

An ‘Unconfined Estuary’ Succession From the Palaeogene of the Barito Basin, Borneo

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ABSTRACT

Modern estuaries are confined areas of mixing of freshwater and the sea, formed as a consequence of sea level rise flooding the mouth of a river. Facies models of estuaries are valley-confined with tidal and/or wave influence, and in sequence stratigraphic terms they mark the transgressive flooding over a valley, formed by incision during a preceding sea level fall. In the Middle Eocene to Early Oligocene of the Barito Basin, Borneo, the Tanjung Formation displays a transition from fluvial to tidally-influenced [WD1] facies and is overlain by a shallow marine succession. Facies interpreted as the deposits of tidal sand bars, tidal mudflats and tidal channels form an assemblage that is consistent with those described for a tidal estuary in current facies models. However, there is no sign of any valley incision and no evidence for lateral confinement. Along with the underlying fluvial deposits the tidal facies are spread over an area in excess of 70 km perpendicular to the fluvial palaeoflow. The Palaeogene paleogeography of the Barito Basin is interpreted as a river system flowing from the SSE to a WSW-ENE oriented shoreline which was undergoing transgression due to extension-related subsidence in the basin. The fluvial facies are considered to have the characteristics of a distributive fluvial system, and the overlying tidal facies formed by the transgressive flooding of a distributive fluvial system forming facies associations similar to that of a modern estuary, but not in a valley-confined setting. Modern analogues have not provided a basis for facies models for similar laterally-extensive transgressive successions as there are few modern examples of distributive river systems meeting a shoreline. However, coastal valley incision driven by high-magnitude sea level falls is a feature of the current icehouse conditions, and consequently modern transgressive settings at the mouths of rivers take the form of valley-confined estuaries. During greenhouse periods, lower amplitude sea level fluctuations provided settings where valley incision was a less common feature along coastlines, and estuarine conditions would have taken the form of laterally-extensive, ‘unconfined estuaries’ during periods of relative sea level rise. Similar facies patterns of ‘unconfined estuary’ successions can be recognised in the Lower Carboniferous of NW Ireland and the Lower Cretaceous of southern England and may be common elsewhere.