1939, 255 wildcats have been drilled, resulting in the discovery of 43 areas of accumulation, accounting for 942 million bbl and 992 Bcf, respectively, of producible oil and gas. The API gravity of most of the oil ranges from 35° to 40°.

The Bahia Supergroup, the principal objective for petroleum exploration, has a maximum thickness of 20,000 ft. These sediments are nonmarine, and range in age from Late Jurassic to Early Cretaceous. The Late Jurassic deposits consist of a typical redbed association, which is overlain by the blanket Sergi Sandstone, the best reservoir rock of the basin. The Early Cretaceous (Neocomian) sediments are composed largely of dark-gray and grayish-green shale of the Itaparica, Candeias, and Îlhas Formations, which are considered to be the source rocks for the hydrocarbons. The "A" sandstone, the lenticular sandstone bodies of the Candeias Formation, and the São Paulo and Santiago Sandstones of the Îlhas Formation are the best reservoir rocks of the Neocomian section.

The present architecture of the Recôncavo basin is an intracratonic half graben, developed chiefly during the times of deposition of the Candeias and lower Îlhas, when the basin became a rapidly sinking trough. The accelerated growth of the Salvador and Mata-Catu uplifts, the most prominent structural features, were responsible for the two principal northeast- and northwest-trending normal fault sets. A late phase of tectonic movements occurred near the end of, or after, deposition of the São Sebastião, reactivating ancient faults and causing new ones to form. As a consequence, the tectonic pattern of the basin is a complex system of faulted blocks.

The six major fields, in which 96 percent of the total producible oil is concentrated, are related to the structural evolution of the basin. It is believed that the early period of faulting, contemporaneous with the deposition of Candeias and lower Îlhas, was a decisive factor in the control of petroleum migration and accumulation in Sergi and "A" sandstones. The horst blocks of Agua Grande, D. João, and Buracica fields, uplifted during this tectonic phase, trapped about 622 million bbl of recoverable oil in the two sandstones. Accumulation of Îlhas reservoirs was controlled mainly by the later phase of faulting. Folds, developed in the downthrown blocks of normal faults, but not related to compressional stresses, were the traps for accumulations in the São Paulo and Santiago Sandstones. Examples of such traps, which accumulated about 186 million bbl of producible oil, are Miranga and Taquipe fields. The genesis of the reservoir sandstone lenses in Candeias field, a stratigraphic trap, is related to syntectonic Candeias deposition. Fractured shale and limestone also constitute reservoir rocks in this field, where 94 million bbl of recoverable oil were trapped.

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Komia Banks (Pennsylvanian) of Southwestern San Juan Mountains, Colorado

Investigation of a Pennsylvanian limestone unit exposed near Molas Pass, southwestern San Juan Mountains, Colorado, reveals a distribution of carbonate materials similar to those on some modern banks of south Florida. Local thickenings of an interval containing the problematical red alga *Komia* suggest bank-like accumulation at shallow sites which were favorable especially for the prolific growth of this organism. The size and twig-like nature of *Komia* and its common association with pelleted micrite matrix suggest a comparison with the modern alga *Goniolithon* which inhabits the Florida banks. Such comparison leads to the interpretation of a very shallow-water environment for the Pennsylvanian counterpart. Micritic matrix is replaced by sparry calcite cement near the fringe of the *Komia* banks and demonstrates the slightly more agitated conditions of the seaward margin where carbonate mud was removed selectively from around *Komia* grains

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Considerations Regarding Formation of Potash Deposits

Commercially valuable potash salts usually occupy only minor parts of evaporite basins, whereas certain noncommercial potassium-bearing minerals have a more widespread distribution.

The processes of the concentration of these potentially valuable salts no doubt begin when salt first is precipitated within the evaporating basin. As brine concentration increases, highly complex solutions are formed which influence not only the chemical but also the physical factors of concentration. Environmental and geologic processes at this time further aid in restricting the depositionally favorable locations in which the potash-bearing solutions can precipitate.

On completion of evaporation and burial of the preserved complex salts, further concentration and enrichment of the potash salts may occur due to metasomatic processes.

Saline precipitation presently is taking place on a reduced scale in some locations along the continental margins of the ocean basins, inland seas, continental brine lakes, and salt pans.

Trace minerals, such as bromine, cesium, and rubidium are of special interest in saline studies, because they furnish much information on the genetic character of the salts. Argon, found commonly in salt sequences where a high concentration of potassium is present, aids in the determination of the age of the salt.

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Upper Devonian Reef Oil Field—Redwater, Alberta, Canada

The Redwater oil field discovered in 1948 has in-place reserves of 1,300 million bbl, about 64 percent of which will be recovered. The field is a single pool 58 sq mi in area along the updip edge of a large Late Devonian (Frasnian) limestone reef complex.

The complex is more than 800 ft thick, roughly triangular in plan and about 225 sq mi in area. More than 900 wells have been drilled in the field area where normal forereef, reef, and backreef facies are recognized. Porosity and permeability were influenced by diagenesis, but conform with the primary facies patterns.

The Redwater reef grew during a major subcycle within the Kaskaskian sequence. Transgression over shoal carbonate of the previous subcycle created a

"reef-prone" shelf of moderate depth. The reef was enveloped by clayey and carbonate muds which prograded across the shelf. Nearly 3,000 million bbl of recoverable oil in Redwater and nine companion reefs attests to favorable trap-to-source relations in this basin setting.

Recognition of "reef-prone" cycles of deposition and early understanding of the depositional/tectonic framework which affects reef distribution are important in guiding exploration for Redwater-like reefs in new areas. Local, less predictable factors can influence the effectiveness of the reefs as traps and the success of exploration. Subsequent basin history is critical, for depth of burial affects the feasibility of seismic exploration and imposes regional cometamorphic patterns of hydrocarbon distribution.

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DIVERGENCE BETWEEN DIP DIRECTION OF CROSS-STRATA AND ENCLOSING CROSS-STRATA SET BOUNDARIES: A CHARACTERISTIC OF ALLUVIAL POINT-BAR SANDS

Repeated post-flood mapping and trenching of laterally accreting point bars along steep, meandering streams in southeastern Louisiana reveal a characteristic divergence between the azimuths of dip of scoured set boundaries and the cross-strata which they enclose. The interrelation offers a potential criterion for recognition of ancient point-bar deposits.

After floods, long curving sand waves are observed to be normal to the low-stage channel high on the emergent point-bar surfaces, but curve in the direction of flow to near parallelism with the low-stage channel near low water level. Cross-strata sets exposed in trenches on the emergent point bar are bounded by scoured surfaces which slope radially toward the low-stage channel (*i.e.*, they mimic the radial slope of the point-bar surface in the meander bend). The enclosed cross-strata dip generally in a downstream direction or obliquely toward the higher part of the point bar, diverging from the channelward dip direction of the scoured set boundaries by 80°–135°.

Sand waves which generated the cross-strata appear to have migrated downstream parallel with contours on the point bar or obliquely up onto the point bar, as revealed in the "frozen" post-flood surface sand-wave patterns. The inferred sand-wave migration pattern and growth of the point bar by lateral accretion into the flood-scoured channel were confirmed by sonic sounding during floods.

Sandstones of apparent point-bar–lateral accretion origin form part of complex belt-like bodies of sandstone in the Carboniferous of central Pennsylvania. The alleged point-bar sandstones are composed of unidirectionally dipping sets of cross-strata, crudely sigmoid in shape, which thin both up and down the dip of the scour surfaces bounding the sets. Enclosed cross-strata dip, on the average, in directions perpendicular to the dip of the set boundaries, indicating that flow was along the original strike, rather than down the dip, of the scour surfaces. Lateral accretion of the point bar into the channel appears to have progressed by addition of sand deposited in the lee of sand waves migrating parallel with the point-bar surfaces, as observed on the modern point bars.

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CHARACTER, ORIGIN, AND SIGNIFICANCE OF LATE SILURIAN BARRIER ISLAND—FUYK SANDSTONE MEMBER OF RONDOUT FORMATION, HUDSON VALLEY, EASTERN NEW YORK STATE

The Rondout Formation of New York State records two transgressive episodes, each represented by 20 ft of section, and each having occurred on a basin-wide scale as determined through correlation with equivalent units in Pennsylvania and central New York. The initial rate of each transgression was sufficiently rapid to allow the development of subtidal carbonate environments. As the rate of transgression slowed, the relative rate of sedimentation increased, allowing shoreline intertidal and supratidal environments to prograde into the line of section. The second transgressive episode was characterized by the development of a quartz sandstone barrier island–dolomite lagoon complex near shore and a coral-stromatoporoid biostromal environment offshore. Preservation of the barrier was effected by the intertidal and supratidal sediments deposited during the progradational phase of sedimentation.

Geometrically, the sand body attains a thickness of 20 ft, a width of 0.5 mi, and scattered exposures occur through a length of 4 mi.

Internally, the sand body can be subdivided into a basal biosparite calcarenite, grading upward into a well churn-burrowed, fragmental fossiliferous quartz sandstone, a thin-bedded cross-stratified and burrowed quartz sandstone, and a medium-bedded, cross-stratified quartz sandstone. Grain size, bedding thickness, skeletal content, and structures change both laterally and vertically.

Paleocurrent data and the character of the sand body suggest that it developed through the southward longshore transport of sediment derived from both terrigenous and offshore-marine sources.

Recognition of the constructional and preservational history of the Fuyk Member has contributed to an understanding of the relation of this and other less well-preserved sandstone bodies (deposited during the same time interval in Pennsylvania and New York) to associated carbonate sediments and to the transgressions in general.

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CONTOUR CURRENTS AND TURBIDITY CURRENTS

Turbidity currents transport sediments downslope and account for many graded sequences included in displaced clastic sediment embedded in deep-water deposits. Contour currents flow parallel with the isobaths and transport fine sediments for thousands of miles along the continental margins. The resulting deposits of these processes are turbidites and contourites. These two deep-water deposits commonly have been confused, even in modern sediments.

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GEOMETRY OF DEVONIAN SWAN HILLS REEF COMPLEX—ALBERTA, CANADA