lithified patches of the formation take on a nodular appearance as bioclastic debris is cemented. Cementation by microspar and bladed pseudospar occurs in burrows, shells, and as random nodules. Microspar is typically equant and uniform with an average crystal diameter of 14 μm. Microspar formation results in an increased crystal volume characterized by exploded shells and extruded matrix. The crystal formation is an early diagenetic phenomena and probably driven by the presence of organic matter.

In addition to microspar, aragonitic shells are commonly replaced by neomorphic sparry calcite. Replacement appears to occur along an advancing front and is probably a result of thin-film reactions. There is no crystal volume increase.

Neomorphic spar (often referred to as "pseudospar") is formed by a different process than microspar (pseudospar) and the final diagenetic effects are different. Distinction should be made between types of pseudospar, and the terminology clarified.

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Should We Permit Mississippi-Atchafalaya Diversion?

About one and a half billion dollars is planned for the relocation of control structures, upgrading guide levees, and developing the Atchafalaya basin as a wetlands resource in the coming decade. What would be the engineering, cultural, environmental, and economic consequences should the Mississippi River be diverted through its Atchafalaya distributary? Perhaps the answer is that the future of southern and coastal Louisiana would be better served if the river were not shackled with artificial and costly engineering restraints and were permitted to choose the shorter, natural path to the sea. This paper proposes an in-depth comparison of situations which: (a) maintain the status quo, (b) consider the effects of a gradual, planned increase in the rate of diversion, and (c) consider the effects of a rapid, uncontrolled diversion during an immense flood or series of floods.

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Modern Lagoonal Ostracodes and Species Diversity Gradients, Gulf of Mexico

Observed species diversity trends have been explained by the time-stability model of Slobodkin and Sanders. Their model predicts low rates of speciation from equable into hostile environments. Species radiation from tropical, unstressed (equable) environments into higher latitude stressed (unequable) zones should be relatively slow. Speciation from hostile (stressed) to equable (unstressed) biotopes should occur faster. These differences in rate will theoretically result in lower species diversity in hostile regions. This model is tested with ostracode population data collected from two modern lagoons in the Gulf of Mexico: Laguna Mandinga, Veracruz, Mexico (19°04′N lat., 96°04′W long.), lies south of the Tropic of Cancer, and is a small (20.39 sq mi or 53 sq km) tidal lagoon indenting the coastal plain of Mexico about 5 mi (8 km) southeast of the port of Veracruz; and Bay St. Louis, Mississippi (30°20′N lat., 89°20′W long.), is a shallow bay of slightly smaller area (16.52 sq mi or 43 sq km) about 13 mi (21 km) southwest of Gulfport. These two brackish-water bodies are separated by 11°16′ lat. (~ 716 mi or 1,146 km) and 6°44′ long. (~ 422 mi or 675 km). Both water bodies have been quantitatively sampled for benthic ostracodes. Total (live + dead) populations from 35 sample stations in Laguna Mandinga and 23 stations in Bay St. Louis ($\sum = 58$) furnish data which provide an estimate of latitudinal diversity gradients between these two depositional environments. Diversity measures calculated for each water body include S (number of species), H(S) (Shannon-Wiener function), and E (equitability). Calculations show that average S values in Mandinga (5.171) are higher than those in Bay St. Louis (2.870). Average H(S) values in Mandinga (1.214) are also higher than in the Bay (0.633). Average E values in Mandinga (0.673) are lower than those in the Bay (0.842). These diversity values indicate ostracode species are more prolific in Gulf of Mexico tropical lagoons; they demonstrate lesser species dominance in tropical Mexican lagoons; and they show less species equitability in the tropical environments. Temperate bays in the northern Gulf apparently support fewer ostracode species, show stronger species dominance, and are more equable in species distribution. These data support the time-stability hypothesis, and suggest the tropical Mexican ostracode fauna is slightly older, hence more diverse than the temperate northern Gulf fauna.

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Environmental and Diagenetic Controls of Carbonate and Evaporite Source Rocks

The organic geochemistry of shale source rocks has been a subject for extensive research during the past two decades. Many useful interpretive techniques have been developed for the assessment of hydrocarbon potential of sedimentary basins in which shales are the principal and logical source for petroleum generation. Nevertheless, the present understanding of carbonate and evaporite source rocks remains superficial. The criteria generally employed to assess shale source rocks are inadequate and misleading when applied to carbonate-evaporite basins.

Most misconceptions regarding the hydrocarbon potential of carbonate and evaporite rocks stem from a simplistic notion that organic matter associated with the sediments on well-aerated carbonate shelves and evaporite-depositing environments is not likely to be preserved. Recent data on organic geochemistry of Holocene carbonates from shallow shelves suggest that (a) organic matter can be preserved in certain environments; and (b) the kerogens produced from degradation of organic matter in carbonate sediments are predominantly sapropelic and therefore much more efficient sources for hydrocarbons than the mixed humic-sapropelic kerogens of shales.

The preservation of organic matter in carbonates and evaporites is controlled primarily by environments of deposition and the diagenetic overprints. Sabkha, lagoonal and basinal environments, for example, are excellent for organic-matter preservation; vadose and freshwater phreatic diagenetic environments are not favorable. However, the marine phreatic diagenetic environment is favorable.

The transgressive-regressive couplets, which consist of numerous upward-shoaling cycles, provide for generation and accumulation of hydrocarbons. The transgressive cycles are generally favorable to preservation of organic matter, whereas the regressive cycles are favorable sites for development of porosity. Where the transgressive-regressive couplets are buried at a sufficient depth to bring about the thermal degradation of organic matter to petroleum, major accumulations of hydrocarbons occur.

The synchronous and post-sedimentary tectonic events also seem to have a positive influence on the source-rock potential of carbonates and evaporites. Rapidly subsiding shelves would place the organic-bearing carbonates below the destructive influence of the freshwater phreatic zones. Late structural movements could produce the microfracture systems which would form the avenues for petroleum migration from source to reservoir rocks.

Geochemical data on ancient rocks strongly suggest that sabkha evaporites should be seriously considered as a possible source rock for petroleum.

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Regional Stratigraphy of Upper Jurassic Smackover Carbonate Rocks of Southwest Alabama

Upper Jurassic Smackover deposition in southwest Alabama was primarily controlled by the Mississippi interior salt basin and the Manila and Conecuh embayments, and closely approximated carbonate sedimentation in the present Persian Gulf. These depositional sites are characterized by distinctive lithofacies and fossil assemblages. Early salt movement produced local variations in carbonate-sediment distribution, and pre-Jurassic paleo-highs, such as the Wiggins uplift and Conecuh arch, also modified carbonate sedimentation.

Throughout much of southwest Alabama, the Smackover Formation consists of a lower predominantly mudstone lithofacies which overlies the Norphlet sandstone and an upper lithofacies sequence dominated by grain-supported textures which is overlain by the Buckner anhydrite. Where present, the lower Smackover lithofacies include laminated mudstone and some peloidal wackestone, peloidal-oncolitic packstone, and dolomite. The upper lithofacies sequence consists of oolitic or oncolitic grainstone, peloidal or oncolitic wackestone to packstone, and some dolomite and mudstone.

Petroleum traps in southwest Alabama are principally combination traps involving favorable stratigraphy and salt anticlines, faulted salt anticlines, or extensional faults associated with salt movement. Reservoir rocks include grainstones; leached and dolomitized wackestones, packstones, and grainstones; and dolomite. Porosity is facies-selective and is developed chiefly in lithofacies of the upper Smackover. Porosity includes primary interparticulate, secondary grain moldic, intercrystalline dolomite, vuggy, and fracture. The algal mudstones that characterize the lower Smackover and are interbedded with upper Smackover lithologies throughout most of southwest Alabama make excellent petroleum source rocks.

The flanks of the Wiggins-Conecuh ridge and updip Smackover grainstones associated with salt structures are excellent areas for petroleum exploration in southwest Alabama. The key to successful prospecting is the delineation of traps associated with salt movement and recognition of either high to moderate energy lithofacies that have had their primary interparticulate porosity preserved or of lithofacies that have been dolomitized or leached with the development of intercrystalline dolomite or secondary grain moldic porosity.

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Geology of Gum Island North and French Island Areas, Jefferson County, Texas

The Gum Island North field is adjacent to a small topographic feature of the same name elevated over 5 ft (1.5 m) above tidal marsh about 13 mi (21 km) west of Port Arthur, Texas. French Island field along Taylors Bayou is 4 mi (6.4 km) due north of Gum Island. The two fields, discovered as a result of the same initial exploration effort, are combination stratigraphic and structural traps. The principal reservoirs are Oligocene middle Frio–Hackberry in age. They are localized as a result of rapid filling of downward troughs created by older growth-fault structural movement, principally of Vicksburg age, but persistent during lower and middle Frio. Pre-Hackberry structural maps, Hackberry sand-distribution maps, and structural and stratigraphic maps, both prior and subsequent to discovery, as well as seismic and subsurface cross sections, demonstrate the nature of the oil and gas traps, as well as the geologic history of the area.

At both French Island and Gum Island, an erosional surface of significant magnitude is at the base of the Hackberry. The resulting unconformity does not greatly affect Hackberry accumulation at French Island, but at Gum Island the stratigraphic position of the unconformity relative to older beds is not only indicative of strong structural uplift, but it also bears a direct relation to individual subsequently deposited Hackberry sand reservoirs.

Exploratory drilling prior to discovery is described, along with an exploration philosophy requiring knowledge of the geologic history and depositional patterns of the trend, detailed geologic analysis of drilling results, stratigraphic integration of paleontologic data, as well as detailed and imaginative geologic use of seismic data, all with a long-term will to persist.

Statistics concerning reserves of oil and gas discovered as a result of this exploration are not made a part of this report. However, the results are expected to be 150 to 250 Bcf of gas and 6 to 10 MM bbl of oil and condensate when ultimately developed. The topside numbers could easily double when additional expected local turbidite "potholes" are drilled.

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Depositional Systems in Nacatoch Sand (Upper Cretaceous), East Texas Basin and Southwest Arkansas