

From Salinity-Stressed Suite to Recurring Ethological Grouping: The Rise of the *Teichichnus* Ichnofacies

S. George Pemberton¹, Murray K. Gingras¹, Shahin E. Dashtgard², Kerrie L. Bann³, and James A. MacEachern^{*2}

¹Ichnology Research Group, Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB, T6G 2E3

²ARISE, Department of Earth Sciences, Simon Fraser University, Burnaby, BC, V5A 1S6, jmaceach@sfu.ca

³Ichnofacies Analysis Inc., Calgary, AB, T3H 2W3

Owing to their departure from the archetypal Seilacherian ichnofacies, salinity-stressed trace-fossil suites are widely described as “impoverished marine assemblages”. In the past, identification of brackish-water suites has necessitated direct comparison to the “fully marine” signal in contemporaneous deposits. Recognizing salinity-stressed trace-fossil assemblages is, however, not always easily accomplished. For example, depositional stresses such as rapid clay flocculation, elevated deposition rates, and reduced oxygen are commonly associated with salinity reduction; yet these are also independent factors that can hamper the recognition of the brackish-water signal. Additionally, the preponderance of heterolithic units (vertically and laterally) favours the occurrence of composite trace suites that are typified by marked variations in their component ichnogenera. Finally, the progressive evolutionary invasion of reduced-salinity settings through time exacerbates the difficulties in discerning those ichnological characteristics indicative of brackish-water stresses.

Careful neoichnological analysis, however, has highlighted a recurring ethological grouping characteristic of the dominant infauna, and constitutes the fundamental basis for erecting a new ichnofacies. Brackish-water endobenthos overwhelmingly construct semi-permanent dwelling structures designed for: 1) interface deposit feeding or sediment ingesting; 2) protection from desiccation and predation; and 3) buffering salinity changes that occur routinely at the sediment-water interface. Persistent animal-sediment interactions record: 1) head-up deposit-feeding behaviours; 2) dwellings wherein the tracemaker leaves to search for food; 3) passive predation; 4) minor filter-feeding, ostensibly via pumping of water through the burrow; and 5) the rapid response of highly opportunistic trophic generalists to localized accumulations of high-quality and abundant food, leading to sporadically distributed biogenically mottled sedimentary fabrics. Such biogenic structures are typically ascribed to more strongly facies-crossing elements of more marine suites (e.g., *Teichichnus*, *Planolites*, *Cylindrichnus*, *Gyrolithes*, *Skolithos*, *Palaeophycus*, and *Thalassinoides*), and probably reflect an abundance of omnivores in the setting. Ancillary characteristics of the different suites include diversity impoverishment, morphologically simple structures, general size reduction compared to fully marine counterparts, and bed-scale juxtaposition of vertical and horizontal elements. Nearly three decades of paleoichnological analysis of brackish-water deposits throughout the Phanerozoic has led to the recognition of suites that support empirically these neoichnological observations.

On the strength of establishing both spatial and temporal recurrence of these characteristics, underpinned by an ethological grouping validated by neoichnological observation, we propose a new ichnofacies archetype: the *Teichichnus* Ichnofacies.