Effects of Oyster Beds on Back-Barrier Geomorphology—Three-Dimensional Model

TUESDAY AFTERNOON, OCTOBER 6

AAPG: RECENT EXPLORATION RESULTS ON ATLANTIC MARGIN: DRILLING RESULTS AND PETROLEUM GEOLOGY OF ATLANTIC MARGIN BASINS

Presiding: MARK G. HARRINGTON, MICHAEL E. HRISKEVICH

1:30 M. G. HARRINGTON: Opening Remarks
1:35 M. E. HRISKEVICH: Petroleum Exploration Results in Western Labrador Sea, Canada
1:55 R. J. BUTOT: The Hibernia Structure
2:15 R. A. MENELEY: Exploration Potential of Scotian Shelf
2:35 Questions and Answers
3:05 Coffee Break
3:35 P. OXLEY: Exploration Potential of Georges Bank
3:55 R. H. BREITENWISCHER: Frontier Exploration—Southeast Georgia Embayment
4:15 P. OXLEY: Exploration Results from Baltimore Canyon
4:35 Questions and Answers

ABSTRACTS

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Stratigraphy and Depositional History of Baltimore Canyon Trough, Mid-Atlantic OCS

Examination of exploration wells, COST wells, and CDP reflection seismic lines reveals many details of the stratigraphy and depositional history of the Baltimore Canyon Trough. Two stratigraphic test wells penetrated about 1,500 m of Cenozoic sediments, 900 m of Upper Cretaceous strata, 1,200 m of Lower Cretaceous strata, and bottomed in Upper Jurassic beds at depths greater than 4,850 m. Criteria used in determining depositional environments of strata include lithology and texture (from electric logs, cuttings, and cores) as well as facies relations and biologic indicators. Seismic stratigraphy and correlations with other basins indicate that Upper Triassic–Lower Jurassic basal strata probably include red beds with basalt flows, dolomite, anhydrite, and salt deposited in arid continental and supratidal sabkha environments. Progradation of carbonates during a Middle-Late Jurassic marine transgression resulted in the formation of reefs and banks on the shelf edge which grade shoreward to terrigenous deposits overlain by limestone on the shelf. During the Early Cretaceous, prograding deltaic wedges built the shelf seaward and covered it with a thick blanket of sandstone and shale. Marine influence gradually increased, and the end of the Early Cretaceous is marked by a broad, thick, nearshore sandstone (Albian-Cenomanian). The transgression continued into the Late Cretaceous as worldwide sea level reached a maximum. Calcareous sheet sands, mudstone, and limestone were deposited across the continental shelf and slope and spilled into the ocean basin. Regional unconformities characterize the Turonian, the Tertiary-Cretaceous boundary, the lower Oligocene, and lower Miocene strata. The Cenozoic sequence of limestone, shale, and sand represents progressively shallower waters.

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Deep-Water Petroleum Prospects, U.S. Atlantic Continental Margin

Petroleum prospects in deep water (300 to 3,000 m) in the U.S. Atlantic continental slope and rise occur in three major trends: shelf-edge/slope carbonate complex, Blake Plateau–Carolina Trough, and the upper continental rise. Data supporting the potential of these trends come from COST wells, DSDP core holes, USGS multichannel seismic profiles, single-channel seismic surveys, and aeromagnetic and gravity surveys.

The carbonate complex parallels the present shelf-slope boundary in 300 to 2,000 m of water along much of the U.S. Atlantic margin and consists of a series of discontinuous barrier-reef structures ranging in thickness from 1,000 to perhaps 6,000 m. Associated with this complex, on the basis of seismic interpretations and COST B-3 well data, are thick, west-dipping, porous sandstone wedges, east-dipping forereef-talus wedges, and elongate anticlinal closures in strata overlying the reefs. The Blake Plateau–Carolina Trough trend contains a series of large salt domes and swells together with low-relief anticlines, fault traps, and patch reefs. Prospects in the upper rise include east-dipping fan deposits, buried slump deposits, channeled unconformities, fault traps, buried seamounts, and oceanic basement highs.

Jurassic and Lower Cretaceous strata contain the most promising potential reservoirs in the carbonate complex and Blake Plateau trends; Cretaceous and Tertiary turbidites, contourites, and chalks may also be prospective in the upper rise. Low and discontinuous porosities and permeabilities may limit some reservoirs, although faults and fracture zones could provide local permeability enhancement. Hydrocarbon maturation depths in the rise are estimated to be greater than 2,000 m below sea floor and as much as 4,000 m in the other trends. Potential source rocks are Lower Cretaceous black shales as well as Jurassic shales and carbonates that may have been deposited in an oxygen minimum zone on a paleoslope.

BAROSH, PATRICK J., Weston Observatory, Weston, MA

Neotectonic Activity of Atlantic Inner Continental Margin

A consistent pattern of neotectonic activity along the inner edge of the Atlantic continental margin is emerging from new data on earthquake activity, contemporary vertical movement and geologic structure. Seismic activity, as shown by both historic and instrumental data, is concentrated in embayments on the Atlantic coastal margin. These are the Southeast Georgia, Salisbury, and Raritan Bay embayments and all major bays and mouths of major rivers in New England.

Present-day subsidence is indicated to be taking place at most of these embayments from studies of releveling and tidal-gauge data, Pleistocene and Holocene shorelines, position of historic construction relative to sea level, and archaeological studies. Releveling studies indicate Passamaquoddy Bay, Maine–New Brunswick, is subsiding at a rate of 9 mm per year relative to Bangor, Maine.

The embayments appear to have developed as irregularities on the general downwarp of the continental margin by early Tertiary. Many of the embayments occur over older grabens, which may help control their position.

The offshore Blake Spur fracture zone trends toward and is aligned with the earthquake activity at Charleston, South Carolina. This fracture zone may also help to control the spacing of the embayments.

The neotectonic activity along the inner continental margin and seismic activity along extensional faults inland from it strongly suggest that slight rifting is still occurring from the opening of the Atlantic. The present downwarping at the continental edge is now concentrated in irregularities, embayments, that possibly developed by sagging over basement structures.

BARSS, M. S., J. P. BUJAK, and G. L. WILLIAMS,* Bedford Inst. Oceanography, Dartmouth, N.S., Canada

Organic Matter Type and Hydrocarbon Occurrences on Eastern Canadian Margin

The type of organic matter present in the Mesozoic-Cenozoic sections of offshore eastern Canada is related to the geologic histories of the western North Atlantic Ocean and the Labrador Sea. On the Scotian Shelf–Grand Banks, marine organic matter (amorphogen), largely the remains of phytoplankton and the primary precursor of oil, did not become abundant until the Late Jurassic, and then only where marine conditions were more fully developed. Floods of terrestrial organic material in deltaic sediments considerably diluted the amorphogen in the Early Cretaceous, particularly on the Scotian Shelf. In contrast, amorphogen continued to be common in the East Newfoundland Basin. Major marine transgression led to uniformly abundant amorphogen throughout the Late Cretaceous and Cenozoic of the Scotian Shelf and Grand Banks, with terrestrial organic material only becoming important in the Neogene. Coloration studies indicate that sediments are generally immature in the Late Cretaceous–Cenozoic, except in: (1) areas where the Cenozoic is extremely thick in the East Newfoundland Basin and Labrador Shelf; and (2) where anomalously high geothermal gradients result as from salt intrusion. Older strata, where mature, are generally gas-prone, except where amorphogen is common. The Labrador Shelf shows a similar but later sequence of organic types with amorphogen being common only in the Paleogene. Our results are consistent with hydrocarbon distribution encountered to date in offshore eastern Canada. They also indicate that the relative abundance of amorphogen increases in an offshore direction, of particular importance where the type of organic material is the limiting factor for oil generation as in the Late Jurassic–Early Cretaceous.

BREITENWISCHER, R. H., Transco Exploration Co., Houston, TX

Frontier Exploration—Southeast Georgia Embayment

During 1978 Transco Exploration Co. and its partners successfully bid on five Sale 43 tracts in the Southeast Georgia Embayment. These leases were acquired on the basis of a subunconformity play different from other prospects in the sale area. During late 1979 Transco, as operator, drilled an exploratory well which will influence future exploration of the prospect.

BRENNER, GILBERT J., State University of New York, New Paltz, NY

Biostratigraphic Changes in Spore and Pollen Record in Middle to Upper Cretaceous of Atlantic Coastal Plain as Reflection of Sea-Floor Spreading, Global Cooling, and Evolution of Wind Pollination

During the middle Albian and continuing through the late Cenomanian, changes in the spore and pollen record of the Middle Atlantic Coastal Plain suggest cooling climatic trends. The decrease in temperature is indicated by a reduction in palynomorphs associated with humid tropical conditions and an increase in gymnosperm pollen. These trends are paralleled by a gradual but continuous evolution of angiosperm types from tricolpate to triporate pollen. The latter events may be associated with cooling and increasing seasonality that would favor selective pressures for the evolution from early insect-pollinated angiosperms to well-developed wind-pollinated types by late Cenomanian. This climatically driven evolutionary trend reaches its acme during the Coniacian-Santonian climatic maximum.

Climatic cooling during the middle Cretaceous, as suggested by oxygen isotope studies, is believed to be related to increased sea-floor spreading. Such plate movements resulted in the fractionation of the circumglobal tropical Tethyan seaway as well as an increasing rate of northward and counterclockwise movement of the Middle Atlantic coastal margin during middle to Late Cretacous times.

BUTOT, R. J., Mobil Oil Canada, Ltd., Calgary, Alberta

The Hibernia Structure

The Chevron et al Hibernia P-15 well discovered hydrocarbons on the Hibernia structure in late 1979. Since that time, the operator Mobil Oil Canada, Ltd., and partners (Gulf Canada Resources, Inc., Petro-Canada Exploration Inc., Chevron Standard Limited, and Columbia Gas Development of Canada, Ltd.) have drilled four appraisal wells on the feature. Results from these wells indicate the presence of a major oil accumulation. Hibernia is located on the Newfoundland Grand Banks 315 km east-southeast of St. John's. Local stratigraphy and seismic structural data indicate potentially productive hydrocarbon zones.

CONNORS, STEPHEN D., Federal Energy Commission, Washington, D.C., HAROLD L. COUSMINER, Israel Geologic Survey, Jerusalem, Israel, and ARTHUR P. LORING, York College of City Univ. of New York, Jamaica, NY

Stratigraphy and Sedimentology of Upper Cretaceous (Raritan) Sediments of Staten Island, New York

Cretaceous sediments on Staten Island have been considered to represent Raritan and Magothy formational units. Recent investigations of subsurface samples by Cousminer and Connors have resulted in correlations with Raritan Formation members exposed in northern New Jersey. Raritan Formation Members identified by pollen stratigraphy and petrologic studies were the Sayreville Sand Member and the Woodbridge Clay Member. No Magothy formational equivalents were found. New data have been collected from outcrop samples for correlation studies. These outcrops are slowly being destroyed by human activity.

Outcrop samples were collected from three localities and analyzed for grain-size distribution and mineralogic content. The Sayreville Sand Member on Staten Island is a light-colored, fine- to medium-grained, thin- to thick-bedded sand. Variegated clays and silts, thin- to thick-bedded, are layered with the sands. Thin micaceous silt and clay beds containing abundant lignitic fragments and some sulfide minerals are also present. The sands are extensively cross-stratified with small planar beds. Quartz is the principal component of the sand