

Ichnofabric Analysis, Event Stratigraphy and Paleoenvironmental Reconstruction: Late Miocene Strata, East Cape - Te Araroa, New Zealand

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A shallowing and coarsening upward marine succession of upper Miocene to lower Pliocene age strata is spectacularly exposed in broad shore platforms over a distance c 20km at East Cape, North Island, New Zealand. The setting was an active continental margin where background hemipelagic sediment accumulation was episodically punctuated by volcanoclastic gravity flows and tephra deposition. Intensive bioturbation destroyed small-scale sedimentary structures and obliterated minor event beds. Trace fossils are sharply defined by the strong contrast between the background, dark grey, sandy mudstone and the light-coloured ash horizons.

The archetypal ichnofacies concept, focussing as it does on discrete and elite traces, lacked the resolution necessary to decipher paleoenvironmental changes associated with event bed deposition in this thoroughly bioturbated sequence. We have utilized Taylor and Goldring's ichnofabric constituent diagrams (ICD's) and proportional bioturbation indices (BI's). Our approach differed in that vertical ordering within ICD's followed stratigraphic succession – older to younger, rather than younger to older.

The diagrams succinctly illustrate sedimentation history, key stratal surfaces, colonisation order, variation in bioturbation intensity, and organism response to event deposition. They also clearly illuminated trace fossil-event bed associations and highlighted ichnofaunal responses to changing environmental conditions. From representative stratigraphic sections, 12 discrete ichnofabrics were identified (Zoophycos, Phycosiphon, Chondrites, Teichichnus, Scolicia, Diplocraterion, Gyrolithes, Thalassinoides, Asterosoma-Thalassinoides, Asterosoma, Asterosoma-Teichichnus, Thalassinoides-Planolites).

There are two main categories of ichnofabric: those related to hemipelagites and those related to event beds. Of the archetypal ichnofacies, only three - Zoophycos, Cruziana and Skolithos - were recognised. Hence in this study, ICD's/BI's provided far more detailed paleoenvironmental resolution than would otherwise have been revealed by Seilacherian archetypal ichnofacies, and is an approach yet to be fully exploited in other sedimentary sequences.