

New Perspectives on the Utility of the *Glossifungites* Ichnofacies

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ABSTRACT

The *Glossifungites* Ichnofacies evolved as a set of ichnological criteria to aid in the identification of relatively high substrate cohesiveness (i.e. firmgrounds) in the sedimentary rock record. The criteria for recognition of trace fossils emplaced into a firm substrate included: a suite of unlined, sharp-walled predominantly dwelling burrows descending from a discrete sedimentary contact; burrow infills derived from the sediment media that overlies the burrowed surface; ichnofossils that cross-cut a palimpsest suite of pre-existing trace fossils; and minimal post-depositional compaction of the firmground burrows. Original assemblages were based on analysis of marginal marine, predominantly intertidal settings.

Subsequently, it was recognized that firmgrounds exhibit a much broader paleoenvironmental distribution than could be related to substrate compaction and subsequent meter-scale unroofing in the intertidal setting alone. Rather, the *Glossifungites* Ichnofacies also indicates changes of depositional base level in marginal marine environments. The ichnofacies continues to be valuable in this sequence stratigraphic application, helping to demarcate discontinuities, particularly where they are cryptic. Unfortunately, despite its common development at transgressive erosion or omission surfaces, many continue to assign *Glossifungites* exclusively to falling stage or lowstand conditions.

Recent research initiatives in ancient and modern deposits have focused on refining ecological and temporal conditions for the development of firmgrounds and the potential burrow structures therein. It is proposed that the time required to compact a substrate can be crudely assessed (within an order of magnitude), by comparing surficial burrow morphologies with those associated with *Glossifungites*-demarcated discontinuities. Surfaces associated with century- or millennia-scale processes have an undulatory surface and exhibit slightly deformed/compacted trace fossils. Burrowed discontinuities in substrates that suffered longer-term compaction (i.e. +10Ka) are essentially planar and display uncompacted burrows. Moreover, research conducted in modern deposits suggest that where a firmground is developed in the absence of desiccation, sediment was likely once buried to depths exceeding 2m.

Modern sites and outcrop studies have also demonstrated characteristics of the *Glossifungites* Ichnofacies that are ecologically revealing: (1) extant firmground elements commonly occur under soft-sediment veneers up to 30cm thick; (2) *Glossifungites*-demarcated discontinuities are commonly coeval with, and can be correlated over, short distances to burrowed palimpsest softgrounds and woodgrounds; (3) muddy firmgrounds are preferentially burrowed over sandy firmgrounds; and, (4) intertidally exposed firmgrounds show a strong bathymetric zonation, principally related to the duration of subaerial exposure during low tides. Although these characteristics add potential colour to geological interpretations, they complicate rock record interpretations and should be applied with caution.