

Seismic Sedimentology and Seismic Geomorphology of a Lacustrine Depositional System From the Deep Zone of the Gaoyou Sag, Subei Basin, Eastern China

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Abstract

Sandstones of the Dainan Formation in the Gaoyou Sag of the Subei Basin are important hydrocarbon reservoirs. This paper studies the sedimentary facies and sandstone dispersal patterns in the Gaoyou Sag, based on the analysis of sedimentology and seismic geomorphology. The data used in this study include lithological data, wire-line-log data and three-dimensional (3D) seismic data. The target strata are the Eocene Daiyi Member (E2d13, E2d12 and E2d11) and the lower Dai'er Member (E2d25), which belong to three third-order sequences. Five types of depositional systems were identified in the Dainan Formation based on core observation and log-facies analysis. They are, respectively, delta, fan delta, sub-lacustrine fan, nearshore subaqueous fan and lacustrine system. Stratal slices from 3D seismic volumes have been used to map the sandstone dispersal patterns and to document the evolution of the depositional systems within these third-order sequences and associated systems tracts. In the low-stand systems tract and the high-stand systems tract, sandstones of delta, fan delta and nearshore subaqueous fan were well developed and can be delineated by stratal slices showing distinct progradation towards the deep lake centre. In the transgressive systems tract, sandstones are less common. Stratal slices indicate that the depositional environments of individual third-order sequences evolved from gravel-rich or sand-rich fans to lacustrine mudstones, and finally to mixed sandstone-mudstone fans. Sandstone dispersal patterns appear to be primarily controlled by

synsedimentary faults, and generally sandstone thickness decreases with distance from the synsedimentary faults. Deltas and fan deltas have different characteristics in sand-body thickness because they have different sedimentary subfacies. The proposed geomorphology and sedimentary evolution of the lacustrine depositional system may aid in the prediction of potential reservoir distribution in the Gaoyou Sag.