The Duperow cycles are widespread and constituent beds only 10-15 ft (3-5 m) thick can be traced completely across the Williston basin. Deposition occurred within a vast back-reef lagoon lying south of the Woodbend reef platform of southern Alberta and stretching to a sandy shore in South Dakota and northern Wyoming. This lagoon was periodically and rapidly flooded with normal marine water, permitting organisms to flourish; the sea then gradually shallowed as sediments filled the basin.

Desiccation produced extensive tidal flats and evaporitic sabkhas and was perhaps responsible for some dolomitization of the carbonates on shelves outside the basin.

The cause of such cyclic sedimentation might have been slow, steady subsidence of the basin with a superimposed climatic rhythm that may have speeded up reef growth and periodically choked off seawater from the basin. Perhaps this process operated coincidentally with sporadic eustatic sea level fluctuation or with abrupt periodic subsidence of the whole basin. The low bathymetric relief that permitted rapid flooding certainly would have aided in development of such cycles.

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Depositional Environments and Diagenesis of D Sandstone, Wild Horse Field, Weld County, Colorado

Wild Horse field is located on the gentle east flank of the Denver basin, northwest of Fort Morgan, Colorado. Production was established during 1981 from a 12-ft (3.7 m) thick porous sandstone in the lower part of the D sandstone of Cenomanian age. To date, 10 producing wells have been completed. Proven productive area is 1,800 ac and estimated reserves are 1.2 million bbl oil equivalent.

D sandstone facies form complex reservoirs associated with regressive deltaic and marine sandstone deposited during a regional sea level drop 95 Ma. Traps are primarily stratigraphic in nature although fracturing has enhanced production. The D sandstones in the Wild Horse field area are interpreted to be the product of an episodic northwestward progradation of a lobate river-dominated delta system.

On the basis of differences of the internal structure, textures, mineral composition, and trace-fossil content, the D sandstone is divided into five lithofacies: shoreface, prodelta platform, delta front, delta plain, and transgressive marker sandstone. The producing sandstones occur in overlapping bars proximal and lateral to principal channels in a bay-filled sequence. Calibration of well logs using cores allows detailed subsurface mapping of producing facies for more efficient development of the field.

Original porosity has been reduced mainly by quartz overgrowth cementation. Porosity interconnection is present due to dissolution of framework grains and of the early diagenetic calcite cement. Pore-filling cements such as chlorite, kaolinite, and pyrite may produce formation damage if not treated during completion operations.

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Geologic Characterization of a Field Laboratory for Coalbed Methane Exploration and Development

Two coalbed methane wells have been drilled at Red Mountain Unit in the Piceance basin near Collbran, Mesa County, Colorado. The wells were drilled as part of the Deep Coal Seam Project, a multi-well project sponsored by the Gas Research Institute to develop, improve, evaluate, and communicate the technology required to produce gas from deeply buried coals. To better characterize the geologic parameters controlling coalbed methane production, research efforts have been directed at a single coal seam at a depth of 5,500 ft (1,800 m). The thickness of the objective or D seam coal, included in the Cameo coal member of the Williams Fork Formation, Upper Cretaceous Mesaverde Group, ranges from 16 to 20 ft (5 to 6.5 m) throughout the unit and is substantiated by nearby well control.

A continuous core, over 200 ft (61 m) thick, was recovered from the first well. Routine and special core tests were performed on samples from both the objective coal and overlying sandstone for the purposes of reservoir evaluation, log analysis, and stimulation design. Pressure transient testing of the objective coal in the first well confirmed the low permeability and/or high skin damage caused by deep invasion of drilling and completion fluids. Interpretation of in-situ state of stress measurements indicates that a conventional hydraulic fracture initiated in the coal will grow upward into the overlying sandstone. Geologic characteristics of the coal and bounding formations were incorporated in a stimulation design to maximize enhancement of the cleat or natural fracture system of the coalbed methane reservoir.

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Tectonics and Sedimentation of Middle Proterozoic Belt Basin, and Their Influence on Cretaceous Compression and Tertiary Extension in Western Montana and Northern Idaho

The Belt Supergroup was deposited in an intracratonic basin, occupied during much of its history by alluvial aprons that sloped down to a landlocked sea. Belt rocks are here analyzed in terms of 13 "sediment types," descriptive taxa in which the metamorphic overprint is filtered out and the original sedimentary aspects are emphasized. The lower Belt records maximum transgression of the Belt sea, during which turbidite sand and pelagic mud were deposited in the central part of the basin, carbonate mud accumulated on its eastern margin, and coarse conglomerate accumulated along its fault-bounded southern side. The Ravalli Group records extensive alluvial apron/mudflat progradation from the south and west. The middle Belt carbonate, representing a second large transgressive period, is characterized by terrigenous-carbonate cycles in the eastern part of the basin and by turbidite sand and mud, derived from the west, in the deeper, locally slumped, western part of the basin. The Missoula Group represents a series of northwest-facing prograded alluvial aprons alternating with transgressive mudflat and shallow-water deposits. The Garnet Range Formation, near the top of the Missoula Group, represents incursion of open marine waters into the Belt basin.

The Belt basin subsided as a group of at least four large crustal blocks, separated by three nearly east-west fault lines and a northwest-trending fault line. Differential subsidence of the blocks is recorded in abrupt thickness changes and soft sediment deformation along the fault lines. Cretaceous thrusting formed western and eastern thrust belts which are continuous across the blocks, but which are segmented and broken along the east-west lines. Tertiary extensional dislocations along the lines.

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Distribution and Significance of Hydrocarbon Source Rocks in Greater Rocky Mountain Region

Stratigraphic and geographic distribution of possible Rocky Mountain source rocks determine which stratigraphic sequences in each geologic province might be considered "hydrocarbon machines" or generation-accumulation cells. Knowledge of source rock facies distribution enables the explorationist to: (1) understand local, regional, and global depositional frameworks, (2) construct useful models of burial history and maturation patterns, (3) reconstruct the most likely migration pathways, (4) correlate these facies to hydrocarbons reservoired in known accumulations, and (5) efficiently explore for undiscovered accumulations. Source rock distribution must be integrated with evaluation of reservoir, seal, and trap distribution as well as with changes in heat flow, diagenesis, tectonics, hydrodynamics, and burial history through time.

The significance of Rocky Mountain source rock facies can be evaluated in terms of the number of accumulations and volume of reserves attributable to each. Unproven source rock facies are evaluated by highlighting their potential based on their geochemical characteristics.

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Stratigraphy of Upper Morrison and Lower Dakota Group of Front Range, Colorado: New Play in Central Denver Basin?

Examination of surface sections along the Colorado Front Range from Walden to Beulah, Colorado, reveals that five sandstone units in the