Geophysical Research Abstracts
Vol. 16, EGU2014-16859, 2014
EGU General Assembly 2014

Onshore-offshore decrease in genus origination rate in Recent tropical bivalves (Red Sea)

Adam Tomasovych (1) and Martin Zuschin (2)

(1) Geological Institute, Slovak Academy of Sciences, Bratislava, Slovakia, (2) Department of Palaeontology, University of Vienna, Vienna, Austria

Broad-scale macroevolutionary and macroecological studies show significant effects of latitude on diversification rates and the clustering of range limits, with temperature being one of the most important correlates of macroecological attributes in marine environments. Temperature, however, also varies predictably with depth, but variation in diversification along bathymetric gradients remains much less explored. Here we assess bathymetric gradients in range configuration (and thus in the clustering of range limits), in taxonomic structure and in age structure of bivalve communities in the Red Sea.

We find that depth minima of bivalve species and genera do not cluster along bathymetric gradients while depth maxima significantly cluster at ∼50 and 700 m. Therefore, bivalve species and genera show a marked nestedness of their bathymetric ranges: taxa restricted to shallow environments are nested within generalistic taxa that have broad bathymetric distribution. Nested ranges imply that extinction, origination and dispersal processes that structure bivalve metacommunities in the Red Sea change significantly with depth. In accord with this, bivalve genera show (1) a significant increase in median age towards deeper environments, implying that genus origination rate decreases with depth, and (2) a significant decrease in the proportion of monotypic genera and increase in the per-genus species richness towards deeper environments, implying that per-species genus origination and in species extinction rates decrease with depth.

These patterns suggest that genera preferentially originated onshore and then expanded offshore in the Red Sea, but still kept their presence in onshore (i.e. offshore specialists are rare). The unique configuration of bathymetric ranges in the Red Sea with rarity of taxa restricted to deeper waters can be related to the lack of temperature stratification. Our analyses, however, indicate that bivalve metacommunities in tropical and warm-temperate ocean-facing environments also show nested configuration of bathymetric ranges, although species and genera restricted to deepest environments become more frequent. The bivalve distribution patterns potentially capture the onshore-offshore dynamic that characterized greenhouse-type conditions with weak temperature gradients that were frequent in the Mesozoic and Early Cenozoic.