Shallow-Marine Ichnology: A Modern Perspective

Murray Gingras*
University of Alberta, Edmonton, AB
mgingras@ualberta.ca

S. George Pemberton
University of Alberta, Edmonton, AB, Canada

and

Shahin Dashtgard and James MacEachern
Simon Fraser University, Burnaby, BC, Canada

Summary

In the marine realm, a large number of ichnofossils have been observed as traces produced by modern burrowing organisms. This papers considers the construction and utility of biogenic structures made by marine, vermiform nemerteans, polychaetes and hemichordates; marine crustaceans; motile bivalves; motile echinoderms; as well as sponges and sea anemones. We report on a range of modern biogenic structures similar to *Arenicolites, Asterosoma, Cochlichnus, Conichnus, Cylindrichnus, Diplocraterion, Gordia, Gyrolithes, Heliminthopsis, Isopodichnus, Ophiomorpha, Palaeophycus, Planolites, Polykladichnus, Protovirgularia, Psilonichnus, Rosselia, Scolicia, Siphonichnus, Skolithos, Taenidium, Thalassinoides*, and a range of cryptobioturbate textures.

Vermiform animals dominantly occupy vertical burrows that range from simple shafts to Y- and U-shaped domiciles. They also construct helical traces. Horizontal traces made by worms range in form, but are dominated by branching and variably sinuous to meandering burrows. Crustaceans primarily excavate and maintain open burrow systems that posses a range of architectures, which are similar to either *Thalassinoides* or *Psilonichnus*. Smaller crustaceans, such as amphipods, mix the sediment and are more likely to generate cryptobioturbate textures. Bivalve traces vary in form, but generally preserve evidence of vertically oriented filter- or interface-deposit-feeding from a stationary location, rapid vertical escape, or horizontal grazing. Echinoderms dominantly preserve body impressions, such as *Asteracites*. An important class of biogenic structure, *Scolicia*, is made by urchins and animals of similar morphology. Finally, sea anenomes can generate large, penetrative, conical structures.

Some groups of animals are reported to make similar traces for different reasons. For example, large, open horizontal networks serve as domiciles and deposit-feeding structures for crustaceans, but which are constructed mainly for the purpose of passive carnivory and establishing an interface-feeding network by worms. We report that the trace fossil *Gyrolithes* potentially represents

mechanical ramps for shrimp but is used as a sediment holdfast for worms. For both animals, the coiled structure may also represent a response to high population densities. Finally, Y-shaped burrows are used for filter feeding by shrimp, and interface deposit feeding in worms. These examples emphasize that inferences of behaviour in the rock record are interpretive.

Modern traces are best known from intertidal and shallow-marine settings and very little is known from deep-water traces. Thus, the ichnofossils of shallow-water ichnofacies such as *Psilonichnus*, *Skolithos*, and proximal expressions of the *Cruziana* ichnofacies are well represented in the modern. In contrast, the distal expressions of the Cruziana Ichnofacies, as well as the *Zoophycos* and *Nereites* ichnofacies are poorly known. Tracemakers from deep-water studies are, themselves, largely unknown.