composite diagenetic sequence based on petrographic analyses of over 300 thin sections from sandstone samples from these environments consists of: (1) bioturbation of sediment and compaction of ductile grains before cementation; (2) infiltration of minor amounts of pedogenic illite and precipitation of chlorite and minor amounts of smectite; (3) cementation by euhedral, syntaxial quartz overgrowths; (4) extensive poikilotopic calcite cementation; (5) widespread dissolution of calcite; (6) precipitation of kaolinite as patches in some of the dissolution pores; (7) replacement of calcite and framework grains by iron-rich carbonates (ankerite-ferroan dolomite, ferroan calcite, siderite). The relative intensities of these diagenetic events, and thus porosity and permeability, are controlled by and vary with the environment of deposition of the sandstones. The two main factors controlling the differences in diagenetic features within the environments are (1) original composition of the sands, and (2) geometry of the sandstone bodies.

Prodelta siltstone and very fine-grained sandstone, deposited as thin frontal-splays, are enclosed in thicker sequences of marine shale. These rocks (dominantly feldspathic litharenite and lithic arkose) typically have the lowest porosity ($\bar{x}=4\%$) and permeability ($\bar{x}=1$ md) of the three environments. Primary porosity was destroyed early by extensive bioturbation and by widespread calcite cementation ($\bar{x}=23\%$). The thicker, impermeable shale above and below the thin, lenticular sandstone bodies served as barriers to subsequent fluid migration, thus inhibiting any creation of secondary porosity by dissolution and any later diagenetic changes.

Channel-mouth-bar and sheet-sand deposits of the delta-front facies are generally more quartz-rich and thus, due to a greater stability of the quartz grains, underwent the least amount of compaction. Consequently, calcite cementation was widespread; later dissolution of calcite produced secondary porosity up to 28% and permeability up to 557 md. These fine to medium-grained sandstones (dominantly feldspathic litharenite, lithic arkose, and subarkose) have the highest porosity ($\bar{x}=18\%$) and permeability ($\bar{x}=81$ md) of rocks from the three facies.

Delta-plain fine to medium-grained sandstone has intermediate porosity ($\bar{x}=8\%$), but low permeability ($\bar{x}=1$ md). These sandstones (primarily feldspathic litharenite) have the highest concentration of sedimentary and volcanic rock fragments, which were squashed during compaction and altered during burial. Thus, only a relatively small amount of pore space remained for calcite cementation. Kaolinite cement filled in most of the secondary porosity created by dissolution of early formed calcite.

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Regressive and Transgressive Sand Bodies Associated with Lafourche Delta in South Louisiana

The beach ridge plains and coastal barrier systems along the seaward margin of the wave-dominated Lafourche delta represent regressive and transgressive events associated with multiple delta lobe progradations and abandonments over the last 1,500 years. Two major delta lobes, the Early Lafourche and the Late Lafourche, can be recognized by the subaerial expression of the abandoned deltaic plain. Associated with each delta lobe is a regressive beach ridge plain deposited during distributary progradation and coastal barrier system deposited during distributary transgression.

The Cheniere Caminada beach ridge plain is associated with the Late Lafourche delta lobe. It consists of more than 70 subparallel beach ridges in an arcuate fan-shaped configuration which flare seaward along the eastern levees of Bayous Lafourche and Moreau. Radiocarbon dates indicate beach ridge building began approximately 600 years ago when Bayou Lafourche built seaward of the older Bayou Blue shoreline and started intercepting westward longshore sediment transport, resulting in the formation of Cheniere Caminada. Near the fan apex, beach ridges are 7 to 8 m (23 to 26 ft) thick and thin westward to 2 to 3 m (6.5 to 10 ft) thick. A typical beach ridge stratigraphic sequence coarsens upward with shoreface silty sands overlain by a cap of washover and aeolian sands. Beach ridge growth ceased approximately 300 years ago when Bayou Lafourche was abandoned.

Distributary abandonment initiated the transgression at Bayou Lafourche and the development of an erosional deltaic headland, the Caminada-Moreau coast, with a set of symmetrical, flanking barriers, the Timbalier Islands to the west and the Caminada Pass spit and Grand Isle to the east. Reworking of distributary and beach ridge sand bodies by shoreface retreat supplies the sand source required for coastal barrier generation. Shore-parallel transport distributes sand from the headland source into downdrift marginal spits, tidal deltas, and flanking barrier islands. Cores show that the flanking barriers (Timbalier Island and Grand Isle) increase in thickness from 2 to 3 m (6.5 to 10 ft) near the headland to 5 to 6 m (16 to 20 ft) at their downdrift ends. A typical flanking barrier stratigraphic sequence shows a coarse-grained tidal inlet fill overlying a finer grained interdistributary bay fill and underlying a thin cap of washover and aeolian sands.

In the Early Lafourche delta, only remnants of an older regressive beach ridge plain, Chenier Caillou, can be recognized owing to its advanced stage of transgression. A series of relict, partially submerged beach ridges associated with the Caillou headland can be seen spreading seaward on their western margin in the central Isles Dernieres indicating the dominant longshore transport direction was westward. Cores show a regressive sequence 7 to 8 m (23 to 26 ft) thick, similar to Cheniere Caminada, where shoreface silty sands underlie washover and aeolian deposits.

The Isles Dernieres represent the transgressive barrier system of the Early Lafourche delta lobe. Abandonment of the Caillou distributaries occurred approximately 600 to 800 years ago. Due to long-term subsidence, the Caillou headland is now submerged below sea level and the Early Lafourche barrier system has evolved into a transgressive barrier island arc separated from the mainland by an intradeltaic lagoon. Sediment dispersal consists of seaward transport into an inner-shelf sand sheet, landward transport into washover deposits, and shore-parallel transport into tidal deltas and marginal recurved spits. Cores show the central Isles Dernieres consist of a thin washover sand sheet 1 to 2 m (3 to 6.5 ft) thick transgressing over delta plain and beach ridge deposits. The downdrift ends of the Isles Dernieres islands are thicker, up to 4 to 5 m (13 to 16 ft), and overlie fine-grained interdistributary bay fills.

In the subsurface of Grand Isle and Cheniere Caminada, lies the transgressive barrier system of the Bayou Blue distributary abandoned 1,200 years ago. The sand source for barrier generation is two Bayou Blue distributaries which lie -10 m (-33 ft) below sea level adjacent to Barataria Pass. The transgressive sand body strikes northwest and is overlain by a sequence of regressive interdistributary clays and silts, regressive beach ridge sands (Cheniere Caminada), and a transgressive flanking barrier sand (Grand Isle). Radiocarbon dates indicate Bayou Blue Barrier was actively transgressing landward 920 years ago.

The identification of regressive beach ridge plains along the Lafourche delta suggests that these wave-dominated delta plain components may be stratigraphically more significant in the Mississippi delta than recognized before. Sequential delta lobe abandonments have led to the development of imbricating regressive

and transgressive sand bodies in the Lafourche delta complex.

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Marine Geology Off Southeast Baffin Island—Results from a 1981 and 1982 Survey

The Centre for Cold Ocean Resources Engineering undertook to analyze cores collected by Canterra Energy Ltd. The seabed sampling program was conducted off southeast Baffin Island during October 1981, and in the summer of 1982. The samples were collected on exploration leases in water depths down to 450 m (1,500 ft) using both a piston and a gravity corer. Core recovery was variable, and core ranged from 15 to 100 cm (6 to 39 in.). Additional samples and data also collected included surface sediment grabs, bottom photographs, sidescan, bathymetry, HUNTEC DTS, and airgun geophysical data.

Two mosaics were compiled from the sidescan data, one at about 350 m (1,150 ft) and the other at about 275 m (900 ft). Both areas show evidence of numerous linear and curvilinear iceberg scours, which are of subdued relief in the deeper site. The deepest iceberg scour is about 4.2 m (14 ft) at the 275 m (900 ft) site. Sidescan sonar records from the 1982 survey indicate that scours are to be found down to depths of 500 m (1,650 ft). Iceberg scours from the 350 m (1,150 ft) site and deeper are considered to be relict.

The cores were visually examined, X-rayed, and logged. The sediments were relatively stiff sandy, silty clays associated with pebbles and granules randomnly distributed along the length of the core; these pebbles are probably iceberg debris and their provenance is being determined. Some of the cores have a 10 to 15 cm (4 to 6 in.) thick band of fine sand, generally about 15 cm (6 in.) below the top of the core. Sediments on either side are very fine silty clays. Micropaleontological analysis using foraminifera from the cores reveal three biostratigraphical zones. From the bottom upwards they record a progressive change from deep to shallower to deep-water conditions, the latter reflecting the modern environment.

Full results of the core analysis, sediment distribution, geotechnical properties and sea level changes, and a comparison with earlier studies are presented in the paper.

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Stratigraphic and Environmental Interpretation of Miocene Radiolarian Assemblages of Maria Madre and Maria Cleofas Islands and Baja California, Mexico

Miocene radiolarian assemblages were collected from Maria Madre and Maria Cleofas islands and five localities along Baja California (Tortugas, Bahia de Asuncion, El Cien, Cabo San Lucas-La Paz, and San Felipe). Most of these sequences are composed of diatomaceous and/or diatomaceous shales or very fine sands.

Stratigraphic correlation with previous work on the Monterey Formation, Experimental Mohole, and DSDP Legs 5, 7, 18, 32, and 66 indicate that the radiolarian zones *Diartus petterssoni, Didymocyrtis antepenultima, Didymocyrtis penultima,* and *Stichocorys peregrina* are present in these newly worked sections.

The oldest dates obtained were from the Tortugas Formation (middle Miocene); the youngest was uppermost Miocene from the section at San Felipe.

Paleoenvironmental interpretations were based on quantitative analyses on warm, cold, deep, and intermediate water forms, as well as abundances of diatoms and silicoflagellates. The Tortugas Formation (middle to upper Miocene) represents a slope biofacies characterized by relatively high percentages of cold and intermediate water forms, and the absence of deep-water radiolarians. Diatomaceous layers increase upsection and show an increase in radiolarian abundance and diversity (especially of cold water forms and silicoflagellates). These conditions reflect an enhancement of upwelling areas and low oxygen depositional facies.

Previous radiolarian and diatom studies in Maria Madre and Bahia de Asuncion as well as Maria Cleofas, indicate that these environments of deposition are analogous to the Monterey Formation. Radiolarian faunas from these three sections are correlated to the *Didymocyrtis antepenultima* Zone and reflect an intensification of upwelling, perhaps as a result of the buildup of the Antarctic ice cap.

The "El Cien" section and the section collected between La Paz and Cabo San Lucas are representative of the *Didymocyrtis penultima* Zone. The "El Cien" sequence is underlain by pillow basalts that may represent the contact between the East Pacific Rise and North America. Radiolarian faunas in both sections represent a mixture of warm and cold water forms with considerable dilution by terrigeneous sediments.

San Felipe, the only section located on the gulf side, contains a unique radiolarian/fauna. This unique fauna may have been the result of "basin isolation" during the opening of the Gulf of California.

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Stratigraphic and Diagenetic Controls on Porosity Distribution Within a Cretaceous Carbonate Bank: West Stuart City Trend, Texas

Cores from four wells from the West Stuart City trend in LaSalle and Webb Counties, Texas, were analyzed to define depositional and diagenetic facies and to determine factors controlling porosity distribution. In all, 1,187 ft (362 m) of core and 220 thin sections were examined in detail, supplemented by SEM analyses of fractured surfaces and plastic casts of microporosity. Attempts to correlate cores purely on the basis of lithology were unsuccessful owing to the high degree of vertical lithologic variability and the rapidity of lithofacies changes over a relatively short distance (approximately 8,000 ft, 2,400 m). However, when lithofacies were integrated with biofacies (based on gross faunal aspect) and related to submarine hardground surfaces, meaningful correlations were possible.

The depositional model envisioned for these deposits is that of a broad, discontinuous, shallow bank constructed of coarse skeletal debris (largely caprinid grainstones) with more restricted lagoonal sediments in its lee (miliolid, requienid wackestones, and mudstones). The buttress zone of this bank was periodically subjected to extensive wave action, evidenced by sheets of skeletal grainstones intertonguing with muddy lagoonal facies.

Important diagenetic effects noted include extensive submarine cementation, neomorphism of aragonitic components with virtually no development of moldic porosity, and extensive pressure solution. Cumulative measurements of stylolites with amplitudes greater than 2 cm (0.8 in.), combined with microscopic observations of small-scale stylolites indicate a loss of stratigraphic section of as much as 20%.

A comparison of lithofacies and biofacies logs with permeability and porosity logs compiled from perm-plug data revealed that zones with permeabilities greater than 0.1 md and porosities of at least 6% were associated with rudistid grainstones cemented by