lapse feature, was a tear fault with a vertical component up on the north; (4) the Wind River fault is a zone consisting of segments that moved separately; and (5) there are at least two unmapped fault zones along which the core of the Wind River Range was uplifted.

These interpretations suggest that compression in the Wyoming foreland continued significantly later than early Eocene. An imbricate thrust model is proposed to accommodate these observations and interpretations.

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Sedimentological Cross Section of Cambro-Ordovician Carbonate Shelf (Knox Group, Conasauga Formation) in Central Alabama: Facies, Diagenesis, Potential Reservoirs

Cambro-Ordovician thrust-imbricated carbonates in central Alabama are the focus of renewed exploration interest. Samples from east-west-trending core holes within the surface-most thrust plates reconstruct the carbonate shelf and shelf-edge facies before deformation. The Upper Cambrian shelf margin now is in the subsurface of Talledega County; coeval dolostones in the western part of the state represent the former shelf interior. Rock analogs to former environments include the following. (1) Barrier shoals (Conasauga Formation)—dark colored, partially dolomitized ooid and skeletal grainstones. (2) Submerged back-barrier and offshelf dolomitized sediments (lower Knox Group)—western belt: finely crystalline algal thrombolites, fenestral dolopelmicrites, rippled beds; eastern belt: finely laminated dolostones, slope-derived pebbles and graded beds. (3) Tidal flats (upper Knox Group)—light-colored, crystalline dolostones, dolomitized pellet grainstones, algal laminites, pseudomorphs after sulfates and early diagenetic chertification. (4) Former emergent shelf-(Knox unconformity)—pelmicrite, skeletal wackestones, erosional chert pebble conglomerate.

Multiple possibilities for hydrocarbon reservoirs appear throughout the sequence. Vuggy and intercrystalline dolostone porosity is primarily in the lower Knox formations. Primary interparticle pores are retained in lower Knox algal buildups. Breccia porosity occurs in the strata below the Knox unconformity through solution of the underlying Knox Group. Fractures in the subsurface are believed to enhance permeability in all porosity types.

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Predicting Pore Pressure and Porosity from VSP Data

Presently, VSP is being used to predict interval velocity and depth beneath the drill bit. The method is to exploit special properties of the VSP to produce a successful inversion to acoustic impedance. Depth and interval velocity are derived from the acoustic impedance prediction. This technique is often a valuable aid in making drilling decisions. Other rock properties may be computed from the same data.

Pore pressure is one such rock parameter that can be computed from interval transit times and depth. The product of interval transit times, depth, normal compaction ratios, and an area constant is pore pressure. Pore pressure prediction is as reliable as the predicted velocities and depths. In reservoir evaluation, and sometimes in the well completion program, porosity is the important rock property. The interval transit times predicted beneath the bit can be used to compute porosity. Unlike pore pressure, porosity computations require knowledge or assumptions about the rock matrix and shale percentages. For certain conditions these values are know. Further penetration of a reef in search of deeper porous zones is an example of a viable condition for porosity prediction.

For both these rock properties the same conventions employed by well log analysis in modifying and interpreting results are needed. Where the parameters assumed fit the actual conditions, the results should have merit. If not, further interpretation is required.

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Porosity Type and Distribution in Selected Richfield Oil Fields, Middle Devonian, Central Michigan Basin

The Richfield zone of the lower Middle Devonian Lucas Formation has been a source of significant quantities of hydrocarbons in the north-central and Saginaw Bay area of Michigan. Production through 1980 totaled 91,639,006 bbl of oil.

Prior work, which interpreted the Richfield's environment of deposition to be sabkha, neglected any detailed study of porosity type and distribution within the zone.

Integration of data from core analysis, contemporary geophysical well logs, and thin-section analysis provided a basis for delineating porosity types and porosity distribution within the fields. Porosity type and origin were determined by using the guidelines of Choquette and Pray. Patterns of porosity were mapped within producing fields and presented as "time-slice" contour maps and cross-sectional fence diagrams.

This approach will allow better understanding of the development of porosity in these sabkha carbonates and provides a more reliable method of predicting porosity trends.

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Mineral Oxidants and Porosity Enhancement

In many important hydrocarbon reservoirs, aluminosilicate framework grain dissolution constitutes an important part of the porosity (i.e., the Gulf Coast). Our experimental work has shown that difunctional carboxylic acids can increase aluminum solubility by three orders of magnitude. Oil field brines are observed to contain concentrations of monofunctional carboxylic acids up to 10,000 ppm, but only traces of difunctional acids. Oxidative degradation of kerogen is a commonly used technique in the study of kerogen structure, and results in extremely high concentrations of difunctional carboxylic acids (up to 40% of the carbon released from type 3 kerogen is in the form of oxalic acid).

The reduction of mineral oxidants and consequent oxidation of organic matter may be as effective in releasing peripheral difunctional carboxylic acid groups from kerogen as thermal degradation in the natural system. The coincidence in time, temperature, and space of smectite/illite ordering (release of Fe^{+3} from octahedral layers) and the peak concentrations of carboxylic acids suggests a possible mechanism for the generation of difunctional carboxylic acids. This mechanism would allow highly soluble difunctional carboxylic acids to be swept through adjacent sandstones just prior to hydrocarbon generation. Thus, an ideal mechanism is available for dissolving carbonates and/or aluminosilicates out of pores and pore throats, thereby enhancing porosity and permeability in hydrocarbon reservoirs.

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Nature and Significance of Austin-Taylor Unconformity on Western Margin of East Texas Basin

The Taylor Marl unconformably overlies the Austin Chalk on the western margin of the East Texas basin. Along this contact, up to 275 ft (84 m) of upper Austin is missing in the Waco area and up to 450 ft (137 m) in Bell County. However, the Austin Chalk appears to have been more-or-less uniformly deposited throughout the study area. Apparently regional uplift caused a regression that terminated Austin deposition and was related to the erosion of the upper Chalk. While the unconformity is areally extensive, slightly angular, and accounts for a relatively long period of time, the mechanism of erosion that caused the unconformity is still uncertain. Erosion was terminated by the deposition of the lower Taylor Marl. Taylor "A", the lowermost subdivision of the lower Taylor, was deposited in a near-shore environment that was highly variable.

Of particular interest is the relationship of this unconformity to structure and probably to oil occurrence in the Austin Chalk in McLennan and Falls Counties. Major Austin fracturing, which apparently does not extend into the Taylor in Falls County, clearly indicates that structure in the Chalk, at least in part, antedates Taylor deposition.

Oil occurrence in the Chalk is clearly related to fracturing and probably is localized by post-Austin-pre-Taylor fracture systems.

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Late Quaternary Shelf Margin Deltas, Northwest Gulf of Mexico

Deltaic deposition during a eustatic sea level fall occurs in two phases, each controlled primarily by the morphology of the sea floor and the rate