Total Organic Calculation Using Geophysical Method: Application to Niger Delta Deposits

Benson A. Olisa
Applied Geophysics, Federal University of Technology, Akure, Nigeria.

A new method, Geophysical technique, for identifying and calculating Total Organic Carbon (TOC)in organic-rich rocks has been developed using well logs. The method employs the overlaying of a properly scaled porosity log (generally the sonic transit time curve) on the resistivity curve. In water-saturated, organic-lean rocks, the two curves parallel each other and can be overlain, since both curves respond to variations in formation porosity; however, in either hydrocarbon reservoir rocks or organic-rich non-reservoir rocks, a sepsration between the curves occurs. The separation in organic-rich intervals results from two effects: the porosity curve respond to the presence of low-density, low velocity kerogen, and the resistivity curve responds to the formation fluid. In an immature organic-rich rock, where no hydrocarbons have been generated, the oserved curve separation is due solely to the porosity curve response. In mature source rocks, in addition to the porosity curve response, the resistivity increases because of the presence of generated hydrocarbons. The magnitude of the curve separation in non-reservoirs is calibrated to total organic carbon and maturity, and allows for depth profiling of organic richness in the presence of sample data. This method allows organic richness to be accurately assessed in a wide varieties of lithologies and maturities using well logs. A comparison is made between log-derived TOC values and measured values in the laboratory. Log-derived TOC varies from 1.6wt% to 7.51wt% for LOM=5 for an immature rock, 0.2wt% to 1.07WT% for LOM=10 for a matured rock and -.07 to 0.34wt% for an over-matured rock.