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Rituparna Bose

Biodiversity and Evolutionary Ecology of Extinct Organisms

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Biodiversity and Evolutionary Ecology of Extinct Organisms

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Bose, R., 2012. A new morphometric model in distinguishing two closely related extinct brachiopod species. Manuscript accepted in *Historical Biology: An International Journal of Paleobiology* 24:1–10 (DOI:10.1080/08912963.2012.658568)

I would like to dedicate this work to Professor David Polly, a true pioneer in the field of Evolutionary Paleontology and geometric morphometrics and a great source of inspiration for me in this field of science; I would also like to dedicate this work to my family who were a great source of moral support throughout my doctoral career

Supervisor's Foreword

Organisms are trade-offs: their structure neither perfectly suits their needs, nor is it random. The vertebrae in our own lower backs are structured differently from our four-legged relatives, providing us with support against gravity for our upper bodies and flexibility for forward locomotion. Despite the transformation in vertebral structure that accompanied the evolution of bipedality, our lower backs are notoriously rickety, subjecting approximately three quarters of us to severe back pain sometime during our adult lives. The structure of our lower back simply is not adequate to both hold our skulls high and move us forward smoothly on our two legs. Like all organismal structures, our backs are a compromise between what we inherited from our ancestors, adaptation of that inheritance through the painful process of natural selection, and non-genetic compensation for stress, strain, and breakage provided by growth and remodeling. Each one of these factors packs its own set of compromises. Our bones are both rigid structural supports whose hydroxyapatite matrix requires a calcium-rich diet and a mineral reservoir to provide our nervous systems with calcium when dietary sources are low. These two functions that are so important to our health often work at cross purposes as anyone with osteoporosis can attest. Every step in the Darwinian descent with modification is a response to the many competing selectional demands of the moment and chance.

The study of the factors that influence organismal structure is both fascinating and challenging. The trade-offs mean that no one factor is ever expected to explain all of the variations we see in a structure; indeed even important factors may only explain a small portion of that variation. The study of the evolution of structures is therefore a statistical pursuit. In this dissertation, Dr Rituparna Bose uses a statistical approach to look at the evolution of brachiopod valves. Brachiopods were important members of marine communities during the Paleozoic Era (542–251 million years ago), living through many cycles of sea level change and extensive reorganization of the continental shelf environments in which they lived. Bose uses a series of case studies of the Atrypidae, a widespread group of brachiopods, to examine the roles of ancestry (phylogeny), geographic isolation, sea level change, encrustations by other marine organisms, and adaptations to

substrates as factors explaining the shape of the valves of these filter-feeding animals. She uses geometric morphometrics, a relatively recent method for measuring biological shape, to analyze the shape of features of the valves and to statistically determine the extent to which these factors are each correlated with valve shape. She finds that despite considerable similarities among atrypides through time and space, their shell shape is indeed a measureable product of ancestry and environmental change.

Prof. Dr. P. David Polly
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About the Author

Dr. Rituparna Bose (M.Sc., Ph.D.) is currently an adjunct Assistant Professor in the Department of Earth and Atmospheric Sciences and in the Department of Biological Sciences and Geology at the City University of New York.

Dr. Bose obtained her undergraduate education at the University of Calcutta, India, and authored a thesis paper in environmental geology (coastal management). She came to the United States in 2004 to pursue higher studies. During the course of her graduate studies at Bowling Green State University and Indiana University at Bloomington, she was the primary author in multiple high-impact peer-reviewed publications. Here she was awarded the Indiana University Dissertation Year Research Fellowship which is given to the best doctoral students of the university. Her work with Dr. Margaret Yacobucci and Prof. David Polly culminated in major findings in evaluating the evolution and determining the biodiversity of extinct organisms.

As a result of her findings which have profound implications in bio-conservation, she won major national awards like the Theodore Roosevelt Memorial Grant (American Museum of Natural History) and Schuchert and Dunbar Grant (Yale Peabody Museum of Natural History). Additionally, BP Global Energy Group funded her to present these findings at North American Paleontology Convention (NAPC) by the prestigious NAPC Travel Award.

Dr. Bose continues to pursue both her teaching and research career. Her research interests lie in applications of quantitative algorithms to study evolutionary biology, micropaleontology, disaster management studies, and other applied geological sciences. In addition, she teaches courses in Physical Geology, Environmental Geology, Earth System Science, Natural Disasters, and Historical Geology.

The foreword of this book has been written by Prof. David Polly, Editor of *Palaeontology* and Executive Editor of *Palaeontologia Electronica*.

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