and 1.1 MMCFGD. This well tested a seismically identified, sub-Jurassic topographic feature. Four unsuccessful confirmation attempts have revealed not only the difficulty in accurately predicting structural position, but also the complex facies relationships present in the upper Smackover.

Conventional cores from 5 wells reveal that in many places original depositional facies are masked by several diagenetic phases of recrystallization and dissolution. Mineralogically, the upper Smackover section is almost entirely dolomite of probably primary origin in the crestal areas, and early secondary origin on the flanks of the structure. Reservoir porosity and permeability are highly variable across the field and are controlled by several interrelated factors. Primary depositional fabric, completeness of dolomitization, and leaching of nondolomitized components were all important in creating reservoir-quality rock. Dolomitization of moderate to high-energy facies in many places resulted in porous and permeable crystalline dolomite with a sucrosic texture. In some places, incomplete dolomitization left remnants of the primary fabric that were later leached, leaving a vuggy texture. The occurrence of nonreservoir-quality rock can be attributed to (1) nonporous dolomite of supratidal origin, (2) occlusion of pore spaces by several later generations of dolomitization, or (3) occlusion of pore spaces by anhydrite.

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Cyclicity and Paleo-Environmental Dynamics of a 1.9 Ga Passive-Margin Carbonate Terrace, Wopmay Orogen, N.W.T.

The 1.90-1.89 billion year old Rocknest Formation in the Northwest Territories is a west-facing, passive-margin carbonate terrace in the foreland of Wopmay orogen. Initial outbuilding of an accretionary stromatolite rim over downslope facies was followed by upbuilding of the rim, local backstepping of the rim, and terminal subduction-related drowning of the entire shelf. The rim was flanked to the west by deep-water slope rhythmite and breccia, and on the east by a carbonate-shoal complex, separating the ocean from a broad (100-200 km wide) lagoon with a siliciclastic eastern shoreline. Concurrently, the shoal complex underwent repeated eastward expansion over the lagoon to form about 150 shoaling-upward cycles (1-25 m thick), consisting of carbonate tidal-flat tufa that overlies storm-dominated, mixed carbonate-siliciclastic lagoonal facies. Correlation of cycles for over 200 km parallel with and 100 km across depositional strike shows that cycle boundaries abut facies boundaries, indicating that complete shoaling of the lagoon to sea level was not required to induce the next submergence increment, suggesting an allocyclic rather than autocyclic mechanism. Radiometric constraints bracket cycle periodicity between 25,000-40,000 yr/cycle. These values are within the range of known earth orbital cycles (periods at 19,000, 23,000, 41,000, and 100,000 yr), the likely cause of Pleistocene glacio-eustatic sea level oscillations, and possibly Rocknest cyclicity. Rocknest cycles can be modeled using period and amplitude of sea level oscillation, and subsidence and sedimentation rates as variables. Resulting computer-generated cyclic stratigraphies are compared to actual Rocknest cyclic stratigraphy in order to constrain variables responsible for cycle development.

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Continuous Fracture Probability Determination as Applied to Monterey Formation

Most open-hole logs can be used for fracture detection. Each petrophysical measurement responds to fractures in a different way, and much literature exists describing the effects of fractures on tool responses. Most fracture detection programs use either one or two logs or many fracture indicators, but make no attempt to tie them together. Since fracture systems appear to provide nearly all the permeability for production in the Monterey Formation, fracture analysis is essential throughout the well. A program has been written to give a continuous output of fracture probability using all fracture information available from well logs, as well as from mud logs and drilling data. It is easily adaptable to local conditions (in particular, the Monterey Formation) through log analyst input. The program computes a composite fracture probability using all available fracture indicators. Each indicator will give an individual probability of fracturing. These probabilities are then weighted and combined to give a composite fracture probability.

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Crustal Rifting and Subsidence of Sirte Basin, Libya: a Mature Hydrocarbon Province

The complex rifting and subsidence history of the Sirte basin serves as an instructive case study of the tectonic evolution of an intercratonic extensional basin. The Sirte basin formed by collapse of the Sirte arch in the mid-Cretaceous. Marine sediments accumulated following initial crustal arching and rifting as the basin was flooded from the north. Upper Cretaceous strata lie unconformably on igneous and metamorphic rocks of the Precambrian basement complex, Cambrian-Ordovician Gargaf Group, or the pre-Cretaceous continental Nubian Sandstone. The most rapid subsidence and accumulation of basinal strata occurred in the early Cenozoic; however, the basin has been relatively stable since the Oligocene. The basin is floored by a northwest-southeast-trending mosaic of narrow horsts and grabens, an important structural characteristic that distinguishes it from the adjacent intracratonic Kufra, Murzuk, and Ghadames basins.

The details of basin subsidence, sediment accumulation rates, and facies variations have been reconstructed for the northern Sirte basin from a suite of approximately 100 well logs and numerous seismic lines. Subsidence-rate maps for short time intervals from the mid-Cretaceous through the Eocene show a continual shifting of the loci of maximum and minimum subsidence. The nonsteady character of basin subsidence may reflect a periodicity of movement on the major basement-rooted growth faults bounding the underlying horsts and grabens.

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Correlation of Illite Crystallinity and Thermal Maturity in Carboniferous Strata of Ouachita Mountains

Carboniferous shales from the Ouachita Mountains have been studied to determine mineralogy and thermal maturities, the latter ascertained by means of vitrinite reflectance and bitumen/organic carbon ratios.

The less than 2 μm fractions of these shales indicate 2 major clay-mineral components, illite and chlorite, and 2 minor varieties, expandable clays and pyrophyllite. Expandable clays are found at low thermal maturities and pyrophyllite at high maturity. Scanning electron micrographs show differences in clay morphology and texture, which are influenced by the degree of thermal maturity.

Weaver's sharpness ratio for illite and Kubler's crystallinity index are both significantly related to mean vitrinite reflectance. The log of the sharpness ratio increases while the log of the crystallinity index decreases with increasing mean vitrinite reflectance. These relationships suggest that illite crystallinity is controlled by the same geologic agents that control vitrinite reflectance, namely temperature and time.

A plot of vitrinite reflectance and/or crystallinity index versus bitumen/organic carbon ratio shows a maximum analogous to a hydrocarbon window.

These statistically significant correlations provide a useful means of estimating the thermal maturity of these strata where they contain insufficient amounts of vitrinite for thermal maturity evaluation.

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Subcrop-Supracrop Play Concept: Example from Manitoba, Canada

In the Canadian portion of the Williston basin, oil exploration has been based on the concept of the subcrop stratigraphic trap. The truncation of porous Mississippian strata at the Paleozoic angular unconformity, combined with either erosional or Mississippian structure, defines the play. In