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Characteristics of Low-order unconformities and controlling on karst reservoir of Middle-lower Ordovician in SW Tarim Basin, China

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Some unconformities, on bed-scale and originated from regional sea level falling down and exposure of neritic carbonate platform, were defined as discontinuities in parallel formation and generally corresponding to low-order sequence-stratigraphic bounding surface. Moreover, this type of low-order unconformities controlling the interlayer karst was qualified with great potential exploration but was difficult to recognize and we aimed to investigate their characteristics and properties and formation mechanism so as to unravel their controlling effects on karst reservoir.

Based on the sedimentary outcrop, logging, trace and rare earth elements, combining with cores, thin slices, isotopes and inclusions, we recognized the low-order unconformities and set up the sequence stratigraphy of high frequency through Milankovitch cycles, within which the properties of the unconformity surfaces and their sedimentary and diagenetic environment could be investigated. And finally, the law of development of the carbonate karst reservoir could be studied through the comprehensive analysis of "sequence-sedimentology-diagenesis".

Two types of low-order unconformities (sedimentary-diagenetic surface and sedimentary one) occurred in the neritic carbonate platform of the Bamai-Yubei area, Tarim Basin. Type one, the interface of T1 between Penglaiba Formation and Yingshan Formation of Lower Ordovician, was the typical sedimentary-diagenetic surface, which was characterized with peak value of NGR caused by high value of U. Below the surface T1, the main lithology of dolomite corresponding to the dark appearance of FMI facies (relatively high conductivity), revealed the sedimentary environment was restricted platform, meanwhile meteoric vadose or phreatic environment occurred in the late stage of HST near to the surface. Above the surface T1, it transformed into the sedimentary environment of open platform in Yingshan Formation. Type two, the other type surface of T2, within the Yingshan Formation, was the typical sedimentary surface. It was still characterized with peak value of NGR caused by high value of U. At this stage the sedimentary environment was open platform, with the main lithology of limestone corresponding to the light appearance of FMI facies (relatively low conductivity). In addition, the sequence analysis suggested that the development of TST enhanced and HST weakened gradually in this period. And thus compared with that of bounding surface of T1, the extent of exposure and leaching of T2 was weak and solution pores were few. And the solution pores controlled by the surfaces of T1 and T2 developed in the syn-diagenetic stage. The micro-facies of dolomitic limestone flat and calcareous dolomite flat and intra-platform shoals in peritidal area and sand shoals in subtidal environment controlled by the surfaces of T1 and T2 were apt to be dissolved in leaching of meteoric vadose or phreatic environment.

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