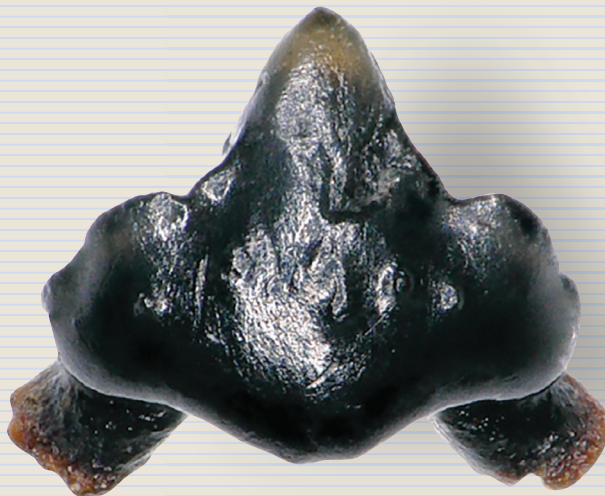


JOURNAL of PALEONTOLOGY



VOL 93 | NO 3 | MAY 2019



CAMBRIDGE
UNIVERSITY PRESS



OFFICERS AND EDITORS OF THE PALEONTOLOGICAL SOCIETY



<p><i>President</i> ARNOLD I. MILLER, Univ. of Cincinnati Arnold.miller@uc.edu</p> <p><i>President-Elect</i> BRUCE MacFADDEN, Florida Museum of Natural History bmacfadd@flmnh.ufl.edu</p> <p><i>Past President</i> STEVEN M. HOLLAND, Univ. of Georgia stratum@uga.edu</p> <p><i>Secretary</i> MARGARET M. YACOBUCCI, Bowling Green State Univ. mmyacob@bgsu.edu</p> <p><i>Treasurer</i> ALYCIA STIGALL, Ohio University stigall@ohio.edu</p> <p><i>JP Editors</i> BRENDA R. HUNDA, Cincinnati Museum Center BHunda@cincymuseum.org</p> <p>JISUO JIN, Univ. of Western Ontario jjin@uwo.ca</p> <p>HANS-DIETER SUES, Smithsonian Institution suesh@si.edu</p> <p>ELLEN CURRANO, University of Wyoming ecurrano@uwyo.edu</p> <p><i>JP Associate Editors</i> NICHOLAS BUTTERFIELD, Cambridge Univ.</p> <p>STYLIANOS CHATZIMANOLIS, Univ. Tennessee–Chattanooga</p> <p>TOM CRONIN, USGS</p> <p>WILLIAM A. DiMICHELE, Smithsonian Institution</p> <p>JAN OVE EBBESTAD Museum of Evolution, Uppsala University</p> <p>ROBERT J. ELIAS, Univ. of Manitoba</p>	<p>NADIA FRÖBISCH, Museum für Naturkunde</p> <p>PETER J. HARRIES, North Carolina State</p> <p>JOACHIM HAUG, Ludwig Maximilian University of Munich</p> <p>MICHAEL HAUTMANN, Univ. of Zurich</p> <p>MARTIN J. HEAD, Brock Univ.</p> <p>THOMAS HEGNA, Western Illinois University</p> <p>SAMANTHA HOPKINS, Univ. of Oregon</p> <p>NIGEL HUGHES, UC Riverside</p> <p>DANIEL KSEPKA, Bruce Museum</p> <p>JAMES LAMSDSELL, West Virginia University</p> <p>MAX LANGER, Universidade de São Paulo</p> <p>STEPHEN A. LESLIE, James Madison Univ.</p> <p>BRUCE LIEBERMAN, Univ. of Kansas</p> <p>STEVEN LoDUCA, Eastern Michigan Univ.</p> <p>RICK LUPIA, Univer. of Oklahoma</p> <p>GABRIELA MÁNGANO, Univ. Saskatchewan</p> <p>GREG McDONALD, Bureau of Land Management</p> <p>MALGORZATA MOCZYDŁOWSKA-VIDAL, Uppsala Univ.</p> <p>ALISON MURRAY, Univ. of Alberta</p> <p>PAULA NOBLE, Univ. of Nevada</p> <p>BRIAN PRATT, University of Saskatchewan</p>	<p>MARY SILCOX, Univ. of Toronto Scarborough</p> <p>EDUARDO LEORRI SORIANO, East Carolina University, Greenville</p> <p>DAVID VARRICCHIO, Montana State Univ.</p> <p>STEVE WESTROP, Oklahoma Museum</p> <p>DAVID M. WORK, Maine State Museum</p> <p>PATRICK WYSE JACKSON, Univer. of Dublin Trinity College</p> <p>MARGARET M. YACOBUCCI, Bowling Green State Univ.</p> <p>SAMUEL ZAMORA, Geological Survey of Spain</p> <p>RENBIN ZHAN, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences</p> <p>SHUNXIN ZHANG, Canada–Nunavut Geoscience Office</p> <p><i>Paleobiology Senior Editor</i> MARK PATZKOWSKY, Penn State Univ.</p> <p><i>Paleobiology Co-Editors</i> CATHERINE BADGLEY, Univ. of Michigan</p> <p>CARLOS A. JARAMILLO, Smithsonian Tropical Research Institute</p> <p>WOLFGANG KIESSLING, Universitat Erlangen</p> <p>SHUHAI XIAO, Virginia Polytechnic Institute</p> <p><i>Peer Review Coordinator</i> JESSICA KASTIGAR, JournalofPaleontology@cambridge.org Paleobiology@cambridge.org</p> <p><i>Communications Officer</i> TONY MARTIN, Emory Univ. geoam@emory.edu</p> <p><i>Program Coordinator</i> MATTHEW CLAPHAM, Univ. of California, Santa Cruz mclapham@ucsc.edu</p>	<p><i>Editor, Special Publications</i> COLIN SUMRALL The University of Tennessee, Knoxville csumrall@utk.edu</p> <p><i>Education/Outreach Coordinator</i> ROWAN LOCKWOOD, College of William & Mary rxlock@wm.edu</p> <p><i>Representatives At Large</i> SUSAN KIDWELL, University of Chicago skidwell@uchicago.edu</p> <p>CAROLINE STRÖMBERG, University of Washington caestrom@u.washington.edu</p> <p><i>Student Representative</i> KRISTOPHER M. KUSNERIK, University of Florida kmkusnerik@ufl.edu</p> <p><i>Section Chairs</i> Cordilleran: CARLIE PIETSCH, carlie.pietsch@sjsu.edu</p> <p>North Central: CARRIE SCHWEITZER, Kent State Univ. cschweit@kent.edu</p> <p>Northeastern: JUDITH NAGEL-MYERS, St. Lawrence Univ. jnagel@stlaw.edu</p> <p>Rocky Mountain: BROOKE LONG, S. Dakota School of Mines & Tech. brooke.long@mines.sdsmt.edu</p> <p>South Central: VICTORIA CHRAIBI, Tarleton State Univ. chraibi@tarleton.edu</p> <p>Southeastern: MICHELLE CASEY, Murray State Univ. mcasey5@murraystate.edu</p> <p><i>Editor – Priscum</i> LEIGH FALL, SUNY Oneonta leigh.fall@oneonta.edu</p> <p><i>Editor – Social Media</i> TARA LEPORE, The Web Schools taorminalepore@gmail.com</p>
---	---	--	---

Cover illustration: Lingual and labial view of *Galagadon nordquistae* teeth from the FMNH "Sue" locality, Hell Creek Formation, latest Maastrichtian, South Dakota. Gates et al., Fig. 7.1 and 7.5.

ISSN 0022-3360

Copyright © 2019 The Paleontological Society. All rights reserved.

SUBSCRIPTION INFORMATION

The Journal of Paleontology [ISSN 0022-3360] is published bimonthly (January, March, May, July, September, and November) by Cambridge University Press (One Liberty Plaza, 20th Floor, New York, NY 10006) for the Paleontological Society. Members of the Paleontological Society automatically receive electronic subscriptions to the *Journal of Paleontology* and *Paleobiology* as a benefit of membership. Institutional subscriptions can be purchased direct from Cambridge University Press or through any major subscription agent. Print-only, online-only, and bundled print and online prices are all available, and subscription prices are tiered according to institution type and size.

Please contact Cambridge University Press for further details:

For customers in North America

Email: subscriptions_newyork@cambridge.org; Phone: (800) 872-7423, option 4

For customers outside of North America

Email: journals@cambridge.org;

Phone: +44 (0)1223-32-6070; Fax: +44 (0)1223-32-5150

Downloads of individual articles are available on <https://www.cambridge.org/core/journals/journal-of-paleontology>.

Reprints of individual articles may be ordered. For information on reprints, please contact Cambridge University Press.

Archives of previous issues are available on <https://www.cambridge.org/core/journals/journal-of-paleontology>.

Permissions All rights reserved. Permissions and reproduction policies, request forms, and contacts are available at: <http://www.cambridge.org/about-us/rights-permissions/>

ADVERTISING

To advertise in the journal please contact M. J. Mrvica Associates, 2 West Taunton Avenue, Berlin, NJ 08009; Phone: 856-768-9360; Fax: 856-753-0064; Email: mjmrvica@mrvica.com

ABSTRACTING AND INDEXING

Abstracting and indexing information for the *Journal of Paleontology* is available at: <https://www.cambridge.org/core/journals/journal-of-paleontology/information/abstracting-and-indexing>.

POSTAL INFORMATION

Periodicals postage rate paid at New York, NY, and at additional mailing offices. POSTMASTER: Send address changes in the USA, Canada, and Mexico to: *Journal of Paleontology*, Cambridge University Press, Journals Fulfillment Department, One Liberty Plaza, 20th Floor, New York, NY 10006. Send address changes elsewhere to the *Journal of Paleontology*, Cambridge University Press, Journals Fulfillment Department, UPH, Shaftesbury Road, Cambridge CB2 8BS, England.

Copyright © 2019 The Paleontological Society. All rights reserved.

Printed in the United States of America

Lane

PALEONTOLOGY

SPECIMEN CABINETS



- * All steel construction
- * Powder paint finish
- * Durable door seal
- * No adhesives
- * Reinforced for easy stacking
- * Sturdy steel trays

LANE SCIENCE EQUIPMENT CORP.

225 West 34th Street
9th Floor
New York, NY 10122-0901

Tel: 212-563-0663
Fax: 212-465-9440
www.lanescience.com