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Prediction and Analysis of Gas Composition in the Arkoma Basin: Abstract

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ABSTRACT

The Arkoma basin is an overmature, gas-dominated basin that straddles the Arkansas-Oklahoma border. It developed from an initial rifting phase, with subsequent continental collision and Ouachita thrusting on the southern margin. Burial histories were developed for locations in the Wilburton, Red Oak, and Bonanza Fields based on published well data. These were combined with thermal histories and used to calculate present day vitrinite reflectance values (R[o]). The models were adjusted until calculated and observed R[o] values agreed. With this information for the temperature at any time during basin evolution a thermodynamics program was used to calculate gas composition. This free energy-minimization pro ram takes fluid composition, rock mineralogy (up to 25 phases) pressure, and temperature as input, and calculates the gas composition for the thermodynamically stable assemblage. The predicted gas composition for the Arbuckle Formation at Wilburton was dominantly methane, while at Bonanza (where temperatures have been higher) it was mainly carbon dioxide. Actual gas compositions were obtained by analyzing gas trapped in fluid inclusions in fracture-filling calcite cements in the Arbuckle. This was done using a pair of computer-controlled, high-speed mass spectrometers that analyzed the gas burst released as each individual inclusion was ruptured by heating in vacuum. Gas analysis takes 25 msec and up to several hundred inclusions can be analyzed using a 10 mg sample. Calcites from the Arbuckle dolomites at Wilburton were dominated by methane, while those from Bonanza contained mainly carbon dioxide. This study confirmed by analysis the gas compositions predicted by thermodynamic calculations.

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