proposed that these cohesive sediments have moved downslope, and that folds developed in response to increasing lateral confinement as sediments converged within bathymetric lows. The general style of deformation, preservation of bedding, and absence of faults suggest that movement occurred at a slow rate, probably as creep.

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Influence of Transcontinental Arch on Cretaceous Sedimentation and Petroleum Occurrences in Western Interior

A regional thinning of the marine Niobrara Formation and equivalent strata, trending northeast across Colorado and adjacent states, reflects movement on the Transcontinental arch during the Late Cretaceous. The isopach pattern reflects low rates of deposition on the arch, a regional unconformity at the base of the Niobrara with onlap onto the broad structural high, and other unconformities within or at the top of the formation.

Isopach maps of the Lower Cretaceous and of four time-stratigraphic intervals in the lower part of the Upper Cretaceous (approximating the Graneros, Greenhorn, Carlile, and Niobrara Formations) were prepared from surface and subsurface data. These maps suggest that tectonic movement of the Transcontinental arch affected the seafloor during times of worldwide changes in sea level. The major movement occurred during deposition of the upper Carlile and Niobrara Formations (late Turonian to early Santonian).

This structural movement on the Transcontinental arch may have been significant in early stratigraphic entrapment of petroleum in high structural positions in the Dakota sandstones at two of the largest gas fields in the area: Wattenberg field in the Denver basin and the Blanco field in the San Juan basin. The downwarping of the traps into their present low structural positions occurred during the Laramide orogeny in latest Cretaceous and early Tertiary time.

The Transcontinental arch is but one of several northeast-trending cross-basin arches that influenced sedimentation and petroleum occurrences in Cretaceous of the Western Interior of North America.

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Comparison of Pore-Filling Material in Some Pennsylvanian and Cretaceous Reservoir and Nonreservoir Sandstones

SEM and thin-section study of core samples from producing sandstones and associated fine-grained facies from several stratigraphic intervals of Pennsylvanian and Cretaceous age in the Rocky Mountain region show different processes of pore-size reduction relating to: (1) original pore-fluid composition; (2) grain size and texture; (3) depositional environment; (4) timing of diagenesis; and (5) depth of burial.

The sandstones studied and depositional environments are: Tyler Sandstone, southwestern North Dakota, shoreline (barrier island); J sandstone, northeastern Colorado, distributary channel and channel margin; Frontier Sandstone, northeastern Wyoming, offshore marine bar; Almond Sandstone, southwestern Wyoming, shoreline (barrier island or tidal channel); Terry and Hygiene sandstones, northeastern Colorado, offshore marine bar; and Raton Formation, southeastern Colorado, fluvial channel and channel margin.

All the reservoir sandstones were deposited by relatively high-energy transport processes in fluvial, brackish, or marine depositional environments, and represent initially "clean" sandstones with relatively good porosity and permeability. Pore space in five of the six reservoir sandstones has been initially reduced by precipitated kaolinite or chlorite. The Tyler Sandstone, a nearshore sandstone which underwent early near-surface diagenesis, exhibits reduced porosity related to precipitation of caliche.

Associated fine-grained, nonreservoir facies show a pore-filling composition that differs from the reservoir facies in both the marine and nonmarine sequences.

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Influence of Basement Tectonics on Depositional Systems and Seismic Stratigraphy

The new field of seismic stratigraphy has focused attention on the reconstruction of depositional models in which seismic responses can be evaluated and interpreted. In many exploration programs, geologists and geophysicists limit their work to processing data from relatively thin petroleum-productive sequences. Amplitude and other seismic anomalies and porosity variations are studied in search for the elusive stratigraphic trap without concern for what geologic conditions are present at the deeper basement level.

Current research in oil-productive basins indicates that recurrent movement on basement fault systems during deposition may have had an important influence on the distribution of "reservoir rock," on early fracture systems controlling petroleum migration, and on other subtle trapping mechanisms. The concept of drape folding over basement faulting can be related to the concept of fault control of facies changes. Therefore, establishment of fault trends in the basement may aid in predicting stratigraphic traps. Using this approach, success in exploration may be improved by developing exploration models which incorporate basement level tectonics with stratigraphic and seismic anomalies occurring at shallower depths.

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Sediment Suspension, Dewatering, and Mass-Movement Processes in Coastal Fluid Muds

Large, northwestwardly migrating mud shoals, parts of which are composed of fluid mud (bulk density 1.05 to 1.25 g/cc), front the shoreline every 30 to 60 km along the 1,600-km-long Guiana coast. The rather spectacular density variations that occur in these soft, gel-