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Rituparna Bose

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A Case Study of Extinct Organisms in Classical Paleontology



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Foreword

Brachiopods are among the most ubiquitous of all Paleozoic groups, and their relatively high preservation potential has resulted in an exceptionally rich fossil record. Although there are approximately 100 extant genera, perhaps 50 times this number are known only from fossils. Brachiopods therefore represent an extant clade that was once vastly more diverse, containing species that were a much more staple and important component of marine ecosystems than they are today. As a group, their diversity was little more than dented by the End-Ordovician, Frasnian, and Serpukhovian events, and they maintained their dominance of most infaunal communities throughout the Paleozoic. Only the End-Permian event severely compromised their diversity, with brachiopods giving way to bivalves as the dominant infaunal clade during the subsequent post-Paleozoic recovery. This book considers their mid-Paleozoic heyday.

The fossil record may offer valuable insights into the current biodiversity crisis. It records ‘natural experiments’ in which groups have repeatedly faced environmental challenges or habitat destruction, and may therefore document patterns of extinction susceptibility and resistance. It also records in which groups have been able to reradiate and diversify in the wake of these environmental upheavals. Thorough scrutiny and analysis of fossil data may therefore yield general principles that can be used to predict the probable responses of living species in the current phase of extinction. Underpinning all such inferences is taxonomy of a uniformly high standard, coupled with detailed stratigraphic, paleobiogeographical, morphological, and ecological data. Dr. Bose makes very significant strides in this direction here.

This book offers an excellent introduction to the paleobiology of mid-Paleozoic brachiopods. It also contains a rich collation of landmark data describing their shape, stratigraphic data describing their temporal ranges, and paleogeographic data detailing their spatial distributions. In combination, these resources enable several novel analyses, including plots of diversity and taxonomic turnover through time, analyses of morphological disparity, and clade dispersal through empirical morphospaces, as well as investigations of speciation mode. In addition, the author discusses the role of brachiopods in extinct ecosystems, as well as the manner in which these ecosystems changed during periods of increased turnover. The book

therefore offers an invaluable reference for graduate students and others seeking to make macroevolutionary and macroecological inferences from paleobiological data. More specifically, it offers an excellent complement to the usual resources on brachiopod taxonomy and evolution.

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Preface

The prerequisite to developing effective strategies for conserving biodiversity is a profound understanding of the taxonomy, evolution, and ecology of all life forms. It is especially important to comprehend the link between evolution, ecology, and environment and perhaps, appreciate the significance of such studies in extinct organisms; especially in organisms that were abundant in a certain geologic era, but have subsequently dwindled or become extinct. Such studies should help to understand extinction, accurately gauge the underlying causes behind loss of biodiversity and make predictions about future distribution of biodiversity. I apply novel quantitative techniques to track biodiversity loss, what should also serve as a starting point for conservation.

An increasing number of species are becoming extinct at an alarming rate today. This will soon lead to a colossal biodiversity crisis; and eventually to the paucity of non-renewable resources of energy making our Earth unsustainable in future. To save our mother planet from this crisis, studies need to be performed at large to discover abundant new fossil sites on Earth for continued access to oil-rich locations. Most importantly, a holistic approach is necessary in solving the present problem of biodiversity loss. This book presents the use of advanced quantitative models in understanding emerging topics in evolutionary biology that include biodiversity, taxonomy, phylogeny, evolution, and ecology of extinct organisms.

Traditionally, the broader view was that ecological interactions occurred in such short time scales than evolution could be easily ignored. A recent study by an evolutionary biologist, Dr. David Reznick in University of California Riverside has shown that certain organisms (freshwater fish) can evolve rapidly in response to ecological interactions. Thus, it is ecology that shapes evolution. These significant results are now published in the journal, *Proceedings of the National Academy of Sciences*. My study on brachiopods is unique in that it involves quantification of the ecological consequences of both slow and rapid adaptation of organisms, which is also known as the evolutionary response of organisms to environment. Ecology also has a direct association with biodiversity; with changing ecological conditions, biodiversity of organisms can also change. Thus, this book will assist future evolutionary biologists in understanding the natural and anthropogenic causes behind biodiversity crisis and ecosystem collapse. Besides