

Diagenesis and Authigenic Clay Minerals inhabiting pore spaces of Reservoirs from Paleocene Niger Delta Province

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Most heterogeneous reservoir of nearly all ages have revealed that Authigenic Clay Minerals (ACM) contribute to the filling or bridging pore spaces within rock that can reduce the reservoir quality. Also, researchers have embarked on studies of clay diagenesis in the reservoirs of Niger Delta and Dahomey basins in order to guide in secondary production. This study was carried out to find out the stage of diagenesis, and how authigenic clay minerals can influence the flow properties of the reservoirs. Cores from 3 wells from both Niger Delta and Dahomey Basins were described using the one-third slabbed sections thereby producing facies associations and depositional environment. The two-thirds were plugged at intervals of 30 cm for a plug. About 350 plugs were taken for porosity and air permeability measurements using porosimeter and permeameter respectively immediately after cleaning and drying to stable weight. Thin sections were cut from end trims, dyed with blue epoxy and taken for petrography, Scanning Electron Microscope while the remaining samples were powdered for X-Ray diffraction to determine clay types and mixed phases. Lithologic description revealed that wells 1 and 2 are mainly mixed sands and mud of delta plain - delta front-prodelta origin, influenced mostly by tides, wave and fluvial actions. Well 3 comprises of complex mixture of sands of various grain sizes, mud, silt, thin beds of limestone, clasts and coalified plant detritus of fluvial-beach-marginal marine, bay, point bar and delta front complex facies with marine influences. Bioturbations are vast in well 3 representing Dahomey Basin. Both Niger Delta and Dahomey basins petrography revealed significant percentage of feldspar in their compositions, ranging from 11- 40%. The feldsparthic minerals in the sediments resulted in several diagenetic alterations such as dissolution producing authigenic minerals such as kaolinites, halloysites and clinochlore. Other minerals filling pores which are either authigenic or detrital are pyrites, gypsum, zeolite, rutile and gypsum. Diagenesis have also created secondary porosity such as moldic, honeycomb, oversized and elongated pores. Kaolinite, microcline and pyrites are the prominent minerals that filled and bridge the pore spaces in Dahomey basin. Well 2 of Niger Delta has developed secondary porosities and sparse fillings within the pore. Hence, good reservoir quality ranging from 2000 to 6000 mD. Well 3 have ACM and detrital such as kaolinites, halloysites, clinochlore, pyrites filling and bridging in addition to intense bioturbations in some areas- all re-defining the pore throats leading to much lower flow properties, 0.01 to 2000mD. Some diagenetic processes have created secondary porosity, but other processes have ACM such as kaolinite, clinochlore occupying the pore spaces of reservoirs. However, authigenic pore filling minerals are not restricted to clays, other Fe-bearing minerals such as pyrites and gypsum contributed to re-shaping of the pore throats.

Biography

Gloria Otosigbo is a PhD student in the University of Ibadan and a lecturer in Alex Ekwueme Federal University, Nigeria. She has just completed her PhD analytical research at University of Alberta Canada under the supervision of Prof Murray Gingras. She had bulk of experience in the oil servicing sector analysing cores from the Niger Delta basin. She is a member of Nigeria Mining and Geoscience Society (NMGS)

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