Fer-March Island shell reefs. Approximately 1,000 km of high-resolution uniboom and 3.5 kHz subbottom-profile seismic data, taken in this area in 1983 and 1984, provide the data base for this study.

Trinity shoal, associated with the abandoned Maringouin delta complex, is a lunate shore-parallel feature approximately 36 km long and 5-10 km wide. Relief on the shoal ranges from 2 to 3 m, and minimum water depths over the shoal vary from −5 to −2 m. The shoal sand body is from 5 to 7 m thick and is composed largely of parallel to low-angle clinoform reflectors. Several levels of buried fluvial channels, ranging in age from early Wisconsinian to Holocene, are associated with the shoal deposit. The occurrence of channel features within the shoal sand itself suggests the presence of tidal inlets, indicating a possible barrier-island origin for the shoal.

The underlying deltaic sediments reach approximately 15 m in thickness and are made up of low-angle clinoform reflectors dipping to the southwest. Distributary, bay-fill, estuarine, and buried oyster-reef deposits can be recognized, making these similar to modern Atchafalaya delta deposits. Continued progradation of the Atchafalaya delta will probably result in burial of the Trinity shoal and Maringouin delta deposits by fine-grained sediments, giving these shoal deposits a high-preservation potential and creating an excellent stratigraphic trap.

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Canada Basin: Age and History of Its Continental Margin

Presently available age controls suggest that the Canada basin formed during the Cretaceous Period between about 131 and 79 Ma. The opening process began with continental breakup that may have involved all parts of the North American polar margin at about the same time. The opening was completed by the formation of oceanic crust during the extended Cretaceous interval of normal geomagnetic polarity. Features characteristics of continental breakup, insofar as they are known, show systematic regional differences. From Brock to Axel Heiberg Island, continental breakup was associated with an extended (100+ Ma) stratigraphic hiatus and, northeastward from Ellef Ringnes Island, with extensive tholeiitic igneous activity. From Banks Island to northeastern Alaska, the breakup interval was abbreviated (20-30 Ma), and sparse igneous activity occurred. These differences can be produced by changes in the rate and/or amount of crustal stretching during margin formation and would imply relatively faster or more stretching northeast of Brock Island. A continental margin of fixed age, exhibiting the indicated pattern of crustal stretching, could be produced along the trailing edge of a rotating block (Arctic Alaska terrane, AA) with its pivot near the Mackenzie delta. When the rotation is restored, however, geological discrepancies are evident between Devonian and older rocks across the conjugate margins, suggesting an earlier history of drifting for the AA. Early Paleozoic correlations appear improved if the AA is placed, polar margin to polar margin, against northern Ellesmere Island and Greenland, where in the middle Paleozoic, it was sheared sinistrally along the Canadian margin to its pre-rotated position opposite Banks Island.

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Late Tertiary Sediment Basin on Continental Slope off Western Nova Scotia

The continental slope off Nova Scotia was shaped during the Cenozoic by progradation, erosion, and intrusion by salt-cored diapirs termed the "Sedimentary ridge." No evidence has previously been reported that Cenozoic sediment accumulation on the slope landward of the Sedimentary ridge was affected by sea-floor deformation owing to growth of diapirs.

As part of a regional survey, seismic stratigraphy in reflection profiles shot on the slope between 61° and 64°W was tied to wells on the upper slope and shelf. Dip profiles show three reflector sequences, each about 0.5 sec two-way travel time thick, which terminate in a seaward direction against diapirs of the Sedimentary ridge. Whereas reflectors within the upper and lower sequences dip at least 2° seaward, reflectors within the middle sequence lie flat, lap out onto an unconformity postdating the Eocene-Oligocene canyon-cutting event along the Scotian shelf, and are truncated seaward by a sharp Pliocene-Pleistocene(?) unconformity. Neither rotation along listric faults nor back-tilting by uplift in the Sedimentary ridge can account for the geometry and along-strike continuity (200 km) of the middle sequence. It is proposed that sediments forming the flat reflectors were ponded landward of a sea-floor ridge in the present position of the Sedimentary ridge. The dam was formed in the late Paleogene by sediments uplifted above linear salt ridges. Subsequently, erosion removed both the dam and the outward portion on the ponded sediments, and diapirs rose from the salt ridges.

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Role of Minerals in Formation of Hydrocarbons During Pyrolysis of Organic Matter—a Material Balance Approach

Monterey Formation and Green River Formation kerogens (types II and I, respectively) were isolated, mixed with common sedimentary minerals, and pyrolyzed under dry and hydrous conditions for various times and temperatures. Analysis of all the pyrolyses products were conducted to perform a material balance and to infer reaction kinetics and mechanisms.

Material balance of the pyrolyses products, in the presence and absence of minerals, reveals that the kerogen degradation results in the formation of bitumen rich in high molecular weight compounds in the initial stages, followed by additional cracking of kerogen and bitumen. However, amount and type of hydrocarbons in the pryrolyses products of kerogen in the presence of montmorillonite are markedly different from those produced by heating kerogen alone or with other minerals. The initial amount of products in the presence of montmorillonite, and in particular the quantities of low molecular weight hydrocarbons, are higher than those in the presence of illite, calcite, and kerogen alone. The composition of these low molecular weight compounds is dominated by branched hydrocarbons, indicating catalytic cracking via carbonium ion mechanism, which is initiated on acidic sites of the clay. Compositional differences are evident also in the distribution of n-alkanes and in the pristane/phytane ratio. The catalytic effect of montmorillonite, however, disappears in the presence of excess water.

These differences may have important implications for the composition and quantities of petroleum generated from source rocks with different mineralogies.

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Oligocene Vicksburg Sandstones of TCB Field—a South Texas Diagenetic "Jambalaya"

Tijerina-Canales-Blucher (TCB) field of Kleberg County, Texas, has produced significant amounts of hydrocarbons from Oligocene Vicksburg sandstones at depths between 8,500 and 11,500 ft. TCB Vicksburg sandstones were deposited in deltaic to shallow-marine environments as evidenced by various sedimentological and biological indicators. Diapirisim of Jackson shale coupled with growth faulting generated highly faulted, rollover elongate anticlines. These faulted, elongate highs along with stratigraphic pinch-outs form the main traps in TCB field.

Detailed examination of cores from six different Vicksburg sand-shale intervals aided in delineation of a complex diagenesis related to depositional environment, lithology, burial, and thermal history of the region. The sandstones vary in lithology from lithic to feldspathic lithic arenites and wackes. A volcanic source during Vicksburgian time is indicated by the presence of high percentages of volcanic-rock fragments. This overabundance of labile constituents is the prime factor that resulted in the "jambalaya" of diagenetic complexities.

Porosity in the TCB Vicksburg sandstones is almost entirely secondary and was generated predominantly by the dissolution of feldspars and volcanic-rock fragments. Permeability was greatly enhanced by dissolution of recrystallized clayey matrix and carbonate cement. An overall smectite-illite signature pervades the vertical section, with an extremely well-developed authigenic imprint of highly crystalline chlorite, kaolinite, illite, and many other mineral species superimposed onto the primary signature, especially with depth. The best TCB reservoirs have the largest average grain size and had the greatest amount of feldspars and volcanic-rock fragments prior to diagenesis. Evolution of secondary porosity was directly related to the generation and migration of hydrocarbons through these reservoirs.