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STRUCTURAL GEOLOGY IN EASTERN MARGIN OF CANADIAN ROCKY MOUNTAINS

Hydrocarbon accumulations in the foothills at the eastern margin of the Canadian Rocky Mountains are structurally trapped. Exploration for these hydrocarbons requires a prediction of the deep geometric configuration of potential reservoir beds in imperfectly understood areas. This prediction commonly is derived from analogies with the most appropriate of the region's typical structures, a pragmatic approach which is effective because the foothills contain a limited suite of relatively simple structural types: (1) concentric folds (with their attendant *décollement*), (2) low-angle thrust faults (commonly folded), (3) tear faults (generally transverse), and (4) late normal faults (commonly listric). The possible assemblage in a particular area is further restricted because it is a function of the degree of deformation and of the lithology of the deformed rocks. Intensity of deformation increases from east to west.

Regional stratigraphic changes alter the major lithologic units whereas local isopach or facies changes alter the distribution of incompetent rocks within units.

The structural styles are all "thin skinned" as the underlying Archean basement is not involved.

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RECOGNITION OF DEPOSITIONAL ENVIRONMENTS THROUGH THIN-SECTION ANALYSIS OF DETRITAL SEDIMENTS

Petrographic analysis can be a powerful tool in the recognition and delineation of depositional environments of detrital sediments. A study of varied fluvial-deltaic, and interdeltaic environments in the Eocene of the Gulf Coast and the Cretaceous of Montana-Wyoming shows that individual environments may be segregated by applying univariate and multivariate statistical techniques to petrographic data (composition and texture).

These results are supported by data collated from Holocene environments in the Mississippi alluvial valley and delta, and Galveston barrier island. Holocene environments that can be segregated with a minimum of 80% reliability are point bar, natural levee, lake, bay, lower shoreface, middle shoreface, upper shoreface-beach, dune, and lagoon. Consequently, full diameter cores may not be necessary for precise environmental interpretation everywhere in the subsurface. Small samples, such as side-wall cores, taken throughout an interval, may yield significant and reliable environmental information. An example is provided by the Lower Cretaceous Muddy Sandstone of Montana in which the subenvironments of the petroliferous barrier-bar complex at Bell Creek field can be recognized from thin-section analysis and verified by a study of full-diameter cores. The presence of the Bell Creek barrier bar can be predicted through thin-section analyses of sediments in dry holes which surround the bar. If thin-section data are integrated with paleogeographic knowledge of the Lower Cretaceous, the relative position and strike of the barrier system may be ascertained.

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CARBONATE-BANK SEDIMENTATION, EASTERN SHARK BAY, WESTERN AUSTRALIA

A carbonate bank of Holocene age extends for 80 mi (129 km) along the mainland coast of Shark Bay, Western Australia. Development of the bank is attributed in part to the modifying influence of seagrasses on the physical environment. Bank formation under organic cover partly explains the origin of older mound-like bodies of carbonate sediment.

The bank is wedge shaped in cross section, has an average width of 5 mi (8 km) and a maximum thickness of 25 ft (7.6 m) at the seaward margin. For descriptive purposes, the bank is divided into 2 intergradational structural forms—the basal sheet and the submarine levees. More than 50 tidal channels cut across the bank. Seaward advance of the bank has been rapid; estimates of average rate of advance range from 528 ft (161 m) to 754 ft (230 m) per 100 years.

Salinity in sublittoral bank environments ranges from 38 ‰ to more than 55 ‰ (metahaline water type of Shark Bay). Substrates are covered in varying density by 3 seagrass communities.

Bank sediments are biogenic carbonates with admixtures of terrigenous clastics. Sediments deposited under seagrass cover are characterized by skeletal fragments of encrusting foraminiferids and articulate coralline algae from the seagrass epibiota. These sediments may contain up to 30% by weight of fine particles ($<62\mu$), most of which are silt-size skeletal fragments of magnesium-calcite. Intertidal and sublittoral sand-sheet sediments are characterized by "micritization" of carbonate grains, whereas seagrass bank sediments become enriched in Fe and Mn.

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GEOLOGY OF HYDROCARBON OCCURRENCE IN WOODBEND REEFS (DEVONIAN) OF WESTERN CANADA

The Upper Devonian Woodbend reefs of central Alberta contain important hydrocarbon reserves. The discovery of 200 million bbl of oil in the Leduc reef in 1947 launched the modern petroleum industry in Canada.

The generation and capture of crude oil and natural gas in major pools require the associated development, within a depositional basin, of adequate volumes of petroleum source rock, reservoir rock, and strata configurations capable of trapping the hydrocarbons entrained in the fluid systems operative within the basin. The occurrence of the 3 requirements in relatively close proximity within the time-space realm provides a maximum opportunity for major hydrocarbon accumulations to form.

The Upper Devonian Woodbend Group of western Canada provided such an opportunity in central Alberta. It was deposited during a vast southerly transgression of the continent. Many depositional environments were present throughout the great length of the epicontinental basin. Clastic sedimentation dominated the northern "open marine" part of the basin, and shelf carbonates and evaporites were deposited in the shallow seas of the southern part. Biotic and depositional conditions, unique to the basin as a whole, developed along the margins of the carbonate seas. Biohermal reefs formed amid organically rich shale banks and both were enveloped within a short period of time