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Applications of Coalbed Gas Systems in Exploration and Development

Coalbed gas is produced from more than 20,000 wells in approximately a dozen U.S. basins. In 2000, coalbed gas accounted for 8.8% of the reserves and 9.2% of the annual production of dry gas in the U.S. Coalbed gas may originate in thermogenic, biogenic or mixed gas systems, but the most productive wells are associated with traps in complex, mixed-gas systems. This paper describes three types of coalbed gas systems and compares the elements critical to effective exploration and development of each.

Key elements of a coalbed petroleum systems are: coal quality, thickness, and extent; thermal maturity; fracture (cleat) development; structural and hydrologic histories; and in-situ stress. Coalbed permeability, which is influenced by cleat density, increases with coal quality and thermal maturity, other factors being equal. In thermogenic coalbed gas systems, methane content of coal commonly increases with level of catagenesis, in basins having a simple burial history; coalbed gas may range from dry to wet ($C_1/C_1 - C_5 = 0.89 - 98\%$) and CO_2 content is $< 2\%$. In contrast, biogenic coalbed gas systems contain secondary biogenic gas in concentrations commonly less than 20% of those encountered in thermogenic gas systems; the gas is chemically dry ($C_1/C_1 - C_5 > 97\%$), and CO_2 ranges from 2 to +15%. Mixed coalbed gas systems, which contain thermogenic, migrated thermogenic, or secondary biogenic gas, are complex and commonly contain the best reservoirs in a basin. Delineating coalbed gas systems is critical in basin evaluation and reservoir development.