

Vertebrate Paleobiology and Paleoanthropology Series



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Sabine Gaudzinski-Windheuser  
Lutz Kindler  
Naama Goren-Inbar

# The Acheulian Site of Gesher Benot Ya'aqov Volume III

Mammalian Taphonomy  
The Assemblages of Layers V-5 and V-6

**The Acheulian Site of Gesher  
Benot Ya'aqov**

**Volume III**

# Vertebrate Paleobiology and Paleoanthropology Series

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# The Acheulian Site of Gesher Benot Ya‘aqov

## Volume III

### Mammalian Taphonomy. The Assemblages of Layers V-5 and V-6

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ISSN 1877-9077 e-ISSN 1877-9085  
ISBN 978-94-007-2158-6 ISBN 978-94-007-2159-3 (eBook)  
DOI 10.1007/978-94-007-2159-3  
Springer Dordrecht Heidelberg London New York

Library of Congress Control Number: 2011916534

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*Cover illustration:* Drawing of a Fallow Deer by Amir Balaban. Photographs of fossil bones from the Acheulian site of Gesher Benot Ya'aqov by Gabi Laron

*Cover design:* Noah Lichtinger

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

# **A Volume in the Gesher Benot Ya‘aqov Subseries**

Coordinated by

**Naama Goren-Inbar**

*Institute of Archaeology, The Hebrew University of Jerusalem*



*In memory of Dr. Eli Lotan, our student, colleague  
and mentor, whose scientific curiosity and vast scope  
of interests are engraved in the memory of all who  
knew him and mourn his loss.*

## Foreword

Each period and part of the globe has its landmark sites, the ones that seem to define what a particular period is all about or the nature of some important step or threshold in the cultural and biological evolution of our species. For the Plio-Pleistocene, all eyes of course are fixed on Africa, the continent where the human story began. And two sites in particular, FLK-Zinj in Olduvai and FxJj50 in Koobi Fora, are clearly the archaeological standards, the reference points for our understanding of this remote page in our evolutionary history, and the ones to which every other site of the same period is compared.

But once hominins began to leave Africa and spread into the rest of the Old World, a process that began about 1.8 Myr, the archaeological record of Israel moves center stage, and for almost every subsequent major development in the human career one or another site in Israel has become a standard by which such developments are characterized and evaluated. For example, for many years the earliest undisputable human habitation outside of Africa was the 1.4 Ma site of ‘Ubeidiya in the Jordan Valley, only recently surpassed by the spectacular and somewhat earlier remains discovered at Dmanisi in Georgia and the redating of the famous paleontological localities in Java where in the nineteenth century the first *Homo erectus* fossils were discovered.

Similarly, in the intense and fascinating debates that surround the origins of anatomically and behaviorally modern humans, there is hardly a student of prehistory anywhere who hasn’t heard of the Middle Paleolithic caves of Skhul and Qafzeh. These classic sites occupy a central position in our ongoing attempts to understand where people with modern anatomy and cognitive capacities came from, and what role they may have played in the demise of Eurasia’s beetle-browed Neanderthals.

The 21 ka site of Ohalo II, exposed during an extended drought by the retreat of the Sea of Galilee, provides us with startlingly early evidence for the beginning stages of the harvesting, grinding, and baking of wild cereal grains, marking the first of a series of dramatic steps toward the “broad spectrum revolution” and the emergence of the world’s first sedentary farming villages.

And now the nearly 800 ka Israeli site of Gesher Benot Ya‘aqov (GBY), also located in the Jordan Valley and not all that far from ‘Ubeidiya, is emerging as a unique and spectacular record of human lifeways during this remote period of the early Middle Pleistocene. GBY, the focus of this timely and important study, not only provides evidence for a second major wave of human expansion out of Africa but, thanks to the painstaking work of project-director Naama Goren-Inbar, together with Rivka Rabinovich, Sabine Gaudzinski-Windheuser, Lutz Kindler, and their many collaborators, GBY is also yielding a record of unparalleled detail about the lifeways and capabilities of these ancient and hitherto poorly known hominins. For example, systematic plots of the spatial distribution of literally thousands of tiny burned flint microchips at GBY revealed the presence of “phantom” hearths, thereby providing some of the most compelling evidence that hominins already had control of fire more than three-quarters of a million years ago. Thanks to its largely waterlogged condition, GBY also preserves an unparalleled wealth of organic remains, including thousands of fruits, seeds, and pieces of



wood, some burned, as well as delicate fossil crabs, amphibians, fish, and molluscs. As the work on this marvelous organic record progresses, we are learning not only about the ancient lakeside environment in which these hominins lived, an invaluable framework in its own right, but we are gaining insights into the unexpectedly varied resource base available to these archaic human foragers. Through ongoing collaborative research with other archaeologists, paleontologists, paleobotanists, geologists, zoologists, isotope chemists, and a host of other specialists, the GBY team led by Naama Goren-Inbar is steadily piecing together a picture of this early period in human history that will serve as a standard for the Eurasian early Middle Pleistocene for many years to come.

The present volume, a detailed look at the bones of some 15 different taxa of medium- to large-sized mammals recovered during seven seasons of excavation at GBY, is an extremely important contribution to our knowledge about the lifeways of these Lower Paleolithic foragers. The site preserves a marvelous record of the animals that hominins procured and butchered on or near the shore of paleo-lake Hula nearly 800 ka. And there are some important insights and surprises here that readers will find of great interest. For example, while most scholars have long abandoned the idea that Middle Paleolithic humans (i.e., Neanderthals and their contemporaries elsewhere) were scavengers rather than hunters, opinion is much more divided about how their Lower Paleolithic predecessors obtained meat. Through the present study, GBY adds its voice to a steadily growing chorus of zooarchaeologists arguing that early Middle Pleistocene hominins, too, were capable hunters, at least by about a million years ago, if not before. At GBY this conclusion is drawn from several lines of evidence, most notably the presence of the full array of skeletal elements for a number of the more important taxa, suggesting that GBY's foragers had early access to whole carcasses, as well as the fact that many of the taxa are well represented by adults, even the elephants (*Palaeoloxodon antiquus*).

There is also a widespread view among paleoanthropologists that Lower Paleolithic sites tend to be heavily dominated by bones of megafauna and that regular use (hunting) of medium-sized ungulates like deer did not become commonplace until much later, perhaps as recently as 300 ka or 400 ka. While the remains of megafauna, both elephants and hippo, are clearly present at GBY, the smaller fallow deer (*Dama* sp.) was the principal mammalian resource exploited by the site's inhabitants, very likely hunted, not scavenged, and probably brought to the site intact, or nearly so. GBY's inhabitants were clearly familiar with the anatomy of their prey and, judging by the abundance of cutmarks and percussion marks, they thoroughly butchered and processed these animals for both meat and marrow.

As is necessary in any comprehensive, contemporary zooarchaeological study, the authors devote a lot of effort to taphonomic issues. This is absolutely essential for several reasons. Obviously, any study that wishes to contribute to our understanding of human behavior must first demonstrate that the bones preserved in an archaeological site of such great antiquity reflect the activities of humans and not the foraging proclivities of hyenas and other carnivores, or the selective transport and winnowing by the moving waters of the nearby lake. Moreover, while there are plenty of *bona fide* cutmarks and humanly induced impact fractures on the GBY bones, there are also lots of curious striations that are probably not a product of butchering or subsequent food processing. In order to figure out how these faunal assemblages came into being, and what produced the striations, the authors conducted an interesting series of tumbling, trampling, and burial experiments which are clearly described in the volume. The gist of their findings is that the GBY assemblages are largely the product of human activities. They find very little evidence that carnivores played more than a minor role in the formation of the assemblages and that density-mediated attrition of the more fragile bones has not seriously impacted the faunal remains. They also show quite convincingly that, despite GBY's proximity to an ancient lake, running water had little or no effect on the composition or spatial arrangement of the remains. As to the striations, they conclude that trampling of bones lying on or in the muddy matrix of the shoreline, by the site's human inhabitants and by animals coming to the lakeshore to drink, were the principal agents responsible for the damage.

This is an interesting and important volume, and an extremely valuable contribution to our growing understanding of the lifeways of Eurasian hominins in the more remote periods of the Paleolithic. Gesher Benot Ya'aqov adds to a steadily growing view that sees hunting of medium- to large-sized prey as an ancient human foraging strategy, emerging not in the Late Pleistocene or late Middle Pleistocene, but much earlier, perhaps as much as a million years ago, and possibly even earlier.

University of Michigan, Ann Arbor, Michigan  
February 2009

John D. Speth

## Preface

Human colonization of the Old World is generally viewed to have been feasible due to the emergence of larger-brained hominins characterized by more advanced abilities than those of their ancestors. *Homo erectus* is considered to be the first hominin to have left Africa, and hence responsible for the earliest sorties “Out of Africa.” The presence of early hominins in Eurasia, documented by hominin skeletal material and, more frequently, by the remains of their material culture, is evidence of their mobility along dispersal routes, of which corridors have been the most widely investigated.

While the dispersal routes and the mechanisms that enabled hominin colonization are still a matter of intensive debate, the evidence emerging from the Levantine Corridor and from the Acheulian site of Geshen Benot Ya‘aqov is of undisputable importance. Recent excavations at the site, among the earliest in Eurasia (ca. 780 ka), uncovered a stratigraphic archive that aids in the reconstruction of the paleohabitats of the early occupants of Eurasia, along with providing unique insight into their behavior.

The site of Geshen Benot Ya‘aqov is a unique phenomenon because of its cultural similarity to the African Acheulian Technocomplex—the only one of its kind in the Levant—expressed by techno-typological markers, and because of the waterlogged nature of its deposits that preserved early organic remains such as wood, bark, fruits and seeds. These aspects and others are further complemented by the impressive preservation of mammal bones, which will be described in this volume.

Though at times meager, the site’s mammal paleontological collection is of great importance as it contributes to the study of the diverse biogeography of the Pleistocene Levant, as well as to the paleoecology of the northern Jordan Valley and the Hula Valley and its vicinity (segment of the Great African Rift System). By utilizing the Early and Middle Pleistocene data retrieved from Geshen Benot Ya‘aqov and its subsequent analyses, we are now better able to reconstruct the paleo-Lake Hula environment and its unique ecological niche, along with shedding new light on the processes that allowed for the excellent bone preservation at the site.

Modern human interference serves as the greatest risk to the site. Boat trips stop here daily, as the excavation area acts as a ramp for dragging the boats out of the water. Despite this and destructive, unnecessary drainage activities that extensively destroyed the landscape (and which are slated to continue), the two remarkable excavation layers (V-5 and V-6; see below) remain exposed on the river bank. Over the course of our excavations, they have yielded a wealth of bones and stone artifacts. Such rich assemblages are undoubtedly due to the still mainly undecipherable social modes of hominin behavior and activities.

The site of Geshen Benot Ya‘aqov stretches for some 3.5 km along the Jordan River. Recent excavations of its eastern bank are the first to have uncovered an extensive depositional sequence featuring several Acheulian archaeological horizons. This volume is dedicated to analysis and interpretation of the faunal assemblages that originated in two of these horizons, Layers V-5 and V-6. Stratigraphically and conformably located one above the other, they yielded the richest and most abundant fossil bone assemblages at the site. More precisely, it is the older of the two, Layer V-6, that contains the exceptionally well-preserved and varied

mammal assemblage, as it has been protected by the overlying layer (V-5), comprised of a multitude of shells (coquina) that had become thoroughly cemented by the river waters.

By the time excavation of the Layers V-5 and V-6 layers began, we had already accumulated substantial experience and moderate understanding of the nature of the site's Acheulian horizons. Despite this, what was revealed upon exposure of the two layers was unmatched by any other previous experience at the site nor by our own naïve and oversimplified predictions; here was an exceptionally high concentration of mammal and other animal bones, reflecting a rich biodiversity and a high degree of human-caused fragmentation and damaged-induced markings (cut marks, percussion marks, etc.).

Due to the different nature of the two layers' content in comparison to the rest of the excavated site, efforts were made to excavate them as extensively as possible, but when what was supposed to be the final season culminated in August 1997, it became clear that we were far from achieving our goal. As a result, we decided to add a previously unplanned field season in September 1997, that would become the seventh and final season, during which extensive effort were made to expose as much as possible of Layer V-6. While we never fully reached our objective of excavating the entire two layers, we succeeded in progressing further and gained a wealth of data.

The good bone preservation and the high number of damage marks seen on them, both natural and hominin-induced, call for the launching of a project aimed at their detailed study. It was only natural that we collaborate with Prof. Sabine Gaudzinski-Windheuser of the Römisch-Germanisches Zentralmuseum, who had served as the sole taphonomy analyst of the large mammal assemblage from the older 'Ubeidiya site. The Gesher Benot Ya'aqov team, composed of the authors of this volume, designed a project that ended up as both a zooarchaeological and an experimental taphonomic study. The aim was to gain insight into site-formation processes, and in particular to learn about the role of post-depositional processes. We do not claim to fully understand the extent of the social and subsistence drives that led to the assemblages' formation, but we do see this study as a thorough presentation of the data and its interpretation.

# Acknowledgements

Many individuals and several foundations supported the Gesher Benot Ya'aqov project, and it is due to their contributions that we are able to present this volume.

Many participants took part in excavations, and the subsequent sieving and sorting of the bone-bearing sediments that originated in Layers V-5 and V-6. The fieldwork was carried out with the help of Idit Saragusti, Gonen Sharon and Nira Alperson-Afil, the all outstanding students of the Institute of Archaeology of the Hebrew University, who acquired vast archaeological experience in the course of the project and participated time and again over many years. The zooarchaeological study profited immensely from the dedication and knowledge of Rebecca Biton. Special thanks again to Nira for her invaluable analysis of the spatial organization of the artifacts and bones. We thank also Shoshana Ashkenazi, for contributing her ecological knowledge to the project, for her invaluable comments and suggestions, and for granting us permission to use her crab database. To Smadar Gabrieli, who undertook the conjoinable bone project. Thanks are due to Uzi Motro for his work on the statistical aspects of the study. Mona Ziegler contributed to the documentation, and Daniela Holst helped tirelessly in carrying out the experiments themselves. Thanks also to Anna Belfer-Cohen for her valuable comments. Nira Alperson-Afil produced the index, and Michal Haber edited this volume with outstanding dedication, insight, and expertise.

We thank Gabi Laron who photographed the archaeological material (Figs. 2.11, 3.1, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 5.30, 5.31, 5.34, 5.35, 7.7, and 7.8), and Noah Lichtinger for her work on the digital illustrations. We thank Daniel Even-Tzur for supplying cement mixer for some of the experiments that took place in the Department of Evolution, Systematics and Ecology (ESE) of the Hebrew University.

We are particularly grateful to the following paleontologists who allowed us to use their innovative and as yet unpublished data, such as their taxonomic identifications and scientific records: Vera Eisenman (Equidae), Bienvenido Martínez-Navarro (Bovidae), Adrian Lister (Elephantidae and Cervidae), and Tal Simmons (Aves). Special thanks to Andy Current (Natural History Museum, London) past and present mentor to Rivka Rabinovich.

We extend our thanks also to the German-Israel Science Foundation and the Römisch-Germanisches Zentralmuseum, Germany, who made this entire study feasible; they granted us the means to conduct the study as well as providing Rivka Rabinovich and Naama Goren-Inbar a unique opportunity to collaborate with Sabine Gaudzinski-Windheuser.

Many thanks also to the Irene Levi Sala Care Archaeological Foundation, the Leakey Foundation, the Israel Science Foundation, the National Geographic Society, the Israel Science Foundation (Grant No. 300/06 to the Center of Excellence, Project Title: "The Effect of Climate Change on the Environment and Hominins of the Upper Jordan Valley between ca. 800 ka and 700 ka ago as a Basis for Prediction of Future Scenarios"), and the Hebrew University of Jerusalem, whose support and contributions to the excavations, analyses and research aided in the presentation of this study.

We wish to thank the administrative staff of the universities and research institutions, whose, work behind the scenes, greatly assisted us in completing the present study: Frida Lederman

and Benny Sekay of the Institute of Archaeology of the Hebrew University, Sarit Levi of the Department of ESE, the administrative staff of the Authority for Research and Development of The Hebrew University and Herbert Auschrat of the Römisch-Germanisches Zentralmuseum.

Many thanks are due to Eric Delson and Eric Sargis, editors of the *Vertebrate Paleobiology and Paleoanthropology* book series, who generously accepted our study for publication, and to the Springer editorial staff, particularly Tamara Welschot and Judith Terpos.

We are most grateful to A.K. Behrensmeyer and Peter J. Andrews, as well as to two anonymous reviewers, who read earlier versions of this manuscript and provided invaluable comments and corrections that improved the manuscript enormously.

Finally, we wish to thank two of our beloved friends and colleagues who were directly involved with the research of Gesher Benot Ya‘aqov and this particular project, and who passed away during the final phases of writing this volume. Prof. Hezy (Jeheskel) Shoshani of the Department of Biology, Addis Ababa University, a world-renowned zoologist and a specialist in all that concerns extinct and extant elephants, was murdered in Ethiopia on June 3, 2008. His commitment, interest, and unmatched enthusiasm will always be remembered. Spurred by his endless curiosity and never-ending search for additional information, Hezy arrived at the site looking for elephant remains. Indeed, his wish came true and, as a great specialist of elephant hyoid bones, he identified several such bone elements and subsequently made them academically known.

Dr. Eli Lotan became a student of archaeology following his retirement from a long and very successful career as a veterinarian in the Jordan Valley. He earned both his BA and MA in Prehistoric Archaeology from the Institute of Archaeology at the Hebrew University of Jerusalem, becoming friend and colleague to students and teachers alike. He participated in numerous archaeological projects and, in due course, joined us at Gesher Benot Ya‘aqov. Though the oldest team member, he was young in both body and spirit. Eli was responsible for most of the excavation and registration of the Jordan Bank, and contributed immeasurably to our observations in all that concerns the identification of fossil mammal bones in the field. His extensive knowledge and scientific curiosity, coupled with a pleasant nature and vast experience, were a source of great inspiration to us all.

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>The Acheulian Site of Gesher Benot Ya'aqov</b>	<b>3</b>
2.1	The Renewed Excavations	4
2.1.1	Area C and the Jordan River Bank	6
2.2	Excavation Methodology	10
2.2.1	Sediment Sorting and Its Analyses	12
<b>3</b>	<b>Materials and Methodology</b>	<b>15</b>
3.1	Systematic Description	15
3.1.1	Body-Size Groups (BSG)	15
3.1.2	Skeletal Elements	15
3.2	Bone Density and Economic Utility	16
3.3	Bone Damage and Surface Modifications	17
3.3.1	State of Preservation	17
3.3.2	Animal-Induced Damage	18
3.3.3	Hominin-Induced Damage	18
3.3.4	Striations	19
3.4	Experiments	19
3.4.1	Experiment Methodology	19
<b>4</b>	<b>Systematic Paleontology</b>	<b>21</b>
4.1	Previous Faunal Studies	21
4.2	Faunal Composition of the Present Study	21
4.3	Systematic Description	22
4.4	Body-Size Groups (BSG)	38
<b>5</b>	<b>Taphonomic Analysis</b>	<b>41</b>
5.1	Bone Preservation	41
5.2	Striations	43
5.3	Skeletal-Element Representation at GBY	45
5.3.1	Dama Skeletal-Element Representation	45
5.3.2	Skeletal-Element Representation of Additional Species and Their Probable BSG	50
5.3.3	Skeletal-Element Representation Versus Density Values	61
5.3.4	Skeletal-Element Representation and Winnowing	63
5.3.5	Nutritional Values and Skeletal-Element Representation	65
5.3.6	Skeletal-Element Representation: Conclusion	67
5.4	Animal-Induced Damage	67
5.5	Hominin-Induced Damage	75
5.5.1	Cut Marks and Indications of Marrow Extraction	75
5.6	Animal- and Hominin-Induced Damage	87

5.7	Conclusions of the Taphonomic Analysis . . . . .	88
5.7.1	Age and Sex Profiles and Occupation Seasons . . . . .	88
5.8	Summary and Conclusions . . . . .	89
<b>6</b>	<b>Reconstructing Site-Formation Processes at GBY—The Experiments . . . . .</b>	<b>93</b>
6.1	The Potential of Actualistic Studies in Taphonomic Research . . . . .	93
6.2	Homogeneity or Non-homogeneity in the GBY Faunal Assemblage? . . . . .	94
6.3	Materials . . . . .	94
6.4	Description of the Experiments . . . . .	97
6.4.1	Scratching Experiment . . . . .	97
6.4.2	Burial Experiment . . . . .	98
6.4.3	Tumbling Experiments . . . . .	99
6.4.4	Trampling Experiments . . . . .	138
6.5	Summary and Results of the Experiments . . . . .	199
6.5.1	Results of the Tumbling Experiments . . . . .	199
6.5.2	Results of the Trampling Experiments . . . . .	203
6.6	Reconstructing the Taphonomic History at GBY Based on Analysis of the Bone-Surface Modifications . . . . .	205
6.7	The Implications of the Experiments for Taphonomic Research . . . . .	222
<b>7</b>	<b>A Reconstruction of the Taphonomic History of GBY . . . . .</b>	<b>223</b>
7.1	Biogeographical Origin of the Faunal Assemblages . . . . .	223
7.2	Paleoecological Reconstruction of GBY Faunal Assemblages . . . . .	225
7.3	Bone Taphonomy and Subsistence Strategies . . . . .	227
7.4	Conclusions Drawn from the Experiments . . . . .	230
7.5	Summary of the Paleontological Analyses . . . . .	231
7.6	Taphonomic History of the Lithic Assemblages . . . . .	232
7.6.1	Introduction . . . . .	232
7.6.2	The Lithic Assemblages of Layers V-5 and V-6 . . . . .	233
7.6.3	Summary of the Lithic Assemblages' Taphonomic Analysis . . . . .	237
7.7	Taphonomy and Aspects of Spatial Distribution . . . . .	238
7.7.1	Spatial Distribution Based on Conjoining Bone Fragments and Other Faunal Observations . . . . .	238
7.7.2	The Spatial Organization of Stone Artifacts . . . . .	240
7.8	Summary and Discussion . . . . .	242
<b>8</b>	<b>Summary and Conclusions . . . . .</b>	<b>245</b>
	<b>References . . . . .</b>	<b>249</b>
	<b>Site Index . . . . .</b>	<b>259</b>
	<b>Subject Index . . . . .</b>	<b>261</b>



## List of Abbreviations Used in the Text and the Tables

Anm	animal-induced damage
AST	astragalus
BC	breadth of caput tali (after Kroll 1991)
BD	greatest breadth of the distal end (after von den Driesch 1976)
BFD	greatest breadth of the Facies articularis distalis (after von den Driesch 1976)
BG	breadth of the glenoid cavity (after von den Driesch 1976)
BOS SP	<i>Bos</i> sp.
BOVINI	Bovini gen. et sp. indet. cf. <i>Bison</i> sp., Bovidae gen. et sp. indet.
BP	greatest breadth of proximal end (after von den Driesch 1976)
BPW	greatest depth of proximal end (after von den Driesch 1976)
BSG	body-size group (with 6 options, as below)
BSGA	weight range (>1,000 kg, e.g., elephant)
BSGB	weight range (approx. 1,000 kg, e.g., hippopotamus, rhinoceros)
BSGC	weight range (80–250 kg, e.g., giant deer, red deer, boar, bovine)
BSGD	weight range (40–80 kg, e.g., fallow deer, caprinae)
BSGE	weight range (15–40 kg, e.g., gazelle, roe deer)
BSGF	weight range (2–10 kg, e.g., hare, red fox)
BT	greatest breadth of the trochlea (after von den Driesch 1976)
CAPR	<i>Caprini</i> indet.
CARN	Carnivore und.
CER	Cervidae sp.
CERP	Centre Européen de Recherches Préhistorique de Tautavel, France
CH1	crown height of first lobe of tooth
CH2	crown height of second lobe of tooth
D1	greatest depth of the lateral half (after Davis 1985)
DAMA	<i>Dama</i> sp.
DD	distal depth (after Eisenmann 1992)
DW	distal width (after Eisenmann 1992)
ELEP	<i>Palaeoloxodon antiquus</i>
FPH	femur proximal shaft longitudinally broken
FSH	femur shaft longitudinally broken
GAZ	<i>Gazella</i> cf. <i>gazella</i>
GB	greatest breadth (after von den Driesch 1976)
GBA	acetabulum width (after von den Driesch 1976)
GBY	Gesher Benot Ya'aqov
GL	greatest length (after von den Driesch 1976)
GLP	greatest length of the <i>processus articularis</i> (after von den Driesch, 1976)
GUI	General Utility Index
H	height of distal humerus (after Davis 1985)
HIPO	<i>Hippopotamus amphibius</i>

HOM	hominin (and hominin induced damage)
HSH	humerus shaft longitudinally broken
HUJ	Hebrew University Collections, Jerusalem, Israel
IQW	Institut für Quartärpaläontologie Weimar (Forschungsinstitut Senckenberg), Germany
JB	Jordan Bank (the area along the left bank of the Jordan River, where Layers V-5 and V-6 lie partially exposed on the surface, but are mainly submerged underneath the river and hence required underwater excavation, but not in accordance with the strike and dip of each layer)
LA	length of the acetabulum (after von den Driesch 1976)
LAR	length of the acetabulum on the rim (after von den Driesch 1976)
LG	length of the glenoid cavity (after von den Driesch 1976)
LM	lower molar
MANF	mandible fragment
MAU	minimum number of animal units
MB	greatest depth of proximal end (after von den Driesch 1976)
MCHDW	width of distal condyle metacarpal (after Davis 1985)
MCLC	diameter or height of distal condyle (metacarpal) (after Davis 1985)
MCSC	width of distal trochlea (metacarpal) (after Davis 1985)
MCSH	metacarpal shaft longitudinally broken
MGPF	University of Florence, Museum of Geology and Paleontology, Florence, Italy
MM	Musée de Préhistoire Régionale de Menton, Menton, France
MNE	minimum number of skeletal elements
MNHN	Muséum national d'Histoire Naturelle, Paris
MNI	minimum number of individual animals
MT	metatarsal
MTHDH	width of distal condyle (metatarsal) (after Davis 1985)
MTLC	diameter or height of distal condyle (metatarsal) (after Davis 1985)
MTPH	metapodial shaft longitudinally broken
MTSC	width of distal trochlea (metatarsal) (after Davis 1985)
MTSH	metatarsal shaft longitudinally broken
NHM	Natural History Museum, London
NISP	number of identifiable specimens
PD	proximal depth (after Eisenmann 1992)
PEL ISH	pelvis ischium
Ph 1	phalanx 1
Ph 2	phalanx 2
PH1PH	phalanx 1 proximal longitudinally broken
PH2D	phalanx 2 distal
PW	proximal width (after Eisenmann 1992)
RDS	radius shaft
RDSH	radius shaft longitudinally broken
RIBP	rib proximal
RIBSH	rib shaft longitudinally broken
SCB	scapula blade
SCD	scapula distal
SCDH	scapula distal longitudinally broken
SD	smallest breadth of diaphysis (after von den Driesch 1976)
SH	smallest height of the ilium shaft (after von den Driesch 1976)
SKFH	skull fragment
SPL	splinter
Str.	striation
SUS	<i>Sus scrofa</i>

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TAU	The Zoological Collections, Tel Aviv University
TBD	tibia distal
TBSH	tibia shaft longitudinally broken
TFH	teeth fragments
TUSKFH	tusk fragment
VATLP	vertebra atlas proximal
VEL	vertebra lumbar
Ver	vertebra
Ver. Ar	vertebral articular surface
VTRS	spine
UNM	unidentified mammal bones

## List of Figures

Fig. 2.1	Location map of Gesher Benot Ya'akov . . . . .	3
Fig. 2.2	The excavation areas and the geological trenches (the <i>shaded squares</i> in the grid have been excavated) . . . . .	4
Fig. 2.3	Schematic composite stratigraphic section of the 34 m thick sedimentary succession of the Benot Ya'akov Formation excavated at GBY (Feibel 2001). Note the diversity of the sediment types and their occurrence in six sedimentary cycles. Note also the layers that contain wood, artifacts, molluscan shells and bones. On the basis of the Brunhes Matuyama Magnetic Chron Boundary (marked B/M) of 0.78 Ma these are correlated with the indicated Oxygen Isotope Stages. Wood— <i>w</i> , mollusks— <i>spiral</i> , artifacts— <i>full triangle</i> , palaeosol— <i>p</i> , clay— <i>c</i> , silt— <i>z</i> , conglomerate— <i>q</i> . (after Goren-Inbar et al. 2002, p. 23, fig. 9) . . . . .	5
Fig. 2.4	Geological map of the study area (after Goren-Inbar et al. 2002, p. 22, fig. 7). (Selected layers mentioned in the text are marked by different symbols and by name reference: Layers II-2 and V-5 are coquinas; Layer IV-25 and the Bar are conglomerates.) . . . . .	6
Fig. 2.5	<i>Upper left</i> : map of Area C with lines and names marking the location of each section (the key map reference is in Israel Grid coordinates). Sections underneath the same heading appear below the map and to its right ( <i>Sections 3, 4, 7</i> ; the horizontal scale in all sections is in 50 cm units) . . . . .	7
Fig. 2.6	A view of the northernmost cross-section . . . . .	8
Fig. 2.7	A view of the southernmost cross-section . . . . .	8
Fig. 2.8	Excavation of the Jordan Bank (JB) . . . . .	9
Fig. 2.9	Excavation of the Jordan Bank (JB) . . . . .	10
Fig. 2.10	The exposed coquina of Layer V-5 in the JB . . . . .	11
Fig. 2.11	View from the western bank of the Jordan River of the exposure of Layer V-5 . . . . .	12
Fig. 2.12	Excavation of Area C . . . . .	13
Fig. 2.13	Excavation of Area C, a view of the southernmost cross-section . . . . .	14
Fig. 2.14	A view of the exposed Layer V-6 . . . . .	14
Fig. 3.1	Examples of bones displaying different states of preservation: <b>a</b> Type 1, <b>b</b> Type 3, <b>c</b> Type 4, <b>d</b> Type 5 . . . . .	17
Fig. 4.1	Elephant hyoid from Layer V-5 (no. 1,652) . . . . .	26
Fig. 4.2	Elephant astragalus from Layer V-6 (no. 9,274, r) . . . . .	26
Fig. 4.3	Elephant M <sub>2</sub> from the JB (no. 735, r) . . . . .	26

Fig. 4.4	<b>a</b> Lateral view of <i>Equus</i> sp. (foal) mandible from Layer V-5 (no. 2,033, r); <b>b</b> occlusal view of the same specimen; <b>c</b> pelvis fragment from Layer V-6 (no. 1,470) . . . . .	28
Fig. 4.5	<b>a</b> Shed <i>Dama</i> antler from the JB (no. 754, r) and <b>b</b> <i>Dama</i> antler fragment from the JB (no. 1,608, r) . . . . .	33
Fig. 4.6	Plot of <i>Dama</i> sp. antler size (burr base width and length) from the following sites: VAL—Vallonnet, SELV—Selvella, WR—West Runton, SWA—Swanscombe, TD6—Atapuerca TD6, Hol—Holon, TD—Tabun D, TEA—Tabun Ea, TEC—Tabun Ec, REC— <i>Dama mesopotamica</i> in Israel, NHM—Recent <i>Dama mesopotamica</i> , NHM, London. See Table 4.5 for details on each site . . . . .	34
Fig. 4.7	<i>Dama</i> sp. teeth from Area C and the JB: upper teeth: <b>a</b> P <sup>4</sup> (no. 5,637, r; Layer V-5), <b>b</b> M <sup>3</sup> (no. 781, r; the JB), <b>c</b> two mandibles (nos. 1,635, l, Layer V-5; 1,461, r, Layer V-6) . . . . .	35
Fig. 4.8	Plot of <i>Dama</i> M <sup>3</sup> length and width from the following sites: VAL—Vallonnet, UNT—Untermassfeld, WR—West Runton, ISER—Isernia, TD8—Atapuerca; Hol—Holon, HD—Hayonim D. See Table 4.5 for details on each site . . . . .	36
Fig. 5.1	Details (a and b) of a cut mark on a cervid atlas from Layer V-6 . . . . .	43
Fig. 5.2	Detail of a cut mark like striation on the corroded surface of a long bone from Layer V-5 . . . . .	44
Fig. 5.3	“Micro-striations” on a rib fragment from Layer V-5 . . . . .	44
Fig. 5.4	Flat-based striations on a long bone from Layer V-5 . . . . .	44
Fig. 5.5	U-shaped striations on a femur fragment from the JB . . . . .	45
Fig. 5.6	Scattered striations on the surface of a humerus from the JB . . . . .	45
Fig. 5.7	Relative frequency of the striated bones per body-size group and layer . . . . .	46
Fig. 5.8	<i>Dama</i> %NISP from Area C and the JB . . . . .	48
Fig. 5.9	Skeletal-element representation of <i>Palaeoloxodon antiquus</i> and BSGA (elephant > 1,000 kg) from Area C and the JB . . . . .	57
Fig. 5.10	Skeletal-element representation of <i>Hippopotamus</i> and BSGB (hippopotamus, rhinoceros < 1,000 kg) from Area C and the JB . . . . .	58
Fig. 5.11	Skeletal-element representation of BSGC (giant deer, red deer, boar, bovine, 80–250 kg) from Area C and the JB . . . . .	59
Fig. 5.12	Skeletal-element representation of BSGE (gazelle, roe deer, 15–40 kg) from Area C and the JB . . . . .	60
Fig. 5.13	Skeletal-element representation of <i>Equus</i> sp. and <i>E. cf. africanus</i> from Area C and the JB . . . . .	61
Fig. 5.14	Skeletal-element representation of <i>Dama</i> plotted against mineral-density values of deer bones (Lyman 1994: table 7.6) . . . . .	62
Fig. 5.15	Skeletal-element representation of BSGE plotted against mineral-density values of deer bones (Lyman 1994: table 7.6) . . . . .	62
Fig. 5.16	Skeletal-element representation of Equids plotted against mineral-density values of <i>Equus</i> (Lam et al. 1999: table 1) . . . . .	62
Fig. 5.17	Susceptibility of <i>Dama</i> to fluvial transport according to Voorhies groups . . . . .	63
Fig. 5.18	Correlation between elephant and BSGA skeletal elements and FTI (Fluvial Transport Index, Frison and Todd 1986) . . . . .	64
Fig. 5.19	Susceptibility of <i>Hippopotamus</i> and BSGB to fluvial transport according to Voorhies groups . . . . .	64
Fig. 5.20	Susceptibility of BSGC to fluvial transport according to Voorhies’ groups . . . . .	64

Fig. 5.21	Susceptibility of BSGE to fluvial transport according to Voorhies' groups . . . . .	65
Fig. 5.22	Nutritional values of equids from Area C and the JB (GUI—General Utility Index from Outram and Rowley-Conwy 1998: table 5) . . . . .	67
Fig. 5.23	<b>a</b> Animal-induced modification by agent from Area C and the JB; <b>b</b> tooth scratches on a <i>Dama</i> distal scapula from Layer V-5 (no. 1,679); <b>c</b> tooth scratches on a <i>Dama</i> distal tibia shaft from Layer V-6 (no. 1,765) . . . . .	68
Fig. 5.24	Cut mark distribution on <i>Dama</i> and BSGD according to body area . . . . .	81
Fig. 5.25	Percentage of percussion marks on <i>Dama</i> bones from Area C and the JB . . . . .	82
Fig. 5.26	Ranked marrow indices (Lyman 1994: table 7.1) and percentage of percussion marks per <i>Dama</i> limb and leg bones from Area C and the JB . . . . .	82
Fig. 5.27	Ranked grease indices (Lyman 1994: table 7.1) and percentage of percussion marks per <i>Dama</i> limb and leg bones from Area C and the JB . . . . .	82
Fig. 5.28	Cut marks on a metapodial <i>Dama</i> -sized shaft from Layer V-6 (no. 12,827) . . . . .	83
Fig. 5.29	Cut marks on a <i>Dama</i> sp. atlas from Layer V-6 (no. 1,714). <i>Top</i> – general view, <i>bottom</i> – detail . . . . .	83
Fig. 5.30	Cut marks on a <i>Dama</i> sp. astragalus from Layer V-6 (no. 829) . . . . .	84
Fig. 5.31	Cut marks on <i>Dama</i> sp. second phalanx from the JB (no. 1,327) . . . . .	84
Fig. 5.32	Cut marks on a <i>Dama</i> sp. cervical vertebrae from Layer V-6 (no. 1,723) . . . . .	84
Fig. 5.33	Cut marks on a <i>Dama</i> sp. femur shaft from the JB (no. 12,668) . . . . .	85
Fig. 5.34	Percussion marks on a <i>Dama</i> sp. femur shaft fragment from Layer V-6 (no. 2,102) . . . . .	85
Fig. 5.35	Lateral and medial views of a <i>Dama</i> sp. split first phalange from <b>a</b> Layer V-6 (no. 1,562) and <b>b</b> Layer V-5 (no. 1,681) . . . . .	85
Fig. 5.36	Location and frequency of cut marks on <i>Dama</i> skeletal elements. Each number indicates the relative abundance (%) of cut marks on a particular skeletal element: <b>a</b> Layer V-6; <b>b</b> the JB; <b>c</b> Hayonim Cave, Layer D1–2; <b>d</b> Hayonim Cave, Layer D3. The sample size of cut marks from Layer V-5 is small and thus does not appear . . . . .	86
Fig. 5.37	Frequency of animal species in Area C and the JB according to %NISP . . . . .	87
Fig. 5.38	Frequency of bone modifications from Area C and the JB (% of total number of recorded bones) . . . . .	87
Fig. 5.39	Frequency of striated bones from body-size groups, Area C, and the JB . . . . .	91
Fig. 6.1	Processing of sheep feet for the experiments. The <i>top row</i> , from left to right, shows feet from the anterior face in different processing stages. The <i>bottom row</i> , from left to right, shows feet in the posterior view in different processing stages . . . . .	95
Fig. 6.2	Scratching experiment: striations produced by <b>a</b> a large <i>Viviparus</i> and <b>b</b> the pointed helix of a <i>Melanopsis</i> . On the <i>left</i> is a dried fresh domestic cow radius shaft, and on the <i>right</i> is a fresh sheep metacarpus . . . . .	98
Fig. 6.3	Smashing of a <i>Bos</i> bone for the burial experiment. On the <i>top left</i> is the positioning of the bone on a large calcareous block before smashing with a blunt-tipped quartzite pebble. On the <i>top</i>	

	<i>right</i> is a detail of the shaft of a <i>Bos</i> tibia after smashing. The periosteum of the bone prevented the disintegration of the bone. On the <i>bottom</i> is a <i>Bos</i> femur after smashing . . . . .	99
Fig. 6.4	Burial experiment. Modifications on a domestic cow femur fragment (Fem-1-10) after burial: <b>a</b> porous bone structure, edge abrasion and rounding; <b>b</b> singular striation; <b>c</b> exfoliation of the bone surface . . . . .	100
Fig. 6.5	Burial experiment. Modifications on a domestic cow tibia fragment (Tib-1-2) after burial. The fragment shows <b>a</b> dry fractures and <b>b</b> gnawing damage by a rodent . . . . .	101
Fig. 6.6	Preparations for a tumbling experiment: <b>a</b> the bone was placed in a plastic container with sediment and water; <b>b</b> the container was affixed to the rotation chamber for tumbling; <b>c</b> the contents of the plastic container after tumbling. A sheep metapodial is seen prior to ( <i>left</i> ) and after tumbling ( <i>right</i> ) . . . . .	102
Fig. 6.7	Tumbling Experiment 1, sheep metacarpus. The posterior face of the diaphysis <b>a</b> before and <b>b</b> after tumbling. Deepening of the sulcus (1), striation (2), and abrasion (3) . . . . .	103
Fig. 6.8	Tumbling Experiment 2, sheep metacarpus. The anterior face of the diaphysis <b>a</b> before and <b>b</b> after tumbling. <i>Top row</i> : pronunciation of the sulcus (1); <i>bottom row</i> : pronunciation of the longitudinal striation (2). Both rows show an identical detail of the sheep metacarpus at different degrees of magnification . . . . .	104
Fig. 6.9	Tumbling Experiment 3, sheep metacarpus. The distal metaphysis <b>a</b> before and <b>b</b> after tumbling. Abrasion of the bone caused by tumbling led to changes in the porous bone structure. The <i>top</i> and <i>bottom rows</i> show an identical detail of the sheep metacarpus at different degrees of magnification . . . . .	105
Fig. 6.10	Tumbling Experiment 4, sheep metacarpus. Striations on the anterior diaphysis <b>a</b> before and <b>b</b> after tumbling. Striations became more pronounced, smoother and wider after tumbling occurred, as is well illustrated by the changed morphology of the start- (1) and endpoints (2) of the striations . . . . .	106
Fig. 6.11	Tumbling Experiment 4, sheep metacarpus. The distal metaphysis <b>a</b> before and <b>b</b> after tumbling. Morphological changes due to abrasion were created by tumbling. Both columns show an identical detail of the sheep metacarpus at different degrees of magnification . . . . .	107
Fig. 6.12	Tumbling Experiment 5, domestic cow femur fragment. Cut marks <b>a</b> before and <b>b</b> after tumbling. Vertical cut marks became more shallow (1); longitudinal cut marks almost vanished (2) . . . . .	108
Fig. 6.13	Tumbling Experiment 5, domestic cow femur fragment. Bone-breakage patterns <b>a</b> before and <b>b</b> after tumbling. Longitudinal cracking along the breaking edge (1) was caused by tumbling and accompanied by leveling of breakage morphology (2) . . . . .	109
Fig. 6.14	Tumbling Experiment 6, domestic cow tibia fragment. Periosteum preservation <b>a</b> before and <b>b</b> after tumbling. <i>Arrows</i> indicate the area of the bone that was magnified. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	110
Fig. 6.15	Tumbling Experiment 6, domestic cow tibia fragment. Bone-breakage patterns <b>a</b> before and <b>b</b> after tumbling. Rounding of bone edges was caused by tumbling . . . . .	111

Fig. 6.16	Tumbling Experiment 6, domestic cow tibia fragment. Anthropogenically induced cut- and scraping marks <b>a</b> before and <b>b</b> after tumbling. (I) Smoothing and rounding of the cut marks were caused by tumbling. Both rows show an identical detail of the bone at different degrees of magnification. The morphological characteristics of the cut marks are indicated by <i>arrows</i> (1–4). (II) Tumbling erased the fine cut mark (1). Tumbling flattened and rounded the morphology of the deep cut mark (2) and smoothed the morphology of the scraping mark (3). Both columns show an identical detail of the bone at different degrees of magnification. The scale bar of the microscope images is 1 mm . . . . .	112
Fig. 6.17	Tumbling Experiment 7, sheep metacarpus. <b>a</b> unabraded diaphysis and <b>b</b> abraded diaphysis after tumbling. On the <i>left</i> are details of the lateral face of the metacarpus at different degrees of magnification. On the <i>right</i> are details of the medial face of the metacarpus at different degrees of magnification. <i>Arrows</i> indicate the areas of the bone that were magnified. The scale bar of the microscope images is 1 mm . . . . .	113
Fig. 6.18	Tumbling Experiment 7, sheep metacarpus. The anterior face <b>a</b> before and <b>b</b> after tumbling. A vertical striation (1) with uneven edges and a rough morphology was created by tumbling . . . . .	114
Fig. 6.19	Tumbling Experiment 8, sheep metatarsus. Cut marks on the posterior bone surface <b>a</b> before and <b>b</b> after tumbling. Only slight modifications of the cut mark (1) were created by tumbling . . . . .	116
Fig. 6.20	Tumbling Experiment 8, sheep metatarsus. Traces of periosteum removal (1, 2) on the anterior bone surface <b>a</b> before and <b>b</b> after tumbling . . . . .	117
Fig. 6.21	Tumbling Experiment 8, sheep metatarsus. Striations on the lateral bone surface <b>a</b> before and <b>b</b> after tumbling. Pronunciation of the scraping marks (1, 2) was caused by tumbling . . . . .	118
Fig. 6.22	Tumbling Experiment 8, sheep metatarsus. The posterior face <b>a</b> before and <b>b</b> after tumbling. Fine oval- and round-shaped punctures, indicated by <i>arrows</i> , were created by tumbling . . . . .	119
Fig. 6.23	Tumbling Experiment 9, sheep metacarpus. The medial edge of the posterior face <b>a</b> before and <b>b</b> after tumbling. Removal of the scraping marks and the appearance of fine vertical striations, indicated by <i>arrows</i> , were caused by tumbling . . . . .	120
Fig. 6.24	Tumbling Experiment 9, sheep metacarpus. The anterior metaphysis <b>a</b> before and <b>b</b> after tumbling. Irregular-, oval-, and round-shaped punctures, indicated by <i>arrows</i> , were created by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	121
Fig. 6.25	Tumbling Experiment 10, sheep metatarsus. The anterior face <b>a</b> before and <b>b</b> after tumbling. Striations, indicated by <i>arrows</i> , were smoothed and broadened by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . .	122
Fig. 6.26	Tumbling Experiment 10, sheep metatarsus. The posterior face <b>a</b> before and <b>b</b> after tumbling. Diagonal marks were smoothed by tumbling. Irregular-shaped punctures, indicated by <i>arrows</i> , were created by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	123



Fig. 6.27	Tumbling Experiment 10, sheep metatarsus. The lateral diaphysis <b>a</b> before and <b>b</b> after tumbling. Irregularly-shaped punctures, indicated by <i>arrows</i> , were created by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	124
Fig. 6.28	Tumbling Experiment 11, sheep metacarpus. The proximal metaphysis <b>a</b> before and <b>b</b> after tumbling. Irregular-, oval-, and round-shaped punctures on the proximal metaphysis, indicated by <i>arrows</i> , were created by tumbling . . . . .	126
Fig. 6.29	Tumbling Experiment 11.1, sheep metacarpus. The distal metaphysis <b>a</b> before and <b>b</b> after four hours of tumbling, and <b>c</b> after ten hours of tumbling. Abrasion and rounding of the distal metaphysis increased with the duration of tumbling . . . . .	127
Fig. 6.30	Tumbling experiment 11.1, sheep metacarpus. The anterior diaphysis <b>a</b> before and <b>b</b> after four hours of tumbling, and <b>c</b> after ten hours of tumbling. Removal of the vertical striations, indicated by <i>arrows</i> , was caused by tumbling . . . . .	128
Fig. 6.31	Tumbling Experiment 11.1, sheep metacarpus. The proximal metaphysis of the medial face <b>a</b> before and <b>b</b> after four hours of tumbling, and <b>c</b> after ten hours of tumbling. A deep vertical striation, indicated by an <i>arrow</i> , was created by tumbling . . . . .	129
Fig. 6.32	Tumbling Experiment 12, sheep metatarsus. The anterior face <b>a</b> before and <b>b</b> after tumbling. The striations, indicated by <i>arrows</i> , deepened and became more pronounced after tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	130
Fig. 6.33	Tumbling Experiment 12, sheep metatarsus. The anterior proximal metaphysis <b>a</b> before and <b>b</b> after tumbling. Pronunciation of the morphology of the sulcus, indicated by an <i>arrow</i> , was caused by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	131
Fig. 6.34	Tumbling Experiment 12, sheep metatarsus. The posterior face of the proximal metaphysis <b>a</b> before and <b>b</b> after tumbling. U-shaped striations, indicated by an <i>arrow</i> , were created by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	132
Fig. 6.35	Tumbling Experiment 12, sheep metatarsus. The medial face of the proximal metaphysis <b>a</b> before and <b>b</b> after tumbling. A deep narrow striation (1) and fine irregular-shaped punctures (2) were created by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	133
Fig. 6.36	Tumbling Experiment 13, sheep metacarpus. The anterior face of the diaphysis <b>a</b> before and <b>b</b> after tumbling. A striation, indicated by an <i>arrow</i> , was created by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	134
Fig. 6.37	Tumbling Experiment 14, sheep metatarsus. The posterior face of the diaphysis <b>a</b> before and <b>b</b> after tumbling. Pronunciation of the sulcus, indicated by <i>arrows</i> , was caused by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	135
Fig. 6.38	Tumbling Experiment 14, sheep metatarsus. The posterior face of the distal metaphysis <b>a</b> before and <b>b</b> after tumbling. Abrasion on the distal metaphysis was caused by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	136

Fig. 6.39	Tumbling Experiment 14, sheep metatarsus. The anterior diaphysis <b>a</b> before and <b>b</b> after tumbling. The deepening and broadening of the striations (1, 2) were caused by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	137
Fig. 6.40	Tumbling Experiment 15, domestic cow femur fragment. Surface modifications <b>a</b> before and <b>b</b> after tumbling. Polishing of the abraded bone surface was caused by tumbling . . . . .	139
Fig. 6.41	Tumbling Experiment 16, domestic cow radius fragment. Surface modifications <b>a</b> before and <b>b</b> after tumbling. Heavy abrasion, rounding, and polishing of the fragment were caused by tumbling . . . . .	140
Fig. 6.42	Tumbling Experiment 16, domestic cow radius fragment. The lateral face <b>a</b> before and <b>b</b> after tumbling. Obliteration of the cut mark was caused by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	141
Fig. 6.43	Tumbling Experiment 17, sheep metatarsus <b>a</b> before and <b>b</b> after tumbling. Considerable rounding of the bone was caused by tumbling. The <i>dotted lines</i> indicate the distal width and depth of the metaphysis prior to tumbling; the <i>black lines</i> indicate the distal width and depth of the metaphysis after tumbling. <i>Arrows</i> indicate the area of the bone that was highly magnified, illustrating the morphological change created by tumbling . . . . .	142
Fig. 6.44	Tumbling Experiment 17, sheep metatarsus. <b>a</b> before and <b>b</b> after tumbling. Damage to the proximal articulation that occurred after tumbling exposed the marrow cavity . . . . .	143
Fig. 6.45	Tumbling Experiment 17, sheep metatarsus. Bone-surface modification on the anterior face of the diaphysis <b>a</b> before and <b>b</b> after tumbling. Smoothing of the vertical striation, indicated by an <i>arrow</i> , was caused by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	144
Fig. 6.46	Tumbling Experiment 17, sheep metatarsus. Bone-surface modification on the anterior face of the proximal metaphysis <b>a</b> before and <b>b</b> after tumbling. Removal of the cut mark, indicated by an <i>arrow</i> , was caused by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	145
Fig. 6.47	Tumbling Experiment 17, sheep metatarsus. Bone-surface modification on the posterior face of the diaphysis <b>a</b> before and <b>b</b> after tumbling. Irregularly-shaped striations (1) and tiny round punctures (2) were created by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	146
Fig. 6.48	Tumbling Experiment 18, domestic cow humerus fragment. Bone modifications <b>a</b> before and <b>b</b> after tumbling. An <i>arrow</i> indicates the area that was magnified. Removal of the periosteum and rounding of the fragment edges were caused by tumbling . . . . .	147
Fig. 6.49	Tumbling Experiment 18, domestic cow humerus fragment. Bone modifications <b>a</b> before and <b>b</b> after tumbling. (I) Exfoliation and (II) exposure of the porous structure of the bone surface were caused by tumbling . . . . .	148
Fig. 6.50	Tumbling Experiment 18, domestic cow humerus fragment. Bone modification <b>a</b> before and <b>b</b> after tumbling. Modifications in the morphology of the cut mark, indicated by an <i>arrow</i> , were created by tumbling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	149

Fig. 6.51	Tramplng Experiment 1, sediment composition: <b>a</b> mixture of mollusks and clay without water; <b>b</b> first day: sediment composition following the experiment; <b>c</b> second day: sediment composition prior to the experiment; <b>d</b> fourth day: sediment composition prior to the experiment; <b>e</b> fourth day: sediment composition following the experiment; <b>f</b> eighth day: sediment composition prior to the experiment; <b>g</b> eighth day: sediment composition following the experiment . . . . .	151
Fig. 6.52	Tramplng Experiment 1, sheep metacarpus. The anterior face of the proximal metaphysis <b>a</b> after tumbling and before tramplng and <b>b</b> after tramplng. (I) Removal of the periosteum and (II) exfoliation of the bone surface, indicated by an <i>arrow</i> , were caused by tramplng . . . . .	152
Fig. 6.53	Tramplng Experiment 1, sheep metacarpus. The lateral diaphysis <b>a</b> after tumbling and before tramplng and <b>b</b> after tramplng. A striation, indicated by an <i>arrow</i> , was created by tramplng. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	153
Fig. 6.54	Tramplng Experiment 1, sheep metacarpus. The anterior diaphysis <b>a</b> after tumbling and before tramplng and <b>b</b> after tramplng. (I) Morphological alteration of the foramen and (II) pronunciation of striations were caused by tramplng. (I and II) Both columns show an identical detail of the bone at different degrees of magnification . . . . .	154
Fig. 6.55	Tramplng Experiment 1, sheep metacarpus. The lateral proximal metaphysis <b>a</b> after tumbling and before tramplng and <b>b</b> after tramplng. Bone-surface modifications, indicated by <i>arrows</i> (1, 2), were created by tramplng. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	155
Fig. 6.56	Tramplng Experiment 1, domestic cow femur fragment <b>a</b> before and <b>b</b> after tramplng. Rounding of the edges of the bone fragment (I) and exfoliation (I and II) were caused by tramplng . . . . .	156
Fig. 6.57	Tramplng Experiment 1, domestic cow femur fragment <b>a</b> before and <b>b</b> after tramplng. Rounding of the edges and a diagonal mark on the exfoliated bone surface, indicated by an <i>arrow</i> , were caused by tramplng. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	158
Fig. 6.58	Tramplng Experiment 1, domestic cow femur fragment <b>a</b> before and <b>b</b> after tramplng. After tramplng, the cut mark (1) was obliterated by striations (2). Both columns show an identical detail of the bone at different degrees of magnification . . . . .	159
Fig. 6.59	Tramplng Experiment 1, domestic cow femur fragment <b>a</b> before and <b>b</b> after tramplng. After tramplng, the cut mark (1) was obliterated by striations (2). Both columns show an identical detail of the bone at different degrees of magnification . . . . .	160
Fig. 6.60	Tramplng Experiment 1, domestic cow tibia fragment <b>a</b> before and <b>b</b> after tramplng. (I and II) Removal of the periosteum was caused by tramplng. The porous structure of the bone became visible after tramplng . . . . .	161
Fig. 6.61	Tramplng Experiment 1, domestic cow tibia fragment <b>a</b> before and <b>b</b> after tramplng. Removal of periosteum during tramplng led to the formation of a flat-bottomed channel, indicated by an <i>arrow</i> . The porous bone structure became visible after tramplng . . . . .	162

Fig. 6.62	Tramplng Experiment 2, domestic cow radius. The posterior face of the distal metaphysis <b>a</b> before and <b>b</b> after tramplng. Morphological changes of the bone due to abrasion were created by tramplng . . . . .	163
Fig. 6.63	Tramplng Experiment 2, domestic cow radius. The posterior face of the bone <b>a</b> before and <b>b</b> after tramplng. Smoothing of the articular zone between the ulna and the radius was caused by tramplng . . . . .	164
Fig. 6.64	Tramplng Experiment 2, domestic cow radius. The anterior face of the bone <b>a</b> before and <b>b</b> after tramplng. Dry fractures were created by tramplng . . . . .	165
Fig. 6.65	Tramplng Experiment 2, domestic cow radius. The anterior face of the distal metaphysis <b>a</b> before and <b>b</b> after tramplng. Striations, indicated by <i>arrows</i> , were created by tramplng. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	166
Fig. 6.66	Tramplng Experiment 2, domestic cow radius. The lateral diaphysis of the bone <b>a</b> before and <b>b</b> after tramplng. Exfoliation of the bone surface was caused by tramplng. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	167
Fig. 6.67	Tramplng Experiment 2, domestic cow radius. The posterior and anterior faces of the diaphysis <b>a</b> before and <b>b</b> after tramplng. The <i>arrows</i> indicate the areas of the bone that were magnified. After tramplng, striations (1–3) were seen to emerge from a round pit with a v-shaped cross-section. Rows on the right side show an identical detail of the bone at different degrees of magnification . . . . .	168
Fig. 6.68	Tramplng Experiment 2, domestic cow rib. The dorsal face <b>a</b> before and <b>b</b> after tramplng. Dry fractures were created by tramplng. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	169
Fig. 6.69	Tramplng Experiment 2, domestic cow rib. The dorsal face <b>a</b> before and <b>b</b> after tramplng. V-shaped pit marks, indicated by <i>arrows</i> , were created by tramplng. (II) Both columns show an identical detail of the bone at different degrees of magnification. The scale bar of the microscope images is 1 mm . . . . .	170
Fig. 6.70	Tramplng Experiment 2, domestic cow rib. The ventral face <b>a</b> before and <b>b</b> after tramplng. V-shaped, cross-sectioned striations, indicated by <i>arrows</i> , superimposed by large pit marks, were created by tramplng. Both columns show an identical detail of the bone at different degrees of magnification. The scale bar of the microscope images is 1 mm . . . . .	171
Fig. 6.71	Tramplng Experiment 2.1, domestic cow radius. The anterior face <b>a</b> before tramplng, <b>b</b> after two hours of tramplng, and <b>c</b> after four hours of tramplng. Dry fractures were created by tramplng . . . . .	172
Fig. 6.72	Tramplng Experiment 2.1, domestic cow radius. The lateral face of the bone <b>a</b> before tramplng, <b>b</b> after two hours of tramplng, and <b>c</b> after four hours of tramplng. Superimposed striations, indicated by <i>arrows</i> , were created by prolonged tramplng. The scale bar of the microscope images is 1 mm . . . . .	173
Fig. 6.73	Tramplng Experiment 3. hyena tibia, ulna, pelvis, MT III, and rib <b>a</b> before and <b>b</b> after tramplng. Only slight morphological changes were created by tramplng . . . . .	174

Fig. 6.74	Trampling Experiment 3, hyena tibia. The foramen nutricium <b>a</b> before and <b>b</b> after trampling. Only minor abrasions were observed after trampling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	175
Fig. 6.75	Trampling Experiment 3, hyena tibia. The lateral face of the diaphysis <b>a</b> before and <b>b</b> after trampling. Shallow pit marks, indicated by an <i>arrow</i> , were created by trampling . . . . .	176
Fig. 6.76	Trampling Experiment 3, hyena MT III. The lateral and medial face of the diaphysis <b>a</b> before and <b>b</b> after trampling. Striations and pit marks (1, 2) were created by trampling. <i>Arrows</i> indicate the area of the bone that was magnified. Rows show identical details of the bone at different degrees of magnification. The scale bar of the microscope images is 1 mm . . . . .	177
Fig. 6.77	Trampling Experiment 4: hyena tibia, radius, pelvis, MT IV, and rib <b>a</b> before and <b>b</b> after trampling. Morphological reduction of the tibia and radius was caused by trampling. The morphology of MT IV remained almost unchanged. Heavy abrasion affected the pelvis, resulting in exfoliation. The rib was straightened, compressed, and dissolved into a fibrous structure . . . . .	178
Fig. 6.78	Trampling Experiment 4, hyena pelvis <b>a</b> before and <b>b</b> after trampling. Morphological changes and exfoliation and dry fractioning of the bone surface, indicated by an <i>arrow</i> , were caused by trampling. (I) On the <i>left</i> is an enlarged view of the ilium; (II) on the <i>right</i> is an enlarged view of the pelvis near the rim of the acetabulum. Both columns show an identical detail of the bone at different degrees of magnification. The scale bar of the microscope images is 1 mm . . . . .	179
Fig. 6.79	Trampling Experiment 4, hyena tibia. The anterior and posterior face of the diaphysis <b>a</b> before and <b>b</b> after trampling. Scattered horizontal striations, indicated by <i>arrows</i> , seen to emerge from pit marks, were created by trampling. (I) Detail of the anterior face of the tibia; (II) detail of the posterior face of the tibia. All columns show an identical detail of the bone at different degrees of magnification. The scale bar of the microscope images is 1 mm . . . . .	180
Fig. 6.80	Trampling Experiment 5, hyena ulna <b>a</b> before and <b>b</b> after trampling. Heavy abrasion, resulting in the reduction of protruding sections of the proximal articulation and the broken distal end, was caused by trampling . . . . .	181
Fig. 6.81	Trampling Experiment 5, hyena ulna. The medial face of the diaphysis <b>a</b> before and <b>b</b> after trampling. Polishing of the bone surface was caused by trampling. The scale bar of the microscope images is 1 mm . . . . .	182
Fig. 6.82	Trampling Experiment 5, hyena ulna. The anterior/lateral face <b>a</b> before and <b>b</b> after trampling. Non-homogeneous bone-surface preservation resulted from trampling. Polishing of the rough parts of the bone and the removal of striations, indicated by an <i>arrow</i> , were also caused by trampling. (I) Detail of the proximal articulation. Both columns show an identical detail of the bone at different degrees of magnification. (II) Detail of the anterior/lateral face. Both columns show an identical detail of the bone at different degrees of magnification. The scale bar of the microscope images is 1 mm . . . . .	183

Fig. 6.83	Trampling Experiment 5, hyena MT II. The lateral face <b>a</b> before and <b>b</b> after trampling. The bone's prominent features became more pronounced after trampling. Both columns show the same detail of the bone at different degrees of magnification . . . . .	184
Fig. 6.84	Trampling Experiment 5, hyena MT II. The posterior and lateral face of the diaphysis <b>a</b> before and <b>b</b> after trampling. Isolated, shallow round pit marks, indicated by <i>arrows</i> , were created by trampling. (I) Detail of the posterior face. Both columns show an identical detail of the bone at different degrees of magnification. (II) Detail of the lateral face. Both columns show an identical detail of the bone at different degrees of magnification. The scale bar of the microscope images is 1 mm . . . . .	185
Fig. 6.85	Trampling Experiment 5, hyena ribs <b>a</b> before and <b>b</b> after trampling. Both the reduction of the bones into a fibrous consistency and bone disintegration were caused by trampling. <i>Arrows</i> indicate the areas of the bone that were magnified . . . . .	186
Fig. 6.86	Trampling Experiment 5, hyena rib. Bone-surface preservation <b>a</b> before and <b>b</b> after trampling. (I) Detail of the polished ventral face. Both columns show an identical detail of the bone at different degrees of magnification. (II) Detail of the lateral face showing isolated pit marks indicated by <i>arrows</i> . Both columns show an identical detail of the bone at different degrees of magnification. <i>Arrows</i> indicate the areas of the bone that were magnified. The scale bar of the microscope images is 1 mm . . . . .	187
Fig. 6.87	Trampling Experiment 6, sheep metacarpus. The foramina on the posterior face of the diaphysis <b>a</b> before and <b>b</b> after trampling. Pronunciation of the foramina was caused by trampling. All columns show an identical detail of the bone at different degrees of magnification . . . . .	188
Fig. 6.88	Trampling Experiment 6, sheep metacarpus. The anterior face of the diaphysis <b>a</b> before and <b>b</b> after trampling. Fine striations and pit marks, indicated by <i>arrows</i> , were created by trampling. Both columns show an identical detail of the bone at different degrees of magnification . . . . .	189
Fig. 6.89	Trampling Experiment 6, domestic cow radius fragment <b>a</b> before and <b>b</b> after trampling. Rounding and smoothing of the shaft fragment were caused by trampling . . . . .	190
Fig. 6.90	Trampling Experiment 6, domestic cow radius fragment <b>a</b> before and <b>b</b> after trampling. Polishing and rounding of the shaft fragment were caused by trampling . . . . .	191
Fig. 6.91	Trampling Experiment 6, domestic cow humerus fragment <b>a</b> before and <b>b</b> after trampling. Polishing and rounding of the shaft fragment were caused by trampling. Both columns show an identical detail of the bone at different degrees of magnification. The scale bar of the microscope images is 1 mm . . . . .	192
Fig. 6.92	Trampling Experiment 6, domestic cow humerus fragment. The proximal edge of the fragment <b>a</b> before and <b>b</b> after trampling. Fine parallel striations, indicated by an <i>arrow</i> , as well as the polishing and smoothing of the bone surface, were caused by trampling . . . . .	193
Fig. 6.93	Trampling Experiment 7, sheep tibia. The lateral and anterior diaphysis <b>a</b> before and <b>b</b> after trampling. (I) Horizontal striations on the anterior face were created by trampling. (II) Smoothing of the striations produced prior to trampling (1), and the formation of new pit marks and striations (2) after trampling . . . . .	194