A review of *Kinneyia simulans*: an ichnotaxonomic approach to wrinkled microbially induced sedimentary structures from New Brunswick, Canada*

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The discovery of new morphologies of microbially induced sedimentary structures in New Brunswick has prompted a restudy of how we communicate traces of microbial mats in the fossil record. Microbially induced sedimentary structures (MISS) are an important facet of recent paleoichnological work because of their taphonomic implications. MISS are extensively studied in terms of their formation processes, recognition in the ancient record, and their diverse morphologies. Classification and terminology schemes are based on their appearance and mode of formation; however, the taxonomic treatment of MISS remains debated. Traditionally MISS have been considered sedimentary structures, and arguments have been made that they cannot be treated as trace fossils under the International Code of Zoological Nomenclature due to MISS being formed by communities of microbiota including algae, cyanobacteria, and others, rather than a single trace maker. We have reexamined MISS using an ichnotaxonomic approach and applied ichnologic terminology and binominal names to specimens from both the Saint John Group (Cambrian) and Horton Group (Mississippian). Upon re-examining the holotype of *Kinneyia* Walcott, a genus commonly used to describe some MISS, we argue it cannot be used to correctly describe wrinkle or ripple-like features seen in MISS, and we agree with previous authors that *Kinneyia* is likely not biogenic in origin. A new ichnogenus and ichnospecies, *Rugalichnus matthewii*, have been assigned to ripple-like sedimentary wrinkle marks known as MISS, separating them from the *nomen dubium* genus *Kinneyia*.

A Mississippian (Albert Formation) example of MISS is distinct from the recently named *Rugalichnus matthewii*. Its regular arrangement of interlocking circular whorls is interpreted to be the result of concentric growth of the living mat outwards from its initial establishment from deposited mat rip-up chips, It is interpreted to have formed in a small, abandoned fluvial sandstone channel that debouched into a marginal lacustrine clastic mudflat environment.

Invertebrate ichnofossils assemblages are directly associated with both examples of *Rugalichnus* and show morphological variability related to their proximity to microbial mats.

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The close association between invertebrate traces and microbial mats in the Mississippian Period may be a relict paleoecological niche from the earlier transition of invertebrates from aquatic freshwater to terrestrial environments and can be inferred to have played an important role in ancient ecosystems as well as playing a major role in the preservation of ichnofossils.

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