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978-0-521-70584-4 - 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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CAMBRIDGE UNIVERSITY PRESS

Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore,
São Paulo, Delhi, Dubai, Tokyo

Cambridge University Press

32 Avenue of the Americas, New York, NY 10013-2473, USA

www.cambridge.org

Information on this title: www.cambridge.org/9780521705844

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First published 2010

Printed in the United States of America

A catalog record for this publication is available from the British Library.

Library of Congress Cataloging in Publication data

Weiner, Stephen, 1948–

Microarchaeology : beyond the visible archaeological record / Stephen Weiner.

p. cm.

Includes bibliographical references and index.

ISBN 978-0-521-88003-9 (hbk.) – ISBN 978-0-521-70584-4 (pbk.) 1. Archaeology –
Methodology. 2. Microscopy. 3. Antiquities – Analysis. 4. Excavations
(Archaeology) I. Title.

CC75-7.W45 2010

930.1-dc22 2009026783

ISBN 978-0-521-88003-9 Hardback

ISBN 978-0-521-70584-4 Paperback

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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

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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.

Stephen Weiner
Weizmann Institute of Science
Rehovot, Israel
May 2009