Geomorphology
Volume 458, 1 August 2024, 109263

Tectonic influence on the evolutionary dynamics of deep-water channel systems along the active accretionary prism margin in the Rakhine Basin, Myanmar: A high-resolution 3d seismic analysis

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https://doi.org/10.1016/j.geomorph.2024.109263

Abstract

This study reveals the morphological transformations of a deep-water channel system within the Rakhine Basin in the northeastern Bay of Bengal through a comprehensive analysis of high-resolution 3D seismic data integrated with drilling logs. Employing the "source-channel-sink" paradigm, this investigation examined the impact of various factors, including tectonic transformations, sediment influx, slope dynamics, climatic changes, and relative sea-level fluctuations, on the evolutionary trajectory of these channel systems. Applying precise time-slicing techniques integrating root-mean-square amplitude attributes, coherent amplitude attributes, and horizontal amplitudes on seismic profiles, this investigation recognized three distinct stages in the evolution of channel-levee complexes (CLCs): the Middle Miocene erosional deep-water channel-levee complex (CLC-1), the Pliocene erosional-depositional deep-water channel-levee complex (CLC-2), and the Pleistocene depositional deep-water channel-levee complex (CLC-3). Comparative analysis revealed that the CLC-3 exhibits unique characteristics,

including shallower channel depth (D), wider channel width (W_C), extensive U-shaped cross-sectional area (S), broader natural levee width (W_L) and height (H), and the highest tortuosity coefficient (L_C/L_S) when contrasted with the other two CLCs. Furthermore, this study substantiated how tectonic processes, primarily the collision between the Indo-Eurasian plates, resulting in the Himalayan and Indo-Burma Range orogenies, have shaped the region's geological and climatic framework, thereby influencing monsoon circulation and precipitation patterns, which in turn augmented detrital material influx into the basin. Moreover, this tectonic collision has led to gradual changes in the slope gradient of the Rakhine Basin and its deep-water areas, impacting internal flow velocities and channel curvature, thus governing deep-water channel systems' development and spatial distribution. Also, episodic sea level fluctuations were identified as significant contributors to sediment transport from shelves to deep-water regions and sediment deposit reworking. Overall, this study underscores the role of tectonic changes after the Eocene in driving the evolutionary dynamics of the deep-water channel system within the Rakhine Basin, Myanmar.

Keywords:

Myanmar, 3d seismic analysis, deep-water channel systems, sediment influx, slope dynamics, climatic changes, and relative sea-level fluctuations,