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Please fill in your abstract title.	Reactive Transport Modeling to Study Local Mesogenetic Dissolution in Carbonate and Sandstone Reservoirs Induced by Natural Gas Acidic Components	
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Abstract

The objective of this study is to investigate the mechanism of local porosity modification in carbonate and sandstone reservoirs caused by acidic components associated with natural gas generation. The following questions are explored with coupled reactive mass transport modeling (RTM): (1) Can acidic matter redistribute/modify the local pores of reservoirs at a large scale? (2) How does the dissolved mass migrate? (3) What is the degree of local porosity change? (4) Dissolution/precipitation of which mineral(s) control(s) porosity redistribution/modification?

Numerical models for the charging of natural gas rich in acidic components (CO₂) were developed for generic carbonate and sandstone reservoirs, respectively. In the reactive transport models, gas-water-rock interactions and multiphase flow are coupled, and spatial heterogeneities of the geochemical reactions and flow were also considered. The models are vertical 2D and the simulation time is 20 Ma. The model parameters are based on the observations from hydrocarbon fields. The simulated gas saturation, flow, solution chemistry, porosity and mineral evolution, etc. are quantitatively analyzed.

For the carbonate reservoir, simulation results indicate (1) CO₂ can induce local mesogenetic dissolution, which occurs mainly in the vicinity of gas-water-contact (GWC) and, for the configuration in this study, results in the porosity increase limited in the trap. After regional groundwater migrates across GWC, groundwater is acidified by the CO₂(g) in the gas zone, and thus will dissolve carbonate minerals to form secondary porosity. Our results indicate that generated secondary porosity due to local mesogenetic dissolution is ~0.04 (volume fraction of total rock), with a maximum value of ~0.27. The dissolved minerals are transferred out by the groundwater flow. (2) Mesogenetic dissolution occurs on the localized area in the formation (e.g., the trap), not the entire formation. Therefore, it only requires a small amount of CO₂ and groundwater. The limited CO₂ from source rock and groundwater flow in the subsurface seem to be sufficient to support local secondary porosity generation. For the sandstone reservoir, similar conclusions are reached. The primary reactive minerals are feldspars and calcite, but the calcite is the prevailing mineral inducing porosity increase. The generated secondary porosity which is mainly limited in the vicinity of GWC is ~0.04.

This is a novel study of diagenesis and porosity changes in the carbonatite and clasolite using numerical modeling. This is an attempt to quantitatively assess the impact of diagenesis on reservoir quality.