

# **Geologic Constraints on Restimulation of the Blair Formation, Brady Field, SW Wyoming**

*Stephen Sturm, Schlumberger DCS, Denver, Colorado*

The Brady Unit was discovered in 1960 with completion of the Brady Unit #1, and multi-pay zone commercial production commenced in the mid-1970's. Blair Sandstone production ramped up in the late 1990's with 11 producing wells completed in the Jackknife Springs and South Brady Shallow Units that are currently operated by Anadarko and Questar. To date, 9.66 Bcf of gas and 38,056 Bbls of oil have been produced from the Blair reservoir. Potentially, 5-15 Bcf of recoverable gas remain in the field based on efficient infill drilling.

The Blair production interval is approximately 450' thick and composed of three laterally discontinuous sandstone reservoirs (B, C and D sands) that vary in thickness from 20 –140' thick across the field. Deposition is believed to have occurred in submarine fan channels. Reservoir properties are variable, with core permeability ranging from 0.001 - >1.0mD and corresponding porosities ranging from 3-14%. Blair wells in the field are characterized by high initial production and rapid decline rates. Review of completion strategy revealed that inefficient hydraulic stage design, excluded pay zones and possibly formation sensitivity to frac fluids in some cases exacerbated production decline.

In 2002, Anadarko and Schlumberger reviewed all completions in the Blair reservoir to determine existing well drainage, restimulation or recompletion opportunities on existing wells, and infill locations. The JKS #7 was selected as a recompletion candidate to evaluate hydraulic stimulation performance and off-structure optimization utilizing a specifically designed CO2 foam fluid for the Blair sandstone to minimize any potential formation damage. Post-frac evaluation indicated that although there was an initial 86% increase in gas production, that height growth of the initial hydraulic stimulation and near wellbore depletion had a dominating affect on efficiency and recompletion and restimulation. Integrated geological and engineering evaluation recognized that the Blair reservoir is a conventional trap with a strong structural component. Efficient producibility is dependent on identification and perforating of all quality Blair reservoir zones, and integrating geology with completion engineering in the design of hydraulic stimulations for maximum half-length and limited height growth. Recognition of internal shale zones that provide both reservoir seals and mechanical stimulation barriers are essential in the future development of the field. Because existing Blair wells drain an estimated 90 acres (or less), at least 10 Bcf of gas is potentially recoverable from uphole recompletions of Nugget and Dakota wells, select Blair zones, and 6-8 infill locations along the Brady structure.