Although the entire Gulf of Mexico region can be regarded as having reached the mature stage of exploration, many areas have not even been explored. As a consequence, it is possible that only half of the potential reserves of the entire Gulf of Mexico region have been found.

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Petrographic, Stratigraphic, and Structural Study of Smackover Gray Sand (Jurassic), North Louisiana

The Smackover Gray Sand is the target of intense exploration activity in the north Louisiana area. The gas-producing Gray Sand, a dark gray to black, very fine-grained sand, occurs as three sand tongues in the lower member of the Smackover Formation in the subsurface of Bossier, Webster, Claiborne, and Lincoln Parishes, Louisiana. The majority of Gray Sand wells have been drilled in Bossier and Webster Parishes; however, the most active exploration presently is to the east in Claiborne and Lincoln Parishes.

Samples of the Gray Sand are classified as subchertarenites because of their high percentage of quartz and the dominance of chert fragments over plagioclase. Additional mineral constituents include muscovite and biotite; oolites are also present. A flaser-bedded silty shale facies indicates deposition on a mid-tidal flat environment.

Smackover deposition during the Jurassic in the study area was located on the gently dipping slope between a broad coastal shelf on the north and a basin on the south. The Gray Sand was deposited over the Norphlet Formation and Louann Salt before flowage and swelling of the Louann Salt began. Uplift and swelling of the Louann Salt later in the Jurassic created growing anticlines; sediment slumped off the structural highs of the growing salt anticlines into basinal muds and silts. By superimposing the isopachous map of the Gray Sand interval over the structure map of the Gray Sand, it can be seen that the thickest Gray Sand intervals lie on the flanks of the anticlinal structures in South Sarepta, Ivan, and Cotton Valley fields. Absence of the Gray Sand between Ivan and Cotton Valley fields indicates a facies pinch-out due to localized deposition of sand tongues on the structural highs.

The Gray Sand, because of its low porosity (7 to 10%) and permeability (0.5 md), must be stimulated through hydraulic fracturing to be productive. Extreme bottomhole pressures and temperatures require the use of tailor-made high viscosity gels and high-strength proppants.

In Lincoln Parish fields, favorable structures for Gray Sand production are located by seismic exploration. The Smackover Gray Sand however continues to challenge exploration geologists because of the lateral pinch-out of its sand tongues.

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Nearshore Bars Along United States Gulf Coast

The microtidal, low-wave energy, United States coast of the Gulf of Mexico is characterized by an abundance of shoreface bars. Four distinct component bars can be identified, though interference patterns exist. Vertical air photos since 1945 and numerous overflights and field measurements during the last two years have shown that the equilibrium bar configuration at any given site is time-invariant. During storms, however, the bars go through cycles of change in a manner similar to those identified by Short.

Based on plan geometry the following four bar types are identified.

Multiple (10 or more) longshore bars—Multiple longshore bars, without interference from other bar types, occur on the low-tide platform in front of a steep beach face, along shoreline segments of convex plan form and low wave energy. The bars have a sinusoidal cross-profile, constant height, and constant spacing suggesting that they form in response to a standing wave pattern established through interference between incident wind waves and waves reflected from the steep beach face.

Transverse bars—Bars oriented at steep angles relative to the shoreline dominate in low energy environments (Mississippi Sound and other sheltered embayments) along the central Gulf coast. Intersecting transverse bars, forming an overall rhombic pattern, dominate the lagoonal platform behind the Mississippi-Alabama barrier chain. The mainland shoreface of Mississippi Sound, however, is dominated by intersecting transverse and multiple longshore bars.

Generally, transverse bar spacing appears to be proportional to bar amplitude. The transverse bar morphology reflects a complex interaction between incident, high-frequency waves and the resultant longshore currents.

Crescentic bars—The Gulf beaches of barriers and spits of the Florida panhandle, Alabama, and Mississippi are characterized by crescentic bars or single longshore bars. The crescentic form is best developed adjacent to, or between, shore-normal structures which might be jetties, groins, or natural headlands. This suggests that the crescentic bar morphology forms in response to a wave motion transverse to that of the incident waves, i.e., edge waves which are expectedly best developed trapped between reflecting shore-normal structures.

Longshore bars—These bars characterize the entire Texas coast and many Louisiana barriers. This coastline has the highest wave energy in the study area. The constant crest-to-trough water depth ratio, the asymmetric cross-profile, and the landward decrease in size and spacing suggest that these are breakpoint bars.

These four component bars, all resulting from different mechanisms of generation, occur either individually or in different patterns of superposition creating six commonly observable bar morphologies along the Gulf Coast barriers and mainland shores. Specific coastal subenvironments are characterized by time-invariant equilibrium bar configurations.

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Late Paleocene Planktonic Foraminiferal Biostratigraphy of Tuscahoma Marls, Southwest Alabama

Using vertical distribution of planktonic foraminifers