

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

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Optimization of Rates of Penetration in Deepwater Drilling: Identifying the Limits

Deepwater drilling in the U.S. Gulf of Mexico [GOM] is usually characterized by very narrow pore pressure / formation fracture gradient [PP / FG] windows. In GOM deepwater drilling, firm control over Equivalent Circulating Density [ECD] is required to help ensure these fracture gradients are not exceeded to reduce lost circulation and minimize expensive non-productive rig time. With the high daily operational cost of deepwater drilling, operators are pushed to drill as fast as possible, yet maintain a stable borehole and remain within the pressure bounds of their particular drilling situation. For these reasons synthetic-based drilling fluids [SBM] are commonly used. Occasional hole pack-offs of large cuttings around the BHA during connections precipitated a study by the operator and drilling fluids service provider to thoroughly study the problem and recommend courses of action to help improve hole cleaning efficiency and optimize drilling operations. With the calculations of hole cleaning efficiency levels for various cases studied, accurate ECD predictions were made, and safe operating windows in terms of ROP were identified. These results were then applied on 2 GOM deepwater wells drilled with SBM having water depths between 2800 and 8800 ft. In this paper, the hydraulic studies and the field results are described and recommendations for future deepwater drilling operations are offered.