Abstract

Compound Delta Clinoforms: A Detailed Analysis of its Morphology and Deposits from Modern and Ancient Examples

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Compound delta clinoforms have long been recognized in modern (Holocene) deltaic systems, where they exhibit an interplay between their shoreline and subaqueous rollovers. While their morphology is noticeable on bathymetry grids and shallow seismic surveys, little effort has been dedicated to spatially delineate their morphologies at and away the sediment sources, and relate these architectures to stratigraphically constrain ancient deposits. This study utilizes high-resolution bathymetry grids of over 20 modern deltas to establish a foundational understanding of compound clinoforms morphologies supported by a robust geospatially quantitative analysis across deltas dominated by wave and tide processes. Gradient maps consistently show two main rollovers – even within unique basin configurations – that display varying delineated geometries at and away from the main riverine sediment source. This spatially geometric mosaic between the bedforms – shoreline clinoform, subaqueous clinoform, and the platform in between – surface an intricate interaction at river mouths and their receiving basins, where dominant signatures of fluvial, tidal, and wave energies vary along the basin and can morph each bedform uniquely along the entire delta.

As a result, extracting geospatial frameworks from modern observations facilitate reinterpretation of ancient deposits, where most compound clinoform recognition difficulty arises from the lack of facies criteria and the limited incorporation of modern systems' insights. We evaluate the Cretaceous Kenilworth Member outcrops in the Blackhawk Formation along the Book Cliffs, Utah, and suggest a new compound delta clinoform hypothesis.

Outcomes of this study extend to anchoring the understanding of sediment transport in deltas and shallow marine systems, and supporting delta numerical models. Concurrently, this study has direct industry implications in expanding hydrocarbon reserves, increasing CO2 sequestration potential, and quantitatively improving facies models for reservoir characterization.

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