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Volcanostratigraphy in the Songliao Basin, NE China and Their Reservoir Significance

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Since 2000, the significant volcanic gas reservoirs have been discovered in volcanic rocks which is filled in the Songliao Basin, NE China. But little is known about the volcanostratigraphic architecture, so that the distribution regularities of the reservoirs are still unclear. Volcanostratigraphy has three essential elements: volcanic boundaries, volcanic units, and stacking patterns. Volcanic boundaries are isochronous stratigraphic interfaces formed by the eruptive intervals. In addition, relatively independent essential units (Volcanic units) are enclosed by these boundaries. Moreover these volcanic units stacking in different patterns form the Volcanostratigraphic architecture. Based on the detailed observation of outcrop at the margin of Songliao Basin and the interpretation of boreholes and seismic data, the types and characteristics of these three elements are studied. Volcanic boundaries can be classified into 3 types: eruptive unconformity boundaries, eruptive interval unconformity boundaries, and intrusive unconformity boundaries. Lava flow units can classified into 4 types by shapes: the braided lava flow units, the tabular lava flow units, the tube and the dome. The stacking patterns can be classified into 5 types: the isolated unit pattern, the intersecting stacking pattern, the layer stacking pattern, the multiple dome stacking pattern, the composite stacking pattern.
Based on volcanic boundaries, volcanic units and their stacking patterns, the volcanic framework can be built. It can constrain spatial temporal distribution of volcanic reservoirs. Primary pore and secondary pore are two important kinds of reservoir spaces in volcanic rocks. The primary pores develop independently in an individual lava flow unit which is divided by eruptive unconformity boundaries and are almost accumulated in the top of lava flow units. In another word, the primary reservoirs in lava distribute along with eruptive unconformity boundaries. The development of secondary dissolved pores depends on weathering processes and almost accumulates near eruptive interval boundaries. The stacking patterns influence the distribution of volcanic reservoirs significantly. For example, the reservoirs in intersecting stacking pattern are intersecting like and in the layer stacking pattern are layer like. Moreover, reservoir heterogeneity is mainly determined stacking patterns.