

Integrated approach for reservoir Geology; case study of the Well Oscar, Niger Delta, Nigeria

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Reservoir geology (sedimentology, geochemistry and petrophysical properties) study was carried out on core samples from Well Oscar in order to have an understanding of the reservoir characteristics, quality and environment of deposition. The lithologic analysis was done using sedimentologic parameters of the rock materials by inspecting under the binocular microscope (10x) and was achieved using a 6 3/4" in diameter core. The porosity and permeability values was achieved using an automated permeameter and porosimeter while the pore throat was determined using scanning electron microscope (SEM). Gas chromatography analysis of mud gas and X-ray fluorescence (XRF) rock analysis represent the reservoir geochemistry aspect. The gas chromatography was used to determine methane through pentane and the XRF was used to determine the major and minor oxides (SiO₂, Al₂O₃, Fe₂O₃, CaO, MgO, SO₃, K₂O, Na₂O) of the reservoir. The lithologic analysis revealed medium – coarse sands / sandstones sequence with little interbeds of shales deposited in distributary channel fill to delta front sub-environments within inner to outer neritic paleodepth. Core residual oil space, core porosity and core permeability (air) average between 21.6- 27.4%, 18.3-25.1% and 55-67 milliDarcy respectively. The measured porosity and permeability from the various interval are high while the pore throat is coarse. This implies that the reservoirs identified in the Papa field are high porosity – high permeability reservoirs and hence, possess the ability to release hydrocarbon (oil and gas). The geochemical results from XRF showed that the sands/ sandstone reservoirs are characterized by quartz (65.50 - 69.59%), low alumina (0.03 – 0.58%) and minute fragments of supplementary minerals (Fe₂O₃: 2.43 – 3.89%, CaO: 4.80 – 8.01%, MgO: 0.09 – 0.96% SO₃: 0.05 – 2.41%, K₂O: 0.14 – 2.73%, Na₂O: 0.39 – 0.90% with LOI: 3.86 – 6.73%) are indicative of good reservoir quality. The results from gas chromatography analysis of the light hydrocarbon (methane through pentane) reveals that the hydrocarbon in the subsurface pools are mostly medium – residual oil and are associated with water and little natural gas.