epoch of activity, extending from the Middle Jurassic until the Early Cretaceous time it has been queiscent and the Central graben has been filled successively by chalks, sandstones, and, finally during most of the Tertiary, by shales or mudstones. The rate of subsidence of the basin, calculated by plotting observed depth in hole versus time, during this quiescent period appears to increase in the later stages. However, when compaction, water depth of deposition, and sediment load are considered, the rate of subsidence of the basement becomes close to linear trending to exponential.

Between 50 and 100% stretching of the Central graben during the last epoch of activity can account for the observed amplitude and rate of subsidence. Such stretching is compatible with the measured heat flow and though there is no actual seismic refraction data across the Central graben this explanation is strongly supported by evidence of a thinner crust under the Viking, Witchground, and Buchan grabens to the north. A geologic model based on stretching which can account for the Jurassic and Early Cretaceous faulting and the general post-mid-Cretaceous saucer-shaped basin is presented. On the basis of this model the thermal maturity and hydrocarbon potential of certain sedimentary horizons in the northern part of the Central graben are examined.

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Early Cretaceous Reef Communities in Gulf Coast

The development of paleocommunity concepts has led to new hypotheses of Cretaceous reef structures. Important biota of Early Cretaceous Tethyan reefs were corals and algae, besides various rudists. Different communities produced distinct structures upon shelf margins, interior shelves, and carbonate ramps. Further, the communities changed through time as rudists evolved. This change in community structure influenced the types of reefs prevalent at different times.

Bound framework associations consisted of coral skeletons thickly encrusted by algae and stromatoporoids and cemented by micrite soon after deposition as indicated by buried erosion surfaces. Boring organisms generated large amounts of micrite as well. Caprinids, radiolitids, and monopleurids are sparse. Bound frameworks developed upon Early Cretaceous shelf margins and carbonate ramps.

Mobile associations consisted of caprinids, radiolitids, and toucasiids encrusted by algae within a loose gravel of skeletal debris. Micrite and sparry cement are both well developed. Mobile associations formed passive banks in the shallower parts of the shelf margin and in high energy parts of the interior shelves. These buildups became important in the Aptian and later replaced the bound frameworks in the Late Cretaceous.

Stable associations consisted of caprinids, toucasiids, monopleurids, radiolitids, and caprotinids surrounded by calcareous mud. Many shells were thinly coated by algae and bored by sponges, among other organisms. The shells still are in a stable growth position. Micrite cement originally was more abundant than spar between grains. These biostromes, thickets, and coppices developed mainly upon interior shelves during Aptian to Maestrichtian time.

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Temperature and Pressure Relations in Thick Sequences of Accumulating Sediments

The various processes involved in fluid flow and thermal energy transfer in major sedimentary basins are closely interrelated. The major thermal energy transfer processes appear to include conduction, convection by upward-moving pore fluids both on discrete and diffuse scales, and possibly endothermic or exothermic reactions. Fluid flow in sequences of accumulating sediments is predominantly the result of excess pressures. These excess pressures were probably produced by compaction disequilibrium and aquathermal pressuring. The latter is strongly temperature dependent as are several other secondary causes of excess pressuring. The combination of pressure-producing factors may create conditions for natural hydraulic fracturing and for subsequent pressure dissipation and upward convection of heat. The pressure and temperature distributions in accumulating sedimentary basins are strongly dependent on (1) the thermal and hydraulic conductivities of the sediment, (2) the rate of sediment accumulation, and (3) the geothermal gradient.

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Paleogeography and Marine Communities of Silurian Carbonate Shelf in Utah and Nevada

Silurian shelf sea communities can be used as a tool in the interpretation of depositional environments in the Great Basin. The Laketown Dolomite was deposited in a shelf sea adjacent to the Silurian margin of the North American plate. Initial deposition began in the middle Llandovery and continued into the Wenlock. Shallow-water communities include a time-sequence of pentamerid communities in shallow, rough water and a dasyclad algae community in shallow, calm water.

Basins to the north and south of the Tooele arch formed in the late Llandovery. The northern basin was nearly filled by the end of the late Llandovery. The southern basin continued to deepen during the early Wenlock but was filled by the middle of the Wenlock. Communities from the basins reveal that the southern basin attained a greater water depth than did the northern basin. With increasing depth, brachiopod guilds were progressively more diverse while shell size and robustness decreased.

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Uranium Deposits of Part of Central Great Divide Basin, Wyoming

Economic uranium deposits occur within tabular, arkosic sandstones of a large Eocene "wet" fan complex known as the Battle Spring Formation in the central Great Divide basin. These "roll-front"-type deposits are located where the fan complex intertongues basinward with finer-grained fluvial, paludal, and lacustrine facies of the Wasatch and Green River Formations.

Two types of roll-front deposits have been identified: (1) essentially tabular, low-grade, disseminated deposits located along the eastern flank of a large tongue of oxidized sandstones, and (2) narrow, higher-grade C-shaped deposits located along the western flank of the same altered sandstone tongue. These uranium deposits occur at the basinward limit of a large alteration system consisting of a series of oxidation cells that extend from the northern margin of the basin 50 km southward. Behind the roll fronts, alteration is characterized by broad zones of various iron-oxidation colors which merge with mineralization on the east and diverge by as much as 1.5 km from mineralization on the west.

The grade of uranium mineralization and the corresponding alteration characteristics apparently relate to the steepness of the Eh gradient across the roll-front interface. Steeper gradients and consequently higher-grade mineralization in the western part of the area are related to the greater abundance of carbonaceous material in intertonguing Wasatch mudstones. Alteration patterns have become somewhat obscured in this western area owing to probable re-reduction of altered sandstones.

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Experimental Compaction of Lime Sediment

More than 30 in-situ cores of modern lime sediments, including environments from tidal flat to shallow marine, have been compressed under loads simulating depths ranging from 280 to 14,000 m of burial. Cores 10 cm in diameter and 30 to 40 cm in length were reduced to between one-quarter to one-third of their original length, resulting in porosity reduction from an initial 70 to 80% to 30 to 45%.

Experimental compaction produced sedimentary structures common to many ancient limestones, including (1) wavy organic seams similar to horsetail or microstylolite swarms; (2) reorientation of randomly oriented fossils toward a more horizontal posture; (3) flattening of filled burrows; (4) complete obliteration of birdseye voids; and (5) color mottling in tidal flat sediments produced by collapse and flowage of oxidized sediment surrounding burrows.

These studies have shown that, during geologically instantaneous periods of compaction (up to 30 days), the bulk of porosity reduction occurred under conditions simulating less than 300 m of overburden. Although fossils generally are not crushed during compaction, the obliteration of birdseye voids indicates that early cementation or infill by evaporitic minerals was necessary for preservation of ancient birdseye or fenestral structures. Pellets in soft lime mud were obliterated, but slightly hardened pellets in Bahamian muds were preserved during experimental compaction. This observation suggests that well-preserved pellets in ancient limestone indicate predepositional hardening or synsedimentary cementation.

Heating of cores to 100°C during compaction has produced hydrocarbon effluents, suggesting that some ancient limestones may have been source rocks.

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Sedimentary Facies Relations and Inferred Dynamics of a Single-Barred Nearshore Environment, Atlantic Coast of Eastern Long Island, New York

Facies relations in a conglomeratic single-barred nearshore environment on the glaciated Atlantic Coast of eastern Long Island, New York, were determined by examination of 42 can cores, bed-form distributions, and sediment textures.

Two principal subtidal zones are recognized. The shoreface zone (0 to 10 m water depth) is composed of clean fine to coarse sand and consists of the planar parallel to megaripple-laminated upper shoreface facies, the massively bedded longshore trough facies, and the megaripple to parallel-laminated longshore bar facies. The inner shelf zone (>10 m water depth) is composed predominantly of organic-rich fine sand and consists of the parallel-laminated transitional facies and the bioturbated offshore facies. Scattered throughout this zone are coarse sand outcrops of megaripple-laminated inner shelf lag facies.

By deployment of dye tracer and by inspection of bed forms in the longshore trough (during low wave-energy, fair-weather conditions) little evidence of longshore or seaward flow could be found. Landward migration of bar deposits over trough deposits was observed over a 6-week period during fair-weather conditions. A core in the trough facies adjacent to the distinct bar-trough contact revealed an underlying bar facies. An equilibrium model of near-continuous fair-weather landward migration of the bar facies interrupted by high wave-energy pulses of seaward movement of trough sediment is believed to account for the stable position of the longshore bar.

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Geometry of Shelf Sandstone Bodies in Shannon-Equivalent Sandstone in Northern Black Hills, Montana and South Dakota

The Groat Sandstone Bed of the Gammon Member of the Pierre Shale (Campanian), equivalent to the Shannon Sandstone Member of the Steele Shale of Wyoming, crops out on the north flank of the Black Hills, where it has been mapped. Subsurface studies in Carter County, Montana, reveal a 3,900 sq km area in which sandstone thickness exceeds 23 m. This area of sandstone includes two small elongate lenses in T6 and 7S, R54 and 55E. The lenses trend northwest and are approximately 16 km long and 6 km wide. In adjacent outcrops, sandstone grades downward and laterally to the northeast into siltstone and then to shale. Sandstone units are less than 15 m thick; near the base they are fine-grained and mottled with clay grading upward into bioturbated medium to fine-grained sandstone, which then grades upward into medium to coarse-grained sandstone with large-scale, trough cross-bedding.

The Groat Sandstone was probably deposited 322 km from the strandline near an outer shelf margin. This interpretation is based on published strandline positions