

and concepts, have been compiled. (1) A geologic tectonic map of the entire territory of Trinidad and Tobago, at a scale of 1:200,000. Apart from the surface geology of the land areas, this map shows the major faults and their displacements and locations, total depths and status of exploration wells, and the positions of major petroleum fields. (2) Five accompanying geologic sections at the same scale. (3) A new stratigraphic correlation chart.

These new compilations attempt to fill the gap in the published literature on the petroleum geology of Trinidad and Tobago.

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#### A Computerized Paleontological Work Station

A microcomputer efficiently replaces the pencil and notepad by the microscope. The same reports produced by hand are produced in less time at lower cost by computer. System components are the Checklist II program, a microcomputer, two disk drives, and a dot-matrix printer. Advantages over manual methods include multiple data use without reentry, automated drafting, more complex capabilities, and no transcription errors. Advantages over mainframe implementation include ease of use, same-day reports, work station mobility, and cost savings.

A computer system should be as easy to use as the manual system it replaces. This ease is achieved by using menus rather than memorized commands, and by duplicating manual procedures already in use. Data are stored by project; each file contains abundances for species in a related group of samples. This speeds program use by keeping all species information in active memory. Completed data files can be fed into a mainframe data base if desired. Various abundance formats are accepted, including specimen counts, relative abundance, presence/absence, and free form. Interpretive information can be entered as comments.

Data can be displayed as a variety of range of charts. Sample can be sorted. Species can be ordered alphabetically, by highest or lowest appearance, or manually. Abundances can be an entered, or converted to percent, presence/absence, total range, relative abundance, or graphic characters. Other analyses such as diversity calculations, cluster analysis, histograms, and graphic correlation can use the same data set.

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#### New Ulm Field: An Example of Cretaceous Shelf-Slope Instability in East Texas

The New Ulm field in Austin County, Texas, is an example of the structural and stratigraphic complexity above the Cretaceous Edwards shelf margin of east Texas. Deep wells and improved seismic data provide documentation of structural patterns and deepwater facies not previously considered in Gulf Coast reservoir play modeling.

Study of the data implies the Late Cretaceous to Eocene section was deposited along a shelf-slope break. Late Cretaceous, pre-Midway sedimentation was affected by structurally induced slope instability, and consequent gravity faulting and slumping resulted in an irregular sea-floor surface. Paleocene Midway sands were carried onto this surface by storm-generated density currents where the uneven topography caused deposition in constructional channels. Continued deposition of the fluvio-deltaic Wilcox on this surface caused faulting and folding by differential compaction. The folds are minor and the faults small and steep, not like the typical large growth faults of the Gulf Coast. Upper Wilcox sediments were progressively less disturbed as the region stabilized.

New Ulm field production includes gas from the Midway Formation and oil and gas from the Wilcox Group. Midway reservoirs are stratigraphic, consisting of turbidite channel sandstones; Wilcox reservoirs are structural, consisting of fluvio-deltaic sandstones within faulted anticlines.

This study adds evidence to data describing shelf-slope geology along the Edwards margin. The setting can be a new type of hydrocarbon play in the Gulf Coast.

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#### Barium Partitioning in Carbonates: Theory and Applications

The partition coefficient for  $Ba^{2+}$  into calcite has been established as  $0.06 \pm 0.01$  at  $25^\circ C$  ( $77^\circ F$ ). The partition coefficient proved independent

of rate of precipitation in a series of 19 runs of varying duration. This value is substantially lower than that reported by Kitano in 1971, reflecting our seeding technique, which focused the experiment on crystal growth rather than on spontaneous nucleation and growth. The 0.06 value is compatible with the values reported for  $Sr^{2+}$  (0.05 to 0.14), a cation of identical charge, but closer to  $Ca^{2+}$  in ionic radius.

The natural partitioning of  $Ba^{2+}$  was examined in fresh (aragonite) and altered (calcite) corals from the Pleistocene reef terraces exposed on Barbados, West Indies. The  $Ba^{2+}$  concentrations ranged from 8 to 15 ppm in the aragonites and decreased to typical values of 1 to 3 ppm in the calcites. The partitioning of  $Ba^{2+}$  in these samples was quantitatively similar to the attendant partitioning of  $Sr^{2+}$ . The partitioning of  $Ba^{2+}$  during the carbonate cycle offers new areas of investigation. The low concentrations of  $Ba^{2+}$  in sedimentary biograins (3 orders of magnitude less than  $Sr^{2+}$ ) make  $Ba^{2+}$  a sensitive monitor of externally derived, barium-bearing solutions involved in diagenetic reactions. Likewise, the low concentrations ensure ideal partitioning behavior in diagenetic solutions of low ionic strength.

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#### Depositional Environments and Invasion Profiling in Heavy Oil Sands, Eastern Venezuela: A Case Study

A comprehensive study of a single well for INTEVEP and Meneven in the Faja Petrolifera del Orinoco—an extensive ( $570 \times 140$  km,  $350 \times 90$  mi) east-west trending heavy oil belt located immediately north of the Orinoco River, eastern Venezuela—resulted in an interpretation of an invasion profile dependent on depositional environments. The data base was derived from: (1) 400 ft (121 m) of whole core (67% recovery) and 124 sidewall cores taken from the 1,500-1,900 ft (457-579 m) interval of the upper Tertiary Oficina Formation, which, in this area, overlies the Precambrian metamorphosed igneous basement. (2) A logging suite of 22 conventional, experimental, and prototype wireline logs.

In this area, the Oficina Formation is a complex series of stacked, heavy oil-saturated, sand-dominant, fluvially-transported, unconsolidated sediments overlain by lignite- and mud-dominant backswamp and estuarine sediments. Bedding, mineralogy, lithology, and paleontology define fluvial-channel fills, channel-lag deposits, crevasse splays, overbank levees, swamps, estuarine lagoons, and estuarine-channel fills in a delta-plain environment.

Reservoir geometry and facies analyses suggest that several short, wide, deep-channelled, meandering rivers flowed generally northward across a tropical-subtropical plain of low relief carrying the bulk of the sediment in bedload traction (channel fills) and a smaller fraction in density suspension (crevasse splays).

A unique logging suite permitted the measurement of invasion in this heavy-oil environment. The invasion of the mud filtrate was measured at varying depths of investigation using, from shallowest to deepest depths: (1) gamma ray spectrometry log, (2) microspherically focused log, (3) nuclear magnetism free fluid index, and (4) deep Laterolog.

In addition, water trapped in the fine-grained sands was characterized by comparing the porosity from the electromagnetic propagation log to the free fluid index from the nuclear magnetism log. Identification of the depositional facies coupled with these log responses produced an innovative interpretation of the invasion profile. From an oil-bearing gross interval of 262 ft (80 m) 9 sand units were defined according to their primary and secondary (steam processing) production capability.

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#### Platform-Margin and Marginal Slope Relationships and Sedimentation in Devonian Reef Complexes of Canning Basin, Western Australia

Devonian limestone platforms in the Canning basin were generally rimmed by reef-margin and reef-flat deposits, constructed by stromatoporoids, algae, and corals in the Givetian and Frasnian, and by algae in the Famennian. However, some platforms were low-relief banks with little or no reef development.