
Which Reservoir Layering for Carbonate Reservoirs? Depositionally or Diagenetically Driven?

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The architecture, heterogeneities and petrophysical properties of carbonate reservoirs result from a combination of platform morphology, related depositional environments, relative sea level changes and a variety of diagenetic events. The reservoir layering built for static and dynamic modelling purposes should reflect the key heterogeneities (depositional or diagenetic) which govern the fluid flow patterns. The layering needs to be adapted to the goal of the modelling, ranging from full field computations of hydrocarbon volumes, to sector-based fine-scale simulations to test the recovery improvement and its control.

This paper illustrates from subsurface to outcrop studies, various reservoir layering types, including schemes dominated by depositional architecture, and those more driven by the diagenetic overprint. The examples include carbonate platform reservoirs from different stratigraphic settings (Tertiary, Cretaceous, Jurassic and Permian) and different regions (Europe, Africa and Middle East areas). This review shows how significant stratigraphic surfaces (such as sequence boundaries or maximum flooding surfaces) with their associated facies shifts, can be often considered as key markers or intervals to constrain the reservoir layering. Examples are given of reservoir layering which are driven by the depositional heterogeneity at both the layering and the intra-layering scale. Conversely, this paper also outlines how diagenesis, resulting in units with particular poroperm characteristics, may significantly overprint the primary (depositional) reservoir architecture by generating flow units which cross-cut depositional sequences. To demonstrate how diagenetic processes can create reservoir bodies with geometries that cross-cut the depositional fabric, different types of dolomitization and karst development are illustrated.
