

## MACRO- AND MICROEVOLUTIONARY ASPECTS OF THE EARLY PALEOGENE RECOVERY OF THE PLANKTONIC FORAMINIFERA

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To date, most macroevolutionary studies have focused on taxonomic data; there are very few data sets that provide a large enough statistical population for extensive macroevolutionary studies involving direct morphometric data. The Cenozoic planktonic foraminifera are exceptional in this regard. Digitally captured shape descriptions of 342 species of Cenozoic planktonic foraminifera have been combined with the available data on their phylogenetic relationships to examine the interplay between speciation rates, size change, and various geometric characters. The results tend, at least for the planktonic foraminifera, to support Stanley's (1973) hypothesis regarding the causal mechanisms behind Cope's Rule. The tendency toward size increase may result from the disadvantages of large size during times of mass extinction rather than from the (conventionally assumed) advantages of larger size.

Additional results derived from morphotypic longevities and morphotypic turnover rates suggest an enhanced probability of speciation early in the Cenozoic, and enhanced longevity in the later Cenozoic.

Microevolutionary studies of patterns of changing variance within the Paleocene and Eocene genus *Morozovella* suggest that conventional foraminiferal taxonomic practice may not accurately reflect biological realities within the group, thus implying that our macroevolutionary results might be interpreted in other ways.

Paedomorphosis has now been seen in several foraminiferal lineages, including *Morozovella angulata*, a focus of the present study. Isotopic data (Shackleton, Corfield, and Hall, 1985) suggests that evolution of this group is accompanied by the invasion of a stratified water column. These observations suggest that one might look for systematic macroevolutionary morphologic tendencies in chamber expansion rate and size as a guide to understanding paleoecological conditions. It also seems reasonable to suggest that the complex morphological changes seen in the morozovellids may not represent morphological adaptation, but resource-related heterochronic shifts with ancillary morphological consequences.