Depositional and Diagnostic Environments of the Mississippian Leadville Limestone at Lisbon Field, Utah

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REGIONAL AND LOCAL SETTING

Lisbon field is located in the salt anticline fold and fault belt region of the Paradox Basin in San Juan County, Utah (Fig. 1). Pure Oil Company discovered the field in January 1960, with a combination of surface, gravity, and seismic work (Parker, 1968). The Pure Oil Lisbon #1 (B-610) discovery well was initially completed in the Devonian McCracken Sandstone Member of the Elbert Formation, but later tested the Mississippian Leadville Limestone for over 4 million cubic feet (113,000 m³) of gas and 196 barrels of condensate per day.

The Mississippian Leadville carbonates at Lisbon have produced a cumulative of approximately 60 million barrels (9 million m³) of oil and condensate, with an additional 45 million barrels (7 million m³) equivalent of gas currently in the reservoir where it has been injected for pressure maintenance. Devonian McCracken production has been less than 2 million barrels (318,000 m³) of oil to date.

Lisbon field encompasses an area of about 5,000 acres (2,000 km²) (Fig. 2). Structural closure is near 2,000 feet (600 m), and the northeast boundary fault has more than 2,500 feet (760 m) of displacement at the crest of the closure (Smith and Prather, 1981). The field is located on the south flank of a faulted, northwest-trending anticline, which had major structural movement during the late Mississippian and early Pennsylvanian. As much as 1,500 feet (450 m) of the oldest Pennsylvanian beds that are present offshore, are absent at the crest of the structure due to non-deposition. The Lisbon structure is totally encased by overlying Paradox salt, and was at least partially responsible for the positioning of the Lisbon Valley salt anticline to the northeast (Fig. 1).

SCOPE OF STUDY AND METHODS

Lisbon field has accounted for more than 90 percent of the Mississippian petroleum production in the Paradox Basin to date. This uniqueness however, is primarily one of structural size. Other Mississippian fields in the basin occur in analogous structural settings and are stratigraphically similar in many ways.

The large amount of well control at Lisbon allows for detailed study of the Mississippian carbonates within the Leadville Limestone. This study utilizes cores, cuttings, and thin sections of the Leadville to delineate the vertical and lateral extent of carbonate facies. In addition, well log correlations were used to make interval isopach maps of the formation. Relating the carbonate facies distributions to isopach maps helped document paleotopographic control of Mississippian deposition and diagenesis at Lisbon field.

LEADVILLE STRATIGRAPHY

The Leadville Limestone is Kinderhookian to Osagean in age, and rests on top of shaly limestones of the Ouray Limestone. The Leadville is 320 to 550 feet (97-170 m) thick at Lisbon, and is capped by a major unconformity which has truncated the formation (Fig. 3). Inspection of well logs through the Leadville reveals two well defined intraformational markers. These markers have pronounced gamma-ray readings and are termed the “B” and “C” markers respectively.

The gamma-ray stratigraphic markers are named after, and generally correspond to, a lithologic subdivision