Using Connection and Total Gasses Quantitatively in the Assessment of Shale Pore Pressure

By Mark Alberty

Hess Corporation, Houston, Texas

Abstract:

Connection and total gas measurements have been used qualitatively for decades in the drilling of oil and gas wells to identify over-balanced, under-balanced or near under-balanced pressure conditions (mud hydrostatic relative to shale pore pressure). Results often conflicted with sand direct measured pore pressures and the pre-existing perceptions of shale pore pressure. The evolution of the understanding of the relationship between mud gases and shale pore pressure, the development of the LWD based annular pressure measurement, and the impact of structural position upon the relationship between sand and shale pore pressures has resulted in the ability to begin to use mud gases in a much more quantitative manner.

The behavior of time based ECD, block movement, flow rate, and total gas from Gulf of Mexico wells are presented and the relationship to shale pore pressure explained. These same examples are then quantitatively analyzed for shale pore pressure and the results compared to sonic based shale pressure analysis and sand based direct measurements. Six principles are then presented to guide interpreters on the use of mud gases quantitatively. The pressure estimates in shale can then be used as calibration points for traditional shale pressure indicators such as resistivity, velocity or Dxc measurements. The resulting improved characterization of shale and sand pore pressures leads directly to more reliable and safer well designs and improved drilling efficiency.