

Rock Physics Modeling to Quantify Geophysical Characteristics of Shale Gas in Lower Cretaceous Southern Indus Basin Pakistan

Muhammad Haroon Afzal¹, Hassan¹, Nisar Ahmad¹, Shahid Ghazi¹, and Perveiz Khalid¹

¹Institute of Geology, University of the Punjab, Pakistan

Abstract

The world focus is turned to exploitation of the unconventional resources such as shale gas to full fill the energy needs. However, geophysical characterization of the organic rich shales are still challenging because the elastic, seismic and petrophysical properties of these rocks vary strongly with change in total organic carbon (TOC), thermal maturity and mineralogy. The Sembar Formation of Lower Cretaceous, widely distributed in southern and central Indus basin of Pakistan, has large potential of shale gas plays. An improved rock physics model is opted to incorporate TOC effects, in addition to other rock physics parameters such as porosity, fluid saturation, mineralogy, formation temperature and pressure to understand the thermal maturity and organic contents on seismic and rock physics properties of shale gas plays. The rock physics parameters are extracted by using wireline log data. The results reveal the seismic response and rock physics properties of shale gas strongly affected by TOC. The compressional wave velocity and acoustic impedance decrease with increase in TOC. Linear regression relation exists between TOC and volume of kerogen. The static elastic parameters (Young's modulus) and dynamic elastic parameters (P- and S- wave moduli) decrease monotonically with increase in clay content and kerogen volume.