

Geochemical evidence for burial dolomitization of upper Permian reservoir rocks in northeastern Sichuan Basin, southwestern China

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Based on outcrop measurement of Longzuimiao in Kai County, Panlongdong in Xuanhan and Huaying Mountains, and core description of 4 wells, it is revealed that the reef type changes from platform margin framework reefs along "Kaijiang—Liangping" trough in northeast Sichuan to intraplatform pinnacle reefs in middle Sichuan area.

The outcrop characteristics of organism reefs distinguish in different facies and different areas. Organism reefs in the Northeastern Sichuan Basin, which are margin reefs, show good cyclicity, which is composed of reef base, reef core and reef cap, or composed of reef base and reef core. The structures are mainly shoals at the bottom, reefs at the middle and the top, and ooid shoals in the overlying Triassic Feixianguan Formation. Abundant residual asphalt can be found in the outcrops, which disseminates in pores, cracks and organism cavities, or distributes in block groups. Many needle pores can also be observed unevenly distributed. Crystal pores and holes are always filled with calcite cements.

The cathodoluminescence characteristics show 2 stages of dolomite zonations, which means dolomitization of 2 stages by different dolomitizing fluids during diagenesis process. Dolostones in the Changxing Formations show petrographic properties of burial dolomite, and geochemical characteristics of high $^{87}\text{Sr}/^{86}\text{Sr}$ isotopes, lower Sr^{2+} content, higher Fe^{2+} content, relatively higher $\delta^{13}\text{C}$, and very negative $\delta^{18}\text{O}$. $\delta^{13}\text{C}$ & $\delta^{18}\text{O}$ is helpful in distinguishing the genetic types of dolomites, and the properties and temperatures of diagenesis fluids. All 21 dolomite samples from study area show minus $\delta^{18}\text{O}$, mostly in $-3\text{‰} \sim -10\text{‰}$, with an average of -4.95‰ , which can indicate a reducing environment (Hudson, 1977). $\delta^{13}\text{C}$ are mostly in $1\text{‰} \sim 5\text{‰}$ with an average of 3.0‰ , which stay within the variation range of normal marine carbonate ($-5\text{‰} \sim +5\text{‰}$); $\delta^{13}\text{C}$ of well samples (2.47‰ in average) is slightly higher than $\delta^{13}\text{C}$ of outcrops (3.7‰ in average). The homogenization temperature and salinity of fluid inclusions are very high, indicating that the dolomitization fluid of the Changxing Formations comes from the marine-originated saline formation water in Upper Feixianguan Formation.

Dolomitization and dissolution added porosity and permeability to the reservoir rocks, while compaction, cementation and late mineral fillings destroy the reservoir to some extent.