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Differential Mechanisms of Acidic Fluid-induced Dissolution in Jurassic Ahe Formation Reservoirs across Various Locations within the Northern Structural Zone of the Kuqa Depression

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Abstract: The northern structural zone of the Kuqa Depression exhibits varying lithological characteristics within the Jurassic Ahe Formation, which is predominantly composed of gray to light gray medium-coarse sandstone with high heterogeneity. Based on the structural features of the region, the northern structural zone is divided into the Horst scetion, North slope section, and the Dibei slope section. Among these, the Horst scetion and the Dibei slope section are the main focus of the study. Utilizing techniques such as thin-section observation, scanning electron microscopy, nuclear magnetic resonance, constant rate mercury injection, and micro-CT, the differences in pore structure characteristics of the Ahe Formation reservoir were investigated. This approach aimed to elucidate the causal mechanisms behind the reservoir variations. The Ahe Formation reservoir is primarily composed of lithic sandstone, with dissolution pores being the predominant pore type, followed by micropores. The development of dissolution pores in the Horst scetion is notably superior to that in the Dibei slope section. Additionally, the Horst scetion exhibits larger pore throat radius and better connectivity, leading to a superior pore structure compared to the Dibei slope section. The impact of dissolution processes on pore structure is evident, and therefore, investigating the controlling factors of differential dissolution in various locations within the northern structural zone is crucial for delineating high-quality reservoirs. The Horst scetion represents a Fault~sand transport system, while the Dibei slope section constitutes a Sand~unconformity transport system. Acidic fluids serve as the primary controlling mechanism for the formation of dissolution features in the study area. On a planar scale, dissolution processes are influenced by injection intensity, with greater injection intensity favoring the occurrence of dissolution. Vertically, these processes are governed by conduit systems. In the study area, fluid migration is significantly more pronounced in conduit systems dominated by faults compared to those dominated by sand bodies. The variation in migration patterns at different locations within the northern structural zone results in differing intensities of dissolution processes, leading to variations in pore structure within the Ahe Formation reservoir.
Key word: The Kuqa depression, Dissolution pore, Microscopic pore structure, Accumulation period, Transport system

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