CHAPTER 9

Searching for Overpressured Frontier Formation Gas in the Washakie Basin, Wyoming

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ABSTRACT

In 1991, Texaco and Union Pacific Resources jointly drilled the Table Rock Unit No. 104 well that discovered overpressured gas in Frontier Formation sandstone on the northern end of Table Rock Field. This well demonstrated the potential for high flow rates and pressures but was determined to be draining a reservoir of limited area. The challenge then became the search for larger reservoir areas charged with hydrocarbons in the Frontier Formation.

In 1994, Texaco conducted a microseep survey over a 25-sq mi area northeast of Table Rock Field. The data from the survey were processed in a manner that combined three different light hydrocarbon gases values and removed the significant variations that can occur between nearby samples. Subsequent to the survey, four wells (three Frontier Formation and one Almond Formation well) were drilled in the area. Two of these wells were located on the edge of the survey, and two were within the survey. The fact that the microseep survey correctly predicted the final status of all of these wells, leads to the conclusion that such surveys are useful tools for locating overpressured gas reservoirs in the Greater Green River Basin.

INTRODUCTION

The Greater Green River Basin of Wyoming and Colorado contains four sub-basins (Sand Wash, Washakie, Great Divide, and Green River) bounded by thrust faults, basement uplifts, and interbasinal arches. Table Rock Field is located on the east flank of the north-south trending Rock Springs Uplift (Fig. 1) and on the axis of the Wamsutter Arch. The Wamsutter Arch trends east-west and separates the Great Divide (Red Desert) and Washakie basins. Both the Red Desert and Washakie basins deepen significantly to the east of Table Rock Field and are (or were) deep and hot enough to generate hydrocarbons from lower and upper Cretaceous shales. Hydrocarbons migrating from these basins were partly concentrated by the Wamsutter Arch and directed updip into the area around Table Rock Field.

Table Rock Field is an anticline that has produced from nine different horizons (Fig. 2). The field was discovered in 1946 with first production from the shallow Wasatch Formation. Progressively deeper drilling established production from the Lewis, Almond, Dakota, Nugget, Weber, and Madison formations. More recent drilling in the field has established production in the Blair and Frontier formations. All of the reservoirs in the field are normally pressured, except for the overpressured Blair and Frontier formations. Production depths in the field range from 3,000 to 18,000 ft. Cumulative production from the field as of 1999 was 6 MMBO and 540 BCFG.

The discovery well for the Frontier Formation was the TRU No. 104 (Sec. 19, T19N, R97W). Drilled in 1991, it yielded an initial production rate of 4,300 MCFD from a depth of 14,400 ft. The initial bottom hole pressure was 11,100 psi, which indicates that the Frontier Formation is significantly overpressured (0.77 psi/ft). While the TRU No. 104 established production from the Frontier reservoir, production history (discussed later) and detailed pressure buildup analysis indicated that the drainage area for this well was limited.

Shortly after the TRU No. 104 was completed, plans were made to conduct a microseep survey over an area considered to have potential for future Frontier formation gas.