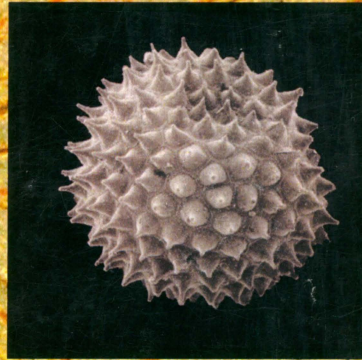
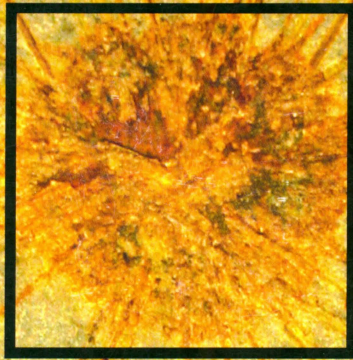


# FROM EVOLUTION TO GEOBIOLOGY

## Research Questions Driving Paleontology at the Start of a New Century

**Patricia H. Kelley and Richard K. Bambach**  
*Editors*





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**The Paleontological Society Papers**  
**Volume 14** **October 2008**

## **COVER**

Cover art designed by Peter Lang and Jennifer McElwain

### **Bottom right**

*Raymondicrinus oregonensis* (Moore & Vokes)

Oligocene, Keasey Formation, Oregon

Photo credit: Hans Hess, Natural History Museum Basel

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Originally published in black and white in “Fossil Crinoids” (Hess et al., 1999, Cambridge University Press)

### **Bottom left**

Skeleton of the pantolestid *Palaeosinopa*

Late early Eocene, Green River Shale, Wyoming

Photo credit: Georg Oleshinsky, Institut für Palaontologie, Bonn, Germany

Permission: Ken Rose, John Hopkins University.

Originally published in Rose, K. D., and W. v. Koenigswald. 2005. An exceptionally complete skeleton of *Palaeosinopa* (Mammalia, Cimolesta, Pantolestidae) from the Green River Formation, and other postcranial elements of the Pantolestidae from the Eocene of Wyoming USA). *Palaeontographica Abteilung A*, 273:55-96.

### **Center page, right**

*Meghystrichosphaeridium*

Ediacaran, Doushantuo Formation (constrained between 635 and 551 Ma), Weng’an, South China

Photo: Shuhai Xiao, Virginia Polytechnic Institute and State University

### **Center page, left**

Molecular Paleobiology - DNA strand wrapped around the bryozoan *Archimedes*

*Archimedes* – Carboniferous, Kinderhook Formation, Indiana

Photo credit: Craig Layne, Dartmouth College

Courtesy: Kevin Peterson, Dartmouth College

### **Background**

Demosponge *Choia*

Middle Cambrian Wheeler Shale, western Utah

Photo credit: Stephen B. Church

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# **FROM EVOLUTION TO GEOBIOLOGY**

## **Research Questions Driving Paleontology at the Start of a New Century**

Presented as a Paleontological Society Short Course  
at the  
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October 4, 2008

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Patricia H. Kelley  
Richard K. Bambach

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## PREFACE

On December 30, 1908, thirty-four paleontologists met at Johns Hopkins University and signed a document indicating their intent to form a professional society with the purpose of “the promotion of the Science of Paleontology” (as stated in our first Constitution; Cleland, 1910, p. 77). One hundred years later, we celebrate the birthday of a Society that has changed in many ways, yet remains vibrant and strong.

Four years ago, in anticipation of this occasion, the Paleontological Society Incoming Council appointed Patricia Kelley and Richard Bambach as organizers of the Centennial Short Course. Although anniversaries are typically times for looking backwards, we quickly decided on a different approach for the Centennial Short Course. Certainly, history is important; after all, the past is the key to the present (to invert a phrase), but rather than focusing on reviewing and celebrating our past achievements we have chosen to look toward the future. Thus our aim for this Centennial program has been to look at a wide spectrum of large-scale research questions that are motivating the rising leaders in our profession. In short, we wish to provide a picture of where the profession is headed, not concentrate on where we have been.

Rather than recruit “the usual suspects” of established senior experts to pontificate, we asked younger scholars of high repute to fill our program. We are all familiar with what the established senior citizens of our profession find interesting, but we are not always aware of what is motivating those who will be the senior leaders at the 125th anniversary of our society. We selected general areas of study (e.g., evolution, paleoecology, geobiology), sought prominent workers in those areas who are still in the early or middle stages of their careers, and let them designate their own specific topics for discussion. They represent the research directions in which the profession is headed.

We asked those who accepted our invitation to (a) frame a large-scale question related to the general topic that fit their research goals and (b) prepare their presentation to both discuss the significance of the question and illustrate how we can address that question with some actual results from finished or ongoing research. Thus we asked each contributor to touch on general theory and concepts, but also to present specific, data-driven or concrete information. After all, research results are what bring general questions to life. They are necessary to give perspective on where we are in fulfilling our overarching research agendas.

We attempt to touch on the full spectrum of intellectual activity in the profession, with scholars drawn from all the general subdisciplines of paleontology (micropaleontology, invertebrate paleontology, vertebrate paleontology, paleobotany) who also represent a cross-section of research approaches (from systematics to ichnology to biogeography). The contributions range across the geologic time scale, from the Archean to the Recent, and we also worked for a demographic balance among the participants (in terms of institutional pedigree, geographic region, gender, type of institution). We recognize that our coverage of the discipline of paleontology is necessarily incomplete. (At one time we thought of asking PS Council if we could have two weeks for this short course, rather than a day!) Nevertheless, we are excited about the diverse group of contributors we have assembled, and the range of topics they cover. No matter what your own specialty is, we believe you will learn something interesting from the program about what paleontology is and can be. It is not a short course in the traditional sense; it is a short course on what is going on in the discipline as a whole.

We hope to avoid the peculiar feeling of datedness common when one reads most anniversary reviews. The *Journal of Paleontology* editors asked Raymond C. Moore to review “the general status of paleontology near the three-fourths mark in the 20th century” (Moore et al., 1968, p. 1327), and he recruited 48 colleagues to write brief essays on the developments in their specialty areas covering the previous half century and looking ahead, too. It is curious now to look at that compilation (Moore et al., 1968). Of the fifty brief essays, only two are conceptually based; the remainder are descriptive of techniques and methods, discuss work done in particular geographic regions, or (thirty-seven of the fifty) deal with particular taxonomic groups. Many of the authors were obvious senior leaders in the profession at the time (including all the winners of the Paleontological Society Medal up to that time, eleven who subsequently received the award, and numerous distinguished foreign scholars). However, very few of the younger scholars who were shaping the “paleobiology revolution” at that time are represented. Although several of the essays make comments that accurately forecast the direction the field moved in the coming years (those by Axelrod, Schindewolf, Newell, and Simpson are particularly forward looking), the overall impression is that this is the field as it had been, not the field that was developing into modern paleontology. It will be interesting in the future to see how closely today’s program connects to the developments in paleontology in our second century.

The program does begin with some history. The two “old fogeys” on the program (Kelley, Bambach) give us some background on the development of the profession, and then a younger historian of science with a personal connection to paleontology (Sepkoski) examines how the fossil record has been regarded as a source of evolutionary data from Darwin’s time to the near present. The topical paleontological presentations start with evolution in deep time (Allwood on Archaean stromatolites, Love on molecular biomarkers, Xiao on Ediacaran events, and Peterson on possible connections between genetics and the nature of the Cambrian Explosion). Evolution remains on stage as Hunt considers evolution within lineages, Boyce deals with the evolution of plant physiology from the leaf record, and Motani follows the evolution of functional morphology in ichthyosaurs. Systematics and phylogeny link up in the papers by Sumrall and Brochu. Large-scale patterns in the fossil record get their due from Lockwood on the role of extinctions in the history of life, Stigall on relationships between paleobiogeography, paleoecology and macroevolution, and Peters on the role of macrostratigraphy in paleobiology. Aspects of paleoecology are dealt with by Tapanila on the direct evidence of symbiosis using trace fossils, Bush on comparative paleoecology of fossil assemblages, and Wilf on leaves as environmental recorders. Dietl ends the program by discussing innovative applications of evolutionary and ecological principles to societal issues.

Our hope is that this wide-ranging suite of conceptual discussions will provide insight into the direction in which paleontological thinking is developing as the Paleontological Society embarks on its second century.

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Patricia Kelley and Richard Bambach  
*Conveners*