apart basin nucleated and subsequently developed throughout Middle Pennsylvanian time. Smaller subbasins developed by orthogonal spreading along intersecting northeast-trending transform faults, where the rate of basin-floor subsidence was related to combinations of normal and strike-slip faulting. The greater Paradox basin was episodically deepened during Middle Pennsylvanian time by rejuvenated extensional basement faulting. Vertical displacement was greatest along the Uncompahgre front, which caused tilting of the basin and deposition of an asymmetrically thick sedimentary sequence.

By mid-Desmoinesian time, the rate of divergent strike-slip faulting slowed considerably. Folds caused by minor wrench movements provided shoaling conditions along the southwest shallow carbonate shelf where porous algal mounds developed. Meanwhile, continued tectonic movement and space-reduction of the basin floor may have triggered salt flowage and diapirism in the deep eastern pull-apart trough. As wrench tectonism diminished from late Desmoinesian through Early Permian time, the eastern portion of the basin continued to subside and was filled with marine and continental sediments.

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Geologic Interpretation of a Seismic Profile Across Oregon Basin Thrust, West Flank of Big Horn Basin, Wyoming

A seismic profile across the central western rim of the Big Horn basin, Wyoming, provides evidence of major flank thrusting beneath the Oregon Basin anticline. Vertical separation at the Precambrian basement level on this westerly dipping thrust zone is at least 6 km (20,500 ft), as verified by a deep footwall test of a spurious subthrust structural closure. The displacement on the Oregon Basin thrust is the same order of magnitude as that measured on the Casper Arch thrust and about half of that on the Wind River thrust. Actual fault plane dip cannot be accurately determined on the seismic profile because of poor seismic returns from the subthrust block, but based on data from other seismic line crossings of the thrust it appears that the fault plane dips west at about 45°. Under this assumption the amount of overhang at the Precambrian-sediment contact is at least 3 mi (4.8 km), and could be as much as 5 mi (8.0 km) if the fault plane is listric. Forward seismic modeling has helped in the selection of the most likely fault-plane solution and in understanding the attenuation of footwall seismic data.

The seismic profile traverses three major thrust-fold trends in the hanging-wall block (all with westerly asymmetry), each of which contains an important oil accumulation. From east to west, these are: Oregon Basin, Horse Center, and Half Moon.

In the footwall block of the thrust, Mesozoic and Paleozoic rocks beneath the Tertiary unconformity dip uniformly west at low angles, and this regional homoclinal dip continues for about 30 mi (48 km) across the Big Horn basin to the first line of thrust-folding (e.g., Garland trend) on the eastern basin flank.

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Pre-Laramide Tectonics—Possible Control on Locus of Turonian-Coniacian Paralic Coal Basins, West-Central New Mexico

Published evidence indicates that Late Cretaceous shorelines trended northwest through west-central New Mexico and adjacent Arizona. Our investigations delineate these shorelines through time and relate them to the prominent northwest-trending monoclinal flexures in the Zuni and southwestern San Juan basins. We related the transgressive (T)-regressive (R) marine cycles (T2-R2, T3-R3, T4-R4) of C. M. Molenaar to deep-rooted monoclinal or asymmetric anticlinal structures. The T2-R2 turnaround is coincident with the Pinon Springs anticline in the northern part of the Zuni basin and appears to be controlled by the Atarque and Gallestina monoclines in the southern part of this basin. Shoreline configurations during the T3 and T4 transgressive maximums coincide with the axis of the Nutria monocline and relate to some subtle pre-Laramide movements along this structure. The R2 regression is unique to New Mexico, suggesting local tectonic control on the configuration of the seaway. The subsequent T3 transgression, which was a major widespread event elsewhere in the Western Interior, was abbreviated in west-central New Mexico near the location of the Nutria monocline.

The T2-R2 through T4-R4 shoreline turnarounds produced numerous paralic basins favorable for the accumulation of organic detritus. A turnaround probably represents a period of slow rates of shoreline migration which allowed a thicker, more extensive accumulation of plant material and hence thicker coals. The present and most of the past coal production in the Zuni and southwestern San Juan basins is from coals formed in paralic basins just landward of the turnarounds caused by pre-Laramide tectonics.

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Continental-Scale Ground-Water Flow Systems and Occurrence of Oil and Gas

Physical processes in continental-scale ground-water flow systems account for the migration and accumulation of oil and gas. Conceptualized discharge areas correlate well with existing fields, and flow-system dynamics offer explanations for discrepancies in physical and chemical properties of hydrocarbons for the observed pressure-temperature regimes.

Quantification of continental-scale ground-water systems demands that we apply Darcy's law and fluid-continuum mechanics to all rocks regardless of geologic and petrologic character. However, difficulties arise in quantifying continental flow systems because data have not been generalized for the purpose. For example, a lot of potentially useful data contain transient components which diminish their utility. In-situ data for rocks with low intrinsic permeabilities are virtually nonexistent.

Slice or slab maps offer a partial solution to overcoming the most difficult problem: how to represent three-dimensional (time-dependent) phenomena adequately using maps and cross sections.

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Time-Temperature Reconstructions of Diagenetic Systems

Predicting the distribution of porosity and permeability enhancement in hydrocarbon reservoirs can be achieved by integrating the generation of carboxylic acids, phenols, mineral oxidants, and liquid hydrocarbons in time-temperature space. Such predictive models can be constructed by linking data from oil-field water chemistry, source rock geochemistry, clay mineralogy, clastic diagenesis, thermal modeling and basin analysis.

The detailed organic and inorganic geochemistry and the thermal scenarios used in the time-temperature analysis must be basin specific. Predictive time-temperature models using kerogen-specific kinetic parameters have been developed for two tectonic settings: rift or "pull-apart" basins, and intermontane or "Laramide" basins. From these integrated reconstructions, the optimum conditions and capacity for porosity and permeability enhancement can be predicted.

The optimum conditions for porosity and/or permeability enhancement are: (1) short migration distances, (2) rapid evolution from organic solvent generation to the liquid hydrocarbon window (thermal environments associated with crustal attenuation or overpressuring could cause such perturbations), (3) adequate fluid flux (organic acids are highly water soluble), and (4) available conduits in potential reservoir rocks (fractures, unconformities, or preserved original porosity).

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Echo Springs Upper Almond Field, Washakie Basin: Study of a Successful Tight Gas Reservoir

The Echo Springs (upper Almond) field is an economically successful tight gas reservoir. A study of the upper Almond reservoir petrophysics and performance was undertaken to explain reservoir and production anomalies between the upper Almond "sweetspot" and "non-sweetspot" areas of the field, and to develop a geologic and economic model of the field that could be used to evaluate other areas for tight gas potential. Well performance in the upper Almond is a unique function of depth of burial and reservoir overpressuring, pore size and pore throat radius, and connate water saturation. The sweetspot and non-sweetspot production profiles correspond to two distinct upper Almond rock types. Variations