structure of strata around the domes, and to ascertain the growth history of the domes as a means to evaluate tectonic stability. Upper Cretaceous to lower Eocene strata bound the upper part of the domes. Three main types of domes have been interpreted from well-log data: (1) at Hainesville dome, Upper Cretaceous strata exhibit notable thickening in a rim syncline, and stratigraphic markers dip toward the dome except near the contact with domal material; (2) at Keechi dome, strata are uplifted and dip away from the dome; strata thin toward the dome; (3) at Oakwood dome, strata are approximately horizontal until near the dome edge, where they are upturned; minor thickening of strata occurs toward the dome. Differences in stratigraphy and structure of Cretaceous-Eocene strata in the vicinity of these domes are attributed to differences in growth history.

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Smackover Reservoir—Interpretation Case Study of Water Saturations Versus Production

Predicting the initial production from wells drilled in certain Smackover reservoirs is often difficult. Production history from the field, core analyses, and log data have not always proved to be helpful.

The Smackover reservoirs for which interpretation is difficult fall into two categories. The first is oolitic limestone characterized by low resistivity, moderate porosity, and reasonable permeability. High water saturation (S_w) calculated from logs does not necessarily preclude hydrocarbon production. The second is oomoldic limestone typically having high resistivity, very high porosity, and low permeability. Although log interpretation indicates low water saturation, no hydrocarbons are produced.

Cores from these reservoirs were studied to evaluate the relations now employed for understanding and predicting production. The investigation included determination of the "m" and "n" exponents (commonly known as the cementation and saturation exponents in Archie's equation), evaluation of the microporosity by scanning-electron microscopy, and laboratory determination of density, porosity, and permeability.

Results of the rock physics investigation support the empirical relations established, provide data for improved interpretation, and can be expanded to include other Smackover reservoirs within the same diagenetic facies.

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Petrography of Some Subsurface Igneous Rocks of Mississippi

Cuttings and cores from test wells in 13 Mississippi counties were examined for igneous material. Samples appearing to be igneous were studied in 41 thin sections. Rocks were classified as intrusive dikes, extrusive volcanics, and basement granite. Alteration of rock types is moderate to severe.

Intrusive dike rocks and extrusive volcanic rocks are present at depths from 3,562 ft (1,085 m) to 10,010 ft (3,043 m). The basement granite observed is present at 11,010 ft (3,347 m) in Lafayette County in north Mississippi and 18,826 ft (5,738 m) in Jackson County in the coastal area.

Basement granite of Precambrian age represents the oldest stratigraphic interval recognized. Volcanic extrusive rocks and plutonic intrusive rocks have been interpreted to be present in sediments of Paleozoic through Cretaceous ages. Available age dates of the volcanic material indicate Jurassic to Late Cretaceous activity.

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Sedimentation on Trailing Plate Margin—Northern Gulf Coast

The breakup of Pangea and the splitting of South America from North America in the early Mesozoic left a rifted and attenuated trailing margin on the latter plate which became the initial depositional surface for a sedimentary sequence of Late Triassic to recent age. The Late Triassic Eagle Mills Formation and its equivalents are interpreted as being the initial deposits confined to rift grabens of the attenuated plate margin. Deposition of Jurassic evaporites resulted from sedimentation by the brine-mixing process in the restricted circulation of a young and narrow seaway similar to the Red Sea. Upper Jurassic and Cretaceous strata represent the transgressive deposits formed as open-marine conditions prevailed as the plates diverged and the North American plate margin subsided. Laramide tectonism in the continental interior provided a rejuvenated hinterland source area that supplied the voluminous sediment for the regressive and prograding Cenozoic clastic wedge.

Studies of this entire sedimentary record reveal the influence of the tensional effects of continental splitting and lower crustal creep that established the initial depositional surface that slowly subsided as proposed by crustal thinning and the thermal-decay curve of cooling oceanic lithosphere. In addition, these studies also reveal the control and influence of (1) inherited structures of the rifted margin, (2) hinterland source areas, (3) the timing and amount of differential subsidence between continental and ocean crust, (4) active syndepositional faults, (5) hinge lines, and (6) postdepositional rejuvenation due to contemporary plate movement.

Not only do these studies add to our understanding of the geologic history of the area, which is most important for development of successful exploration programs, but they provide a guide for the study of sedimentary infills within ancient lithospheric plates, a neglected but important task facing all who are confronted by the complex problem of interpreting the sedimentary record of ancient basins.

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