

Geomaterials in Cultural Heritage

The Geological Society of London
Books Editorial Committee

R. PANKHURST (UK) (CHIEF EDITOR)

Society Books Editors

J. GREGORY (UK)
J. GRIFFITHS (UK)
J. HOWE (UK)
P. LEAT (UK)
N. ROBINS (UK)
J. TURNER (UK)

Society Books Advisors

M. BROWN (USA)
R. GIERÉ (Germany)
J. GLUYAS (UK)
D. STEAD (Canada)
R. STEPHENSON (Netherlands)
S. TURNER (Australia)

Geological Society books refereeing procedures

The Society makes every effort to ensure that the scientific and production quality of its books matches that of its journals. Since 1997, all book proposals have been refereed by specialist reviewers as well as by the Society's Books Editorial Committee. If the referees identify weaknesses in the proposal, these must be addressed before the proposal is accepted.

Once the book is accepted, the Society Book Editors ensure that the volume editors follow strict guidelines on refereeing and quality control. We insist that individual papers can only be accepted after satisfactory review by two independent referees. The questions on the review forms are similar to those for *Journal of the Geological Society*. The referees' forms and comments must be available to the Society's Book Editors on request.

Although many of the books result from meetings, the editors are expected to commission papers that were not presented at the meeting to ensure that the book provides a balanced coverage of the subject. Being accepted for presentation at the meeting does not guarantee inclusion in the book.

More information about submitting a proposal and producing a book for the society can be found on its web site: www.geolsoc.org.uk.

It is recommended that reference to all or part of this book should be made in one of the following ways:

MAGGETTI, M. & MESSIGA, B. (eds) 2006. *Geomaterials in Cultural Heritage*. Geological Society, London, Special Publications, 257.

SHORTLAND, A. J., HOPE, C. A. & TITE, M. S. 2006. Cobalt blue painted pottery from 18th Dynasty Egypt. In: MAGGETTI, M. & MESSIGA, B. (eds) *Geomaterials in Cultural Heritage*. Geological Society, London, Special Publications, 257, 91–100.

GEOLOGICAL SOCIETY SPECIAL PUBLICATION NO. 257

Geomaterials in Cultural Heritage

EDITED BY

MARINO MAGGETTI

University of Fribourg, Switzerland

and

BRUNO MESSIGA

Università degli Studi di Pavia, Italy

2006

Published by
The Geological Society
London

THE GEOLOGICAL SOCIETY

The Geological Society of London (GSL) was founded in 1807. It is the oldest national geological society in the world and the largest in Europe. It was incorporated under Royal Charter in 1825 and is Registered Charity 210161.

The Society is the UK national learned and professional society for geology with a worldwide Fellowship (FGS) of 9000. The Society has the power to confer Chartered status on suitably qualified Fellows, and about 2000 of the Fellowship carry the title (CGeol). Chartered Geologists may also obtain the equivalent European title, European Geologist (EurGeol). One fifth of the Society's fellowship resides outside the UK. To find out more about the Society, log on to www.geolsoc.org.uk.

The Geological Society Publishing House (Bath, UK) produces the Society's international journals and books, and acts as European distributor for selected publications of the American Association of Petroleum Geologists (AAPG), the American Geological Institute (AGI), the Indonesian Petroleum Association (IPA), the Geological Society of America (GSA), the Society for Sedimentary Geology (SEPM) and the Geologists' Association (GA). Joint marketing agreements ensure that GSL Fellows may purchase these societies' publications at a discount. The Society's online bookshop (accessible from www.geolsoc.org.uk) offers secure book purchasing with your credit or debit card.

To find out about joining the Society and benefiting from substantial discounts on publications of GSL and other societies worldwide, consult www.geolsoc.org.uk, or contact the Fellowship Department at: The Geological Society, Burlington House, Piccadilly, London W1J 0BG; Tel. +44 (0)20 7434 9944; Fax +44 (0)20 7439 8975; E-mail: enquiries@geolsoc.org.uk.

For information about the Society's meetings, consult *Events* on www.geolsoc.org.uk. To find out more about the Society's Corporate Affiliates Scheme, write to enquiries@geolsoc.org.uk.

Published by The Geological Society from:
The Geological Society Publishing House
Unit 7, Brassmill Enterprise Centre
Brassmill Lane
Bath BA1 3JN, UK

(Orders: Tel. +44 (0)1225 445046
Fax +44 (0)1225 442836)

Online bookshop: www.geolsoc.org.uk/bookshop

The publishers make no representation, express or implied, with regard to the accuracy of the information contained in this book and cannot accept any legal responsibility for any errors or omissions that may be made.

© The Geological Society of London 2006. All rights reserved. No reproduction, copy or transmission of this publication may be made without written permission. No paragraph of this publication may be reproduced, copied or transmitted save with the provisions of the Copyright Licensing Agency, 90 Tottenham Court Road, London W1P 9HE. Users registered with the Copyright Clearance Center, 27 Congress Street, Salem, MA 01970, USA: the item-fee code for this publication is 0305-8719/06/\$15.00.

British Library Cataloguing in Publication Data

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

ISBN 1-86239-195-5

Typeset by Techset Composition, Salisbury, UK
Printed by MPG Books Ltd, Bodmin, UK

Distributors

USA

AAPG Bookstore
PO Box 979
Tulsa
OK 74101-0979
USA

Orders: Tel. +1 918 584-2555
Fax +1 918 560-2652
E-mail bookstore@aapg.org

India

Affiliated East-West Press Private Ltd
Marketing Division
G-1/16 Ansari Road, Darya Ganj
New Delhi 110 002
India

Orders: Tel. +91 11 2327-9113/2326-4180
Fax +91 11 2326-0538
E-mail affiliat@vsnl.com

Japan

Kanda Book Trading Company
Cityhouse Tama 204
Tsurumaki 1-3-10
Tama-shi, Tokyo 206-0034
Japan

Orders: Tel. +81 (0)423 57-7650
Fax +81 (0)423 57-7651
E-mail geokanda@ma.kcom.ne.jp

Contents

Preface	vii
MAGGETTI, M. <i>Archaeometry: quo vadis?</i>	1
SMITH, D. C. A review of the non-destructive identification of diverse geomaterials in the cultural heritage using different configurations of Raman spectroscopy	9
Pottery (BC)	
BASSO, E., BINDER, D., MESSIGA, B. & RICCARDI, M. P. The Neolithic pottery of Abri Pendimoun (Castellar, France): a petro-archaeometric study	33
LAVIANO, R. & MUNTONI, I. M. Provenance and technology of Apulian Neolithic pottery	49
MAGGETTI, M. & GALETTI, G. Late La Tène pottery from western Switzerland: one regional or several local workshops?	63
MOMMSEN, H., BONANNO, A., CHETCUTI BONAVITA, K., KAKOULLI, I., MUSUMECI, M., SAGONA, C., SCHWEDT, A., VELLA, N. C. & ZACHARIAS, N. Characterization of Maltese pottery of the Late Neolithic, Bronze Age and Punic Period by neutron activation analysis	81
SHORTLAND, A. J., HOPE, C. A. & TITE, M. S. Cobalt blue painted pottery from 18th Dynasty Egypt	91
SHOVAL, S., BECK, P. & YADIN, E. The ceramic technology used in the manufacture of Iron Age pottery from Galilee	101
SMITH, M. S. & TRINKLEY, M. B. Fibre-tempered pottery of the Stallings Island Culture from the Crescent site, Beaufort County, South Carolina: a mineralogical and petrographical study	119
Pottery (AD)	
BIANCHINI, G., MARROCCHINO, E., MORETTI, A. & VACCARO, C. Chemical–mineralogical characterization of historical bricks from Ferrara: an integrated bulk and micro-analytical approach	127
ÇOLAK, M., MAGGETTI, M. & GALETTI, G. Golden mica cooking pottery from Gökeyüp (Manisa), Turkey	141

DELL' AQUILA, C., LAVIANO, R. & VURRO, F. Chemical and mineralogical investigations of majolicas (16th–19th centuries) from Laterza, southern Italy	151
VENDRELL-SAZ, M., MOLERA, J., ROQUÉ, J. & PÉREZ-ARANTEGUI, J. Islamic and Hispano-Moresque (múdejar) lead glazes in Spain: a technical approach	163
Glass	
ARLETTI, R., CIARALLO, A., QUARTIERI, S., SABATINO, G. & VEZZALINI, G. Archaeometric analyses of game counters from Pompeii	175
ERAMO, G. Pre-industrial glassmaking in the Swiss Jura: the refractory earth for the glassworks of Derrière Sairoche (ct. Bern, 1699–1714)	187
FREESTONE, I. C. Glass production in Late Antiquity and the Early Islamic period: a geochemical perspective	201
MARCHESI, V., NEGRI, E., MESSIGA, B. & RICCARDI, M. P. Medieval stained glass windows from Pavia Carthusian monastery (northern Italy)	217
Stone	
ANTONELLI, F., SANTI, P., RENZULLI, A. & BONAZZA, A. Petrographic features and thermal behaviour of the historically known 'pietra ollare' from the Italian Central Alps (Valchiavenna and Valmalenco)	229
BELLELLI, C., PEREYRA, F. X. & CARBALLIDO, M. Obsidian localization and circulation in northwestern Patagonia (Argentina): sources and archaeological record	241
D'AMICO, C. & STARNINI, E. Prehistoric polished stone artefacts in Italy: a petrographic and archaeological assessment	257
GANDIN, A., CAPEZZUOLI, E. & CIACCI, A. The stone of the inscribed Etruscan stelae from the Valdelsa area (Siena, Italy)	273
MILLER, S., MCGIBBON, F. M., CALDWELL, D. H. & RUCKLEY, N. A. Geological tools to interpret Scottish medieval carved sculpture: combined petrological and magnetic susceptibility analysis	283
MORGENSTEIN, M. Geochemical and petrographic approaches to chert tool provenance studies: evidence from two western USA Holocene archaeological sites	307
QUARESIMA, R., GIAMPAOLO, C. SPERNANZONI, F. & VOLPE, R. Identification, characterization and weathering of the stones used in medieval religious architecture in L'Aquila (Italy)	323
Mortar	
CARÒ, F., DI GIULIO, A. & MARMO, R. Textural analysis of ancient plasters and mortars: reliability of image analysis approaches	337
Index	347

Preface

The scientific study of monuments, as well as objects from excavations and museums, deals with their origin, technique, age and conservation. Such topics were addressed during the one-day topical symposium 'Geomaterials in Cultural Heritage' of the 32nd International Geological Congress held in Florence on 20–28 August 2005. We have edited this volume by assembling papers of participants of the Florence meeting, as well as invited contributions, to present a wide view of the interdisciplinary application of geoscience disciplines, and to reaffirm the important contribution of geosciences to solve problems concerning the study of complex materials such as minerals, rocks, glass, metals, mortar, plaster, slags and pottery. This interdisciplinary application of geosciences includes field geology, geophysics, microscopy, textural analysis, physical methods and geochemistry as fundamental support to disclose hidden information, retained by the ancient materials, such as the raw materials provenance, the firing technology, the ancient recipes and the alteration pathway. The volume

is dedicated to all scholars eager to undertake or to continue an exciting research activity.

Many colleagues helped us in the review process and we thank C. D'Amico, F. Antonelli, M. Baxter, C. Belevi-Pereyra, G. Bianchini, G. Bigazzi, F. Carò, G. Eramo, I. Freestone, A. Gandin, K. Gherdan, B. Grobety, R. Heimann, A. Jornet, R. Laviano, L. Lazzarini, S. Miller, H. Mommsen, R. Quaresima, M. P. Riccardi, G. Schneider, V. Serneels, A. Shortland, S. Shoval, D. C. Smith, S. Smith, G. Thierrin-Michael, M. Tite, S. Trümpler, M. Vendrell-Saz, G. Wagner and S. Wolf for their goodwill and rigorous review of the submissions. We acknowledge the efficient assistance and the exemplary editorial support of the Geological Society publishing staff (particularly Angharad Hills and Sally Oberst) and the remarkable technical help from Nicole Bruegger.

Marino Maggetti
Bruno Messiga