

New LWD Technologies for Unconventional Reservoirs

Craig Barnett¹ and Aly Bassiouny²

¹Weatherford Drilling Services, Houston, Texas, USA

²Weatherford Petroleum Consulting, Saudi Arabia

Abstract

An LWD (Logging While Drilling) spectral azimuthal gamma ray (SAGR) sensor provides a number of valuable measurements for horizontal well placement and evaluation in unconventional reservoirs, including uranium, potassium, and thorium concentrations, high-quality real-time and recorded gamma ray borehole images, and a high-precision total gamma ray measurement. In many shale reservoirs, uranium shows a strong correlation with formation kerogen and TOC, while the potassium and thorium provide a means for evaluation and clay-driven brittleness/ductility when the total gamma ray value is influenced by kerogen-associated uranium or other non-clay factors. Real-time gamma ray borehole images provide formation dip information and show whether the bit is drilling stratigraphically up or down to improve geosteering and well placement.

A new, unique LWD azimuthal sonic tool has been developed to resolve shear wave anisotropy in fast formations and provide borehole images of compressional and shear acoustic slowness, in addition to providing conventional DTC and DTS logs. Azimuthally focused LWD sonic measurements of compressional and anisotropic shear wave slowness provide new and valuable information from horizontal shale wells, supplying geomechanical data necessary for more informed hydraulic stimulation programs, as well as providing geophysicists with key anisotropy parameters and complementing data available from vertical wells to provide a complete three-dimensional compressional and shear velocity model.