developed Bouma sequences. Few sequences exceed thicknesses of 1 ft (0.3 m) in distal channels.

Canyon sandstones are low-permeability reservoirs, with mean porosity and permeability of 10% and 0.2 md, respectively. Isoporosity and isopermeability maps indicate that porosity and permeability are greatest in turbidite channels and decrease laterally. Interchannel sandstones have limited lateral extent and make poor reservoirs.

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Prediction of Oil or Gas Potential by Near-Surface Geochemistry

Recent development in surface geochemical prospecting have enabled this age-old seep-detection technology to be used to determine the gas versus oil character of a potential fairway. Extensive field work has demonstrated that the chemical compositions exhibited by near-surface hydrocarbon soil gases are strongly coupled to the chemical compositions known to exist in the nearby underlying reservoirs. By using the compositions and ratios of the light hydrocarbons (methane, ethane, propane, and butane), it is possible to predict whether oil or gas is more likely to be discovered in the prospect area. Histograms which represent average soil gas compositions are observed to be strongly correlative with reservoir gas analysis histograms and with compositions from gas shows recorded in downhole mud logging. This correspondence with the actual formation gases suggests that the upward migration of reservoired light hydrocarbons into near-surface soils represents a viable mechanism, allowing surface geochemical exploration techniques to be utilized for regional hydrocarbon evaluations.

Geochemical investigations indicate that seep magnitudes depend on tectonic activity to aid migration along the fault and fracture avenues which appear to provide the major migration pathways. This fault association suggests the diffusion process to be of secondary importance. Geochemical prospecting must be used with caution, and only in conjunction with geologic and geophysical tools, because the location and shape of geochemical anomalies are commonly governed more by the local tectonic structure of the region rather than by the actual physical shape of the deposit. Thus geochemical prospecting, when used alone, cannot predict whether or not a particular soil gas anomaly is associated with a commercial deposit. It can only be used to verify the existence of petroleum hydrocarbons and to predict whether a potential structure is likely to contain gas or oil. Geochemical prospecting yields excellent regional evaluations of hydrocarbon potential.

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Geologic Interpretation Based on Dipmeter Data—Field Study

The Lambert Granite Wash field was discovered in Oldham County, Texas, in 1979. With the exception of the discovery well, every well in the field was logged with a 4-arm high-resolution dipmeter, and the log data were processed by computer. The data interpretation identified the paleoenvironment of the field and determined the source of the granite wash and how it was transported.

Log data indicated that a subsea distributary-channel system transported the detrital granite, and that the deposition was influenced by the remnants of a small Precambrian ridge. The channels were diverted around the ridge until it was eventually buried. The deposition continued, from the west, until the source of granite was depleted.

Through analysis of the dipmeter data, the Bravo dome was identified as the source of the granite, and it was determined that the channel system was located on the north side of the dome in Oldham County.

During Late Pennsylvanian time, a horst formed in the area as a result of basin subsidence. Log data indicate this horst is a suitable structure for the accumulation of hydrocarbons and has overlying shale which forms a stratigraphic trap.

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Carbonate Cementation of Gulf Coast Barrier-Island Sands and Formation of a Stratigraphic Trap

Field investigations in the area of Grand Isle, Louisiana, indicate the presence of active carbonate precipitation. Modern shoreline facies are being cemented by high-magnesium calcite, ranging from 10 to 50 mole % magnesium carbonate. Cementation occurs between the beach and marsh environments as surface crusts or laminae. The environment is characterized by seasonal high temperature (up to 50°C), high salinity (40 to 90° /₀₀), supratidal stromatolites and organic decomposition.

After burial, lithified crusts undergo chemical alteration, as indicated by a decrease in magnesium carbonate content (20 to 35 mole %). The cement eventually undergoes dissolution and reprecipitation, forming a well-cemented sandstone. Rip-up clasts of these sandstones are found along Gulf Coast beaches where a transgressive sequence occurs. These clasts are typically cemented by high-magnesium calcite with 10 to 15 mole % magnesium carbonate. Carbon isotope analyses of rip-up clasts indicate that dissolution and reprecipitation processes are methane-derived due to organic decomposition.

Buried crusts may be preserved in the subsurface and form an effective barrier to fluid migration. Where cementation is extensive, porosity is occluded on the marsh-side of the barrier-island sequence. Cement distribution is, therefore, a primary controlling agent of hydrocarbon migration and subsequent entrapment. Migration of hydrocarbons from organic-rich marsh sediments would be prevented by the early formation of the permeability barrier. Cementation, then, would account for accumulation of hydrocarbons on the marsh side of the barrier-island sequence and the formation of a stratigraphic (or "diagenetic") trap.

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Principles of Dipmeter Interpretation in Fluvial Systems

Identification of fluvial reservoirs has become increasingly more important in exploration. Stratigraphic information provided by dipmeter data is useful in defining the fluvial facies and reservoir morphology.

Field studies utilizing dipmeter data indicate that the middle Bartlesville sandstones in southeast Kansas and northeast Oklahoma are fluvial in origin and are composed of point-bar and longitudinal-bar facies. Dipmeter patterns within composite bedsets of each facies display a decrease in dip upward. This pattern indicates an upward decrease in the scale of sedimentary structures from cross-laminated to ripple-