AAPG Annual Meeting
March 10-13, 2002
Houston, Texas

Stephen P. Cumella[1], Stephen Laubach[2], Orlando Ortega[2], Astrid Makowitz[2], Peggy Rijken[3] (1) Barrett Resources, Denver, CO (2) University of Texas at Austin, Austin, TX (3) Department of Petroleum & Geosystems Engineering, The University of Texas at Austin

Natural Fracture and Diagenetic Controls on Producibility of Low Permeability, Upper Cretaceous Williams Fork Formation Sandstones, Piceance Basin, Colorado

The Upper Cretaceous Williams Fork Formation of the Mesaverde Group is the primary reservoir in Grand Valley, Parachute, and Rulison gas fields in Garfield County, Colorado. Gas is produced from stacked highly lenticular fluvial sandstone bodies with average widths of approximately 750 ft. Due to extensive cementation by authigenic clays, the matrix permeability of these sandstones is extremely low, on the order of microdarcies. Natural fractures significantly increase reservoir permeability, but massive multistage artificial fracing is required for commercial production. A 16-well pilot study is being undertaken to determine the viability of 10-acre spacing. Numerous studies are characterizing the reservoir. Reservoir permeability and pressure are calculated from G-function analysis of pump-in tests and from pressure build up tests. Formation image logs will be used to determine to presence and orientation of natural fractures. Nuclear magnetic resonance log analysis can detect possible depleted zones and provide estimates of formation permeability. Results of the permeability and depletion zone well log analysis will be compared with the G-function and buildup analysis to determine how accurately these key reservoir properties can be determined from well log data. To quantify the role of fractures in production, a study is being conducted on Williams Fork core samples. These studies are evaluating the relationship of diagenesis to fracture growth and evolving rock properties. Diagenesis plays a critical role in both fracture growth and in the capacity of fractures to conduct fluid. Microfracture populations are being used to quantify fracture intensity, and cement/fracture timing relations predict locations of open and sealed fractures. Core data will also be used to generate input for a fracture-mechanics-based crack growth simulator, which generates realistic fracture patterns based on reservoir properties such as Young's modulus, sub-critical crack growth index, reservoir bed-height, and rock strain.