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Use of Ichnology in Paleoenvironmental Reconstructions: State of the Art and Perspectives

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Since the recognition that trace fossil distribution is strongly controlled by environmental parameters, ichnology has been extremely successful as a tool in facies analysis. Despite its utility, not all depositional environments have been explored with the same level of detail from an ichnologic perspective and predictive models are available only in some cases. Undoubtedly, shallow-marine clastic ichnology has been at the forefront of research. However, not all shallow-marine clastic environments have been explored to the same depth. In particular, the ichnology of wave-dominated environments has been analyzed in more detail than their tide-dominated counterparts, resulting in the proposal of a predictive and integrated sedimentologic-ichnologic model (i.e. the "shoreface model"). This situation has started gradually to change with recent studies revealing more detailed information about controls on trace-fossil distribution in tide-dominated settings, such as tidal flats and subtidal sandbars. In turn, the ichnologic content of modern sandy shores is much better known than that of muddy coasts to the point that some specific types of muddy shorelines (e.g. chenier plains) remain essentially unrecognized in the geologic record. End-members with respect to wave and tidal dominance are better understood than mixed systems. Deep-marine ichnofaunas have been the focus of detailed systematic work, but the integration of sedimentologic and ichnologic datasets in deep-marine environments is less precise than in their shallow-water counterparts. In any case, recent progress on the ichnology of deep-marine systems has been attained, resulting in a more refined use of trace fossils to differentiate between hyperpycnal and episodic turbidity currents. In marginal-marine environments, studies resulted in the proposal of the "brackish-water model", which has been essential to improve recognition of incised estuarine valleys. This was followed by an increased understanding of the ichnology of deltaic systems. The recognition that some brackish-water suites do not represent estuarine or deltaic environments has promoted research on the ichnology of alternative marginal-marine environments, such as bays. With respect to carbonate systems, work has been done on the ichnology of Bahamian-type carbonates, reefs, chinks and rocky shorelines, but the overall field is less developed than clastic ichnology. Finally, continental ichnology has experienced an explosion of research during the last twenty years, which has resulted in a dramatically changed appreciation of the ichnology of lakes, rivers, paleosols and eolian systems.

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