Geologic Controls on Coalbed Methane Occurrence and Productibility in the Fruitland Formation, Cedar Hill Field and COAL Site, San Juan Basin, Colorado and New Mexico

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ABSTRACT

Cedar Hill field contains some of the most productive coalbed methane wells in the San Juan basin. To determine geological controls on occurrence and producibility of coalbed methane at Cedar Hill field and the COAL site (Completion Optimization and Assessment Laboratory) we mapped structure, coal occurrence, net sandstone thickness, and production from coalbed methane wells.

The primary targets for coalbed methane production in Cedar Hill field are thick, basal Fruitland Formation coals (coal group A) that formed in a coastal plain setting. Group A coal beds are the thickest, up to 35 ft (11 m), and most continuous. In contrast, at the COAL site the thickest coal beds are more than 30 ft (9 m) thick and occur in the middle Fruitland (coal group C).

Fruitland coal beds are complex reservoirs as a result of coal bed-sandstone relationships and minor structural deformation. Coals formed in fluvial and delta-plain settings; compaction-induced folds are present where coals are interbedded with channel-fill sandstones. Coal beds may be more intensely fractured and thus more permeable where folded. The northwest-trending hingeline of the basin and a syncline that crosses Cedar Hill field contribute to reservoir complexity.

Maximum daily production rates of more than 1,500 MCF (42,450 m³) per well in the field occur where coal beds have been folded along the synclinal axis. Fractures associated with these folds may increase coal permeability and therefore enhance production. Other highly productive areas within Cedar Hill field coincide with greatest net-coal thickness.

INTRODUCTION

Cedar Hill field, located in northwestern San Juan basin (Figure 1), has produced coalbed methane since 1977. The field, operated by Amoco Production Company, produces predominantly from basal Fruitland Formation coal beds at a depth of approximately 2,800 ft (854 m). These basal beds contain an estimated 313 million short tons (284 million t) of coal and 89 BCF (2.52 x 10⁹ m³) of gas in place (Decker and others, 1988). About 17.2 BCF (0.49 x 10⁹ m³) of coalbed methane and 737,000 bbl (117,183 m³) of water were produced from 1976 through 1989 (Petzet, 1990).

The COAL site, approximately 2.5 miles (4 km) northwest of Cedar Hill field (Figure 1), is a field research laboratory operated jointly by Amoco Production Company, Gas Research Institute (GRI), and GRI’s field contractor, Resource Enterprises Inc. Research here is designed to compare the effectiveness of open-hole cavity completions, and to determine parameters that favor open-hole cavity completions.

Objectives

This area was chosen for study because Cedar Hill field has the longest history of coalbed methane production in the basin and thus has a large production database. The COAL site was included in this study to characterize reservoir conditions and to provide a framework for interpreting results from coalbed methane research at the site. The objectives of this study were to (1) identify Fruitland coal groups and depositional units in the Cedar Hill and COAL site areas; (2) define geologic controls on thickness, continuity, trends, and structural attitude of major coal beds (reservoirs) within each coal group; (3) map Fruitland coalbed methane production; (4) characterize reservoir conditions; and (5) clarify geologic and hydrologic controls on coalbed methane occurrence and producibility.