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FACIES RELATIONSHIPS OF THE
TENSLEEP SANDSTONE AND MINNELUSA FORMATION,
WESTERN POWDER RIVER BASIN,
JOHNSON COUNTY, WYOMING

by

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A thesis submitted to the Faculty and the Board of Trustees of the Colorado School of Mines in partial fulfillment of the requirements for the degree of Master of Science (Geology).

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ABSTRACT

Outcrop and core study of the Tensleep Sandstone and Minnelusa Formation in the western Powder River Basin, Johnson County, Wyoming has revealed alternating cycles of eolian sandstone and subtidal dolomite. These cycles are interpreted to represent the rise and fall of sea-level on the Wyoming shelf during Pennsylvanian and early Permian time. Falling sea-level was marked by development of a scour surface at the base of each cycle and progradation of eolian dunes over an exposed, shallow carbonate-shelf. Subsequent sea-level rise resulted in the reworking of dune sand through wave activity and Skolithos burrowing. Sandy dolomites that overlie the reworked dune sands grade upward into shallow, subtidal dolomites. These subtidal dolomites are fossiliferous mudstones to wackestones, generally lacking quartz sand. The knife-sharp scour surface, normally present directly on the subtidal units, indicates that erosion during dune encroachment eliminated any regressive deposits that may have been present.

Recognition of subtidal dolomites within the Tensleep or Minnelusa supports subsurface correlations that trace individual carbonate units through large portions of the study area. The thickness of sandstone in the section

decreases eastward toward the Lusk embayment. Approximate shorelines can be established where sandstones pinch-out into dolomites, providing opportunities for stratigraphic trapping.

Brecciation and vug development related to exposure of dolomites likely contributed to porosity development in petroleum reservoirs in the Reno field area. Enhanced brecciation and thinning of dolomite reservoirs may have occurred over paleotopographic highs. In the Reno field area, deep valleys on the unconformity at the top of the Minnelusa, generally overlie thicker Minnelusa dolomites, suggesting that these areas were persistent paleolows. Although all present production from the Tensleep/Minnelusa in the western Powder River Basin is related to Laramide structural highs, sandstone production associated solely with unconformity trapping in other parts of the basin and dolomite production associated with brecciation and vug development in the Reno field area, provide significant future exploration plays in unexplored areas of Johnson County.

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The original material for this dissertation includes a significant number of oversized pages. The full text can be viewed by accessing the supplement file.

