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TECTONICALLY-CONTROLLED TRANSGRESSIVE AND REGRESSIVE DEPOSITIONAL SYSTEMS TRACTS: AN EXAMPLE FROM LATE DEVONIAN COASTAL AND ALLUVIAL FACIES (ROCKFIELDS MEMBER) IN A HINTERLAND-TYPE FORELAND BASIN, BROKEN RIVER PROVINCE, NORTHERN TASMAN OROGEN

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ABSTRACT

The Rockfields Member (Late Devonian) is an unconformity-bounded, coastal and alluvial facies sequence that forms the lower 800 m of a thick, non-marine and marine sedimentary basin succession (Bulgeri Formation, 3600 m) in the Broken River Province (BRP) of the Tasman Orogen, northeastern Australia. During the Late Devonian, sedimentation in the BRP was profoundly influenced by a major east-west oriented oblique-slip mobile zone (Clarke River Fault Zone) that separated an uplifted Early Palaeozoic and Pre-Cambrian cratonic basement in the south from a rapidly subsiding basin to the north in which the Bulgeri Formation accumulated. Furthermore, sedimentation in the basin was also influenced by a rising source area to the east, due to the progressive development of a fold-thrust belt affecting the pre-Late Devonian strata of the BRP east of a north-south oriented fault system (Gray Creek Fault). The thrusting was the result of the Australian craton colliding with and overriding the pre-Late Devonian sedimentary basins of the Tasman Orogen (including the eastern BRP), and it was part of a continent-wide tectonic movement. The Bulgeri Formation was therefore deposited in a complex hinterland-type foreland basin that lay to the north and west of the two major fault systems, and therefore tectonics appear to have been the dominant factor influencing facies and sequence development.

The succession unconformably overlies carbonates and clastics that formed part of a Silurian to Middle Devonian passive margin succession that can be traced along the Tasman Orogen. Facies analysis of the lower part of the Rockfields Member has recognised a variety of architectural elements and lithofacies typical of a transition from coastal to alluvial depositional environments. The lowermost 40 m of the succession (basal conglomerates, overlain by clean sandstones interbedded with grey to reddened siltstone and fine sandstone, containing marine fossils in place) overlies an extensive, incised erosional surface. A depositional model is proposed that interprets the lowermost succession as an incised valley system that was partially filled during a transgression with coastal plain and mixed fluvial-, wave-, and tide-influenced estuarine sediments that pass into barrier shoreline and ultimately shallow marine sediments to the north. Following the peak of the transgression, the valley began to overfill, and this is represented by an overlying, thick, non-marine succession (mainly fine- to medium-grained sandstones interbedded with variegated and reddened siltstone and reworked tuffs) interpreted as alluvial sediments deposited in broad, sandy, low-sinuosity channels and semi-permanent floodplain lakes during a prolong regression.

The thin basal transgressive facies overlain by the thick, but relatively fine-grained regressive facies are thought to represent tectonically-influenced transgressive and regressive depositional systems tracts respectively. The succession developed in the Late Devonian during the early development of a hinterland-type foreland basin, and it appears global eustatic sea-level fluctuations played a relatively minor role.

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