Computer Simulations of Flow Baffles and Barriers

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ABSTRACT: Deposition systems often involve complex interplay of allogenic and autogenic controls. Auto-genic processes are the dynamical processes that are intrinsic to a depositional system. They often include processes of fluid flow, sediment transport, erosion, deposition, subsidence and compaction. Allo-genic processes are the dynamical processes that are extrinsic to the depositional system. They typically include sea level variations, tectonics and climate changes. The interplay between autogenic and allogenic processes creates complex reservoir architectures composed of high perm sedimentary bodies that are bounded by hierarchy of shales that form flow baffles and barriers. Poor understandings of the origins, and the hierarchical nature of these flow baffles and barriers, are often the biggest contributor to the high uncertainties in flow simulations and reservoir forecasting.

Here, we demonstrate that significant insights can be obtained from process based forward numerical models on the nature and organization of these baffles and barriers. The process based model we used is developed in ExxonMobil. It is fully based on the physics of fluid flow and sediment transport. The model is currently able to produce realistic stratigraphic architectures and sedimentary body geometries and property distribution at multiple scales in both shallow and deep water environment.

The study demonstrated that the close link between the flow and sedimentary processes and the formation of these baffles and barriers. It suggests that the organizations in deposition processes, both autogenic and allogenic processes, are the origins of many scaling relationships and hierarchies we observed in rock record (e.g. hierarchy of shales).