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978-0-521-88003-9 - Microarchaeology: Beyond the Visible Archaeological Record

Stephen Weiner

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## MICROARCHAEOLOGY

The archaeological record is a combination of what is seen by the eye and the microscopic record revealed with the help of instrumentation. The information embedded in the microscopic record can significantly add to our understanding of past human behavior, provided that this information has not been altered by the passage of time. *Microarchaeology* seeks to understand the microscopic record in terms of the types of information embedded in this record, the materials in which this information resides, and the conditions under which a reliable signal can be extracted. This book highlights the concepts needed to extract information from the microscopic record. Intended for all archaeologists and archaeological scientists, it will be of particular interest to students who have some background in the natural sciences and archaeology. This book

- emphasizes the nature of the materials in which information is embedded and the problems associated with extracting a real signal,
- provides a comprehensive list of the types of information embedded in the microscopic archaeological record, and
- offers an in-depth overview of the use of infrared spectroscopy for analyzing the microscopic record, the only one of its kind available.

Stephen Weiner is director of the Kimmel Center for Archaeological Science at the Weizmann Institute of Science in Israel. He is the author, with Heinz A. Lowenstam, of *On Biomineralization* and has published more than 250 scientific journal articles.

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# Microarchaeology

**BEYOND THE VISIBLE  
ARCHAEOLOGICAL RECORD**

**Stephen Weiner**

Weizmann Institute of Science



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## Contents

<i>Preface</i>	<i>page xvii</i>
<b>1 Archaeology, Archaeological Science, and Microarchaeology</b>	<b>1</b>
Archaeology Is a Difficult Science	3
Historical Perspective	4
Archaeological Science	5
The Microscopic Record	6
Tool Kit for Deciphering the Microscopic Archaeological Record	8
The Importance of Integrating Microarchaeology with Macroarchaeology	8
The ideal solution to this problem	9
The reality	10
On-Site Laboratory	10
The Concept of This Book	10
Conclusions	12
<b>2 Information Embedded in the Microscopic Record</b>	<b>13</b>
Archaeobotanical Record	16
Dating	18
Perspective on techniques used for dating materials from archaeological sites	18
Radiocarbon dating	19
Uranium series dating	21
Dendrochronology	21
Trapped charge dating: Thermoluminescence (TL), optical stimulated luminescence (OSL), and electron spin resonance (ESR)	22
Dating by fluoride uptake	23

vi		
CONTENTS		
	Obsidian hydration dating	23
	Amino acid racemization dating	24
	Dating by archaeomagnetism	25
	Life History Reconstruction of Individuals	26
	Paleodiet Reconstruction	27
	Stable isotope paleodiet reconstruction	28
	Strontium contents of human bones	29
	Molecules trapped in ceramics (residue analysis)	29
	Paleoenvironmental Reconstruction	30
	Micromorphology	30
	Archaeobotany	31
	Rare earth elements	31
	Pollen	32
	Stable isotope compositional variations	32
	Paleogenetics	33
	Paleomigration	35
	Pottery Contents	35
	Provenience and Procurement Strategies	36
	Provenience studies	36
	Limited sources	37
	Obsidian	37
	Amber	37
	Soapstone (Steatite)	37
	Marble	38
	Metals	38
	Abundant sources	39
	Pottery	39
	Flint (Chert)	40
	Procurement strategies	40
	Season of Occupation	41
	Archaeobotanical remains	41
	Rhythmic growth	41
	Site Formation Processes	42
	Site Spatial Organization	43
	Weaning Age	44
	<b>3 Completeness of the Archaeological Record</b>	<b>46</b>
	How Bad Is the Archaeological Record?	47
	The Almost Complete Record	47
	The Incomplete Record: Conceptual Framework for	
	Assessing the Missing Record	51
	Macroscopic versus microscopic records	51
	Time frame	52

Cambridge University Press

978-0-521-88003-9 - Microarchaeology: Beyond the Visible Archaeological Record

Stephen Weiner

Frontmatter

[More information](#)

The driving forces of degradation	54
Mechanical disturbances	54
Hydrological regime and chemical reactions	54
Materials that degrade	56
Organic material	57
Minerals	59
Minerals rearranging at the atomic level	61
Summary of the conceptual framework for estimating the missing record	62
Time frame	62
Agents of degradation	62
Assessing the extent of degradation	62
Conclusions	62
Practical applications of the conceptual framework	63
Future Prospects for Improving Our Understanding of the Missing Archaeological Record	66
<b>4 Common Mineral Components of the Archaeological Record</b>	<b>68</b>
Minerals and Mineral Identification	70
Optical mineralogy	70
X-ray diffraction	70
Infrared spectroscopy	71
Raman spectroscopy	71
Chemical elemental analyses	72
Size and Shape of Mineral Particles	72
In Situ Assemblages of Minerals (Micromorphology)	73
Zhoukoudian Layer 10 (China): Are these anthropogenically produced ashes?	74
Calcite and the Calcium Carbonate Mineral Family	76
Calcium carbonate pH buffering capacity	77
Calcite and aragonite: Similarities and differences	77
Possible origins of calcite in archaeological sites	78
Geogenic calcites	78
Pyrogenic calcites	79
Biogenic calcites	79
Possible origins of aragonite in archaeological sites	80
Diagenesis of calcite and aragonite	80
Embedded information	81
Aragonite and calcite: Assessing the preservation state of the minerals in a site	81
Differentiating among geogenic, biogenic, and pyrogenic calcites	81

viii		
CONTENTS		
	Cemented sediment: Recrystallized wood ash or a geogenic cement?	82
	Carbonate Hydroxylapatite	83
	Atomic structure	84
	Stability field	85
	Diagenesis	86
	Embedded information	86
	Identifying areas in a site that had high organic contents	86
	Differentiating between biogenic and geogenic carbonate hydroxylapatites	87
	Paleoclimate reconstruction	87
	Using authigenic phosphate minerals for identifying strata in which bones have dissolved	88
	Polymorphs of Silicon Dioxide	88
	Quartz and flint/chert	88
	Silica	89
	Silicon dioxide polymorphs produced at high temperatures	90
	Diagenesis	90
	Quartz	90
	Silica	90
	Microcrystalline quartz in flint and chert	90
	Embedded information	91
	Provenience of quartz	91
	Provenience and procurement strategies of flint and chert	91
	Dating of flint tools	92
	The Clay Family	92
	Clay structures and classification	93
	Identifying clay minerals	94
	Clay and organic materials	94
	Diagenesis	95
	Embedded information	96
	Better preservation in clay-rich sediments	96
	Clay provenience	96
	Was the clay exposed to elevated temperatures?	97
	General Implications of Mineral Assemblages for Site Preservation	97
	Assessing the Completeness of the Archaeological Record	98
	<b>5 Biological Materials: Bones and Teeth</b>	<b>99</b>
	Biom mineralization: Archaeological Perspective	99
	Bone and Bones	101

Bone the material: The hierarchical structure	102
Level 1: The basic constituents	102
Level 2: The mineralized collagen fibril	106
Level 3: The fibril arrays	106
Level 4: The packing motifs of fibril arrays	107
Level 5: Osteonal bone	107
Level 6: The spongy to compact bone continuum	108
Level 7: Whole bone	108
Porosity	109
Diagenesis of bone the material	110
Mineral diagenesis	110
Organic matrix diagenesis	112
Microbial and fungal diagenesis	113
The pseudomorph and cast issue	115
Timescales for bone diagenesis	115
Bones lying on the soil surface	115
Buried bones	116
Burned bone	117
Embedded information	118
Migration pathways	118
Paleodiet reconstruction	119
Paleogenetics	121
Paleoenvironmental reconstruction using rare earth elements	122
Radiocarbon dating	122
Reconstructing aspects of an individual's life history	123
Teeth	123
Enamel: The hierarchical structure	124
Level 1: The basic constituents	124
Level 2: Crystal arrays (prisms)	126
Level 3: Reticulate three-dimensional network of prisms	126
Level 4: Graded changes in structure	126
Level 5: The whole enamel layer	126
Dentin: The hierarchical structure	126
Level 1: The basic constituents	127
Level 2: The mineralized collagen fibril	127
Level 3: The fibril arrays	128
Level 4: The packing motifs of fibril arrays	128
Level 5: The tubules and peritubular dentin	128
Level 6: The whole dentin component of the tooth	128
Whole teeth	129
Cementum	129
Dental calculus	130



Cambridge University Press

978-0-521-88003-9 - Microarchaeology: Beyond the Visible Archaeological Record

Stephen Weiner

Frontmatter

[More information](#)

x		
CONTENTS		
	Diagenesis of teeth	130
	Enamel diagenesis	130
	Dentin diagenesis	131
	Embedded information	132
	Enamel	132
	Dentin	133
	Cementum	133
	Dental calculus	134
	<b>6 Biological Materials: Phytoliths, Diatoms, Eggshells, Otoliths, and Mollusk Shells</b>	<b>135</b>
	Phytoliths	135
	Phytolith material	136
	Phytolith formation and morphology	137
	Information categories obtained from phytolith assemblages	139
	Taxonomy	139
	Plant categories	140
	Plant parts	140
	Strategy for studying phytoliths in an archaeological context	141
	Reference collection	141
	Sampling and analysis	142
	Diagenesis	143
	Embedded information	145
	Fuel use at a site	145
	Identifying ancient irrigation practices and/or rainfall	145
	Genetic information	146
	Identifying plant taxa brought to the site	146
	Paleodiet	147
	Paleovegetation ecology	147
	Radiocarbon dating of phytoliths	148
	Reconstructing relative amounts of plant materials used	148
	Use of space	148
	Final comment	149
	Diatoms	149
	Cell wall composition	150
	Diagenesis	150
	Embedded information	150
	Ancient irrigation practices	150
	Provenience of pottery	151
	Reconstructing the paleoenvironment	151

Cambridge University Press

978-0-521-88003-9 - Microarchaeology: Beyond the Visible Archaeological Record

Stephen Weiner

Frontmatter

[More information](#)

Avian (Bird) Eggshells	151
Basic morphology and structure	151
Diagenesis	152
Embedded information	152
Dating using amino acid racemization	152
Reconstructing the paleoenvironment	153
Radiocarbon dating	153
Avian Gizzard Stones	154
Otoliths	154
Morphology, ultrastructure, and mineralogy	154
Diagenesis	156
Embedded information	156
Reconstructing the paleoenvironment	156
Season of occupation of a site	157
Mollusk Shells	157
Taxonomy	159
Shell ultrastructure and mineralogy	159
Mineral phase	160
Organic matrix	162
Embedded information	162
Dating	163
Reconstructing the paleoenvironment	163
Season of occupation	164
Site preservation	164
<b>7 Reconstructing Pyrotechnological Processes</b>	<b>165</b>
Basic Concepts of Heating and Cooling	166
Order and Disorder in Solids	167
Ash	168
Composition of ash	169
Ash from Wood and Bark	170
Diagenesis	172
pH above 8	172
pH below 8	173
Identifying ash produced by burning wood and bark	174
Embedded information	175
Demonstrating control of fire by humans	175
Fuel types used for fires	176
Radiocarbon dating	177
Thermoluminescence and electron spin resonance dating	177
Type of wood used for fires	177
Charcoal and Charred Materials	178

xii		
CONTENTS		
	Molecular structure of modern wood charcoal produced in natural fires	179
	Molecular structure of fossil wood charcoal from archaeological sites	181
	Diagenesis	182
	Embedded information	183
	Impact of fires produced by humans on the local vegetation and soils	183
	Ink	183
	Identification of charred organic material in sediments	184
	Radiocarbon dating	184
	Seed and fruit identification	184
	Wood identification	184
	Plaster and Mortar	185
	Binders	185
	Calcite binder	186
	Gypsum	188
	Hydraulic plaster and mortar	188
	Aggregates	189
	Proportions of aggregates and binders	189
	Identifying plaster and mortar	190
	Diagenesis	190
	Embedded information	191
	Radiocarbon dating	191
	Reconstructing production procedures and functions	192
	Refractory materials produced by heating carbonate rocks	193
	Residue analysis	194
	Specific features in a site	194
	Ceramics and Pottery	194
	The essentials of pottery manufacture	195
	Raw materials	195
	Temper	195
	Fluxes	195
	Shaping and decorating	196
	Drying	196
	Firing conditions	197
	Diagenesis	198
	Embedded information	198
	Provenience and trade	198
	Production areas	200
	Manufacturing processes	202
	Refractory ceramics	205
	Concluding Comment	206

<b>8 Biological Molecules and Macromolecules:</b>		
<b>Protected Niches</b>	207	xiii
Brief Overview of Different Biomolecules of Interest in Biomolecular Archaeology	208	CONTENTS
DNA	209	
Proteins	210	
Polysaccharides	210	
Lipids	211	
Historical Perspective	211	
Protected Niche 1: Intracrystalline Macromolecules	212	
Embedded information	214	
Amino acid racemization dating	214	
Paleoenvironmental reconstruction	214	
Radiocarbon dating	215	
Protected Niche 2: Macromolecules inside Intergrown Biogenic Crystals (Crystal Aggregates)	215	
Embedded information	217	
Paleodiet reconstruction	217	
Paleogenetic information	218	
Radiocarbon dating	218	
Protected Niche 3: Molecules Preserved in Ceramics	219	
Optimize environmental preservation conditions	220	
Optimize ceramic porosity	220	
Optimize ceramic material type	221	
Embedded information	222	
Vessel contents	222	
Radiocarbon dating	222	
The Enigmatic Preservation of Starch Grains	222	
Where Were There Once Large Concentrations of Organic Materials?	223	
Preserved Organic Molecules: Are They Really in Context and Not Intrusive?	225	
Possibility of Finding Other Protected Niches for Organic Molecules	225	
<b>9 Ethnoarchaeology of the Microscopic Record: Learning     from the Present</b>	227	
Microartifacts: The Ethnographic Evidence of Their Usefulness	228	
Controls	230	
Ethnoarchaeology of the Microscopic Record	231	
Inferences on the microscopic record of Aliabad based on macroscopic observations	232	
Features outside house complexes	232	

	Features inside house complexes	234
	Inferences on the microscopic record of an Eskimo winter house based on macroscopic observations	236
	Wood pile and the hearth	237
	Dump of bone splinters	237
	Areas of human waste disposal	237
	Animal Dung: Merging of the Archaeozoological and Archaeobotanical Microscopic Records	237
	Identifying and Characterizing Livestock Enclosures	239
	Phytolith and Charcoal Microscopic Records in Sarakini, Northern Greece	240
	Phytoliths	240
	Charcoal	243
	Activity Areas Using Phosphate Concentrations: Ethnoarchaeological Verification	244
	Concluding Remarks	244
<b>10</b>	<b>Absolute Dating: Assessing the Quality of a Date</b>	245
	Understanding a Date: The Communication Gap Problem	247
	Solution to the Communication Gap Problem	248
	Designing a Program for Dating a Site	249
	Calibration	249
	Context	250
	The macrocontext	250
	The microcontext	251
	Context for trapped charge dating	252
	Choice of sample type	254
	Number of samples to collect and analyze	255
	Prescreening for sample preservation and purity	256
	Bone collagen	256
	Charred organic material for radiocarbon dating	258
	Purifying the sample	258
	Charcoal purification	258
	Collagen purification	259
	Analyzing the Results: A Team Effort	259
	Radiocarbon Laboratory Measurements: Are There Biases?	259
	Future Prospects	260
<b>11</b>	<b>Reading the Microscopic Record On-Site</b>	261
	Benefits of an On-Site Interactive Laboratory	261
	On-Site Laboratories for the Analysis of the Macroscopic Record	262
	Choice of Instruments for On-Site Analysis of the Microscopic Record	263

Cambridge University Press

978-0-521-88003-9 - Microarchaeology: Beyond the Visible Archaeological Record

Stephen Weiner

Frontmatter

[More information](#)

Basic considerations	263
Choice of instruments	264
Binocular microscope	264
Petrographic microscope	264
Wet-sieving apparatus for charred materials	264
Fourier transform infrared spectroscopy	265
X-ray fluorescence spectrometer	265
Raman spectroscopy	266
UV-visible spectrophotometer	266
Mapping and three-dimensional reconstructions	267
Photography	268
Operation of the Laboratory	268
Useful Work Program for the On-Site Interactive	
Laboratory	269
First visit to the site	269
Operation of the on-site laboratory during excavation	
seasons	270
Identifying problems	270
Solving an identified problem	270
Controls	270
Further analyses in the home laboratory, data	
analysis, and synthesis	271
Examples of Questions to Ask about the Microscopic	
Record of a Site	271
What components are missing because they were not	
preserved or because they were not brought to the	
site?	271
What fuel was commonly used at the site?	271
Are there indications of pyrotechnological activities	
other than making fires?	272
Where is the site on the rural-urban continuum?	273
On-Site Artifact Conservation	273
Future Trends	273
<b>12 Infrared Spectroscopy in Archaeology</b>	<b>275</b>
Sample Preparation	276
Points to Note	277
Sampling	277
Grinding	277
Reproducibility	277
Quantification	277
Background subtraction	278
Artifacts due to the quality of the KBr pellets	278
Interpretation of the Spectra: Some General Pointers	278

xvi		
CONTENTS		
	Mineral, macromolecule, or small organic molecules?	278
	Mixtures of compounds	279
	Shifting of peak maxima	279
	Variations in peak widths	280
	Sharp peak at 1,384 wavenumber	281
	Infrared Microscopy	281
	Available literature	281
	Library of archaeologically relevant infrared spectra	281
	Overviews	282
	1. Polymorphs of calcium carbonate	282
	2. Calcite disorder: Distinguishing between calcites formed by different processes	284
	3. The apatite family: Hydroxylapatite, carbonate hydroxylapatite, and carbonate fluorapatite	286
	4. Crystallinity of bone, dentin, and enamel: The splitting factor	289
	5. Burned bones	292
	6. Authigenic phosphate minerals	295
	7. Silicon dioxide polymorphs: Quartz, flint (chert), silica (opal), and other polymorphs	297
	8. Clays	300
	9. Clay exposed to elevated temperatures	303
	10. Calcium oxalates	306
	11. Collagen: State of preservation	307
	12. Wood and olive pit preservation	309
	13. Natural organic materials: Resin, copal, amber, gum, bitumen, and humic and fulvic acids	312
	14. Presence of soluble salts in sediment samples	315
	<i>Appendix A: Identifying Minerals Using Microchemical Analysis</i>	317
	<i>Appendix B: Identifying Minerals and Compounds Using Infrared Spectra: Table of Standard Minerals and Compounds for Which Infrared Spectra Are Available</i>	320
	<i>References</i>	327
	<i>Index</i>	373
	<i>Color plates follow page 174.</i>	

## Preface

The familiar archaeological record is the record that we see with the naked eye. The record that we do not see with the naked eye is as large and as fascinating as the visual macroscopic record. Instruments are needed, however, to reveal this microscopic record. The aim of this book is to provide archaeologists interested in exploring both the macroscopic and microscopic records with broad-ranging and basic conceptual information on the types of information that may be embedded in the microscopic records of their sites, the conditions under which this information can be extracted, and the means for assessing the reliability of this information. This is not a book about methods, nor a book about materials chemistry (although both are important); rather, it is a book about archaeology beyond the visual record. I have therefore called this book *Microarchaeology*.

For many years now, the trend in archaeology, and especially in prehistory, has been to excavate less but to extract more information from the archaeological record. This not only involves making better use of remote sensing and global positioning systems and better documentation of the macroscopic record, it also involves extracting as much information as possible from the microscopic record. It is hoped that this book will facilitate access to the microscopic record for all interested archaeologists and enable the specialists and archaeological scientists to obtain a broader view of the potential of the microscopic record. The book does not simplify the problems involved, but an attempt is made to explain the issues as well as possible. In fact, while writing the book, I had in mind as a reader an advanced undergraduate or graduate student studying both natural sciences and archaeology. I hope that this book will encourage many more students to choose this field of research. I can promise entry into a wonderfully interesting world.

If this book has a special tone, then it can probably be attributed to the unique training that I received from my former PhD supervisor, who also became a colleague, collaborator, and close friend: the late Professor Heinz A. Lowenstam. He taught me how to enjoy revealing nature's



Cambridge University Press

978-0-521-88003-9 - Microarchaeology: Beyond the Visible Archaeological Record

Stephen Weiner

Frontmatter

[More information](#)

xviii

PREFACE

secrets and introduced me into the rich world of mineral formation by organisms, or *biomineralization*. I dedicate this book to the memory of Heinz Lowenstam.

I would like, first and foremost, to acknowledge my wife, Nomi Weiner, who understands and enthusiastically supports all my efforts to explore my two professional worlds: archaeology and biomineralization. I would also like to acknowledge the lifelong support that my late father, Motty Weiner, gave me in pursuing my scientific career as well as the support I have received from my children Danya, Noa, and Allon.

I was introduced into the world of archaeology by Ofer Bar-Yosef, who spent a year with me at the Weizmann Institute of Science in the late 1980s. Together with our colleague Paul Goldberg, we have worked together ever since. I owe much to both of them as well as to all the colleagues with whom I worked in the Kebara and Hayonim Caves in Israel. I am also particularly thankful to Elisabetta Boaretto and Ruth Shahack-Gross, two of my colleagues at the Kimmel Center for Archaeological Science at the Weizmann Institute. Over more than a decade of collaboration, we have established the framework for educating a new generation of archaeologists trained in both the natural sciences and archaeology. These students are also trained to work in the field and in the laboratory. Much of this book reflects the spirit of the Kimmel Center for Archaeological Science. I am also grateful to all the students and postdocs who have and are working at the Center. Finally, I want to acknowledge the support of Helen Kimmel and the late Martin Kimmel for recognizing that archaeology and archaeological science do contribute significantly to our self-concepts and that pursuing these endeavors is important. The Kimmel Center for Archaeological Science is a tribute to their vision.

I would like to thank Haya Avital for preparing all the figures. I would also like to thank the following colleagues for reading various chapters: Lia Addadi, Elisabetta Boaretto, Adi Eliyahu, Panagiotis Karkanis, Dvory Namdar, Lior Regev, Ruth Shahack-Gross, Clive Trueman, and Georgia Tsartsidou.

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