Architectural Heterogeneities in Tight Reservoirs: A Case Study in the Lower Part of the Yanchang Formation in the West Ordos Basin, China

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ABSTRACT

The distribution of available pore spaces in clastic reservoirs are commonly heterogeneous, and affect importantly the efficiency of tight reservoirs for petroleum accumulation. The lower part of the Yanchang Formation in the west Ordos Basin may be looked as a typical case to understand the migration and accumulation mechanisms and processes in tight clastic reservoirs. It is found, through observations on cores and thin sections, that four different types of lithofacies may be identified in the low permeable petroliferous sandy bodies: oil bearing facie, water bearing facie, calcareous cemented tight facie and plastic granule rich tight facie. The porosity and the permeability statistic distribution characteristics are obviously differentiable among the four types of lithofacies. And the permeability of oil bearing facie is generally large, 1~10 millidarcy, though the reservoirs may be looked as tight one if average permeability were taken into account. Accordingly, the diagenesis phenomena and processes are quite different in the four types of lithofacies. One can identify three types of fluorescent bituments in oil bearing facie rocks, corresponding to geological periods of the Late Jurassic, the middle stage of the Early Cretaceous and the late stage of the Early Cretaceous. These fluorescent bituments may be used as time indicators to separate the diagensis process in the oil bearing facie rocks into three sequences, as well as those in the adjoining water bearing rocks. However, in the calcareous cemented tight facie and plastic granule rich facie, the diagensis activities occurred principally in the period corresponding to the early stage of the first diagensis sequence. The last two types of tight lithofacies locate commonly along the surfaces of lower levels of architectural elements. These restraining barriers constitute a restraining network that influenced obviously fluid currents and oil migration and accumulation, resulting important heterogeneities in reservoirs. Furthermore, a dynamical model on migration and accumulation in tight sandy reservoirs is proposed to demonstrate the causes and evolution of the heterogeneities of geofluids, reservoir properties, diagenesis phenomena, and the sweet points distribution.