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**Evaluating Key Controls on Reservoir Fluid Mixing**

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One of the most important and unconstrained aspect of petroleum systems analysis concerns the charging and emplacement of petroleum to a structure or prospect. Trap geometry, petroleum charge rates, charge compositions, leakage, and spill, all affect residence time in a reservoir and associated fluid mixing processes. Improving our understanding of these processes can have significant impact on production strategies since they can, for example, help us in evaluating fluid compartmentalization, and assist in the prediction of oil quality in advance of expensive drilling programs.

This paper deals with the use of petroleum-systems-guided compositional fluid mixing simulators and their application in evaluating the key controls on fluid mixing processes. These tools enable the forward simulation of detailed reservoir charging and fluid property evolution, coupling the effects of advection, diffusion, gravity segregation and rock/fluid alterations. We look at how compositional heterogeneities in reservoir fluids arise, how these fluid heterogeneities equilibrate, and provides guidance on the timescales and characteristics of the mixing processes.