Petrography and Stable Isotope Geochemistry of Cretaceous Sandstones, Orange Basin, South Africa

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The siliciclastic rocks of the Orange Basin were subjected to diagenetic and reservoir quality evaluation. 33 core and side wall core samples were collected for this investigation within the genetically related packages (systems tracts); lowstand systems tract (LST), transgressive systems tract (TST) and highstand systems tract (HST) to determine the prevailing conditions at deposition and post deposition of the sediments. The samples were subjected to petrographic and mineralogical analyses including bulk stable isotope analysis of oxygen and carbon. Petrograhically the basin shows complex diagenetic histories which include compaction, cementation/micritization, dissolution, silicification/overgrowth of quartz, and fracturing. The Eh-pH shows that the cements in the area of the basin under investigation were precipitated under weak acidic and slightly alkaline conditions. The $\delta^{18}O$ isotope values range from -1.648 to 10.054 %, -1.574 to 13.134 %, and -2.644 to 16.180 % in the LST, TST, and HST, respectively. While $\delta^{13}C$ isotope values range from -25.667 to -12.44 %, -27.862 to -6.954% and -27.407 to -19.935 % in the LST, TST, and HST, respectively. The plot of $\delta^{18}O$ versus $\delta^{13}C$ shows that the sediments were deposited in shallow marine temperate conditions. The consistency of $\delta^{13}C$ isotope across the stratigraphic sequences indicates that the burial diagenesis has no significant effect on geochemical pattern of the $\delta^{13}C$ isotope in the sandstones under investigation. The authigenic minerals precipitated blocked the grain interspaces and interlayers and with continued burial, compaction impeded the development of secondary porosity resulting in the poor reservoir quality. The origins of the cementing materials are both autochtonous and allochtonous.