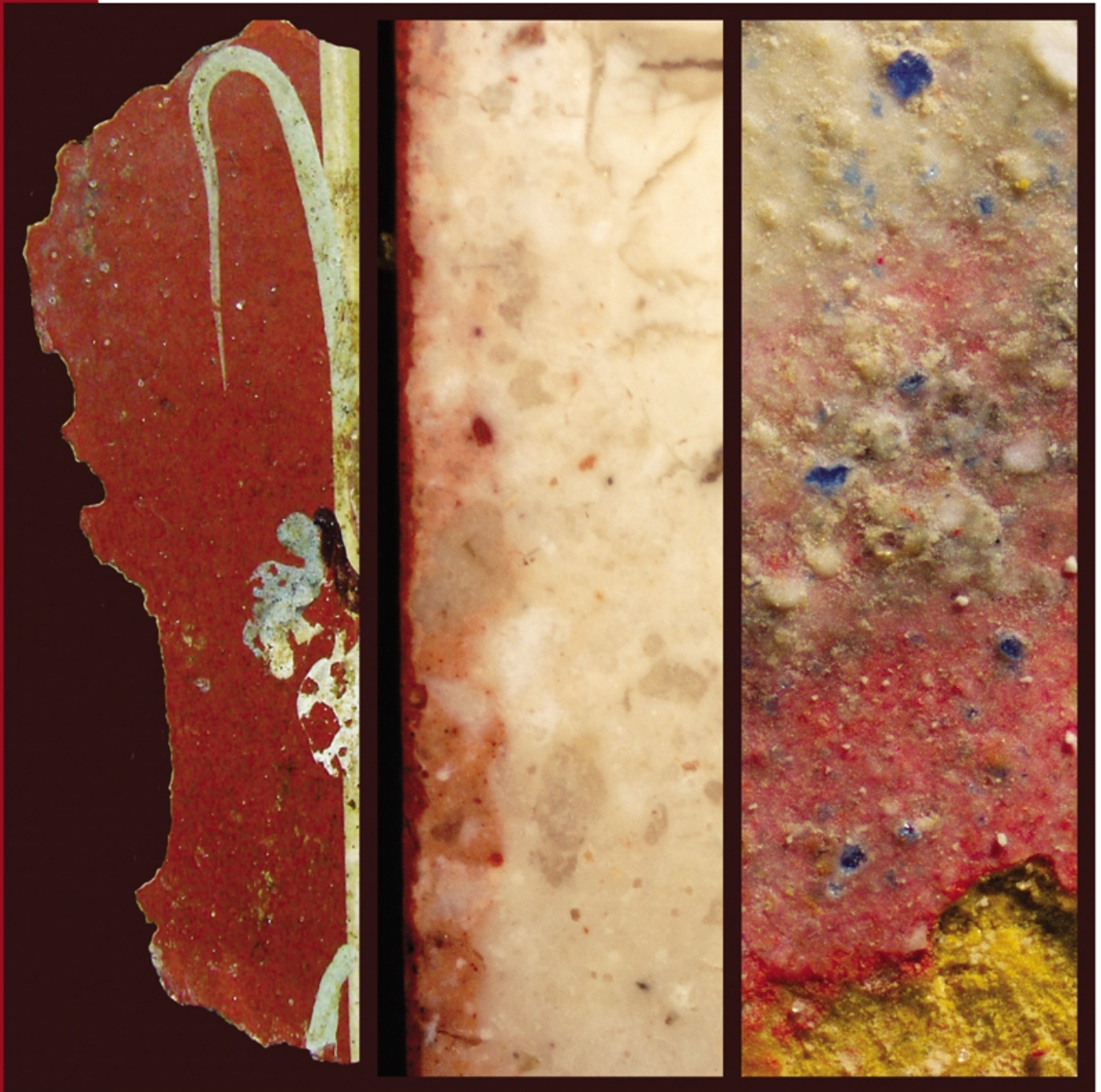




ASSOCIAZIONE ITALIANA RICERCHE PITTURA ANTICA

AIRPA



*La peinture murale antique :
méthodes et apports d'une approche technique*

Actes du colloque international
Louvain-la-Neuve 21 avril 2017

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In copertina: frammento d'intonaco dipinto dal Caseggiato dei Lottatori di Ostia (foto M. Marano); fotografia di una sezione sottile di malta pittorica da Ostia (E. Cantisani) e microfotografia della superficie pittorica di un frammento dipinto di Ostia (S. Bracci). Diritti del Parco archeologico di Ostia antica. Composizione P. Tomassini.

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MÉTHODES ET APPORTS D'UNE APPROCHE
TECHNIQUE*

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édités par
Marco Cavalieri, Paolo Tomassini



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INTRODUCTION
ÉTUDIER LA PEINTURE ANTIQUE PAR L'ARCHÉOMÉTRIE :
HISTOIRE ET PERSPECTIVES D'UNE APPROCHE TECHNIQUE

Marco Cavalieri, Paolo Tomassini¹

Au cours des dernières décennies, les analyses physico-chimiques, devenues de plus en plus variées et précises, ont acquis une place prédominante dans les études archéologiques, en fournissant un apport fondamental à la datation, à la caractérisation et à l'étude de tout type de vestige antique. La peinture murale ne fait pas exception et a grandement profité de ces avancées techniques. En effet, les technologies les plus sophistiquées permettent aujourd'hui d'identifier la nature des pigments et la composition des mortiers de préparation aux peintures, offrant aux spécialistes une quantité considérable d'informations sur les matériaux utilisés par les artisans antiques et les procédés mis en œuvre dans l'exécution des peintures. L'apport de ces données nouvelles a été considérable, puisque, en s'intégrant à l'analyse stylistique et iconographique des décors, il a été possible d'élaborer des discours sur les dynamiques de production et le travail des ateliers ; sur la provenance des matières premières ainsi que sur leur élaboration matérielle ; sur les pratiques récurrentes ou spécifiques à des réalités locales ou plus globales, ou encore à une période en particulier. Les techniques d'analyses employées sont aujourd'hui bien établies et sont devenues, grâce aux avancées technologiques, moins onéreuses, plus faciles à transporter et – surtout – de moins en moins invasives et destructrices. Cela a débouché sur la formation de centres spécialisés disséminés dans le monde, s'intéressant de près ou de loin à la question des pigments et mortiers antiques. Quiconque travaille sur la peinture antique est nécessairement appelé à se confronter tôt ou tard aux données de laboratoire, qui sont devenues une partie intégrante et indispensable de toute étude en toichographologie².

L'idée de tirer profit des avancées scientifiques pour mieux comprendre la peinture antique n'est certes pas récente, puisque déjà en 1809 le chimiste Jean-Antoine Chaptal publia ses travaux sur l'étude de « sept échantillons de couleurs trouvés à Pompeïa dans la boutique d'un marchand de couleurs »³. Chaptal identifie de l'argile verte, de l'ocre rouge, de l'ocre jaune et du blanc tiré de

¹ Les éditeurs du volume profitent de cette occasion pour remercier toutes les personnes qui ont contribué à ce que le volume voie le jour. Nous remercions N. Coisman et N. Buche, de l'UCLouvain, ainsi que C. Gioia et I. Montali, du CeSPRO, pour leur aide indéfectible dans la préparation et l'organisation du colloque de Louvain-la-Neuve. Nous souhaitons remercier également le comité de direction de l'*Associazione italiana ricerca pittura antica* (AIRPA) pour la proposition de publier les actes au sein de cette belle collection AIRPA, ainsi qu'Alix Barbet d'avoir accepté de "parrainer" la journée en animant les débats et en proposant la conclusion du colloque et de cet ouvrage. Toute notre gratitude revient à Martina Marano pour son aide précieuse et constante dans toutes les étapes du colloque et de la publication des actes. Enfin, nous devons exprimer notre reconnaissance aux diverses institutions et entreprises qui ont financé le colloque et sa publication : l'UCLouvain, l'Institut des civilisations, arts et lettres, le Centre d'étude des mondes antiques, le Fonds de la recherche scientifique – FNRS, le *Centro studi pittura romana ostiense*, les Amis des Musées d'Arlon, Carl Zeiss AG et l'entreprise *Kremer Pigmente*.

² Ce néologisme, proposé par P. Vannier à l'initiative de l'Association française pour la peinture murale antique (AFPMA), a été choisi pour désigner les études sur la peinture murale qui tiennent compte non seulement de l'aspect iconographique des décors peints mais aussi des aspects archéologiques, matériels et techniques de l'enduit peint. Voir VANNIER 2014 à ce propos.

³ CHAPTAL 1809, pp. 22-31.

Pierre ponce, et est intrigué par deux couleurs, qu'il soumet à une série d'analyses chimiques pour en identifier la nature. L'une sera identifiée comme de la laque de garance ; l'autre est un « beau bleu, intense et nourri », qui serait composé, selon Chaptal, « d'oxide de cuivre, de chaux et d'alumine », qui est produit de manière artificielle selon un procédé de vitrification, « ou plutôt d'une véritable fritte », semblable à ce que d'autres avant lui avaient retrouvé sur des peintures égyptiennes. Chaptal est donc le premier à identifier ce qui sera appelé par la suite le bleu égyptien, qu'il distingue des pigments utilisés en son temps comme l'azur et l'outremer. Beaucoup de chemin a été parcouru depuis les recherches pionnières de Chaptal, mais les questions restent essentiellement identiques. Quels étaient les pigments utilisés ? Comment étaient-ils mis en œuvre ? Que peuvent apporter ces analyses à notre connaissance de la peinture antique ? En 1967, Selim Augusti, qui est le premier à établir un catalogue complet des pigments retrouvés à Pompéi (et dans une moindre mesure à Herculaneum) publie « *I colori pompeiani* »⁴. Ses travaux ont sans aucun doute ouvert la voie à la recherche de réponses à ces questions. Augusti est en effet parmi les pionniers à multiplier les échantillons et les techniques d'analyses dans un souci d'objectivité⁵, et à confronter ces résultats avec ce que nous rapportent Pline et Vitruve sur les couleurs antiques.

Il faudra attendre les dernières décennies du XX^e siècle pour que l'on se rende compte de la nécessité d'analyser les peintures de manière systématique et régulière et d'élargir les analyses aux pigments mélangés et aux mortiers de préparation, grâce à un intérêt marqué pour les peintures fragmentaires. C'est cette voie que suivent les travaux de Michel Frizot sur les mortiers de préparation des enduits en Gaule et les recherches d'Hamdallah Béarat sur les pigments romains du plateau suisse⁶. Les premières rencontres entre spécialistes des analyses archéométriques pour l'étude de la peinture antique commencent à voir le jour, comme celle de 1985 intitulée « Datation-caractérisation des peintures pariétales et murales ». La publication qui en découla en 1987 présente un bilan des connaissances sur la peinture antique et affronte avec lucidité et compétence les nombreuses questions relatives à l'étude des pigments⁷, en particulier l'article d'Alix Barbet « Qu'attendre des analyses de pigments ? ». Elle s'interroge sur la valeur des analyses archéométriques, en concluant que ces analyses, bien qu'indispensables, ne sont pas une fin en soi mais un outil intervenant dans une analyse plus large dont l'objectif est d'identifier la nature des matériaux, éventuellement leur origine, dans le but d'identifier des écoles, des centres de production et des courants commerciaux, pour reprendre ses propres termes⁸. Les recherches sur les pigments antiques ont également été marquées par la publication des actes du colloque « Pigments et colorants de l'Antiquité et du Moyen Âge. Teinture, peinture, enluminure, études historiques et physico-chimiques », qui s'est tenu à Orléans en 1988⁹, dans le but de faire dialoguer des experts des sciences humaines et des sciences exactes, rassemblés par les mêmes interrogations sur les méthodes de laboratoire à utiliser et évaluer l'apport de cette approche multidisciplinaire à la connaissance des couleurs de l'Antiquité et du Moyen Âge. Ce n'est toutefois qu'en 1996 qu'une réflexion entièrement dédiée aux aspects technico-historiques de la peinture murale antique – et romaine en particulier – verra le jour, avec l'organisation du workshop de Fribourg « *Roman Wall Painting: Materials, Techniques, Analysis and Conservation* »¹⁰. Publiés en 1997, les actes de ce colloque ont démontré clairement l'importance de l'approche interdisciplinaire, qui réunit autour de problématiques communes non seulement les archéologues, mais aussi les archéomètres, les historiens de l'art et les restaurateurs. Le workshop de Fribourg a su montrer les avantages et inconvénients de l'approche scientifique à la peinture antique. D'un côté les analyses de laboratoire sont devenues fondamentales, mais de l'autre il faut éviter qu'elles ne deviennent la panacée de tout

⁴ AUGUSTI 1967.

⁵ Il préleva en tout 252 échantillons, qu'il soumit à une analyse au microscope et à des examens spectrographiques par infrarouge et diffraction des rayons X. AUGUSTI 1967, pp. 15-17.

⁶ FRIZOT 1975; BÉARAT 1996; BÉARAT 1997; BÉARAT, FUCHS 1996.

⁷ DELAMARE, HACKENS, HELLY 1987.

⁸ BARBET 1987, pp. 155-169.

⁹ GUINEAU 1990.

¹⁰ BÉARAT *et alii* 1997.

problème, et pour cela il est nécessaire que ces données soient correctement interprétées et insérées dans une problématique plus large.

Une vingtaine d'années après le workshop de Fribourg, la recherche sur les techniques de la peinture antique a bien progressé, notamment grâce au développement et à la systématisation des analyses archéométriques, qui ont pris une place primordiale dans l'étude matérielle de la peinture antique. Toutefois, cette prolifération de données scientifiques n'a pas été accompagnée, comme il avait été souhaité durant les débats de Fribourg, par une réflexion plus globale sur les apports et les méthodes des analyses et sur le rapport entre les différentes réalités territoriales. Le besoin s'était fait sentir de poursuivre la réflexion sur les techniques d'exécution de la peinture romaine et de faire une synthèse sur les nombreux acquis accumulés.

C'est dans cette optique que s'inscrit ce volume, qui recueille les actes du colloque éponyme « La peinture murale antique : méthodes et apports d'une approche technique », organisé à Louvain-la-Neuve le 21 avril 2017, à l'Université catholique de Louvain. Cette journée, organisée par le Centre d'étude des mondes antiques (CEMA) et le *Centro studi pittura romana ostiense* (CeSPRO), s'était donnée comme objectif de proposer une nouvelle occasion de confrontation et de dialogue, tout en offrant la possibilité d'établir un bilan de la situation. Plus de quarante chercheurs issus de huit pays différents se sont réunis avec comme objectif de proposer un premier état de la question et jeter les bases d'une réflexion commune. L'occasion a été celle de pouvoir dialoguer entre archéologues, physiciens, chimistes et géologues, de présenter les résultats des recherches de chacun en détaillant les méthodes utilisées.

Les contributions présentées au cours de la journée et publiées dans ce livre montrent comment l'approche technique et archéométrique de la peinture murale antique permet de mettre en évidence, à l'intérieur des différentes réalités locales, des changements nets dans les techniques d'exécution de la peinture au cours des siècles. Un cas emblématique par rapport à ces questions est celui d'Ostie, « port et porte de la Rome antique »¹¹, que nous avons choisi de proposer comme point de départ à cette réflexion. En effet, les analyses archéométriques, menées au cours des dernières années sur différents contextes de la ville par les membres du CEMA et du CeSPRO, ont montré comment la technique picturale et les « recettes » utilisées pour confectionner les pigments et les mortiers changent au cours du temps. Cette transformation est un phénomène qui n'est pas uniquement dicté par des exigences esthétiques mais qui dépend également de contraintes en termes de sources d'approvisionnement et de la progressive standardisation de la production picturale du port de Rome entre le I^{er} s. a.C. et le II^e s. p.C. Au-delà de l'exemple d'Ostie, cet ouvrage a tenté de recouvrir une échelle chronologique et géographique la plus ample possible, en étudiant diverses réalités locales dans le but de les insérer dans un tableau plus large. Pour cette raison, les articles repris dans cet ouvrage présentent des cas d'étude provenant de Rome et du Latium, de la région vésuvienne, du nord de l'Italie, de la Gaule romaine, de l'Asie Mineure et du Levant, depuis l'époque républicaine jusqu'à la période byzantine.

Plusieurs problématiques sont abordées dans les pages qui suivent, les plus importantes étant les types de techniques physico-chimiques à utiliser pour l'interprétation des résultats d'analyses. Le dialogue entre les différentes disciplines s'est avéré particulièrement fructueux, dans la mesure où il a permis de mettre en évidence une série d'incompréhensions entre archéologues et archéomètres mais également au sein même des deux disciplines. La difficulté de créer un dialogue est principalement causée par l'absence d'un glossaire partagé. À titre d'exemple, la terminologie employée pour décrire les couches de préparation varie sensiblement en fonction de la langue ou de la discipline. Les archéomètres parlent le plus souvent d'*intonaco* et d'*arriccio*, les archéologues francophones de couche de finition et de couche de préparation, alors que les archéologues italophones utilisent plutôt les termes d'*intonachino* et *intonaco*. Ces divergences constituent un obstacle non des moindres

¹¹ Pour reprendre une désormais célèbre expression tirée du titre de l'ouvrage édité par J.-P. Descœudres en 2001 *Ostie. Port et porte de la Rome antique : catalogue de l'exposition*, Genève.

pour l'échange d'informations entre spécialistes de diverses langues et disciplines, un obstacle qu'il serait judicieux de contourner par la mise au point d'un lexique commun et international. Une autre difficulté rencontrée, soulevée au cours du débat conclusif du colloque de Louvain-la-Neuve, est la question de la compatibilité et de la comparabilité des résultats de différentes analyses physico-chimiques. De fait, puisque chaque laboratoire utilise son propre protocole opérationnel, les données archéométriques ne peuvent bien souvent pas être mises en relation. Une solution à ce problème pourrait être la création d'un protocole d'analyses et d'une base de données commune, permettant de partager les informations et les résultats. En effet, ce n'est qu'en multipliant les données et en les rendant accessibles que l'on pourra mieux définir le tableau – encore trop fragmenté – de la technique picturale antique et spécialement romaine, qui s'est déclinée sur toute la surface de l'Empire pendant plusieurs siècles. La seule solution possible est de faire grandir l'analyse technico-matérielle de la peinture murale, cette branche encore jeune de la recherche toichographologique, à travers des rencontres régulières et spécifiques, qui renforcent les collaborations déjà établies et contribuent au processus de partage des données, indispensable pour faire évoluer la connaissance de la technique picturale antique.

Beaucoup de chemin a déjà été parcouru mais la route est encore longue... Le meilleur souhait que l'on puisse formuler est que les pistes qui sont ici proposées soient bien accueillies par la communauté scientifique et qu'archéologues, physiciens, chimistes, géologues et restaurateurs continuent à dialoguer afin d'exploiter au mieux ce filon de la recherche, qui commence seulement à révéler toute sa richesse.

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ARCHAEOOMETRY AND ROMAN WALL PAINTING: THE CASE OF PRE-HADRIANIC PAINTINGS IN OSTIA ANTICA¹

Susanna Bracci, Emma Cantisani, Stella Falzone, Martina Marano, Paolo Tomassini

ABSTRACT

Il presente contributo, suddiviso in cinque articoli, vede riuniti insieme archeologi, chimici e geologi aventi un obiettivo comune, quello di analizzare e comprendere le caratteristiche tecniche e i processi produttivi della pittura di Ostia, con particolare riguardo per i contesti frammentari. In questo e nei seguenti articoli si vuole dimostrare l'importanza di un approccio combinato che unisce allo studio archeologico degli intonaci quello archeometrico. Solo applicando e coniugando i metodi delle diverse discipline si può tentare di rispondere ad alcune, frequenti, domande come ad es.: quali sono le analisi attualmente realizzate nei diversi laboratori per determinare la composizione chimica dei pigmenti e le componenti geologiche degli strati preparatori di malta delle pitture antiche? Che tipo di dati forniscono tali analisi? Fino a che punto l'archeometrista e l'archeologo possono spingersi nell'utilizzo e nell'interpretazione dei dati ottenuti? Lo studio archeometrico fornisce la prova scientifica all'identificazione delle botteghe di decoratori, effettuata su base stilistica? Trovare le stesse "ricette" per il confezionamento di malte e pigmenti in un unico contesto urbano significa realmente aver identificato l'opera di un'unica bottega? I contesti pittorici pre-adrianei di Ostia si presentano come terreno fertile per questo tipo d'indagine: in particolare lo studio archeometrico degli intonaci di Quarto Stile messi in luce in diversi settori della città ha permesso l'acquisizione di nuove informazioni sulla produzione pittorica di I sec. d.C. e sul lavoro delle botteghe, verosimilmente botteghe locali, che hanno utilizzato le stesse materie prime, le stesse miscele di pigmenti e lo stesso repertorio decorativo.

PAROLE CHIAVE: archeometria, pittura romana, Ostia, Quarto Stile, pigmenti, strati preparatori di malta, tecnica, botteghe
KEY-WORDS: archaeometry, Roman Painting, Ostia, Fourth Style, pigments, mortars, technique, craftsmanship

In order to illustrate the potential of the "technical approach" in the study of ancient wall paintings, the archaeological site of *Ostia Antica* appears as an excellent case study. *Ostia Antica*, the harbour of Rome, offers a particularly rich field of investigation, with its numerous testimonies of Roman wall painting, covering ca. seven centuries of Roman art, from the 2nd c. BC to the 5th c. AD². The excellent state of preservation and the variety of the paintings – fragmentary and *in situ*, decorating walls and ceilings – offer a diachronic and accurate view of the evolution and the change of Roman painting. Ostia is mainly known for the paintings from its *insulae*, the multi-storey buildings dating to the 2nd c. AD, which are among the rare testimonies of the "post-Pompeian" pictorial production of central Italy³. In the last years, recent studies have brought to light several fragmentary contexts belonging to the so-called Pompeian Styles, showing a previously unknown

¹ The authors would like to express their gratitude to the *Parco archeologico di Ostia antica* for their support, and especially to Angelo Pellegrino, who made the analyses possible. We would also acknowledge the *Fonds de la Recherche Scientifique* - FNRS for the funding obtained and Adelaide Steinfield for her precious and accurate reading of the paper.

² For a general overview of Ostia's pictorial production, see FALZONE 2007.

³ See FALZONE 2007, pp. 51-129 with bibliography. For a recent in-depth analysis of one of the most famous Ostian pictorial contexts of the 2nd c. AD, the so-called *Case a Giardino*, see also FALZONE, ZIMMERMANN 2010, pp. 107-160; FALZONE, PELLEGRINO 2014, pp. 88-195. For a general analysis of the Roman mid imperial age pictorial production see BALDASSARRE *et alii* 2006, pp. 278-343.

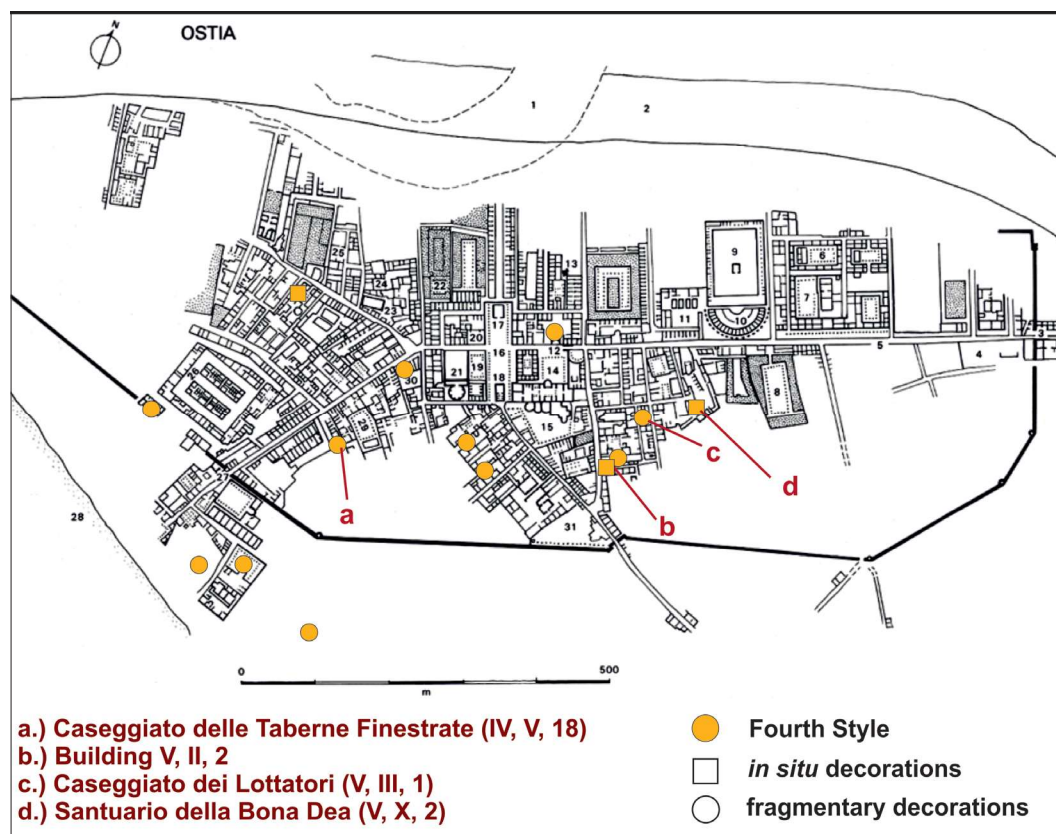


Fig. 1 - Ostia, plan of the city with localization of the Fourth Style paintings and of the studied buildings (elab. P. Tomassini).

page of the history of the city, which was occupied in the late Republic and first Imperial age by richly decorated *domus*, not inferior in terms of quality to the finest buildings in the capital⁴. Much has thus been done by modern research. However, the previous studies were mainly interested in stylistic and art-historical aspects, but the question of the technique was only rarely been tackled, except in isolated cases⁵. Working on fragmentary paintings, it is possible to observe not only the decoration but also the mortar layers. Therefore, the fragments allow the analysis of technical aspects, concerning for example the execution technique and the production processes, much more than it would be possible on *in situ* paintings. This first part of the book will try to demonstrate, with practical examples, how fruitful the collaboration between archaeologists, chemists and geologists can be, on single contexts but also on broader and more complex questions concerning

⁴ Concerning the First Style decorations in Ostia see FALZONE, TOMASSINI 2019, pp. 117-120; concerning the Second Style see DE RUYT, ALAVOINE 2007, pp. 113-121; MORARD 2007, pp. 55-80; BOCHERENS 2012; FALZONE 2017, pp. 335-337; FALZONE 2020 and MARANO, TOMASSINI forthcoming-a; concerning the Third Style see FALZONE 2007, pp. 38-42 with bibliography and FALZONE 2017, pp. 335-337; concerning a general analysis of the Fourth Style fragments see FALZONE 2007, pp. 42-47 with bibliography; FALZONE 2017, pp. 337-338; MARANO, TOMASSINI 2018, pp. 503-512 with bibliography and MARANO, TOMASSINI forthcoming-b.

⁵ See FALZONE *et alii* 2010, pp. 925-929; CIAFREI *et alii* 2013, pp. 191-202; TERRAPON 2007, pp. 81-98; FALZONE, MARANO, TOMASSINI 2021; HERENS forthcoming. More recently, a new phase of study has started, thanks to two different projects carried out on Ostian later paintings. The first is part of a whole reconsideration of the *Case a Giardino* complex through virtual archaeology and archaeometry, carried out by P. Ruggendorfer with S. Falzone, both from the *Institut für Kulturgeschichte der Antike - Österreichische Akademie der Wissenschaften* in Vienna, in collaboration with the *Parco archeologico di Ostia antica*, the *Sapienza Università di Roma*, the *Deutsches Archäologisches Institut Rome*, the *Österreichisches Historisches Institut Rom* and *University of Applied Arts in Vienna*. The second project is conducted by P. Tomassini on the pictorial technique of Ostia through the centuries, along with the *École française de Rome* and in collaboration with the *Pratt Institute of New York* (E. Del Federico) and the *Institute of Macromolecular Chemistry* of the Aachen University (B. Blümich).

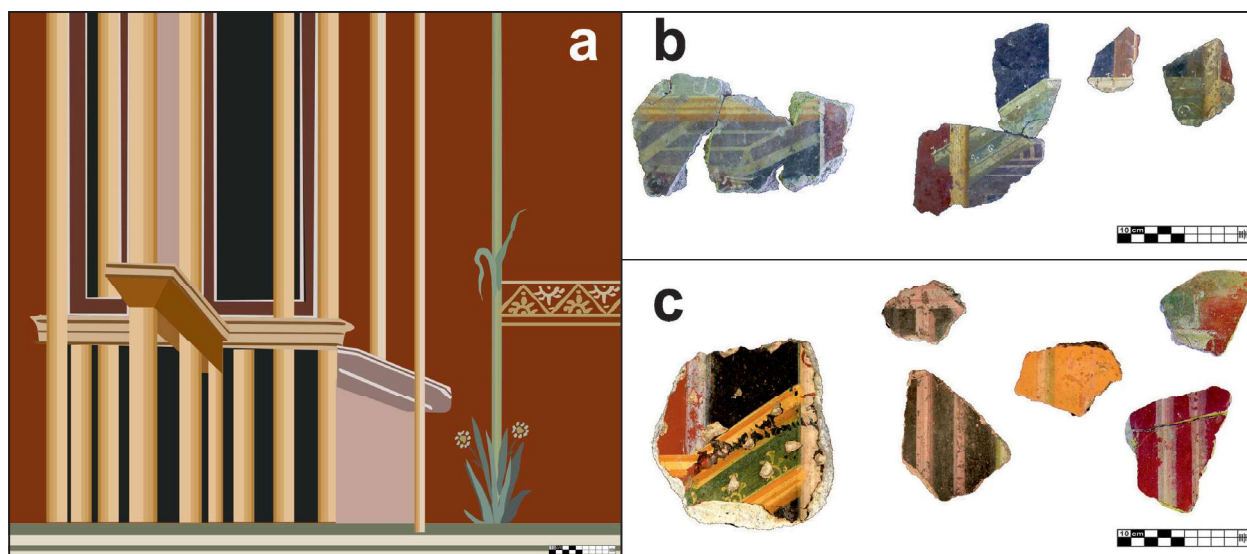


Fig. 2 - Ostia, Fourth Style paintings with architectural elements: a. *Santuario della Bona Dea*; b. *Caseggiato dei Lottatori*; c. *Caseggiato delle Taberne Finestrate* (elab. M. Marano, P. Tomassini).

the pictorial production of Ostia in the 1st c. BC - 1st c. AD. In this and in the following papers, we will present the first results of the collaboration between archaeologists and archaeometrists with a focus on the Ostian Fourth Style fragmentary paintings now stored in the *Nuovi Depositi* in Ostia. The Fourth Style, following the famous classification of the Pompeian paintings by August Mau⁶, conventionally refers to the paintings dating from the second half of the 1st c. AD and probably the beginning of the 2nd c. AD⁷. In Ostia, Fourth Style paintings are mostly preserved through fragments, with two notable exceptions: the *Santuario della Bona Dea* in the 5th region, which preserves the *in situ* decoration of the portico⁸, and the building V, II, 2 which preserves a white wall painting with red panels framed by embroidery borders⁹. Pre-Hadrianic paintings in Ostia are rarely preserved on large surfaces because of the significant renovation works undergone in the city in the 2nd c. AD, after the building of the new port of Trajan in *Portus*, which entirely transformed the appearance of Ostia¹⁰. Nevertheless, Fourth Style fragments are largely attested, and they have been discovered all over the excavated area of the ancient city (fig. 1). This important presence of Fourth Style fragments is probably to be linked to the first wave of prosperity brought to the city by the construction of the port basin in *Portus* by emperors Claudius and Nero, which led to many construction works in the city¹¹. Four different fragmentary Fourth Style contexts have been analysed in this study: the *Caseggiato dei Lottatori*, the *Caseggiato delle Taberne Finestrate*, the building V, II, 2 and a group of fragments of unknown provenance, found in the archaeological deposit of the *Insula di Bacco Fanciullo*. Thanks to a patient work of recomposition, several wall and ceiling decorations have been reconstructed, showing the high level of the artisans and the wealth of the patrons¹².

⁶ MAU 1882.

⁷ For recent studies on Fourth Style wall paintings in the Vesuvian area (with a deepening on the Fourth Style chronology) see ESPOSITO 2009, especially pp. 16-17; ESPOSITO 2014.

⁸ FALZONE 2007, pp. 42-44; MEDRI, FALZONE 2018, pp. 53-64 with bibliography; TOMASSINI 2019b, pp. 83-84.

⁹ FALZONE 2007, p. 44 with bibliography.

¹⁰ Concerning *Portus* see KEAY, PAROLI 2011; concerning the 2nd c. AD architecture in Ostia see DELAINE 2002, pp. 41-102; HEINZELMANN 2002, pp. 103-122.

¹¹ MORELLI, MARINUCCI, ARNOLDUS HUYZENDVELD 2011, pp. 47-65; FALZONE 2018b, p. 94.

¹² Members of the CeSPRO separately published the Ostian Fourth Style contexts. For more information we recommend the following papers: TOMASSINI 2014; CONTE *et alii* 2017, pp. 344-347; FALZONE 2017, pp. 337-338; MARANO 2017b, pp. 349-353; CONTE *et alii* 2018; FALZONE 2018b, pp. 94-97; FALZONE *et alii* 2018, pp. 200-202; MARANO 2018b; TOMASSINI 2019a, pp. 70-73. A first synthesis of the Fourth Style production in Ostia has been recently published in the



Fig. 3 - Ostia, *Nuovi Depositi*. Comparative view of the mortar layers of four fragments from the *Caseggiato delle Taberne Finestrate*: from the 2nd c. BC to the 2nd c. AD (elab. P. Tomassini).

A close comparison between the different contexts revealed how similar they are in terms of decoration (fig. 2), the use of common schemes and motifs. In a paper published in 2018, it was said that Ostian Fourth Style paintings share a taste for light architectural elements rendered always in the same manner, with a succession of coloured bands, generally yellow and orange, green and grey or pink and purple, giving the impression of relief¹³. These architectural elements, generally used to subdivide the wall into panels, tend to exceed the limits of the single panels (fig. 2; see also fig. 2 in both papers of P. Tomassini and M. Marano in this book)¹⁴. Another example of the homogeneity of Ostian Fourth Style paintings comes from single motifs and small decorative elements, which seem to have been painted following the same models. It is the case of various vegetal elements, as garlands, plant stems, leaves and flowers¹⁵, but also of more specific and peculiar motifs. We are thinking in particular to a plant-like peacock feather, painted in purple, green and pink colours and enriched with yellow and green vine leaves; the feather probably belonged to a *candelabrum* motif, as it is sometimes found in the Vesuvian towns¹⁶. This motif is replicated in the exact same manner in the *Caseggiato delle Taberne Finestrate*, in the *Caseggiato dei Lottatori* and in the V, II, 2 building (see respectively fig. 11 of P. Tomassini's paper, fig. 8 of M. Marano's paper and fig. 1 in the last paper of the Ostia section in this book)¹⁷.

Similarities between the Fourth Style contexts do not concern only the motifs and decorations. In fact, the mortar layers of the different Fourth Style fragments in Ostia are also very homogeneous,

proceedings of the 13th and 14th AIPMA Conferences, see MARANO, TOMASSINI 2018, pp. 503-512; MARANO, TOMASSINI forthcoming-b.

¹³ MARANO, TOMASSINI 2018, p. 509.

¹⁴ This peculiarity is not common in other Fourth Style decorations. For example, in Pompeii, the only known cases are in the *Casa di Sallustio* (*cubiculum* 33; PPM IV, 780-800) and the *Casa dei Capitelli Colorati* (*æcus* 14; PPM VI, 1010-1011).

¹⁵ See MARANO, TOMASSINI 2018, pp. 509-510, fig. 7.

¹⁶ Although rare, it is attested in the *Casa di Umbricius Scaurus* in Pompeii (PPM VII, 1096), on the ceiling of the room *a* of the *Casa del Salone Nero* in Herculaneum (BARBET 2009, p. 173) and in the portico 60 of the *Villa A (di Poppea)* in Oplontis (CLARKE, MUNTASSER 2019, especially chapter 4 by D. Esposito, loc. 369-388).

¹⁷ See MARANO, TOMASSINI 2018, pp. 509-510, fig. 8.

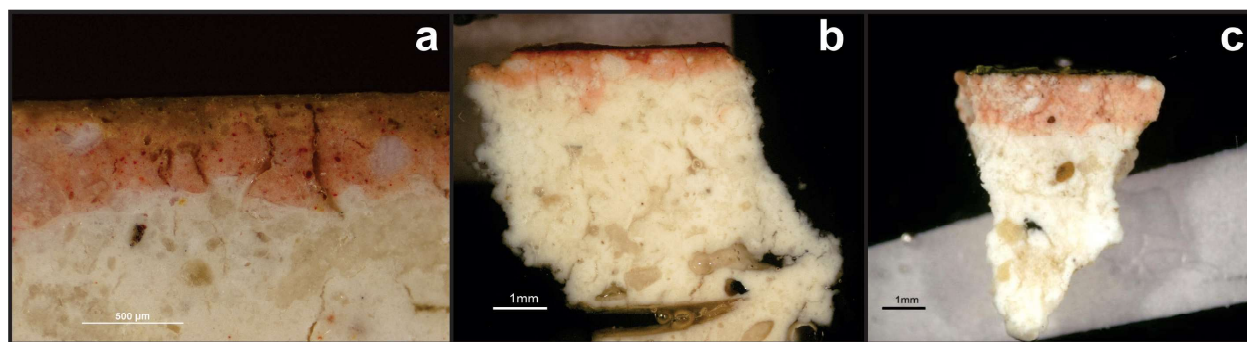


Fig. 4 - Ostia, *Nuovi Depositi*. Cross sections of the *intonachino* layer of three Fourth Style fragments with the red under-layer: a. sample OS_PI_B4 from the *Caseggiato delle Taberne Finestrate*, yellow background; b. sample OS_PAV_1 from the *Caseggiato dei Lottatori*, red background; c. sample OS_PIV_5 from the deposit of the *Insula di Bacco Fanciullo*, black background (elab. E. Cantisani).

in terms of both composition and layout of the mortars (for more details see the paper of M. Marano and P. Tomassini in this book)¹⁸. A macroscopic observation of the mortars is sufficient to distinguish the Fourth Style fragments from earlier examples, which are characterized by thicker layers (especially concerning the *intonachino*) and from later examples, which on the other hand are of an inferior quality (fig. 3)¹⁹. Moreover, a close observation of the Fourth Style fragments showed two recurrent features in the plastering technique of the walls. First, in all the known examples, the low zone and the median zone are plastered during the same *giornata*; secondly, it is very common to find a red under-layer, permeating the *intonachino* layer, visible under red, black and yellow background colours (fig. 4)²⁰. All these stylistic and technical similarities between the contexts, coming from different areas of the city, could suggest the paintings were executed by the same workshop, or at least that the Ostian painters used very similar techniques and drew their inspiration from the same repertoire. In this optic, archaeometry seemed to be the best way of testing these hypotheses and to see whether the arguments collected during the macroscopic analysis would be confirmed or not by the microscopic analyses.

For this reason, a collaboration was set up between the *Centre d'Étude des Monde Antiques* of the *Université catholique de Louvain* (CEMA), the *Centro Studi Pittura Romana Ostiense* (CeSPRO) and the *Istituto per la Conservazione e la Valorizzazione dei Beni Culturali* in Florence (ICVBC). Thanks to the expertise of the ICVBC in the field of archaeometry applied to ancient painting, it was possible to examine 27 fragments from the four buildings already mentioned, in order to identify the raw materials used and understand the execution techniques.

In this paper we have presented the premises that led to the fruitful collaboration between archaeometrists and archaeologists. The following paper, written by S. Bracci and E. Cantisani, is dedicated to the laboratory methods and techniques used on the fragments. Then P. Tomassini and M. Marano will focus on the two main *ensembles* analysed, respectively the *Caseggiato delle Taberne Finestrate* and the *Caseggiato dei Lottatori* providing a detailed account of each sample and recontextualizing the fragments through the archaeological perspective. In the last paper, the same authors will present the results of the archaeometric analyses of two other Ostian Fourth Style samples (from the V, II, 2 building and from the deposit of the *Insula di Bacco Fanciullo*) and will propose some conclusive reflections in the light of the comparison between all the analysed contexts.

¹⁸ MARANO, TOMASSINI 2018, pp. 507-509, fig. 6.

¹⁹ FALZONE, MARANO, TOMASSINI 2021.

²⁰ Similar traces have been found in Aquileia (see the paper of DILARIA *et alii* in this book).

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FRAGMENTS OF WALL PAINTING FROM OSTIA: THE APPROACH TO DIAGNOSTIC AND ARCHAEOMETRIC STUDIES

Susanna Bracci, Emma Cantisani

INTRODUCTION

The study and the knowledge of the original materials, the techniques and the executive procedures are essential prerequisites for the evaluation of this type of artwork, for its geo-chronological collocation, the possible attribution, and, not less important, for the identification of the ongoing degradation phenomena. The knowledge of the materials of the artwork and its state of conservation is also at the basis of a correct and conscious restoration intervention.

In the framework of the collaboration set up between the *Centre d'Étude des Mondes Antiques* of the *Université catholique de Louvain* (CEMA), the *Centro Studi Pittura Romana Ostiense* (CeSPRO) and the *Istituto per la Conservazione e la Valorizzazione dei Beni Culturali* of the *Consiglio Nazionale delle Ricerche* in Florence (ICVBC, now ISPC), as part of the FPO Project (Fragmentary Paintings from Ostia), ICVBC examined a series of fragments from different contexts of the city, in order to identify the raw materials used and understand the execution techniques. In this paper the protocol applied to the set of fragments will be described and discussed with particular attention to the techniques employed.

ANALYTICAL PROTOCOL

Nowadays a high number of techniques are available for the analysis of wall paintings¹ or more generally works of art, starting from methods that are non-invasive, portable, with possible *in situ* use up to laboratory techniques or analyses conducted on the synchrotron lines of big facilities dedicated to cultural heritage². Taking into account that a single technique that can answer all questions placed in the archaeometric field does not exist, a choice has to be done to implement an efficient analytical protocol. A multidisciplinary approach is therefore currently privileged as the drawbacks of a single diagnostic technique can be overcome by integrating and implementing the data set acquired³. The planning of the analytical protocol has to be based on different aspects such as the type of research questions (composition/fabrication condition), the type of material (extensive or limited possibilities of collecting samples) and the available resources (time, *in-situ/ ex-situ* availability, budget).

¹ BRACCI, BARTOLOZZI 2020.

² DEBASTIANI *et alii* 2016.

³ CLEMENTI *et alii* 2011; PARADISI *et alii* 2012; GIL *et alii* 2015; GAROFANO *et alii* 2016; GEBREMARIAM, KVITTINGEN, BANICA 2016; PEREIRA-PARDO *et alii* 2016; PROIETTI *et alii* 2016; AMATO *et alii* 2017.

For this study a two phase analytical protocol was chosen. The first step was based on non-invasive portable techniques and, once the results were acquired and evaluated, a second step based on the collection of a few samples to be analysed with other techniques was conducted. In the case of the Ostia fragments, the choice could have been the sampling of the various fragments of wall paint available. Non-invasive analyses on the fragments were preferred essentially for two reasons. The first reason is that thanks to the possibility to analyze large areas (with imaging techniques) or different points (with single spot techniques) on the same fragment, it is possible to obtain a general overview of the materials present. Sampling of a fragment, even if possible, is always necessarily very localized, small in size and may not fully represent all the materials present. The second reason is that in the continuation of the collaboration, *in situ* measurement campaigns may be planned, no longer on fragments but on wall paintings still in original position where the non-invasive approach will certainly be fundamental and the data acquired on the fragments will be a solid basis for comparison.

ANALYTICAL PROTOCOL – FIRST PHASE

In general, non-invasive analyses can be divided into two main groups on the basis of the type of data collected: imaging and single spot techniques. The imaging techniques included UV fluorescence (UVf), which is commonly used for mapping organic materials such as lakes⁴ or binders in *secco* paintings⁵. The other imaging technique used is Visible Induced Luminescence (VIL), a very powerful tool for mapping the presence of a specific pigment, Egyptian Blue⁶.

Photographic images were taken with a modified Canon EOS400D camera with the low-pass infrared filter removed. The camera was equipped with a mm 22.2 × 14.8 CMOS sensor with an effective resolution of 10.10 Mpixel and an RGB primary color filter. The images were recorded in RAW format with a nominal sensitivity of 100 ISO. White balance and exposure control were performed with the color calibration table. As sources, two Q Flash T5D-R by Quantum Instruments flashes were used, equipped with a filter holder ring. The following Schneider OpticsB + W filters were used to filter the different wavelengths, at the flash output. FORS spectra were acquired using a Tungsten source and an Ocean Optics spectrometer (model HR2000) equipped with optical fibers. The measuring head with 45° illumination and 0° signal collection allowed the acquisition of the reflectance spectrum of an area of about 2 mm². Each acquired spectrum was the average of 30 scans. As a reference, a Spectralon® plate (WS-1S-L Labsphere certified standard, 99% reflective material) was used. The acquired reflectance spectra were compared with reference data included in the ICVBC FORS spectral library of pigments⁷. For X-ray fluorescence measurements, a portable XRF spectrometer (Bruker, Tracer III SD) with micro X-ray tube with rhodium anode was used. The analysis was performed in the following conditions: 40 keV - 12 A. The irradiated area was about 155 mm². The spectrometer was equipped with an SDD detector (FWHM < 145 eV at 100.000 cps) cooled with a Peltier cell. Acquisition time for each spectrum was 60 s.

As already said, being both non-invasive techniques it was possible to acquire, for each fragment, more spectra in different color zones but also to repeat the measurements in areas of the same color but in different points. All the spots and areas analysed were documented with a portable digital microscope with different magnification (Scalar DG-2A, optical zoom 25-200x, magnification @ 25x - area mm 13 x 8).

⁴ BUZZEGOLI, KELLER 2009; BARTOLOZZI *et alii* 2017.

⁵ MOUNIER *et alii* 2011; PICOLLO *et alii* 2016.

⁶ ACCORSI *et alii* 2009; VERRI 2009; DYER, VERRI, CUPITT 2013; NICOLA *et alii* 2018.

⁷ ICVBC-CNR FORS database.

ANALYTICAL PROTOCOL – SECOND PHASE

As already mentioned above, based on the results of the first phase, samples were taken from selected fragments. The samples were selected to answer those questions that non-invasive investigations can not, by their nature, give an answer. In particular, we refer to all the stratigraphic and morphological information not otherwise obtainable of the pigment levels or of the materials constituting the plaster. Once the micro samples had been taken, they were documented with a microscope, and subsequently, thin and cross sections were obtained embedding the sample in a special resin. In general, cross sections⁸ are used to study pigments by observation with an optical microscope in reflected light under different magnifications according to the available microscopy objectives⁹. In this case a Nikon Eclipse E600 optical microscope has been used. Oriented thin section (thickness μm 30) were used for studying plasters and observed and analysed under a polarized optical microscope. A Zeiss A.1 AxioScope optical microscope, combined with a camera with high resolution, a dedicated software for the image elaboration and measuring of main characteristics of materials, was used. Images with magnification from 2.5x to 40x were elaborated.

A mortar/plaster can be defined as «a mixture of inorganic or organic binder, aggregates, water and possible addition of organic/inorganic additives in such proportions as to confer to the mixture, in the fresh state, a suitable workability and, in the hardened state, suitable physical, mechanical, and aesthetic characteristics, with good durability»¹⁰. So a mortar is realized with binder, aggregate, water, possible addition of materials providing hydraulic characteristics, possible additives and admixtures. The petrographic approach allows a deepened characterization of binder, aggregate and inorganic additives and admixtures in a mortar/plaster¹¹. Using this method number and thickness of each strata, cohesion among strata can be investigated, together with the ratio between the binder and the aggregate, the composition of the aggregate and its distribution in the mixture, the characteristics and composition of the binder, the addition of material providing hydraulic characteristics, the porosity, the behaviour towards alteration. Some suggestions on technology used for the preparation of mixture and application of painting layers can be obtained. The study of binder in an ancient mortar can be performed directly on the binder or on “lumps”. The lumps are described with «a whitish appearance, sometimes inconsistent»¹². In some cases the observation in a thin section of these lumps, as reported by several contributors¹³, allows us to recognize the type of carbonate rock burnt in the kiln. The lumps, indeed, can be referred to binder not well mixed in the paste, under burnt fragments (remnants of under burnt limestone), over burnt fragments of limestone, hydrated and carbonated over burnt fragments after the setting reaction of the mortar.

The observation of thin sections under optical microscope allows the definition of mineralogical composition, of texture (micritic, microsparitic, sparitic), of structure (homogeneous, heterogeneous, with lumps), of interaction with the aggregate or the binder. In particular it allows the recognition of materials providing hydraulicity to the mixture, such as *pozzolana* or *cocciopesto* (crushed ceramics). *Pozzolana* and *cocciopesto*, containing silicium and aluminium, react with lime and determine the formation of hydrated calcium silicate and hydrated calcium aluminium silicate, able to set in condition of high humidity or even in underwater environments. In the thin section reaction rims and new phases can be recognized. The aggregate of a mortar/plaster, acting as a framework, is the component of the mortar which opposes to the shrinkage phenomena which give rise to cracks. It can be of natural origin or obtained by crushing rocks or minerals. In the first case it is an incoherent material of sedimentary origin, such as river sand, sea beach sand, quarry sand from marine or

⁸ DERRICK *et alii* 1994.

⁹ BRACCI 2018.

¹⁰ UNI 10924 2001.

¹¹ PECCHIONI, FRATINI, CANTISANI 2014; PECCHIONI, FRATINI, CANTISANI 2018.

¹² BUGINI, TONIOLO 1990.

¹³ HUGHES, LESLIE 2001; FRATINI, PECCHIONI, CANTISANI 2008.

continental deposits, fine gravels from detritus slope deposits, incoherent deposits of pyroclastic origin. In the second case the material, with generally sandy size, is obtained by grinding rocks or minerals such as calcite veins. This material can be used just like this or it can be sieved and/or mixed to obtain the desired grain size distribution. The observation in thin sections allows us to recognize: the mineralogical and petrographic composition of aggregate and, then, to identify the provenance of raw materials, the grain size (mean size, grain size distribution) and shape (rounding and sphericity) that permit the identification of the selection/sieving of aggregate and the natural (sand) or artificial (crushed rocks) origin, the distribution of aggregate in the mixture that suggests the type of care used in the preparation of the mixture, the orientation of the grains that allow identifying the type of application, for example, of a plaster. According to the amount of binder compared with the aggregate, it is possible to distinguish pastes with high binder/aggregate ratio (fat mortars) and pastes with a low binder/aggregate ratio (lean mortar). The observation of thin sections allows also the description of macroporosity, with the definition of aspect of pores, the distribution and the percentage in volume and the description of admixtures (i.e. straw, wood), if present. With regard to raw materials used in the realization of a mortar, this type of study provides information on the supply areas. The use of different raw materials can be linked to the change in the commercial network/transport or the development of new production processes, or to gain new knowledge with respect to the Material Culture of the archaeological site. Furthermore, both thin and cross sections were analysed by using SEM-EDS for the identification of materials. Scanning electron microscopy (SEM) is a method for high-resolution imaging of surfaces. Advantages of SEM over light microscopy include much higher magnifications (300,000x) and a greater depth of field up to 100x compared to optical microscopy¹⁴.

The SEM generates a high-energy beam of incident electrons in an electron column above the sample chamber. The energy of the incident electrons can be as low as 100 eV or as high as 30 keV depending on the examination aims. The incident electrons cause electrons to be emitted from the sample. High-energy electrons that are ejected by an elastic collision of an incident electron, typically with a sample atom's nucleus, are referred to as *backscattered electrons*. Emitted lower-energy electrons resulting from inelastic scattering are called *secondary electrons*. Secondary electrons provide high-resolution imaging of fine surface morphology.

Backscatter electrons provide image contrast as a function of elemental composition and surface topography. Higher atomic number elements appear brighter than low atomic number elements. Qualitative chemical analysis information is obtained using an energy dispersive X-ray spectrometer (EDS or EDX) coupled with the SEM. Characteristic X-rays are emitted from a sample when an electron beam irradiates it. EDS detects and analyses these, and determines the chemical elements contained in the sample. The EDS X-ray detector measures the relative abundance of emitted X-rays versus their energy. The analysis is performed as a point measurement or in mapping mode. Usually, in conventional SEM the samples must be conductive or covered with graphite to avoid the accumulation of charge on the surfaces which would make the analysis impossible. In our case the instrument used was an ESEM (Environmental SEM, Quanta FEI 200) where the samples could be analyzed in low vacuum (1 torr), which avoids metallizing the sample or the section. Therefore, in this modality, this analysis can be considered non-invasive with respect to the sample/section. Furthermore, in some cases, further sampling under microscope of specific parts of the sample was also carried out and the materials were analyzed with FTIR or with XRD.

Fourier Transform Infrared (FTIR) spectroscopy is an analytical technique capable of providing a molecular characterization of the various materials of artistic interest. Here the ATR (Attenuated Total Reflectance) configuration was used. The instrument used was Alpha Bruker and each spectrum was the mean of 128 scans @ 4 cm⁻¹ resolution.

¹⁴ For more information concerning this technique, see the paper of J. Weber and A. Baragona in this book.

A small amount of powder obtained from samples was analyzed using an X-ray diffractometer. This technique allows the identification of crystalline phases present in a powder. It was used for pigments and plasters. In the case of plasters, it is not possible to distinguish crystalline phases belonging to binder with respect to those belonging to the aggregate. A X'Pert Pro PanAnalytical diffractometer for powders with Cu anticathode was used. In order to reduce the amount of powder to be analyzed, a zero-background sample stage was used.

RESULTS

FIRST PHASE – NON INVASIVE ANALYSES

We report the results obtained by showing some significant examples. The detailed presentation of the samples with the results of the analyses on the pigments and the mortars can be found in the tables of the following contributions by P. Tomassini and M. Marano, with an archaeological, stylistic and chronological recontextualization.

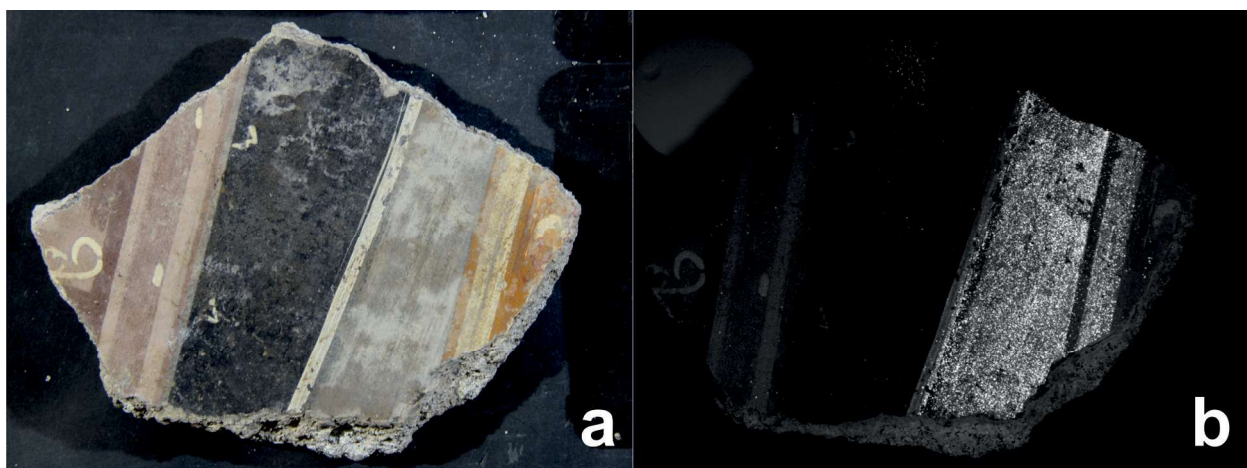


Fig. 1 - Ostia, *Nuovi Depositi*. Fragment OS_PIV_2 from the *Caseggiato dei Lottatori*: a. VIS image; b. VIL image (elab. S. Bracci).

None of the 27 fragments analyzed gave a positive response to the observation with ultraviolet light. From this we can deduce that there are neither organic pigments (e.g. lakes) nor pigments applied *a secco* (with organic binder). Furthermore, conservative treatments that have used fluorescent organic materials (e.g. waxes, etc.) can be excluded. In the case of the VIL technique, many Fourth Style fragments have given a positive response. In *fig. 1*, the visible (VIS) and VIL images of the fragment OS_PIV_2 from the *Caseggiato dei Lottatori* are reported. The bright luminescence highlights the presence of Egyptian Blue, even if it was invisible to the naked eye. In fact, the Egyptian Blue pigment has not been used exclusively to create blue motifs: in Ostia it is present in green, yellow and gray decorative elements, such as the peacock feather from the *Caseggiato dei Lottatori* (OS_PAV_1) (*fig. 2*).

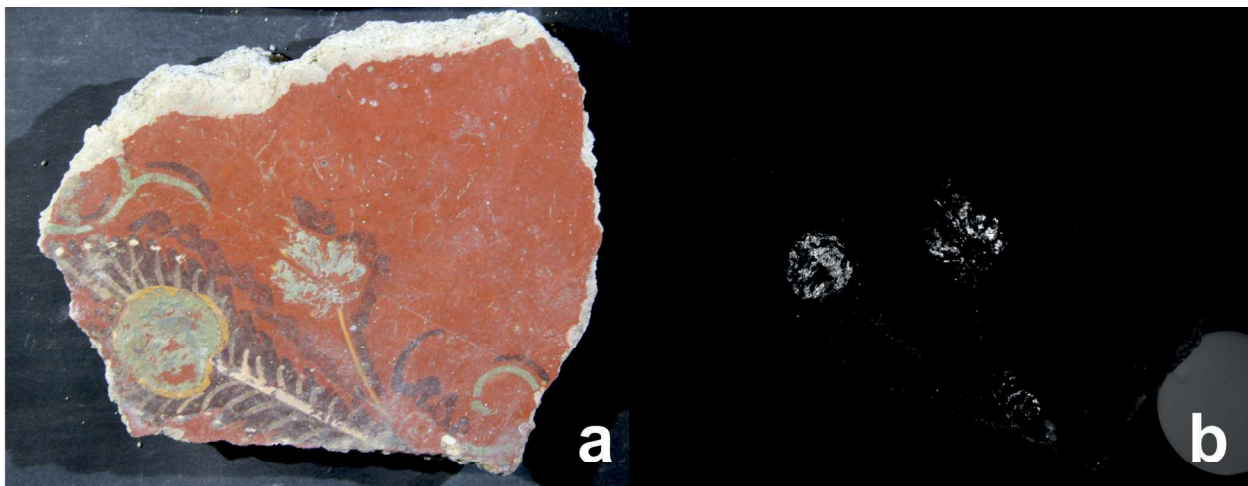


Fig. 2 - Ostia, *Nuovi Depositi*. Fragment OS_PAV_1 from the *Caseggiato dei Lottatori*: VIS (a) and VIL (b) images (elab. S. Bracci).

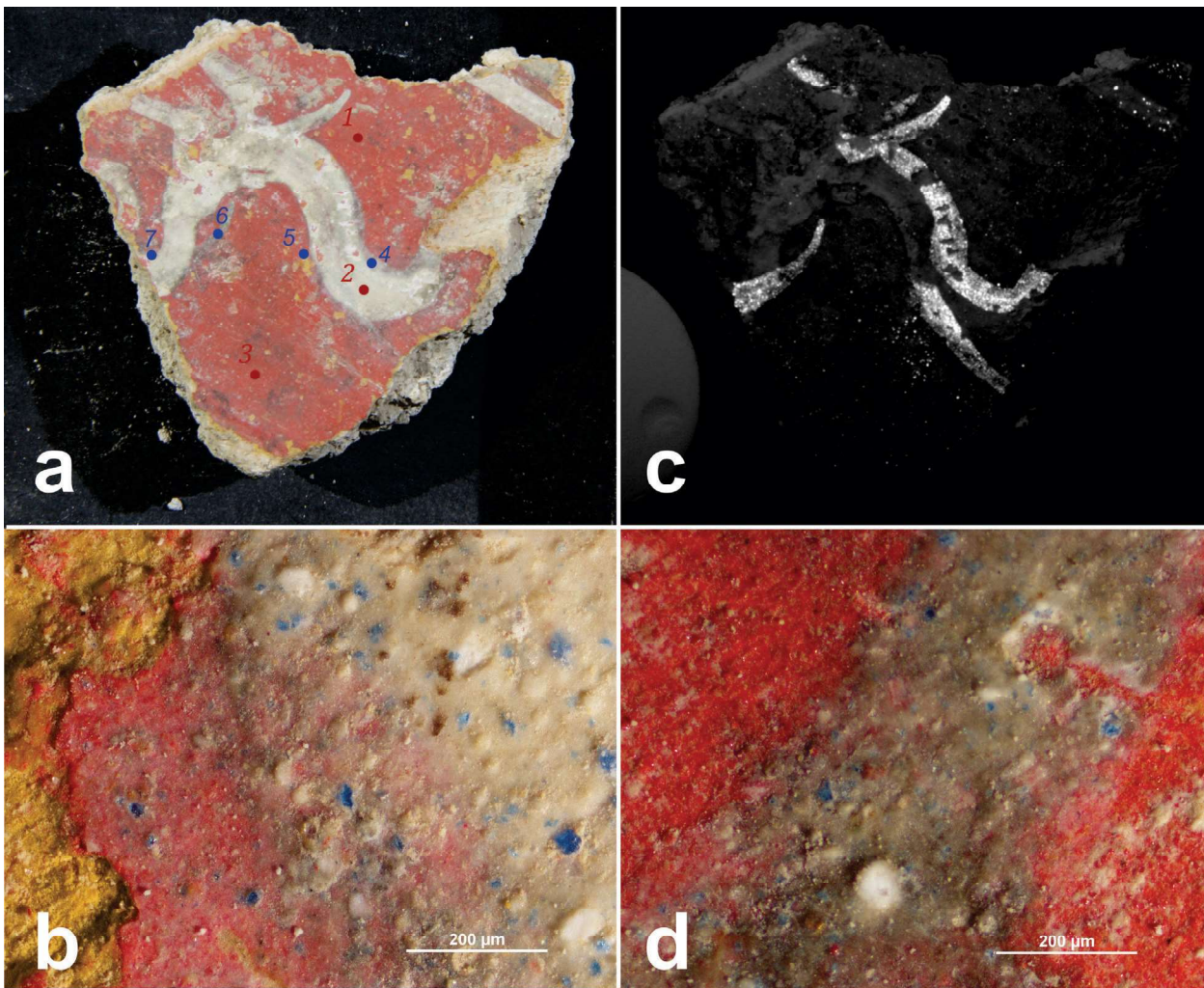


Fig. 3 - Ostia, *Nuovi Depositi*. Fragment OS_PI_B3 from the *Caseggiato delle Taberne Finestrate*: a. VIS image; b. microphoto with digital microscope (point 5); c. VIL image; d. microphoto with digital microscope (point 6) (elab. S. Bracci).

Another fragment deserving special attention is the sample OS_PI_B3, from the *Caseggiato delle Taberne Finestrate*. The fragment belongs to one reconstructed wall¹⁵ and shows a small white marine animal painted inside a red frame (fig. 3a). To the naked eye, the motif appears to be white, but the VIL image clearly shows traces of Egyptian Blue, as can be seen in fig. 3c, although there are no green or blue elements. The drawn lines containing Egyptian Blue do not follow the white colour decoration but overlap and cross it. The presence of the Egyptian Blue is clearly visible even in images acquired under an optical microscope (fig. 3b, d). The reason for this overlap is not clear because the fragment is small. It would be interesting to understand whether this presence is confirmed on similar fragments.

The spot test analyses conducted after the imaging survey gave information about all pigments present on the fragments. For each fragment at least one point for each colour was analysed. In fig. 4 and fig. 5, data acquired with FORS and XRF are reported for fragments OS_PI_A1 and OS_PI_B2 from the *Caseggiato delle Taberne Finestrate*.

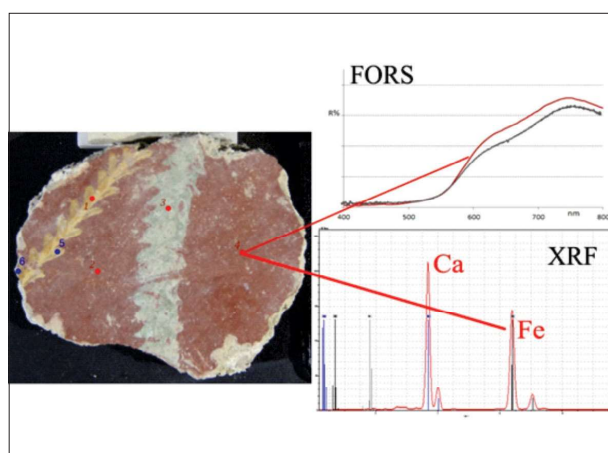


Fig. 4 - Ostia, *Nuovi Depositi*. Fragment OS_PI_A1 from the *Caseggiato delle Taberne Finestrate* with the indication of measured points. On the right of the picture: FORS spectrum of point 4 (red line) compared with reference spectrum of red ochre (gray line) and XRF spectrum of the same point 4 showing calcium (Ca) and iron (Fe) (elab. S. Bracci).

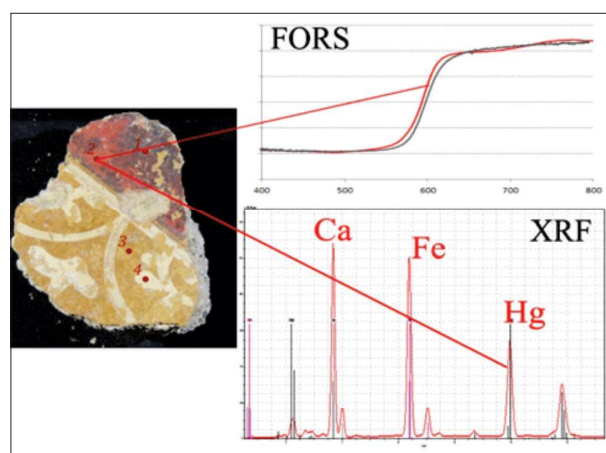


Fig. 5 - Ostia, *Nuovi Depositi*. Fragment OS_PI_B2 from the *Caseggiato delle Taberne Finestrate* with the indication of measured points. On the right of the picture: FORS spectrum of point 2 (red line) compared with reference spectrum of cinnabar (gray line) and XRF spectrum of the same point 2 showing signals of calcium (Ca), iron (Fe) and mercury (Hg) (elab. S. Bracci).

SECOND PHASE – ANALYSES OF SAMPLES

The mineralogical and petrographic approach allows to identify the number and the composition of the mortar layers. All the samples are characterized by the presence of a layering represented by: a painted layer, an *intonachino* layer and an *intonaco* layer. The samples OS_PI_A4¹⁶ and OS_PI_B4¹⁷ from the *Caseggiato delle Taberne Finestrate* are characterized by a similar layering, which confirms that they belong to the same wall, as it was supposed by P. Tomassini on the stylistic and technical observation¹⁸.

¹⁵ See fig. 2 of P. Tomassini's paper in this book.

¹⁶ See fig. 6 of P. Tomassini's paper in this book.

¹⁷ See fig. 10 of P. Tomassini's paper in this book.

¹⁸ TOMASSINI 2019a, pp. 70-71, tav. XVI.1-2 with bibliography.

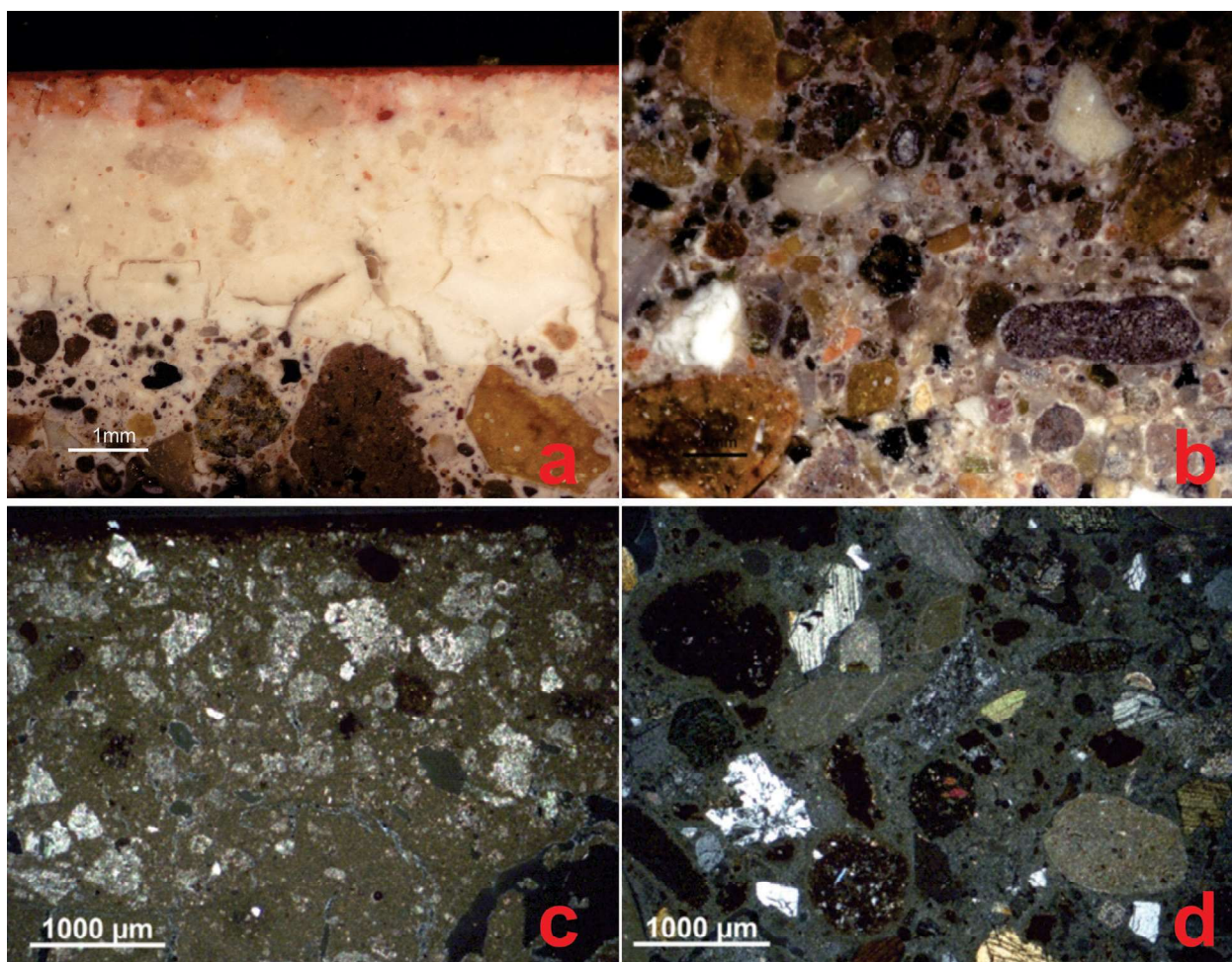


Fig. 6 - Ostia, *Nuovi Depositi*. Cross and thin sections of sample taken from fragment OS_PI_A4. a. and c. *intonachino*; b. and d. *intonaco* (elab. E. Cantisani).

In both cases, the layering consists of:

- a painted layer with a mean thickness of μm 100;
- an *intonachino* layer with a mean thickness of mm 4-5 realized with calcic lime added with carbonate rock fragments, with subangular shape and with grain size from mm 1 to μm 100. The aggregate is not evenly distributed in the mixture, indeed in the final portion of layer only fractured lime is present (fig. 6a, 6c);
- an *intonaco* layer realized with calcic lime added with red *pozzolana*, some fragments of carbonate rocks and single crystals of pyroxenes (fig. 6b, 6d). The ratio binder/aggregate is almost 1/3. The grain size of aggregate ranges from mm 1-1.5 to μm 100, the sub angular aggregate is well distributed in the mixture. The macroporosity is due to microcracks.

In these two samples, under the painted layer, a red “layer” with an irregular thickness was observed (the red colour is due to the addition of iron oxydes). The sample taken from fragment OS_PI_C1 from the *Caseggiato delle Taberne Finestrate* (peacock feather)¹⁹ has a similar layer, but a lower amount of *pozzolana* was added to *intonaco*, pyroxenes and rock fragments are more abundant. The

¹⁹ See fig. 11 of P. Tomassini’s paper in this book.

samples OS_PIV_1²⁰ and OS_PIV_2²¹ from the *Caseggiato dei Lottatori* have a similar stratigraphic layering with respect to the Fourth Style fragments from the *Caseggiato delle Taberne Finestrate* (OS_PI_A group and OS_PI_B group). The *intonaco* layer of the two samples from the *Caseggiato dei Lottatori* was generally obtained by mixing lime with an abundant amount of pyroxenes, carbonate rock fragments and minor amount of *pozzolana*. The mean ratio binder/aggregate is 1/3. The pyroxenes have a mean grain size of almost μm 800, while the rock fragments >1 mm. In the case of *intonachino*, a mixture of calcic lime and fragments of travertine was used. A red layer under the painted layer was also visible in both samples. Notable exceptions are the samples OS_PIV_3²² and OS_PIV_4²³ from the *Caseggiato dei Lottatori*, which have no red underlayer. This probably confirms the hypothesis of M. Marano that these fragments belong to another wall decoration.

The three fragments with the peacock feather also deserve to be mentioned. While the fragments from the *Caseggiato dei Lottatori* (OS_PAV_1) and the *Caseggiato delle Taberne Finestrate* (OS_PI_C1) are very similar in structure and composition of the mortar layers, the fragment from the V, II, 2 building (OS_PAV_2) has peculiar characteristics. In fact, OS_PAV_2 is different from any other sample examined, because, under the painted layer, a thin *marmorino* layer was present, realized by adding calcite to the lime. This layer covered an *intonaco* layer, obtained with *cocciopesto* and volcanic fragments²⁴.

Finally, the samples coming from a ceiling found in the *Caseggiato delle Taberne Finestrate* (OS_SII_1 to 6)²⁵ have an *intonachino* made of calcic lime added with carbonatic rock fragments and calcite, with subangular shape and with grain size from mm 1.5 to μm 100. The *intonaco* layer was obtained mixing lime with fragments of volcanic rocks, pyroxenes and carbonatic rocks. The volcanic rock fragments have a maximum grain size up to mm 4. For the sample OS_SII_4, two layers of *intonaco* were identified.

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²⁰ See fig. 3 of M. Marano's paper in this book.

²¹ See fig. 5 of M. Marano's paper in this book.

²² See fig. 6 of M. Marano's paper in this book.

²³ See fig. 7 of M. Marano's paper in this book.

²⁴ See fig. 1 of M. Marano and P. Tomassini's paper in this book.

²⁵ See figures 12 to 18 of P. Tomassini's paper in this book.

ANALYSING THE PAINTINGS, UNDERSTANDING THE PAINTERS: THE CASE OF THE *CASEGGIATO DELLE TABERNE FINESTRATE*

Paolo Tomassini

The *Caseggiato delle Taberne Finestrata* is a particularly rich context for the understanding of pre-Hadrianic painting in Ostia, with one of the largest amounts of plaster fragments found in the excavations, dating from the 2nd c. BC to the middle of the 2nd c. AD. Over 3000 fragments of various dimensions were studied and recomposed, which allowed the identification of several decorations of First, Second and Fourth Style among them¹. Thanks to the funding of the *Fonds de la Recherche Scientifique* – FNRS, it was possible to conduct archaeometric analyses on twenty-one samples. In this paper we will present the results of the analyses on 15 fragments, carried out on Fourth Style wall paintings.

THE CONTEXT

Before starting it is useful to spare some lines for the presentation of the context and the origin of the plaster fragments. The *Caseggiato delle Taberne Finestrata* is one of the so-called *insulae* of Ostia, the multi-storied residential and commercial buildings, that became very frequent in the city by the end of the 1st c. AD and especially the beginning of the 2nd c. AD, after an important phase of reassessment and transformation caused in part by the construction of Trajan's port basin². It is located in the fourth region of the city, along one of the main streets that led from the Forum to the *Porta Marina* (fig. 1). The building consists of several shops disposed around a very narrow courtyard, which is connected to the street by a long corridor, and by a backyard reachable by a long corridor. One of the main characteristics of the building is the presence of large windows next to the doors of the shops, which gave to the excavators the idea of its modern name, which can be translated as «the building of the shops with windows». The building was mostly unearthed during the intensive excavations of 1938-1939, which have preserved very few materials and archival record³.

The wall painting fragments were brought to light in 1973, during stratigraphic and more accurate excavations in one of the rooms of the building (in red on fig. 1), on the occasion of the restoration work on the mosaics covering the floor of the room. This excavation of 1973 helped identify the remains of a previous building, with two main building phases from the late Republic to the Julio-Claudian era, on which the foundations of the Hadrianic *caseggiato* rest⁴. The existence of this previous building was already known since the 1940s, when small surveys documented part of the plan, with a central courtyard occupied by a basin and a well, around which were disposed small

¹ See TOMASSINI 2019a, pp. 67-76.

² On the urban development of Ostia during the 2nd c. AD, see HEINZELMANN 2002, pp. 103-121; FALZONE 2007, pp. 52-54; DELAINE 2012, pp. 328-332; PAVOLINI 2018, pp. 34-35.

³ TOMASSINI 2016; TOMASSINI forthcoming.

⁴ TOMASSINI 2016; TOMASSINI 2018, pp. 201-206.

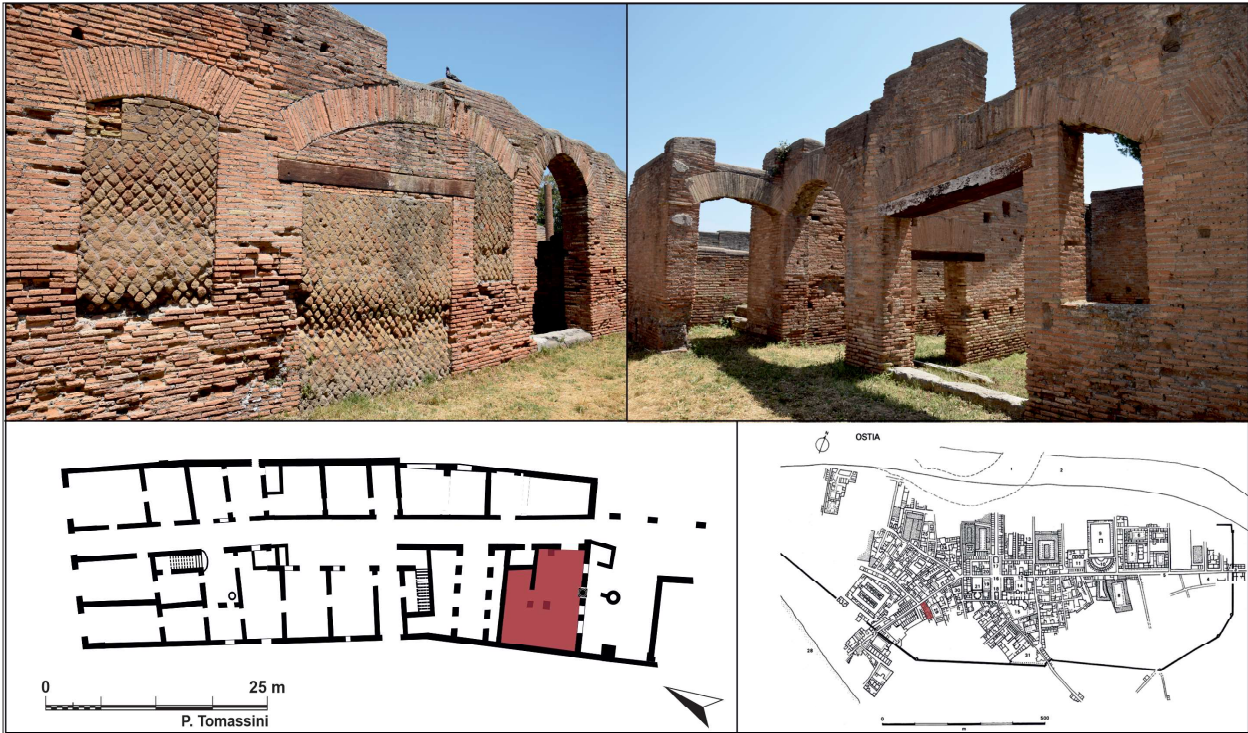


Fig. 1 - Ostia, *Caseggiato delle Taberne Finestrate* (IV, V, 18) – pictures, plan and localization (pictures and elab. P. Tomassini).

rooms⁵. The 1970's surveys brought to light the southern sector of the building, which was adorned by mosaic and concrete pavements. Formerly identified as a *domus* with *atrium*, the nature and actual function of this building has still to be discussed⁶. The wall painting fragments come mainly from three different layers, used to raise the ground level, a very common activity in Ostia due to the frequent floods and the upwelling of the groundwater⁷. The fragments could come from the building under the *Caseggiato delle Taberne Finestrate*, but they were all found in secondary position, without any clear relation to the original walls. It could also be possible that the paintings originally came from another building in the neighbourhood. The oldest layers in the parcel of land brought to light the earliest plaster fragments known in Ostia, with all the characteristics of the so-called First Style⁸; these fragments were found in the preparation layers of the pavements of the first phase (mid-1st c. BC) but also in the raising layers between the first and the second phase (end 1st c. BC – first half 1st c. AD), where Second Style fragments were unearthed, with black orthostates and coloured bands⁹. All the Fourth Style fragments come from a single layer, whose function was to cover the remains of the 1st century building and to prepare the floor levels of the *Caseggiato delle Taberne Finestrate* after the construction of the foundations¹⁰. This layer, approximately m 1 thick, presents some features

⁵ CALZA *et alii* 1953, pp. 108-109; BECATTI 1961, n. 386, p. 203; ARENA TADDEI 1977, pp. 21-24; PAVOLINI 2018, p. 290.

⁶ TOMASSINI 2016; TOMASSINI 2018, p. 201-206; TOMASSINI forthcoming.

⁷ Concerning the level rising in Ostia, we recommend the proceedings of a conference entirely dedicated to this question: MOLS, VAN DER LAAN 1999.

⁸ First Style decorations were also found in Ostia in the excavations of the *Insula di Giove e Ganimede* (MOLS 2002, p. 152) and in the *Domus dei Bucrani* (MORARD 2018). For more information see FALZONE, TOMASSINI 2019, pp. 117-120; TOMASSINI 2019a, pp. 69-70, tav. XV.1; TOMASSINI forthcoming.

⁹ Concerning the Second Style fragments from the *Caseggiato delle Taberne Finestrate* see FALZONE *et alii* 2018, pp. 199-200, fig. 2b; TOMASSINI 2019a, pp. 69-70, tav. XV.2-3; FALZONE, MARANO, TOMASSINI 2021; TOMASSINI forthcoming.

¹⁰ Dating this layer is a particularly complex task, because it was in fact composed of two distinct layers, one dating to the construction of the *caseggiato*, around the years 120 AD, the second dating to renovation works in the building in the second half of the 2nd c. AD. Due to the absence of any pavement, the distinction between the two layers was almost invisible by the excavators. Concerning the Fourth Style fragments from the *Caseggiato delle Taberne Finestrate* see TOMASSINI 2019a, pp. 70-73, tavv. XVI-XVIII; TOMASSINI forthcoming.

of interest, for it was composed exclusively by pressed earth with ceramic and plaster fragments, without any trace of the rubble material from the destruction of the previous building, which was accurately removed. The presence of the plaster fragments was therefore intentional, and we can imagine that they were chosen as a waterproof material and for their drainage capacity¹¹. Despite being selected and moved from their original location, the Fourth Style fragments found in this layer were very homogeneous, in terms of both technique and decoration. In fact, all the fragments seem to belong to a very limited number of decorations, approximately three walls and three ceilings. This homogeneity of the fragments was particularly helpful for the study of these decorations, which led to the total reconstruction of one of the walls (*fig. 2*) and one of the ceilings (*fig. 12*), but also to the reconstruction of several motifs and portions of decoration.



Fig. 2 - Ostia, graphical reconstruction of a Fourth Style wall decoration from the excavations in the *Caseggiato delle Taberne Finestrate* (elab. P. Tomassini).

¹¹ For more information, see TOMASSINI 2019c. Concerning the problematic of the reuse of painted fragments and the management of this kind of “waste” in Antiquity we recommend CARRIVE 2017.

THE FRAGMENTS

FRAGMENTS OF A FOURTH STYLE WALL PAINTING

A conspicuous group of Fourth Style fragments from the *Caseggiato delle Taberne Finestrato* seems to belong to the same wall decoration, which could for this reason be almost entirely reconstructed (*fig. 2*).

The layout of the decoration is essentially tripartite, with three horizontal zones subdivided vertically in panels, in a very typical composition that has many parallels with other known examples from the same period in Rome and the Vesuvian towns. Three panels occupied the central zone, separated by large black bands. The central panel had a red background and was occupied in the middle by a figurative scene (mostly lost), which was the focus of all the decoration, framed by light architectural motifs, garlands and a stylized thyrsus. These architectural elements take the shape of a yellow and green architrave supported by yellow columns; both have their origin in the black inter-panel on each side of the central panel, towards which they converge.

The side panels of the central zone are characterized by a yellow background and are mostly occupied by a large architectural structure, painted in purple, pink and grey colours, composed by a double entablature supported by columns, enriched by small elements in red cinnabar and white, as a small *pinax* with a marine beast, and a very delicate embroidered pattern with flowers and *palmettes*.

Thanks to a fragment whose mortar kept the imprint of a wooden structure (possibly a window frame), it was possible to associate this central zone with a group of fragments belonging to an upper zone of the same wall, also characterized by the presence of a window on one side. This upper zone is subdivided in three main panels, a red one at the centre and two yellow panels with black bands at their side. All the panels are separated by large vertical garlands, richly decorated with flowers and leaves. The red panel at the centre is occupied by three narrow bands, probably the three feet of a tripod. The rest of the panel, as well as the lateral yellow panels, are decorated with light architectural motifs, garlands and small embroidered bands¹².

Even if the number of fragments and the preserved area of the wall decoration seem to be few for such a complete reconstruction, the general layout of the decoration is scientifically plausible, due to a series of factors:

- The decoration: the motifs represented on the fragments are sufficiently recognizable and are typical of specific elements of Fourth Style decorations. The ambiguous motifs that could not be attached to a specific element were not included in the reconstruction.
- The technique: all the fragments share the same technique, especially concerning the mortars (number of layers, thickness and composition).
- External elements: the window imprint was not the only element that helped associate different fragments. There are some external marks, as a large number of picket traces on all the fragments, which were made to enhance the adhesion of the mortar layers of a later decoration, which is completely lost.

¹² This Fourth Style decoration has already been published, we will therefore omit all the stylistical interpretation and details, focusing on the technical aspects resulting from the archaeometric analyses. For more information see TOMASSINI 2014, pp. 30-42; CONTE *et alii* 2017, pp. 344-347; FALZONE 2018b, p. 95, fig. 8; TOMASSINI 2019a, pp. 70-71, tav. XVI; TOMASSINI forthcoming.

Eight fragments were analysed by the ICVBC/ISPC with XRF, VIL and FORS, while only two samples, belonging to the central and the side pannels, were analysed petrographically. The archaeometrical analyses were carried out in order to answer the following questions: did all the fragments belong to the same wall? Which pigments were used? How was this painted wall realised? Here are the results of the analyses.

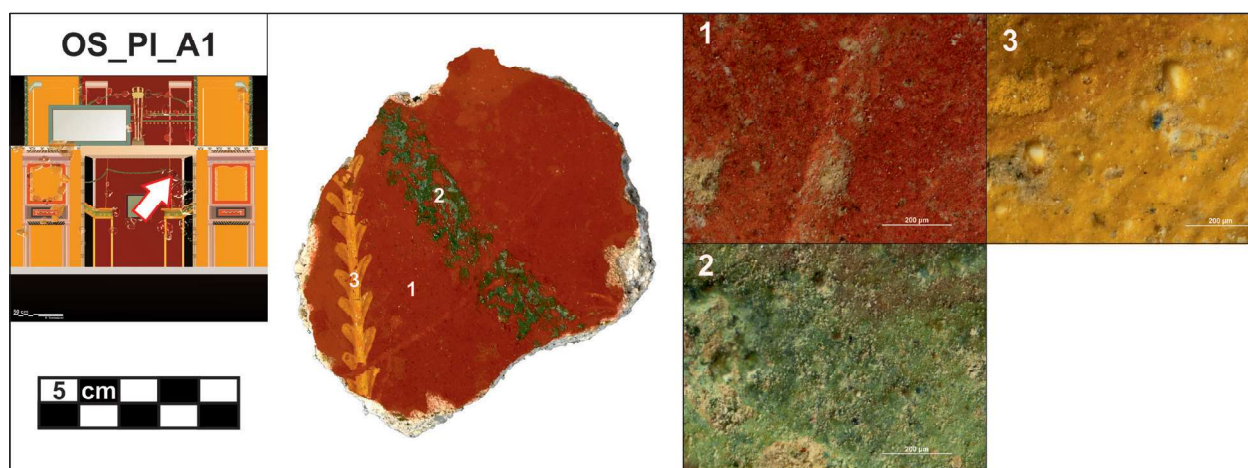


Fig. 3 - Ostia, *Nuovi Depositi*. Fragment OS_PI_A1 from the *Caseggiato delle Taberne Finestrate*, Fourth Style (elab. S. Bracci, P. Tomassini).

Fig. 3	OS_PI_A1	green garland and yellow thyrus, red background		
Mortars (macroscopic observation)	<i>intonachino</i>	colour	White	
		thickness	0,4-0,5 cm	
		aspect	Compact	
		aggregate	Carbonate rocks very finely crushed	
	<i>intonaco</i>	colour	Grey-white	
		thickness	1,5-1,7 cm	
		aspect	Crumbly	
		aggregate	Carbonate rocks, volcanic rocks, straw + small fragment (diam. 2,5 cm) of mortar; medium granulometry	
Technique	Background and decorative elements <i>a fresco</i> , details added <i>a mezzo fresco</i> . An irregular red under-layer has permeated in the <i>intonachino</i> , under the paint layer.			
Pigments	Colour	XRF	FORS	VIL
	Red	Ca (Sr), Fe++, Pb+	Red ochre	Neg.
	Green	Ca (Sr), Fe++, Pb+, Si +, K+, Cr+, Ni (tr)	Green earth, iron based	Neg.
	Yellow	Ca (Sr), Fe++, Pb+	Yellow ochre	Very light reaction, traces of Egyptian blue
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

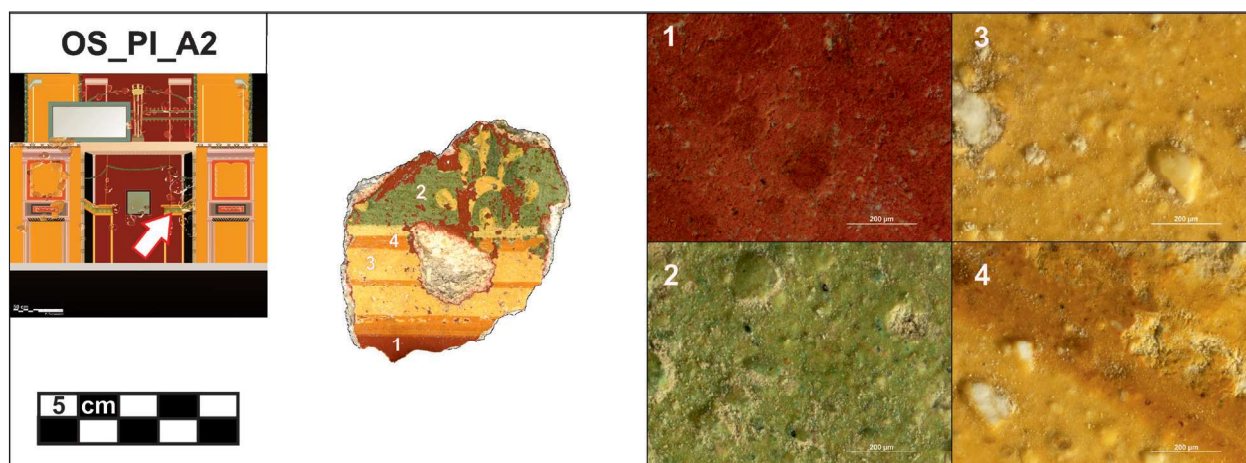


Fig. 4 - Ostia, *Nuovi Depositi*. Fragment OS_PI_A2 from the *Caseggiato delle Taberne Finestrate*, Fourth Style (elab. S. Bracci, P. Tomassini).

Fig. 4	OS_PI_A2	green and yellow architecture, red background		
Mortars (macroscopic observation)	<i>intonachino</i>	colour	White	
		thickness	0,4-0,5 cm	
		aspect	Compact	
		aggregate	Carbonate rocks very finely crushed	
	<i>intonaco</i>	colour	Grey-white	
		thickness	1,4-1,7 cm	
		aspect	Crumbly	
		aggregate	Carbonate rocks, volcanic rocks, straw: medium granulometry	
Technique	Background and decorative elements <i>a fresco</i> , details added <i>a mezzo fresco</i> . An irregular red under-layer has permeated in the <i>intonachino</i> , under the paint layer.			
Pigments	Colour	XRF	FORS	VIL
	Red	Ca (Sr), Fe++, Pb+, As (tr), Ti (tr), presence of Cl	Red ochre	Neg.
	Green	Ca (Sr), Fe++, Pb+, Si +, K+, Cr+, Ni (tr)	Green earth, iron based	Neg.
	Yellow	Ca (Sr), Fe++, Pb+, Ni (tr)	Yellow ochre	Very light reaction, traces of Egyptian blue
	Orange	Ca (Sr), Fe++, Pb+	Yellow ochre	Very light reaction, traces of Egyptian blue
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

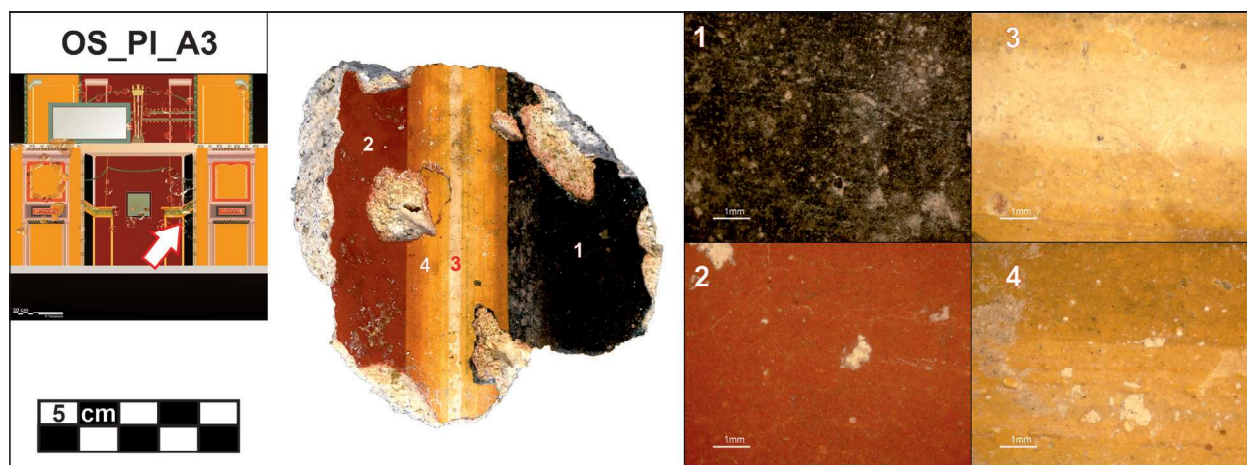


Fig. 5 - Ostia, *Nuovi Depositi*. Fragment OS_PI_A3 from the *Caseggiato delle Taberne Finestrate*, Fourth Style (elab. S. Bracci, P. Tomassini).

Fig. 5	OS_PI_A3	yellow column, red and black background		
Mortars (macroscopic observation)	<i>intonachino</i>	colour	White	
		thickness	0,5-0,6 cm	
		aspect	Compact	
		aggregate	Carbonate rocks very finely crushed	
	<i>intonaco</i>	colour	Grey-white	
		thickness	1,4-1,6 cm	
		aspect	Crumbly	
		aggregate	Carbonate rocks, volcanic rocks, straw; medium granulometry	
Technique	Background and decorative elements <i>a fresco</i> , details added <i>a mezzo fresco</i> . An irregular red under-layer has permeated in the <i>intonachino</i> , under the paint layer.			
Pigments	Colour	XRF	FORS	VIL
	Red	Ca (Sr), Fe++, Pb+, As (tr), Ti (tr)	Red ochre	Neg.
	Black	Ca (Sr), Fe+, Pb+, Si+, K+	Not significant spectrum	Neg.
	Yellow-orange	Ca (Sr), Fe++, Pb+	Yellow ochre	Very light reaction, traces of Egyptian blue
	Light yellow	Ca (Sr), Fe+, Pb+	Yellow ochre and white (lead white?)	Very light reaction, traces of Egyptian blue
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

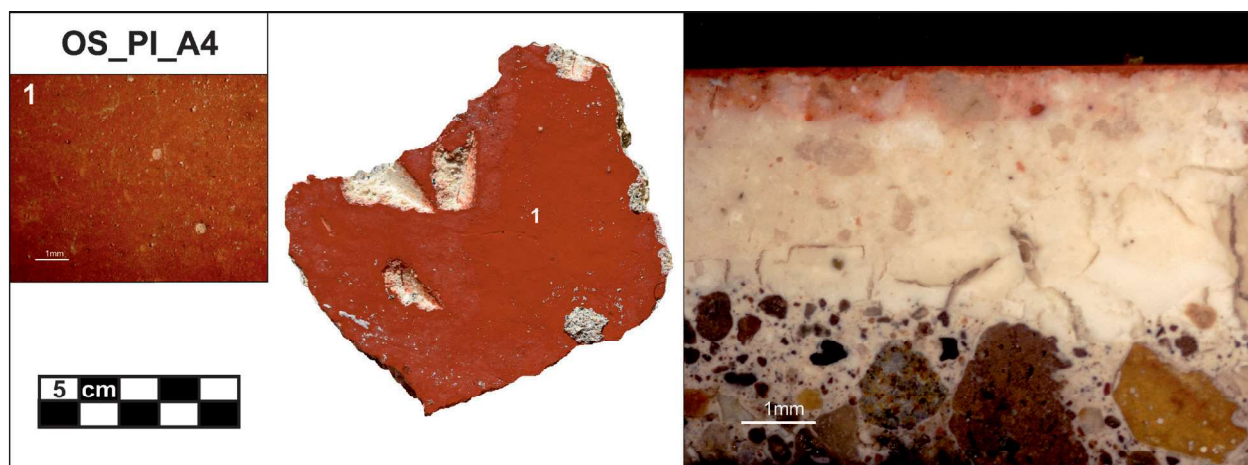


Fig. 6 - Ostia, *Nuovi Depositi*. Fragment OS_PL_A4 from the *Caseggiato delle Taberne Finestrate*, Fourth Style. On the right side of the picture: cross section of the *intonachino* and *intonaco* layers (elab. S. Bracci, E. Cantisani, P. Tomassini).

Fig. 6	OS_PL_A4	Monochromatic fragment, red background		
Mortars (petrographic analysis)	intonachino	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic/microsparitic
		aggregate	composition	Carbonate rock fragments
			distribution	Heterogeneous
			granulometry	100 μm to 1 mm
			shape	Subangular
		bind./agr. ratio	1/2	
		porosity	High amount due to microcracks and pores of irregular shape	
	thickness	0,7-0,8 cm		
	intonaco	binder	composition	Calcic lime
			structure	Heterogeneous
			texture	Micritic/microsparitic
		aggregate	composition	Volcanic rocks (red <i>pozzolana</i>), pyroxenes, carbonate rocks
			distribution	Heterogeneous
			granulometry	Max. grain size >1 mm, min 100 μm
			shape	Subangular
		bind./agr. ratio	1/3	
		porosity	Med. amount due to microcracks and pores of irregular shape	
		thickness	1,7-2 cm	
Technique		Red pigment layer, compact, thickness: 100 microns. An irregular red under-layer has permeated in the <i>intonachino</i> , under the paint layer.		
Pigments	Colour	XRF	FORS	VIL
	Red	Ca (Sr), Fe++, Pb+, As (tr), Ti (tr), presence of Cl	Red ochre	/
	Red (2 nd spot)	Ca (Sr), Fe++, Pb+, As (tr), Ti (tr)	Red ochre	/
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

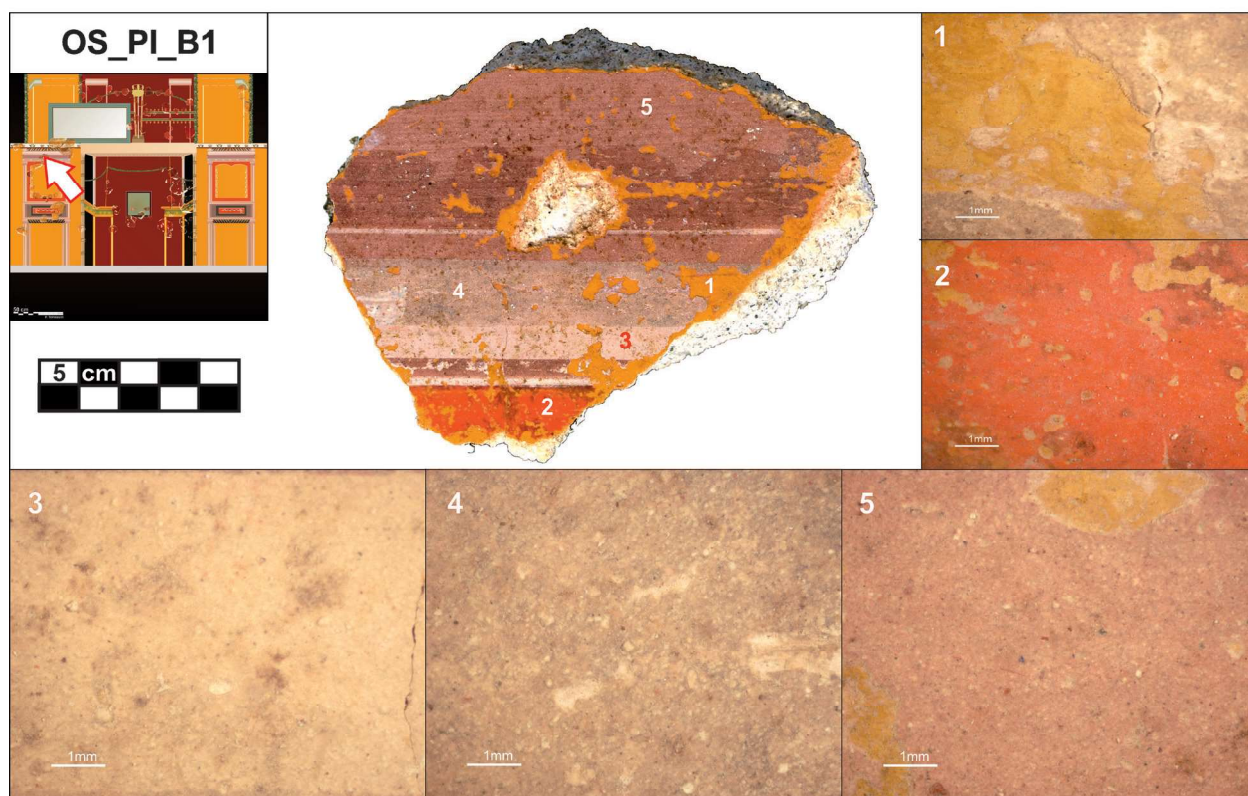


Fig. 7 - Ostia, Nuovi Depositi. Fragment OS_PI_B1 from the *Caseggiato delle Taberne Finestrate*, Fourth Style (elab. S. Bracci, P. Tomassini).

Fig. 7	OS_PI_B1	purple and grey entablature, yellow background		
Mortars (macroscopic observation)	<i>intonachino</i>	colour	White	
		thickness	0,3-0,5 cm	
		aspect	Compact	
		aggregate	Carbonate rocks very finely crushed	
	<i>intonaco</i>	colour	Grey-white	
		thickness	1,8-2 cm	
		aspect	Crumbly	
		aggregate	Carbonate rocks, volcanic rocks, straw; medium granulometry	
Technique	Background and decorative elements <i>a fresco</i> , details added <i>a mezzo fresco</i> . An irregular red under-layer has permeated in the <i>intonachino</i> , under the paint layer.			
Pigments	Colour	XRF	FORS	VIL
	Yellow	Ca (Sr), Fe++	Yellow ochre	/
	Red	Ca (Sr), Hg++, Fe+	Cinnabar	/
	Grey	Ca (Sr), Fe+	Calcium-based white + ochres	/
	Dark grey	Ca (Sr), Fe+/-	Calcium-based white + ochres	/
	Purple	Ca (Sr), Fe+	Calcium-based white + ochres	/
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

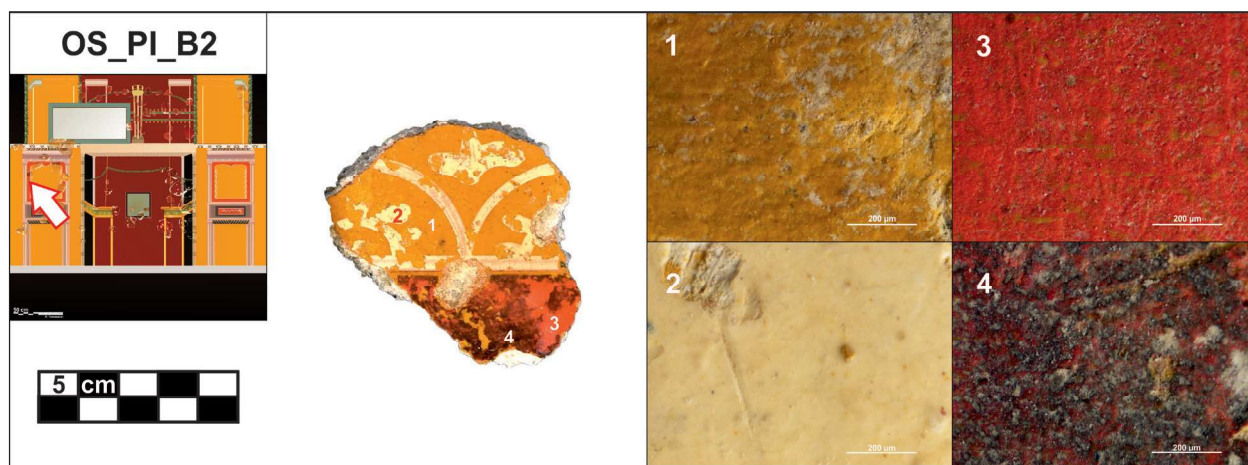


Fig. 8 - Ostia, *Nuovi Depositi*. Fragment OS_PI_B2 from the *Caseggiato delle Taberne Finestrate*, Fourth Style (elab. S. Bracci, P. Tomassini).

Fig. 8	OS_PI_B2	white border and red band, yellow background		
Mortars (macroscopic observation)	<i>intonachino</i>	colour	White	
		thickness	0,5-0,7 cm	
		aspect	Compact	
		aggregate	Carbonate rocks very finely crushed	
	<i>intonaco</i>	colour	Grey-white	
		thickness	1,8-2 cm	
		aspect	Crumbly	
		aggregate	Carbonate rocks, volcanic rocks, straw; medium granulometry	
Technique	Background and decorative elements <i>a fresco</i> , details added <i>a mezzo fresco</i> . An irregular red under-layer has permeated in the <i>intonachino</i> , under the paint layer.			
Pigments	Colour	XRF	FORS	VIL
	Yellow	Ca (Sr), Fe++	Yellow ochre	/
	White	Ca (Sr), Fe++	Calcium-based white + ochres	/
	Red	Ca (Sr), Hg++, Fe+	Cinnabar	/
	Blackened red	Ca (Sr), Hg++, Fe++	Cinnabar	/
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

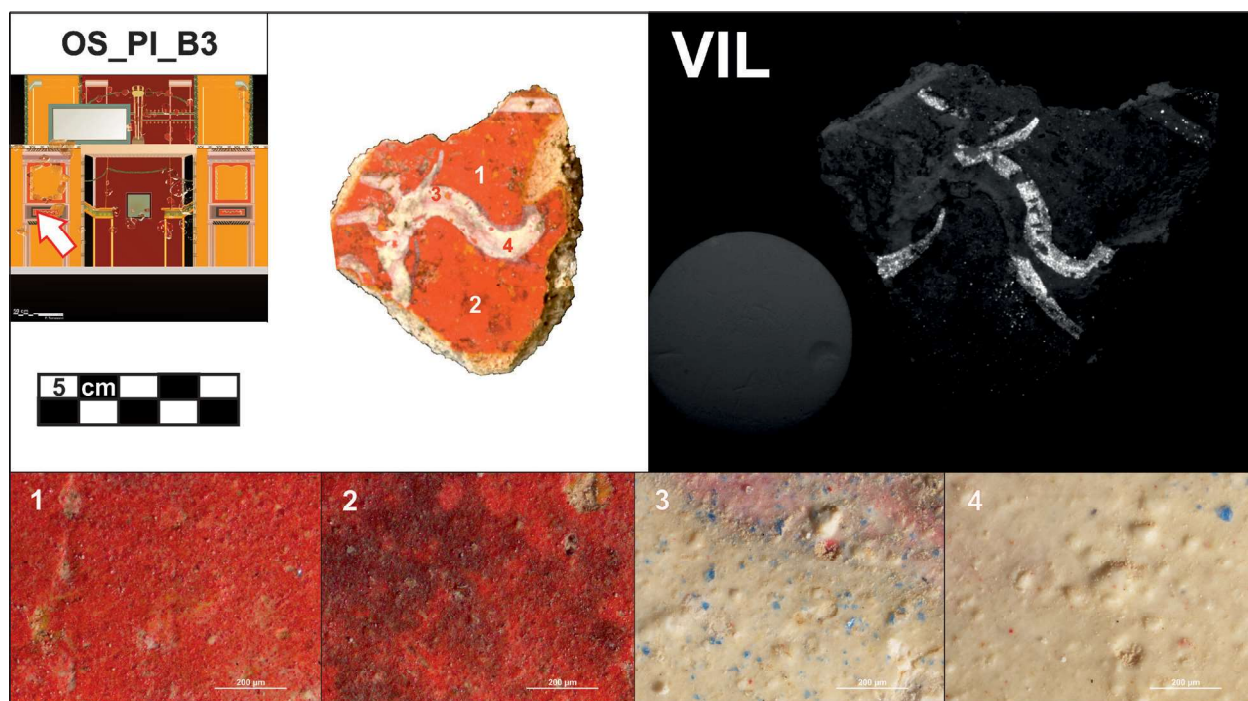


Fig. 9 - Ostia, *Nuovi Depositi*. Fragment OS_PI_B3 from the *Caseggiato delle Taberne Finestrate*, Fourth Style (elab. S. Bracci, P. Tomassini).

Fig. 9	OS_PI_B3	white marine animal, red basis on yellow background		
Mortars (macroscopic observation)	<i>intonachino</i>	colour	White	
		thickness	0,4-0,7 cm	
		aspect	Compact	
		aggregate	Carbonate rocks very finely crushed	
	<i>intonaco</i>	colour	Grey-white	
		thickness	1,8-2 cm	
		aspect	Crumbly	
		aggregate	Carbonate rocks, volcanic rocks, straw ; medium granulometry	
Technique	Background <i>a fresco</i> , cinnabar band and details added <i>a mezzo fresco</i> and <i>a secco</i> . An irregular red under-layer has permeated in the <i>intonachino</i> , under the paint layer.			
Pigments	Colour	XRF	FORS	VIL
	White	Ca (Sr), Hg+, Fe+, Cu+	Calcium-based white	Positive, Egyptian blue mixed to the white in several points
	Red	Ca (Sr), Hg++, Fe++	Cinnabar	Neg.
	Blackened red	Ca (Sr), Hg++, Fe+	Cinnabar	Neg.
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				



Fig. 10 - Ostia, *Nuovi Depositi*. Fragment OS_PI_B4 from the *Caseggiato delle Taberne Finestrate*, Fourth Style (elab. S. Bracci, E. Cantisani, P. Tomassini).

Fig. 10	OS_PI_B4	monochromatic fragment, yellow background		
Mortars (petrographic analysis)	<i>intonachino</i>	binder	composition	Calcic lime
			structure	Heterogeneous, some lumps are present
			texture	Micritic/microsparitic
		aggregate	composition	Carbonate rock fragments
			distribution	Heterogeneous
			granulometry	100 μm to 1 mm
			shape	Subangular
		bind./agr. ratio	1/2	
		porosity	High amount due to microcracks and pores of irregular shape	
		thickness	0,7-0,8 cm	
	<i>intonaco</i>	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic/microsparitic
		aggregate	composition	Volcanic rocks fragments (red <i>pozzolana</i>), pyroxenes, carbonate rocks (calcarenites and micritic limestones), flint
			distribution	Heterogeneous
			granulometry	Max. grain size >1 mm, min 100 μm
			shape	Subangular
		bind./agr. ratio	1/3	
		porosity	Medium amount due to microcracks and pores of irregular shape	
		thickness	1,7-2 cm	
Technique	Yellow pigment layer, compact; thickness: 100 microns. An irregular red layer has permeated in the <i>intonachino</i> , under the paint layer.			

Pigments	Colour	XRF	FORS	VIL
	Yellow	Ca (Sr), Fe++	Yellow ochre	/
	Yellow (2 nd spot)	Ca (Sr), Fe++, presence of Cl	Yellow ochre	/
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

The main element emerging from the archaeometric analyses is the the strong similarities between all the fragments, both in terms of composition and technique. The raw materials used by the painters are fundamentally the same, for the pigments but also for the mortars. Interestingly, the colour palette of the painters, although varied and diversified with many nuances, is the result of the mixing of very few colours: red ochre, yellow ochre, calcium white and perhaps lead white, green earth, but also rarer colours, as red cinnabar and Egyptian blue. The chemical composition of these pigments, identified thanks to the XRF and FORS analyses, seems to be identical in all the samples, which leads us to think that the painters used a single supply source and mixed it in the exact same way. It is also the case of the mortar layers, which share identical characteristics. The thickness of the layers seems to be constant (ca. cm 0,5 for the *intonachino* and cm 2 for the *intonaco*, when preserved in its entirety), and the nature of the binder and aggregate seems to be the same: calcic lime with finely crushed carbonate rocks for the *intonachino*, calcic lime with medium-crushed red *pozzolana*, carbonate rocks, calcarenites, micritic limestones and fragments of *opus caementicium*. These strong analogies, coupled with the other features mentioned *supra* (picket traces, surface aspect), support the theory that the fragments with the yellow background belong to the same wall as the fragments with the red background.

Moreover, archaeometric analyses give a series of details that are useful for understanding the techniques of execution. Petrographic thin sections (OS_PI_A5 and OS_PI_B4) revealed that all the paintings, whatever their background colour, were laid down on a red-coloured base, permeating the *intonachino*. The SEM analysis revealed the presence of iron oxydes, causing this pigmentation¹³, which suggests this red base is an iron-based pigment coloured layer applied on a still-fresh *intonachino*. Secondly, the analyses on the pigments revealed some of the practices of the painters concerning the preparation of colours. Concerning the green colour, used for the garlands and the vegetal elements, the XRF and FORS analyses have confirmed the presence of green earth, sometimes mixed with lime white, but no traces of Egyptian blue have been found. The green earth, identifiable thanks to the presence of iron and potassium, is very rich in chromium, which is a peculiarity found on other Ostian Fourth Style contexts and which could be interpreted as a characteristic of a specific supply source (see below). Concerning the yellow colour, some of the fragments have reacted very lightly to the VIL analysis, which reveals the presence of Egyptian blue in the mixture. Due to their feeble amount, the traces of Egyptian blue in the yellow were probably not intentional and could therefore be caused by an unwashed brush or a painters' palette with more colours on it. The situation changes when speaking of sample OS_PI_B3, where VIL analysis revealed the presence of a large amount of Egyptian blue intentionally mixed with the calcium white in order to create a very delicate greyish white, which gives to the figure a denser texture and a bluish light on the fins of the animal.

A group of fragments was not included in the reconstruction of the wall decoration, although it shares with the other fragments the same technical characteristics. It shows a couple of purple peacock feathers on a red background, whose sides are enriched by small vine leaves. The feathers were probably to be located at the upper end of a *candelabrum*, unfortunately not preserved. One fragment was analysed (*fig. 11*), that show strong technical similarities with the reconstructed wall but also, as we will see further on, with other fragments, depicting the exact same motif but coming from other areas of the city.

¹³ See the papers of S. Bracci and E. Cantisani in this book.

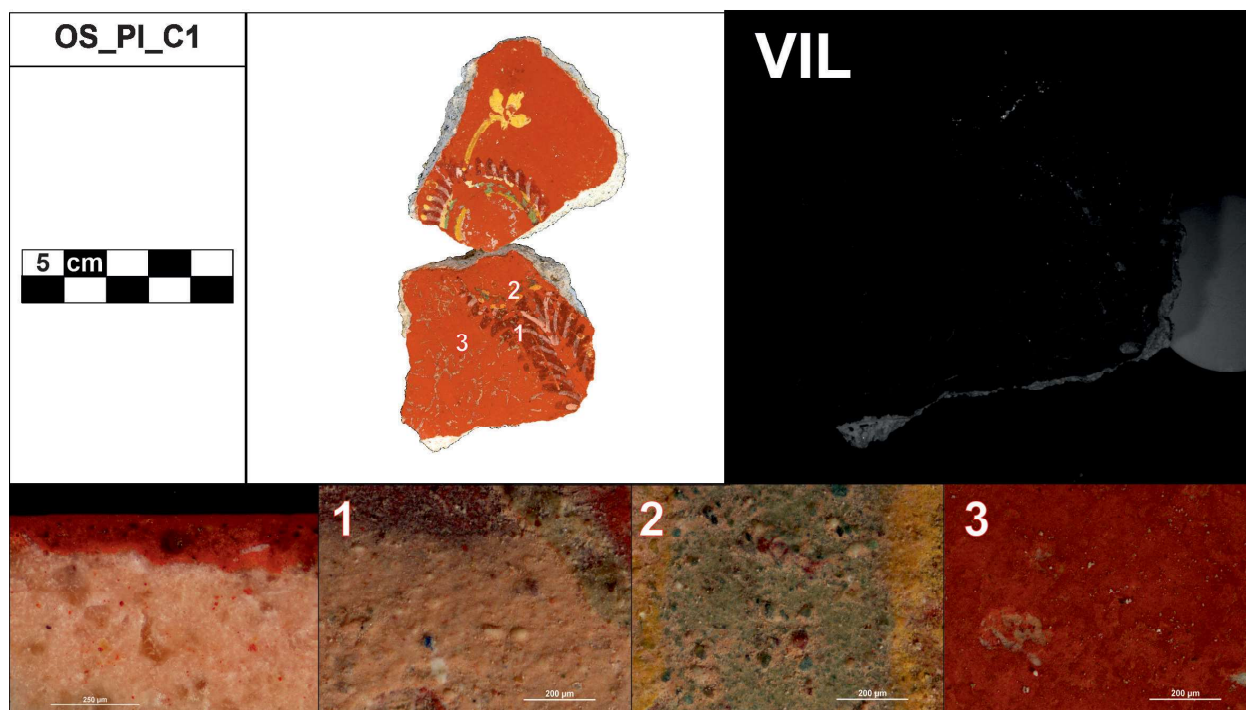


Fig. 11 - Ostia, *Nuovi Depositi*. Fragment OS_PI_C1 from the *Caseggiato delle Taberne Finestrate*, Fourth Style. In the lower part of the picture: cross section of the *intonachino* layer (elab. S. Bracci, E. Cantisani, P. Tomassini).

Fig. 11	OS_PI_C1	fragment with peacock feather, red background		
Mortars (petrographic analysis)	<i>intonachino</i>	binder	composition	Calcic lime
			structure	Heterogeneous, some lumps are present
			texture	Micritic/microsparitic
		aggregate	composition	Carbonate rock fragments
			distribution	Heterogeneous
			granulometry	100 μm to 1 mm
			shape	Subangular
		bind./agr. ratio	1/2	
		porosity	Medium amount due to microcracks and pores of irregular shape	
		thickness	0,5-0,6 cm	
	<i>intonaco</i>	binder	composition	Calcic lime
			structure	Heterogeneous, some lumps and burned fragments of travertine are present
			texture	Micritic/microsparitic
		aggregate	composition	Pyroxenes, few silicate and carbonate rock fragments, few <i>cocciopesto</i> grains
			distribution	Heterogeneous
			granulometry	Max. grain size 1,5 mm, min 100 μm;
			shape	Angular to Subangular
		bind./agr. ratio	1/3	
		porosity	Scarce amount.	
		thickness	1,7-2 cm	
Technique	Red pigment layer, compact; thickness: 100 microns. A red under-layer has permeated in the <i>intonachino</i> .			

Pigments	Colour	XRF	FORS	VIL
	pink	Ca (Sr), Fe ++, Pb +, Mn (tr)	Lime white with red ochre; lead red?	/
	purple	Ca (Sr), Fe ++, Pb +/-	Lime white with red ochre; lead red?	/
	green (eye)	Neg.	Neg.	Positive, traces of Egyptian blue
	red (background)	Ca (Sr), Fe ++, Pb +/-	Red ochre	/
	Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.			

FRAGMENTS OF A FOURTH STYLE CEILING

The second group of analysed fragments belongs to a painted ceiling with a geometrical and floral pattern on a red background (*fig. 12*). We are sure in this case the fragments belonged to a ceiling and not a wall because all fragments maintain the imprint on their back of the reeds that were tied together to the beams in order to create a flat but irregular surface for a better coating of the plaster. A large number of fragments were found during the excavations, allowing us to reconstruct most of the

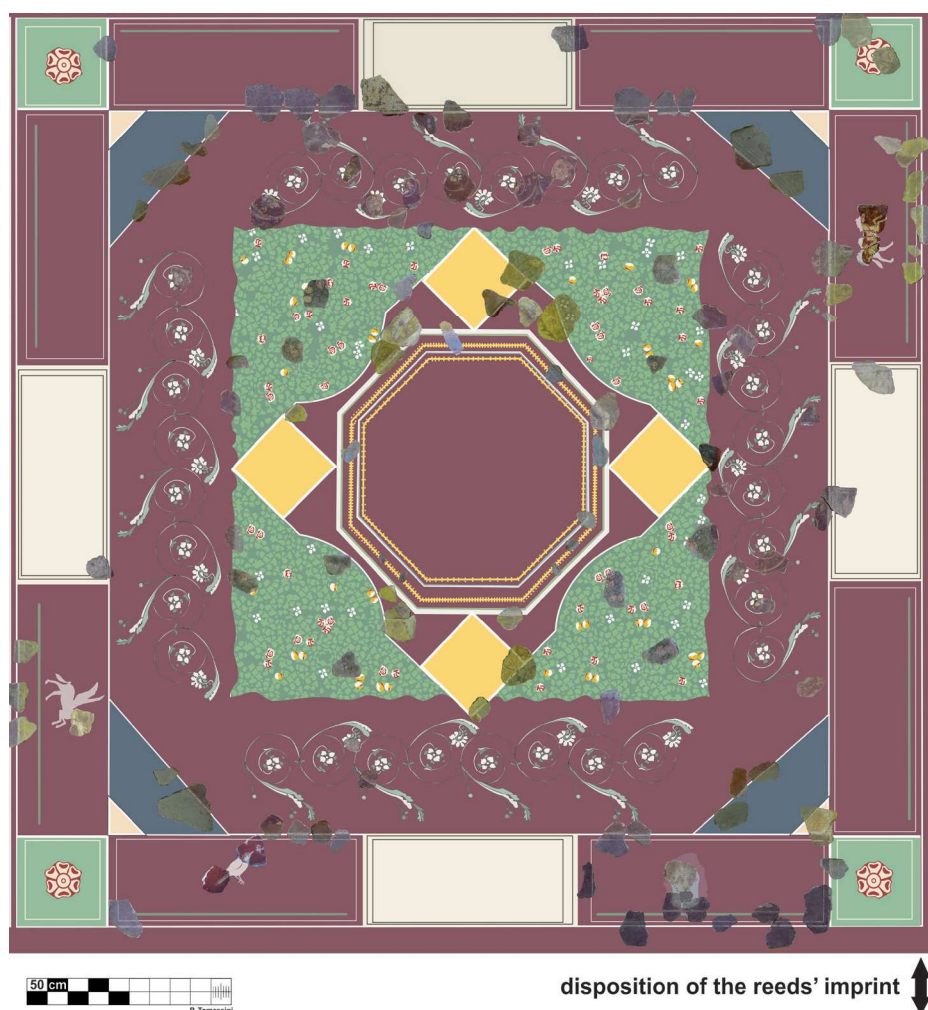


Fig. 12 - Ostia, graphical reconstruction of a Fourth Style ceiling decoration from the excavations of the *Caseggiato delle Taberne Finestrate* (elab. P. Tomassini).

layout and several motifs, even if we do not have the original dimensions of the ceiling. Like the wall described earlier, the quality of execution is particularly high, as it is also shown by the complexity of the general scheme. The main structure of the decoration was made by a succession of different registers, disposed all around a central composition¹⁴. A large octagon, formed by a series of white, yellow, and green lines and bands, occupies the centre of the decoration. It was inscribed within a complex geometric shape, an irregular concave dodecagon, whose extremities were marked by four yellow squares. This central composition was surrounded by a large vegetal pattern, whose shape seems to be a square. The pattern is in fact a plant carpet, painted in green and enriched with a large variety of leaves and flowers, among which are small roses and yellow fruits, perhaps apples or plums. The vegetal square is then followed by three different square registers, each of which is delineated by a thin white line. The first register, the closest to the centre, was occupied by very rich vegetal scrolls, ornated with white flowers, oak leaves and acorns. The second register was subdivided in smaller frames: the four corners were occupied by small green squares, with a large red flower at the centre, while on the sides of the register were larger rectangular frames, alternating a white and a red background. The rectangles with a red background were adorned in the centre with different figures: a horse, a griffin, a bird and a couple of masks could be identified, but there were probably others that were not preserved. Finally, the third register was occupied, at least on two of its sides, by a strapwork of horizontal spindles interloped tangentially and adorned with stylized gems and flowers. Several fragments show this register was the last one, for they preserve the end of the ceiling (recognizable to the irregularity of the mortar), bordered by a thin vertical garland. The scheme used for the decoration of this ceiling corresponds to what Alix Barbet calls «composition centrée à emboîtements»¹⁵ and finds many parallels in Fourth Style decorations in central Italy¹⁶, which possibly dates the ceiling to a mature period of Fourth Style, around the last quarter of the 1st c. AD.

One of the peculiarities of the ceiling, that we wanted to investigate more thoroughly with archaeometry, is the fact that it was partially re-decorated in a later phase. In fact, several fragments show traces of red, blue and yellow pigments applied *a secco* on the previous decoration, apparently without any motif. This re-decoration, to be dated before the destruction of the building at the beginning of the 2nd c. AD, touched only specific areas of the ceiling (namely the first and second registers and part of the centre) but kept the first layout of the composition untouched.

Six fragments were sampled and analysed with VIL, XRF and FORS in order to obtain the composition of the pigments used. Two fragments were analysed petrographically in order to characterize the mortar layers. The results are very interesting, for they show some differences with the results of the analyses on the wall, even though the two decorations date from the same period and belong possibly to the same building.

¹⁴ For a detailed description, see TOMASSINI 2019a, pp. 71-73, tavv. XVII-XVIII; MARANO, TOMASSINI forthcoming.

¹⁵ Type H of BARBET 2004, pp. 33-34. P. Meyboom and E. Moormann use rather the definition «composizione centrale racchiusa» (type 2b), see MEYBOOM, MOORMANN 2013, pp. 115-118.

¹⁶ For example the *Domus Aurea*, in particular the famous golden vault or the ceilings of rooms 119 and 129 (MEYBOOM, MOORMANN 2013, p. 126), but also in the *villa San Marco* in Stabia, especially in room 30 and in the access ramp (BARBET, MINIERO 1999, pp. 298-299, fig. 677 and pp. 267-307 respectively). The ceiling decoration of the *cubiculum d* of the *Casa dei Quadretti Teatrali* in Pompeii (BARBET 2009, pp. 47-149; PPM I, 387) or the *Casa del Colonnato Toscanico* in Herculaneum (BARBET 2009, pp. 154-155), although slightly older, share some common features with the Ostian ceiling.

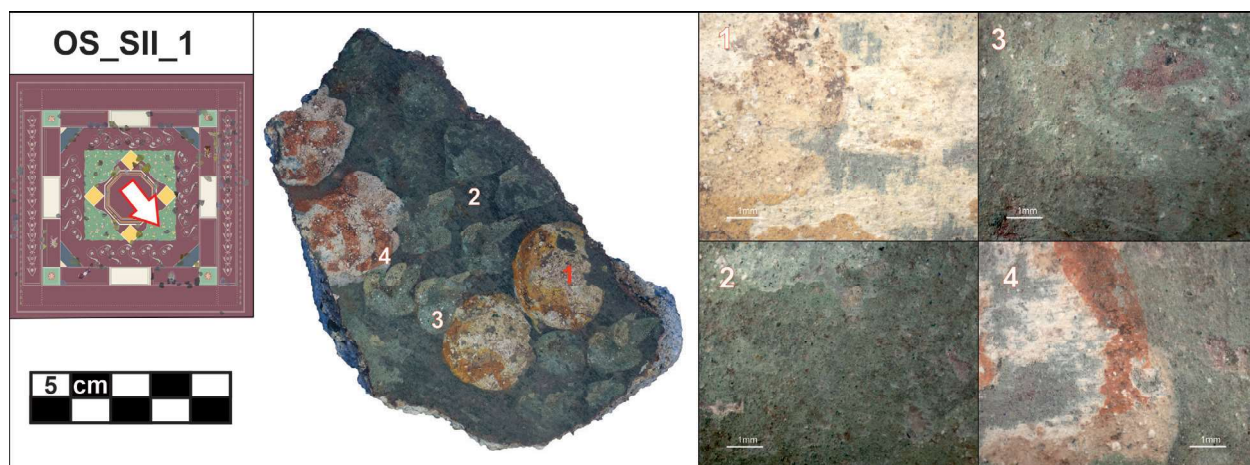


Fig. 13 - Ostia, *Nuovi Depositi*. Fragment OS_SII_1 from the *Caseggiato delle Taberne Finestrate*, Fourth Style ceiling (elab. S. Bracci, P. Tomassini).

Fig. 13	OS_SII_1	vegetal pattern with flowers and fruits, green basis on red background			
Mortars (macroscopic observation)	<i>intonachino</i>	colour	White		
		thickness	0,2-0,4 cm		
		aspect	Compact		
		aggregate	Spathic calcite? very finely crushed		
	<i>intonaco</i>	colour	Grey-white		
		thickness	1,6-1,8 cm		
		aspect	Crumbly		
		aggregate	Carbonate rocks?, <i>pozzolana</i> , pyroxenes? medium granulometry		
	<i>arriccio</i>	colour	Grey-brown		
		thickness	0,3-0,5 cm		
		aspect	Clayey		
		aggregate	Vegetal elements, straw		
Technique	Red background covered by a green layer <i>a fresco</i> , flowers and fruits added <i>a secco</i> on a white basis <i>a mezzo fresco</i>				
Pigments	Colour	XRF	FORS	VIL	
	White (basis colour for fruits)	Ca (Sr), Fe++, Pb (tr), Cu (tr)	Calcium-based white	Positive	
	Green (background)	Ca (Sr), Fe+, Cu++, K+, Cr+	Green earth	Egyptian blue homogeneously mixed to the green	
	Green (leafs)	Ca (Sr), Fe+++, Pb+++, Cu+, V (+)	Not identified	Positive	
	Pink-orange (flowers)	Ca (Sr), Fe+++, Pb+++, Cu+, V (+)	Not identified	Positive	
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.					

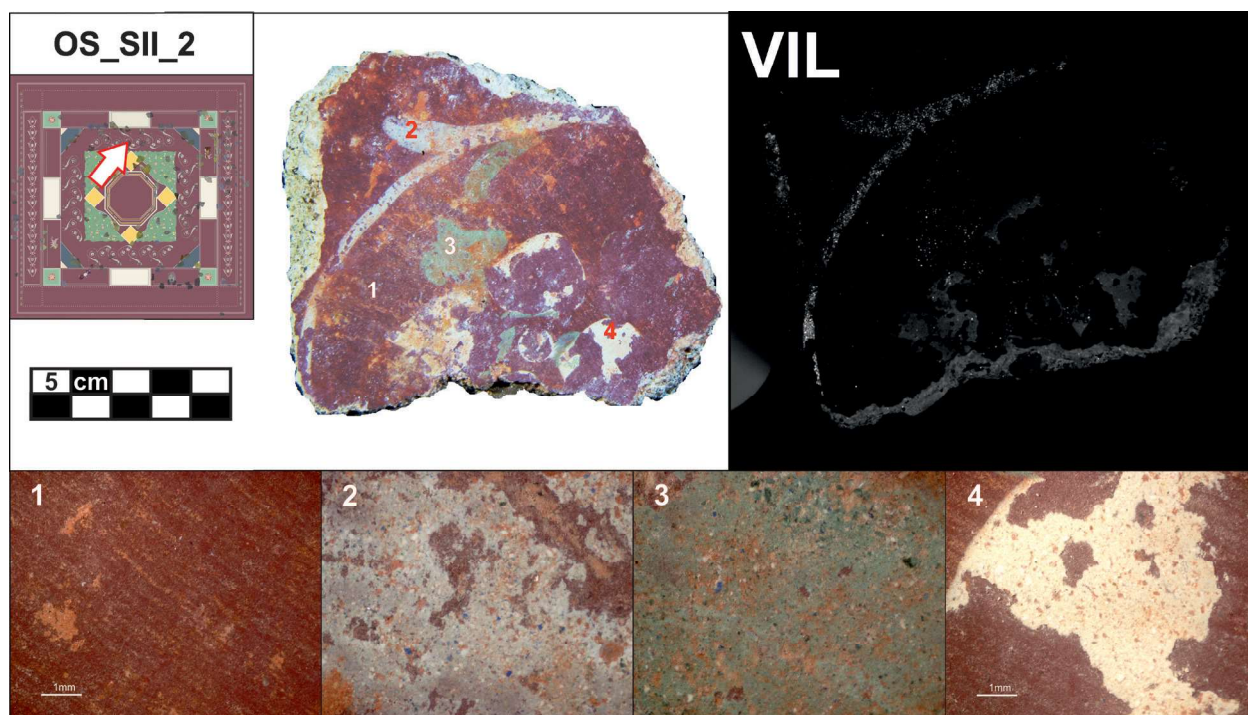


Fig. 14 - Ostia, *Nuovi Depositi*. Fragment OS_SII_2 from the *Caseggiato delle Taberne Finestrate*, Fourth Style ceiling (elab. S. Bracci, P. Tomassini).

Fig. 14	OS_SII_22	vegetal scroll with white flowers, red background			
Mortars (macroscopic observation)	intonachino	colour	White		
		thickness	0,1-0,2 cm		
		aspect	Compact		
		aggregate	Spathic calcite? very finely crushed		
	intonaco	colour	Grey-white		
		thickness	1,8 - 2 cm		
		aspect	Crumbly		
		aggregate	Carbonate rocks?, <i>pozzolana</i> , pyroxenes?; medium granulometry		
	arriccio	colour	Grey-brown		
		thickness	0,4-0,5 cm		
		aspect	Clayey		
		aggregate	Vegetal elements, straw		
Technique	Red background <i>a fresco</i> , decoration added mostly <i>a secco</i>				
Pigments	Colour	XRF	FORS	VIL	
	Red	Ca (Sr), Fe ⁺⁺⁺ , Pb (tr), Cu (tr)	Red ochre	Neg.	
	White (scroll)	Ca (Sr), Fe ⁺⁺ , Pb ⁺⁺ , Cu ⁺	Lead-based white	Positive, Egyptian blue homogeneously mixed	
	Green	Ca (Sr), Fe ⁺⁺⁺ , Pb ⁺⁺ , Cu ⁺ , K ⁺	Green earth	Positive, Egyptian blue homogeneously mixed	
	White (flowers)	Ca (Sr), Fe ⁺⁺⁺ , Pb ⁺⁺	White with ochre	Neg.	
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.					

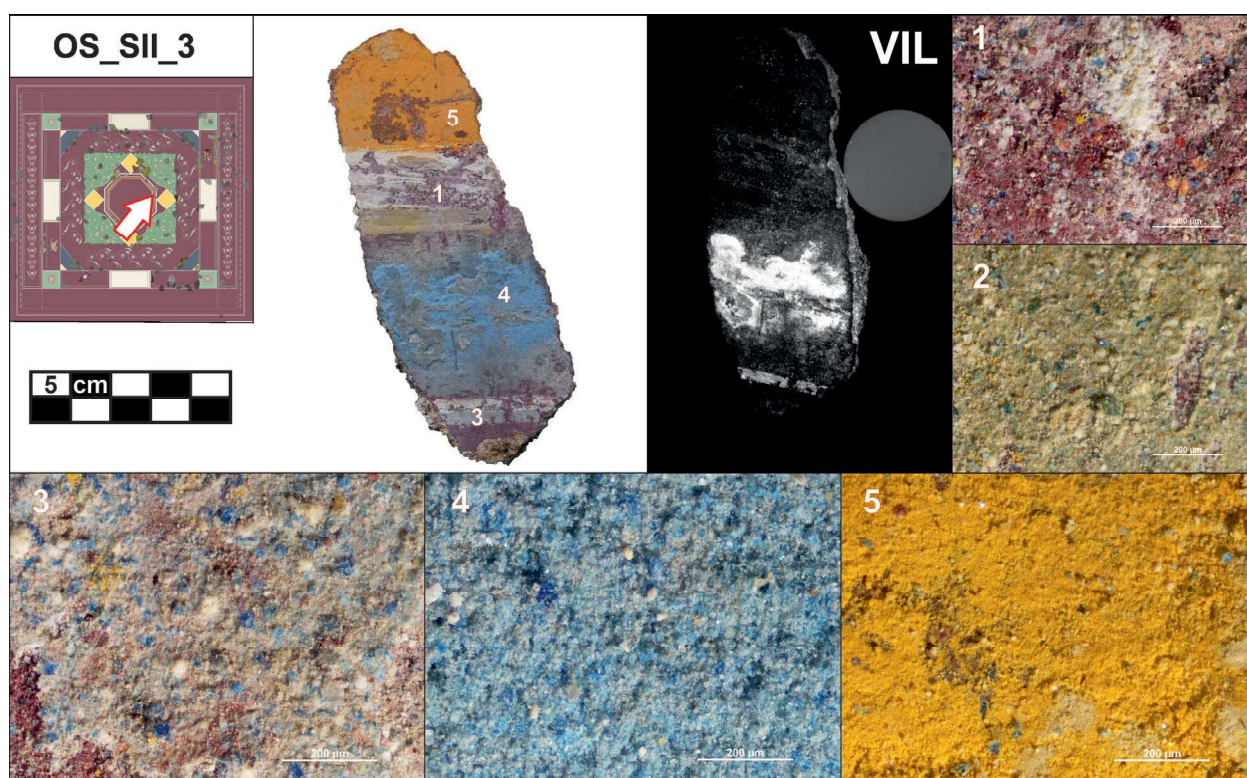


Fig. 15 - Ostia, *Nuovi Depositi*. Fragment OS_SII_3 from the *Caseggiato delle Taberne Finestrate*, Fourth Style ceiling (elab. S. Bracci, P. Tomassini).

Fig. 15	OS_SII_3	bands belonging to the central octagon and re-decoration		
Mortars (macroscopic observation)	<i>intonachino</i>	colour	White	
		thickness	0,2-0,3 cm	
		aspect	Compact	
		aggregate	Spathic calcite? very finely crushed	
	<i>intonaco</i>	colour	Grey-white	
		thickness	1,6 – 1,8 cm	
		aspect	Crumbly	
		aggregate	Carbonate rocks?, <i>pozzolana</i> , pyroxenes?; medium granulometry	
	<i>arriccio</i>	colour	Grey-brown	
		thickness	0,2-0,3 cm	
		aspect	Clayey	
		aggregate	Vegetal elements, straw	
Technique	Red background <i>a fresco</i> , decoration added mostly <i>a secco</i>			
Pigments	Colour	XRF	FORS	VIL
	Red (background)	Ca (Sr), Fe+++, Cu +/-	Red ochre	Neg.
	Green (octagon)	Ca (Sr), Fe+++, Cu +/-	Green earth	Positive, Egyptian blue homogeneously mixed
	Light Blue (octagon)	Ca (Sr), Fe+++, Cu+	Calcium-based white with Egyptian blue	Positive, Egyptian blue homogeneously mixed

Pigments	Colour	XRF	FORS	VIL
	Blue (re-decoration)	Ca (Sr), Fe++, Cu++++	Egyptian blue	Positive
	Yellow (re-decoration)	Ca (Sr), Fe++++, Ti+, K+	Yellow ochre	Neg.

Semi-quantitative evaluation: (+++): very abundant; (++) : abundant; (+): secondary; (+/-): low amount; (tr): traces.

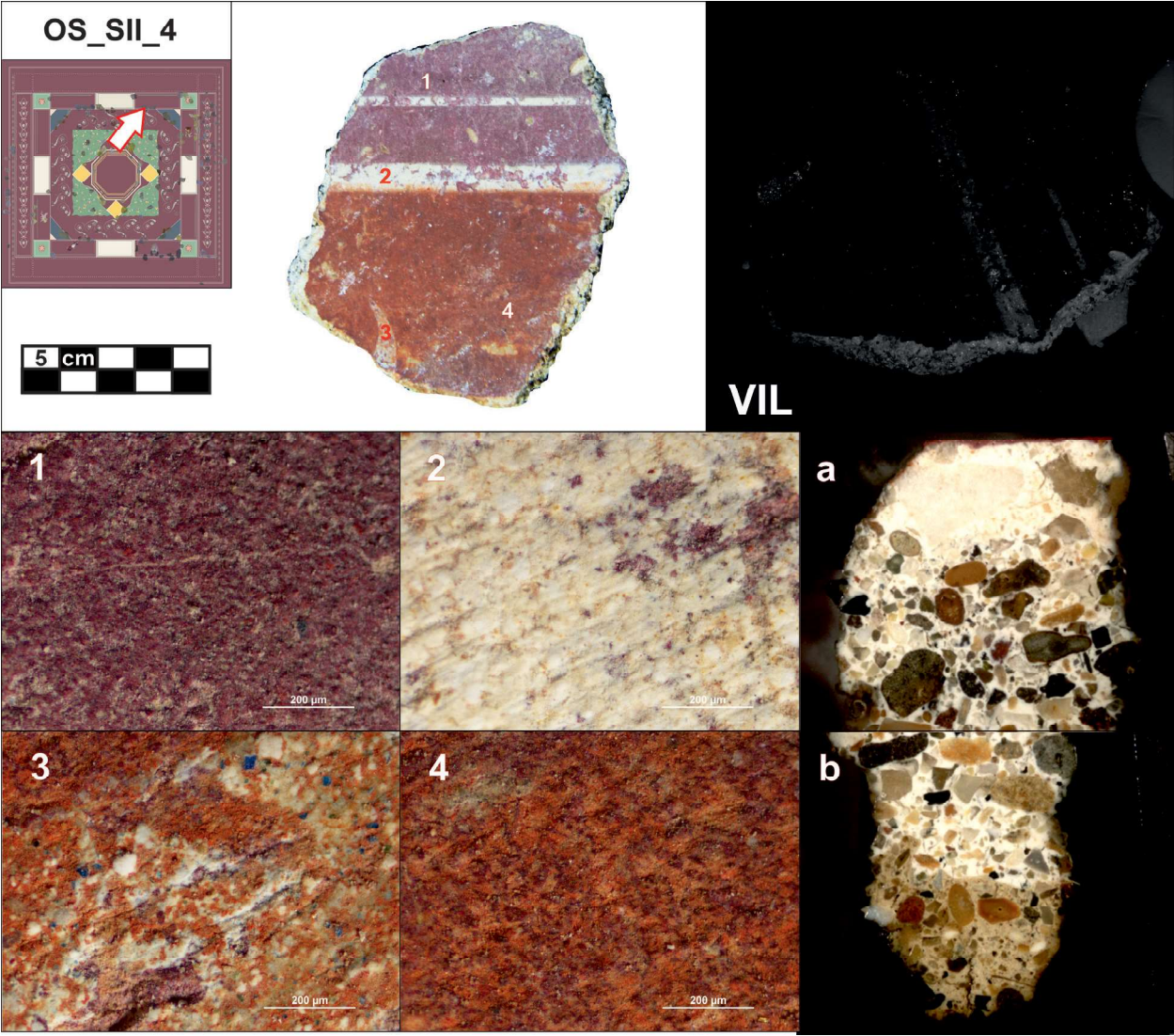


Fig. 16 - Ostia, *Nuovi Depositi*. Fragment OS_SII_4 from the *Caseggiato delle Taberne Finestrate*, Fourth Style ceiling. In the lower part, cross sections: a. *intonachino*; b. *intonaco* (elab. S. Bracci, E. Cantisani, P. Tomassini).

Fig. 16	OS_SII_4	bands dividing the first and the second register		
Mortars (petrographic analysis)	intonachino	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic
		aggregate	composition	Carbonate rock fragments, calcite
			distribution	Bimodal
			granulometry	100 μm to 1,5 mm
			shape	Angular
		bind./agr. ratio	1/2	
		porosity	Medium amount due to microcracks and pores of irregular shape	
		thickness	0,3-0,5 cm	
	intonaco	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic
		aggregate	composition	Volcanic rock fragments, pyroxenes, carbonate rock fragments
			distribution	Homogeneous
			granulometry	Max. grain size 4 mm (volcanic fragments), min 150 μm, mean 700-800 μm
			shape	Subangular
		bind./agr. ratio	1/2	
		porosity	Medium amount due to pores of rounded and irregular shape	
		thickness	0,5 cm	
arriccio	binder	composition	Calcic lime	
		structure	Homogeneous	
		texture	Micritic	
	aggregate	composition	Volcanic rock fragments, carbonate rock fragments, pyroxenes	
		distribution	Homogeneous	
		granulometry	Max. grain size 2,7 mm (carbonate fragments); min 150 μm	
		shape	Subangular/subrounded	
	bind./agr. ratio	1/2		
	porosity	Medium amount due to pores of rounded and irregular shape		
	thickness	0,5 cm		
Technique	Red background and white bands <i>a fresco</i> , trace of re-decoration <i>a secco</i>			
Pigments	Colour	XRF	FORS	VIL
	Red (background)	Ca (Sr), Fe+++, Pb (tr)	Red ochre	Neg.
	White (lines)	Ca (Sr), Fe+++, Pb+	Calcium-based white with ochres	Positive
	Red (re- decoration)	Ca (Sr), Fe+++, Pb+	Red ochre	Neg.
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

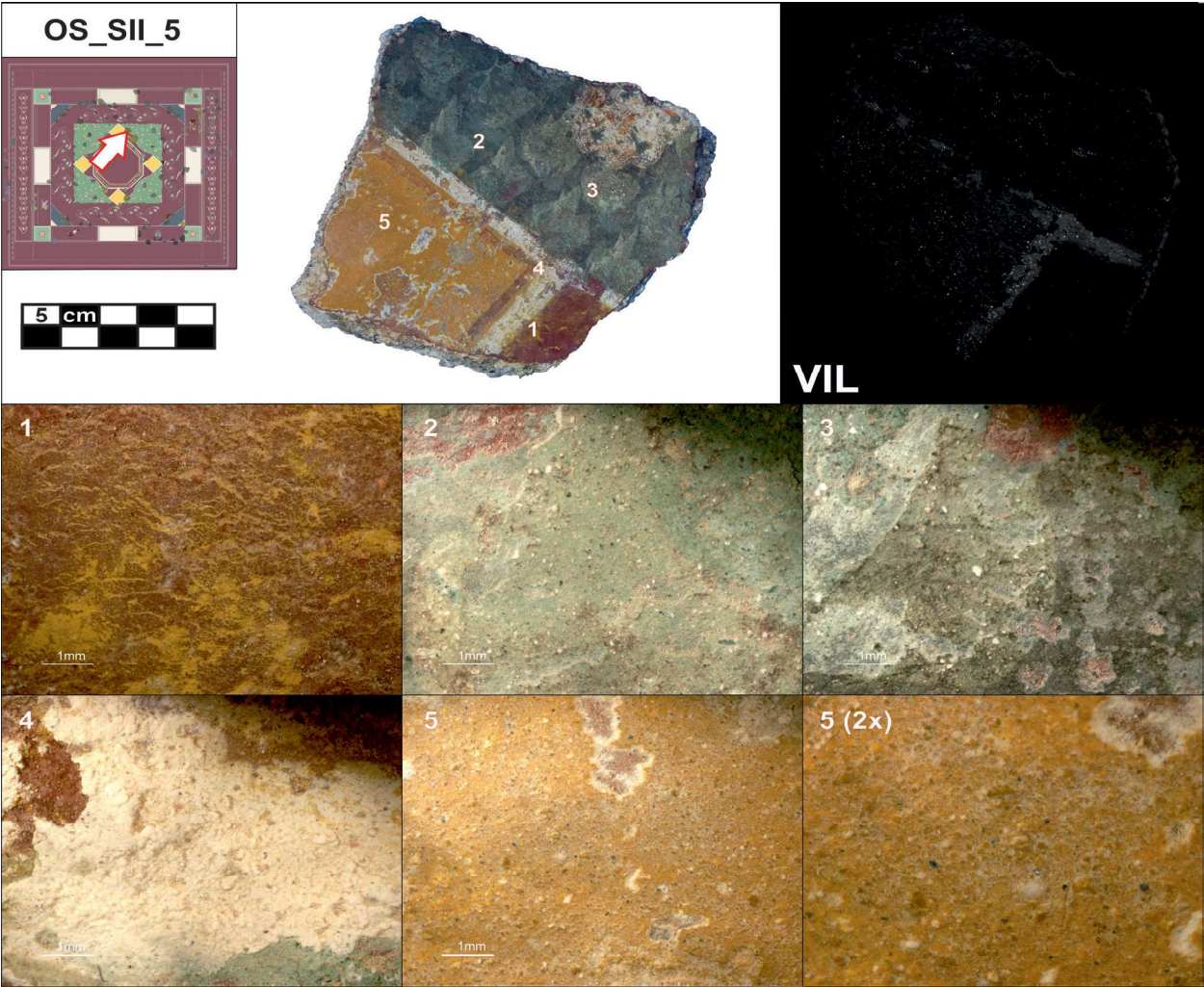


Fig. 17 - Ostia, *Nuovi Depositi*. Fragment OS_SII_5 from the *Caseggiato delle Taberne Finestrate*, Fourth Style ceiling (elab. S. Bracci, P. Tomassini).

Fig. 17	OS_SII_5	green pattern, yellow square and yellow re-decoration	
Mortars (macroscopic analysis)	<i>intonachino</i>	colour	White
		thickness	0,2-0,3 cm
		aspect	Compact
		aggregate	Spathic calcite? very finely crushed
	<i>intonaco</i>	colour	Grey-white
		thickness	1,6 – 1,8 cm
		aspect	Crumbly
		aggregate	Carbonate rocks?, <i>pozzolana</i> , pyroxenes? ; medium granulometry
	<i>arriccio</i>	colour	Grey-brown
		thickness	0,2-0,3 cm
		aspect	Clayey
		aggregate	Vegetal elements, straw
Technique	Red background <i>a fresco</i> , decoration added mostly <i>a secco</i>		

Pigments	Colour	XRF	FORS	VIL
	Red (background) with yellow re-decoration	Ca (Sr), Fe+++ , Pb (tr), Cu (tr)	Red ochre	Neg.
	Green (background)	Ca (Sr), Fe+, Cu+, Pb (tr)	Not identified	Egyptian blue homogeneously mixed to the green
	Green (leaves)	Ca (Sr), Fe++, K+, Cr+, Cu (tr), Pb (tr)	Green earth	Egyptian blue homogeneously mixed to the green
	White	Ca (Sr), Fe+, Pb+, Cu (tr)	Not identified	Positive
	Yellow (square)	Ca (Sr), Fe++, Pb+, Cu (tr)	Yellow ochre	Slightly positive
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

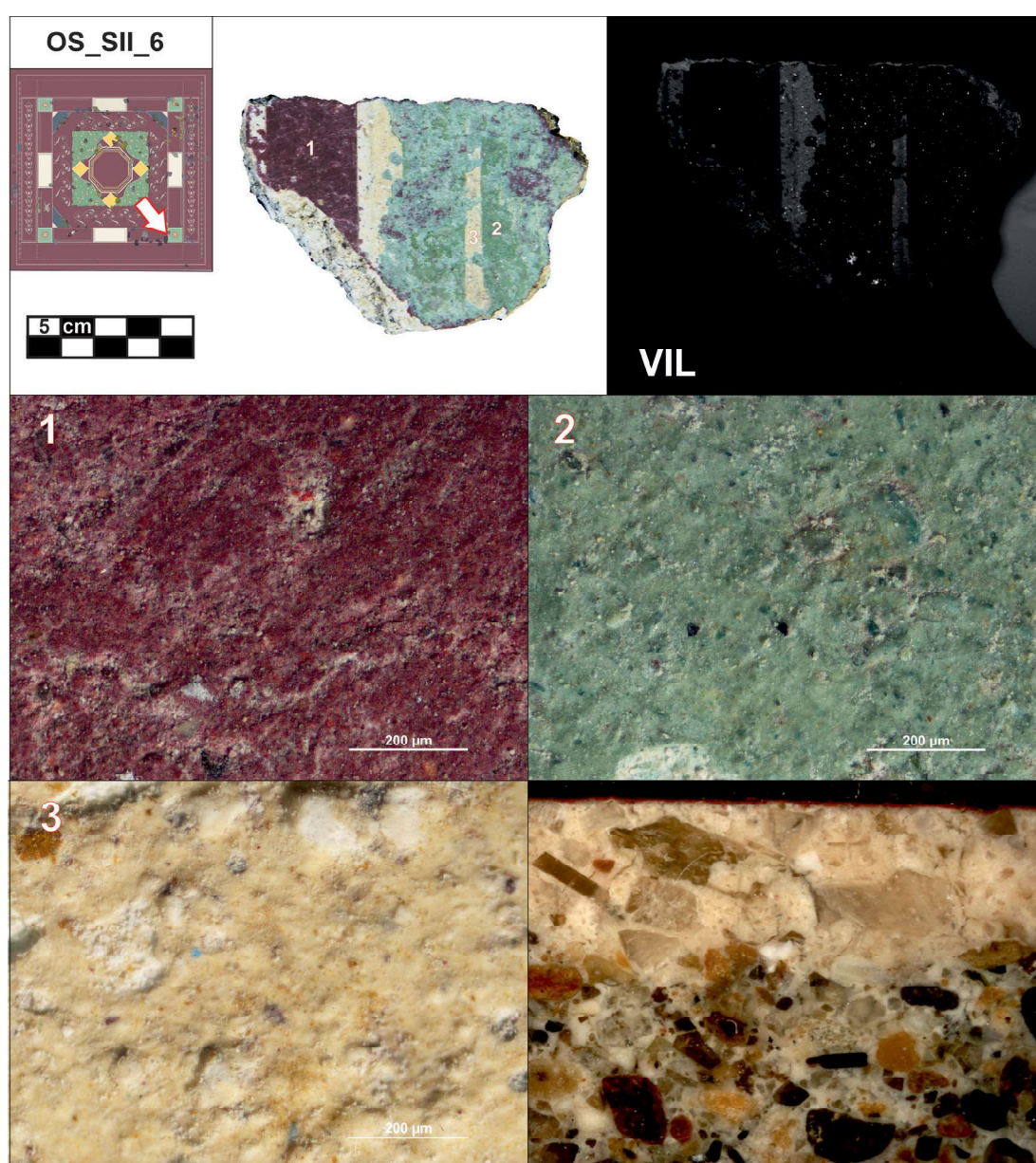


Fig. 18 - Ostia, *Nuovi Depositi*. Fragment OS_SII_6 from the *Caseggiato delle Taberne Finestrate*, Fourth Style ceiling. Below, on the right: cross section of first two layers (elab. S. Bracci, E. Cantisani, P. Tomassini).

Fig. 18	OS_SII_6	green frame with white lines		
Mortars (petrographic analysis)	intonachino	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic
		aggregate	composition	Carbonate rock fragments, calcite
			distribution	Bimodal
			granulometry	100 μm to 1,5 mm
			shape	Angular
		bind./agr. ratio	1/3	
		porosity	Medium amount due to microcracks and pores of irregular shape	
		thickness	0,3-0,5 cm	
	intonaco	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic
		aggregate	composition	Volcanic rock fragments, pyroxenes, carbonate rock fragments
			distribution	Homogeneous
			granulometry	Max. grain size 1,5 mm (volcanic fragments), min 150 μm, mean 700-800 μm
			shape	Subangular/subrounded
		bind./agr. ratio	1/2	
		porosity	Medium amount due to pores of rounded and irregular shape	
		thickness	0,3-0,5 cm	
	arriccio	not preserved		
Colour	Red background and decoration <i>a fresco</i>			
Pigments	Colour	XRF	FORS	VIL
	Red (background)	Ca (Sr), Fe+++	Red ochre	Neg.
	Green (square)	Ca (Sr), Fe+, K+, Cr+, Cu (tr), Pb (tr)	Green earth	Egyptian blue homogeneously mixed to the green
	White	Ca (Sr), Fe+, Pb++, Cu (tr)	Not identified	Positive
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

As the largest Fourth Style ceiling known in Ostia, the decoration of the *Caseggiato delle Taberne Finestrate* is of a crucial importance in order to understand the practices of the ateliers working in that period in the harbour of Rome. The archaeometric analyses were therefore essential to gather as much data as possible on the materials and the techniques used.

Stylistically speaking, the ceiling decoration seems to be very different from the Fourth Style wall decorations in Ostia¹⁷. It is much more accurate, elaborate and elegant. The lack of contexts prevents us from explaining whether this difference is related to a different chronology or a different workshop or to a specific practice, consisting of putting more effort and money in the ceiling decorations rather than the wall decorations, as it is seen in later Ostian examples¹⁸. This difference also concerns the technical characteristics of the ceiling, which were identified thanks to the archaeometric analyses. In fact, one of the main peculiarities of this ceiling is the massive use of Egyptian blue, which is never used for representing the blue colour (except for the re-decoration phase), but which is systematically mixed with other pigments, like green earth, yellow ochre and calcium-white, in order to add more thickness to these colours and create singular colour tones, as it was already seen – in smaller scale – for the reconstructed wall decoration. The raw materials used seem to be the same, but with some differences. The use of lead white is attested by the very high amount of lead found in the white flowers of the floral carpet and the vegetal scrolls (OS_SII_1 and OS_SII_2), but also on the white lines of the last register (OS_SII_6) and perhaps mixed with the green in the leaves of the floral carpet (OS_SII_1). Only the green pigment has the same characteristics in both ceiling and wall decorations: the same type of green earth rich in chromium seems to have been used, which seems to indicate that the same supply source has been used. It is interesting to mark that chromium wasn't found in earlier example of green earth found on First and Second Style paintings.

Another interesting result coming from the archaeometric analyses concerns the second re-decoration phase: the very low amount of calcium compared to the high amount of iron for the yellow and red ochres and of copper for the Egyptian blue, suggest that the pigments were applied *a secco* without being much diluted with a whitewash.

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¹⁷ Concerning Fourth Style Ostian ceilings see MARANO, TOMASSINI forthcoming-b.

¹⁸ As for example in the *Insula delle Ierodule* in the *Casa a Giardino* complex (FALZONE, PELLEGRINO 2014).

MORTARS AND PIGMENTS UNDER THE MICROSCOPE: ARCHAEOMETRIC ANALYSES OF FOURTH STYLE PLASTER FRAGMENTS FROM THE *CASEGGIATO DEI LOTTATORI* IN OSTIA

Martina Marano

As mentioned in the previous pages¹, a renewed interest in the study of the 1st c. BC – 1st c. AD plaster fragments has produced in recent years new knowledge concerning the characteristics of the so-called Pompeian Styles in Ostia. This is not the place to analyse the results of these studies in detail, but it is worth pointing out that these researches have produced a large bibliography² and have shown the close relationship between the pictorial production of Rome and its surroundings³. Furthermore, these studies have demonstrated the increase in Fourth Style paintings compared to those of the First, Second and Third Style⁴. This paper focuses precisely on the Fourth Style pictorial fragments found in the so-called *Caseggiato dei Lottatori* in Ostia (V, III, 1) and presents the results of the archaeometric analyses made up on five fragments by the researchers of the ICVBC of Florence.

THE ARCHAEOLOGICAL CONTEXT

The so-called *Caseggiato dei Lottatori* is located on the north side of the block V, III in Ostia⁵. The construction of the building in yellow and red *opus testaceum* took place in the first half of the 2nd c. AD⁶. The *caseggiato* is rectangular in plan and consists of a sequence of rooms organized

¹ See the papers of S. Bracci, E. Cantisani, S. Falzone, M. Marano and P. Tomassini in this book.

² FALZONE, PELLEGRINO 1995, pp. 205-207, figg. 6-10; MOLS 2002, p. 151-174; FALZONE 2004-2005, pp. 265-290; DE RUYT, ALAVOINE 2007, pp. 113-121; FALZONE 2007, pp. 29-47; MORARD 2007, pp. 55-80; BOCHERENS 2012; TOMASSINI 2014, pp. 30-42; DAVID, MILANI, MELEGA 2017, pp. 57-62; DAVID *et alii* 2017, pp. 355-361; FALZONE 2017, pp. 335-341; MARANO 2017b, pp. 349-353; FALZONE 2018b, pp. 87-97; MARANO 2018b; MARANO, TOMASSINI 2018, pp. 503-512; FALZONE, TOMASSINI 2019, pp. 117-120; GIRARD, MORARD 2019, pp. 45-65; TOMASSINI 2019a, pp. 67-76; MARANO, TOMASSINI forthcoming-a; MARANO, TOMASSINI forthcoming-b.

³ We can mention some examples: the First Style plaster fragments discovered in the archaeological excavations of the *Caseggiato delle Taberne Finestrate* in Ostia present the same technical and stylistic features of the First Style fragments found in the centre of Rome (FALZONE, TOMASSINI 2019, pp. 117-125 with bibliography). The Second Style paintings from the *Domus dei Bucrani* in Ostia have been compared with the plaster fragments discovered in the *Villa del Cavalcavia di Salone* in Rome (FALZONE, GIOIA, MARANO 2018, pp. 481-482; concerning the paintings from the *Villa del Cavalcavia di Salone* see ANGELELLI, MUSCO 2019, pp. 129-134). Moreover, the plaster ceiling found in the excavations of the *Terme Bizantine* in Ostia shows strong similarities with the fragmentary ceilings discovered in the *Villa Medici* in Rome (FALZONE 2018b, pp. 91-94, fig. 6 with bibliography). Concerning the ceilings from *Villa Medici* see ERISTOV 2009, pp. 103-119; CASALE *et alii* 2015, pp. 176-180).

⁴ See the plan published in MARANO, TOMASSINI 2018, fig. 1.

⁵ For the localisation of the *caseggiato* see fig. 1 of the paper of S. Bracci, E. Cantisani, S. Falzone, M. Marano and P. Tomassini in this book. The black-and-white mosaic floor of the vestibule (fig. 1.1) gave the name to the *caseggiato*. This mosaic shows a competition between two wrestles (NEWBY 2002, pp. 193-194, fig. 7; LICORDARI, PELLEGRINO 2019, pp. 416-417).

⁶ In *Scavi di Ostia I* the *Caseggiato dei Lottatori* was mentioned among the buildings constructed at the age of the Emperor Hadrian (CALZA *et alii* 1953, p. 236). Later, G. Hermansen, C. Pavolini and H. Stöger accepted this chronology

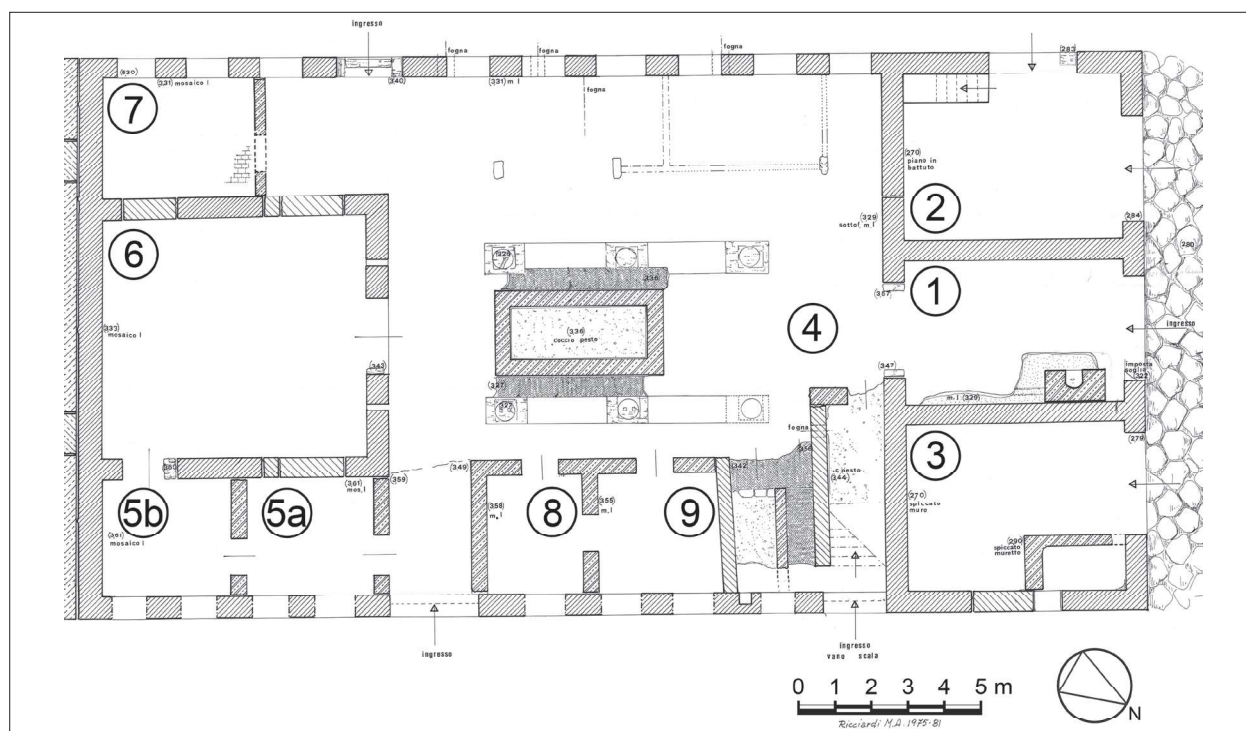


Fig. 1 - Ostia, plan of the *Cassegiato dei Lottatori* (MARANO 2018a, p. 46, fig. 2).

along an axis: a vestibule (fig. 1.1) flanked by two shops (fig. 1.2 and 1.3), a central courtyard with a rectangular basin (fig. 1.4) and a large hall on the bottom, called *tablinum* (fig. 1.6). Small rooms are ranged on the east and west sides of the courtyard and of the *tablinum*⁷. At first, the *caseggiato* was considered as a *domus*⁸; recently, it was rightly considered as a guild seat mostly due to the presence of four entrances from the streets outside⁹, signifying the importance of an easy access and the openness towards the external space¹⁰. The *Casseggiato dei Lottatori* was discovered in the years 1938-1942 during the extensive excavation directed by G. Calza in Ostia for the *Esposizione Universale di Roma*¹¹ and it was investigated again in 1975 by the *Soprintendenza per i Beni Archeologici di Ostia*¹². The excavation of 1975 evidenced further architectural structures in *opus reticulatum* and *opus reticulatum mixtum* as well as mortar pavements (with and without tessera designs) under the mosaic floors of the *caseggiato*¹³. Some deep soundings realized on this occasion in the *tablinum*

(HERMANSEN 1981, pp. 76-77, 113-115; PAVOLINI 2018, p. 223; STÖGER 2009; STÖGER 2011, pp. 215-242). More recently, the *Casseggiato dei Lottatori* was the topic of my doctoral thesis concerning the analysis of the construction phases of the block V, III in Ostia (M. Marano, *Il c.d. Casseggiato dei Lottatori e l'isolato V, III di Ostia: analisi delle trasformazioni edilizie, Università degli Studi di Roma "Tor Vergata"*, PhD dissertation: 28/03/2017). This study yielded evidence for different phases of life of the *caseggiato* from the 2nd c. AD to at least the 3rd-4th c. AD (see MARANO 2017a, pp. 4-11).

⁷ The east side of the building was entirely raised and repaved in the 3rd-4th c. AD (MARANO 2017a, pp. 4-11).

⁸ CALZA et alii 1953, p. 236.

⁹ The main entrance is located on the *Via della Fortuna Annonaria* while three other entrances open onto the *Via delle Ermette* and the *Via della Casa del Pozzo*.

¹⁰ HERMANSEN 1981, pp. 76-77, 113-115; PAVOLINI 2018, p. 223; STÖGER 2009; STÖGER 2011, pp. 215-242. C. Pavolini speculated that the building was the seat of a wrestlers' association.

¹¹ Concerning the E42 see SANTA MARIA SCRINARI 1987, pp. 179-188; OLIVANTI 2001, pp. 60-62.

¹² The results of this excavation remained unpublished. However, the excavation reports written by I. Pohl and M.G. Picozzi and the drawings by M.A. Ricciardi, now kept in the Ostian archives, give us a lot of information concerning the architectural structures found under the *caseggiato* (*Parco Archeologico di Ostia Antica, Archivio Giornali di Scavo*, vol. 155). In 1981 the *Casseggiato dei Lottatori* was restored as well as the other buildings of the blocks V, III and V, II: on this occasion, the architectural structures found in 1975 were buried (MANNUCCI 1988, pp. 483-487).

¹³ These structures date to the Late Republican and Julio-Claudian periods. These were destroyed in the 2nd c. AD in order to build the *Casseggiato dei Lottatori* (MARANO 2018a, pp. 45-51; MARANO 2020a, pp. 339-348).



Fig. 2 - Ostia, graphical reconstruction of a Fourth Style wall decoration from the excavations of the *Caseggiato dei Lottatori* (MARANO 2017b, p. 350, fig. 2).

revealed also archaeological layers containing abundant Second and Fourth Style plaster fragments of high quality used as fillers for the ground level elevation at the time of the construction of the *Caseggiato dei Lottatori* by virtue of their draining power¹⁴. Consequently, we ignore the original provenance of these fragments, found in secondary position, as well as the function of these paintings in their original context¹⁵. Nevertheless, the plaster fragments found in the *Caseggiato dei Lottatori* “speak” to us and allow us understanding the taste of the patrons and following the “fashion changes” during a crucial period for Roman history, from the Late Republic to the first Imperial period. In particular, the Fourth Style fragments, to which the following pages are dedicated, show a good state of conservation and a strong stylistic resemblance with the other contemporary Ostian pictorial contexts¹⁶. All the Fourth Style fragments found in the *Caseggiato dei Lottatori* seem to belong to a limited number of decorations. At this stage of the research, two wall decorations have been partially reconstructed¹⁷ (fig. 2 shows the most complete one), and many fragments belonging to black, red, yellow and white walls and ceilings have been identified¹⁸. Concerning the chronology of the Fourth Style fragments found in the *Caseggiato dei Lottatori*, it is important to say that the close stylistic analogies with the decoration of the portico of the *Bona Dea* Sanctuary in the fifth region of Ostia suggest to date the plaster fragments analysed below in the second half of the 1st c. AD, probably to the Neronian-Flavian period¹⁹.

¹⁴ Concerning the Second Style fragments from the *Caseggiato dei Lottatori* see MARANO, TOMASSINI forthcoming-a; concerning the Fourth Style fragments see MARANO 2017b, pp. 349-353; MARANO 2018b; MARANO 2020b.

¹⁵ It is not possible to determine if the fresco fragments originally covered the architectural structures found in 1975 under the *caseggiato*.

¹⁶ See the other papers on Ostia in this book.

¹⁷ MARANO 2017b, pp. 349-353; MARANO 2018b.

¹⁸ MARANO 2020b; MARANO, TOMASSINI forthcoming-b.

¹⁹ Concerning the *Bona Dea* Sanctuary see MEDRI, FALZONE 2018, pp. 53-64 with bibliography; TOMASSINI 2019b, pp. 83-84.

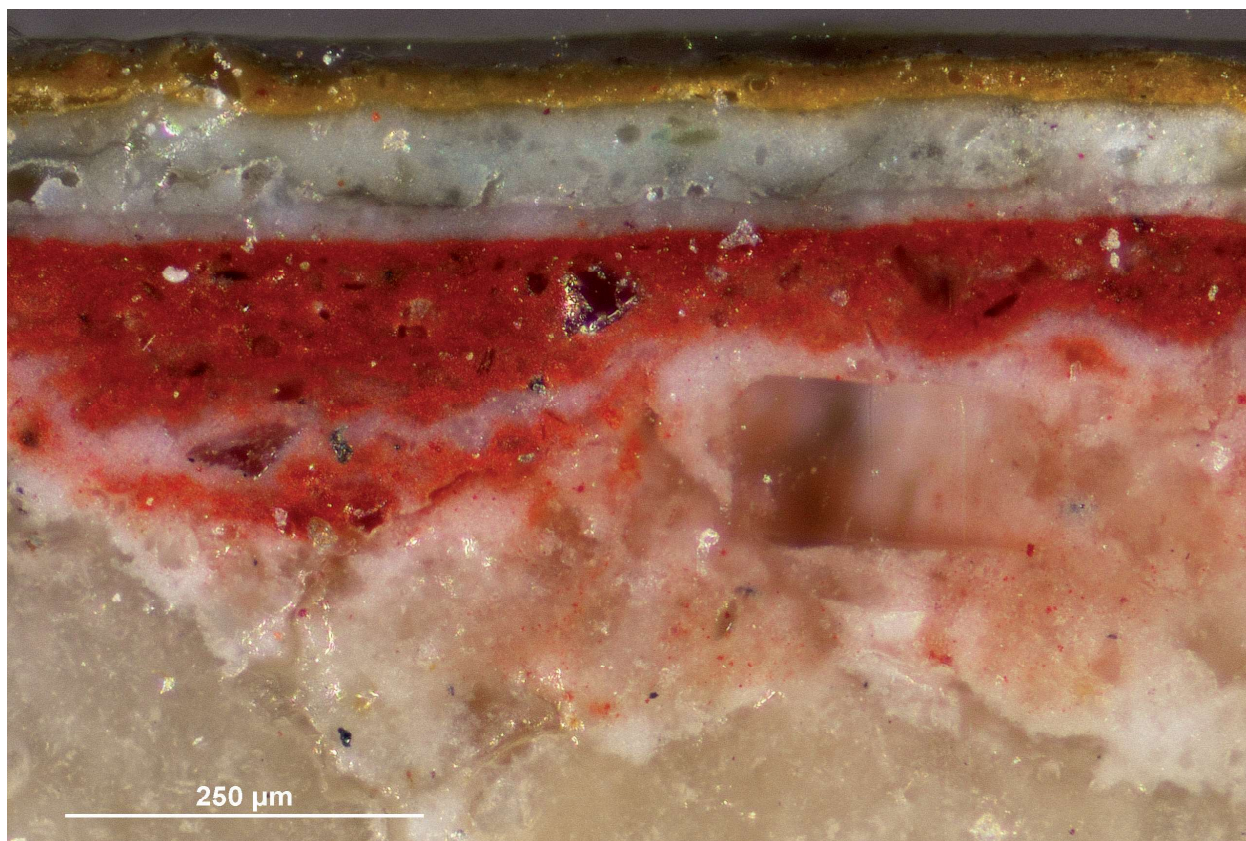


Fig. 3 - Ostia, *Nuovi Depositi*. Fragment OS_PIV_1 from the *Caseggiato dei Lottatori*, Fourth Style. Cross section of the *intonachino* layer characterized by the red under-layer and partially covered by a very thin layer of plaster corresponding to the contact point between the medium and the high zone of the wall (elab. E. Cantisani).

THE FRAGMENTS

As mentioned before, five fragments have been archaeometrically analysed during the study. They have not been chosen for their aesthetic value: they have been chosen because they present similar features to the fragments of the *Caseggiato delle Taberne Finestrate*²⁰, specifically concerning the decorative motifs, the chromatic palette and the mortar layers. Two were the main purposes of the archaeometric analyses: on the one hand, to verify if the macroscopic similarities visible to the naked eye were real from a scientific point of view; on the other, to obtain the pigments “recipes” and the mortars composition of the selected fragments. The archaeometric analyses confirmed that two of these fragments (OS_PIV_1 and OS_PIV_2) really belong to the same wall decoration, already presented elsewhere²¹ and partially recomposed (fig. 2): according to the remaining fragments, the decoration was structured in wide red panels and narrow black inter-panels in the medium zone (we can suppose that the red panels were decorated by framed figurative scenes, unfortunately lost)²². The red panels were framed by embroidery borders, while the black inter-panels were decorated with articulated architectures. In the lower part of the wall, there was a uniform zone (*zoccolo*), painted in black and adorned with different decorative motifs (embroidery borders, garlands, birds and bushes)²³. This reconstruction is based on key fragments (that allow to associate fragments with

²⁰ See the paper of P. Tomassini in this book.

²¹ MARANO 2017b, pp. 349-353.

²² For some fragments of these figurative scenes see MARANO 2020b.

²³ As said before, this wall painting presents close stylistic analogies with the portico of the *Bona Dea* Sanctuary in Ostia (see MARANO 2017b, pp. 349-353; MARANO 2018b).

different decoration) and on technical features, as the mortar layers (number of layers, thickness and composition). Fragments with different decorative features (as samples OS_PIV_3 and OS_PAV_1) or with different mortar layers (as sample OS_PIV_4) have not been included in the reconstruction. The fragments OS_PIV_1 and OS_PIV_2 come from the upper part of the medium zone, respectively the central red panel (*fig. 4*) and the left black inter-panel (*fig. 5*). The two fragments examined, as well as all the fragments belonging to this wall, have a red under-layer between the paint layer and the *intonachino* (this red under-layer is clearly visible in *fig. 4* and *fig. 5b*).

FRAGMENT OS_PIV_1 (*fig. 3-4*)

This fragment depicts a section of an architectural motif with a green frieze (green earth) and a yellow cornice (yellow ochre) on a red background (red ochre; *fig. 4*). This motif can be compared with the fragment OS_PI_A2 from the *Caseggiato delle Taberne Finestrate* (see P. Tomassini's paper). A horizontal band of dark yellow (yellow ochre) was overlaid to create a depth effect on the cornice. The frieze shows a yellow and white circular motif, probably a *patera*. As said before, this fragment belonged to the central red panel of the recomposed Fourth Style wall painting (*fig. 2*) and was to be located between the medium and the high zone (*fig. 3*). The yellow cornice that hides the point of contact between the medium and the high zone was created after having laid a very thin layer of plaster, as shown in *fig. 3*. The VIL analysis, as well as the microphotography (*fig. 4*) revealed the presence of a small number of Egyptian blue grains in the green and yellow elements of the decoration (frieze and cornice).

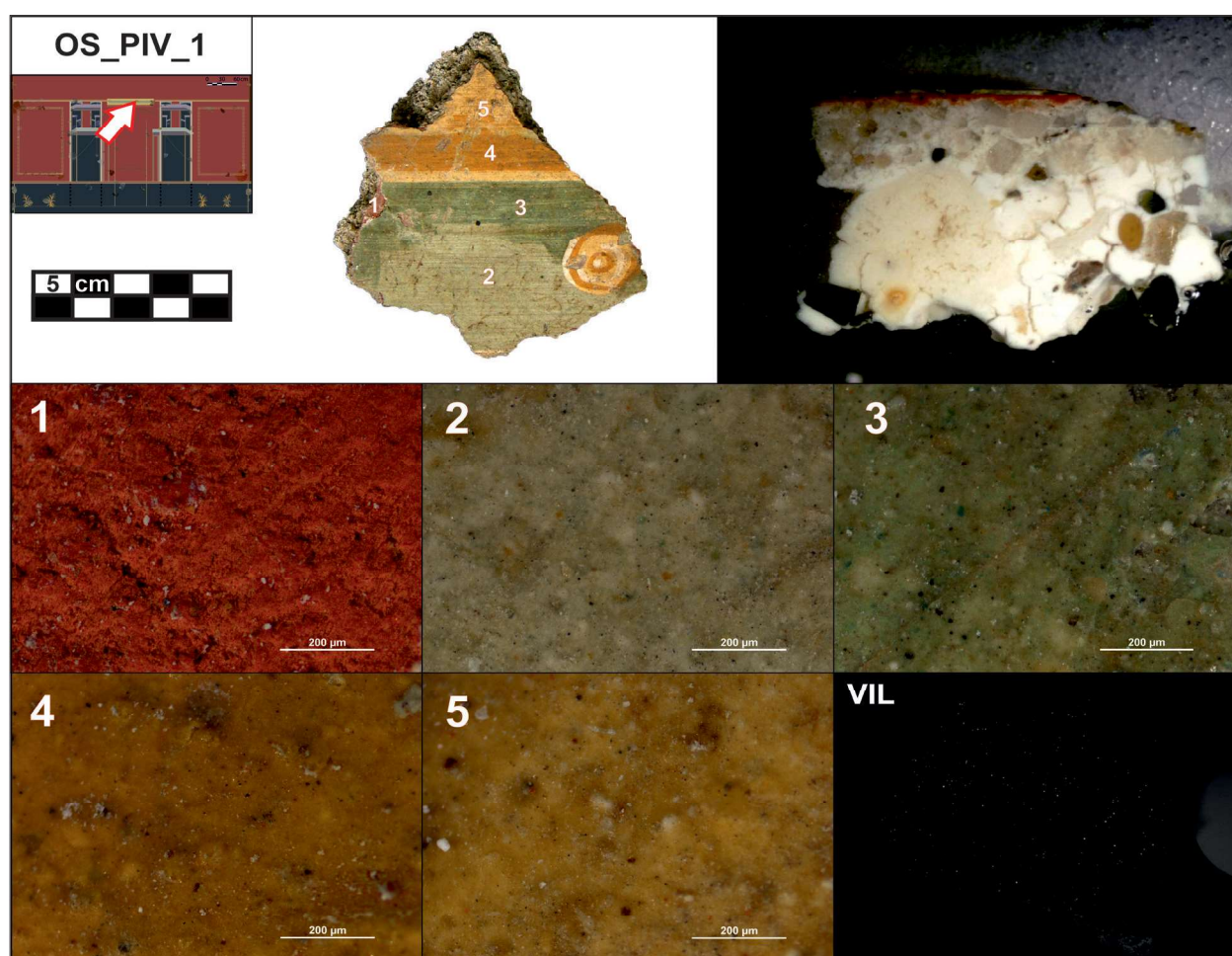


Fig. 4 - Ostia, *Nuovi Depositi*. Fragment OS_PIV_1 from the *Caseggiato dei Lottatori*, Fourth Style. On the right: cross section of the *intonachino* and *intonaco* (elab. S. Bracci, E. Cantisani, M. Marano, P. Tomassini).

OS_PIV_1	fragment with a green frieze and a yellow cornice, red background (fig. 3-4)				
Mortars (petrographic analysis)	Intonachino	binder	composition	Calcic lime	
			structure	Homogeneous	
			texture	Micritic/microsparitic	
		aggregate	composition	Carbonate rock fragments (travertine fragments are prevalent)	
			distribution	Bimodal	
			granulometry	150 µm to 2 mm	
			shape	Sub-angular	
		bind./agr. ratio	1/3		
		porosity	Medium amount due to microcracks and pores of irregular shape		
		thickness	0,4-0,5 cm		
	intonaco	binder	composition	Calcic lime	
			structure	Homogeneous	
			texture	Micritic	
		aggregate	composition	Pyroxenes are prevalent, few volcanic and carbonate rock fragments	
			distribution	Homogeneous	
			granulometry	Approximately 800 µm	
			shape	Sub-angular	
		bind./agr. ratio	1/3		
		porosity	Medium amount due to microcracks and pores of irregular shape		
		thickness	Not preserved		
	Technique	Traces of red under-layer on the <i>intonachino</i> layer			
	Pigments	Colour	XRF	FORS	VIL
		Red	Ca (Sr), Fe ++	Red ochre	Neg.
Light green		Ca (Sr), Fe ++, K +, Cu +/-	Green earth	Positive. Few crystals of Egyptian blue	
Dark green		Ca (Sr), Fe +++, Pb ++, Cu (tr), K (tr)	Green earth	Positive. Few crystals of Egyptian blue	
Light and dark yellow		Ca (Sr +), Fe ++, K +, Cu (tr)	Yellow ochre	Positive. Few crystals of Egyptian blue	
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.					

FRAGMENT OS_PIV_2

This fragment shows a section of one of the narrow black inter-panels with architectural motifs of the Fourth Style wall painting reproduced in *fig. 2*. The horizontal band in the upper part of the fragment is an entablature realized in light and dark yellow (yellow ochre; *fig. 5*). This entablature was originally located at the top end of the medium zone²⁴. A grey arch framed by a white line is visible under the entablature. At the bottom of the fragment, a small portion of a red-violet entablature (red ochre) is preserved. The yellow and the red-violet entablatures show white and yellow motifs quickly drawn.

The VIL analysis revealed the presence of the Egyptian blue in the grey arch and in the light-yellow line of the upper entablature.

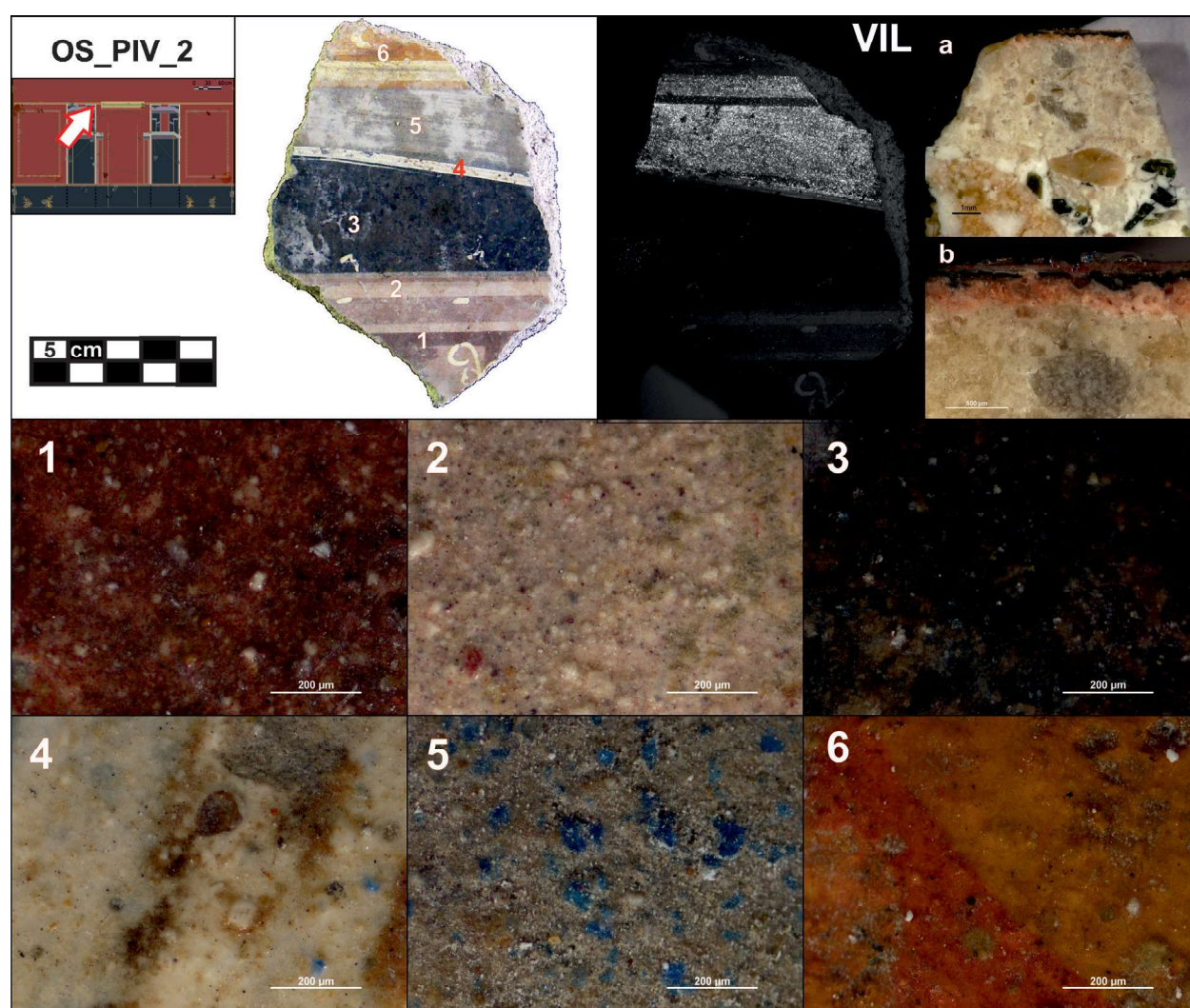


Fig. 5 - Ostia, *Nuovi Depositi*. Fragment OS_PIV_2 from the *Caseggiato dei Lottatori*, Fourth Style. On the right of the picture: a. thin section of the *intonachino* and *intonaco* layers; b. detail of the cross section of the *intonachino* layer with traces of the red under-layer (elab. S. Bracci, E. Cantisani, M. Marano, P. Tomassini).

²⁴ It may not be visible on the picture, but on the upper part of the fragment we can see a red background belonging to the beginning of the upper zone.

OS_PIV_2	fragment with architectural motifs, black background (<i>fig. 5</i>)				
Mortars (petrographic analysis)	<i>Intonachino</i>	binder	composition	Calcic lime	
			structure	Homogeneous	
			texture	Micritic/microsparitic	
		aggregate	composition	Carbonate rock fragments (travertine fragments are prevalent)	
			distribution	Bimodal	
			granulometry	50 µm to 700-800 µm	
			shape	Sub-angular/sub-rounded	
		bind./agr. ratio	1/3-1/4		
		porosity	Medium amount due to microcracks and pores of irregular shape		
		thickness	0,4-0,5 cm		
	<i>intonaco</i>	binder	composition	Calcic lime	
			structure	Homogeneous	
			texture	Micritic/microsparitic	
		aggregate	composition	Pyroxenes are prevalent, carbonate rock fragments, few silicate rock fragments	
			distribution	Homogeneous	
			granulometry	Approximately 800 µm	
			shape	Sub-angular	
		bind./agr. ratio	1/2-1/3		
		porosity	Medium amount due to microcracks and pores of irregular shape		
		thickness	Approximately 1,5 cm		
Technique	Traces of red under-layer on the <i>intonachino</i> layer				
Pigments	Colour	XRF	FORS	VIL	
	Dark violet	Ca (Sr), Fe ++, K (tr)	Red ochre	Neg.	
	Light violet	Ca (Sr), Fe +, K (tr)	Red ochre	Neg.	
	Black	Ca (Sr), Fe +/-, K (tr)	Not identified	Neg.	
	White	Ca (Sr), Fe +/-, K (tr)	White with ochre	Neg.	
	Grey	Ca (Sr), Cu ++, Fe +/-, K (tr)	Not identified	Positive	
	Yellow	Ca (Sr), Fe +++	Yellow ochre	Neg. except for the light yellow line in the upper part of the fragment	
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.					

FRAGMENT OS_PIV_3

This group of three fragments is a part of a black inter-panel and depicts an architectural motif formed by a green frieze (green earth) with white decorations, a yellowish architrave (yellow and red ochre) and a red-violet coffered ceiling (ochre; *fig. 6*). This architectural motif can be compared with the fragment OS_PI_A2 from the *Caseggiato delle Taberne Finestrate* showing the same chromatic palette (see P. Tomassini's paper in this book). The perspective of the ceiling is obtained by drawing a series of white-grey lines (ochre) parallel and oblique. A white stylized column capital appears in the background, supporting the ceiling (in the lower

part of the fragment we can also see traces of an unidentifiable red element belonging to this architecture). This black inter-panel is framed on the right by a red band and a white line. The VIL analysis did not reveal the presence of the Egyptian blue. For this fragment, it was not possible to analyse the mortar layers. We can only say that the *intonachino* is 0,4-0,5 cm thick and is composed by a white mortar with few aggregates. There are no traces of the red under-layer, visible in the fragments OS_PIV_1 and OS_PIV_2. The *intonaco* layer is a grey calcic lime mortar containing a large amount of aggregate. This layer is very compact and contained straw.

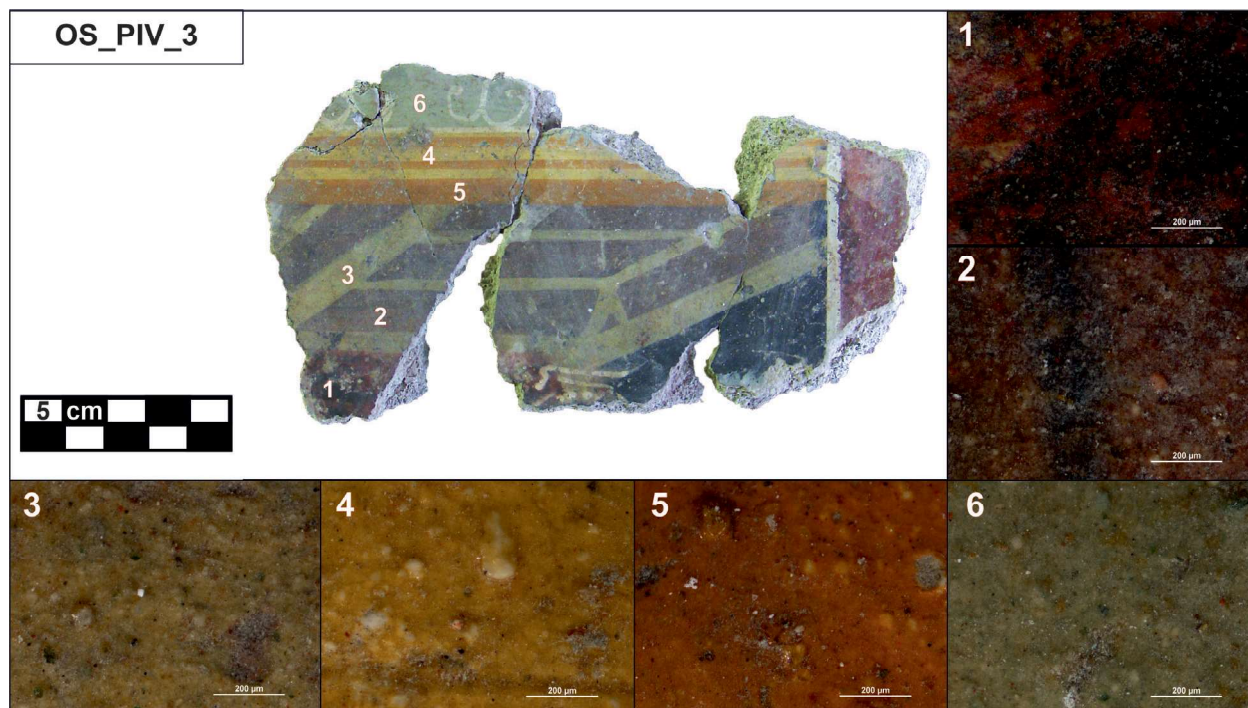


Fig. 6 - Ostia, *Nuovi Depositi*. Fragment OS_PIV_3 from the *Caseggiato dei Lottatori*, Fourth Style (elab. S. Bracci, M. Marano, P. Tomassini).

OS_PIV_3	fragment with architectural motif (entablature, coffered ceiling), black background (fig. 6)			
Pigments	Colour	XRF	FORS	VIL
	Black	Ca (Sr), Fe +, Pb +	Not identified	Neg.
	Red-violet	Ca (Sr), Fe ++	Ochre	Neg.
	White-grey	Ca (Sr), Fe +++, Pb ++, K (tr), Ni (tr)	Ochre	Neg.
	Light yellow	Ca (Sr), Fe +++	Yellow ochre	Neg.
	Dark yellow	Ca (Sr), Fe +++	Yellow ochre/red ochre	Neg.
	Green	Ca (Sr), Fe +, K +, Si +, Cr +, Ni +	Green earth	Neg.
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

FRAGMENT OS_PIV_4

This fragment shows a portion of a column shaft rendered by different shades of yellow (yellow ochre) on a black and red background (fig. 7), very similar to the fragment OS_PI_A3 from the *Caseggiato delle Taberne Finestrate* (see P. Tomassini’s paper in this book). The column is flanked on one side by a pale-pink band, poorly preserved (red ochre).

This fragment has not been included in the reconstruction of the wall painting described above (fig. 2) because the mortar layers are slightly different, although the decoration and the chromatic palette are very similar. In this case, only the *intonachino* layer could be analysed: it contains crystals of calcite (absent in fragments OS_PIV_1 and OS_PIV_2) and there is no trace of the red under-layer (present in fragments OS_PIV_1 and OS_PIV_2).

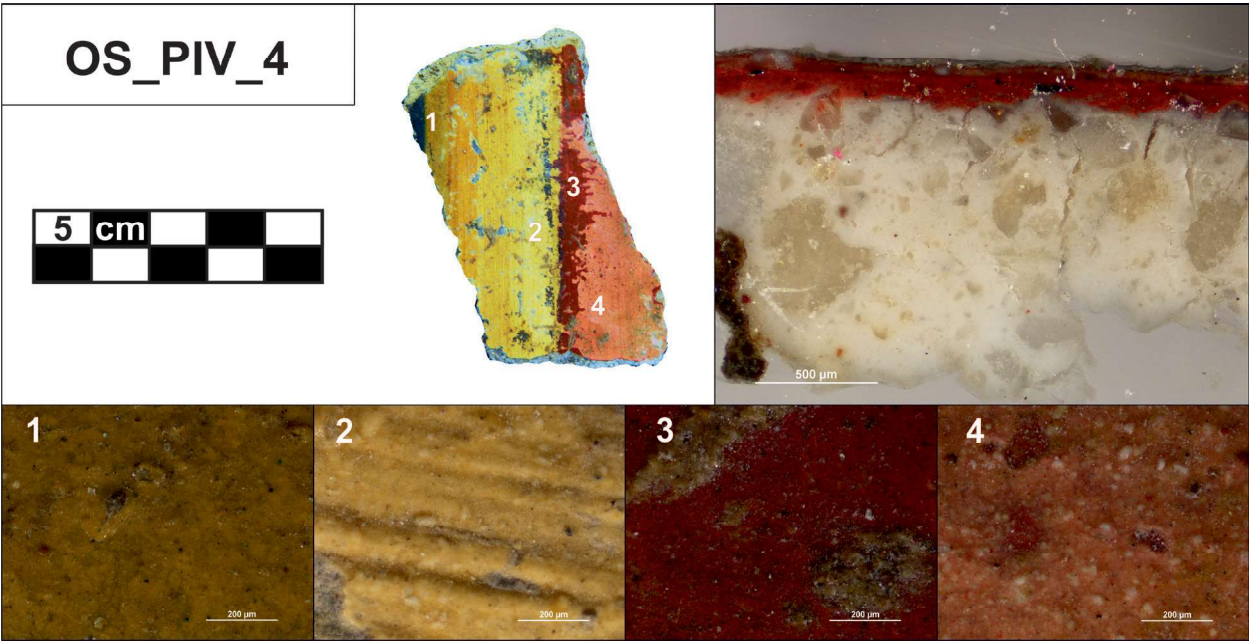


Fig. 7 - Ostia, *Nuovi Depositi*. Fragment OS_PIV_4 from the *Caseggiato dei Lottatori*, Fourth Style. On the right of the picture: cross section of the *intonachino* layer (the red paint layer is clearly visible, instead there are no traces of the red under-layer; elab. S. Bracci, E. Cantisani, M. Marano, P. Tomassini).

OS_PIV_4	fragment with a column shaft and a pink band, black and red background (fig. 7)			
Mortars (petrographic analysis)	Intonachino	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic
		aggregate	composition	Carbonate rock fragments, single crystals of calcite (perhaps crushed marble)
			distribution	Bimodal
			granulometry	50 µm to 500 µm
			shape	Sub-angular
		bind./agr. ratio	1/2	
		porosity	Medium amount due to microcracks and pores of irregular shape	
		thickness	0,4 cm	

	<i>intonaco</i>	Not analysed (badly preserved)		
Pigments	Colour	XRF	FORS	VIL
	Dark yellow	Ca (Sr), Fe ++, K +, Cr +, Pb (tr), Ni (tr), Ti (tr)	Yellow ochre	Not used
	Light yellow	Ca (Sr), Fe ++, K +, Pb (tr), Ni (tr), Ti (tr)	Yellow ochre	Not used
	Red	Ca (Sr), Fe +++, Pb (tr), Ni (tr), Ti (tr)	Red ochre	Not used
	Pale-pink	Ca (Sr), Fe +++, Pb (tr), Ni (tr), Ti (tr)	Red ochre	Not used
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

FRAGMENT OS_PAV_1

This plaster fragment shows a peacock feather on a red background (red ochre; *fig. 8*). The feather is red-violet (red ochre) with a green-blue eye (green earth) encircled by a thin yellow line (yellow ochre) and a white central quill (lead white?). The feather is surrounded by green-blue and yellow leaves (green earth and yellow ochre). This fragment is part of a more complex motif realized by using preparatory lines (we can see only one preparatory line on the right of the fragment, but there was probably another line on the left side of the feather). The VIL analysis revealed that the peacock's eye and the leaves are made up of a mixture of green earth and a discrete amount of Egyptian blue. The paint layer is approximately 100 microns thick and we can see the red under-layer between the paint layer and the *intonachino*.

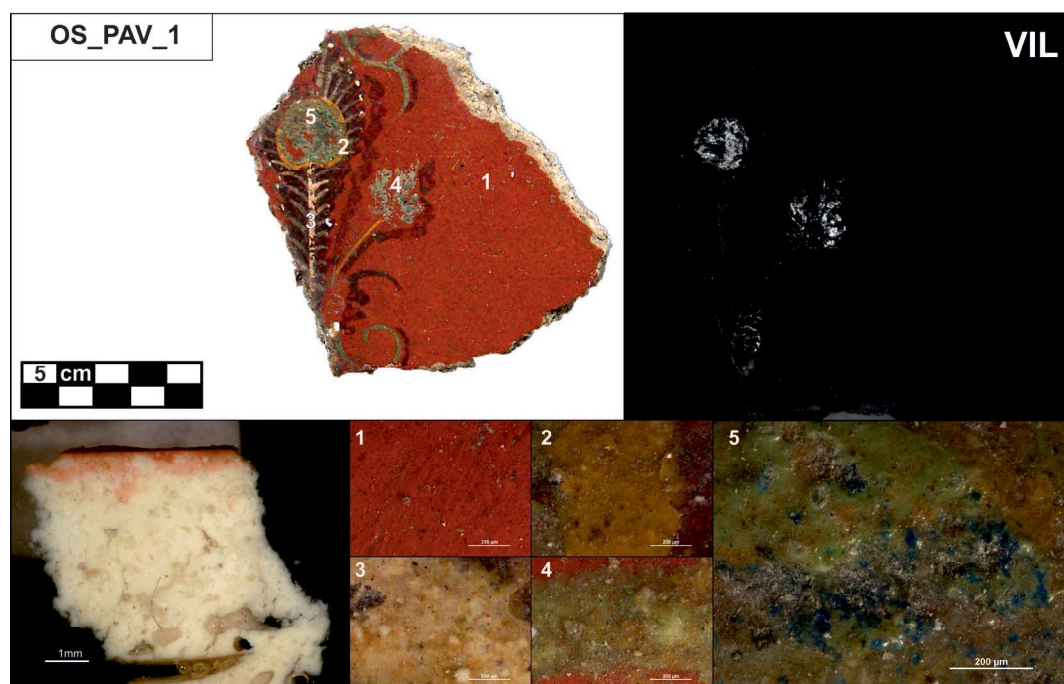


Fig. 8 - Ostia, *Nuovi Depositi*. Fragment OS_PAV_1 from the *Caseggiato dei Lottatori*, Fourth Style. On the bottom left, cross section of the *intonachino* (elab. S. Bracci, E. Cantisani, M. Marano, P. Tomassini).

OS_PAV_1	fragment with a peacock feather, red background (<i>fig. 8</i>)			
Mortars (petrographic analysis)	<i>Intonachino</i>	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic/microsparitic
		aggregate	composition	Carbonate rock fragments (some lumps appear as under burnt fragments)
			distribution	Heterogeneous
			granulometry	50 µm to 1 mm
			shape	Sub-angular/sub-rounded
		bind./agr. ratio	1/2	
		porosity	Medium amount due to microcracks and pores of irregular shape	
		thickness	0,8-1 cm	
	<i>intonaco</i>	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic
		aggregate	composition	Pyroxenes are prevalent, carbonate and silicate rock fragments
			distribution	Homogeneous
			granulometry	150 µm to 1,5 mm
			shape	Sub-angular
		bind./agr. ratio	1/3	
		porosity	Medium amount due to pores of rounded shape	
		thickness	Approximately 1 cm	
Technique	Traces of red under-layer on the <i>intonachino</i> layer			
Pigments	Colour	XRF	FORS	VIL
	White	Ca (Sr), Fe ++, Pb +, Cu (tr)	White with ochre; lead white?	Neg.
	Red	Ca (Sr), Fe +++, Pb (tr)	Red ochre	Neg.
	Yellow	Ca (Sr), Fe ++, Pb (+), Cu (tr), Cr + (perhaps from the green colour)	Yellow ochre	Neg.
	Green-blue (peacock feather)	Ca (Sr), Fe ++, Cu ++, Cr +, K +, Si +, Pb (tr)	Not identified	Positive, abundant amount of Egyptian blue
	Green-blue (leaves)	Ca (Sr), Fe +, Cu ++, Pb (tr)	Green earth with Egyptian blue	Positive, abundant amount of Egyptian blue
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

CONCLUSIONS

These results provide important information concerning the nature of pigments and mortars used in the Fourth Style paintings in Ostia, with particular regard to the wall fragments (in this study there are no fragments of ceilings). The results are very homogeneous and show the predominant use of red and black backgrounds, in some cases associated in the same composition (see fragments OS_PIV_1, OS_PIV_2 and OS_PIV_4). Concerning the black background, the FORS analysis was not able to identify the nature of the pigment, while the red used for the background is systematically made of red ochre.

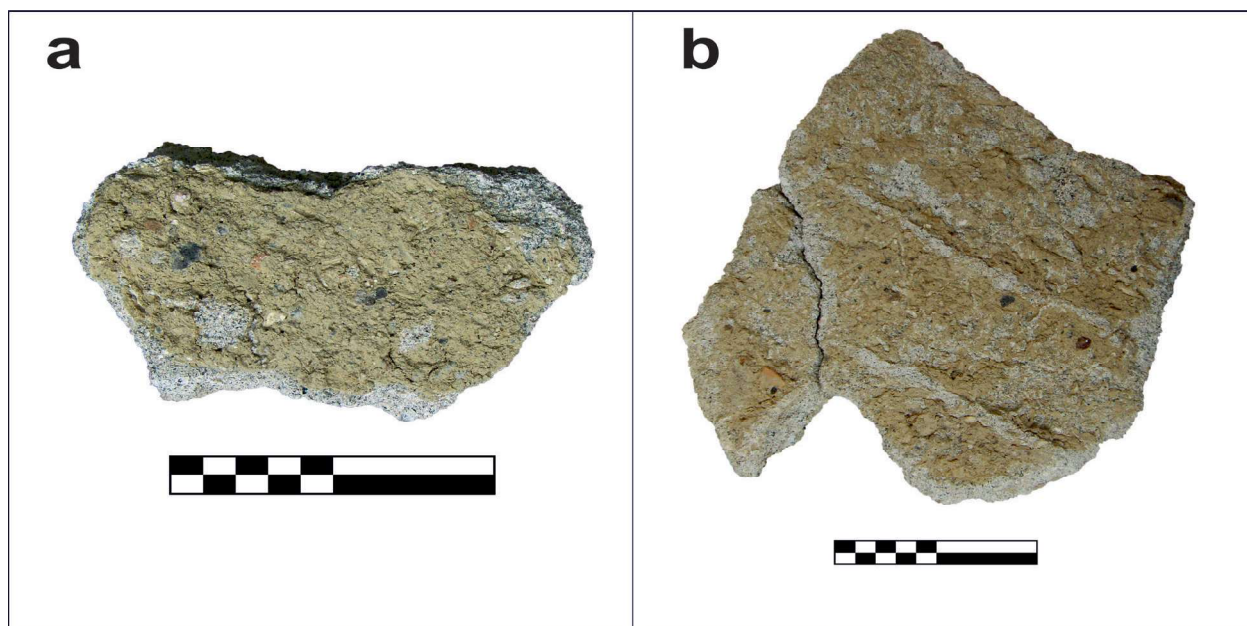


Fig. 9 - Ostia, *Nuovi Depositi*. The rear of two Fourth Style fragments from the *Caseggiato dei Lottatori*: a. detail of the *arriccio* layer; b. detail of the *intonaco* layer with parallel stripes in a fishbone pattern (elab. M. Marano, P. Tomassini).

The decorative motifs are mostly made in yellow, red, red-violet, pale-pink, white, grey and green. In all the fragments, the red, pink and red-violet pigments have been identified as red ochre and the yellow pigment as yellow ochre²⁵. An exception is the yellow band of the sample OS_PIV_2, positive to the VIL analysis and containing Egyptian blue. The white colour was probably obtained by using a calcium-based pigment: only on sample OS_PAV_1 the white pigment could eventually be interpreted as lead white due to the large amount of lead shown by the XRF spectrum. Most rewarding was the analysis of the green pigment used for the decorative motifs, characterized as green earth (see the fragments OS_PIV_1, OS_PIV_3 and OS_PAV_1). The XRF analysis revealed the presence of iron [Fe], potassium [K] and Chromium [Cr]. The fragments of the *Caseggiato delle Taberne Finestrate* have the same chemical composition and this could indicate that in the 1st c. AD the painters have used a same source of supply of green earth. This pigment was used both pure (without the adding of other pigments), as in fragment OS_PIV_3, or it was mixed with Egyptian blue. In fact, the VIL analysis on the fragment OS_PAV_1 revealed presence of Egyptian blue mixed with the green earth, probably to create a more intense shade of green for the eye and the leaves of the peacock feather. A smaller amount of Egyptian blue crystals has been found also in the green earth of the fragment OS_PIV_1, but in this case it is difficult to determine whether these traces are the result of a mixture realised by the painter or the result of a dirty brush, as very similar traces of Egyptian blue are visible also in the yellow pigment of this fragment. This is not a surprise, as archaeometric analyses revealed the Egyptian blue was not used pure in the fragments of the *Caseggiato dei Lottatori*; it was mixed with other pigments, for example with a grey pigment or a yellow pigment, as we can see on the fragment OS_PIV_2.

The petrographic and geological analyses revealed that the recomposed wall painting from the *Caseggiato dei Lottatori* (fig. 2) has homogeneous mortar layers, formed by a white *intonachino* (calcic lime and carbonate rock fragments²⁶) 0,4-0,5 cm thick and a white-grey *intonaco* (calcic lime, pyroxenes, few volcanic and carbonate rock fragments; see samples OS_PIV_1 and OS_PIV_2).

²⁵ The different yellow shades depend on the type of ochre and on the grinding of the pigment. It is also possible that in some cases the yellow ochre has been mixed with a white pigment in order to create a light yellow.

²⁶ Travertine fragments are prevalent. We can also distinguish an abundant presence of lime lumps in the *intonachino* referred to under-burnt fragments of limestones.

Originally, there was a third layer, the *arriccio*: in most cases, this layer has fallen away and it has left only little traces, analysed only at a macroscopic level (*fig. 9a-b*). The *arriccio* layer was a brown-yellow mortar of a very friable consistency composed by a small number of fragments of carbonate and volcanic rocks, crushed ceramics and an abundant amount of straw. In some cases, parallel stripes in a fishbone pattern ensured the adherence of the *arriccio* to the *intonaco* (*fig. 9b*). The composition and the layout of the mortar layers of the fragment OS_PAV_1 are very similar to the fragments OS_PIV_1 and OS_PIV_2. Otherwise, only the *intonachino* of the fragment OS_PIV_4 contains single calcite crystals, probably derived from crushed marble.

To conclude, archaeometric analyses enrich the archaeological study with information about the chemical composition of mortars and pigments, paving the way for a new branch of studies in Ostia²⁷. The hope is this kind of research can continue in the future in order to compare the painting technique of the different “Pompeian Style” contexts and to understand the differences between these contexts and the more recent ones.

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²⁷ Concerning the application of the archaeometry techniques to the Ostian wall paintings see TERRAPON 2007, pp. 81-98; FALZONE *et alii* 2010, pp. 925-929; CIAFREI *et alii* 2013; FALZONE, MARANO, TOMASSINI 2021 ; HERENS forthcoming.

FOURTH STYLE WALL PAINTINGS FROM OSTIA: GENERAL CONSIDERATIONS IN THE LIGHT OF ARCHAEOMETRIC DATA

Martina Marano, Paolo Tomassini

As previously said, the *Caseggiato dei Lottatori* and the *Caseggiato delle Taberne Finestrate* are not the only contexts analysed by the ICVBC. Indeed, two other fragments of Fourth Style wall paintings have been collected during the study: the first one comes from the excavation of the V, II, 2 building (fragment OS_PAV_2); the second one has been found in the deposits of the *Insula di Baccho Fanciullo* and its original provenance is unknown (fragment OS_PIV_5). The archaeometric data relating to these two samples (see *infra*) and those presented in the previous pages¹ led us to make more general considerations concerning Ostian Fourth Style wall paintings. In this paper we will try to summarize the results of the research and to demonstrate the homogeneity of both pigments and mortars between the analysed contexts.

FRAGMENT OS_PAV_2

This fragment was found in secondary position in the archaeological excavations of the V, II, 2 building². It shows a peacock feather on a yellow background (yellow ochre; *fig. 1*). The feather is very similar to those found in the *C. dei Lottatori* (fragment OS_PAV_1) and in the *C. delle Taberne Finestrate* (fragment OS_PI_C1): it is characterised by a red-violet base (red ochre) and a green-blue eye (green earth) encircled by a thin yellow line. It shows a white and light pink central quill and is surrounded by green leaves (green earth). On the left of the fragment we can see some traces of a red illegible motif, probably a vegetal motif (red ochre). The VIL analysis revealed that the peacock's eye is made up of a mixture of green earth and a discrete amount of Egyptian blue (instead, the leaves do not contain Egyptian blue). The paint layer is approximately 100 microns thick and we can see the red under-layer on the *intonachino*. The strong similarities between the three peacock feathers concerning the colour palette and the painting execution were already supposed by the macroscopic observation³, but the non-invasive analyses have given a stronger confirmation of the bonds between these fragments: they show not only a common stylistic repertoire but also a common technique and skill.

¹ See the papers of S. Bracci, E. Cantisani, S. Falzone, M. Marano and P. Tomassini in this book.

² PETRIAGGI 1984, pp. 119-204.

³ MARANO, TOMASSINI 2018, pp. 509-510, fig. 8.

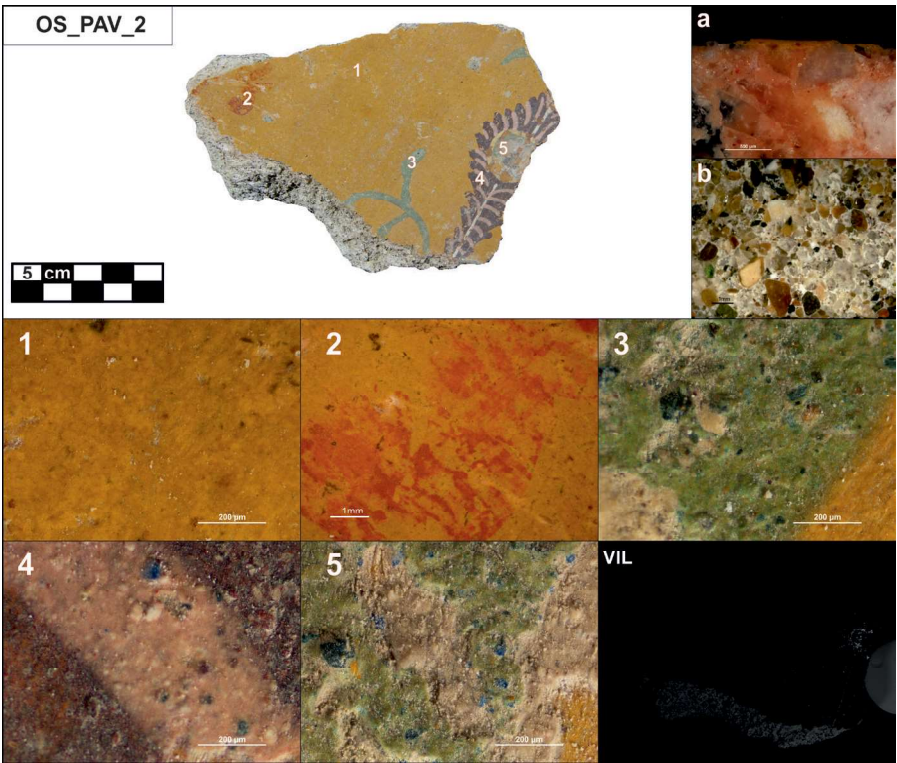


Fig. 1 - Ostia, *Nuovi Depositi*. Fragment OS_PAV_2 from the building V, II, 2, Fourth Style. On the right of the picture: cross section, a. *intonachino*, b. *intonaco* (elab. S. Bracci, E. Cantisani, M. Marano, P. Tomassini).

OS_PAV_2	fragment with a peacock feather, yellow background (<i>fig. 1</i>)			
Mortars (petrographic analysis)	<i>Intonachino</i>	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic
		aggregate	composition	Spathic calcite
			distribution	Bimodal
			granulometry	100 µm to 1 mm
			shape	Angular
		bind./agr. ratio	1/3	
		porosity	Scarce	
		thickness	0,5-0,6 cm	
	<i>intonaco</i>	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic
		aggregate	composition	Pyroxenes, <i>cocciopesto</i> , few carbonate rock fragments
			distribution	Homogeneous
			granulometry	100 µm to 700 µm
			shape	Sub-angular
		bind./agr. ratio	1/2	
		porosity	Scarce	
		thickness	Approximately 1 cm	
Technique	Traces of red-under-layer on the <i>intonachino</i>			

Pigments	Colour	XRF	FORS	VIL
	Red	Ca (Sr), Fe ++, Cu (tr)	Not identified	Neg.
	Red-violet (peacock feather)	Ca (Sr), Fe ++, Pb (tr)	Not significant	Neg.
	Yellow	Ca (Sr), Fe ++, Pb (tr)	Yellow ochre	Neg.
	Green-blue (peacock feather)	Ca (Sr), Fe ++, Cu ++, Pb (+/-), K (tr), Cr (tr)	Green earth with Egyptian blue	Positive, abundant amount of Egyptian blue
	Green (leaves)	Ca (Sr), Fe ++, Pb (tr)	Green earth	Neg.
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

FRAGMENT OS_PIV_5

This fragment of unknown provenance is a part of a black inter-panel decorated with an architectural motif: three yellowish column shafts are visible in the foreground (yellow ochre), while in the background there is a green arched architecture (green earth; *fig. 2*)⁴.

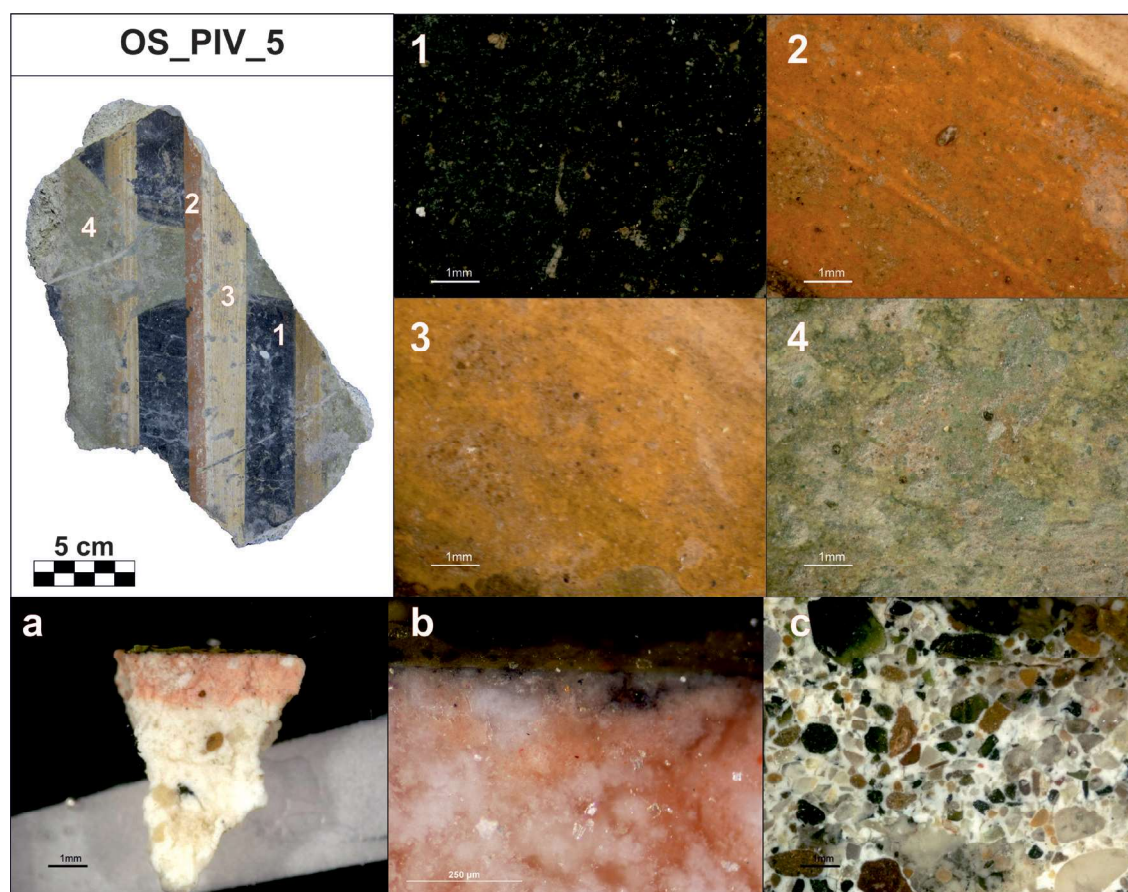


Fig. 2 - Ostia, *Nuovi Depositi*. Fragment OS_PIV_5 from the deposit of the *Insula di Bacco Fanciullo*, Fourth Style. At the bottom, thin sections: a. and b. *intonachino*; c. *intonaco* (elab. S. Bracci, E. Cantisani, M. Marano, P. Tomassini).

⁴ This architectural motif can be compared with the black inter-panels of the portico of the *Bona Dea* Sanctuary in the 5th region of Ostia (MARANO, TOMASSINI 2018, pp. 509-510, fig. 7d-e with bibliography).

OS_PIV_5	fragment with yellowish column shafts and green arched architecture, black background (<i>fig. 2</i>)			
Mortars (petrographic analysis)	<i>Intonachino</i>	binder	composition	Calcic lime
			structure	Heterogeneous
			texture	Micritic/microsparitic
		aggregate	composition	Spathic calcite, carbonate rock fragments (they have the appearance of lumps)
			distribution	Heterogeneous
			granulometry	150 µm to 1 mm
			shape	Sub-angular/sub-rounded
		bind./agr. ratio	1/2	
		porosity	Medium amount due to microcracks and pores of irregular shape	
		thickness	1,2 cm	
	<i>intonaco</i>	binder	composition	Calcic lime
			structure	Homogeneous
			texture	Micritic/microsparitic
		aggregate	composition	Pyroxenes, carbonate rock fragments, few volcanic rock fragments
			distribution	Homogeneous
			granulometry	Approximately 200-300 µm; max. >1 mm (carbonate rock fragments)
			shape	Sub-angular/sub-rounded
		bind./agr. ratio	1/2-1/3	
		porosity	Medium amount due to microcracks and pores of irregular shape	
		thickness	Approximately 1 cm	
Technique	Traces of red-under-layer on the <i>intonachino</i>			
Pigments	Colour	XRF	FORS	VIL
	Black	Ca (Sr), Fe (tr)	Not identified	Neg.
	Dark yellow	Ca (Sr), Fe ++, K (tr), Ti (tr), Ni (tr)	Yellow ochre	Neg.
	Light yellow	Ca (Sr), Fe +, K (tr), Ti (tr), Ni (tr)	Yellow ochre	Neg.
	Green	Ca (Sr), Fe +++, K +, Cr +, Si +, Pb (tr)	Green earth	Neg.
Semi-quantitative evaluation: (+++): very abundant; (++): abundant; (+): secondary; (+/-): low amount; (tr): traces.				

Three other fragments, now stored in the *Nuovi Depositi* of Ostia, show the same decoration and made part of the same wall composition⁵. The VIL analysis did not reveal the presence of the Egyptian blue. The paint layer is approximately 300 µm thick.

CONCLUSIONS

OSTIAN FOURTH STYLE PIGMENTS

The archaeometric analyses provide relevant information concerning the chemical composition of pigments and mixtures used in different Fourth Style contexts. It is important to say the pigments and mixtures used to decorate wall paintings are always the same. The ceiling from the *Caseggiato delle Taberne Finestrate* (OS_SII group) has been realized by using the same pigments of the wall paintings but with the addition of more particular pigments, such as lead white or pure Egyptian blue. The use of these pigments, the complexity of the decorative motifs and the quality of the mortar layers seem to suggest special attention to the execution of this ceiling.

White pigments

The white pigment is used for the backgrounds (unpublished fragments from the *C. dei Lottatori*, *C. delle Taberne Finestrate* and *in situ* wall painting of V, II, 2⁶), but the chemical composition of these decorations has not yet been analysed. Instead, we know the chemical composition of the white decorative motifs: in most cases, we have a calcium-based white pigment mixed with ochres (fragments OS_PI_B1, OS_PI_B2 and OS_SII group from the *C. delle Taberne Finestrate* and fragment OS_PIV_2 from the *C. dei Lottatori*). In some cases, the calcium-based white has been mixed with Egyptian blue in order to create a delicate greyish white-blue (fragments OS_PI_B3 and OS_SII group from the *C. delle Taberne Finestrate*). The identification of lead white is more difficult. Traces of a lead-based white pigment have been found in the central feather of the fragments OS_PAV_1 from the *C. dei Lottatori* and OS_PI_C1 from the *C. delle Taberne Finestrate*. A mixture of lead white and Egyptian blue is used for some lines and scrolls of the ceiling from the *C. delle Taberne Finestrate* (OS_SII group). Finally, it is possible that in fragment OS_PI_A3 from the *C. delle Taberne Finestrate* the white pigment used to decorate the column shaft is a mixture of lead white and yellow ochre.

Red pigments

The red colour is used both for the backgrounds and for the decorative motifs: it is almost always red ochre (iron-based pigment), except for some decorative motifs realized in red cinnabar (fragments OS_PI_B1, OS_PI_B2, OS_PI_B3 from the *C. delle Taberne Finestrate*). In the panorama of the Ostian Fourth Style decorations, red cinnabar remains very rare and we do not know compositions with a red cinnabar background, although it was used earlier in Second Style paintings⁷.

⁵ MARANO, TOMASSINI 2018, pp. 509-510, fig. 7e.

⁶ FALZONE 2007.

⁷ DE RUYT, ALAVOINE 2007, pp. 113-121; MORARD 2007, pp. 55-80; BOCHERENS 2012; FALZONE 2017, pp. 335-337; FALZONE forthcoming and MARANO, TOMASSINI forthcoming-a.

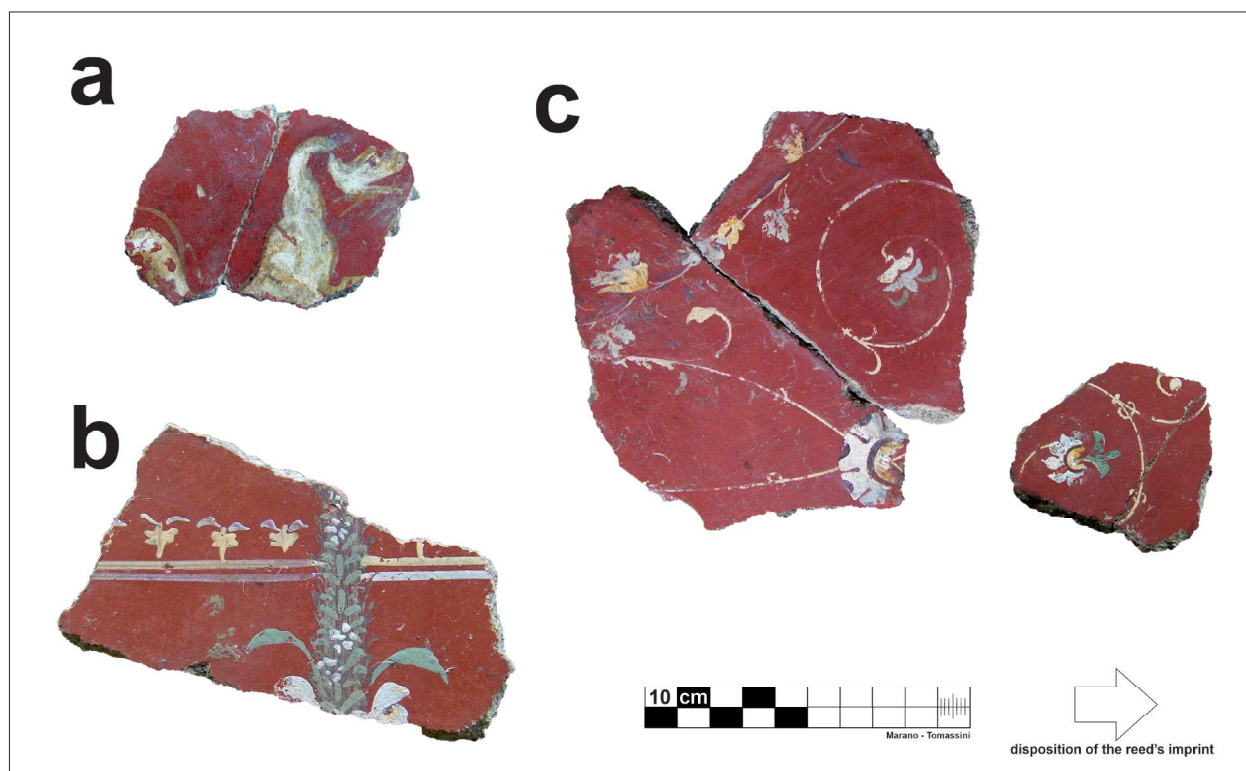


Fig. 3 - Ostia, *Nuovi Depositi*. Fourth Style ceiling fragments from the *Caseggiato dei Lottatori*, red background: a. fantastic creature; b. garlands and embroidery border; c. acanthus scrolls (elab. M. Marano, P. Tomassini).

Yellow pigments

The yellow pigment is used for the backgrounds and for the decorative motifs and it is almost always yellow ochre (iron-based pigment). In some cases, the yellow ochre may be mixed with other pigments, as shown by the fragments OS_PIV_2 from the *C. dei Lottatori* and OS_SII_5 from the *C. delle Taberne Finestrate*, where we find a mixture of yellow ochre and Egyptian blue. In some other cases, the yellow pigment contains only a small amount of Egyptian blue crystals (fragments OS_PI_A1, OS_PI_A2, OS_PI_A3 and OS_PIV_1 from the *C. delle Taberne Finestrate* and *C. dei Lottatori*). As said in the previous papers, we cannot exclude that these traces are probably not intentional and have to be attributed to a dirty brush or to a painters' palette with too many colours on it.

Green pigments

The green pigment is used only for specific decorations, in particular vegetal and architectural motifs. The painters have used both pure green earth (fragments OS_PI_A1, OS_PI_A2, OS_PAV_2, OS_PIV_5 and OS_PIV_3 from all the analysed contexts) and a mixture of green earth and Egyptian blue (fragments OS_PAV_1, OS_PAV_2 and OS_SII group from the *C. dei Lottatori*, *C. delle Taberne Finestrate* and V, II, 2 building)⁸. The green earth used in all Fourth Style contexts is very rich in potassium and has systematically traces of Chromium in it. Chromium does not appear in the green earth used for the First and Second Style paintings⁹, which could indicate the use of a new supply source in Ostia in the 1st c. AD.

⁸ In the fragment OS_PIV_1 from the *C. dei Lottatori* we found a small amount of Egyptian blue. As said in the paper of M. Marano, it is possible that in this case the crystals of Egyptian blue are due of a dirty brush.

⁹ FALZONE, MARANO, TOMASSINI 2021.

Blue pigments

The blue pigment is rare and it is used only for decorative motifs: pure Egyptian blue is attested only on the ceiling from the *C. delle Taberne Finestrate* (fragment OS_SII_3, re-decoration phase). In all other cases, the Egyptian blue is mixed with other pigments (especially green earth, calcium-based white and yellow ochre).

General considerations

As said previously, the comparison between wall and ceiling paintings seems to suggest the decoration of the ceilings was particularly accurate, probably in some cases more accurate than the walls, as shown by the OS_SII group from the *Caseggiato delle Taberne Finestrate*. The archaeometric analyses recently carried out on the pigments of some ceiling fragments from the *Caseggiato dei Lottatori* confirm this impression¹⁰: also in this case, the decoration is of a very high level with a prevalence of elegant vegetal elements¹¹ and the Egyptian blue is widely used mixed with white pigments (fig. 3c). If we consider that in the OS_SII group the white pigment has been interpreted as a lead white (in the wall painting decorations we usually find a calcium-based white pigment) and the Egyptian blue has been largely used (see the re-decoration phase), we can assume that the ceilings probably played a more important role in the decoration of the rooms than the walls.

OSTIAN FOURTH STYLE MORTAR LAYERS

The samples taken from the wall painting fragments reveal the presence of two mortar layers with homogeneous characteristics. If we try to compare the results, we realize that the *intonachino* is composed almost always by calcic lime and carbonate rock fragments¹² (ratio binder/aggregate: 1/2-1/3)¹³. The *intonaco* is composed by calcic lime, pyroxenes, carbonate rock fragments and volcanic rock fragments (ratio binder/aggregate: 1/2-1/3). In most of the fragments the last layer of mortar, the *arriccio*, has not been found, but it was present originally, as shown by some little traces still visible today¹⁴. We have to note that the fragments OS_PIV_4 (*Caseggiato dei Lottatori*) and OS_PIV_5 (unknown provenance) show some small differences: in these two fragments the *intonachino* layer contains also some crystals of calcite (probably crushed marble). Except for the samples OS_PIV_3 and OS_PIV_4 from the *Caseggiato dei Lottatori*, all other plaster fragments show a red under-layer between the paint layer and the *intonachino*. This red under-layer is clearly visible on the wall painting fragments, but it is completely absent on the ceiling fragments from the *Caseggiato delle Taberne Finestrate* (OS_SII group).

If the fragments described so far reveal a certain homogeneity, we have to consider that the archaeometric study revealed an exception. In the fragment OS_PAV_2 the *intonachino* layer is a *marmorino* composed by calcic lime and spathic calcite (the mortar shows traces of the red under-layer; ratio binder/aggregate: 1/3). The *intonaco* layer is white-grey and contains calcic lime, *cocciopesto*, pyroxenes and few carbonate and volcanic rock fragments (ratio binder/aggregate: 1/2).

¹⁰ These analyses have been made by the Pratt Institute of New York in 2019 (E. Del Federico) and are still unpublished.

¹¹ MARANO, TOMASSINI forthcoming-b.

¹² In the case of the samples OS_PIV_1 and OS_PIV_2 from the *C. dei Lottatori* we can identify these fragments as travertine fragments.

¹³ Only the fragment OS_PIV_2 from the *Caseggiato dei Lottatori* shows a ratio of 1/3-1/4.

¹⁴ See fig. 9 of the paper of M. Marano in this book.

This is the only case of a Fourth Style *intonachino* layer composed by a *marmorino* and an *intonaco* layer containing mainly *cocciopesto*¹⁵.

Concerning the ceiling fragments, the archaeometric analyses revealed a different chemical composition from the walls (OS_SII group from the *Caseggiato delle Taberne Finestrate*). In this case, the *intonachino* is composed by calcic lime, carbonate rock fragments and probably spathic calcite; the *intonaco* is composed by calcic lime, pyroxenes, carbonate rock fragments and *pozzolana*; the *arriccio*, laid in contact with the reeds attached to the beams of the ceiling in order to create a flat surface for the plaster, contains vegetal elements and straw (clayey matrix). Only the sample OS_SII_4 revealed the presence of a second *intonaco* layer with exactly the same composition of the first one. It is impossible to compare the OS_SII group with other Ostian ceiling fragments as this is the only ceiling analysed so far. We hope the continuation of the study will bring further light to the subject.

Thanks to the “technical approach”, our understanding of the pictorial production of Ostia during the second half of the 1st c. AD is today much deeper. Despite of the fact we merely have fragments and only a few *in situ* wall paintings, we can appreciate the technical skills of the painters and retrace the practices of the ateliers working in the city in that period. In the case of Ostian Fourth Style paintings, archaeometry has confirmed, beyond any possible doubt, the strong analogies between all the known contexts. The raw materials used by the painters are fundamentally the same, for the pigments and for the mortars, as well as the supply sources. Moreover, the way the materials are selected and mixed together seem to follow the same “recipe”, as we have seen for the red underlayer, whose function – technical or aesthetic – is still to be determined, but also for the execution of particular motifs, as the peacock feather and the architectural elements.

All these technical similarities and the stylistic correlations between most of the Fourth Style paintings from different areas of the city, support the hypothesis the analysed wall paintings were executed by a group of painters using very similar techniques and drawing their inspiration from the same repertoire. Archaeometric analyses have played a fundamental role in this study, as they are the only ones to allow us to identify the materials used and to understand the execution processes. However, the results could be achieved only after a thorough archaeological and macroscopic analysis, carried out by the CeSPRO during the last years, which enabled the collection of enough arguments and questions that were solved by the microscopic analysis. In fact, it is only by working together and in synergy between archaeologists, chemists, geologists and physicists that the technical approach becomes truly effective, as it has been the case for the pre-Hadrianic paintings of Ostia.

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¹⁵ Small quantities of *cocciopesto* grains have been found also in the *intonaco* layer of the sample OS_P1_C1 from the *C. delle Taberne Finestrate*.

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