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

isopachous submarine cement and packstones with a finely crystalline rhombic calcite matrix. This general porosity distribution is modified by basinward tilting so that the most favorable traps lie in updip positions where grainstones intertongue with and are sealed by muddy lagoonal facies, (i.e., in a more landward position behind the bank proper).

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Using a Microcomputer for Entry of Geologic Core Descriptions

Sohio realized the need for computer manipulation of lithologic data from a large number of cored wells. The specific goals were (1) comparing lithologic observations with foot-by-foot log measurements, and (2) rapid generation of lithologic maps. These goals required the creation of a consistent core description data base. Traditional geologic core descriptions, where many feet of rock are often summarized in a written paragraph, were found unsuitable for incorporation into a data base. Core description data sheets were also found unsatisfactory because of the time and cost required to locate and correct errors inherent in these forms.

With the Sohio Digital Entry of Core Description (SODECD), there is immediate data entry into a microcomputer, thereby providing excellent quality control. An assistant types the data into the microcomputer as the geologist describes the core. Features of the software include: (1) prompts for each data category, (2) cursor will skip past prompts not relevant, (3) allows movement forward and backward through prompts, (4) displays menus of valid responses, (5) completes quality control checks and displays error messages when invalid data is entered, (6) saves each foot of core description on diskette, and (7) allows the core description data to be transferred to the main computer and incorporated into the data base.

Compared to using core description data sheets, SODECD was found a more rapid and less expensive method of creating a core description data base. This data base is more accurate and consistent because the following problems are eliminated: (1) invalid data entries, (2) data entered in wrong column, (3) omission of significant data categories, (4) null versus zero ambiguity, (5) geologic inconsistencies, and (6) keypunching cost and errors.

The incorporation of core descriptions into a data base allows a variety of computer analysis, such as rapid production of lithologic maps, plots of lithologic data along with log measurements, and computer-produced stratigraphic columns.

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Wagwater Trough, Jamaica: Model for Aulacogen Transgressive Sedimentation

The Wagwater Trough, Jamaica, tectonically and sedimentologically represents a failed rift arm of the Cayman Trough, a Tertiary extensional plate boundary zone between the North American and Caribbean plates. Integration of regional geologic-geophysical data with the geometrical relationships of the northern Wagwater Belt sediments and volcanics demonstrates that the trough has proceeded through the four major stages of development for failed rift arms outlined by Burke in 1977. Initial basement swelling, rifting, rupture (sedimentation/subsidence), and later convergent deformation stages were correlated to the Tertiary depositional and deformational history within the Wagwater Trough. The transgressive depositional package tectonically recorded these events and can be divided into 4 lithogenetic units: (1) upper Paleocene-lower Eocene Wagwater alluvial fan conglomerates, (2) lower Eocene Nutfield pillow basalts, (3) lower Eocene Richmond fan delta/submarine fan conglomerates to mudstones, and (4) middle Eocene Font Hill deep marine limestones.

The thermal doming and swelling stages occurred during the late Cretaceous-early Paleocene as evidenced by concordant ages of granodiorites (65 m.y.B.P.) in the Cayman and Wagwater Troughs and by the Paleocene unconformity at the base of the Wagwater Formation. This stage resulted in the eventual formation of an active triple junction within the Cayman Trough by late Paleocene.

Initial rifting and deposition are recorded by the basal Wagwater Formation. The graded, boulder-cobble conglomeratic litharenites with granodiorite clasts were deposited in an alluvial fan environment adjacent to the fault scarps bounding the recently created Wagwater Trough. The volcanic activity associated with the triple junction is represented by the Nutfield spilitic pillow basalts, extruded in deep marine waters following the deposition of the terrestrial Wagwater Formation. These events together with the following indicate rapid deposition, subsidence, and ocean encroachment into the Wagwater Trough.

Active rifting ensued between the North American and Caribbean plates along the east-west-trending Cayman Trough. This rupture stage is characterized by thick transgressive sedimentation and differential subsidence as the nonmarine Wagwater Formation grades into the marine Richmond Formation. This depositional transition is further manifested by both slope and shelf facies of litharenites within the Richmond. The slope facies consists of thick boulder conglomerates fining up into turbidite sequences and volcanic slide conglomerates overlying the Nutfield flows. The shelf facies include: (1) a pebble-cobble conglomeratic fan delta complex, (2) several sandstone feeder channel deposits radiating north from the fan delta to the shelf break, and (3) progradational mudstones and siltstones. The interfingering of the Richmond and Wagwater lithogenetic units along a major east-west contact zone in the northern end of the belt is in direct contrast to the abrupt yet conformable slope facies contact between the two formations. These events indicate a much slower subsidence on the shelf in contrast to the rapid subsidence on the slope. By middle Eocene, clastic input was shut off, subsidence and marine transgression ensued, and a deep marine biomicrite, the Font Hill Limestone, capped the Richmond Formation within the Wagwater Trough.

The final stage of aulacogen development began during middle Miocene associated with a change from north-south rifting to left lateral motion along the Cayman Trough. As a consequence of this change in plate motion, the Wagwater Trough was uplifted and wrenched by left lateral transcompression. Today, fluvial sedimentation along the Wagwater River, the largest in Jamaica, progresses down the ancient axis of the Wagwater Trough.

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Laramide Foreland Thrust Faulting in Southwestern Montana

Two major schools of thought exist on the nature of Rocky Mountain foreland (Laramide) deformation: (1) advocates of the classical "fold-thrust" model of R. R. Berg, including variations and plate-tectonics settings by J. K. Sales, J. D. Lowell, A. W. Bally, and others; and (2) advocates of the classic upthrust or drape-fold model of J. J. Prucha and others, with recent vigorous support based on field and model studies by D. W. Stearns and his students. The first school concentrates on lateral-