diagenesis is nearly isochemical.

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Relation of Lithofacies and Diagenesis to Porosity Development, Mission Canyon Formation (Mississippian), Eastern Montana and Western North Dakota

The ability to map lithofacies trends suitable for hydrocarbon reservoirs is critical for a successful exploration program. In exploring basins with carbonate reservoirs, diagenetic alterations must also be understood in relation to porosity development. The Mission Canyon Formation (Mississippian) of the Williston basin provides an excellent example of the need to understand the lithofacies/diagenesis relation.

During the Mississippian, the Williston basin was the site of subtidal to supratidal carbonate deposition. In general, depositional environments became more restricted from Montana, eastward into North Dakota. Subsurface mapping suggests a strong relation between the degree of marine restriction and diagenesis and porosity development in carbonate sediments. Two fields that produce from the Mission Canyon interval illustrate this relation.

MonDak field, situated on the Montana-North Dakota border, lies west of the limit of massive Mission Canyon anhydrite, in a sequence of normal marine sediments. Reservoir porosity is due to fracturing of tight, fine-grained limestones. Low matrix porosity and sparse, erratic fracturing are responsible for low daily production rates.

The Billings Nose–Little Knife trend (Billings, Dunn, and McKenzie Counties, North Dakota) lies well within the limit of massive anhydrite. Reservoir porosity in this case consists of a thick sequence of intertidal-supratidal sucrosic dolomites which are sealed by 20 to 25 m of massive anhydrite. Reflux of Mg-rich brines is believed to be the process leading to dolomitization.

Good matrix porosity and permeability allow for higher daily production rates. Regional mapping indicates that the presence or absence of anhydrite is in direct correlation with the development of good matrix porosity.

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Regional Assessment and Interregional Comparison of Oil Exploration Potential—Breaking the Time Barrier

At any time, the degree of exploration may vary widely within a region or between regions. Regional assessments or interregional comparisons based on projections of field-size distributions in time-series discovery data are therefore dependent upon non-uniform evaluation of oil potentials. In this study, drilling history data from wells in Kansas are used to identify the various times at which all locations within regions of the state achieve selected exploration levels. Maps of the regional variation in time associated with a uniform level of exploration demonstrate the historical step-out pattern of the industry.

Known oil fields in Kansas are ranked in relation to prior exploration in the vicinity of discovery wells, with low-rank values corresponding to low density of prior exploration. All known fields within a region are classified into sets. Each set consists of fields discovered at various times, but at a uniform exploration level. Probabilities of discovering fields at different levels of exploration are developed in relation to field size. Projections of the ultimate number of fields in each size class expected within a region are then obtained through analysis of field-size distributions within each of the uniform exploration sets. By subtracting known fields from the ultimate number expected in each size class, a measure of future regional potential for continued exploration is obtained. Measurements of the success of exploration by the petroleum industry relative to the potential success from random drilling are also obtained.

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Arumbera Sandstone: A Possible Late Proterozoic-Early Cambrian Deltaic Complex, Central Australia

A detailed investigation of the Arumbera Sandstone was undertaken in the northeastern Amadeus basin, central Australia, where the unit forms distinctive strike ridges with orange-white cliffs and dark reddish slopes. The Arumbera is divisible into four informal, readily mappable units.

Approximately 80% of the "average" stratigraphic section is composed of recessive, pale-red, thin to medium-bedded, fine to medium-grained arkose with major proportions of siltstone and mudstone. These sediments are interpreted as a complex assemblage of coastal and nearshore marine environments including tidal flats, tidal channels, estuaries, and beaches. Evidence includes: (1) predominance of alpha, beta, and xi cross-stratification with common herringbone laminae, hummocky cross-strata, planar foreshore stratification, and flaser bedding; (2) bimodal paleocurrents; (3) records of intermittent subaerial exposure; and (4) rare to abundant marine trace fossils.

The remaining 20% of the Arumbera is composed of cliff-forming orange-white thick-bedded, fine to medium-grained arkose and lithic arkose with pebble to cobble conglomerate. This facies probably is a fluvial sheet sandstone. It is characterized by: (1) pi and omicron cross-stratification; (2) general paucity of mudrocks, but abundant shale pebbles; (3) unimodal, northeast-oriented paleocurrents; (4) wedging channel-sand bodies; (5) absence or extreme rarity of trace fossils; (6) sheet-like geometry; and (7) decrease in maximum grain size to the northeast.

The Arumbera probably was deposited in a coastal environment unrestricted by vascular land plants, but perhaps analogous in other ways to the delta of the modern Godavari River of India. Evidence includes: (1) a pronounced depocenter for the unit in the central part of the study area (thickness northeasterly from 216 to 1,123 m in 80 km); (2) unidirectional paleocurrents from fluvial sheet sands that radiate to the north, northeast, east, and southeast; (3) fluvial and coastal deposits in vertical, repetitive succession; and (4) east and northeast-trending zones of thicker deposits within fluvial sheet sands which may be distributary lobes.

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Diagenesis of Lime Mud, Mississippian-Age Bioherms, Sacramento Mountains, New Mexico

Samples from six Waulsortian bioherms were examined from the Mississippian Lake Valley Formation, Sacramento Mountains, New Mexico, to determine the timing and mechanisms of lime-mud cementation and to evaluate the role of this cementation in biohermal stabilization and growth.

Petrography and cathodoluminescence of bioherm and interbioherm muds defined distinct diagenetic mud types. Each mud type is characterized by a distinct grain size, mud color, and cathodoluminescence. Bioherm *type 1* mud is dark gray, fine-