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Architectural variability of confined turbidite sheet-sands: facies, geometry and infill of associated elementary channels. Examples from the Trois Evêchés Basin, Annot Sandstone Formation, SE France

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The worldwide known Annot Sandstone Formation has been considered as a reference of confined siliciclastic turbidite system. This formation crops out in SE France and represents the Upper Eocene to Lower Oligocene gravitary infill of complex foreland basins, developed in front of the Alpine thrusts. This system can be assimilated as a sand-rich turbidite ramp, sourced by multiple fan deltas leading to topographically complex sub-basins. Highly bypassing channelized systems dominate in the most proximal and most confined areas. They distally evolve to relatively less confined areas, in which sedimentary bodies appear to be more continuous and homogenous on a regional scale. These last architectural elements, defined as sheet-sands or depositional lobes, have been the focus of this study in poorly documented areas.

From an important dataset made of very high resolution outcrop correlations (gathered mainly in the Trois Evêchés and Lauzanier sub-basins), we have quantified the complex distribution of sedimentary facies and structures, grain-size and key surfaces in sand-rich sheets. This was done to understand their variability from depositional event to architectural element scales and to better characterize dimensions and characteristics of their components. Six main types of architectural elements were defined, composed of both channelized and unchannelized elements. Channelized units show a high variability in terms of facies, geometry and patterns of infill that are related to multiple erosional and depositional processes, which will be discussed. We notably relate some evidences of sinuous channels, represented by lateral accretion deposits in the channel complex axis and by low angle cross-bedded facies. We interpret this particular facies as the result of flow deconfinement and overbanks above channel margins. The stratigraphic analysis of elementary objects allows us to propose a genetic model and a spatial distribution model of sheet-sand architectural elements. The latter provides their longitudinal repartition, from proximal vertically stacked internal channels to distal compensating sheets.

Those features have not been accurately described in relatively distal sand-rich turbidite deposits so far and this high internal variability necessarily implies heterogeneities both in terms of petrophysical characteristics and reservoir connection. Besides, it also implies reconsidering sedimentary processes involved in these environments.

Key Words: Annot Sandstones, Confined Systems, Reservoir Heterogeneities, Turbidite Sheet-sands.