The Swan Hills reef complex is in the subsurface of west-central Alberta, 96 mi northwest of Edmonton. Early in 1957, Home Oil Company Limited discovered oil in these rocks at Virginia Hills and Swan Hills, and other discoveries in similar reservoirs within this complex soon followed. Before this, no commercial hydrocarbon production had been obtained from the rocks of this formation in Western Canada. By the end of 1966, the Swan Hills Formation ranked second in Western Canada in order of recoverable oil reserves.

Between the year of discovery and the end of 1966, a total of 219,160,459 bbl of oil and 48 Bcf of gas have been recovered from 12 oil fields and 1 gas field. Total remaining recoverable reserves are estimated at 2,105,955,111 bbl of oil and 1,380 Bcf of gas.

The oil is a paraffin-base crude with a gravity ranging from 38° to 45° API. Sulfur content of the crude may run as high as 0.42 percent but generally is less than 0.2 percent.

Drilling depths differ considerably, depending on the position of the field relative to the regional dip, ranging from 6,950 ft in the northeast to 11,350 ft in the western parts of the producing area.

The Swan Hills Formation is probably early Late Devonian in age and occupies a stratigraphic position low in the Beaverhill Lake Group. The reef complexes of this formation are situated along the edge of a broad carbonate platform south of the Peace River arch and east of the Western Alberta ridge. Continuing reef growth formed limestone mounds that consist largely of successive layers of superimposed atolls, each having an organic rim surrounding lagoon deposits. The resulting rocks form a complex pattern of porosity and permeability. The limestones of the reservoirs, with a few exceptions, have not been dolomitized. Stromatoporoids are the dominant organisms. The fields are simple stratigraphic traps, the oil and gas being held in the porous reef rocks by the surrounding impermeable rocks.

In the productive area, the Swan Hills reefs are enclosed in a shale and dense limestone facies of the Beaverhill Lake Group. North and northeast of this area, in northern Alberta, a gradual lateral facies change to predominantly shale of the basin facies occurs. South and southeast in southern Alberta and Saskatchewan, there is a lateral facies gradation to dense limestone and dolomite, accompanied by a gradual thinning of the total thickness. A band of coarsely crystalline vuggy dolomite is present along the margin of this shelf. Farther south, anhydrite is interbedded with the dolomite and salt beds are present.

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Storms and Sedimentary Processes Along Northern British Honduras Coast

The destructive capacity of coastal storms is well known; it is not generally known that, in some places, storms may be the principal agents of coastline construction. This capability of storms can be demonstrated along the coast of northern British Honduras, which is on the southern edge of the Caribbean storm track and is struck by periodic hurricanes and lesser storms.

The coastline of British Honduras is a complex of lagoons, mangrove marshes, and barrier ridges. Comparison of individual lagoons indicates an evolutionary sequence as tidal deltas grow into the lagoon from the rear edge of the barriers. Other, less active, sedimentary processes are: (1) filling of the lagoon with mud and shell debris, (2) encroachment by mangrove marshes, and (3) gradual elevation of mudflats. Together, these processes represent "normal" conditions.

Numerous abandoned tidal deltas occur along the barriers. In these deltas, the seaward mouth of the tidal channel has been blocked by barrier ridges. Thus, the construction of barrier ridges represents an additional process which, at least locally, is able to upset the balance of forces responsible for the construction of tidal deltas. Major storms can be shown to be the cause.

Scattered, newly formed beaches composed of soft, black, H_2S-rich mud occur in small bights along the coast. At Northern River Lagoon, the sequence, from top to bottom, of black mud (18 in.), flotsam (2 in.), and clean quartz sand (at least 4 ft) indicates that the beaches did not accrete slowly, but formed during a single event. As these beaches do not appear on photographs taken in 1944, the most likely event is Hurricane *Hattie*, which struck the coast in 1961.

At Midwinters Lagoon, a well-developed tidal channel, open in 1944, is now blocked by a beach at least 100 ft wide with ridge-and-swale topography. If colonized by mangrove, this beach probably will become a permanent addition to the barrier ridges.

The development of the British Honduras coast can be understood only by considering both "normal" and "catastrophic" events. The complex interplay of all agents must be appreciated.

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Diagenetic Changes of Organic Sediments in Atchafalaya Basin, Louisiana

Most sediments have been developed in association with some forms of biological activity. Thus the changes in distribution and the corresponding function of the organic matter in solubilization, complex formation, translocation, and subsequent recrystallization of secondary minerals must be considered in studying diagenetic processes during the post-deposition interval. An undisturbed core 120 ft long was obtained from the fresh-water environment of the Atchafalaya basin and studied. A deep boring from a brackish environment of the lower Mississippi delta was included for comparison. The organic matter in the sediments was hydrolyzed with 6N HCl for 12 hr; the clear hydrolysates separated were neutralized with NaOH. The soluble forms of total hydrolyzable-N, α-amino acid-N, hexosamine-N, and NH_4^+-N were determined quantitatively by a simple micro-steam distillation technique. The results showed that, in the Atchafalaya basin, the α-amino acid-N was higher in lacustrine environments (145 μg/g at 30-ft and 81 μg/g at 120-ft depths) and lower in well-drained swamps (68 μg/g at 67-ft and 49 μg/g at 96-ft depths). The distribution of hexosamine-N ranged from 95 μg/g at 30-ft to 36 μg/g at 120-ft depths. In the lower Mississippi delta core, the α-amino acid-N decreased sharply from 220 μg/g at the surface of a brackish-marsh environment to only 20 μg/g in a prodelta environment at a depth of 100 ft, whereas the hexosamine-N increased from 130 μg/g to 380 μg/g at the same levels. This suggests that the α-amino acid and hexosamine compounds were well preserved even to 100-ft depth and that their distribution was related to the initial environments of deposition. It was also found that in the fresh-water environment the percent organic-C was nearly parallel with the percent of $<5\mu$ fine clay and that the C/N ratio was related closely to the percent of total cementing minerals (such as $FeCO_3$, $MnCO_3$, $CaCO_3$, Fe- and Mn-oxides) which accumulated with depth. In addition, organic-N was found in the nodules. This demonstrates one of the important roles of soluble organic matter in the translocation or diffusion and subsequent redeposition or recrystallization of various minerals during the diagenetic process.

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PROGRESS REPORT ON TWO UNUSUAL ALASKAN SEDIMENTS—RECENT BEACH CARBONATE FROM THREE ENTRANCE BAY, AND POLISHED GRAINS FROM EASTER EGG HILL

BEACH CARBONATE

Modern southeastern Alaska cold-water skeletal carbonates are composed chiefly of whole and fragmented mollusks, barnacles, echinoderms, and foraminifers mixed with basalt pebbles and sand from the island bedrock. Average $CaCO_3$ content is about 80 percent by weight and increases from 0 percent at -4ϕ (16.0 mm) to 88 percent at 4ϕ (0.0625 mm). Texturally this beach sediment is polymodal, with two dominant modes: a gravel mode about -4ϕ and a sand mode about 2ϕ (0.25 mm). Traces of carbonate mud are present. Fractionating this sediment into carbonate and silicate mineral phases shows that these gravel and sand modes are present in each mineral phase. This suggests that selective size sorting in the beach environment, rather than fragmentation into certain size classes, may be the chief process involved in the formation of modal size classes for this sediment.

POLISHED GRAINS

Highly polished particles occur in (?)Pleistocene pebbly sandy loess on a topographic ridge in interior Alaska. Most polished particles have near-perfect roundness and occur in all sizes between -5.1ϕ (34 mm) and 4ϕ (0.0625 mm). Polished grain surfaces essentially are smooth, with some pits and very few facets. Rounded and polished grains are mixed with totally angular and dull grains. Polished grains seem to have bimodal size distribution, being abundant about -3.6ϕ (12 mm) and 0.5ϕ (0.25 mm). Modes from size analysis of loess do not correspond to modes for abundance of polished grains. Attempts to duplicate polished grains by tumbling unpolished grains from the same locality with wet and dry loess failed. Most polished grains are quartz; some are chert. Origin of these polished grains is uncertain. The following origins have been rejected: polish by wind-blown silt or ice crystals, solifluction, *in situ* chemical polish, and inheritance.

It is believed that these polished grains are gizzard stones produced by Pleistocene bird(s). Gizzard stones collected from grouse and ptarmigan in late winter are highly polished. Unfortunately, modal classes of gizzard stones from birds now living in interior Alaska do not coincide with modes of polished grains from the loess; average size of grouse gizzard stones is -1.0ϕ (2.00 mm) and of ptarmigan stones is -1.3ϕ (2.5 mm).

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SEDIMENTOLOGIC AND RESERVOIR CHARACTERISTICS OF ABANDONED DELTA DISTRIBUTARY

An abandoned delta distributary of the Bethel-Sample Formations, a very small part of the Michigan River system that supplied sand and mud to and across the Illinois basin during the Late Mississippian, has been delineated for 15 mi in west-central Indiana by outcrop mapping and shallow drilling.

This elongate sandstone body has sharp and relatively straight boundaries, averages 2 mi in width, and has a maximum thickness of 145 ft. Along its axis of maximum thickness the sandstone body fills a shallow channel cut in the underlying thick limestone sequence. Cross-bedding and ripple marks constitute its two principal facies and form as many as five fining-upward cycles. The ripple-bedded facies is very fine grained and much less permeable than the generally coarser grained cross-bedded facies. Cross-bedding dips uniformly southeast except in the very basal part of the sandstone body where the orientation is northwest—considered to be the product of up-channel tidal currents that introduced sparingly glauconitic marine sand into the shallow channel prior to deposition of the fluvially derived sand.

Decementation by groundwater percolating downward into the underlying carbonate has greatly increased the permeability of the sandstone body. The cross-bedded facies has an average permeability of 400 md except within 20–30 ft of the base where permeability values in excess of 2,000 md occur. Intra-sandstone-body channeling plus the distribution of the low permeability ripple-bedded facies modify permeability.

Comparable buried reservoirs should occur where an ancient distributary system is truncated by an unconformity with 100–200 ft or more of relief. Permeability will be enhanced greatly in such reservoirs if they are underlain by limestone and if the limestone-sandstone contact was above stream level during the development of the unconformity.

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GEOLOGY OF WOODBINE FORMATION IN EAST TEXAS OIL FIELD AND RELATED AREAS

The East Texas oil field is in the eastern part of Texas. It was discovered by random drilling by Columbus M. ("Dad") Joiner, October 3, 1930, on completion of the No. 3 Daisy Bradford.

The producing formation is the Upper Cretaceous Woodbine Sandstone. The geology of the Woodbine Sandstone in the East Texas field and related areas is comparatively simple. Regionally the field is on the western flank of the Sabine uplift, which controlled