

The Impact Of Sedimentary Heterogeneity On Oil Recovery In Basin-plain Turbidite: An Outcrop Analogue Simulation Case Study

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Abstract : In turbidite reservoirs with volumetrically significant thin-bedded turbidites (TBTs), thin-pay intervals may be underestimated during calculation of reserve volume due to poor vertical resolution of conventional well logs. This paper demonstrates the strong control of bed-scale sedimentary heterogeneity on oil recovery using six facies distribution scenarios that were generated from outcrop data from the Eocene Itzurun Formation, Basque Basin (northern Spain). The variable net sand volume in these scenarios serves as a primary source of sedimentary heterogeneity impacting sandstone-mudstone ratio, sand and shale geometry and dimensions, lateral and vertical variations in bed thickness, and attribute indices. The attributes provided input parameters for modeling the scenarios. The models are 20-m (65.6 ft) thick. Simulation of the scenarios reveals that oil production is markedly enhanced where degree of sedimentary heterogeneity and resultant permeability contrast are low, as exemplified by Scenarios 1, 2, and 3. In these scenarios, bed architecture encourages better apparent vertical connectivity across intervals of laterally continuous beds. By contrast, low net-to-gross Scenarios 4, 5, and 6, have rapidly declining oil production rates and higher water cut with more oil effectively trapped in low-permeability layers. These scenarios may possess enough lateral connectivity to enable injected water to sweep oil to production well; such sweep is achieved at a cost of high-water production. It is therefore imperative to consider not only net-to-gross threshold but also facies stack pattern and related attribute indices to better understand how to effectively manage water production for optimum oil recovery from basin-plain reservoirs.

Keywords : architecture, connectivity, modeling, turbidites

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