaling 51.7 million ac, have been offered for lease in the Atlantic. Of the 506 tracts receiving bids, 410—totaling 2.3 million ac—were leased for a total bonus of $2.8 billion. There have been four Mid-Atlantic sales, three South Atlantic sales, and one North Atlantic sale, with one reoffering sale in the Mid- and South Atlantic.

Resource potential for proposed North Atlantic sales centers around the Georges Bank basin and the Upper Jurassic shelf edge (reef trend). Associated with the reef trend are a series of back-reef anticlines, faults, and pinch-outs. Cross sections indicate post-rift depocenters affected by block faulting and salt movement. Eight exploratory wells, all dry, and two continental offshore stratigraphic test (COST) wells have been drilled in the area.

Thirty-two exploratory wells have been drilled in the Mid-Atlantic in the Baltimore Canyon Trough. Targets have included an intrusive dome, fault blocks, deep-seated diapirs, and the Jurassic shelf-edge reef trend. Two COST wells were drilled, one encountering a show of gas. Five of the exploratory wells tested hydrocarbons, the others were dry.

The Carolina Trough appears to offer the best resource potential in the South Atlantic even though it has yet to be drilled. It has sufficient sediment thickness, a regional salt bed producing a number of diapirs on the seaward edge of the basin, and growth faults associated with the salt flow that may provide other traps.

The Blake Plateau offers some stratigraphic trap possibilities and may contain thermally mature sediments. However, no wells have been drilled in the basin. The Southeast Georgia embayment consists of a thin sedimentary section of mainly Cretaceous continental clastics and Paleozoic metasedimentary basement rocks. Six exploratory wells, all dry, and one COST well have been drilled in this basin.

DE WITT, WALLACE, JR., U.S. Geol. Survey, Reston, VA

Penetration Rates in Drilling Pioneer Salt Wells

The tools and drilling techniques used by early oil-well drillers were developed in this country by salt-well drillers in their search for brine during the 50 years before Colonel Drake's 1859 oil well. The Ruffner brothers drilled the first salt well near Charleston, West Virginia, in 1807, to a depth of 58 ft. Their well, which penetrated 40 ft of the Pennsylvanian Charleston Sandstone at a rate of 4 in./12-hour day, required about 4 months to drill. In 1831, the L. G. Barker salt well was completed in the Mississippian Big Injun sand to a total depth of 820 ft at McConnelsville, Ohio. Penetration rates for various rocks in a 24-hour day were mud rock or shale, 4-10 ft; silty or sandy shale, 2-4 ft; limestone, 1.5-2 ft; sandstone, 0.5-1.0 ft; chert, 2-3 in., and ganister, 1 in. Correlating these drilling rates with the detailed sample log of the Barker well suggests a minimum continuous drilling time of 20 months. In all probability, the well required at least 2-2.5 years to drill considering fishing jobs, repairs to equipment, and similar vicissitudes that beset the early salt-well drillers. Except that he was able to substitute steam power for muscle power, "Uncle Billy" Smith's drilling time of 13 days for the 34 ft of sandy bed rock in the Drake oil well is closely comparable to drilling time for similar shallow salt wells of that period.

DONALDSON, ALAN C., West Virginia Univ., Morgantown, WV, and DALE SKOFF, Hydrocarbon Exploration, Buckhannon, WV

Lithostratigraphic Analysis of Huntersville Chert of Central Appalachians

The Huntersville Chert (Onesquethawan Stage) of the central Appalachians was deposited in a detrital sediment-starved basin where a restricted sea hosted mainly silicisponges of probable Demospongid fauna. The Huntersville Chert grades into the Onondaga Limestone to the west and the Needmore Shale to the east. These Onesquethawan rocks record an initial transgression followed by regression, maximum transgression, and a final regression. Basement sub-blocks as growing structures influenced sedimentation. Differential subsidence of basement sub-blocks and eustatic changes in sea level periodically exposed the basin margins or allowed reworking of low-energy shoreline and shoal sediments. Five mappable stratigraphic units are recognized in the Onesquethawan Stage in the chert-filled basin covering the Rome trough in northern West Virginia, southwestern Pennsylvania, and northeastern Ohio. Shale tongues extending from the east interbed with the chert where the eastern West Virginia arch was low in northern West Virginia and western Maryland, but do not to reach the basin center. Carbonates accumulated over the shelf to the west of the chert basin and periodically over parts of the southern, eastern, and central arches. A moderately steep ramp is interpreted for the facies change from chert to limestone in proximity to the western margin of Rome trough. Are ancient reefs located at this shelf margin? The upper chert lithofacies is the most productive reservoir within the Huntersville.

DRIVER, EDGAR S., and ROBERT V. BRODINE, Independents, Wexford, PA

Interpretation of Soil Gas Geochemical Anomalies at Rose Hill Oil Field, Lee County, Virginia

Soil gases were recovered with hand-held probes in a survey pattern over the Rose Hill oil field in Lee County, Virginia. The gases were analyzed for lighter hydrocarbon gases (C_1-C_4) plus hydrogen and helium, using a custom-built, dual-column chromatograph. Methane and pro-