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Reconstructing the History of Pore Evolution of Ultra-deep Carbonate Reservoir, Constrained by Multiple Geochemical Parameters

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There are multiple stages of diagenesis fluids flow modification during the forming process of dolomite reservoir in Ordovician of Gucheng area, Tarim basin. These process made the reservoir's strong heterogeneous and caused the controversy during the study on dolomitiation path of different domomite occurrence and their reservoir space evolution process. Lock down key diagenesis stage accurately is a crucial step to study the reservoir evolution process including relative sequence of diagenesises and their matching relation with reservoir spaces. Based on techniques such as laser ablated U-Pb dating and element mapping, samples from typical well cores were analyzed. Rock components including powder dolomite, surrounding rock, medium-coarse crystal dolomite on the wall of pore or vug, calcite cementation in vug were tested by the method of laser ablation in situ U-Pb dating. Dating results show that the age of origin high energy shoal carbonate sediment is approximately 475.35Ma, which found the material base of reservoir evolution. There are obvious 2 stages of dolomitation fluids and 1 stage of calcite fluid cementation interacted with reservoir in order during its evolution process. The age of first stage dolomitation is approximately 470.1Ma, which indicate a shallow burial stage. During this stage the dolomitation of surrounding rock and local seepage silt occurred and first stage fine-medium dolomite crystal on the wall of pore or vug formed. The age of second stage dolomitation is approximately 452.1Ma, which made dolomites crystals of surrounding rock larger and the formation of second stage coarse dolomite along the wall of pore or vug. The age of calcite cementation is not later than 448Ma, which caused the damage of local reservoir spaces. The existing pore spaces in dolomite mainly inherits from the preexistent pores of origin high energy shoal carbonate sediment, instead of the traditional understanding of tectonic hydrothermal corrosion pores. Fracture and hydrothermal fluid are important modification factors for pore evolution but not the major factors. These information from laser ablation in situ U-Pb dating can provide several evidence for the study of reservoir spaces formation and effective reservoir prediction of deep dolomite reservoir in Tarim basin and Sichuan basin.