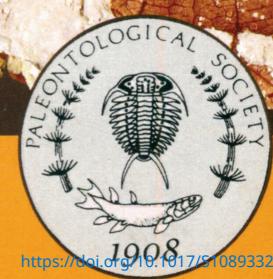


Ecosystem Paleobiology and Geobiology

Andrew M. Bush, Sara B. Pruss,
and Jonathan L. Payne, editors



The Paleontological Society Papers Volume 19

ECOSYSTEM PALEOBIOLOGY AND GEOBIOLOGY



Cosponsored by:
Geological Society of America

Andrew M. Bush, Sara B. Pruss, and Jonathan L. Payne, Editors

The Paleontological Society Papers

Volume 19

October 2013

COVER PHOTO: Early Eocene leaf from the Wind River Basin, Wyoming. Photo by Ellen Currano.

ECOSYSTEM PALEOBIOLOGY AND GEOBIOLOGY

Presented as a Paleontological Society Short Course
at the
Annual Meeting of the Geological Society of America
Denver, Colorado

October 26, 2013

Convened by
Andrew M. Bush
Sara B. Pruss
Jonathan L. Payne

A Publication of the Paleontological Society

Series Editor

Sara A. Marcus

Oregon Institute of Technology

3201 Campus Dr.

Klamath Falls, OR 97601 USA

Copyright © 2013 by the Paleontological Society

ISSN 1089-3326

All rights reserved. This entire publication may not be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without permission in written form from the Secretary of the Paleontological Society. Diagrams, figures, tables, illustrations, and graphs may be reproduced by photocopying and distributing free of charge for educational purposes if proper credit is given to the author(s) and the Society.

Printed by Yale University Printing and Publishing Services.

OFFICERS OF THE PALEONTOLOGICAL SOCIETY

2013

President

Sandra Carlson, Davis, CA

President-Elect

Steven M. Holland, Athens, GA

Past-President

Philip D. Gingerich, Ann Arbor, MI

Secretary

Mark A. Wilson, Wooster, OH

Treasurer

Peter Harries, Tampa, FL

Councilor (unrestricted)

Peter Wilf, University Park, PA

Councilor (under 40)

Margaret Fraiser, Milwaukee, WI

Program Coordinator

Tom Olszewski, College Station, TX

Education Coordinator

Margaret (Peg) Yacobucci, Bowling Green,
OH

Webmaster

Dena M. Smith, Boulder, CO

Student Representatives

Sarah Tweedt, College Park, MD
Max Christie, University Park, PA

Co-Editors, Journal of Paleontology

Steve J. Hageman, Boone, NC
Brian R. Pratt, Saskatoon, SK

Co-Editors, Paleobiology

Bruce MacFadden, Gainesville, FL
Douglas Jones, Gainesville, FL
Jonathan Bloch, Gainesville, FL
Michal Kowalewski, Gainesville, FL

Editor, Special Publications

Sara A. Marcus, Klamath Falls, OR

Communications

Leif Tapanila, Pocatello, ID

Chair, PalSIRP

Ronald Parsley, New Orleans, LA

Section Chairs:

Cordilleran

Nicole Bonuso, Fullerton, CA

North-Central

Benjamin F. Dattilo, Fort Wayne, PA

Northeastern

Alexander Bartholomew, New Paltz, NY

Rocky Mountain

Leif Tapanila, Pocatello, ID

South-Central

Ben Waggoner, Conway, AR

Southeastern

Gwen Daley, Rock Hill, SC

CONTRIBUTORS

TANJA BOSAK

Department of Earth, Atmospheric and
Planetary Sciences E25-649
MIT
Cambridge, MA 02139
<tbosak@mit.edu>

ANDREW M. BUSH

Department of Ecology and Evolutionary
Biology and Center for Integrative
Geosciences
University of Connecticut
Storrs, CT 06269-3043
<andrew.bush@uconn.edu>

ELLEN D. CURRANO

Department of Geology and Environmental
Earth Science
Miami University
114 Shideler Hall
Oxford, OH 45056
<currane@miamioh.edu>

SIMON A. F. DARROCH

Department of Geology & Geophysics
Yale University
PO Box 208109
New Haven, CT 06520-8109 USA
<simon.darroch@yale.edu>

SETH FINNEGAN

Department of Integrative Biology
University of California, Berkeley
1005 Valley Life Sciences Building #3140
Berkeley CA 94720-3140
<sethf@berkeley.edu>

SABINE GOLLNER

German Center for Marine Biodiversity
Research (DZMB)
Senckenberg am Meer
Südstrand 44
D-26382 Wilhelmshaven
Germany
<sabine.gollner@senckenberg.de>

PINCELLI M. HULL

Department of Geology & Geophysics
Yale University
PO Box 208109
New Haven, CT 06520-8109 USA
<pincelli.hull@yale.edu>

GIULIO MARIOTTI

Department of Earth, Atmospheric and
Planetary Sciences 54-827
MIT
Cambridge, MA 02139
<giuliom@mit.edu>

FRANCIS A. MACDONALD

20 Oxford Street,
Department of Earth and Planetary Science
Harvard University
Cambridge, MA 02138
<fmacdon@fas.harvard.edu>

JONATHAN L. PAYNE

Department of Geological and
Environmental Sciences
Stanford University
450 Serra Mall, Building 320
Stanford, CA 94305
<jlpayne@stanford.edu>

J. TAYLOR PERRON
Department of Earth, Atmospheric and
Planetary Sciences 54-1022
MIT
Cambridge, MA 02139
<perron@mit.edu>

SARA B. PRUSS
The Department of Geosciences
Clark Science Center
Smith College
Northampton, MA 01063
<spruss@smith.edu>

BAS VAN DE SCHOOTBRUGGE
Institute of Earth Sciences
Utrecht University
Budapestlaan 4
3584 CS Utrecht
The Netherlands
<van.de.Schootbrugge@em.uni-frankfurt.de>

ERIK A. SPERLING
20 Oxford Street
Department of Earth and Planetary Sciences
Harvard University
Cambridge, MA 02138 USA
<sperling@fas.harvard.edu>

JONATHAN P. WILSON
Department of Biology
Haverford College
370 Lancaster Ave.
Haverford, PA 19041 USA
<jwilson@haverford.edu>

ECOSYSTEM PALEOBIOLOGY AND GEOBIOLOGY

Table of Contents

Introduction: Ecosystem Paleobiology and Geobiology: Connecting the Biological and Earth Systems

Andrew M. Bush, Sara B. Pruss, and Jonathan L. Payne.....xi

Theoretical Eospace for Ecosystem Paleobiology: Energy, Nutrients, Biominerals, and Macroevolution

Andrew M. Bush and Sara B. Pruss.....1

Quantifying Seafood Through Time: Counting Calories in the Fossil Record

Seth Finnegar.....21

Microbial Sedimentology of Stromatolites in Neoproterozoic Cap Carbonates

*Tanja Bosak, Giulio Mariotti, Francis A. Macdonald, J. Taylor Perron,
and Sara B. Pruss*.....51

Tackling the 99%: Can We Begin to Understand the Paleoecology of the Small and Soft-Bodied Animal Majority?

Erik A. Sperling.....77

Altered Primary Production During Mass-Extinction Events

Bas van de Schootbrugge and Sabine Gollner.....87

Mass Extinctions and the Structure and Function of Ecosystems

Pincelli M. Hull and Simon A. F. Darroch.....115

Ancient Bug Bites on Ancient Plants Record Forest Ecosystem Response to Environmental Perturbations

Ellen D. Currano.....157

Modeling 400 Million Years of Plant Hydraulics

Jonathan P. Wilson.....175

