

## Ichnofacies: a network perspective

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Several systems can be described as networks, that are sets of nodes and links. For instance, food webs consist of species connected by trophic interactions; social networks are made by people connected by relations; the World Wide Web is formed by webpages connected by hyperlinks. Similarly, ichnological systems can be conceived as sets of ichnotaxa connected by association relationships (Baucon and Felletti, 2013; Baucon et al. 2014). The goal of this study is to see the ichnofacies model in the network perspective.

The ichnofacies model synthesizes the environmental significance of traces, and, as such, it has been one of the most influential concepts in ichnology since its introduction. The ichnofacies model was developed by Adolf Seilacher on the basis of empirical observation of several ichnoassociations (Buatois and Mángano, 2011; MacEachern et al., 2012; Seilacher, 1967). The observations on which the ichnofacies model is based have been recorded as a table that describes the ichnofaunal composition of several ichnosites (Seilacher, 1978, p. 176). The table has been recently presented in Seilacher (2007), pag. 205, and is herein referred to as ‘ichnofacies table’.

The ichnofacies table can be modelled as a network by representing ichnotaxa as nodes, and association relationships as links. In other words, the rule for translating the ichnofacies table into an ichnonetwork is 'connect with a link those ichnotaxa that co-occur in the same ichnosite'.

The resulting network (Fig. 1) is characterized by two cohesive subgroups that correspond to the typical ichnotaxa of the Nereites and the Cruziana ichnofacies. These subgroups are connected by nodes with high betweenness, that is, nodes that is a topological metric that measures how nodes are embedded within the whole system. High betweenness nodes are topological bridges between different structural areas of the network. Intriguingly, high betweenness nodes corresponds to those ichnotaxa that are characteristically described as 'facies-crossing ichnogenera' in the ichnofacies model.

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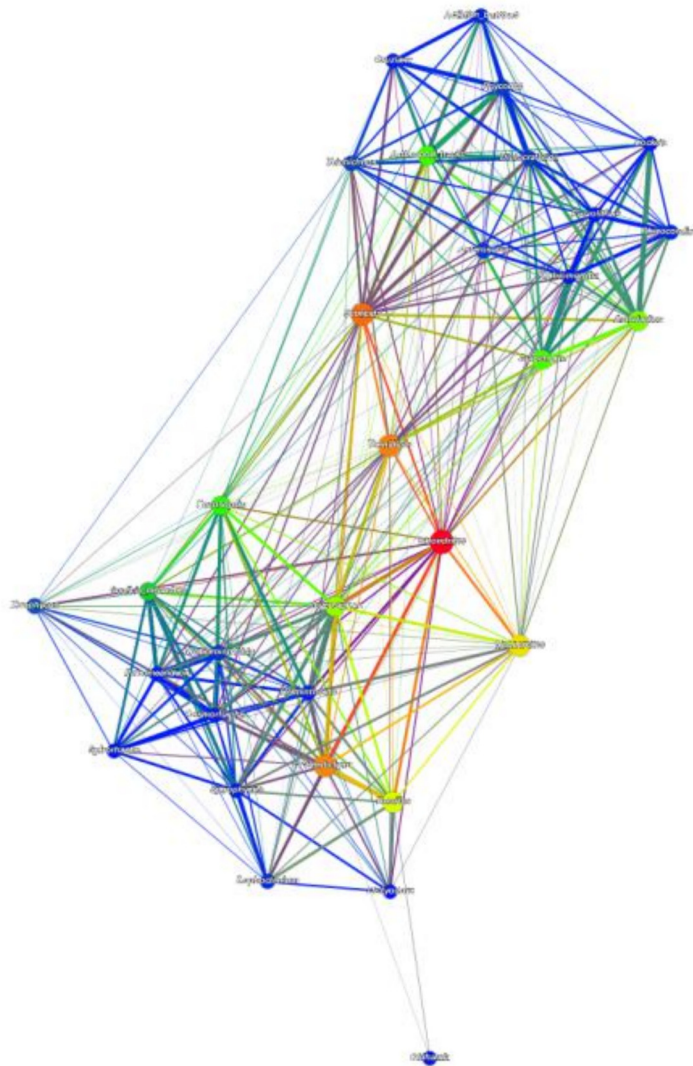


Fig. 1. Ichnofacies network.