

New Insight Into the Late Cretaceous Deformation and Sytectonic Sedimentation in the Songliao Basin, Northeastern China: Implications for Basin Evolution on the Pacific Northwest Continental Margin

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Abstract

The Songliao Basin is a well-known sag basin formed in response to the post-rift thermal subsidence in northeastern China during the Late Mesozoic; however, the simple sag basin model cannot explain new observations from recently acquired 3D seismic and well data. There are following five critical observations, among others, regarding the Cretaceous depositional facies and structural grains: (1) an unconformity between two maximum flooding surfaces within the thick succession that was previously assumed to be a single conformable sequence formed during the post-rift thermal subsidence; (2) an asymmetric distribution of heavy oil and oil sands that are only present in the western slope of the Basin; (3) a significant increase in the thickness of sedimentary sections towards the Zhangguangcai Mountain Range in the southeast of the Basin; (4) a profound shift in the detrital source from the northwest in the Early Cretaceous to the southeast in the Late Cretaceous; and (5) an asymmetric, west-vergent fold-and-thrust belt, with the contractional intensity decreasing from the Mountain Range in the southeastern margin to the center of the Basin. These observations suggest that the pre-existing sag basin was overprinted by a foreland during the Later Cretaceous. The findings, which have been poorly documented in previous studies, reveal the spatial and temporal relationship between

the Songliao Basin as a post-sag foreland basin and the Zhangguangcai Mountain Range as a hinterland fold-and-thrust belt. This newly defined evolutionary episode of the Songliao Basin indicates the Late Cretaceous tectonic inversion following the rift and thermal subsidence in the northeastern China, which was most likely driven by a major orogenic event during the Late Mesozoic on the Pacific Northwest Continental Margin.