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ABSTRACT BOOK

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Contents

On both sites, cloister like structures were identified with the presence of human remains in primary burial position (as well as ossuary and reductions). We aim to compare and characterize both burial sites from a funerary bioarchaeological standpoint in regards to the buried population type, the use of lime and type of materials present with the human remains.

13 THE INFORMATIVE ROLE OF POST-MEDIEVAL OSSUARIES: THE EXAMPLE OF THE CRYPT OF SANT'AGOSTINO IN SASSARI (XVII-XIX CENTURIES)

Milanese, Marco (University of Sassari - Department of History, Human Sciences and Education) - Moshfegh Monazah, Leila (Insitutt for historiske og klassiske studier - NTNU - Trondheim (NO)) - Roggio, Cinzia (University of Sassari - Department of History, Human Sciences and Education)

In postmedieval cemeteries and churches is commonly reported the presence of ossuaries and burial crypts, which are usually excluded from the anthropological analysis due to the high cost of these studies and to the wrong convention of the uselessness of this kind of secondary deposition to the reconstruction of the bioarchaeological context.

The proliferation of confraternities, often linked to corporations, favored the creation of burial places dedicated to them, identifiable by crypts or chapels built in cemeteries or churches that were the headquarters of the confraternity.

The crypt of the Church of St. Augustine, Sassari, excavated under the chapel of the Gremio dei Viandanti, contains hundreds of remains of the brothers of the Gremio, dated back between 1633 and 1810.

The crypt is the subject of a multidisciplinary project aimed at reconstructing the history of the members of the Gremio dei Viandanti, a post-medieval corporation that is still alive.All bones will be analysed to assess the biological profile and reconstruct the health status of this limited social group. In addition, the presence of tissues, through genomic analysis, can supply useful data to complement the information obtained from bioarchaeological and paleopathological studies.

Bibliography

Milanese M., Azzalin G., Moshfegh Monazah L., Magnini L., 2024. La cripta sepolcrale del Gremio dei Viandanti nella chiesa di Sant'Agostino in Sassari, in "Archeologia Postmedievale", 28.

14 PALAEOPATHOLOGICAL ANALYSIS OF INDIVIDUALS FROM A POST-MEDIEVAL SITE IN SLOVENIA

Lisic Fox, Nidia (University of Ljubljana) - Leskovar, Tamara (University of Ljubljana)

Researching post-medieval cemeteries can provide significant insights into past events and overall population by forming biological profiles of individuals and creating demographic structure of a specific population. This can often be supported by other resources and documented events offering a wider picture of a certain location and period. Moreover, palaeopathological studies are an integral addition to skeletal remains analysis in order to learn about health conditions, diseases and even population changes.

However, post-medieval cemeteries are often neglected due to being so close to the present as well as raising possible ethical questions. The aim of our research is to show how studying post-medieval cemeteries can contribute to overall research development of different time periods, better population understanding and specific past-present connections.

The basic analyses were performed on the skeletons discovered in 196 graves at site Vrazov trg, Slovenia. It was noted that numerous individuals were with various pathological changes. For this study, 10 most interesting individuals were chosen in order to highlight the potential of more in detail palaeopathological study.

15 PATHOLOGICAL CHANGES IN HUMAN BONES FROM THE MODERN PARISH CEMETERY AT ST. BARBARA CHURCH IN WROCLAW

Galdyn, Natalia (Wroclaw University of Environmental and Life Sciences) - Bernacka, Natalia (Wroclaw University of Environmental and Life Sciences) - Kwiatkowska, Barbara (Wroclaw University of Environmental and Life Sciences) - Dąbrowski, Paweł (Wroclaw Medical University)

The study aimed to characterize pathological changes in the bones of Wroclaw residents buried at St. Barbara's Church, a modern parish cemetery dating back to the 17th-18th centuries. The study involved analyzing 58 specimens from 12 sites, including 19 male, 16 female, and 23 specimens of indeterminate sex, including 13 juveniles and children. The conditions were characterized using Gladykowska-Rzeczycka's division in 1976.

Lesions of the masticatory apparatus were observed in the greatest numbers, with injuries being equally frequent in each age category and slightly more frequent in men. Degenerative changes were more common in adults and mature individuals, while inflammatory changes occurred only in the adultus and maturus age categories. Developmental disorders were comparably frequent in both sexes, while endocrine disorders, metabolic disorders, and neoplasms were least frequently observed.

The population from St. Barbara's Church was compared to the populations from St. Paul's and St. Peter's churches and the Salvatore cemetery. Most remains belonged to adults, while the most pathology was present in the populations from St. Barbara's church and the Salvator cemetery. However, lesions characteristic of diseases like tuberculosis were rarely present in all three populations.

The bone remains used in the research came from: Grant number: NCN 2017/25/B/HS3/02006. Grant title: " On the threshold of industrialization – interdisciplinary evaluation of prosperity and quality of life of early modern inhabitants of Wroclaw".

736 INTERDISCIPLINARY TRAJECTORIES IN MORTAR ANALYSIS OF HISTORICAL BUILDINGS

Session theme: **2. Archaeological Sciences, Humanities and the Digital era: Bridging the Gaps**

Session organisers: **Bellato, Giulia (Trinity College, University of Cambridge) - Bianchi, Giovanna (Department of History and Cultural Heritage, University of Siena) - Lubritto, Carmine (Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, MAReA Centre, University of Campania "Luigi Vanvitelli") - Arrighetti, Andrea (École normale supérieure, Université PSL)**

Session format: **Regular session**

The relationship between archaeology, history, and archaeometry is a long-debated topic that has become increasingly prominent in recent years, thanks to the constant evolution of research procedures, as well as the increasing sophistication of the tools of analysis at our disposal. As such, the creation of new frameworks of research and the continuous updating of skills and technical knowledge are essential to keep up with these developments.

To enhance current models and pave the way for new research directions, a collaborative approach is crucial. This hinges on a close dialogue between scientists and social science researchers, underpinned by a shared understanding of the procedures defining the various archaeometric specialisations.

The proposed session makes a case for this interdisciplinary approach by focusing on the processes of production of the mortars used in the construction of historical buildings. Within this field of research, the analytical archaeometric procedures adopted in recent years have become increasingly more precise in defining both the characteristics and the dating of samples. In most studies, however, the work of the scientists remains isolated from the overall data produced by historical and archaeological research.

This session draws from the experience acquired within an ongoing research project studying a series of Italian medieval castles through the archaeometric analysis of their mortars. Its objective is to initiate a dialogue with other interdisciplinary projects where mortar analysis plays a pivotal role in shaping historical models.

Taking a wide diachronic perspective, it presents a set of case studies examined through field- and lab-based procedures, comparing both different methods and their results. Ultimately, it intends to offer a valuable model of a research process that elaborates a unified and seamless interpretive framework based on different kinds of data and on the integration of different specialisations.

ABSTRACTS

1 APPLICATION OF THE RADIOCARBON METHOD TO MORTARS IN ARCHAEOLOGICAL CONTEXTS

Vecchiattini, Rita (Dipartimento Architettura e Design (DAD) - Università di Genova; Istituto di Storia della Cultura Materiale (ISCUM)) - Pesce, Giovanni (Department of Mechanical and Construciton Enginering - Northumbria University; Istituto di Storia della Cultura Materiale (ISCUM))

Among all the archaeometric dating methods, the dating of organic material using the Radiocarbon method has been one of the most commonly used since the 1960s, especially in the archaeological and anthropological fields. Since early 2000s, however, the Radiocarbon method has also been applied with some success to "lumps of pure lime" contained in historic mortars, within archaeological or architectural contexts.

The possibility of extending the application of the Radiocarbon dating method from the organic material deliberately or accidentally included in the mixtures, to the inorganic material (i.e., lime) is changing the research perspectives and its application. Dating the carbonation of lime in a mortar means, in fact, directly dating its setting time and therefore, the actual construction time of a building.

The experience, accumulated by the authors and by ISCUM since 2008, in selecting, preparing and radiocarbon dating over 70 lumps of lime extracted from mortars of 28 different contexts allows now some reflections on this particular application of the Radiocarbon method.

This paper summarises the main critical limitations and potentials related to the application of the radiocarbon method to lime mortars samples in archaeological contexts with examples derived from specific case studies.

2 LIFE AFTER 14 YEARS OF EXPERIENCE WITH MORTAR DATING BY CRYO(2)SONIC PROCEDURE: CURRENT STATE OF THE ART AND FUTURE PERSPECTIVES

Marzaioli, Fabio (Universita degli studi della Campania, Dipartimento di Matematica e Fisica) - Passariello, Isabella (Universita degli studi della Campania, Dipartimento di Matematica e Fisica) - Terrasi, Filippo (Universita degli studi della Campania, Dipartimento di Matematica e Fisica) - Nonni, Sara (The University of Manchester at Harwell) - Secco, Michele (Università degli Studi di Padova-Dipartimento dei Beni Culturali: archeologia, storia dell'arte, del cinema e della musica (DBC)) - Ricci, Giulia (Università degli Studi di Padova- Dipartimento di Geoscienze) - Artioli, Gilberto (Università degli Studi di Padova- Dipartimento di Geoscienze) - Lubritto, Carmine (Universita degli studi della Campania, DiSTABiF)

This contribution aims to describe the history of Mortar Radiocarbon Dating by CryoSoniC method since its first developments and testing in 2010. CryoSoniC (CRYO-Breaking, SONIcation and Centrifugation) was firstly developed and applied @ CIRCE (Centre for Isotope Research on Cultural and Environmental heritage) Laboratory- Università degli Studi della Campania "Luigi Vanvitelli" (formerly Seconda Università degli Studi di Napoli) - Department of Mathematics and Physics based on a development of a procedure defined by Nawrocka, et al. (2011). Over about 1.5 decade initial procedure was developed and adapted in order to respond accurately to the great heterogeneity of real field mortars including low degree hydraulic ones (i.e. cocciopesto and pozzolanic). This procedure aims at the physical isolation of a real fraction from mortars differently from a widely spread family of procedures based onto stepped digestion.

Several study cases with well constrained chronological boundaries have been tested in order to verify procedure accuracy. Based onto experienced intensive testing of Cyo(2)SoniC, current state of the art (including efficiency %) and future perspectives of the applied procedure will also be described.

3 TECHNOLOGICAL CHANGES AND CONTINUITIES IN MORTAR PRODUCTION: A VALUABLE TOOL FOR THE CHRONOLOGICAL INTERPRETATION OF COMPLEX HERITAGE CONTEXTS

Razzante, Valeria (Dipartimento dei Beni Culturali, Università di Padova) - Secco, Michele (Dipartimento dei Beni Culturali, Università di Padova) - Dilaria, Simone (Dipartimento dei Beni Culturali, Università di Padova) - Ricci, Giulia (Dipartimento di Geoscienze, Università di Padova) - Previato, Caterina (Dipartimento dei Beni Culturali, Università di Padova) - Bonetto, Jacopo (Dipartimento dei Beni Culturali, Università di Padova) - Chavarría Arnau, Alexandra (Dipartimento dei Beni Culturali, Università di Padova) - Brogiolo, Gian Pietro (Dipartimento dei Beni Culturali, Università di Padova) - Marzaioli, Fabio (Dipartimento di Matematica e Fisica, Università degli Studi della Campania Luigi Vanvitelli)

In the last decades, archaeometric analysis of historic mortars has provided promising responses to improve knowledge on the technical evolution of construction practices. In this contribution, an interdisciplinary and multi-analytical approach is presented, combining historical research, archaeology, and archaeometry, to highlight noticeable variations and continuities in mortar production practices throughout different historical periods in two paradigmatic sites: the city of Padua and the site of Castelseprio-Torba (Varese).

Due to the presence of differentiated geological resources from the Euganean Hills, the city of Padua offers a peculiar context of great variability in mortar recipes. The multi-analytical study applied to mortars sampled from different Roman public structures of the city and its surroundings indicated a systematic utilization of Euganean volcanic aggregates as activators of the pozzolanic reaction; in post-classical periods the adoption of pozzolanic binders was replaced by a consistent production of natural hydraulic lime. The regular use of the Euganean marl – a clayey limestone – as raw material for lime production, has been identified both in the sections of the medieval and Carrarese walls, as well as in the latest Renaissance defensive structures.

A different perspective, linked to a continuing standardization over time, is offered by the late antique and medieval site of Castelseprio-Torba. Recent research highlighted a traditional way of producing mortars linked to the exploitation of local natural deposits (clay-rich sediments), to promote articulated pozzolanic reaction processes based on both calcium and magnesium systems, with formation of calcium and magnesium aluminum silicate hydrates (C-A-S-H and M-A-S-H, respectively). In this context, radiocarbon dating was applied to mortar samples collected from the masonry structures of the Torba monastery, providing an absolute chronological reference, and overcoming intrinsic limitations of relative chronology subjected to the diachronic continuity of mortar production technologies.

4 BINDER SELECTION PROCEDURE OF FLORENTINE HISTORICAL BUILDINGS FOR RADIOCARBON DATING

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Mortar of historical building reveal details about raw materials, ancient technology, original recipes, and supply areas. These details let us identify the phases of construction. Since the pioneering studies of Labeyrie and Delibrias, (1964), mortar binder can be dated by absolute dating using radiocarbon. In principle, the datable carbon fraction is represented by the so-called anthropogenic calcite ($CaCO_3$), i.e. the carbonate binder resulting from the hardening of slaked lime [$Ca(OH)_2$] reacting with CO_2 from the atmosphere. The possibility of dating an aerial mortar has by radiocarbon depends on the complete separation of the binder from source of contaminations (components in the mortar mixture). Standard and approved experimental strategies for removing the sources of contamination have not yet been established.

The purpose of our research is to design a binder selection procedure for radiocarbon dating of historical mortars and apply it to mortars from the Florentine area (Cantisani et al., 2021).

Our procedure for selecting binder includes: 1) chemical, minero-petrographic characterization of mortar samples to identify the nature of binder, aggregates, the presence of lumps and hydraulic behavior; 2) mechanical separation of lumps or/and bulk samples and their characterization using non-destructive methods: cathodoluminescence, spectroscopic methods (ATR-FTIR and micro-Raman) (Calandra et al., 2022; Calandra et al., 2023) to evaluate the origin of calcite; and also, X-ray powder diffraction (XRPD) to identify mineralogical phases. And then proceeded to select samples consisting mainly of anthropogenic calcite; 3) carbonate micro-sample preparation (acid dissolution combined with Lilliput graphitization reactors (Fedi et al., 2020)) and 14C measurement by accelerator mass spectrometry (AMS).

This workflow has been applied on mortars from Trebbio castle, an important architectural Cultural Heritage in the surroundings of Florence (Italy). The procedure has allowed us to select suitable mortar samples, obtaining reliable dating results, comparable with the historical construction phases of the castle.

5 CHARACTERIZATION AND PREPARATION OF ARCHAEOLOGICAL MORTARS FOR AN EFFECTIVE RADIOCARBON DATING: THE CASE-STUDY OF SAMPLES FROM MEDITERRANEAN AREA

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The dating of historical buildings is a crucial aspect of their study and evolution. Lime-based mortars are a highly effective building material for providing dating clues. This is because the carbon dioxide absorbed during the setting of the mortar on archaeological structures reflects the content of 14C that existed in the atmosphere at that time. However, it is important to note that some factors may influence the reliability and accuracy of radiocarbon measurements.

Due to the complexity of the problem, a number of chemical and mechanical procedures have been used in recent decades to prepare lime mortars for radiocarbon dating, including the Cryo2SoniC preparation protocol. However, these procedures may not completely eliminate contamination agents such as carbonate in aggregate, calcination relics, or secondary calcite from the carbon in the original binder, which can result in inaccurate dating of samples.

To minimise the impact of contaminants on dating procedures, the selection of the material must be accurate, and an appropriate characterization of mortar is fundamental.

The following research focuses on preparing, characterising and dating samples from various archaeological Mediterranean contexts. It highlights the importance of conducting a preliminary minero-petrographic characterisation using Polarised Light Microscopy, Fourier Transform Infrared Spectroscopy and simultaneous thermal analyses to identify potential sources of dating contamination. The presentation will cover:

- the case-study of decorated plasters from an archaeological site Pollena Trocchia (Campania region, Italy), representing the "ideal" materials for reliable dating procedure, because of their nature (lime-based mortars containing volcanic aggregate) and their strict chrono-stratigraphic constrains, marked by the deposits of 79 CE and 472 CE Vesuvius' eruptions;

- the case-study of mortars collected by Medieval Andalusian Castles, studied with the aim of highlighting how contamination effects can affect radiocarbon dating.

6 THE LIMEKILN OF THE MEDIEVAL SETTLEMENT OF MONTECORVINO (FOGGIA, APULIA): A MULTIDISCIPLINARY RESEARCH

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Montecorvino (Volturino-FG) is an abandoned medieval site in the north-western Apulia; it was a kastron, founded by the Byzantines in the first half of the 11th century. The arrival of the Normans, after a few decades, involved the reorganization of the town: at the western end, an artificial embankment was built, surrounded by a moat; at the top a castrum was planted, dominated by a high quadrangular tower; it was articulated over time, with the construction of a wall and a second tower, up to transform, in the 2nd half of 13th century, into a fortress, densely occupied. Below the hill, towards the east, in the direction of the town, in recent excavations a limekiln (diam. about 3 m) has been discovered; given its size, it would seem to refer to one of the main building phases of the castrum. The structure was found with its last load of stone and full fuel.

The peculiarity of the discovery provided opportunity studying the context with a multidisciplinary approach: archaeological examination, archaeometric analyses and archaeobotanical study.

Archaeometric analyses have been set, aimed at acquiring information both on the nature and origin of the materials used to build the kiln and to make lime, and on the operation of the kiln. Samples underwent to petrographical analysis in thin section, X-ray powder diffraction (XRPD) and scanning electron microscopy coupled with energy-dispersive spectroscopy (SEM-EDS). Blocks of local siliceous limestones are the prevalent lithotype used for both the kiln and the lime production. Moreover, it was developed an experimental protocol to map the temperature distribution in the kiln.

Anthracological analysis of the charcoals remains allows us to determine the composition of the fuel, the formation way of the anthracological assemblage and the choices adopted for the functioning of the limekiln.

7 COMBINING MORTAR, WOOD, CARTOGRAPHIC AND DOCUMENTARY EVIDENCE TO UNDERSTAND THE MEDIEVAL TOWERS OF NEGROPONTE

Blackler, Andrew (Hellenic Society for Near-Eastern Studies) - Panagopoulou, Adamantia (Institute of Nanoscience and Nanotechnology "Demokritos" National Center for Scientific Research, Athens)

More than a hundred towers once dotted the medieval landscape of the Greek island of Euboea (Negroponte). They have traditionally been seen in a colonial context as constructed by Frankish and Venetian feudal landowners to display their power and control the local population immediately following the annexation of central Greece in 1204 by forces of the Fourth Crusade. In 2022/23, in a program supported by the Castle Studies Trust (UK), samples of mortar and wood were taken from within the walls of seven towers on the island.

The results of their analysis undertaken at the 'NCSR' Demokritos laboratory in Athens have enabled not only a revised build dating but also, through chemical study have identified different construction technology phases and raw material provenance sites. These results combined with GIS analysis, and contemporary documentary and cartographic evidence, have contributed to the development of a completely new understanding of their role during the nearly three centuries of Latin control (1204-1470).

This paper studies the process of sampling from the initial identification of target towers, given budget limitations, to the interaction between the various specialists and how this contributed to secondary analyses being undertaken. It then discusses how an understanding of the historical context coupled with the involvement of experts from multiple scientific disciplines was critical to the development of the final conclusions.

8 THE KEYS TO SUCCESS: INTERDISCIPLINARITY IN THE DATING OF MORTARS FROM SANTALLA DE BÓVEDA (LUGO, GALICIA, SPAIN)

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Since 2007, a team made up of geologists, archaeologists, art historians and restorers began to work collaboratively from different institutions in Galicia, University of A Coruña, University of Santiago, CSIC, and now in Portugal, University of Minho, we started to work with the mortars of different historical buildings with the aim of characterising and dating them, in the conviction that the mortars, being a material that must be made at the time of construction, were the key to answering some important historiographical debates about different architectures located in this region of the Iberian Peninsula, mainly for the Late Antiquity and Early Medieval Ages.

At that time, we began to work on Santalla de Bóveda, an important monument that preserves some mural paintings that have been identified as Roman, Early Christian or Early medieval, although researchers have not reached a consensus. The building was a very attractive case of study not only because it was a challenge to respond to this lack of consensus, but also because it preserves mortars of very different functionality and paintings that are an icon for the history of art, archaeology and architecture.

The continuous process carried out since then has been a methodological path that has accompanied the advances in dating techniques. Today, the monument has 40 dates, result of having combined three methods and that allow us to clearly date the stratigraphic sequence identified thanks to the archaeological study. Only the combination of different dating techniques applied to different materials and an interdisciplinary study, where archaeology and geology have collaborated closely with other disciplines to formulate the right questions, select the right samples and refine the methodology, have allowed us to reach solid conclusions that today open new interpretative hypotheses for early medieval architecture in Galicia.

9 THE CASTLES PROJECT

Bianchi, Giovanna (University of Siena) - Arrighetti, Andrea (École normale supérieure, Université PSL) - Bellato, Giulia (University of Cambridge) - Lubritto, Carmine (University of Campania "Luigi Vanvitelli") - Garzonio, Carlo Alberto (University of Florence)

The study of medieval castles and of their transformations, in both structural and socio-political terms, is a long-standing key theme of Italian historiographical research. Though it has been tackled extensively through historical, archaeological, and archaeometric study, it still retains numerous open questions that carry significant historiographical implications. The precise chronology of the transformations of castles between the second half of the 11th century and the end of the 12th, for instance, remains unclear. One of the key elements of this transformation involves the shift to durable materials, accompanied by the increasing use of lime-based binders.

This paper presents the preliminary findings of an ambitious project developed by the universities of Siena, Florence, Turin, and Campania. It is based on a study of a set of Italian medieval castles from Tuscany, Piemonte, and Liguria, selected because of their historical and archaeological significance. It is aimed as refining our understanding of castles construction phases, specifically through the development of new protocol for the dating of historical lime-based mortars.

The field of archaeometry has seen great strides in recent years, especially in terms of the development of increasingly precise procedures for the dating of historical mortars. However, these types of analyses still retain significant challenges, not least that of successfully integrating the archaeometric data with that produced through historico-archaeological research. The paper presents an innovative framework of research which centres mortar dating in the creation of historical models. At the same time, it also explores the contribution that historico-archaeological analysis can bring to archaeometry, especially regarding the creation of new protocols of analysis. It aims at offering a valuable example of interdisciplinary research and at opening a fruitful discussion regarding the challenges and the advantages of creating research frameworks that can integrate data from different specialisations.