Abstract

This thesis demonstrates that geological setting, depositional facies, open system flux of hot basinal brines and descending of shallow waters have a strong impact on the distribution of the diagenetic alterations within continental and paralic/shallow marine sandstones which in turn control the quality and heterogeneities of the reservoirs.

Geological setting controls the mineralogical and textural maturity of sandstone, whereas depositional facies control the pore water chemistry (marine, brackish or meteoric), sedimentary texture and sand body geometry. Eogenetic alterations in the fluvial deposits are dominated by precipitation of infiltrated clays, kaolinitization of detrital silicates, whereas the shallow marine deposits are dominated by precipitation of early calcite and kaolinite. Conversely mesogenetic alterations are dominated by clay minerals transformation, quartz overgrowths and Ferroan-carbonates, barite and anhydrite. Flux of hot basinal brines is evidenced by precipitation of mesogenetic minerals that lack of internal sources (e.g. barite, anhydrite and ferroan carbonate cements), which is evidenced by: (1) restricted occurrence of these minerals in downthrown blocks. (2) The high fluid inclusion homogenization temperatures (Th) of quartz overgrowths (Th > 110-139°C), and carbonate cements (T > 80-140°C), which also have light δ18Oc, v(PDB) (-17.6‰ to -6.7‰). Flux of hot basinal brines is further evidenced by occurrence of saddle Fe-dolomite along stylolites. Fluid inclusion microthermometry further revealed a dramatic shift in pore-water chemistry from NaCl dominated brines during precipitation of quartz overgrowths to NaCl-CaCl2 dominated brines during cementation by Fe-dolomite. Presence of mixed brine (NaCl+CaCl2) systems in the fluid inclusions suggests flux of descending waters, which have circulated in the overlying carbonate-evaporite successions. The restricted occurrence of oil-filled inclusion to quartz overgrowths and methane to Fe-carbonate cements suggest migration of oil during precipitation by quartz and migration of methane during precipitation by Fe-carbonate cements. The extensive mesogenetic cements in the down thrown blocks is attributed to flux of basinal brines along deep seated faults, i.e. open system diagenesis.

Integration of fluid inclusion microthermometry, isotopes, Raman spectrometry and thermal tectonic evolution of basins are essential techniques for unraveling the evolution of basinal fluids, cementation conditions and relative timing of hydrocarbons migration.

Keywords: Diagenesis, Structural setting, Depositional facies, Basin thermal history, Thermal/Hot basinal brines, Fluid inclusions, Raman Spectrometry, Stylolites, Hydro-carbon migration

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