that the Tx-La basin was periodically isolated from normal seawater during Louann deposition; radiogenic fluids, derived either from local red beds or from meteoric waters, equilibrated with seawater prior to anhydrite precipitation.

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Seismic Structure and Stratigraphy of Eastern New York–Western Vermont

A reconnaissance grid of 550 mi of Vibroseis data extending from northernmost Vermont to slightly north of Albany, New York, provides a framework for analyzing subsurface structure and stratigraphy of eastern New York and western Vermont.

Regional stratigraphic analysis based on outcrop sections indicates northward and eastward thickening of the Cambrian-Ordovician shelf sequence. Synthetic seismograms from wells in Quebec and southwestern Washington County, New York, document this change in the subsurface and correlate the seismic stratigraphy. Seismic data indicate thickening occurs north of the "Whitehall culmination," an approximately 40-mi long buttress area of Adirondack Grenville basement. Changes in thickness appear to be gradual and not fault controlled.

Foreland thrust systems of New York and Vermont relate via a displacement transfer or lateral ramp zone associated with the "Whitehall culmination." Both thrust systems accomplish final emplacement of metamorphic sheets, deform them, and transport shelf material, which is predominantly shale in New York with increased percentage of carbonates in Vermont. Deflection of several major structural elements illustrates the culmination's buttress effect.

Subsurface structural elements in New York include western graben, central horst block, and eastern fault-zone trends. No analogous trends have been identified in Vermont where predominant faulting is down-to-the-east. Significantly, in southwestern Washington County, New York, preexisting horst blocks do not serve as ramps to deflect thrusts upward. Instead, the Snake Hill-Smiths basin and Schuylerville thrusts shear off the upper sedimentary sequence of the horst and transport it westward.

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Powder River Basin, Wyoming: Structural Development, Hydrocarbon Migration, and Accumulation

The geographical location of oil accumulations in the Powder River basin, Wyoming, is closely related to present basement structure. About 70% of the basin's cumulative oil production has been obtained from only 12 fields or 23% of the total fields. Each major oil field lies in an area of a pronounced positive Bouguer gravity anomaly and in the path of preferred regional hydrocarbon migration. Powder River basin Bouguer gravity anomalies most likely are caused by a combination of present basement structure and density changes in post-Paleozoic sediments; the latter are the result of synsedimentary basement structure and/or related topographic features influencing post-Paleozoic sedimentation. Stratigraphic and structural traps occur in close interrelationships across the basin. Published geochemical data in connection with available regional subsurface data permit mapping the preferred migration paths for oil and gas across the basin. Future discoveries of major hydrocarbon fields will be made in these hydrocarbon migration paths and areas in and around regional positive Bouguer gravity anomalies. Powder River oil field distribution follows general rules known from practically all producing basins but rarely used for lack of sufficient integration of geological and geophysical data. Gas field distribution is expected to be similar to oil field distribution.

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Examples, Causes, and Consequences of Vitrinite Reflectance Suppression in Hydrogen-Rich Organic Matter—a Major Unrecognized Problem

Vitrinite reflectance (R_0) is regarded as one of the most powerful tools available to petroleum organic geochemistry. A major limitation of this method is the severe suppression of R_0 by significant exinite maceral concentrations (hydrogen-rich types I and II kerogen) in association with vitrinite macerals. This effect is not subtle, as R_0 in hydrogen-rich organic matter (OM) is suppressed at least 3-5 times from what the value would be in oxygen-rich OM (type III kerogen), and the effect extends to at least $R_0 = 4.0$. The effect has been attributed to the migration of early generated bitumen from hydrogen-rich OM into the associated vitrinite macerals with the bitumen retarding maturation of vitrinite macerals. However, this explanation for R_0 suppression is inadequate in many cases.

Suppression of R_0 is due more likely to 2 factors: (1) anaerobic conditions at deposition and diagenesis when much greater amounts of hydrogen than "normal" are incorporated into the vitrinite macerals, and (2) hydrogen-rich OM requiring significantly higher burial temperatures to attain the same maturation rank as oxygen-rich OM. Thus, all maturation indices, including R_0 and the threshold of intense hydrocarbon generation (TIHG), are suppressed in hydrogen-rich OM compared to oxygen-rich OM buried under the same conditions.

R_0 values are primarily derived from exinite-rich sediments, leading to the establishment of the R_0 value of 0.6 (± 0.1) for the TIHG in hydrogen-rich OM. Far higher R_0 values are read in oxygen-rich OM at the same regional rank for the TIHG in hydrogen-rich OM. The "oil deadline" has been defined as occurring at $R_0 = 1.35$. There is a sharp decrease in the maximal values of the hydrocarbon coefficient (mg HC/g OC) at $R_0 = 0.9$ to the very low values at $R_0 = 1.35$ in type III OM. This decrease of the hydrocarbon coefficient, previously assumed to result from the thermal destruction of C_{15+} hydrocarbons by carbon-carbon bond breakage, is actually due to a loss of C_{15+} hydrocarbons by intense primary petroleum migration by gaseous solution. This general lack of recognition of R_0 suppression and the necessity of higher burial temperatures to attain the same maturation rank in hydrogen-rich OM compared to oxygen-rich OM has led to a miscalibration of the regional ranks necessary for significant petroleum generation from hydrogen-rich OM and the oil deadline. Examples from the Los Angeles and Williston basins as well as other areas demonstrate these problems.

The consequences have staggering implications to petroleum exploration and to basinal and worldwide petroleum resource estimates.

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Controls on Pennsylvanian Algal-Mound Distribution in Mid-Continent North America

Middle (Desmoinesian) and Upper (Missourian) Pennsylvanian phylloid algal-mound distribution in Missouri, Kansas, and Oklahoma is largely controlled by subtle sea-floor topography. Topographic highs served as loci favoring initiation and continued growth of complexes. Topographic highs controlling mound distribution are the "shelf-edge rise" in northeastern Oklahoma, the "Bourbon arch" in southeastern Kansas, and the " Mine Creek prodeltaic shale buildup" in west-central Missouri.

Outcrop studies document controls on development of these mounds and reveal the potential for development of stacked mounds. This will help exploration for these features in the subsurface to the west.

The shelf-edge rise and Mine Creek prodeltaic shale buildup control the location of the Oologah algal-mound complex and an isolated algal mound in the Pawnee Limestone, respectively. These apparently were positive features only during Middle Pennsylvanian time. In contrast, the Bourbon arch apparently was controlled by basement faulting and remained high for a more-extended period of time. Both Middle and Upper Pennsylvanian algal mounds coincide with the geographic position of the Bourbon arch and result in a stacked-mound complex. Evidence suggesting that the Bourbon arch was a positive feature are (1) thinning of clastics over the feature and (2) change from anoxic, black, fissile, and phosphatic basinal shales to oxygenated, diversely fossiliferous gray shales over the arch.

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Petrology of Middle Jurassic Twin Creek Limestone, Lincoln and Sublette Counties, Southwestern Wyoming