High-Resolution Sequence Stratigraphy of Shallow Lacustrine Delta Front: 
The Second Member of Sangonghe Formation, Central Junggar Basin

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Shallow lacustrine delta front (SLDF) comprises mainly sheetlike subaqueous distributary channels (SDC) formed in shallow, gentle, and tectonically steady slope (Cai and Zhu, 2011). SDC proves an important hydrocarbon reservoir type in the Daqing oilfield, Changqing oilfield, and the newly discovered Moxizhuang oilfield in Central Junggar Basin. However, SDC tends to prograde quickly and move laterally frequently, resulting in a very complex architecture of SLDF and a great difficulty in the direct identification of sedimentary rhythms from well-logging data, and this has hindered reservoir characterization and development of oilfields.

This study incorporated integrated prediction error filter analysis (INPEFA) (Djin, et al., 2005) into high-resolution sequence stratigraphy (HRSS) study (Kjemperud, et al., 2008) on the second member of the Sangonghe Formation (Lower Jurassic) (J1s2) in Moxizhuang oilfield.

Assisted by INPEFA of GR, the vertically stacking pattern of SDC is apparent, consisting of 2 medium-term INPEFA cycles and 5 short-term INPEFA cycles (Fig. 1). These cycles correspond well with base-level cycle of HRSS, that is, the increasing trend of INPEFA value stands for a base-level-rise high-cycle (BLRHC), the decreasing trend of INPEFA value a base-level-fall half-cycle (BLFHC).

Correlation of base-level cycles in profile perpendicular to sediment source direction of SLDF soundly reveals the SDCs’ distribution rhythm in HRSS framework. SDCs tend to cradle each other around the turnaroundsurfaces of BLFHC to BLRHC, and form blanket-like sandbodies. The turnaroundsurfaces of BLRHC to BLFHC usually correspond with widespread dark grey shale, in which SDCs are encased isolated. There is a tendency that SDCs become more isolated from the turnaroundsurfaces of BLFHC to BLRHC to those of BLRHC to BLFHC.

Furthermore, the correlation of base-level cycles in the whole oilfield was carried out, and thus the 3-D HRSS framework was acquired. Through the study of microfacies distribution of SLDF, a sedimentary model was summarized, indicating that the base-level controls the sedimentation of SDC and with the different terms’ fluctuation of base-level, sets of progressive or regressive sequences are deposited.

Porosity and permeability test data of cores from producing wells shows that reservoir quality has a positive relationship with the sandstone grain size. Medium-fine...
sandstone is the low-limit of reservoir, and reservoir develops in the relatively large scale SDCs. It is thus concluded that fluctuating base-level controls the reservoir distribution. Laterally connected reservoir lies near the turnaround surfaces of BLFHC to BLRHC and is widespread; laterally isolated reservoir is encased within lacustrine shale and appears near the turnaround surfaces of BLRHC to BLFHC. The oil-water relationship from producing wells proves the effectiveness of this reservoir distribution rhythm, and furthermore base-level's control on the sedimentation of SLDF.

This study improves the theory of HRSS by incorporating INPEFA, and proves it effective in bettering stratigraphy study and reservoir characterization of SLBD.

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References