gressive phase form carbonate reservoirs that are widespread in Texas, Arkansas, Louisiana, Mississippi, Alabama, and Florida. Although much of the upper Smackover displays packstone and grainstone textures, there are variations in the type of allochems, percentage of micrite, and clastic sand content. For example, there are oolitic grainstones in the upper Smackover of east Texas, Arkansas, Louisiana, and southeastern Mississippi; micritic, pellet packstones are most common in parts of Alabama and the Florida panhandle; and deltaic, beach, and offshore-bar clastic sands are intermixed with carbonate beds in much of Mississippi.

Of greater significance to the exploration geologist are variations in the amount and type of porosity within similar Smackover lithologies. These variations result from differences in diagenetic regimes. In Arkansas, Louisiana, and eastern Mississippi, the best reservoirs display incompletely cemented primary porosity. The preservation of porosity may be the result of early freshwater cementation, which occurred in areas that were uplifted and exposed during salt movement. Most of the updip Smackover carbonate grainstones contain leached moldic porosity, developed as extensive freshwater flushing occurred near the regional shoreline. Combinations of dolomitized intercrystalline and leached moldic porosity are prevalent in east Texas and Alabama-Florida. Dolomite porosity is less dependent on early salt tectonics, although salt structures may still affect the shape of the productive reservoir.

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Hudson Bay Basin

The Hudson Bay basin is a pre-Carboniferous intracratonic basin of about 375,000 sq mi (970,000 sq km) with a maximum sediment thickness of about 8,000 ft (2,400 m). Outcrop study and limited drilling prior to 1970 indicated the presence of Upper Ordovician carbonate rocks with thin, immature source beds; Middle Silurian carbonate rocks, including a significant porous biostromal unit; Upper Silurian to Lower Devonian red beds, evaporites, and carbonate rocks; and Middle to Upper Devonian carbonate rocks, evaporites, and clastics.

Detailed refraction mapping by Aquitaine et al suggested large north-trending fault blocks in the central part of Hudson Bay. Early reflection seismic profiling proved unrewarding until 1973 when Shell Canada Resources employed an experimental energy source and array that largely overcame previous problems. Reflection data confirmed the presence of fault blocks and added previously unavailable stratigraphic and structural detail. After extensive seismic surveys two offshore tests were drilled in 1974. One well (total depth in Precambrian granite at 5,170 ft; 1,550 m) encountered tight, secondarily cemented Silurian carbonate rock; the second test (total depth 4,341 ft; 1,302 m in Precambrian basement) penetrated a thin Carboniferous clastic sequence and found the objective Silurian carbonate section salt plugged. No hydrocarbons or indications of source rocks were found in either well. Although three tests in an offshore area about the size of Alberta are not conclusive, the lack of preserved porosity and the absence of hydrocarbons and source rocks are negative indications. However, the presence of up to 8,000 ft (3,400 m) of sediments in the central area of the basin would allow maturation of Ordovician source rocks, if such exist. Thus, there is still some potential in the Hudson _ay basin for hydrocarbon generation and accumulation.

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Laurentian Fan—Deep-Sea Fan Models, Fine-Grained Sediment Distribution, and Hydrocarbon Exploration

Thick sediment accumulations in deep water provide a new target in the search for oil and require an innovative approach to hydrocarbon exploration. The Laurentian fan is a large, deep-sea (2,000 to 5,000 m) fan in the western North Atlantic, and has been the major depocenter off Nova Scotia since at least the early Tertiary. The main development of the present depositional-erosional fan morphology occurred in the past 2 to 3 m.y. and was closely related to onshore glacial history.

The slope above the fan has been the site of rapid sedimentation and consequent slumping. A network of tributaries on the upper fan appears to feed three main channel systems, incised up to 800 m between broad asymmetric levees. These channels meander widely across the lower fan, then die out abruptly and pass into a lobate suprafan. Differences between the Laurentian fan and typical fan models result, in part, from the muddy nature of the sediment and the supply system.

The channels contain thick, coarse gravels which probably grade distally into sandy lobes. Both should produce good reservoir bodies with suitable source and trapping mechanisms. Fine-grained sediments were more important in fan construction. Interbedded turbidites, contourite, and hemipelagites are recognized in the late Quaternary sequence. The distribution of these sediments and, in particular, the recognition of structural sequences, textural trends, and fabric types in the fine-grained turbidites can be used to characterize particular parts of the fan environment. The development of this approach should prove useful in future hydrocarbon exploration.

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Evolution of Hydrographic Basins and Limnology of Eocene Lakes Gosiute and Uinta

The changes in Eocene Lakes Gosiute and Uinta are defined by patterns of clastic facies; chemistry, mineralogy, and biology of lacustrine sediments; and stratigraphic distribution of rock types. The variations in the dispersal of sand, distribution of rich oil shale, and mineralogic variations in evaporite facies correspond to major changes in hydrographic limits of the lake systems. The hydrographic limits of the basins controlled the input of terrigenous debris, the supply and nature of solutes, water depth, and organic productivity of the lake systems.

Expansion of the Lake Uinta hydrographic basin to include waters from the Lake Gosiute basin, late in the history of Lake Gosiute, led to a significant increase in water supplies to Lake Uinta. Initially, the sediment load of this water was trapped in the greater Green River basin during the final stages of Lake Gosiute, so that the water from the north was devoid of clastic debris. The influx of this water, nearly devoid of terrigenous material, resulted in high biologic productivity and the deposition of rich oil shales (Mahogany Bed) in the Piceance basin.

Facies patterns in the Green River Formation in the Piceance Creek and Uinta basins suggest that these two basins were separate lakes until the addition of water from the Lake Gosiute hydrographic basin. Prior to the merging of the lakes in the Piceance and Uinta basins, the brine evolution and, hence, the saline mineralogy were different in the two basins. In the Piceance Creek basin the evaporite minerals were sodium carbonates and chlorides, whereas, in the Uinta basin, the evaporite minerals were sulfate-rich. After merging of the lakes into greater Lake Uinta, the evaporite facies were characterized by sodium carbonate minerals.

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Biostratigraphy of Early and Earliest Late Cretaceous Ostracoda from Peninsular Florida

Deep wells in central and southern Florida have yielded 68 species of marine and brackish-water Ostracoda of Early Cretaceous and earliest Late Cretaceous ages. About 40% of the ostracods are referable to described species. The rock sequence is more than 2,250 m thick.

A partly oolitic limestone facies of the Washitan Stage (early Cenomanian–late Albian) contains 17 species, of which 15 are restricted to the unit. Brackish-water, and perhaps freshwater, as well as marine Ostracoda are represented.

Pre-Washitan Cretaceous rocks of peninsular Florida are principally massive, interbedded carbonate rocks and evaporites and thin shales. Ostracods occur chiefly in the shales. Of 23 species in the Fredericksburgian Stage (middle Albian), nine are restricted to the unit; marine and a few brackish-water species are represented.

Trinitian Stage (early Albian–late Aptian) ostracods are represented by 21 species, of which seven are restricted to that unit; several are brackish-water forms.

Coahuilan Series (early Aptian–Neocomian) rocks contain 35 species, of which 25 are confined to that unit; several are brackish-water types.

The environment represented by the ostracod populations is mainly that of an open-marine shelf bordered by partly brackish-water lagoons. Trinitian Stage rocks contain representatives of a few species which indicate outer-shelf or slope environments.

The population as a whole has strongest affinities for Cretaceous species of the Gulf coastal or Atlantic coastal United States. Several of the Coahuilan and Trinitian species show relationships to European and to South American forms. Few such relations are shown by Fredericksburgian and Washitan species.

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Normally and Reversely Graded Beds Within Large-Scale Foresets of Oolitic Lake-Margin Bench Sequence—Shoofly Oolite of Southwestern Idaho

Pliocene lacustrine oolites composing the lower part of the Glenns Ferry Formation crop out in a 40-km northwest-southeast-trending belt along the southwestern margin of the Snake River plain. Near Oreana, Idaho, where this limestone reaches 40 m in thickness, the oolite occurs as three progradational sequences, each consisting of thinly coated ooids in foreset beds up to 20 m thick; these beds are abruptly overlain by thickly coated, massive, burrowed oolite. Foreset beds, each 5 to 15 cm thick, dip basinward to the northeast at 30°; they exhibit both coarsening- and fining-upward trends. Reversed grading (coarsening upward) occurs high in each foreset unit, but the beds become normally graded (fining upward) near the base.

The Shoofly Oolite was deposited as three progradational bench sequences which built lakeward during short periods of stillstand in a longer transgressive phase of Lake Idaho. As such, each bench sequence is analogous to a "Gilbert" delta which extended laterally along the lake margin, but was fed by littoral sands which became coated during transport on the bench platform. Deposition of foreset beds by grain flow on the upper parts of the bench slope, and by fluidized sediment flow on the lower parts of the bench slope, resulted in the formation of reversely graded beds near the bench platform and normally graded beds near the base of the slope. During periods of rising lake level, but prior to the deposition of a subsequent bench sequence, abandoned bench platforms were extensively burrowed and winnowed by waves. As a result, deposition of cortical laminae on platform ooids continued, and the massive oolites which now cap each progradational bench sequence were formed.

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South Hallettsville; Gas Field in Lower Wilcox, Lavaca County, Texas

South Hallettsville field, discovered in 1976, produces gas and condensate from a lower Wilcox clastic wedge. The discovery well, General Crude Oil 1 Anderson, was drilled on an Edwards seismic closure, encountered high pressure gas sands in the lower Wilcox, blew out, and was abandoned. The replacement well had potential of 23,926 MCFGD flowing and 38.7 bbl condensate per MMCF of gas through perforations from 9,909 to 10,011 ft (2,973 to 3,003 m). Within 2 years this well had produced 2.1 Bcf of gas and 74,543 bbl of condensate.

The wedge has a sandstone shale ratio of 20%. Reservoir sands are medium to very fine grained, individual or stacked, and several inches to 25 ft (7.5 m) thick. The sand is 40 to 70% quartz with 10 to 35% feldspar and lithic fragments. The matrix is kaolinite, chlorite, illite, and illite/smectite with minor carbonate cement. Reservoir sands have porosities of 18 to 24.7% and permeabil-