

Origin and spatial distribution of clay coatings in estuarine deposits: Comparisons between a modern analogue (Gironde estuary, France) and deep sandstone reservoirs (Bonaparte Basin, Permian).

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The development of clay (mainly chlorite) coatings around detrital quartz can be a major factor controlling reservoir quality in deeply buried sandstone reservoirs (> 3500 m). These coatings prevent quartz overgrowth and thus preserve porosity and permeability during burial. Although the link between clay coatings and good porosity has been established in a number of ancient estuarine sandstone reservoirs (e.g. North Sea, Bonaparte Basin...), questions remain about their initiation (sedimentary, diagenetic), the factors controlling their evolution and the prediction of their spatial distribution. Answering these questions would reduce the uncertainty associated with the exploration of such reservoirs, for deep hydrocarbons or geothermal purposes. The method consists in the comparison of estuarine facies and petrography by investigating a deep sandstone formation (offshore Australia, Bonaparte Basin) and a modern analogue (the Gironde estuary). The objective is to better predict the spatial distribution of well-preserved reservoirs properties within deeply buried sandstone reservoir. Relationships between the development of detrital clay grain coats, the sedimentary characteristics (facies, geobody types, grain size, clay mineralogy...) and reservoir properties will be established.

Cores descriptions allow to determine similar facies between both environments. Petrographic and mineralogical experiments on 38 samples from Bonaparte basin and almost 400 samples from the Gironde were realized. On Bonaparte basin samples, clay coatings (mainly composed of chlorite, illite and mixed-layer clay minerals) are observed around sand grains. Samples from the Gironde show the presence of detrital coats mainly composed of clay minerals associated with diatoms, silt-size grains, and coccoliths. Coats are partially developed on most grains (10-30 % of sand grains surface) forming various textures. They are formed during sand grains deposits and preferentially in the inner part of the estuary (from the Bay Head Delta to estuarine channels). In the Bonaparte basin (3500 m depth), observations of aggregates located around sand grains could be precursors relic which formation could be syn-sedimentary. After mechanical compaction or at the beginning of chemical compaction, transformations of those aggregates may allow the formation of continuous chlorite coatings around quartz grains. Thus, paleo-Bay Head Delta must be found in ancient sandstone during reservoir exploration.

Mots-Clés: Coatings, Estuary, Reservoirs, Diagenesis, Comparisons

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