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Relative role of transfer zones in controlling sequence stacking patterns and facies distribution: insights from the Fushan Depression, South China Sea

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In sedimentary basins, a transfer zone can be defined as a coordinated system of deformational features which has good prospects for hydrocarbon exploration. Although the term “transfer zone” has been widely applied to the study of extensional basins, little attention has been paid to its controlling effect on sequence tracking pattern and depositional facies distribution. Fushan Depression is a half-graben rift sub-basin, located in the southeast of the Beibuwan Basin, South China Sea. In this study, comparative analysis of seismic reflection, palaeogeomorphology, fault activity and depositional facies distribution in the southern slope indicates that three different types of sequence stacking patterns (i.e. multi-level step-fault belt in the western area, flexure slope belt in the central area, gentle slope belt in the eastern area) were developed along the southern slope, together with a large-scale transfer zone in the central area, at the intersection of the western and eastern fault systems. Further analysis shows that the transfer zone played an important role in the diversity of sequence stacking patterns in the southern slope by dividing the Fushan Depression into two non-interfering tectonic systems forming different sequence patterns, and leading to the formation of the flexure slope belt in the central area. The transfer zone had an important controlling effect on not only the diversity of sequence tracking patterns, but also the facies distribution on the relay ramp. During the high-stand stage, under the controlling effect of the transfer zone, the sediments contain a significant proportion of coarser material accumulated and distributed along the ramp axis. By contrast, during the low-stand stage, the transfer zone did not seem to contribute significantly to the low-stand fan distribution which was mainly controlled by the slope gradient (palaeogeomorphology). Therefore, analysis of the transfer zone can provide a new perspective for basin analysis. In addition, the transfer zone area demonstrated unique hydrocarbon accumulation models different from the western and eastern areas. It was not only a structural high combined with sufficient coarse-grained reservoir quality sands, but was also associated with large-scale sublacustrine fan deposits with high quality reservoirs, indicating that the recognition of transfer zones can improve the prediction of hydrocarbon occurrences in similar settings.