Abstract

The Early Permian Pebbley Beach Formation is exquisitely exposed for long distances along the coast of the south Sydney Basin of Australia, and comprises a complex alternation of mudstones, silty mudstones, sandy mudstones, and sandstones. Previous interpretations regarded the succession to represent inner to outer shelf and slope environments. Integrated ichnological and sedimentological analyses, however, demonstrate that the interval actually represents a complex juxtaposition of offshore, shoreface, prodelta, and distal delta-front environments recording progradation of discrete parasequences, locally truncated by subtle erosional discontinuities overlain by estuarine channel and estuarine embayment complexes.

Marine deposits typically display elevated bioturbation intensities, high trace fossil diversities and a predominance of wave-generated structures within intervening sandstone layers. Deltaic successions show sporadically distributed burrowing, with generally lower bioturbation intensities and reduced trace fossil diversities, in facies containing mud-draped wave-, storm-, and current-generated physical structures. In many locations, offshore and prodelta mudstones are erosionally overlain by current- and combined-flow-dominated lenticular to wavy-bedded heterolithic intervals, characterized by low bioturbation intensities and low ichnological diversities made up of facies-crossing elements. Such facies are typical of marked physico-chemical stress, and are interpreted as estuarine in origin.
Erosional juxtaposition of estuarine over offshore and prodelta deposits indicates a period of relative sea level fall, followed by transgression. The resulting sequence boundaries typically cut through shoreface and delta-front sandstones and into the offshore and prodelta mudstones, respectively. Once capped by transgressive estuarine mudstones these discontinuities show minimal lithologic contrast. Ichnologically, however, these subtle mud-on-mud contacts are demarcated by firmground suites of the Glossifungites Ichnofacies.

The integration of ichnology and sedimentology has been essential for developing a high-resolution sequence stratigraphic framework for the Pebbley Beach Formation. Through this approach, a series of highly top-truncated and condensed sequences have been recognized and reliably correlated over several kilometers of continuous exposure.
The Early Permian Pebble Beach Formation is exclusively exposed for long distances along the coast of the south Sydney Basin of Australia, and comprises a complex alternation of mudstones, sandy mudstones, sandy mudstones, and sandstones. Previous interpretations regard the succession as composed mainly of sandy and shale stratigraphic packages, based on lithological and sedimentological analyses. However, recent detailed facies analysis and more through scrutiny of the three dimensional nature of the deposits indicates that many of the mudstone and heterolithic deposits in fact represent the deposits of shore platforms and shoreface settings (Ziegler et al., 1998).}

The Early Permian Pebble Beach Formation is exclusively exposed for long distances along the coast of the south Sydney Basin of Australia, and comprises a complex alternation of mudstones, sandy mudstones, sandy mudstones, and sandstones. Previous interpretations regard the succession as composed mainly of sandy and shale stratigraphic packages, based on lithological and sedimentological analyses. However, recent detailed facies analysis and more through scrutiny of the three dimensional nature of the deposits indicates that many of the mudstone and heterolithic deposits in fact represent the deposits of shore platforms and shoreface settings (Ziegler et al., 1998).