

J	O	U	R	N	A	L	O	F			
P	A	L	E	O	N	T	O	L	O	G	Y

EXTINCTION, SURVIVAL, AND RECOVERY
OF LAGENIDE FORAMINIFERS IN THE PERMIAN–TRIASSIC
BOUNDARY INTERVAL, CENTRAL TAURIDES, TURKEY

JOHN R. GROVES, DEMİR ALTINER, AND ROBERTO RETTORI

THE PALEONTOLOGICAL SOCIETY MEMOIR 62

SUPPLEMENT TO JOURNAL OF PALEONTOLOGY □ ISSN 0022-3360 □ JPALAZ 79 4 II 1–38 JULY 2005

Memoirs of The Paleontological Society are occasional publications consisting of monographs and symposia that are too extensive for publication in the *Journal of Paleontology* as part of the regular issues. Ordinarily, memoirs are published as supplements to a regular issue of the *Journal*. Inquiries concerning submittal of manuscripts for inclusion in the Memoir Series may be made to the Editors of the *Journal of Paleontology*.

For information on cost and availability of back numbers of the Memoir Series, please contact: SEPM Business Office, 1731 East 71st St., Tulsa, OK 74136-5108, for numbers 1 (1968) through 16 (1985) or *Journal of Paleontology*, P.O. Box 1897, Lawrence, KS 66044-8897, jps@allenpress.com, for number 17 (1986) and following.

The JOURNAL OF PALEONTOLOGY (ISSN 0022-3360) is published bimonthly by the Paleontological Society, 810 East 10th St., Lawrence, KS 66044, USA. Dues and subscriptions for members of The Paleontological Society are \$65 per year. Subscription price is \$110 per year. Periodical postage paid at Lawrence, KS. For information on prices of back issues of the JOURNAL, please contact: SEPM Business Office, P.O. Box 4756, Tulsa, OK 74159, for volumes 1 (1927) through 59 (1985) or Paleontological Society Business Office, P.O. Box 1897, 810 East 10th St., Lawrence, KS 66044-8897, for volumes 60 (1986) and following.

Communications about the JOURNAL, notices, subscriptions, rates, changes of address, and nonreceipt of preceding numbers should be addressed to: JOURNAL OF PALEONTOLOGY Subscriptions Office, P.O. Box 1897, 810 East 10th St., Lawrence, KS 66044-8897, U.S.A., jps@allenpress.com. Claims for nonreceipt of preceding numbers must be submitted within three months (six months if foreign) of the date of publication in order to be filled gratis. Communications about membership and requests for blanks for nomination of new members in The Paleontological Society should be directed to the Secretary: Roger D. K. Thomas, Department of Earth and Environment, Franklin & Marshall College, P.O. Box 3003, Lancaster, PA 17604-3003.

Address manuscripts to:

Editors, *Journal of Paleontology*
Department of Geology
121 Trowbridge Hall
University of Iowa
Iowa City, IA 52242-1379
fossils@uiowa.edu

Editors for the *Journal* are Jonathan Adrain, Christopher A. Brochu, and Ann F. Budd, Department of Geoscience, University of Iowa, Iowa City, IA 52242-1379. Associate editors are: Laurie C. Anderson, Louisiana State University, laurie@geol.lsu.edu; Daniel B. Blake, University of Illinois, dblake@ux1.cso.uiuc.edu; Matthew Carrano, National Museum of Natural History, carrano.matthew@nmnh.si.edu; Robert L. Carroll, McGill University, robert.carroll@mcgill.ca; Richard Cifelli, University of Oklahoma, rlc@ou.edu; Keith Dewing, Geological Survey of Canada, kdewing@NRCan.gc.ca; William A. DiMichelle, Natural Museum of Natural History, Dimichelle.Bill@NMNH.SI.EDU; William P. Elder, Lafayette, California, chronovision@attbi.com; Robert J. Elias, University of Manitoba, eliasrj@Ms.UManitoba.CA; Michael Engel, University of Kansas, msengel@u.edu; John R. Groves, University of Northern Iowa, John.Groves@uni.edu; Steven J. Hageman, Appalachian State University, hagemansj@appstate.edu; Peter J. Harries, University of South Florida, harries@chuma.cas.usf.edu; Martin J. Head, University of Cambridge, mh300@hermes.cam.ac.uk; Eric Hilton, Field Museum of Natural History, ehilton@fieldmuseum.org; Peter Jell, Queensland Museum, Australia, Peter@qm.qld.gov.au; Stephen A. Leslie, University of Arkansas, saleslie@ualr.edu; Richard Lupia, University of Oklahoma, rlupia@ou.edu; Mike Melchin, St. Francis Xavier University, Canada, mmelchin@stfx.ca; Molly F. Miller, Vanderbilt University, MillerMF@ctr.vax.vanderbilt.edu; Brian Pratt, University of Saskatchewan, brian.pratt@usask.ca; Peter Roopnarine, California Academy of Sciences, proopnarine@calacademy.org; Eric Scott, San Bernardino County Museum, escott@sbc.m.sbccounty.gov; James Sprinkle, University of Texas, echino@mail.utexas.edu; Steve Westrop, University of Oklahoma, swestrop@ou.edu; David M. Work, Maine State Museum; david.work@maine.gov; Shuhai Xiao, Virginia Polytechnic Institute, xiao@vt.edu.

The JOURNAL OF PALEONTOLOGY is printed offset by Allen Press, Inc., Lawrence, KS 66044.

Copyright © 2005, The Paleontological Society
ALLEN PRESS, INC., LAWRENCE, KANSAS

COPYRIGHT STATEMENT

The appearance of the code at the top of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use, or for the personal or internal use of specific clients. This consent is given on the condition, however, that the copier pay the stated per copy fee through the Copyright Clearance Center, Inc., P.O. Box 765, Schenectady, New York 12301, for copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale.

Ⓢ This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

CONTENTS

ABSTRACT	1	CRYPTOMORPHINA LIMONITICA Sellier de Civrieux and Dessauvagie, 1965	27
INTRODUCTION	1	Genus LANGELLA Sellier de Civrieux and Dessauva- gie, 1965	27
PREVIOUS WORK	2	LANGELLA sp	28
STRATIGRAPHY	3	Genus PSEUDOLANGELLA Sellier de Civrieux and Des- sauvagie, 1965	28
<i>Regional stratigraphy and localities</i>	3	PSEUDOLANGELLA ACUS Pronina, 1989	28
<i>Permian–Triassic boundary interval</i>	5	Genus CRYPTOSEPTIDA Sellier de Civrieux and Des- sauvagie, 1965	28
<i>Paleoenvironmental interpretations</i>	7	CRYPTOSEPTIDA ANATOLIENSIS Sellier de Civrieux and Dessauvagie, 1965	28
EXTINCTION, SURVIVAL, AND RECOVERY OF LAGENIDES	9	Indeterminate genus and species	29
<i>Extinction</i>	9	IIA3. Triangular chambers	29
<i>Survival and recovery</i>	9	Genus PSEUDOTRISTIX Miklukho-Maklay, 1960	29
DISCUSSION	14	PSEUDOTRISTIX TCHERDYNZEVI (Miklukho-Maklay, 1960)	29
SYSTEMATIC PALEONTOLOGY	14	IIA4. Polygonal chambers	29
<i>Introduction</i>	14	Genus RECTOSTIPULINA Jenny-Deshusses, 1985	29
Class FORAMINIFERA Eichwald, 1830	15	RECTOSTIPULINA QUADRATA Jenny-Deshusses, 1985	29
Order LAGENIDA Delage and Hérouard, 1896	15	RECTOSTIPULINA PENTAMERATA new species	31
I. Nonseptate lagenides	15	IIB. Coiled	31
IA. Unpartitioned tubular chamber	15	Genus CALVEZINA Sellier de Civrieux and Dessauva- gie, 1965	31
Genus SYZRANIA Reitlinger, 1950	15	CALVEZINA OTTOMANA Sellier de Civrieux and Des- sauvagie, 1965	31
IB. Partitioned tubular chamber	15	Genus ROBULOIDES Reichel, 1946	32
Genus TEZAQUINA Vachard, 1980	15	ROBULOIDES LENS Reichel, 1946	32
TEZAQUINA? LUPERTI (Efimova, 1974)	15	ACKNOWLEDGMENTS	33
II. Septate lagenides	15	REFERENCES	33
IIA. Uniserial	15		
IIA1. Circular chambers	15		
Genus NODOSINELLOIDES Mamet and Pinard, 1992	15		
NODOSINELLOIDES SAGITTA (Miklukho-Maklay, 1954)	17		
NODOSINELLOIDES CAMERATA (Miklukho-Maklay, 1954)	17		
NODOSINELLOIDES AEQUIAMPLA (Zolotova <i>in</i> Zolo- tova and Baryshnikov, 1980)	17		
Genus NODOSARIA Lamarck, 1812	19		
“NODOSARIA” ELABUGAE Cherdyntsev, 1914	19		
“NODOSARIA” sp. I	19		
“NODOSARIA” HOAE (Trifonova, 1967)	20		
“NODOSARIA” SKYPHICA Efimova, 1974	20		
“NODOSARIA” EXPOLITA Trifonova, 1978b	20		
IIA2. Flattened chambers	22		
Genus GEINITZINA Spandel, 1901	22		
GEINITZINA ARAXENSIS Pronina, 1989	22		
Genus PACHYPHLOIA Lange, 1925	22		
PACHYPHLOIA OVATA Lange, 1925	22		
PACHYPHLOIA SCHWAGERI Sellier de Civrieux and Dessauvagie, 1965	23		
Genus ICHTHYOFRONDINA Vachard <i>in</i> Vachard and Ferrière, 1991	23		
ICHTHYOFRONDINA PALMATA (Wang, 1974)	25		
ICHTHYOFRONDINA ORNATA (Miklukho-Maklay, 1954)	25		
Genus FRONDINA Sellier de Civrieux and Dessauvagie, 1965	25		
FRONDINA PERMICA Sellier de Civrieux and Dessau- vagie, 1965	27		
Genus CRYPTOMORPHINA Sellier de Civrieux and Des- sauvagie, 1965	27		

ILLUSTRATIONS

FIGURES

1—Map of Turkey showing Neotethyan sutures and distribution of Middle and Upper Permian outcrops	2
2—Taurides region Medial–Late Permian carbonate platform	3
3—Map of southwestern central Taurides showing thrust-bounded tectonic units and location of Demirtaş and Taşkent measured sections	4
4—Columnar stratigraphic section of Taşkent locality	4
5—Columnar stratigraphic sections of Permian–Triassic boundary interval at Demirtaş and Taşkent localities	5
6—Thin section prints of skeletal wackestone/packstone facies and uppermost Permian oolite facies	6
7—Thin section print of Permian–Triassic boundary and outcrop photo of basal Triassic stromatolites	6
8—Cubic and framboidal pyrite occurrences in basal Triassic stro- matolite facies	7
9—Foraminiferal “disaster forms” in basal Triassic stromatolite fa- cies (<i>Earlandia</i> sp. and <i>Rectocornuspira kalthori</i> Brönni- mann, Zaninetti, and Bozorgnia, 1972)	7
10—Thin section prints of recrystallized Lower Triassic oolites	8
11—Aviculopectinin coquinite with linguloid brachiopods, Taşlica Member of Sapadere Formation	8

12—Stratigraphic occurrences of lagenide taxa at Demirtaş measured section	10	20—“ <i>Nodosaria</i> ” <i>hoae</i> (Trifonova, 1967), <i>Geinitzina araxensis</i> Pronina, 1989, and <i>Pachyphloia ovata</i> Lange, 1925	21
13—Stratigraphic occurrences of lagenide taxa in lower part of Taşkent measured section	11	21— <i>Pachyphloia schwageri</i> Sellier de Civrieux and Dessauvague, 1965, <i>Froncina permica</i> Sellier de Civrieux and Dessauvague, 1965, and <i>Ichthyofroncina ornata</i> (Miklukho-Maklay, 1954)	24
14—Stratigraphic occurrences of lagenide taxa in upper part of Taşkent measured section	12	22— <i>Ichthyofroncina palmata</i> (Wang, 1974), <i>Froncina permica</i> Sellier de Civrieux and Dessauvague, 1965, <i>Cryptomorphina limonitica</i> Sellier de Civrieux and Dessauvague, 1965, and <i>Langella</i> sp.	26
15—Lagenide species diversity across Permian–Triassic boundary at Demirtaş and Taşkent measured sections	12	23— <i>Rectostipulina pentamerata</i> n. sp., <i>Rectostipulina quadrata</i> Jeny-Deshusses, 1985, <i>Pseudolangella acus</i> Pronina, 1989, <i>Pseudotristix tcherdynzevi</i> (Miklukho-Maklay, 1960), <i>Calvezina ottomana</i> Sellier de Civrieux and Dessauvague, 1965, <i>Cryptoseptida anatoliensis</i> Sellier de Civrieux and Dessauvague, 1965, and indeterminate genus and species	30
16—Stratigraphic abundance versus last observed occurrence below Permian–Triassic boundary for species that did not survive end-Permian extinction	13	24— <i>Calvezina ottomana</i> Sellier de Civrieux and Dessauvague, 1965 and <i>Robuloides lens</i> Reichel, 1946	32
17—Lower and Middle Triassic lagenide species diversity	14		
18— <i>Syzrania</i> spp., <i>Tezaquina? luperti</i> (Efimova, 1974), <i>Nodosinelloides aequiample</i> (Zolotova in Zolotova and Baryshnikov, 1980), and <i>Nodosinelloides sagitta</i> (Miklukho-Maklay, 1954)	16		
19—“ <i>Nodosaria</i> ” sp. 1, “ <i>Nodosaria</i> ” <i>skyphica</i> Efimova, 1974, “ <i>Nodosaria</i> ” <i>expolita</i> Trifonova, 1978b, “ <i>Nodosaria</i> ” <i>elabugae</i> Cherdyntsev, 1914, and <i>Nodosinelloides camerata</i> (Miklukho-Maklay, 1954)	18		