sociated with this exposure period destroyed much of the original depositional texture.

A statistical data-reduction method was developed and used to construct a representative picture of the spatial distribution of reservoir properties. There is a correlation between stratigraphic and reservoir facies, markedly modified by diagenesis.

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TECHNIQUE OF OBSERVATION OF ORGANIZED ORGANIC REMAINS IN CARBONATES

Conversion of carbonate grains to fluorite gives a microporous pseudomorph in which the contained organic material may be dyed and observed. Photographs illustrate the application of this technique to *in-situ* observation of perforating algae and other organisms in modern Bahama ooids and skeletal grains. A similar group of organisms, that demonstrates the preservation of detailed cellular structure at least from Pleistocene time, has been found in Miami Oolite ooids. Other possible applications are to ancient carbonates and to carbonates trapped by blue-green algae.

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FOREREEF SLOPE ECOLOGY AND DEPOSITIONAL PROCESSES IN JAMAICA

The forereef slope is a well-defined zone of the reef biotope. In Jamaica, its maximum limits lie between about −20 m and −120 m, roughly from wave base to the depth of compensation for photosynthesis of green algae and zooxanthellae. In practice, the upper and lower limits of the forereef slope habitat appear to be defined by the 15 and 0.3% isophotes respectively.

Morphologically, the Jamaican forereef slope is divided horizontally by rimmed terraces at about the −18-m, −35-m, −65-m, and −120-m levels. Each terrace is set back from the one below by a steep coral-covered drop-off which may be vertical or even overhanging. These levels are related to eustatic sea level changes during the late Pleistocene and Holocene marine transgressions.

Biologically, the forereef slope has a rich and diverse benthos whose biomass may in some places exceed that of all other reef zones combined. From −20 m to −60 m, hermatypic corals are dominant, below that Porifera prevail. The algal flora is dominated by immense populations of various species of *Halimeda*, the chief sand builders of this zone. Frame cementation is mainly by encrusting coralline red algae and the colonial foraminifer, *Gypsina*. A common attribute of many groups in this habitat is gigantism, notably among the sponges, corals, *Gorgonia*, Antipatharia, and *Halimeda*. There is a high degree of endemism; *i.e.*, the forereef slope harbors many species not found elsewhere in the reef. Among these are the recently discovered sclerosponges which are important frame cementers of the twilight zone in caves, crevices, and subreef tunnels. Many of the endemic forms are precise habitat indicators, and thus may be of considerable paleoecologic significance.

Sedimentologically, the forereef slope is a region of accelerated deposition and erosion. There, transient sediment of shallow-water origin mingles with locally produced skeletal detritus, resulting in a poorly sorted mixture with a high proportion of fines. The rimmed terraces usually dam large pools of talus through which project nunataklike isolated pinnacles and outcrops of the substrate. The drop-offs in front of the terraces are steep, and dissected by gullies through which drainage of sediment into deep water takes place. Few organisms grow in these chutes, the richest organic communities are on the precipitous rocky promontories between the chutes. Mass transport of sediment downslope is by creep, turbidity currents, and slides. Sporadic fallout of corals results in an imbricated scree piled against the source area. Avalanches spread large amounts of coral detritus in disordered heaps far downslope. Slumping displaces very large blocks of reef framework into deep water. Extensive submarine organic and inorganic lithification tends to stabilize quickly the masses of detritus, even on very steep slopes and in spite of the structural weakening due to boring sponges.

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GEOLOGIC RECONNAISSANCE OF CHUKCHI SEA, BASED ON ACOUSTICAL PROFILING AND MAGNETIC DATA

(No abstract submitted)

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BIOSTRATIGRAPHY OF CARBONIFEROUS ROCKS, SAN SABA COUNTY, CENTRAL TEXAS

Increased understanding of complex carbonate facies patterns in Carboniferous rocks of central Texas permits systematic investigations of macropaleontology and biostratigraphy. Fossils studied were collected from exposures of Chappel, Barnett, Marble Falls, and Smithwick formations in the north-central part of the Llano uplift.

The first purpose of this investigation was to identify and describe the macrofauna as completely as possible. Brachiopods, particularly productids and chonetids, dominate the fossil assemblages. However, colonial and solitary corals, bryozoans, gastropods, pelecypods, goniatites, nautiloids, crinoids, and a few trilobites are also present.

A second purpose of the investigation was to assess relations among faunas and the several different carbonate and shale facies. For example, the fauna preserved in Chappel beach sediment is completely different from that fauna preserved in conformably overlying Barnett Shale. Most of the taxa from the Barnett range upward into the Marble Falls Limestone, where initiation of carbonate sedimentation resulted in greatly increased fossil abundance and species diversity. This population explosion was halted by the rapid influx of prodeltaic Smithwick mud.

An examination of the faunas across the Mississippian-Pennsylvanian and Morrowan-Atokan boundaries determined that changes within specific groups were adaptations to different ecologic conditions.

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LATEST DEVONIAN CONCHOSTRACANS ALONG CORDILLERAN MIOGEOSYNCLINE, ALBERTA, MONTANA, UTAH, AND NEVADA

Lioestheriid conchostracans are numerous in thin

beds within correlative uppermost Devonian rocks along the Cordilleran miogeosyncline. They are present in the Exshaw Formation of southwestern Alberta, Sappington Member of Three Forks Formation throughout western Montana, lower part of Leatham Formation of northern Utah, and middle part of Pilot Shale of west-central Utah and southeastern Nevada.

These phyllopod bivalve crustaceans or clam shrimp are found most commonly in greenish-gray and grayish-black shales. The shales directly overlie extremely thin discontinuous fish- and conodont-bone beds and are overlain by carbonate beds that generally contain numerous algal nodules (oncolites). Conchostracans also are present in limestone and in channel siltstone.

The associated biota generally comprises inarticulate brachiopods, principally *Lingula* and *Orbiculoidea*, orthocone, nautiloid, and goniatite cephalopods, *Tasmanites*, and fish fragments, but locally includes abundant to rare ophiuroids, blastoids, and other pelmatozoans, articulate brachiopods, ostracods, conodonts, trilobites, horn corals, and sponge spicules. The conchostracans are small and thin valved in noncalcareous shale but their size and valve thickness increase relative to higher carbonate content of enclosing rocks. The bivalves are flattened in shale but undistorted in carbonate beds; open articulated valves are commonly preserved.

A brackish-water environment is suggested for these latest Devonian conchostracans. Optimum conditions apparently were a muddy bottom, restricted circulation, shallow and quiet water, and slow deposition.

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PALEOCURRENTS AND ORIGIN OF HURONIAN LORRAIN FORMATION, ONTARIO AND QUEBEC

The Lorrain Formation crops out in 3 areas between Sault Ste. Marie, Ontario, and Ville-Marie, Quebec—Bruce Mines, Whitefish Falls, and Cobalt. It conformably overlies the Gowganda Formation in each area; in the Cobalt area it also locally overlies Archean granite. The Lorrain is overlain by the Gordon Lake Formation.

In ascending order, the Lorrain Formation consists of arkose, subarkose, jasper-bearing orthoconglomerate, and orthoquartzite. In the Bruce Mines area the Lorrain is 8,300 ft thick and is divided into 5 members (A-E); in the eastern areas the Lorrain is only 5,000 ft thick and is divided into 3 members (lower, middle, and upper). In each area, mineralogic and textural maturity increases upward; grains in immature arkose at the base are subrounded and 44% feldspar, and grains in supermature orthoquartzite at the top are well rounded and 95–100% quartz. Chronologically, the depositional environments suggested are shallow-water marine, lacustrine, delta fringe, overshelved beach, and high-energy beach.

Currents flowing south and southeast deposited most of the sediments; however, in jasper-bearing conglomerate of the Bruce Mines area, cross-bedding and pebble composition indicate a 90° variance in transport direction, and an additional source on the east. Abundant potash feldspar and lack of metamorphic and sedimentary rock fragments in the lower members suggest a plutonic provenance. Subsequent deposition of jasper, chert, and quartz-rich detritus indicates erosion and reworking of Precambrian jaspilites and igneous source rocks similar to those now exposed in the Canadian shield.

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TRENDS OF FAUNAL MORPHOLOGIC VARIATION AND THEIR ENVIRONMENTAL SIGNIFICANCE: KEY TO PALEOECOLOGIC ANALYSIS

Analysis of trends of morphologic variation within faunal assemblages is significant for paleoecologic interpretation, and complements paleoenvironment interpretations based on analogy with Holocene sedimentary environments. The Rondout Formation (Late Silurian), Hudson Valley, New York, demonstrates the importance of such analysis.

The Glasco Limestone Member (12 ft) records offshore subtidal deposition. It is overlain and underlain by supratidal mudflats—the Whiteport Dolomite (1–7 ft) and Rosendale Dolomite Members, respectively.

Within the Glasco, 5 units in vertical sequence from base to top show morphologic variation of halysitids, coenitids, stromatoporoids, and various algae, coincident with shallowing: Unit I (1 ft), "amoeboid" stromatoporoids in wackestone matrix; Unit II (4 ft), thin, laminar stromatoporoids, "head-shaped" halysitids, encrusting algae, and small-diameter branching coenitids in packstone and grainstone matrix; Unit III (1 ft), halysitids change to "blade" morphology; Unit IV (4 ft), no halysitids, bloom of larger diameter branching coenitids, branching and encrusting algae, and laminar and "amoeboid" stromatoporoids in packstone and grainstone matrix (rare wackestone); Unit V (2 ft), massive domal stromatoporoids in calcareous shale.

Transitions from "heads" to branches, from "heads" to "blades," from smaller to larger diameter coenitids, and from encrusting to branching algae are interpreted as adaptation to increased turbulence. Halysitid establishment and laminar stromatoporoid morphology correlate with "firm" substrate. A "soft" substrate supported "amoeboid" stromatoporoids. A decrease of turbulence permitted vertical expansion of stromatoporoids to domal morphology.

Paleoecologic interpretations based on single morphologic occurrences, as contrasted with trends, must be made with reservation.

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FORMATION PRESSURE PATTERNS IN CRETACEOUS VIKING FORMATION, ALBERTA

Regional potentiometric maps of the Lower Cretaceous Viking Formation in central Alberta indicate a low-pressure area or "sink" centered on the Joffre-Bentley-Gilby trend of oil fields, with formation waters in central Alberta flowing into the trend. According to integrated geologic and pressure studies, the "sink" actually consists of 6 separate, nearly static, pressure systems controlled by the environmental facies and subsequent structural deformation.

The Viking reservoirs are interpreted to be lenticular sandstone bodies deposited as *en échelon* offshore bars with a NW-SE trend. Postdepositional uplift and subsequent erosion have exposed the Viking sandstones at their lateral extremities; in places, these extremities are covered by a thin veneer of permeable glacial deposits. Five of the 6 pressure systems in the Viking appear to be controlled by the distribution of these bars and by the elevations of outcrops. The sixth system is characterized by pressures 1,200 psi below hydrostatic pres-