

Dolomitization and Reservoirs Characteristics of Chx-Fxg Formation in Sichuan Basin(SW China)

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The upper Permian Changxing(Chx) Formation reef complexes and the lower Triassic Feixianguan(Fxg) Formation oolitic shoal carbonates in the subsurface of Sichuan basin are significant reservoir rocks of several gas fields, and have been the focus of numerous studies on dolomitization in recent years.

The deep-burial Chx-Fxg carbonate reservoirs in Longgang area of Sichuan basin occur at present day depth of more than 5000m. High-quality carbonate reservoirs are restricted to dolomitized strata and they are generally distributed along the platform margin, reflecting facies and diagenetic (i.e. dolomitization) control on reservoir quality. Nearly all the discovered gas pools in Longgang area are distributed in these dolomites. Understanding the mechanisms of dolomitization in these deep gas reservoirs is of vital importance for efficient hydrocarbon exploration.

Petrography, stable isotope, fluid inclusion and trace element analysis are conducted to shed light on the origin of dolomitization. A burial dolomitizing model was proposed based on the following evidences: (1) Replacement dolomites often distribute along or overlap stylolites, suggesting formation after considerable burial; (2) Isotopic values of dolomites range from 1.74 to 3.57‰PDB for $\delta^{13}\text{C}$ and -4.63 to -7.33‰PDB for $\delta^{18}\text{O}$. Negative oxygen isotopic values and positive carbon isotopic values indicate high precipitation temperatures and scarcely any influence from freshwater; (3) Homogenization temperatures (range from 85 to 115 degree Centigrade) of primary fluid inclusions in dolomites suggest their deep-burial origin; (4) High concentration of Sr and Fe in dolomites indicates a closed system and anoxic diagenetic environment.

A preliminary dolomitizing process was put forward. During sedimentation of Chx and Fxg carbonate, meteoric leaching was taken place due to periodic sea-level change. Meteoric leaching resulted in mold and/or intragranular porosity in the precursor carbonate, providing the space for subsequent dolomitizing fluids. After considerable burial, dolomitizing fluids were compelled out of the underlying shales and/or the basinal shales in Kaijiang-Liangping Trough. Dolomitizing fluids migrated upward along faults and fractures and entered the porous and permeable Chx-Fxg carbonate altered by meteoric leaching, and dolomitization occurred.