

Quantifying the effect of chlorite on reservoir quality and CO₂ sequestration in deep saline sandstone reservoirs

ZIYI WANG, YAXIN SHANG AND KEYU LIU

China University of Petroleum (East China)

Chlorite can strongly affect the quality of clastic sandstone reservoirs and may also impact the potential of geologic sequestration of CO₂ in saline aquifers. At present, there is a lack of quantitative evaluation of the effect of chlorite on CO₂ sequestration in sandstones. Here we applied a suite of analytical techniques including petrographic and petrological analysis, X-ray diffraction measurement, petrophysical analysis, and CO₂-fluid-rock reactive-transport simulations to investigate the impact of chlorite on reservoir quality and CO₂ geological sequestration in the Upper Permian sandstones in the northeastern Ordos Basin. Three chlorite types in sandstone are identified: grain-coating, pore-throat-blocking, and pore-filling. Grain-coating chlorite sandstones feature thin chlorite wrapping on sand grain surfaces that effectively prevent quartz cementation, thus enhancing reservoir quality. Pore-throat-blocking chlorite sandstones generally exhibit high porosity but low permeability; the thick chlorite coatings curb quartz cement growth, maintaining good porosity but potentially obstructing pore throats, substantially reducing permeability. Conversely, pore-filling chlorite sandstones demonstrate low porosity and permeability due to extensive chlorite filling the pore spaces as matrix. Based on one-dimensional reactive transport simulations, it is found that high-quality reservoirs may not always be the most suitable for CO₂ geological sequestration when considering the key geochemical sequestration mechanisms (dissolution and mineral trapping). When disregarding the impact of chlorite on reservoir quality, pore-filling chlorite sandstones, with their high chlorite content, are most suitable for CO₂ sequestration due to their greater capacity for trapping CO₂ via mineralization. However, when both chlorite content and reservoir quality factors are considered, pore-throat-blocking chlorite sandstones are more favorable for CO₂ sequestration.