The Paleontological Society Papers, Volume 22

VIRTUAL PALEONTOLOGY



Editors Leif Tapanila and Imran Rahman





Virtual Paleontology



Leif Tapanila and Imran Rahman, Editors

The Paleontological Society Papers

Volume 22

September 2016

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

September 24, 2016

Convened by

Leif Tapanila and Imran Rahman

A Publication of the Paleontological Society

Special Publications Series Editor Sara A. Marcus Reno, NV

Copyright © 2017 by the Paleontological Society

Print ISSN 1089-3326 Online ISSN 2399-7575

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.

OFFICERS AND REPRESENTATIVES OF THE PALEONTOLOGICAL SOCIETY 2015-2016

President Steven M. Holland, Athens, GA

President-Elect Arnold I. Miller, Cincinnati, OH

Past-President Sandra Carlson, Davis, CA

Secretary Margaret Yacobucci, Bowling Green, OH

Treasurer Peter Harries, Raleigh, NC

Councilor (unrestricted) Laurie Collins, Miami, FL

Councilor (under 40) Kate Bulinski, Louisville, KY

Program Coordinator Matthew Clapham, Santa Cruz, CA

Education/Outreach Coordinator Margaret Fraiser, Milwaukee, WI

Chair, PalSIRP Ronal Parsley, New Orleans, LA

Student Representatives Lucy Chang, Berkeley, CA Sharon McMullen, Madison, WI

Co-Editors, *Journal of Paleontology* Brenda Hunda, Cincinnati, OH Jisuo Jin, London, ON, Canada **Co-Editors**, *Paleobiology*

Catherine Badgley, Ann Arbor, MI Carlos Jaramillo, Panama Michal Kowalewski, Gainesville, FL Shuhai Xiao, Blacksburg, VA

Editor, Special Publications Sara A. Marcus, Reno, NV

Communications Director Leif Tapanila, Pocatello, ID

Editor, *Priscum* Matt Powell, Huntingdon, PA

Editor, Social Media Phoebe Cohen, Williamstown, MA

Section Chairs

Cordilleran Nicole Bonuso, Fullerton, CA

North-Central Rebecca Freeman, Lexington, KY

Northeastern Alexander Bartholomew, New Paltz, NY

Rocky Mountain Leif Tapanila, Pocatello, ID

South-Central Vacant

Southeastern Christy Visaggi, Atlanta, GA

TABLE OF CONTENTS

- vii Leif Tapanila and Imran A. Rahman *Preface*
- 1 Mark Sutton, Imran Rahman, and Russell Garwood *Virtual Paleontology–An Overview*
- 21 Rachel Racicot Fossil Secrets Revealed: X-Ray CT Scanning and Applications in Paleontology
- 39 Alexander D. Ball, Tomasz Goral, and Seyit A. Kamanli Confocal Microscopy Applied to Paleontological Specimens
- 57 Jesse B. Pruitt, Nicholas G. Clement, and Leif Tapanila Laser and Structured Light Scanning to Acquire 3-D Morphology
- 71 P. David Polly and Gary J. Motz Patterns and Processes in Morphospace: Geometric Morphometrics of Three-Dimensional Objects
- 101 Stephan Lautenschlager Digital Reconstruction of Soft-Tissue Structures in Fossils
- 119 Imran A. Rahman and Stephan Lautenschlager Applications of Three-Dimensional Box Modeling to Paleontological Functional Analysis
- 133 Charlotte A. Brassey Body-mass Estimation in Paleontology: A Review of Volumetric Techniques
- 157 Doug M. Boyer, Gregg F. Gunnell, Seth Kaufman, and Timothy M. McGeary MorphoSource: Archiving and Sharing 3-D Digital Specimen Data
- 183 Renaud Lebrun and Maëva Orliac MorphoMuseuM: An Online Platform for Publication and Storage of Virtual Specimens
- 197 Claudia A. Grant, Bruce J. MacFadden, Pavlo Antonenko, and Victor J. Perez 3-D Fossils for K–12 Education: A Case Example Using the Giant Extinct Shark Carcharocles megalodon