

Characterization of a Sandy Tide-Dominated Incised Valley Fill System Using Ichnofabric Analysis: Woollybutt and East Spar Fields, Barrow Sub-Basin, Western Australia

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Seismic data from the Barrow Group in the Barrow Sub-basin reveals the presence of a NE-trending incised valley fill system with an anomalously thick section in the East Spar and Woollybutt fields, and dramatic thinning of the section laterally on adjacent interfluvial areas to the east and west. This model is supported by evidence from palynology, FMI and core data. Ichnofabric analysis is crucial in (1) accurately characterising the different facies associations within the incised valley and, in particular, (2) accurately determining degrees of marine influence within the channelised strata.

A series of stacked fluvially and tidally distributary channel fill strata, overlain by fully marine middle shoreface, lower shoreface and shelfal sediments, dominate the succession. For example, *Teichichnus*-dominated ichnofabrics characterise delta front sandstones associated with intense fairweather bioturbation, while more distal delta front strata are characterised by heterolithics with *Ophiomorpha*, *Teichichnus* and *Phycosiphon*. The channel fills comprise multiple fining-upward packages of coarse to medium, trough cross-bedded and planar stratified, with thick clay drapes and dense colonisation by very large, robust-walled *Ophiomorpha nodosa*. Colonisation within tidally influenced channels is interpreted. In contrast, the fluvially dominated channel fills are non-bioturbated and locally display rootlet horizons towards their tops.

A series of backstepping, sharp-based shoreface sandstones are recognised towards the top of the study interval, associated with progradation of a shoreline across the marine portions of the valley fill. Dense colonisation by firmground *Skolithos* and *Diplocraterion*, cross-cutting a background mottled ichnofabric with *Ophiomorpha*, is evident. The sandbodies represent detached forced regressive shoreface sandstones deposited during stillstands prior to major transgression and deposition of the Mardie Greensand and subsequent Muderong Shale. The incised valley fill itself is a compound fill comprising multiple episodes of channel incision associated with falls in relative sea level.