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ABSTRACTS

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Distribution and Facies of Pennsylvanian Rocks of Sangre de Cristo Mountains and Raton Basin, New Mexico

In Pennsylvanian and early Permian time north-central New Mexico and the adjacent part of Colorado were the site of the Rowe-Mora geosyncline—a narrow, north-trending depositional basin bounded on the west by the ancestral San Luis-Uncompahgre highland and on the east by the ancestral Sierra Grande uplift. The southern part of the geosyncline was divided by the Pedernal uplift, the main trough being at the west, and the Las Vegas sub-basin at the east. Sediments of the Magdalena group of Pennsylvanian age were deposited as a predominantly marine suite during formation of the geosyncline, and sediments of the overlying Sangre de Cristo formation of Pennsylvanian and Permian age were deposited as a predominantly non-marine suite which finally filled the geosyncline. During Laramide orogeny the troughal part of the geosyncline was elevated to form the Sangre de Cristo uplift and the shallower eastern part was downfolded to form the Raton basin.

Rocks of the Magdalena group exhibit two facies. Thick limestone and sandstone and interbedded shale were deposited on a shelf in the southern part of the geosyncline. These rocks are as much as 2,500 feet thick. The shelf facies thickens northward and grades rapidly into a geosynclinal facies. The gradation occurs along a belt trending northeastward across the mountains and into the subsurface of the southern part of the Raton basin. The geosynclinal facies is dominantly black shale containing thick beds of sandstone and thin beds of limestone. This facies originally was more than 10,000 feet thick in the deeper part of the trough and is more than 5,000 feet thick in the subsurface of the western part of the Raton basin in Mora County.

In the southern part of the geosyncline on the Pedernal uplift, the shelf facies of the Magdalena group is truncated locally by the Sangre de Cristo formation. At the east side of the Las Vegas subbasin the shelf facies is truncated by the Sangre de Cristo formation, which rests on Precambrian rocks of the ancestral Sierra Grande uplift.

At the north in Colfax County, on much of the eastern limb of the Raton basin, the Sangre de Cristo formation or Triassic rocks rest on Precambrian rocks of the ancestral Sierra Grande uplift. A thick sequence of the geosynclinal facies of the Magdalena group is present in the mountains at the west. These rocks wedge out beneath the Sangre de Cristo formation in the subsurface of the western part of the Raton basin.

Thick black shales of the geosynclinal facies might be sources of petroleum; however, the interbedded sandstones and limestones are "tight." Sandstones of the shelf facies generally are more porous and permeable. Limestones of the shelf facies could be the best reservoirs, and shows of oil and

gas have been reported from these rocks in the Las Vegas sub-basin and near the southern end of the mountains. Small bioherms and associated calcareous clastic rocks occur at places in the shelf facies, particularly near the western margin of the Pedernal uplift, and may be present also in the subsurface along the eastern margin of the uplift and along the northeast-trending belt of transition from shelf to geosynclinal facies.

Combination stratigraphic and structural traps may occur along the belts of wedge-out of the Magdalena on the Pedernal uplift and the west flank of the ancestral Sierra Grande uplift. Whether suitable reservoir rocks are present in these areas of wedge-out is not known.

A thin but widespread sequence of Devonian(?) and Mississippian age contains cavernous limestone and breccia, but these rocks lie beneath possible source beds and rest on Precambrian crystalline rocks.

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Facies of Mesaverde Formation, East-Central Wyoming

The Mesaverde formation of east-central Wyoming consists of sandstone, shale, and lignite beds. These units were deposited in near-shore, littoral, lagoonal, coastal swamp, and fluvial environments along the western margin of the Late Cretaceous interior sea. Eastward regression of the sea was interrupted by periods of stillstand and minor transgressions. The facies of the Mesaverde formation can be resolved in terms of regression, stillstand, and transgression.

During eastward regression the environments of deposition also migrated eastward, maintaining their same positions relative to the shoreline. The normal succession of facies in a regressive sequence includes, in ascending order, the facies of the near-shore, littoral, coastal swamp, and fluvial environments.

Stillstand occurred at times of maximum regression or transgression, and during pauses in regression or transgression. The shoreline and environments of deposition were essentially stationary during stillstand. Thickening of the facies of the near-shore, littoral, and coastal swamp environments is indicative of stillstand.

Westward transgressions of the sea inundated former lowland areas. The absence of persistent near-shore and littoral deposits at the base of transgressive sequences in east-central Wyoming may reflect rapid transgression.

The two major regressive sequences of the Mesaverde formation in east-central Wyoming are the Phayles Reef member (new name) of the Mesaverde formation in the Wind River Basin, and the Parkman sandstone member of the Mesaverde formation in the Powder River Basin. The Teapot sandstone member of the Mesaverde formation defies a simple regressive or transgressive interpretation. The Wallace Creek tongue (new name) of the Cody shale in the Wind River Basin, and the unnamed middle member of the Mesaverde formation in the Powder River Basin are transgressive marine tongues.

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Some Remaining Potentials of Northwest Colorado

The history of production in northwest Colorado lends background to the problems of the exploration geologist in the region such as: the paucity of geologic literature specifically on the region and the resultant hodge-podge of stratigraphic and structural nomenclature therein, the presence of severe Laramide deformation masking older structure, and the high cost of exploration.

The Eastern Uinta-Axial arch-White River uplift structural element has potential in undiscovered structural traps similar to those now producing and in the older section with included evaporites, clastics, and carbonates of Pennsylvanian and Mississippian age which point to the similarity between the Eagle and Paradox basins. The Piceance basin has potential based on the thinning of the pre-Green River–post-Mancos section, with its thousands of feet of included sand, westward from the White River uplift onto the Douglas arch.

A third selected potential is the stratigraphic possibilities present in the upper Mancos-Mesaverde beach and bar sands deposited over the region by a generally but sporadic northeastward regressing sea.

The potential of the Mancos fracture production has not been realized in that exploration and hence production to date have been restricted to closures probably because these have invited drilling, and that other fracture accumulations will be discovered off-structure where adequate vertical stress has been applied to form fracturing.

The need for the exploration geologist in northwest Colorado is to turn his primary interest from the search for structural closure to detailed stratigraphic study and to correct technical interpretation and application of data at hand. Finally the geologist must wean managing departments away from grading prospects on closure alone and sell them on accepting and drilling prospects uncovered by this less orthodox approach.