Extrabasinal, Intrabasinal Source, or Mixture in a Narrow Elongate Half-Graben?: A Case Study of the Upper Eocene Liaoxi Sag in the North Offshore Bohai Bay Basin (Northeast Asia) with Constraints of Detrital Mineral, Zircon Geochronology, and Seismic Geo

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Abstract

The interaction of provenance systems is quite complicated in a narrow elongate half-graben basin, such as some small sags in the Liaodong Bay region, north offshore Bohai Bay Basin in Northeast Asia. The provenance identification has been conducted with an integrated analysis of petrographic data, heavy mineral, detrital zircon U-Pb data, and three-dimensional (3D) seismic data in the Upper Eocene Liaoxi Sag, offshore Bohai Bay Basin. According to the trends of (light or heavy) detrital mineral indices and the spatiotemporal distribution of heavy mineral assemblages, the Mesozoic-dominated extrabasinal source of local rivers from the Yanshan Mountain and the Neoarchean-dominated intrabasinal source of the Liaoxi Low Uplift contributed to the provenance mixture in the study area. The detrital zircons sampled from the candidate mixture area comprise both of the detrital zircon ages from intrabasinal and extrabasinal sources, and it also suggests the potential evolution of the hanging-wall drainage system between the syn-rift and the post-rift stages. The overlapped deltaic area between the western shoal-margin braided-river delta and the eastern border-fault fan deltas, a direct visualization of the provenance mixture, were well imaged during

the SQ3 lowstand period, but it failed to be recorded from the seismic geomorphological evidence during the SQ4. Further investigation reveals that it could be mainly attributed to the gradually submerged Liaoxi Low Uplift and the more frequent delta autogenic shifting. Shallower water depth and more efficient wave transport could be another cause of the sediment mixing within the presence of widely distributed lacustrine beach-bars between transverse deltas from both margins during the post-rift stage. This study has enhanced understandings of sediment mixing and drainage evolution in an oilfield scale from a source-to-sink perspective, and it also provides a better geological model for future reservoir characterization.