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ABSTRACT BOOK

ORIGIN AND SPATIAL DISTRIBUTION OF SAND GRAIN COATS IN SHALLOW MARINE CLASTIC DEPOSITS: INSIGHTS FROM A MODERN ESTUARINE RESERVOIR ANALOGUE (GIRONDE ESTUARY, FRANCE)

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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 objective of the scientific project CLAYCOATing in shallow marine clastic deposits to improve reservoir quality prediction" is to establish the origin, nature, and spatiotemporal distribution of clay precursors in a well-constrained stratigraphic and sedimentary framework. The first phase of this project is the study a modern mud-rich estuary characterized by the presence of a Turbidity Maximum Zone (TMZ, few tens of $g.l^{-1}$), the Gironde estuary (SW France). All tidal bars, point bars and mid-channel bars have been sampled (surface sampling) from the Bay-line to the estuary mouth along a 150 km long transect, during low and high-river stage. Surface sands have been sampled in trenches during low-tide slack-water, less than 6 hours after the deposition of sandy ebb dunes. In addition, 9 boreholes were drilled with a total recovery of 50 m in order to assess the evolution of vertical facies associations. Within studied sands bars, fine fraction (< 2 m) is not negligible and accounts for 16 wt. % of the sediment on average. This fine fraction is composed of quartz, carbonate, muds and clays. The clay mineral associations are made of kaolinite, chlorite, illite and smectite. Optical and scanning electron microscopy show the existence of anisopachous sand grain coats, composed mainly of illite, smectite, a mix of smectite and chlorite or illite and chlorite, associated with diatoms, silt-size grains, and coccolithophorids. Coats are partially developed on most grains (10-30 % of sand grains surface) forming ridged, bridged, drapes or clumped textures, and rarely continuous clay drapes. In surface samples, twenty-eight percent of detrital grains are coated, on average, along the estuary. Sand grain coats are mainly located in heterolithic tidal bars from the Gironde inner estuary funnel (25 % of sand grains are coated on average) and in estuarine heterolithic point bars from estuarine channels (34 %). Lowest percentage is located downstream in the Gironde outer estuary funnel (8.5 %). Distribution of sand grain coats fits quite well with the position of the TMZ, where most of the suspended clay flocculate. The TMZ is centered on the estuarine channel during low-river stage and on the Gironde estuary funnel during high-river stage. The presence of diatoms within clay envelopes indicates a possible role of Extracellular Polymeric Substances (EPS) possibly produced by diatoms in the aggregation of clay minerals around quartz. Sand coats may also be derived from infiltration of turbid water within sand-dominated sediment.