

Coupled mineral alteration and oil degradation in thermal oil-water-feldspar systems and implications for organic-inorganic interactions in hydrocarbon reservoirs

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Organic-inorganic interactions after oil charging are critical for determining the ongoing evolution of hydrocarbons and rock quality in reservoirs. It is the conceptual approach of this study to simulate and decipher these interactions, using quantitative analyses of the interrelated changes of minerals, water, hydrocarbons, gases and organic acids in different hot oil-water-rock systems. Oil and feldspar have little interaction in anhydrous system. In hydrous system, oil degradation can accelerate feldspar alteration; in turn, the mineral alteration catalyzes the oil degradation in deionized water systems but retards the oil degradation in NaCl-water systems. The mutual exchange of H⁺ and OH⁻ ions among minerals, water, and hydrocarbons results in the mutual interaction between oil degradation and mineral alteration, with water serving as a bridge for the ion exchange. Organic-inorganic interactions proceed along different pathways in different geochemical systems, and may result in degradation of hydrocarbon and reservoir quality in oil layers but improvement of hydrocarbon and reservoir quality in oil-water layers.