Sand vs. Mudstone Pressures, Capillary Sealing, and

Large Column Heights at Mad Dog

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ABSTRACT

The Mad Dog Field is a mid-Miocene sub-salt oil field in the southeastern Green Canyon protraction (Gulf of Mexico). It is part of a regional mid-Miocene play, the Tahiti Embayment, that includes Atlantis, K2, Tahiti and other fields (Hauser et al., 2013). These fields have a pressure regression within the reservoir interval; at Mad Dog there is a decrease in excess pore pressure with depth of ~3,000 PSI (Fig. 1). The Mad Dog oil column is ~4700 feet (Merrell, 2012), much larger than the ~1,000 foot columns that we have examined at other fields (e.g. Bullwinkle, Auger, Popeye). The very large column heights suggest that there is enhanced seal capacity due to higher capillary entry pressure. We suggest that the water pressure is less in the reservoir than in the cap rock due to the regional pressure regression and that this elevates capillary sealing (Fig. 2). At the crest of the Mad Dog structure, the mudstone pore pressure is 250 PSI greater than the reservoir water pressure (Merrell et al. (2013)). This pressure difference can trap an additional ~3500 feet of oil column. We present a simple quantitative approach to estimate this effect.

Hauser, M.R., Petitclerc, T. , Branusdorf, N.R., and Winker, C.D., 2013, Pressure prediction implications of a Miocene pressure regression*, The Leading Edge.*

Merrell, M.P., Flemings, P.B., Bowers, G.L., 2014, Subsalt Pressure Prediction in the Miocene Mad Dog Field, Gulf of Mexico, AAPG Bulletin, v. 98, no. 2, p. 315-340, doi:10.1306/06251312156.

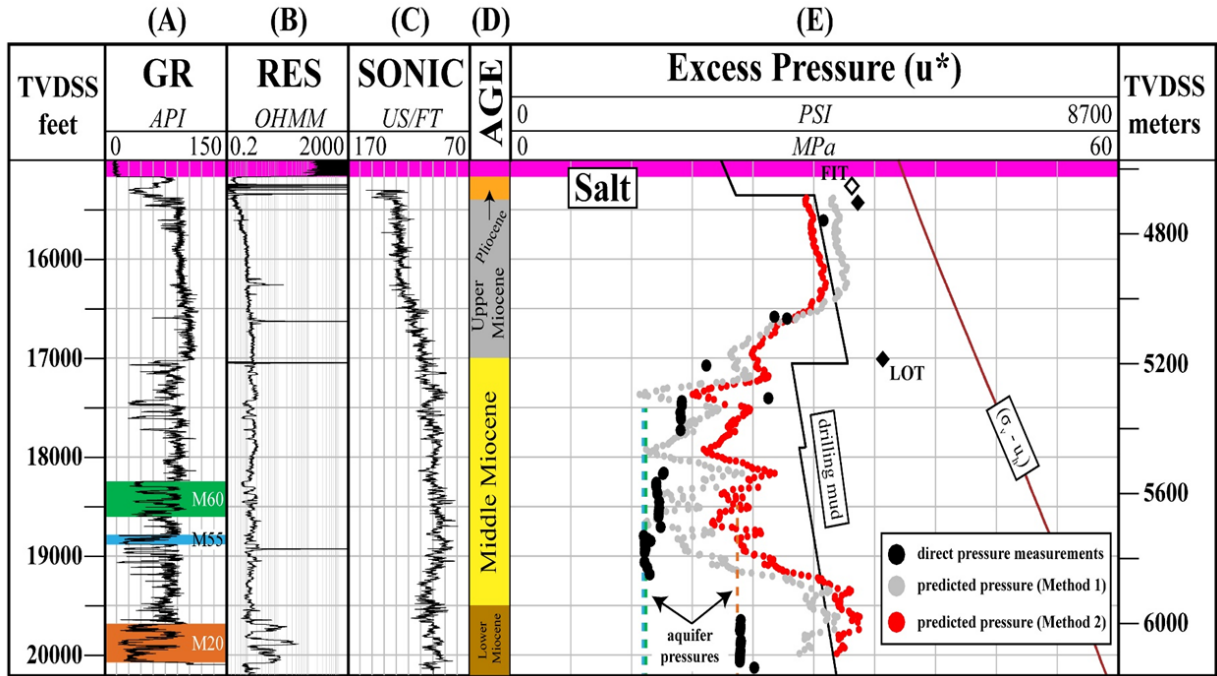Merrell, Michael, 2012, Pressure and Stress at Mad Dog Field, Gulf of Mexico, U.T. M.S. thesis.
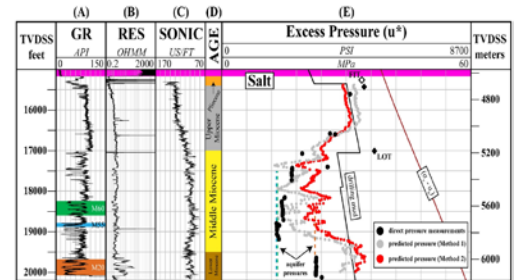
Figure 1: The major reservoir interval at the Mad Dog oil field is the M20 sand, which is within a significant pressure regression (Merrell et al., 2014)
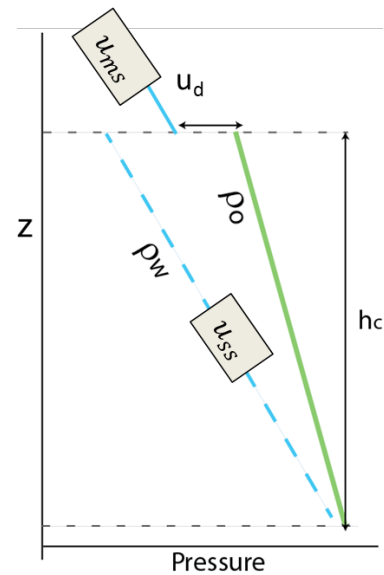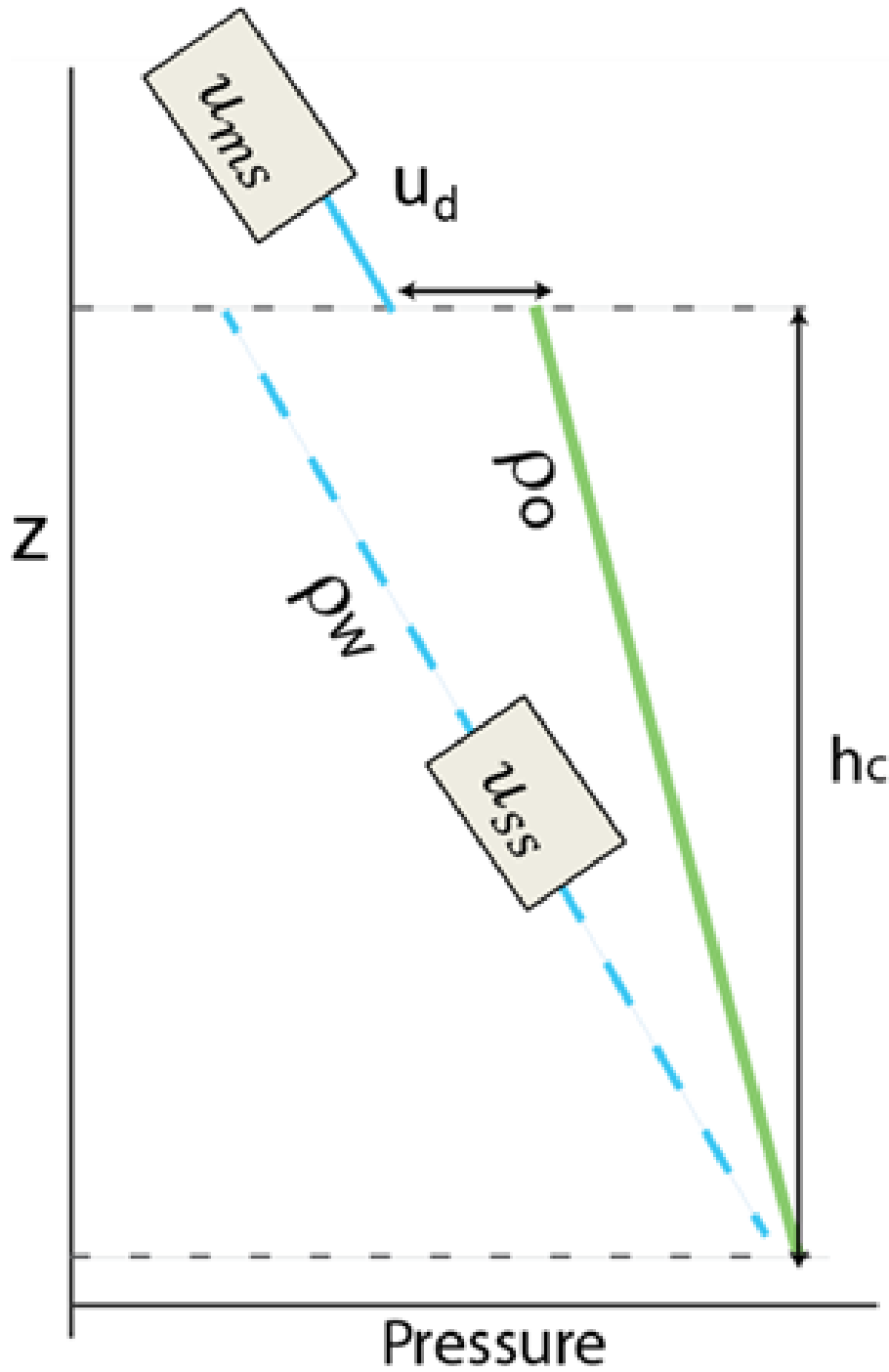

Figure 2: Example of a trapped hydrocarbon column (h_c) beneath a cap rock with pressure u_{ms}. The water pressure in the reservoir (u_{ss}) is less than the water pressure in the caprock (u_{ms}). The cap rock has a sealing capacity of u_d. Elevated pore pressure in the cap rock results in an additional sealing capacity.

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