on the margin. The result was to store sediment in the continental interior until much later in the development of the margin. Cenozoic sea level decline coincided with the interaction of North America and Pacific spreading centers focusing anomalously large volumes of sediment on the northern Gulf margin. The only other passive margins with similar timing and which might have a similar history are those associated with the initial splitting of Gondwanaland.

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Diagenesis and Pore Types of Norphlet Sandstone (Upper Jurassic), Hatters Pond Area, Mobile County, Alabama

The Norphlet Sandstone is one of the productive hydrocarbon reservoirs in the Hatteras Pond field. Despite its great burial depth (− 18,500 ft or − 5,638 m), this sandstone retains fairly good porosity (10 to 14%), but has low permeability (0.1 to 5.0 md). Evaluation of pore-size measurements and pore types helps to explain the low permeability. Pore types are classified on time of generation (primary, secondary), size (megapore, mesopore, micropore), and mode of occurrence (intergranular, intragranular, micropore). Analyses of published data of permeability, porosity, and pore types indicate that intergranular pores produce the best permeability, and that intragranular and micropores provide low permeability. Microporosity is determined empirically as the difference between the porosity determined by porosimeter and in thin section.

Effective hydraulic pore radius ($\bar{r}_e$) is defined as the radius of a straight capillary pipe having the same permeability as the rock under consideration. Most $\bar{r}_e$ values for Norphlet samples indicate the presence of micropores. Observation shows that pores of the water-bearing Norphlet are mostly intergranular and intragranular pores, whereas the hydrocarbon-bearing part has mostly micropores because of extensive illite cementation. Following decementation of carbonate and anhydrite, authigenic illite was precipitated in the sandstone and produced low permeability by two means: (1) by plugging throats of relatively large intergranular pores, and (2) by developing septa that subdivide large intergranular pores into small ones.

Principal diagenetic events in the Norphlet were (1) shallow cementation by anhydrite and calcite, (2) decementation, (3) dolomitization and illitization, (4) deep cementation, and (5) stylolitization. Decementation of anhydrite and calcite is probably related to hydrocarbon generation and accumulation and with briny formation water. Authigenic illite developed in secondary pores following decementation and largely controlled reservoir behavior. Differences in reservoir quality in the water-bearing and hydrocarbon-bearing zones are interpreted to be caused by different times of decementation and durations of illite development in the two zones.

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Reliability of Microfossil Assemblages as Paleoenvironmental Indicators

Ostracoda and Foraminifera have been used throughout the petroleum industry as paleoenvironmental indicators even when the reliability of the assemblages cannot be demonstrated. Such reliability can be evaluated only by knowing if the fossils have been subject to transport by water currents.

In this study, threshold velocities of shells were measured in a flume with a moveable sediment substrate. The velocities were different for the several genera and some species thereby providing a means of evaluating fossil assemblages. An assemblage composed of specimens with the same threshold velocities would have been transported (sorted) or represent the residual after other shells had been moved away. An assemblage with shells having different velocities would be undisturbed and would be reliable as an environmental indicator.

The best predictors of threshold velocity for the small calcareous shells are several measures of shape including the maximum projection sphericity and operational sphericity. They can be used to predict (.01 level) threshold velocities and provide a reliable objective means of testing the usefulness of fossil assemblages.

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Marine Environmental Terminology and Depth-Related Environments

To aid the petroleum geologist concerned with geologic and paleontologic reconstructions, this paper reviews the classification of marine environments as used widely by oil company micropaleontologists in the coastal regions of the Gulf of Mexico, and offers a tabulation in categories of the more commonly used environmental terms to clarify their usage. Uniform usage of environmental terms by geologists and paleontologists is desirable for clear communication, especially those terms relating to depth-related environments identified by fossils, such as the neritic, bathyal, and abyssal realms.

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Diagenesis and Reservoir Potential of Upper Jurassic Smackover Formation of South Texas

The hydrocarbon potential of the Smackover Formation in south Texas is virtually untested. Much of the section penetrated is impermeable, however, reservoirs as thick as 33 ft (10 m), with porosity ranging from 4 to 26% and permeabilities ranging from 0.1 to 6.5 md, have been cored at depths below 18,000 ft (5,486 m). Nearly complete dolomitization has resulted in the development of intercrystalline porosity in inner-shelf wackestones and shoal-complex grainstones. In addition, some grainstones have subsurface-derived oomoldic porosity.

In the grainstone facies, four general stages of diagenesis affected porosity: Stage 1 (marine-phreatic environment)—precipitation of an isopachous carbonate cement and extensive grain micritization; State 2 (shallow-meteoric environment)—precipitation of very coarse-crystalline snytaxial calcite and fine-crystalline equant calcite, dissolution of aragonitic skeletal grains, and incipient solution-compaction; Stage 3 (regional fluid-mixing environment)—pore precipitation of and grain matrix replacement by fine- to medium-crystalline rhombic dolomite; and Stage 4 (subsurface environment associated with basinal fluid expulsion)—dissolution of ooids and dolomite, microstylolitization by solution compaction resulting from decarboxylation of kerogen, and precipitation of coarse-crystalline calcite and baroque dolomite. The magnitude of each general diagenetic stage varies regionally.

Porosity development in dolomitized wackestones is sporadic but within grainstones porosity is in part facies related. Hydraulically equivalent oolitic grainstone and oolitic quartzarenite facies are commonly dolomitized and have