07.09: Pore Pressure Analysis at the Macondo

F. William M. Pinkston, University of Texas at Austin

ABSTRACT

I study pore pressure in the Macondo Well (Mississippi Canyon Block 252) based on in-situ pressure measurements and the occurrence of kicks during drilling (Fig 1). Four kicks constrain pore pressure in the upper portion of the well; 21 direct pressure measurements taken with a modular formation dynamics tester (wireline) or Geotap (logging while drilling) span four sand bodies between 17637 ft and 18110 ft TVDSS (true vertical depth below sea level). Both measurements and kicks are used to parameterize a sonic-velocity-to-effective-stress transform (Fig 2) from Bowers (1995) and a resistivity-to-effective-stress transform based on Eaton (1975). The transforms estimate pore pressure in shales along the wellbore (Fig 1). The resistivity-based result suggests that pore pressures roughly parallel the overburden gradient from ~8,000 to ~17,000 feet. Beneath 17,000 ft, measurements record a striking pressure regression of 1360 psi over 365 ft from a total pore pressure of 12,990 psi at 17639 ft to 11,791 psi at 18004 ft TVDSS. In the future, I will also examine how the least principal stress varies with pore pressure and incorporate adjacent well data.

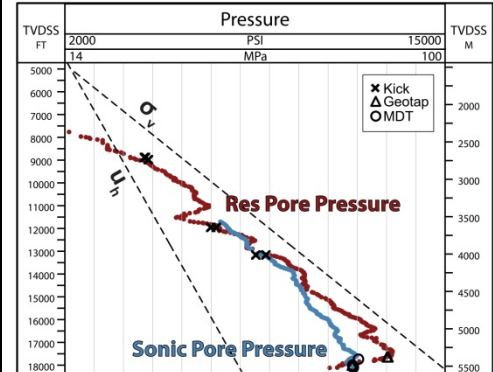**CLICK ON IMAGE FOR LARGER VIEW**

Fig 1: Macondo Well pore pressure prediction with depth in TVDSS. Pore pressure predicted from velocity-effective stress relationship (Fig. 2) is shown in blue. Resistivity-based approach shown in red.
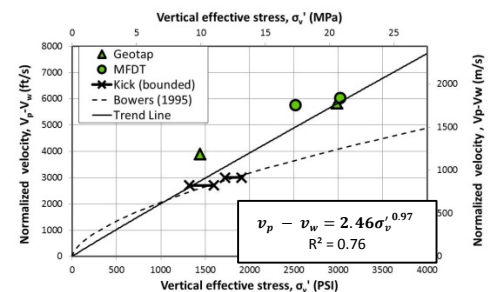

Fig 2: Velocity vs vertical effective stress, σ_v', plot for measured pore pressure values. An exponential regression is used to determine the parameters for Bowers (1995) equation.
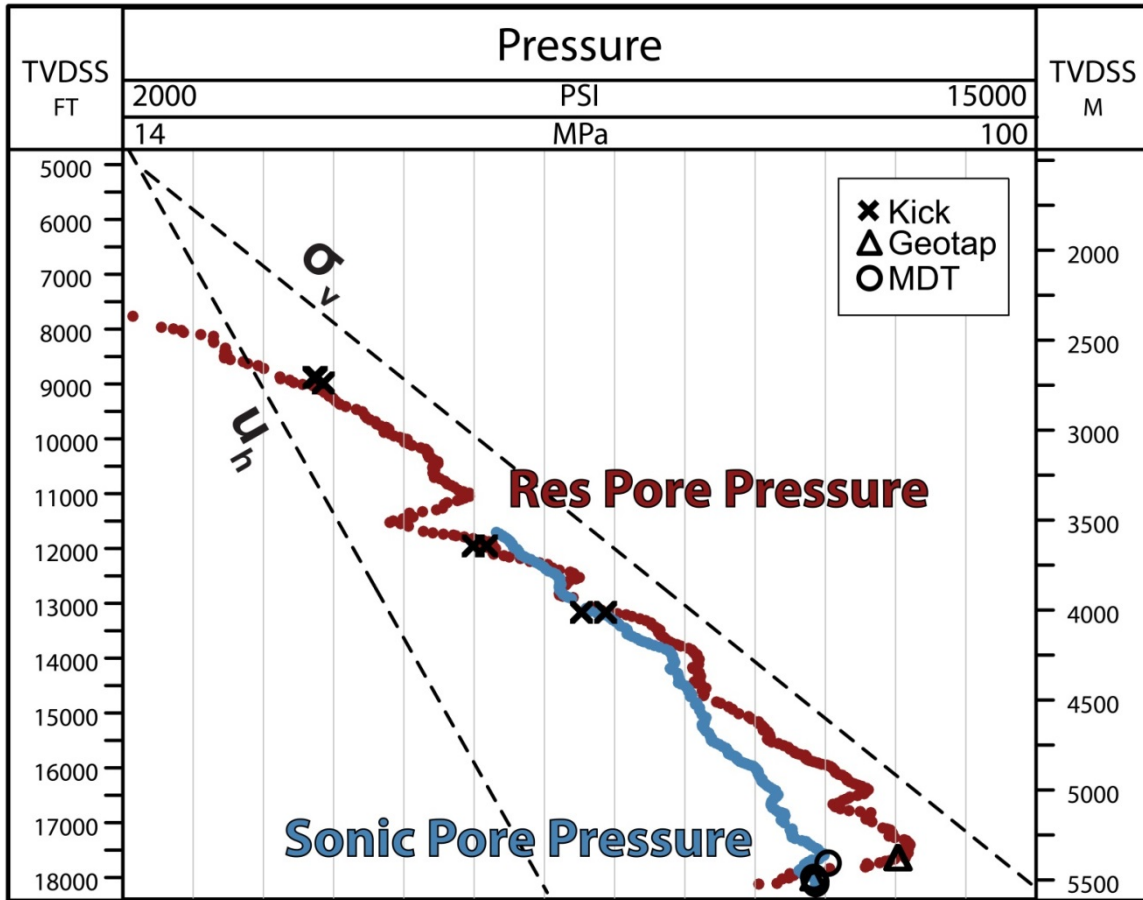
Fig 1: Macondo Well pressure/depth profile in TVDSS. Pore pressure predicted from velocity-effective stress relationship (Fig. 2) is shown in blue and resistivity-effective stress relationship is shown in red.
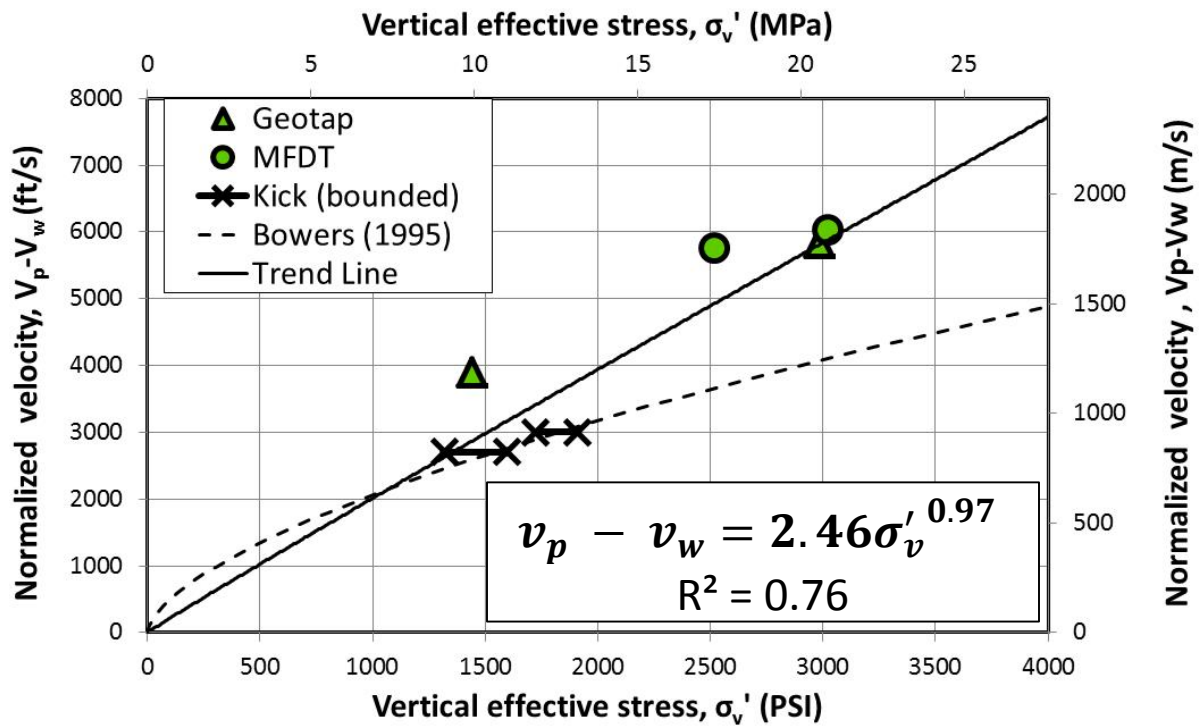
Fig 2: Velocity vs. vertical effective stress, σ_v', plot for measured pore pressure values. A power-law regression is used to determine the parameters for Bowers (1995) equation.

Back