

Formation Mechanism and Distribution of Lacustrine Carbonate Reservoir in Yingxi Area of Qaidam Basin (North West China)

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ABSTRACT

The upper member of Xiaganchaigou formation in the Yingxi area of Qaidam Basin is located in the source sag, which is rich in hydrocarbon resources. However, exploration in the past three decades has not resulted in significant oil and gas discoveries. One reason is that there is not a good understanding of reservoir rock types and distributions. This study, based on an integration of outcrops, cores and experimental data, proposes that the carbonate banks and flats were controlled by paleo-highs in the sag and that carbonate reservoirs with matrix porosity, contrary to carbonate reservoirs with fracture porosity claimed in previous studies, exist in the study area. These findings, listed as follows, change the exploration strategy in the study area. Six sets of large-scale lacustrine carbonate reservoirs deposited in banks and flats were developed in the upper member of Xiaganchaigou formation in Yingxi area, of which carbonates with fractures and dissolution vugs are highly efficient reservoirs. Carbonates with granular, porphyritic and laminated textures are the preferential lithologies that have dissolution vugs. It is suggested that there are inherited paleo-highs developed in the sag. Carbonates of bank-flat facies deposited in paleo-highs were frequently leached by meteoric water due to lake-level changes, resulting in dissolution vugs. Furthermore, intercrystalline porosity was created during penecontemporaneous dolomitization produced by hyper saline lake water. Overall, paleo-highs in the sag controlled the formation, distribution and oil-gas accumulation of these carbonate reservoirs. Log and seismic related methods developed in this study shed light on the distribution of lacustrine carbonate reservoirs. It is predicted that the favorable exploration area is approximately 150 km² in Yingxi area. These findings supported petroleum exploration in Yingxi area. More than 10 exploration wells obtained high oil and gas production during 2014 and 2016, and predicted oil and gas reserves are up to 100 million tons.