Taphonomy studies the transition of organic matter from the biosphere into the geological record. It is particularly relevant to zooarchaeologists and paleobiologists, who analyze organic remains in the archaeological record in an attempt to reconstruct hominid subsistence patterns and paleoecological conditions. In this user-friendly, encyclopedic reference volume for students and professionals, R. Lee Lyman, a leading researcher in taphonomy, reviews the wide range of analytical techniques used to solve particular zooarchaeological problems, illustrating these in most cases with appropriate examples. He also covers the history of taphonomic research and its philosophical underpinnings. Logically organized and clearly written, the book is an important update on all previous publications on archaeological faunal remains.

VERTEBRATE TAPHONOMY

CAMBRIDGE MANUALS IN ARCHAEOLOGY

Series editors

Don Brothwell, *University of London*
Graeme Barker, *University of Leicester*
Dena Dincauze, *University of Massachusetts, Amherst*
Ann Stahl, *State University of New York, Binghamton*

Already published

J.D. Richards and N.S. Ryan, *Data processing in archaeology*
Simon Hillson, *Teeth*
Alwyne Wheeler and Andrew K.G. Jones, *Fishes*
Peter G. Dorrell, *Photography in archaeology and conservation*
Lesley Adkins and Roy Adkins, *Archaeological illustration*
Marie-Agnès Courty, Paul Goldberg and Richard MacPhail, *Soils and micromorphology in archaeology*
Clive Orton, Paul Tyers and Alan Vince, *Pottery in Archaeology*

Cambridge Manuals in Archaeology are reference handbooks designed for an international audience of professional archaeologists and archaeological scientists in universities, museums, research laboratories, field units, and the public service. Each book includes a survey of current archaeological practice alongside essential reference material on contemporary techniques and methodology.

VERTEBRATE TAPHONOMY

R. Lee Lyman
Department of Anthropology
University of Missouri-Columbia

CAMBRIDGE
UNIVERSITY PRESS

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE
The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS
The Edinburgh Building, Cambridge CB2 2RU, UK
40 West 20th Street, New York, NY 10011–4211, USA
10 Stamford Road, Oakleigh, VIC 3166, Australia
Ruiz de Alarcón 13, 28014 Madrid, Spain
Dock House, The Waterfront, Cape Town 8001, South Africa

http://www.cambridge.org

First published 1994
Reprinted 1996, 1999, 2001

A catalogue record for this book is available from the British Library

Library of Congress Cataloguing in Publication data
Lyman, R. Lee.
Vertebrate taphonomy / R. Lee Lyman.
p. cm. – (Cambridge manuals in archaeology)
Includes bibliographical references and index.
ISBN 0 521 45215 5 (hard). – ISBN 0 521 45840 4 (pbk.)
1. Animal remains (Archaeology). 2. Taphonomy. 3. Vertebrates.
I. Title II. Series.
CC79.5.A5L96 1994 93–28675
930.1′0285–dc20 CIP

ISBN 0 521 45215 5 hardback
ISBN 0 521 45840 4 paperback

Transferred to digital printing 2004

SE

To Barbara, John, and Michael

CONTENTS

FIGURES

TABLES

PREFACE

When I started my studies of vertebrate faunal remains recovered from archaeological sites over twenty years ago, I had no idea what taphonomy was nor was I particularly concerned about what are today typically asked questions concerning the preservation and formation of the archaeofaunal record. But as I read the zooarchaeological literature while completing my doctoral dissertation in the mid-1970s, I found an increasing number of papers dealing with taphonomic issues. The fact that since then it has become increasingly difficult to keep up with the ever growing literature on taphonomy is something of a mixed blessing. It is a mixed blessing because (a) we are constantly realigning the relation between what we *want* to learn and what we *think we can* learn from the vertebrate faunal remains we recover from archaeological sites, and thus our conclusions tend to be much more strongly founded than even a decade ago (this is good), and (b) it is nearly impossible for any one analyst to conceive of all of the logically possible taphonomic problems that a single reasonably sized assemblage of vertebrate remains might present. The latter is not bad; it just means a taphonomist's and zooarchaeologist's (and thus my) job is much more difficult now than it was a mere decade ago. Simply put, the analysis of zooarchaeological remains is no longer the simple, straightforward task that it was in the 1960s or 1970s. Taphonomic research has found a home in zooarchaeology, and it is here to stay.

Today, the number of zooarchaeologists who simply identify the bones, tally them up, and write a report about what prehistoric hominids were eating, is diminishing. Most reports on zooarchaeological remains written in the past ten years contain a more or less detailed consideration of at least a few taphonomic issues. This book is about how taphonomic questions might be analytically addressed and, sometimes, answered. It is a book that I wanted to write ten years from now. However, when Ann Stahl talked to me in the Spring of 1991 about the possibility of writing it, I realized, upon reflection, that now (from May 1991 until January 1993) was just as good a time as later. In fact, the more I thought about it, the better the idea of writing it now became. Many of my friends and professional colleagues were working hard on important taphonomic problems, and virtually all of them were eager to tell me what they were working on and what they were learning. Writing the book would, I decided, be easy because of all of these wonderfully knowledgeable people, and there weren't more of them than I could keep track of with a little effort. Any value

this book has is a tribute to all of those people who knowingly and unknowingly helped me with putting it together. For being a friend and taphos colleague as I wrote this book, I thank Diane Gifford-Gonzalez, Donald K. Grayson, Stephanie D. Livingston, Fiona Marshall, Dave N. Schmitt, and Mary C. Stiner. I especially thank Lee Ann Kreutzer for finding and sending me a couple of reprints at the last minute, and keeping me informed about her studies of bone density. Many other people have helped me over the years by reviewing some of my manuscripts and by always being ready to share ideas and reprints. For help in many ways taphonomic and zooarchaeologic, I thank Anna K. Behrensmeyer, Robert L. Blumenschine, Robson Bonnichsen, Luis A. Borrero, Virginia L. Butler, Gary Haynes, Jean Hudson, Eileen Johnson, Richard G. Klein, Curtis W. Marean, Duncan Metcalfe, Richard Morlan, James F. O'Connell, Paul W. Parmalee, James Savelle, Pat Shipman, Gentry Steele, and Lawrence C. Todd. There are, to be sure, many others whose talks I have heard and whose papers I have read; they have, no doubt, influenced my thoughts more than I realize.

Permission to reprint some of the illustrations that are critical to the volume was provided by several individuals doing important taphonomic research. To these individuals I can only say "I owe you one:" Peter Andrews, Anna K. Behrensmeyer, Lewis R. Binford, J. D. Currey, Diane Gifford-Gonzalez, Brian Hesse, Eileen Johnson, Lee Ann Kreutzer, Larry G. Marshall, Richard H. Meadow, Stanley Olsen, T. B. Parsons, Richard Potts, and Mary C. Stiner.

I have been given many opportunities to analyze and study archaeofaunal remains over the years. Without that breadth and depth of experience, this book would be much less than it is, and, I probably would not have written it. Frank C. Leonhardy and Carl E. Gustafson initiated my interest in bones, and Frank gave me the assemblage on which I cut my teeth. I am deeply saddened that his untimely death prevented his being here to see what he helped create. My early interests were fine tuned by Donald K. Grayson, who provided me access to several unique collections (including the Mount St. Helens crispy elk) and who knew when to let me figure out I was headed in the wrong direction and when to not waste time and tell me I was wrong. Other friends who provided boxes of bones for me to study include Kenneth M. Ames, David R. Brauner, Richard L. Bryant, Terry Del Bene, David T. Kirkpatrick, Dennis E. Lewarch, Michael J. O'Brien, Kenneth C. Reid, and Richard E. Ross. In particular, Jerry R. Galm has, over the past decade, seen to it that I didn't go more than six months without receiving a box of bones in the mail; thanks, Jerry, for ensuring that I didn't have to suffer withdrawal.

Many people helped in small but important ways. Gail Lawrence, Amy Koch, and Rob Dunn helped with some of the early word processing. Eugene Marino and Paul Picha helped with correspondence via the fax machine. Virginia L. Butler, James Cogswell, Dolores C. Elkin, Donald K. Grayson, and Paul Picha variously helped me obtain several hard-to-find articles and books,

and kept me up-to-date with what was coming off the presses. Michael B. Schiffer was always ready to visit and offer encouragement; thanks, Mike, for a copy of the tomato book. Gregory L. Fox made sure I went fishing occasionally during the early writing phases, and the students in my zooarchaeology class made sure I identified the big errors in some of my early reasoning. Ann Stahl and Anna K. Behrensmeyer provided helpful comments on an early draft of several chapters and thereby made sure I was on the right track. Ann subsequently read the entire manuscript, doing all of us a major service by ensuring that the more cumbersome sentences were revised. Linden Steele printed some of the photographs. The University of Missouri-Columbia, Department of Anthropology helped get some figures reproduced.

Finally, without the faith in my ability shown by my wife, Barbara, and the distractions provided by my sons John and Mike, it never would have been finished.

January 26, 1993

ACKNOWLEDGEMENTS

For permission to reproduce figures, I thank the following:

Figure 2.5, Richard Meadow; Figures 2.6, 4.4, and 4.14, Brian Hesse and Taraxacum Press; Figure 2.7, Anna K. Behrensmeyer and The Paleontological Society; Figure 2.8, Peter Andrews and The Royal Anthropological Institute; Figure 3.2, Diane Gifford-Gonzalez and Academic Press; Figure 3.3, Diane Gifford-Gonzalez and The Center for the Study of the First Americans; Figures 4.1 and 4.3, T. S. Parsons and W. B. Saunders Company; Figure 4.2, J. D. Currey and Edward Arnold Ltd.; Figures 4.9, 4.10, 4.11, 4.12, and 4.13, Stanley J. Olsen and the President and Fellows of Harvard College, Peabody Museum; Figure 6.1, Anna K. Behrensmeyer and Plenum Press; Figure 6.5, Anna K. Behrensmeyer and Harvard University, Museum of Comparative Zoology; Figures 6.10, 6.21a, and 6.22, Center for the Study of the First Americans; Figures 7.4 and 8.2, Academic Press; Figure 7.5, Academic Press, Ltd.; Figures 8.1a, 8.13a and 8.13b, Society for American Archaeology; Figure 8.4, Larry G. Marshall and The Center for the Study of the First Americans; Figure 8.6, Eileen Johnson and Academic Press; Figure 9.4, Richard Potts and Aldine de Gruyter; Figure 9.7, Lewis R. Binford and Academic Press.