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Diagenesis and its impact on the reservoir quality of Chang 7 tight sandstones in Ordos basin, China

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Chang 7 sandstones, which were deposited in the delta-lacustrine system in late Triassic in Ordos basin, were interbedded with the adjacent source rocks, creating favorable conditions required for the formation of tight oil reservoirs. A combination of thin sections, SEM, BSE, EDS, XRD and fluid inclusions was used to investigate the diagenesis and its impact on the reservoir quality of Chang 7 tight sandstones.

A detailed petrography observation reveals that quartz cement usually occurs as overgrowths or euhedral quartz. Extensive dissolution and albitization of K-feldspar can be observed. Five types of carbonate cements, including ferrocalcite, ankerite, dolomite, calcite and siderite, occur during different diagenesis stages. Two main types of illite are observed: scattered, chaotic sheet-like illite and fibrous illite. Chlorite mainly occurs as clay coatings or rims and occasionally as double rims or rosettes. Kaolinite mainly occurs as booklets and vermicular aggregates. The illitization and chloritization biotite, mixed-layer I/S and other minor minerals can also be observed.

The diagenetic environments of Chang 7 sandstones underwent a process from “acid—alkaline—acid—weak acid”. In response to the evolution of diagenetic environments, different diagenesis processes occurred during burial period including: 1)compaction, alteration of volcanic materials and mica, formation of smectite, kaolinite, early-stage quartz cement and chlorite; 2)calcite cement and quartz dissolution; 3)smectite illitization, late-stage quartz cement and feldspar dissolution; 4)feldspar albitization, late-stage carbonate cement and authigenic illite and chlorite. Finally, a more detailed, systemic and comprehensive diagenetic history is established.

Compaction and cementation are almost equally important factors for porosity reducing in Chang 7 sandstones. Among all cements, carbonate cement exerts a dominant impact on reduction of porosity, whereas quartz cement and authigenic clays are less important. However, It’s worth mentioning that pore-lining clays are conducive to porosity preservation. As for Chang 7 sandstones, most of the porosity variations are caused by a combination of these factors including compaction, carbonate cement, quartz cement and authigenic clays.

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