

Methods of calculating total organic carbon from well logs and its application on rock's properties analysis

S. Z. Sun¹, Y. Sun¹, C. Sun², Z. Liu¹, and N. Dong³

¹*Lab for Integration of Geology and Geophysics, China University of Petroleum (Beijing)*

²*Dongshenboda Technologies Inc. (Beijing, China)*

³*Petroleum Exploration and Development Institute SINOPEC (Beijing, China)*

Abstract

The total organic carbon content (TOC) is a crucial indicator for the evaluation of shale gas reservoirs, traditionally estimated by measuring cores, cuttings or sidewall cores in laboratory with source rock evaluation instruments. Limited by the number of rock samples, the experimental results are not continuous and it is impossible to show the whole face of a source rock bed. Continuous high resolution logging information contributes to overcoming the restraints mentioned above. In this paper, the measured TOC data obtained from geochemical analysis of the core samples has a really low correlation with any single logging curve from a shale gas well in southern China. The TOC calculated from the commonly used method $\Delta\log R$ technique has a relatively low correlation with the measured ones, especially in the interval of low TOC. Three methods of $\Delta\log R$ technique, optimal superposition coefficient $\Delta\log R$ technique, CARBOLOG (Carbon Organic LOG) technique are applied to calculate TOC and compared. Calculated results show that TOC from CARBOLOG technique is better related to the measured TOC with the correlation coefficient for 0.83. Based on the calculated TOC from CARBOLOG technique, analysis of TOC effects on rock properties is performed, showing the characteristics of high S-wave Impendence (SI), high poisson's ratio (ν), high Vp/Vs ratio (Vp/Vs) with high TOC, which is consistent well with the forward modeling results using the 3D SCA_DEM rock physics model for organic-rich shale.