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Controls on the sedimentary characteristics of shelf-edge deltas in a source-to-sink context

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Shelf-edge deltas constitute important components of source-to-sink (S2S) systems. They distribute sediment to continental slopes and basin floors from rivers that have prograded across shelves, and due to their scale they form significant sediment accumulations at shelf margins. Because of their intimate relationship with regressive conditions, several geological controls govern their evolution, including relative sea-level changes, sediment budgets, river hydrology, and hydrodynamic processes; these factors are themselves influenced by characteristics of terrestrial catchments and continental shelves, and by climate. Despite their important role in sediment dispersal to shallow- and deep-marine environments, shelf-edge deltas are commonly overlooked in models that describe S2S systems, perhaps because of their relative paucity during the present-day highstand conditions. In subsurface and outcrop, their recognition can be difficult in cases where information with which to constrain the physiographic environment is limited, such that the spatial position of a delta relative to the shelf margin cannot be determined unequivocally.

This study aims to improve our understanding of controls on the sedimentary characteristics of shelf-edge deltas. For this purpose, >40 shelf-edge deltas of Late Triassic to late Quaternary age from >30 globally-distributed shelf-margin successions have been investigated, utilising literature-derived seafloor-, subsurface- and outcrop data. Following a database approach, sedimentary records have been quantitatively analysed in terms of geometry (e.g. dimensions, thickness, gradients) and facies characteristics (e.g. lithology, sedimentary structures) of depositional environments (e.g. delta top, delta front) and architectural elements (e.g. delta lobes, distributary mouth bars). Specific consideration has been given to assessment of palaeoenvironmental setting (e.g. hydrodynamic process regime, margin type, bathymetric setting, palaeolatitude). Moreover, scaling relationships between these properties and attributes of the S2S system (e.g. fluvial-system and catchment attributes, shelf configuration, shelf-slope transition) have been evaluated. Accordingly, the relative importance of controls on the sedimentary characteristics of shelf-edge deltas has been assessed.

This analysis demonstrates that environmental factors influence the sedimentary record of shelf-edge deltas via a complex interplay of dynamic processes and physiography of the S2S segments catchment, shelf and slope. Based on these findings, new facies models for shelf-edge delta types are developed, which are placed in the context of S2S linkages. Outcomes of this study aid the identification and classification of shelf-edge deltas and their preserved deposits, as well as the

reconstruction of associated environmental conditions from stratigraphic records.