Predicting Dolomite Geobodies: Exploitable Insights from Reactive Transport Models

Gareth Jones*
ExxonMobil Development Company, Houston, Texas, United States
gareth.d.jones@exxonmobil.com

and

Yitian Xiao
ExxonMobil Upstream Research Company, Houston, Texas, United States

Abstract
Understanding the geometry and the spatial distribution of petrophysical properties in dolomite geobodies is critical for optimal field development and production of dolomite reservoirs. Existing predictions of dolomite in the subsurface are largely observationally based with often limited qualitative dependency on hydrologeologically-based conceptual models.

In contrast, Reactive Transport Models (RTM's) that explicitly couple fluid flow and chemical reactions to facilitate quantitative investigations of diagenetic geobody evolution are a recent addition to the dolomite prediction tool kit. The approach is illustrated with a generic study designed to investigate the fundamentals of brine reflux dolomitization. Results provide new insights on:

- The geometrical evolution of reflux dolomite geobodies,
- Permeability heterogeneity and dolomite finger development,
- The evolution of petrophysical properties including "overdolomitization",
- Dolomitization and anhydrite cementation (including feedbacks on flow and reactions)
- The significance of mesosaline versus hypersaline brine sources.

In addition, critical assumptions and limitations of the Reactive Transport Modeling approach will be emphasized and discussed.

Used in combination with available observational data and paleoenvironmental reconstructions we contend that this process-based approach has significant implications for reservoir exploitation in augmenting and developing scenarios for predicting reflux dolomite geobodies.

The application of reactive transport models to well-constrained field examples of different styles of dolomitization will test the limits of this technology to help predict the distribution and petrophysical properties of dolomite geobodies in the subsurface.