

## **Niobrara Production from the Lowry-Bombing Range Area Denver Basin, a Deep-Basin, Continuous, Paleostuctural Trap**

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### **Abstract**

The Lowry-Bombing Range (LBR) field (Arapahoe County, CO) is productive from the Niobrara B and C chalks at vertical depths of 7300 to 7950 ft. Both the Niobrara B and C chalk beds range in thickness from 20 to 30 ft in the field area. Porosities in the B chalk range from 10 to 12%; porosities in the C chalk are approximately 10%. The LBR field is being developed by horizontal drilling.

Resistivity mapping in the Niobrara chalks show anomalously high resistivities in areas of Niobrara production. The high resistivities (> 50 ohms) are due to hydrocarbon accumulation/charge in the chalk beds (as evidenced by high residual oil saturations in cores). The high resistivities also coincide with mapped high vitrinite reflectance ( $R_o > 0.8$ ) and high bottom hole temperatures on well logs and drill stem tests (geothermal gradient 1.9 to 2.5°F/100 ft).

The total Niobrara is thin in the LBR compared to surrounding areas and averages thickness of approximately 350 ft. Thinning occurs in the Niobrara A marl across the area. This thinning is interpreted to be due a paleostructure high being present in the LBR area. Paleostucture also appears to influence thicknesses in lower Cretaceous strata. This paleostuctural feature is herein named the LBR High. The paleostucture trends W NW across the area and is approximately 25 miles wide and 60 miles in length. Present-day structure in the LBR is primarily due to the Laramide Orogeny and regional dip is to the west across the LBR area at approximately one-half a degree.

The marls between the chalk beds are regarded as source beds for oil found in the chalk beds. Source rock total organic carbon weight percent (TOC) and Tmax data for the Niobrara in LBR is as follows: A marl, 2-3.4 wt.%, 445°C; B marl, 2.58-3.74 wt.%, 445°C; C marl, 3.5-6.27 wt.%, 451°C; D marl, 0.8 wt.%, 450°C. Source rock data for the Carlile is as follows: TOC 1.5-2.2 wt.% and Tmax 453°C. The overlying Sharon Springs source bed has TOC's ranging from 2.5-4.0 wt.%. Thus, the Sharon Springs, Niobrara, and Carlile have good source rock potential (> 2 wt.%).

Production from horizontal wells is variable and ranges from 199 to 1613 BOPD. The best production is from longer reach laterals drilled in an east-west direction (~2-mile laterals). Maximum horizontal stress direction is interpreted to be NW SE.

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