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Composition Driven Diagenesis: Stratigraphic, Burial History and Sedimentologic Control on Mass-transfer

Composition Driven Diagenesis (CDD) is a conceptual model that postulates that the initial compositional variations, early diagenetic processes and their products, and the thermal history control the majority of later reservoir diagenesis in many clastic reservoirs. In this conceptual model, diagenetic effects such as cements or secondary porosity are classified as either intrinsic or extrinsic. Thus, the model offers a theoretical basis for the many observations that diagenesis appears to be related to stratigraphic and depositional processes.

In this context, conventional reservoirs are those in which the majority of burial diagenesis is controlled by local compositional variations, which are intrinsic, rather than extrinsic factors such as invasive fluids. These intervals have low advective flow volumes and heating is controlled by burial alone. Mass re-distribution during diagenesis is dominantly by diffusive transport. In contrast, unconventional reservoirs are defined as those where the majority of diagenesis is controlled by extrinsic factors such as anomalous heat sources and large advective flow of extrinsic fluids (e.g. flow along faults, aquifers, and fracture network).

The coupling of the CDD conceptual model to the WRIS.TEQ software produces an effective tool for predicting reservoir quality. WRIS.TEQ is a general multi-mineralic water-rock interaction simulator that implements advective and diffusive mass-transfer, and kinetic and equilibrium reactions among minerals and water. Using WRIS.TEQ, the CDD concept is tested on several published studies. Simulation results help evaluate to 1) the role of intrinsic properties on overall mass-transfer; and 2) better delineate the extrinsic affects that produce unconventional reservoirs.