

bank and reef that existed along most of the margin. Facies C and D are common on the shelf, C being particularly significant on and seaward of Late Jurassic deltas. Two submarine-fan complexes formed off present Nova Scotia and the Middle Atlantic states. Seasonal upwelling plus fan development produced mixed B-C and C facies along the margin. Facies D dominated the deep basin.

The middle Cretaceous organic facies reflect profoundly changed conditions from those that existed in the Late Jurassic. The continent had a warm, humid, temperate-tropical climate producing abundant vegetation. Ancestral rivers carried large volumes of detrital plant material to the sea. Thus, facies C is virtually ubiquitous except for the inner shelf and isolated parts of the ocean basin. Active reefs and carbonate-bank development at the shelf break was limited to the low latitudes. In the early Cenomanian, a major transgression substantially broadened the shelf and upwelling probably occurred on the middle shelf. Facies B-C is postulated to exist on the upper slope, locally, and in the basin where anoxia prevailed.

Exploration targets for oil are the buried carbonate bank and reef and related fore-reef talus deposits. Secondary objectives are interreef channels and their seaward extensions, the upper parts of submarine fans. The shelf and margin basins are dominated by facies C source rocks. In the Late Jurassic, however, locally ideal conditions permitted deposition of facies B source rocks.

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Significance of EOM/TOC Ratios in Identifying Possible Migration Fairways, NPRA, North Slope, Alaska

Analyses of 958 samples from 54 wells in the NPRA (National Petroleum Reserve in Alaska) for TOC (total organic carbon) and EOM (extractable organic matter) have been made available as part of an extensive exploration program sponsored by the U.S. Geological Survey. In the present study, these data have been analyzed using the equation: $EOM(wt. \%) / TOC(wt. \%) \times 0.80 = \text{Generation Index}$. The ratio of EOM to TOC is generally used as an indicator of thermal maturation. Work done by D. R. Baker demonstrates, however, that values in excess of 0.05 are indicative of migrated hydrocarbons in the sample.

Initial results of mapping these ratios for 11 structural zones in the NPRA indicate younger strata (i.e., Nannushuk, Torok, Pebble Shale, Kingak, and Sag River formations) have a significant probable migration fairway developed along the trace of the north-south-trending Meade arch, and toward the eastern margin of the NPRA. Older strata (i.e., Shublik, Ivishak, Echooka, Lisburne, Endicott formations and basement) generally show ratios in excess of 0.05 along the northern and northeastern margins of the NPRA. Although not enough data are available for detailed EOM/TOC mapping of these older trends, they may be related, in part, to the juxtaposition of younger source rocks that unconformably overlie these older strata.

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Reexamination of Middle Eocene Genus *Cubitostrea* Based on Collections from Central Virginia Coastal Plain

Three species of oysters from the middle Eocene *Cubitostrea* lineage are used for local and regional correlation and zonation of sediments in the Gulf coastal plain. However, oysters from the middle Eocene Piney Point Formation in Virginia also include the co-occurrence of specimens that exhibit the morphologic characteristics of these 3 Gulf Coast species.

Examination of approximately 150 specimens from 8 bulk samples collected in a vertical sequence along the Pamunkey River revealed that, in addition to co-occurring, a continuum exists from one form to the next. The general shape of the forms is related to size, with juvenile oysters characterized by a triangular shape and prominent ribs, whereas the adults are oval with large auricles and a saddle-shaped form.

Results indicate that the morphologic variation of oysters in the middle Eocene sediments of Virginia does not represent an evolutionary lineage with each form a species, as proposed for the Gulf coastal plain. Rather, the forms are related to the growth stages of the species *C. sellaeformis*. Therefore, the Gulf model is not applicable to the middle Eocene sediments of Virginia and possibly not to other depositional areas.

Oysters from the underlying Nanjemoy Formation (lower Eocene) previously included within the species *C. sellaeformis* should not be so designated. This distinction is based on the coarser and fewer number of ribs

on the Nanjemoy oyster as compared to *C. sellaeformis* from the Piney Point Formation.

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Exploration Applications Through Remote Sensing of Ice-Wedge Polygons

Petroleum exploration is facilitated through remote-sensing techniques such as Landsat digital data processing and aerial photointerpretation. These techniques were applied to reconstruct past geologic environments and to analyze the present geomorphic setting of the Colville delta on the North Slope of Alaska. By examining differences in the distribution of selected characteristics of ice-wedge polygons, the positions of former fluvial channels and lake beds and the relative age of the surface could be determined.

Characteristics of ice-wedge polygons such as size, shape, central relief, and rim condition were delineated using aerial photography of various scales and dates. Maps of selected characteristics assisted in identifying outcrops of the Pleistocene Gubik Formation, frequently flooded areas, and the locations of former distributary channels and lake beds. Although Landsat digital data were not as effective as aerial photography in geologic mapping, primarily due to pixel resolution being one order of magnitude larger than an individual polygon, major surface features and outcrops could be identified from variations in vegetation and the surface water content of ice-wedge polygons. In addition, tundra surface with ice-wedge polygons could be differentiated from that without.

An understanding of ice-wedge polygon characteristics, which infer geologic environment and evolution, and the application of similar remote-sensing techniques can assist exploration geologist in determining past and present geologic environments in inaccessible periglacial regions.

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Williston Basin Seislog Study

This paper describes the results of Seislog® (trade name) processing and interpretation of an east-west line in the North Dakota region of the Williston basin. Seislog processing involves inversion of the seismic trace data to produce a set of synthetic sonic logs. These resulting traces, which incorporate low-frequency velocity information, are displayed in terms of depth and isotransit times. These values are contoured and colored, based on a standard stratigraphic color scheme.

The section studied is located just north of a dual producing oil pool from zones in the Ordovician Red River and Devonian Duperow Formations. A sonic log from the Long Creek 1 discovery well was digitized and filtered to match the frequency content of the original seismic data. This allows direct comparison between units in the well and the pseudosonic log (Seislog) trace nearest the well. Porosity development and lithologic units within the lower Paleozoic stratigraphic section can be correlated readily between the well and Seislog traces.

Anomalous velocity zones within the Duperow and Red River Formations can be observed and correlated to producing intervals in the nearby wells. These results emphasize the importance of displaying inversion products that incorporate low-frequency data in the search for hydrocarbons in the Williston basin. The accumulations in this region are local in extent and are difficult to pinpoint by using conventional seismic data or displays. Seislog processing and displays provide a tested method for identification and delineation of interval velocity anomalies in the Red River and Duperow stratigraphic sections. These techniques can significantly reduce risks in both exploration and delineation drilling of these types of targets.

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Use of Seislog for Basin Evaluation and Field Development

Generation of synthetic sonic logs (Seislogs) from seismic data can provide lithologic, porosity, and fluid-content identifications in a variety of