2nd Historic Mortars Conference and RILEM TC 203-RHM Final Workshop

(HMC 2010)

RILEM Proceedings Pro 78

Prague, Czech Republic 22 – 24 September 2010

Volume 1 of 2

Editors:

J. Valek J.J. Hughes C. Groot

ISBN: 978-1-61782-731-0

Printed from e-media with permission by:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2010) by RILEM Publications SARL All rights reserved.

Printed by Curran Associates, Inc. (2011)

For permission requests, please contact RILEM Publications SARL at the address below.

RILEM Publications SARL 157 rue des Blains F-92220 Bagneux France

Phone: +33 1 45 36 10 20 Fax: +33 1 45 36 63 20

www.rilem.net

Additional copies of this publication are available from:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571 USA

Phone: 845-758-0400 Fax: 845-758-2634

Email: curran@proceedings.com Web: www.proceedings.com

Contents

Preface	CXIII
Scientific Committee	XXV
Organising CommitteeX	XVI
RILEM TC 203-RHM Final Workshop PrefaceX	XVII
THEME I: CHARACTERISATION OF HISTORIC MORTARS	
Gypsum mortars of the Khoja Zainuddin Mosque in Bukhara (Uzbekistan): a contribution to building archaeological studies J. Badr, Ch. Huck-Stiasny, R. Drewello	3
Understanding historic mortars and their variations - a condition for performing restoration with traditional materials K. Balksten	11
Irish medieval mortars: implications for the formulation of new replacement mortars J. Bolton	19
Ancient mortars under action of marine environment: a physico-chemical characterisation C. Borges, A. Santos Silva, R. Veiga	2 9
Chemical, mineralogical and microstructural characterization of historical morfrom the Roman villa of Pisões, Beja, Portugal G. Borsoi, A. Santos Silva, P. Menezes, A. Candeias, J. Mirão	
Petrographical study of Meroitic mortars from an Amun temple (el-Hassa) M. Bouchar	55
Famous men busts decorating a Parisian facade: Characterization and decay process of a cast artificial stone from the XIXth century A. Bourgès, S. Cord, V. Vergès-Belmin	65
How did the Romans form concrete underwater? C.J. Brandon	73
Mortars from historical buildings in Switzerland: petrographic examination G. Cavallo, A. Jornet, C. Mosca, G. Corredig	83
Proteomic identification of milk proteins in historical mortars M. Crhova, S. Kuckova, R. Hynek, M. Kodicek	91

Development of a methodology for characterization of historicalmortars in the Walloon region (Belgium) M. Demelenne, F. Dagrain, J-C. Scaillet
Lime mortar with natural hydraulic components – characterization of reaction rims with FTIR-imaging in ATR-mode A. Diekamp, R. Stalder, J. Konzett, P.W. Mirwald
Ancient wall plasters found in archaeological excavations in Marseilles (France): evolution of techniques and materials A-M. D'Ovidio, P. Bromblet
Hydraulicity in historic lime mortars: a review J. Elsen, K. Van Balen, G. Mertens
Characteristics of mortars from ancient bridges D. Frankeová, Z. Slížková, M. Drdácký147
Characterization of gypsum-selenite plasters from historic buildings in the Emilia-Romagna region (Italy) E. Franzoni, F. Sandrolini, L. Baldazzi
Characterization of decorative Portuguese gypsum plasters from the XIX-XX th centuries: the case of the Bolsa Palace in Oporto T. Freire, A. Santos Silva, R. Veiga, J. Brito
Petrographic examination of Gothic mortars of the house of Lords of Kunštát in Brno, Czech Republic M. Gregerová, D. Všianský, R. Procházka, L. Kurdíková
Case study Nako in Western Himalayas, India. On the relevance of earthen supports material characterisation M. Gruber, G. Krist
Ancient gypsum mortars from Sta. María Magdalena church (Zaragoza, Spain): advances in technological manufacture J. Igea, P. Lapuente, M.T. Blanco-Varela, S. Martínez-Ramírez
Micromorphological textures and pozzolanic cements in Imperial Age Roman Mortars M. Jackson, B.E. Scheetz, F. Marra
Cement compositions and durability in ancient Roman seawater concretes M.D. Jackson, G. Vola, B.E. Scheetz, J.P. Oleson, Ch.Brandon, R.L. Hohlfelder
Medieval gypsum mortars as a material of architectonic details from the castle of the Teutonic Order in Toruń, Poland M. Jakubek, F. Schlütter, W. Oberta, J. W. Łukaszewicz
Traditional mortars with burned alum shale as artificial pozzolan S. Johansson, J.E. Lindavist 239

Mineralogical and microstructural analysis of mortars from Kushite archaeological sites J-P. Letourneux, S. Feneuille
Identification of mortars in the Ottoman era in Algeria through historical documentation and laboratory analyses N.A. Mahindad, M. Hamiane
Historic documents in understanding and evaluation of historic lime mortars C. Marinowitz, C. Neuwald-Burg, M. Pfeifer
The mortars and plasters under the mosaics and the wall paintings of the Roman villa at Piazza Armerina, Sicily B. Megna, G. Rizzo, L. Ercoli
How did expertise in maritime hydraulic concrete spread through the Roman empire? J.P. Oleson, M.D. Jackson
Thermal activation of kaolinite used as hydraulic additive of old lime mixtures: a literature study G.L.A. Pesce
Radiocarbon dating of lumps of not completely mixed lime contained in old constructions: the sampling problem <i>G.L.A. Pesce</i>
The earliest use of lime and gypsum mortars in Cyprus M. Philokyprou
Characterization of Roman mortars and plasters in Tarsus (Cilicia-Turkey) I. Polat-Pekmezci, A. Ersen
Development of an analytical protocol for characterisation of historical mortars L. Rampazzi, C. Corti, C. Colombo, C. Conti, M. Realini325
Mapping of mortars and ashlars in watchtowers of Reconquest Ages in Cuenca district, Spain J.R. Ruiz Checa, V. Cristini
Stone-imitating plasters in the Renaissance Ducal Palace in Mantua (Italy): characteristics and decay with relation to microstructure F. Sandrolini, E. Franzoni, E. Sassoni
Physico-chemical characterization of the plasters from the church of Santissimo Sacramento in Alcântara, Lisbon A. Santos Silva, G. Borsoi, R. Veiga, A. Fragata, M. Tavares, F. Llera345
Air lime-mortars with vegetable fat addition: characteristics and research needs A. Shasayandi, E. Salayessa, F.P. Torgal, S. Jalali

Characterisation of dolomitic lime mortars from the Benedictine monastery in Riesa, Saxony (Germany) H. Siedel, S. Michalski, B. Ullrich
Characterisation of ancient gypsum mortars from the archaeological site of Amathus, Cyprus P.E. Tsakiridis, E-E. Toumbakari
Mineralogical and petrographic characterization of ancient Roman maritime concretes from Mediterranean harbours G. Vola, M.D. Jackson, J.P. Oleson, Ch. Brandon, R.L. Hohlfelder
Gravel Lime? Research into Danube gravel as the main ingredient of the historic mortars at Castle Prandeggin Upper Austria R. Wacha
19 th century "Novel" building materials: Examples of various historic mortars under the microscope <i>J. Weber, K. Bayer, F. Pintér</i>
Characterization of mortars in historical modern monuments: a realistic and an analytical approach G. Zacharopoulou
THEME II: ASSESSMENT OF MORTARS AND MASONRY
Testing the freeze/thaw cycles in lime mortar S. Botas, V.M. Rato, P. Faria
Assessment of an experimental test setup for glazed tiles by finite element simulations P. Cachim, A. Velosa
Lime lump development and textural alteration during the production of mortar D. Carran, J. Hughes, A. Leslie, C. Kennedy
Characterization of mortars using DRMS: Tests on field panels samples D. Costa, A. Magalhães, R. Veiga447
Influence of mechanical properties of lime mortar on the strength of masonry A. Costigan, S. Pavía
Non-standard testing in characterisation and consolidation assessment of historic mortars M. Drdácký
In situ techniques for the characterization of rendering mortars A.P. Ferreira Pinto, R. Nogueira, A. Gomes 475

The role of mortars in ancient brick masonries' decay: a study in the Pio Palace at Carpi (Italy) E. Franzoni
Historical busts made of cement mortar – methods of examinations and causes of corrosion A. Gralinska, J.W. Łukaszewicz, W. Topolska
Deterioration of cement-rendered brick masonry buildings: case study of a World War II airfield in East Lothian, Scotland I. Griffin, A. Hamilton, J. Tate
The Influence of calcium hydroxide on the plasticity of lime putties D. Klein, S. Hogewoning, S-O. Schmidt, B. Middendorf
Influence of interfacial material pore structure on the strength of the brick/lime mortar bond M. Lawrence, P. Walker, Z. Zhou
Analytical diagnosis protocol to assess the impacts of environmental stressors on historical mortars acting as the support of wall paintings M. Maguregui, U. Kmuutinen, K. Castro, I. Martinez-Arkarazo, J.M. Madariaga527
Problems in the assessment of the stress-strain relationship of masonry C. Neuwald-Burg, M. Pfeifer
Application of ¹ H NMR in the hydration monitoring of lime-pozzolan mortars M. Tziotziou, E. Karakosta, I. Karatasios, M. Fardis, P. Maravelaki-Kalaitzaki, G. Papavassiliou, V. Kilikoglou
Desalination of concrete sculptures on the Battle of the Nations M. Zötzl, T. Löther, S. Weise, R. Burkhardt, C. Franzen
THEME III: CONSERVATION AND RESTORATION ISSUES
Rui Barbosa Museum's architectural surfaces in Rio de Janeiro: reflections and planning issues C.S. Rodrigues de Carvalho, M.I. Kanan
Practical case study: mortar conservation for the Connaught building, Ottawa, Ontario, Canada J. Cooke, M.I. Subercaseaux, W.Y. Mou
Mud mortars in masonry construction - Malton, North Yorkshire N. Copsey, B. Gourley, R. Allen
Conservation of the plaster at the Lavriotike ore washeries Y. Doganis, A. Galanos

Rosendale natural cement: reintroduction of an authentic North American historic binder M.P. Edison
Traditional Portuguese techniques for application and maintenance of historic renders P. Faria, M. Tavares, M. Menezes, R. Veiga, G. Margalha
Drayton Hall: a case study, mortar analysis and replication F. Henderson Ford, K.A. Stojsavljevic
Santa Ana church – Lagos - Portugal, tender for renovation and restoration <i>P.J.T. Jones</i>
Comparison between traditional, lime based, and industrial, dry mortars A. Jornet, C. Mosca, G. Cavallo, G. Corredig
Types of mortars in wall paintings by the "Older Villach's Workshop" and their followers (15 th Century) A. Križnar, A. Ruíz-Conde, P. J. Sánchez-Soto
The restoration of the cathedral at Kirkjubøúr in the Faroe Islands P. Klenz Larsen, T. von Konow, S. Johansson
Restoration and conservation of the renderings of Santíssimo Sacramento de Alcântara church, Lisbon, Portugal F. Llera, B. Barreiros, M. Tavares, T. Teixeira
Oscarshall (Oslo, Norway) - case study of a restoration of a natural cement rendered facade from 1849. M. Moe, J. Lukacs, T.S. Hansen
Causes of decay of the Aveleiras House decorative plasters (in Torre de Moncorvo) M.E. Costa Salavessa, A. Shahsavandi, F.P. Torgal, S. Jalali
Sgrafitto in Portugal: a contribution to its study and preservation S. Salema, J. Aguiar
Environmental decay of ancient stucco decorations subject to outdoor exposure F. Sandrolini, E. Franzoni, E. Sassoni
The restoration of the 12 th century engraved estrich gypsum floor from the Church in Wiślica M. Stec
Restoration plaster for the wall paintings presentations in three Pre-Romanesque churches on the Adriatic coast V. Sulic
Conservation of an Amun Temple in the Sudan T. Sweek, I.R. Anderson, S. Tanimoto.

Grouting mortars for consolidation of historical renders showing loss of adhesion M.L. Tavares, R. Veiga, A. Fragata
Vitruvius and Antique techniques of plaster work and painting L. Thiemann, S. Gerzer, R. Kilian
Mortars in the buildings of Pre-Hispanic Peru: structural behavior studies H.E. Torres Peceros
Strengthening of heritage buildings by means of grout injection-problems and solutions M. Uranjek, R. Žarnić, V. Bosiljkov
Restoration of the tile cladding of a post-war modernist building complex Y. Vanhellemont
Repair mortars for the National Congress building, Argentina S. Velázquez, I. Dolmann, M. Domínguez, F. Luna, E. Etchechourry, G. Alonso, S. Acri, M. Mancini
Ceramic façades in Portugal - conservation issues A.L. Velosa, R. Veiga
Investigation of 14 th century Byzantine and Serbian provenance fresco painting N. Vesić, C. Kyriakou, A. Bakolas, I. Tsamasfyrou, E.T. Delegou, A. Moropoulou 813
Traditional stucco techniques in interior surface coatings: Northern Portugal (XIX-XX th centuries) E.S. Vieira
Overview of the 100 Mortars Project at the archaeological site of Herculaneum A. De Vita, P. Pesaresi, V. Puglisi
THEME IV: REPAIR MORTARS FOR HISTORIC MASONRY
Lime - natural pozzolan conservation mortars: parameters that affect reactivity and strength
E. Ampatzioglou, I. Karatasios, B. Colston, D. Watt, V. Kililoglou845
Effect of pozzolanic activity of metakaolin on the mechanical properties of air and quicklime mortars
S. Andrejkovičová, A.L. Velosa, F. Rocha
Comparison of different methods to determine the packing density of fresh mortars A. Arizzi, C. Giuseppe
Characterization of stone masonry panels consolidated by injection of grouts in buildings damaged by the 2009 Abruzzo earthquake G. Artioli, M. Secco, C. Mazzoli, C. Coletti, M.R. Valluzzi, F. da Porto

The influence of water repellent admixture on lime and lime cement mortars diffusion properties L. Balik, J. Kolisko
Energy renovation by lime renders M.M. Barbero Barrera, F.J.N. González, L.M. Ramos, A. García Santos, K. Van Balen
Impact of non-uniform distribution of temperature on the state of stress of masonry P. Beran
Repair mortars for the sandstones of the cathedral of Berne C. Bläuer, H. Häberli, A. Löffel, B. Rousset
Lime-metakaolin mortars applied on the Soledade palace, Recife, Brazil T.M.A. Bonilla, A.F. Ferreira, A.F. Nóbrega, E.C.R. Silva, M.L. Souza, A.M.P. Carneiro
Compatibility of repair mortars with 19 th century natural cement cast stone from the French Rhône-Alpes region M. Bouichou, E. Marie-Victoire, E. Cailleux, D.Sommain927
Properties of lime-based restoration mortars modified by the addition of linseed oil E. Čechová, I. Papayianni, M. Stefanidou
Characterization of repair mortars for the assessment of their compatibility Ö. Cizer, L. Schueremans, E. Janssens, G. Serre, K. Van Balen947
Flexural strength of fiber reinforced lime mortars for historic masonry structures E. Erdogmus, C.K. Armwood, H. Haider, Y. Yang957
Effect of rice husk ash particle size in lime based mortars A.P. Ferreira Pinto, N.G. Almeida, A. Gomes
Masonry repair options and their philosophical ramifications A.M. Forster
Salt crystallization in substitution renders for historical constructions A. Fragata, R. Veiga, A.L. Velosa
Hydration of roman cements used for architectural restoration C. Gosselin, K.L. Scrivener, S.B. Feldman
Two views to deal with rain penetration problems in historic fired clay brick masonry C. Groot, J. Gunneweg
_
Durability to salt decay of commercial ready-mixed mortars for the conservation of cultural heritage C. Tedeschi, L. Binda, D. Gulotta, L. Toniolo

Design of jointing mortar compatible with the masonry of the Villa Maheddine of the "Ottoman era" M. Hamiane, S. Aitouakli, L. Boumghar, W. Zekagh, M. Saidi
Water transport between mortar and brick: the influence of material parametrs R. Hendrickx, S. Roels, K. Van Balen
Roman cement for the production of conservation mortars D.C. Hughes, J. Weber, R. Kozlowski
Design and production of repair mortars for historic masonry taking into account the characteristics of old mortars I. Ioannou, M. Philokyprou, A. Ilia
Stress rate sensitivity of masonry units bound with hydraulic lime mortar Md.T. Islam, R. Chan, V. Bindiganavile
The design and use of repair mortars for historical masonry in Australia B. Jordan
The effect of relative humidity on the performance of lime-pozzolan mortars I. Karatasios, M. Amenta, M. Tziotziou, V. Kilikoglou
The new groups of Formulated Limes (FL) of lime standard EN 459 – bane or boon? B. Middendorf, D. Klein, S. Hogewoning, S-O. Schmidt
Impact of historically inspired processes of lime mortar preparation on its properties D. Michoinová
Mortars for conservation-restoration of wall painting support in rupestral churches I. Mohanu, I. Gomoiu, D. Mohanu, D. Nastac
Strengthening of pure lime mortars with nanoparticles of calcium hydroxide C. Moreau, Z. Sližková, M. Drdácký
Grouts for injection of historical masonries: influence of the binding system and other additions on the properties of the matrix I. Papayianni, M. Stefanidou, V. Pachta
Influence of sand fines on the mechanical and physical properties of lime-based renders and plasters I. Papayianni, M. Stefanidou, S. Christodoulou
The long-term effectiveness of renovation plasters from Jevíčko castle M. Peřinková
Mortars from Roman cement and their properties A. Peterová, K. Doubravová, V. Machovič, J. Jiroušek
Nano-lime as a binder for injection grouts and repair mortars E. Maryniak-Piaszczynski, G. Ziegenbalg

High fired gypsum mortar for screeds, terrazzo and masonry repair on historic monuments. Production, properties and sample applications F. Schlütter, W. Kaiser, H. Juling
Design of conservation mortars for the restoration of the Piraeus stones at the monuments of the Acropolis of Athens N-A. Stefanis, P. Theoulakis
Repair mortars studied for the conservation of temple G1 in Mỹ Sơn, Vietnam C. Tedeschi, L. Binda, P. Condoleo
Two siliceous grouts for the preservation of stone. A. Thorn
Cement-stabilized earth mortars for application in archaeological sites and prehistoric monuments E-E. Toumbakari, A. Ntziouni, V. Kasselouri-Rigopoulou
Design of mortars and grouts for restoration and strengthening of historic buildings M. Uranjek, R. Žarnić, V. Bokan-Bosiljkov
Experimental study of hot mixed mortars in comparison with lime putty and hydrate mortars J. Válek, T. Matas
Conservation of historic renders and plasters: from lab to site R. Veiga
High-temperature gypsum plaster: investigations into conservation and restoration of historic gypsum objects U. Wende, P. Kozub, T. Arnold, J. Meinhardt
Reducing shrinkage cracks in Roman cement renders D. Wilk, L. Bratasz, R. Kozłowski
Correlation of initial and final available lime, and free water in lime putties to carbonation rate and mechanical characteristics of lime mortars G. Zacharopoulou
The effect of wet slaked lime putty and putty prepared from dry hydrate on the strength of lime mortars G. Zacharopoulou
Historic and modern injection grouts used in Poland for wall painting conservation K. Zajadacz, J. Nykiel, S. Simon
Nano-lime - a new material for the consolidation and conservation of historic mortars G. Ziegenbale, K. Brümmer, J. Pianski

2nd	Historic Mortars Conference HMC2010and RILEM TC 203-RHM Final Workshop
	22-24 September 2010, Prague, Czech Republic

Analysis and testing methodology of mortars: a case study of the Báthory castle in Şimleu Silvaniei, Romania
A.B. Magó, A. Cosma, M Guttmann, B. Szabó
RILEM TC 203-RHM 'REPAIR MORTARS FOR HISTORIC MASONRY' FINAL WORKSHOP
The role of mortar in masonry: an introduction to requirements for the design of repair mortars J. Hughes, RILEM TC 203-RHM members
Influence of masonry typology and mortar joints on the mechanical behaviour of masonry walls
L. Binda, RILEM TC 203-RHM members
Repair mortars for historic masonry. From problem to intervention: a decision process
R. van Hees, RILEM TC 203-RHM members
Testing of repair mortars for historic masonry B. Bicer-Simsir, RILEM TC 203-RHM members
Performance and repair requirements for repointing mortars M. Subercaseaux, RILEM TC 203-RHM members
Performance and repair requirements for bedding mortars B. Middendorf, RILEM TC 203-RHM members
Performance and repair requirements for renders and plasters C. Groot, RILEM TC 203-RHM members
Performance and repair requirements for flooring mortars I. Papayianni, RILEM TC 203-RHM members
Performance and repair requirements for surface repairs J. Válek, RILEM TC 203-RHM members
Authors' index