Diagenetic Processes in Clastic Pre-salt Reservoirs, Onshore Espírito Santo Basin, Eastern Brazil

De Ros, Luiz F.[1]; Goldberg, Karin [1]; Dani, Norberto [1]; Armelenti, Garibaldi [1]; Carvalho, Awilsa S.[1]; Zambonato, Eveline E.[2] (1) Geosciences Institute, UFRGS, Porto Alegre, Brazil. (2) UN-ES/EXP/SE, PETROBRAS, Vitória, Brazil.

Fluvial and estuarine sandstones of the Aptian Mucuri Formation are major reservoirs in the onshore Espírito Santo Basin, eastern Brazil. They are temporally equivalent to the huge offshore pre-salt reservoirs under exploration. The quality of the Mucuri reservoirs is strongly impacted by intense diagenetic processes. The sandstones are dominantly medium to coarse-grained, and very rich in detrital feldspars, biotite, garnets and other heavy minerals. The main diagenetic process involved the authigenesis of rims, coatings and microcrystalline aggregates of smectitic clays, as intergranular cement and replacing grains of feldspars, biotite and unstable heavy minerals, in places also dissolved and replaced by kaolinite. Cementation by coarse calcite was very heterogeneous, and concentrated in the sandstones with less smectite. Coarse pyrite replaced biotite, mud intraclasts, and previous diagenetic constituents. Minor diagenetic constituents include dolomite, K-feldspar overgrowths and Ti minerals. Porosity is mostly primary, dominantly reduced by cementation, although secondary intragranular and moldic pores from grain dissolution are locally significant. Diagenesis promoted the development of very heterogeneous, complex and irregularly-connected pore systems, what strongly impacts oil recovery from the reservoirs. The intense and complex diagenetic processes are interpreted as product of the interaction between the unstable primary composition and reactive pore fluids. Meteoric fluids related to the alluvial setting promoted grain dissolution and kaolinite authigenesis. The voluminous authigenesis of smectite and calcite was caused by reactions between the feldspars, heavy minerals and micas, and brines derived from the adjacent saline environments and from overlying Aptian evaporites. The precipitation of replacive pyrite was related to fluids charged in H2S derived from thermal sulfate reduction. The characterization of the types, amounts, and time and space distribution of the major diagenetic processes responsible for porosity modification in the Mucuri sandstones is of paramount importance for increasing oil recovery from producing reservoirs, as well as for the reduction of exploration risks through the development of quality-predictive models. Furthermore, the understanding of eodiagenetic conditions taking place in pre-salt marginal settings should shed light on the origin and evolution of the voluminous offshore reservoirs.