

## COEVOLUTION AND MUTUALISM

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The Neodarwinian Synthesis was essentially non-ecological. This attitude has persisted to the present. The paleontological reality of community evolution within ecological-evolutionary units and subunits (what Brett and Baird, 1995, have termed "coordinated stasis") has been ignored by those trying to understand evolution. The generically rigid content of the many evolving community groups within each ecological-evolutionary unit and subunit has been ignored by those trying to understand evolution. Does this mean that the lengthy stratigraphic ranges of many co-occurring community groups has no evolutionary significance? These are biostratigraphically monumental regularities. Could these regularities reflect long term stabilizing selection among co-evolved taxa? Could the species-to-species level changes in the less common to rare genera, without any long term relative abundance changes, result from neutralism? On land we are aware of varied mutualistic relations within some communities, commonly involving different trophic levels, with such things as more obligate mycorrhiza and pollinators, coming to mind. We realize too, that removing one or even a few taxa at a specific trophic level does not result in community collapse. In the marine benthic environment we are not very well informed about mutualistic, co-evolved interactions between widely different trophic levels, particularly the lower levels potentially involving microscopic organisms. Evidently studying the more microscopic, lower trophic levels, to try to understand potentially key interactions, is much more difficult in the marine environment than in the terrestrial. The microorganisms receive little ecological attention in the marine environment - bacteria, fungi, viral organisms, the microbiota. This leaves the paleontologist concerned with marine benthos in a difficult position. Are the long term biofacies non-evolutionary artifacts merely reflecting monumental environmental stability of lengthy time intervals of the past as contrasted with a wildly varying modern environment? Or do the long term biofacies of the fossil record, within each ecological-evolutionary unit reflect the character of community evolution structured by strong stabilizing selection and neutralism?

All of this adds up to concluding that the rich fossil record provided by marine benthos, in the light of our present biological ignorance about co-evolved and mutualistic relations, can't be unequivocally interpreted vis-a-vis mutualism. What can be done from the fossil record is to produce overwhelming support for the long term stability of co-evolved and mutualistic relations on a more 1:1 basis (see Boucot, 1990, for examples). If the 1:1 relations provided by the fossil record can be taken as clues to the overall conservatism, long term stability of mutualism and co-evolved relations, then one may suggest that benthic marine community stability might provide the bulk of the examples.