Role of Micro-Organisms in Formation of Limestone

The modern oölite, coral reefs, calcarenite, calcilutite, and beach rock are cemented with a $CaCO_3$ cement which consists of crystals of aragonite. Experimental evidence supports the view that the crystals of aragonite are formed by organisms which are thought to be actinomycetes.

The Floridan and Puerto Rican beach rocks are formed in tropical and subtropical climates in littoral and supralittoral environments and are confined to high-energy areas where there is daily agitation of water and a supply of fresh nutrients.

The Floridan beach rock occurs as an intermittent shallow shelf on the Atlantic coast from Key West to Key Largo and along the east coast from West Palm Beach to Jupiter. However, the Puerto Rican beach rock is primarily confined to the north side of the island where the formation of beach rock may be related to the path of the currents which bring nutrients to the surface.

The aragonite in these sediments is most likely of a biogenetic origin. However, the partial to complete alteration of the cementing agent to calcite is by penecontemporaneous solution and redeposition. In the alteration of aragonite to calcite, some of the $CaCO_3$ is removed in solution. Consequently, voids are formed within the matrix of the rock and the resulting rock can be very porous because of the development of microporosity.

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Résumé of Jurassic to Recent Sedimentation History of Gulf of Mexico Basin

The oldest marine sediments that are known to occur on all sides of the Gulf of Mexico basin are of Late Jurassic age. These sediments, mainly carbonates, overlie generally unfossiliferous sandstone, and shale, anhydrite, and salt of unknown age—possibly Jurassic, Triassic, or Permian. The Late Jurassic was deposited only after a probable shield area (which is postulated to have occupied the Gulf of Mexico basin) sank.

The Late Jurassic Smackover Limestone and equivalents were deposited above a very thick salt section. As the bordering lands rose, gravel, sand, silt, and mud of the Cotton Valley (up to 4,000 ft thick) were deposited. Deposition continued unbroken into Early Cretaceous time, beginning with up to 4,000 ft of Hosston and equivalents. In the southeastern part of the Gulf of Mexico, Early Cretaceous equivalents include carbonate, evaporite, and some black shale. After Hosston deposition, carbonates were deposited around the entire Gulf basin, though terrigenous clastics also were deposited in the northern region.

There is no significant regional depositional break between the Lower and Upper Cretaceous. In medial Late Cretaceous time, the sea transgressed farthest, coinciding with a worldwide eustatic sea-level rise. The Mississippi embayment formed and the sea reached southern Illinois.

Mountain-building activity and uplift at the end of Cretaceous time forced the sea from much of the continent. Carbonate deposition continued in the southeast from Paleocene through Miocene, but fine terrigenous clastics were deposited in the north and west (Midway-Velasco). As the mountains of the interior rose, clastic debris supplied to the basin was more abundant and coarser. In general the northwestern gulf shoreline was pushed seaward, though important transgressions occurred in early, middle, and late Eocene times and during the Oligocene. Deltas formed, and the local shifts in Miocene deltaic depocenters caused numerous local transgressions and regressions during that time. Sedimentation rates increased steadily. The Pleistocene deposits reach a thickness of 15,000 ft in the northern Gulf of Mexico.

Although a marine basin has occupied the Gulf of Mexico since Late Jurassic time, the existing gulf may be a very young feature. In fact, parts of the gulf may have been land during much of Jurassic-Pleistocene time.

The depositional and tectonic history, insofar as it is known, of the large gulf basin is described briefly. The need for more information on the geological history of all parts of the basin is apparent to anyone charged with exploring for minerals in this area.

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Structural and Stratigraphic Traps Related to Extrusive Rocks in South-Central Texas

Paralleling the Balcones fault zone, yet most numerous in the Uvalde salient and the Zavala syncline, are several dozens of ill-defined, olivine-basalt extrusives, most of which have been altered to serpentinite. Oil and gas production from rocks of Late Cretaceous to Tertiary ages exists on the crests and off the flanks of many of these domal features. There are many more domal extrusive complexes known from reconnaissance exploration, but, as yet, untested by the drill bit.

Age and rock type of the objective reservoir rocks are determined by the time when the underlying igneous body was extruded. Structural deformation or stratigraphic development above these effusive masses is primarily influenced by the presence of the extruded rock on an older rock surface. There are more clastic-rock reservoirs than domes. Oil or gas affinity for accumulation in either sandstone or limestone seems random. The serpentinite itself may serve as reservoir rock. Outpourings of igneous magma are concentrated in the Upper Cretaceous. Structure and stratigraphy of the overlying rocks into the Tertiary sediments are affected.

Hydrocarbon production from the domes ranges in depth from a few hundred feet to approximately 4,000 ft. The shallowest production is found above the shallowest extrusives, markedly demonstrating their structural and stratigraphic influence.

Exploration methods include surface geology, magnetic surveys, subsurface geology, and core drill near-surface geology. All methods are extremely effective where that particular geological method may be applied. From the standpoint of geology, land, and drilling, profitable objectives may be explored at minimum costs.

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Relationship of Mineral Composition of Shales to Density

(No abstract submitted.)

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Comparison of Some Gulf Coast Mesozoic Carbonate Shelves

(Read by title)

Three prominent periods of Mesozoic carbonate-shelf development in the Gulf Coast are represented by the Smackover-Haynesville, the Hosston-Sligo, and the Glen Rose-Edwards-Georgetown. In spite of obvious differences in character of shelves of these three intervals, certain similarities of depositional pattern should be helpful in predicting stratigraphic trends in unexplored areas or at untested depths. The most useful parameters for mapping were found to be percentages of the carbonate section having (1) dolomite and (2) oölites. Regionally the depositional patterns and consequent porosity patterns were dependent on climate and supply of clastics as well as on water depths and the distribution of the Louann Salt. Smackover depositional and structural patterns were affected by faults involving the pre-Mesozoic rocks. Reefs and shellbanks became more important in determining depositional patterns in the Cretaceous. Reef distribution appears to be related to the extent of the salt dome basins.

As additional subsurface control becomes available, patterns of reefing will be found to be more complex than can be demonstrated at present, with a possibility of echelon arrangement of some barrier reefs, and with more of the reefing demonstrably related to salt movement. There is also a possibility that some of the earliest salt movement may be related to loading by growth of thick carbonate shelves, as well as to triggering by movement on major faults.

The present economic limitations in some of the carbonate trends will be overcome by improved deep drilling techniques, more effective seismic methods, particularly at great depths and in the salt dome basins, and by new knowledge of the regional geology as a factor in determining porosity patterns.

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RECENT GEOLOGIC HISTORY OF WEST COAST OF FLORIDA: COASTAL MANGROVE SWAMPS, AND FLORIDA BAY

The Recent (last 10,000–11,000 years) geologic history of the northeastern corner of the Gulf of Mexico, *i.e.*, western and southern continental shelves of peninsular Florida, is recorded by the character and stratigraphy of outer-shelf and nearshore deposits. These deposits chiefly reflect the interplay of a generally rising sea level and the proximity of sources of terrigenous detritus, especially detrital quartz. For example, seaward of west-central Florida the outer shelf is essentially a bedrock surface overlain by a thin veneer of bioclastic sediment and biogenic reef growths that initially formed in a shallow nearshore environment. In contrast, the inner part of the shelf is flooded with shelly quartz sand or silt. Some of this detrital debris has been transferred to the shore to form prisms of quartzose beach sand, tracks of prograding beach ridges, and high coastal dunes. The quartz is chiefly derived from reworking of residual shelf and terrace deposits and drowned coastal plain sediments of Pleistocene age. Sources of detrital quartz disappear toward the south; consequently the inner belt of quartzose deposits narrows and becomes increasingly mixed with shell debris and finer calcilutaceous components in this direction. As an important constituent of shelf sediments, detrital quartz essentially vanishes by the latitude of Cape Sable (25°15′N). Attesting to this, the carbonate content of unconsolidated sediment in Florida Bay (just south of the cape) averages nearly 90 percent. This sediment is primarily composed of comminuted molluscan, foraminiferal, and algal debris, 80–85 percent of which consists of "metastable" aragonite and high-magnesian calcite.

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The calcarenitic and calcilutaceous deposits of Florida Bay are as much as 4 m thick and overlie a thin stratum of fresh-water peaty and calcareous sediment resting on a karsted bedrock surface of Pleistocene age. The basal fresh-water deposits have a radiocarbon age of approximately 4,000 years, which implies that sea level at this time was about 4 m lower than its present position. Also beginning about 4,000 years ago marine water slowly inundated the western margin of the fresh-water swamps of the Everglades, thereby providing the necessary paralic environment for the growth of the magnificent coastal mangrove forest and swamps of southwestern Florida. Strata underlying submerged waterways, intra-forest bays, and tidal channels of the swamps form a simple transgressive sequence consisting of a basal fresh-water unit of peat and calcitic mud, a middle unit of paralic and brackish-water peat, and an upper marine unit of organic-rich quartzose sediment or shell debris. Deposits underlying the floor of the mangrove forest, or associated salt-grass marshes, range from peaty and calcareous quartzose sand and silt to compact, fibrous autochthonous peat. These organic-rich units also indicate approximately 4 m of marine submergence during the last 4,000 years. Concomitant with this submergence a complex sequence of peaty and calcareous sediments accumulated along the western margin of the Everglades.

If lithified, the modern shelf and coastal deposits of the northeastern corner of the Gulf of Mexico would be mapped as a somewhat discontinuous and slightly time-transgressive stratigraphic sequence consisting of a variety of shallow-water facies composed of mixtures of three lithologic end members: (1) calcarenite and calcilutite, (2) quartzose sandstone and siltstone, and (3) coal. These facies, and their stratigraphic relations, duplicate some of the essential aspects of Paleozoic cyclothems.

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STRATIGRAPHY OF UPPER CRETACEOUS AUSTIN GROUP, CENTRAL TEXAS

The Austin Group in central Texas represents a distinct cycle of carbonate deposition that consists predominantly of soft, white, sparse to well-packed, pelecypod and foraminiferal biomicrite, popularly called chalk. The abundance of biomicrite and the general absence of biosparite suggest deposition below wave base on a broad carbonate shelf.

Between Dallas and San Antonio the Austin Group can be divided into four geologically distinct areas based on facies changes and thickness. These changes reflect the presence of two slightly positive areas, the San Marcos arch and the Belton high, that represented a more stable part of the shelf than the adjacent, more rapidly subsiding areas. The negative area between the San Marcos arch and the Belton high has been named the Roundrock syncline and the negative area north of the Belton high is referred to as the Dallas basin.

In the Roundrock syncline, from the type area in Travis County north through Bell County, the Austin Group ranges in thickness from 350 to 550 ft and is