

Making Roman Mosaics in Aquileia (I BC – IV AD): Technology, Materials, Style and Workshop Practices. Two Case Studies from the *insula della Casa delle Bestie Ferite*

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Introduction

The study of Roman mosaics is traditionally dominated by an aesthetic and stylistic approach. During the last couple of decades, a new interest for the material aspects has started to emerge, opening different perspectives of study and interpretation.¹ This material-based approach is particularly effective for investigating the economic aspects of mosaics and for assessing their social value. High-end mosaics are likely to combine a complex decorative project, with the use of expensive materials, like marble or glass *tesserae*. However, determining the high quality is difficult and involves the evaluation of a combination of factors. An accurate mosaic project starts from designing and building appropriate foundations and beddings and continues with the creation of the surface. The elements that we need to assess accurately include the identification of the materials used in the construction of the mosaic and their distribution, the evaluation of the accuracy in cutting and laying the *tesserae*, and the care taken in planning the decoration and respecting the drawing.

This comprehensive analysis of mosaics is particularly important for the study of decorations in domestic contexts. Here, spaces paved by mosaics and used for the reception of the guests play a key role in the decorative project of the building. These mosaics were a proper means of communication, expressing the social status of the owner. Looking at the details of tessellata floors, we discover that mosaics covering large surfaces with figural decorations, surely made to impress, are not always accompanied by a high technical quality.

In this paper we present the results of the application of this methodological approach, by investigating two mosaics excavated at the site of Aquileia, at the *insula della Casa delle Bestie Ferite* (*insula* of the House of the Wounded Beasts) (fig. 1).

C.B.

With the *insula della Casa delle Bestie Ferite*, we refer to a sector of the ancient town in which different housing contexts are present. These were first investigated in the early sixties,² and the University of Padova has directed stratigraphic excavations here since 2007. The plan and phases are still being defined, but the lifespan of the houses can be initially split into three main periods.³ The first building and decorative phase can be dated between the middle-late 1st century BC and the 1st century AD. Later, during the 2nd century, the organization of the spaces was only partially modified, due to some limited building activities. In detail, some floors were re-decorated, as attested by new mosaics

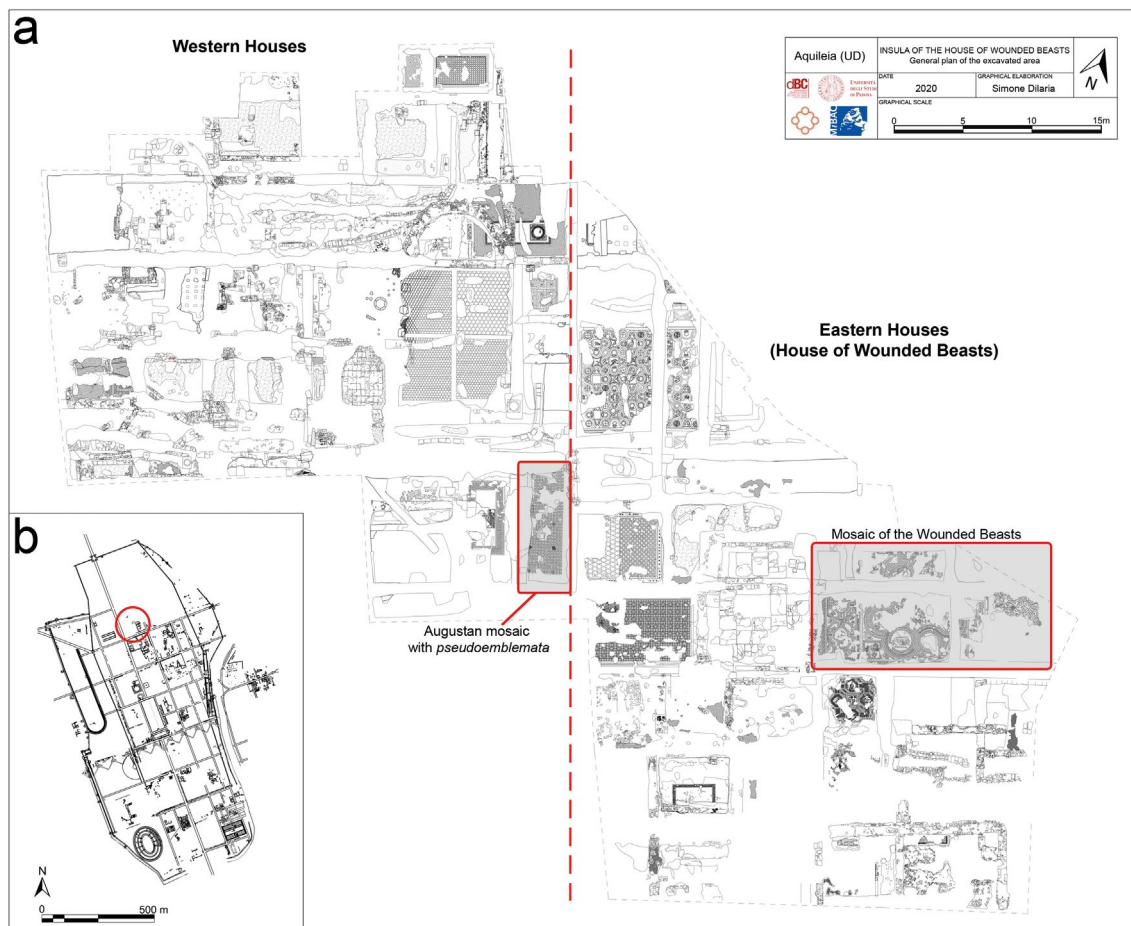


Fig. 1: a) Plan of the archaeological area of the *insula della Casa delle Bestie Ferite*, with reference to the two analysed mosaics; b) Plan of Aquileia with the indication of the *insula della Casa delle Bestie Ferite* area.

laid on revetments of the first phase. Finally, during the 4th–5th century, the houses were object of a major reconstruction. This change reflects new social and economic developments, due to the Imperial influence on the town administration. In this period, Aquileia is interested by important building interventions, such as the creation of the Constantine Baths in the western sector of the town.⁴

S.D., M.S.

Materials and Methods

The mosaics discussed here were analyzed in their whole building process, from the setting of the foundations to the laying of the surface. Our methodology integrates the on site examination of the pavements,⁵ with petrographic analyses performed on representative samples of *tesserae*. Bedding mortars and concretes were sampled and

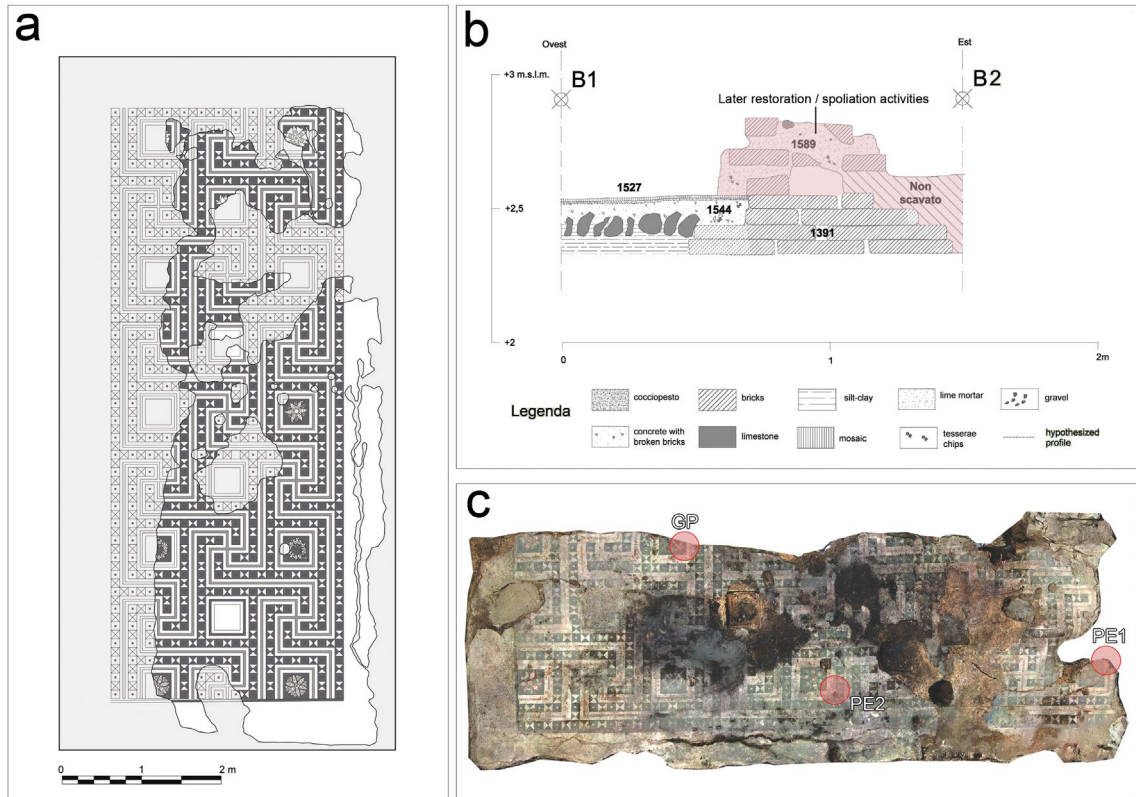


Fig. 2: a) Reconstruction plan of the Augustan mosaic with *pseudoemblemata*; b) Section B-B1 of the Augustan mosaic with *pseudoemblemata* and eastern closing wall; c) Orthophoto of the Augustan mosaic with *pseudoemblemata*, with indication of the sampling points (see tab. 1 for codes).

investigated by means of different analytical techniques (Optical Microscopy, XRPD, SEM-EDS) and the results are discussed in a previous publication.⁶ The data will be mentioned again here to produce a coherent discussion of the constructive techniques.

C.B., S.D., C.M.

Case Studies

Augustan Mosaic with *pseudoemblemata*

The first case study is the earliest *tessellatum* of the house and was selected in order to represent significantly the way of making mosaics at Aquileia at the end of the 1st century BC. The mosaic paved a rectangular reception room and was decorated by a pattern of meanders, interrupted by square figural panels (*pseudoemblemata*). The figural panels alternate images of polychrome flowers and laurel garlands crossed by spears, against a black background (fig. 2a). This geometric scheme finds parallels in a consistent number of early occurrences from central Italy and is attested in northern Italy since the reign of

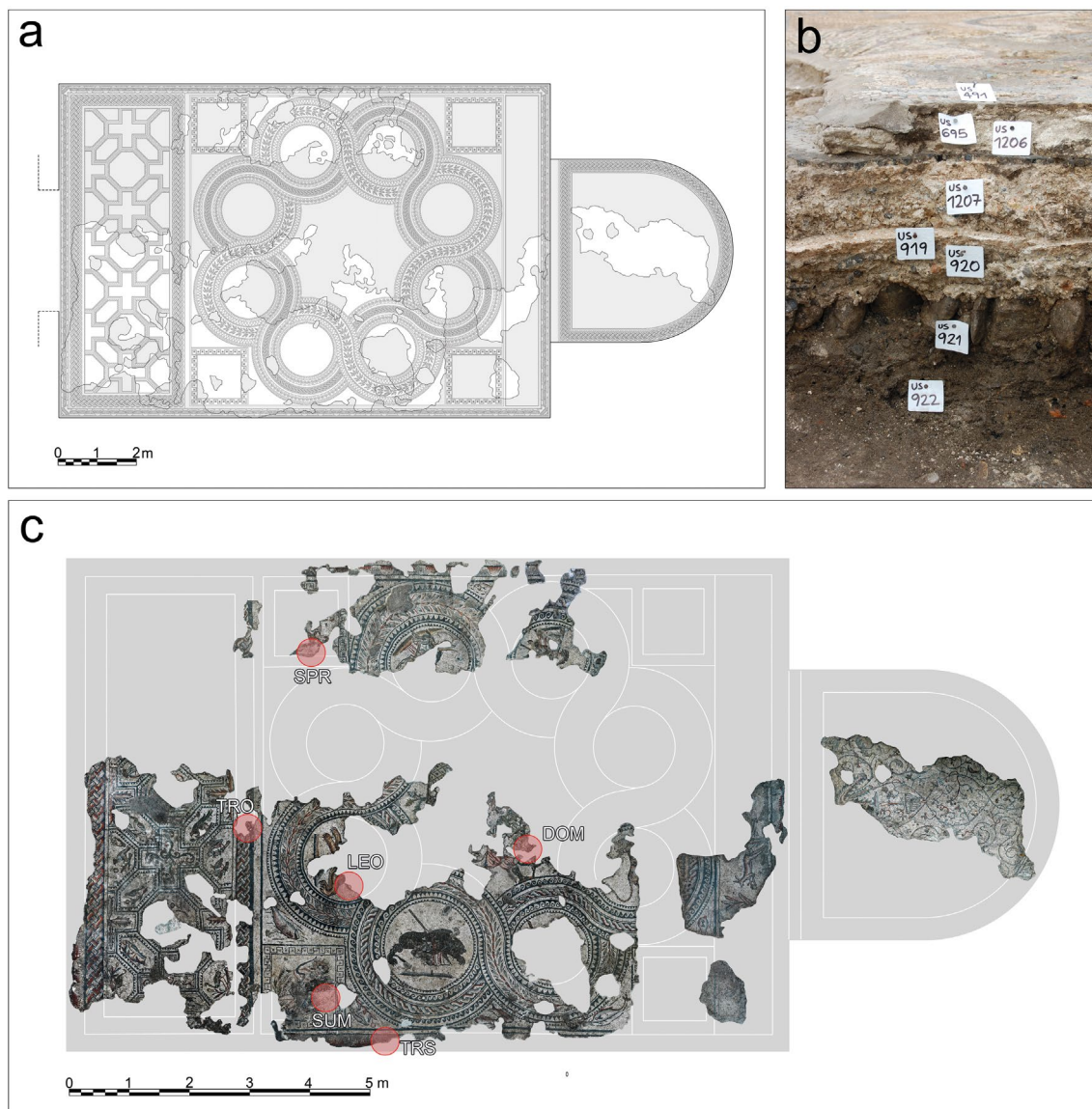


Fig. 3: a) Reconstruction Plan of the Mosaic with Wounded Beasts; b) Exposed prospect of the bedding sequence of pavements; c) Orthophoto of the Mosaic with Wounded Beasts with reconstruction of the decoration patterns and indication of the sampling points (see tab. 1 for codes).

Augustus.⁷ If the flowers are popular subjects, rooted in the Hellenistic tradition,⁸ while the garlands crossed by spears have a typically Roman connotation. The latter were identified as *signa militaria*, military decorations attributed to the *dominus* during his military career. According to this interpretation, these decorations become an important element for attributing to this mosaic a character of self-celebration.⁹

Mosaic of the Wounded Beasts

In order to represent the 4th century monumentalisation of the house, we selected the mosaic paving of the most important room of this phase: a nearly 100 m² reception hall with a raised circular apse. Rooms of this kind were used as dining space and reflect the new late antique habit of dining sitting around the *sigma*, a half-circular table, placed in the apse (fig. 3a).¹⁰ The decoration of this mosaic is very complex and combines the geometric scheme articulating the space with a multitude of figural elements, including birds, fishes, and beasts. A badly preserved hunting scene, likely representing the *dominus*, decorated the central part of the room and was surrounded by circular medallions, which were filled by figures of wild exotic beasts, wounded by spears (fig. 3). At the corners, four squares were decorated with the images of the Four Seasons. The apse was fully covered by a network of vine tendrils, with a parrot in a cage, hanging in the centre.¹¹

C.B.

Foundations and Bedding Characterization

As frequently attested in the first construction phases of Aquileia, the Augustan mosaic with *pseudoemblemata* was laid over a 50 cm thick silty-clay foundation dump, placed in order to raise the floor from the natural ground level and protect it from soil moisture.¹² The mosaic was realized in strict synergy with the house construction (fig. 2b). Above the foundation is a layer of loose limestone shards and brick fragments that function to insulate and drain the area;¹³ this layer has a thickness corresponding to the brick foundation of the closing walls (ca. 10 cm), while the screed deliberately extended above the wall grade planes. This has an overall thickness of around 10 cm and can be distinguished by (fig. 4a): a) a layer of concrete with broken bricks¹⁴ (around 7–8 cm thick), made of a mixture of *terracotta* fragments and lime, with the sporadic occurrence of fine/medium gravel¹⁵ and the frequent inclusion of discarded *tesserae* chips.¹⁶ The binder/aggregate (B/A) ratio of this mixture is 1 : 3; b) a layer of *cocciopesto*¹⁷ (around 1.5 cm thick), characterized by a mixture of small *terracotta* fragments and lime. The B/A ratio of this is 1 : 1.5; c) a thin *tesserae* setting bed¹⁸ (ca. 0.1 cm thick), composed of pure lime and the sporadic occurrence of sparry calcite.

Figural panels, which are made *in situ* and can be considered as *pseudoemblemata*,¹⁹ are set on finer bedding mortar, as “layer b” is here composed of lime mixed with finely grinded *terracotta*.²⁰ This results in a uniform layer which allows for a more precise setting of the *tesserae* for the finer figurate parts of the mosaic.²¹

Therefore, the sequence of layer of loose stones and bricks, screed “layer a” and “layer b”, strictly matches the *statumen*, *rudus*, and *nucleus* layers described by Vitruvius,²² while the *tesserae* setting bed is not reported in the ancient literature. The characterization of the mortars also has demonstrated how the compositional binder/aggregate ratio of 1:3 of the *rudus* (layer a) could be strictly correlated with

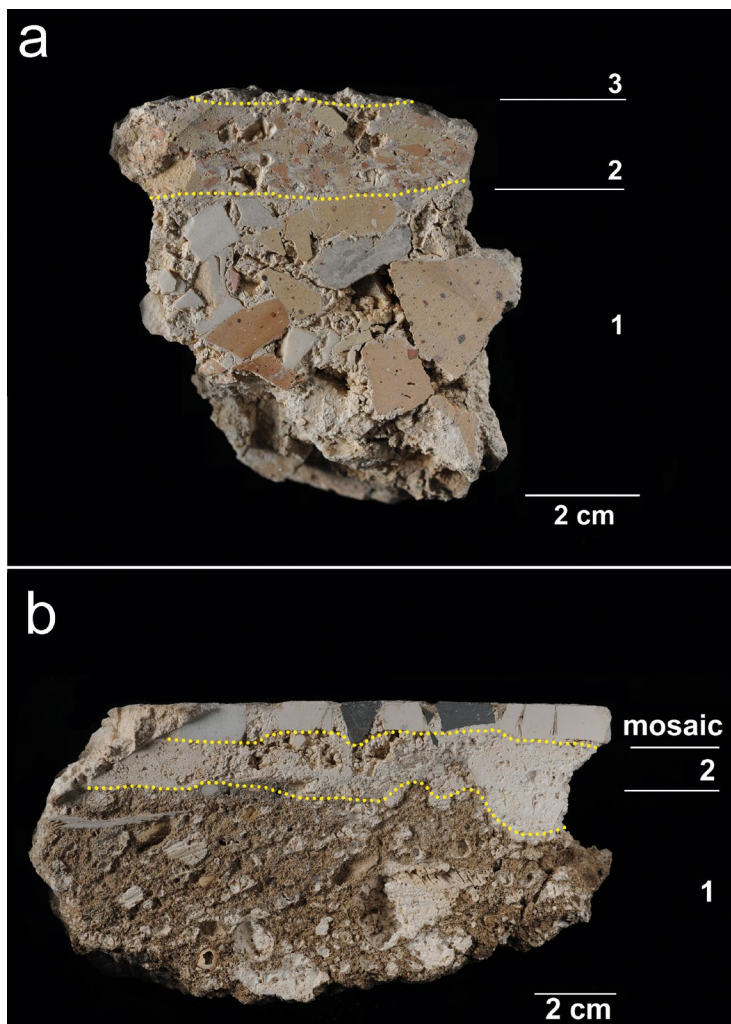


Fig. 4: a) Sample of screed layers for the Augustan mosaic with *pseudoemblemata*;
 b) Sample of the screed layers of the apse of the mosaic with Wounded Beasts.

Vitruvian recipes,²³ while the slightly thicker ratio of 1 : 1.5 of the *nucleus* (layer b) reflects the optimal proportions for mortar layers with reduced thickness.²⁴ However, the overall thickness of 30 cm reported in ancient literature for mosaic beddings, split in around 22 cm (3/4 of a Roman feet) for the *rudus* and 11 cm for the *nucleus* (six fingers),²⁵ did not find any comparison with the overall thickness of 10 cm for both the layers documented in the present case study.

The Mosaic with Wounded Beasts, on the other hand, is directly laid over a previous one dated to the 2nd–3rd century AD (fig. 3b).²⁶ The pavement in the apse and in the northern portions of the rectangular hall, extends over the limits of the room of the previous phase and it is directly set on a soil dump, with no *statumen* layer. The bedding

is composed of (fig. 4b): a) a gray friable lime mortar, varying in thickness from 2 to 6 cm, with a lean binder/aggregate ratio of 1:3, and an aggregate represented by locally sourced silicate and carbonate sand. Lime lumps and calcination relicts are frequent and macro-pores are recurrent, raising the mortar's crumbliness. The presence of clay in traces demonstrates that the sand was not properly washed before the use; b) the *tesserae* setting bed is made of pure lime plaster, with a thickness varying from 0.5 to 1 mm.

There are no correspondences in the ancient literature for such a mosaic bedding technique.

S.D.

***Tesserae* Layout**

The analysis of the bedding of the Augustan mosaic revealed the traces of a very accurate work. This character is reflected by the way the decoration was designed and how the *tesserae* were laid. The geometric scheme was carefully planned and adapted to the shape and size of the room. This scheme was perfectly respected, as shown by the absence of mistakes or incongruences in the decoration. In the geometric parts, the size of the *tesserae* is very regular. Challenging passages, like the junctions at the angles, are always resolved adopting the same technical solution (fig. 5a). The white band between the end of the geometric motif and the wall is filled by perfectly aligning *tesserae* laid in parallel rows. The same care can be observed in the figural panels, where the *tesserae* are cut and laid in order to maximize the pictorial effect of the figures, creating lines varying in thickness that imitate the effect of brush-strokes (fig. 5b). The passages between one colour and the other are made by juxtaposing rows of *tesserae* of different colours. In some particularly well-preserved portions, some remains of the finishing surface are still visible. The gaps between the *tesserae* were filled by stucco and, finally, the whole surface was polished. To reinforce the colour of the pink bands of the meander and to minimize the disturbing effect of the white colour of the joints, the stucco was coloured applying a red pigment on the surface (fig. 5c).²⁷

If the *tesserae* of the Augustan mosaic were laid very accurately, the mosaic with Wounded Beasts reveals a completely different way of working. As already observed, the large surface of the floor was paved without paying too much attention to the details of the decoration schemes and drawings.²⁸ The layout of the *tesserae* is inaccurate, resulting in an irregular *andamento* (fig. 5d). The plain backgrounds are made with frequent and unpredictable changes of direction. In the figural parts, the contribution of artisans with very different technical skills can be clearly recognised. Glass *tesserae*, surely the most expensive material used for this mosaic decoration, are all concentrated in the better-executed parts of the mosaic.

C.B.

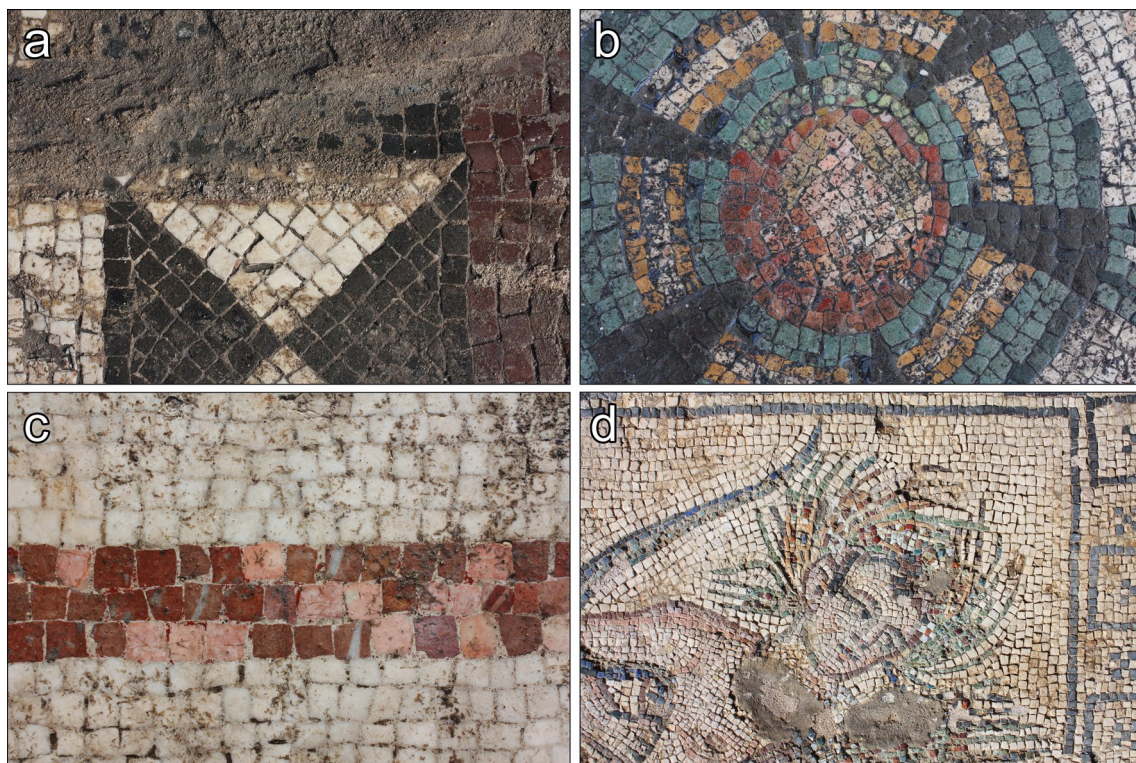


Fig. 5: a) Augustan mosaic with *pseudoemblemata*: a close-up detail of the geometric decoration of the mosaic. The *tesserae* are laid accurately, with the result of a very homogeneous mosaic texture; b) Augustan mosaic with *pseudoemblemata*: a close-up detail of one of the flowers, decorating the panels. The *andamento* of the *tesserae* suggests the movement of a painted surface; c) Augustan mosaic with *pseudoemblemata*: a close-up detail of the mosaic, preserving the surface finishing. The gaps between the *tesserae* are filled with stucco and the joints of the red line are painted in red; d) Mosaic with Wounded Beasts: a detail of the panel depicting the personification of Summer. The chaotic *andamento* of the *tesserae* is well visible in the white background, where we can observe several changes of direction in the layout.

Petrographic Characterization of the *tesserae*

A set of 46 *tesserae* from the Augustan mosaic with *pseudoemblemata*, and 36 *tesserae* from the mosaic with Wounded Beasts were collected and petrographically analysed under optical microscope (tab. 1). Samples were taken from different portions of the pavements, including the figural panels, the geometric decorations, and the background (fig. 2c; fig. 3c). 3 discarded *tesserae* chips came from the screed of the Augustan mosaic and were analysed for comparison with those used in the pavement surface. The analysis allowed to define the petrographic characteristics of the *tesserae* and to discuss the provenance of the relative rock types. However, in many cases the evidence is missing

regarding whether the stones were intentionally quarried for cutting mosaic *tesserae* or were reused from blocks and slabs originally destined for other building activities.

In both mosaics, the majority of the analysed *tesserae* were realized from locally quarried stones.

Trieste Karst and the Aurisina district are the quarry basins of white limestones widely employed in Aquileia.²⁹ *Tesserae* realized with these rock types are frequent in both the analyzed mosaics (fig. 6d; fig. 7d) and probably represent the reuse of blocks primarily employed in architecture and statuary.

Pink and red *tesserae* were cut down from stones imported from the Veneto Prealps. Petrographically, they are wackestones and mudstones belonging to the “Scaglia Rossa” and “Rosso Ammonitico” formations (figs. 6c, f; fig. 7a). These formations, which also crop out in numerous localities of the Apennines,³⁰ provided the raw materials for the preparation of the *tesserae* for several mosaics such as those in Desenzano (Veneto) and Brescia (Lombardy).³¹ The white Aurisina stones are mainly grainstones and rudstones; these rock types were used in Aquileia for paving the courts of houses, public buildings,³² and for gravestones.³³

It is more difficult to define the geographical origin of the rock types employed for the black and grey *tesserae* made of mudstones due to the lack of diagnostic fossiliferous assemblages in most of the samples. The provenance from the Pontebba of Forni di Sopra districts in the Carnic Alps have been reported for the *tesserae* employed in mosaics from the area located north of the “Porto Fluviale”.³⁴ The black mudstones used in the studied mosaics were quarried probably from the Trieste-Istrian Karst region, as recognized for *tesserae* employed in the mosaics of Emona, Mošnje, and Izola.³⁵ In particular, the sample from the “Spring” season in the mosaic with Wounded Beasts (fig. 7b) strictly matches the microfacies B1 of some *tesserae* of the mosaics of Slovenia.³⁶ Less probable is a provenance from the Lower Cretaceous layers east of the Brenta river, as was identified for black *tesserae* in the mosaics of Asolo.³⁷

Other rock types certainly were imported. Black *tesserae* of Campanian tephrite (fig. 6a) and yellow *tesserae* of Giallo Siena Marble (fig. 6e) are documented only in the Augustan mosaic with *pseudoemblemata*. This represents the first example of their use at Aquileia. In the *pseudoemblemata*, white *tesserae* are generally made of a fine-grained marble, characterised by the presence of rare euhedral albite crystals, a feature typical of the Lunense (Carrara) marble (fig. 6b). However, more detailed studies are required for the precise identification of their provenance. In addition, *Marmor Numidicum*, a crystalline limestone imported from Tunisia, is also attested in the mosaic with Wounded Beasts (fig. 7c), where also Biancone limestone is used for the light yellow and pink colours. Finally, fragments of pottery and bricks have been used for the preparation of some red and yellow *tesserae* (figg. 7e, f) in the mosaic with Wounded Beasts, while these materials are absent in the Augustan mosaic with *pseudoemblemata*.

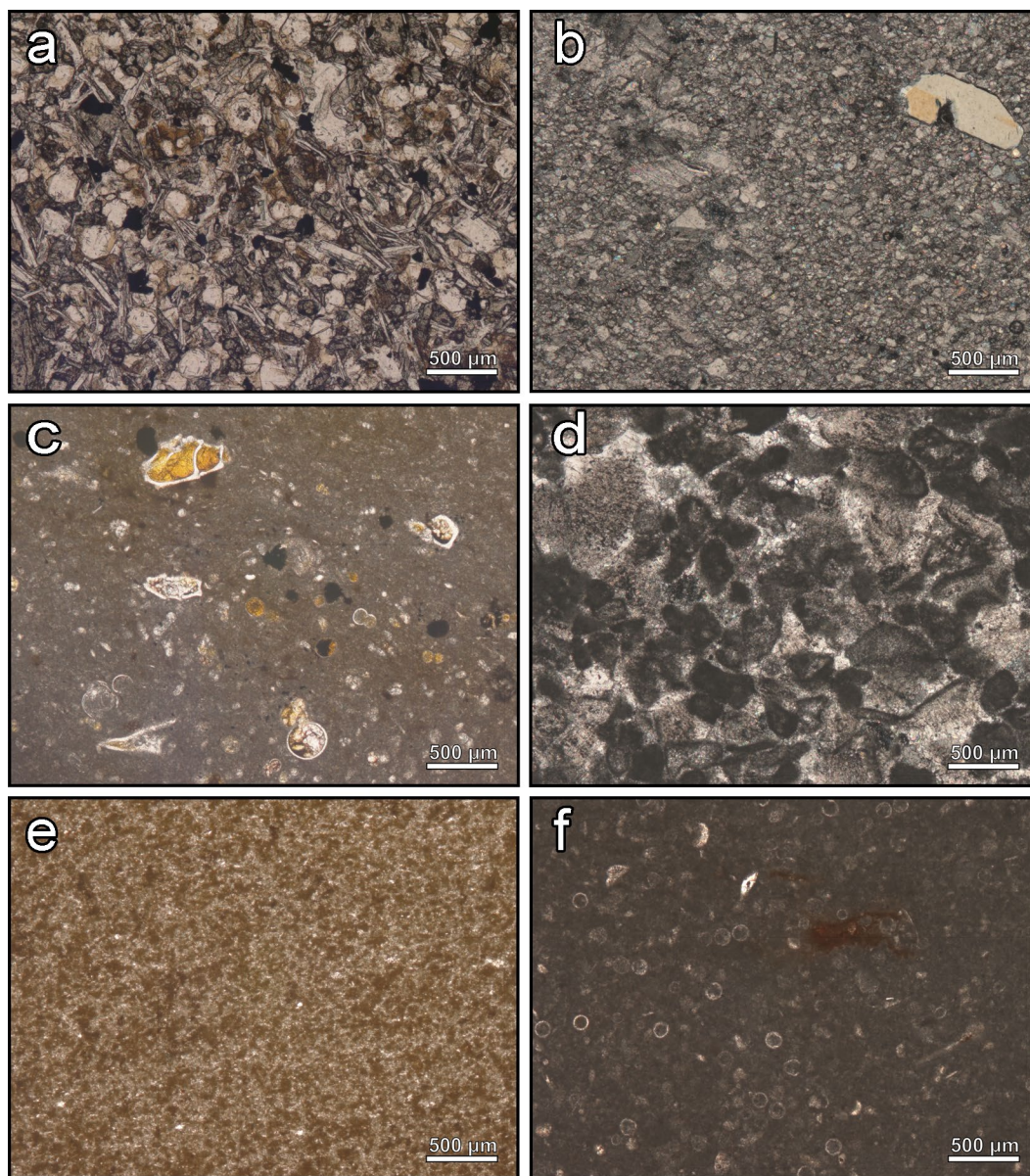


Fig. 6: Micro-photograph of representative *tesserae* from the Augustan mosaic with *pseudoemblemata* (for sampled area see fig. 2c); a) Black tephrite *tessera* from PE2; b) White mylonitic Lunense marble from PE2; c) Scaglia Rossa wackestone from PE2; d) Aurisina grainstone from GP; e) Giallo Siena marble from PE2; f) Rosso Ammonitico wackestone from GP.

In relation to spatial distribution of *tesserae* lithotypes, white Aurisina limestone *tesserae* are common in the geometric portions of the Augustan mosaic with *pseudoemblemata*, while there is a prevalent use of Lunense and Giallo Siena marbles in the panels. Black tephrite *tesserae* are homogeneously employed in both the

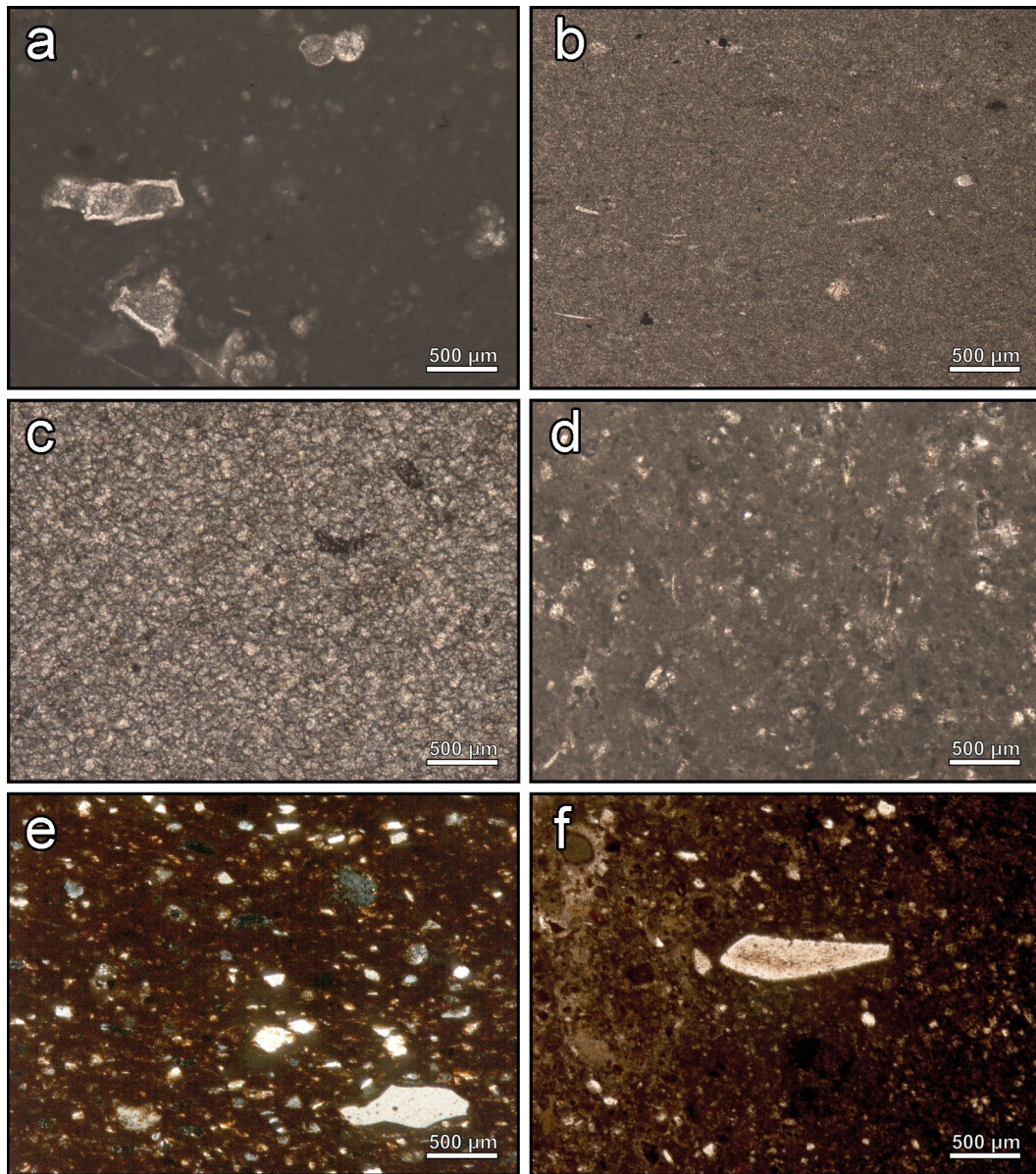


Fig. 7: Micro-photograph of representative *tesserae* from the mosaic with Wounded Beasts (for sampled area see fig. 3a); a) Scaglia Rossa wackestone from SUM panel; b) Mudstone microsparite with rare Ostracod shells and planktonic foraminifera from SPR panel; c) Giallo Antico marble (*marmor numidicum*) from SUM panel; d) Wackestone of the Trieste Karst region from TRO; e) Ceramic fragment from TRO; f) Brick fragment from TRO.

figurative and geometric portions of the mosaic. In the mosaic with Wounded Beasts, the yellow-red ceramic *tesserae* are mainly used in the guilloche decoration, but they are also sporadically present in figurative panels, where *tesserae* made of Rosso

Ammonitico, Scaglia Rossa or even Biancone limestones are prevalent. Other colored limestones, such as *Marmor Numidicum* are attested only in figurate portions.

C.M., S.D.

Conclusions

This study shows how complex artefacts, for instance mosaics need to be analysed by adopting an organic approach, which comprehensively investigates each part. Partial investigations could lead to incomplete interpretations and misleading conclusions.

The technical and petrographic analysis of the two mosaics yielded new elements for advancing hypotheses on the origin of the workshops that made them. It also allowed us to open a window on the technical know-how of mosaic workshops active in Aquileia at the beginning and at the end of the Empire. During this broad period of time, the way of working appears to have radically changed.

The use of local rock types is common in both the mosaics and it does not seem to be an index of a particular value. Workshops making mosaics in Aquileia were likely sourcing most of their materials from the local market, where building and ornamental stones from the nearby region were available. What makes the difference in the two case studies analyzed here are the most unusual materials, which needed to be imported. The identification of Campanian tephrite and Giallo Siena in the Augustan mosaic with *pseudoemblemata* is likely linked to the provenance of the workshop which made it. This mosaic is a high-quality product and appears isolated in the context of 1st century BC Aquileia. It is therefore possible that a workshop from central or southern Italy moved to the North-East following the increasing demand connected to the urban expansion of the region. Artisans likely brought rock types (probably roughly cut into slabs) to Aquileia to make the mosaic decoration. These non-local materials were reserved to the complex *pseudoemblemata*. At the same time, locally quarried stones (mainly white and pink limestones) were used in the geometric decoration, the less prestigious part of the mosaic.

The mosaic with Wounded Beasts was a pretentious, but not perfectly executed mosaic. The bedding construction cannot be considered adequate, if compared to the late antique tradition,³⁸ which substantially perpetrates Vitruvian precepts. The extensive use of cheap and easily available *terracotta* for most of the red and yellow *tesserae* is accompanied by a limited use of marbles randomly laid together with different types of local limestones. Finally, observing the distribution pattern of these materials in the mosaic, we have reason to think that the *tesserae* were sourced as reused materials. The same pattern of supply was already observed for the glass *tesserae* used in this mosaic.³⁹

C.B., S.D.

Mosaic with <i>Pseudoemblemata</i>				
Colour	Petrographic description	Provenance	Mosaic portion	n. of tesserae
<i>white</i>	Pelmicrite with rare Ostracods and planktonic porcelaneous foraminifera. Porosity is sealed by sparry carbonate cement.	Istrian region	GP	1
	Medium-grained (MGS = 1 mm) weakly lineated white marble with homogeneous texture and curved to embayed grain boundaries.	Pentelic or Lunense (Carrara)	GP	1
	Highly compacted grainstone with deeply fragmented Rudist and Echinoderm shells in a micritic matrix.	Aurisina	GP	1
	Grainstone with abundant fragments of Rudists, Echinoderms and peloids in a sparry carbonate cement. Rare foraminifera (Textularids) are present. Porosity is low.	Aurisina	GP	2
	Rudstone with abundant fragments of Rudists in a partially recrystallized microcrystalline matrix.	Aurisina	<i>rudus</i>	1
	Micritic grainstone with abundant micritised foraminifera; among them, Miliolids, <i>Brokeina</i> , <i>Nezzazata</i> , <i>Precrysalidina</i> , <i>Moncharmontia</i> have been recognised.	Aurisina	<i>rudus</i>	1
	Very fine grained marble with coarser portions characterised by twinned calcite crystals, probably a mylonitic facies of a coarser marble. Rare euhedral crystals of albite are also present.	Lunense (Carrara) (?)	PE1 PE2	5 6
<i>black</i>	Leucite-bearing tephrite with aegirine-augite clinopyroxene and olivine phenocrysts in a plagioclase-clinopyroxene-leucite-opaque minerals matrix.	Montefiascone Volcanic Complex or Somma-Vesuvio	GP PE2	3 11
<i>red</i>	Wackestone with abundant bioclasts of Dasyclad algae (<i>Clypeina</i> ?) and peloids. Locally fenestrae and fractures are sutured by a sparry carbonate cement.	Trieste Karst region	GP	2
<i>pink</i>	Wackestone with Calpionellids (<i>Calpionella alpina</i>), Ostracods, and Dasyclad algae probably of the gender <i>Clypeina</i> .	Upper Rosso Ammonitico Formation (Asiago)	GP	1
	Mudstone with rare ghosts of micritised bioclasts (Gastropods, foraminifera, Dasyclad algae). Rare fenestral cavities and fractures are cemented with sparite.	Rosso Ammonitico Formation	GP	1
	Wackestone with abundant foraminifera. Bioclasts of Globotruncana are often filled with iron hydroxides, probably derived from glauconite oxidation.	Scaglia Rossa Formation.	PE2	2
<i>yellow</i>	Highly compacted grainstone with deeply fragmented bioclasts in a sparry carbonate cement. Porosity is low.	Aurisina	GP	1
	Carbonate-rich siltstone with evident tractive textures.	Unknown	<i>rudus</i>	1
	Extremely fine grained micritic limestone uniformly spotted with tiny iron hydroxides.	Giallo Siena (?)	PE1 PE2	5 4

Tab. 1: *Tesserae* samples petrographic description (see fig. 2c and 3c for sampling area). PE1 = *pseudoemblema* 1; PE2 = *pseudoemblema* 2; GP = Geometric portions; TRO = Western guilloche decoration; TRS = Southern guilloche decoration; LEO = Lion panel; SUM = Summer panel; DOM = *dominus* panel; SPR = Spring panel.

Mosaic with Wounded Beasts				
Colour	Petrographic description	Provenance	Mosaic portion	n. of tesserae
white	Medium-grained (MGS = 2 mm) white marble with partially heteroblastic texture and curved boundary shapes. Rarely plagioclase euhedral crystals are present.	Thasian or Lunense (Carrara)	SUM	1
	Bioclastic grainstone with abundant shallow water benthic foraminifera and algal fragments. Among bioclasts, Miliolids, <i>Moncharmontia apenninica</i> , <i>Broeckina sp.</i> , Dicyclina and <i>Thaumatoporella parvovesiculifera</i> are present.	Cenomanian, Trieste Karst region	TRS	1
	Grainstone with heavily micritised bioclasts of difficult identification in a sparry carbonate cement. Miliolids and algal fragments (probably <i>Thaumatoporella</i>) can be recognised.	Trieste Karst region	TRO	1
	Wackestone with rare fragments of Dasyclad green algae, sponge spicules, Ostracods, calcispheres, calcified Radiolarians.	Trieste Karst region	TRO	1
	Wackestone with rare sponge spicules, fragments of Dasyclad green algae (<i>Clypeina</i>), <i>Thaumatoporella parvovesiculifera</i> , and planktonic porcelaneous foraminifera.	Trieste Karst region	SPR	2
	Wackestone with rare fragments of Ostracods, benthic foraminifera and calcispheres.	Trieste Karst region	SPR	1
	Wackestone with rare fragments of Dasyclad green algae, Ostracods, Echinoderms and calcispheres.	Trieste Karst region	DOM	1
	Wackestone with ghost fragments of Echinoderms and Rudists with bioturbation patterns. Calcispheres and unidentified foraminifera are also present.	Trieste Karst region	LEO	1
black	Bituminous Carbonaceous microsparite lacking bioclasts	Unknown	TRO TRS DOM LEO	1 1 1 2
	Microcrystalline equigranular highly diagenetised grainstone with rare larger twinned calcite crystals	<i>Giallo antico (marmor numidicum)</i>	DOM	1
gray	Mudstone with <i>Globotruncana</i> shells	Scaglia Rossa Formation	SUM	1
	Grainstone made of micritised bioclasts cemented by sparite. Among bioclasts, the following have been recognised: Miliolids, <i>Moncharmontia apenninica</i> , agglutinated foraminifera, fragments of Echinoderms, <i>Bacinella irregularis</i> .	Trieste Karst region	TRS	1
	Mudstone microsparite with rare Ostracod shells and planktonic foraminifera	Istrian region	SPR	1

Tab. 1 (continued).

Mosaic with Wounded Beasts (continued)				
Colour	Petrographic description	Provenance	Mosaic portion	n. of tesserae
<i>orange</i>	Microcrystalline equigranular highly diagenetised grainstone	<i>Giallo antico (marmor numidicum)</i>	<i>SUM</i>	1
<i>pink</i>	Wackestone with Calpionellids (<i>Calpionella alpina</i>), Radiolarians and rare Ostracods.	Berriasian, Maiolica Formation (<i>Biancone</i>)	<i>SUM</i>	1
	Wackestone-packstone with abundant thin-shelled bivalves, fragments of Echinoderms, rare Protoglobigerinids. Matrix is composed of micrite, locally with sparry carbonate cement. Iron hydroxides are common, especially within bioclasts.	Rosso Ammonitico Formation (Verona or Asiago).	<i>DOM</i>	1
<i>red</i>	Wackestone with Globotruncana shells, sponge spicules, Ostracods, and pelsparite intraclasts.	Scaglia Rossa Formation	<i>SUM</i>	1
	Wackestone with Globotruncana shells and other smaller planktonic foraminifera. The intense colour is determined by abundant iron hydroxides, which are often concentrated along stylolitic joints.	Scaglia Rossa Formation	<i>TRO</i> <i>LEO</i>	1 1
	Red pottery with optically active matrix and strong orientation of temper grains. Grains are mainly constituted by quartz, muscovite, with rare fragments of quartzite.		<i>TRS</i>	1
	Red wheel-thrown pottery with strongly oriented pores in the matrix. Well-rounded temper grains are mainly made of quartz and minor fragments of carbonate rocks, including foraminifera bioclasts and clay pellets.		<i>TRO</i>	1
	Ceramic material, probably fragment of brick, made of well-rounded temper grains in a deep red optically inactive matrix. Temper grains are mainly constituted by quartz, rare plagioclase and small rock fragments of mudstone.		<i>TRS</i>	1
	Fragment of pottery with oriented structure (wheel-thrown forming). Matrix is optically inactive, with a deep red colour. Temper is mainly made of double-spaced rounded quartz grains up to 300 microns.		<i>SPR</i>	1
	Ceramic material, probably of brick, with rounded quartz grains a rare clay pellets rich in iron hydroxides, in a deep red optically inactive matrix.		<i>DOM</i>	1
	Ceramic fragment with an optically active brownish red matrix. Temper is constituted by abundant angular fragments of quartz, especially in the fine fraction, few larger rounded grains of acidic and intermediate volcanic rocks, and rare carbonate fragments.		<i>LEO</i>	1

Tab. 1 (continued).

Mosaic with Wounded Beasts (<i>continued</i>)				
Colour	Petrographic description	Provenance	Mosaic portion	n. of tesserae
yellow	Fragment of yellow brick made of marly clay. Temper is extremely scarce, within a very fine-grained matrix. Macroporosity is low, with few elongated vesicles. Scanty iron hydroxide-rich Argillaceous Rock Fragments (ARF) are present, often with secondary planar voids and vughs.		TRS	1
	Fragment of yellow brick made of marly clay with rare temper grains of quartz, iron hydroxide-rich Argillaceous Rock Fragments (ARF), and mudstones. Porosity is mainly made of vesicles. Elongated blocky pores suggest the addition of straw to the paste, burnt out during firing.		TRO	1
	Mudstone with fenestral fabric. Fenestrae are completely filled with sparry carbonate cement. Numerous peloids and rare ghosts of foraminifera and ostracods can be observed. Numerous fractures are filled with sparry calcite.	Lower Cretaceous of the Istrian region (<i>Istrian yellow</i>)	LEO	1
	Grainstone with fine-grained mosaic of sparry calcite and few isolated larger twinned calcite crystals.	<i>Giallo antico (marmor numidicum)</i> (?)	LEO	1
light yellow	Wackestone with abundant Calpionellids (<i>Calpionella alpina</i>), fragments of Ostracod shells, Radiolarians and rare sponge spicules. Iron hydroxides are also present with a spotted pattern, often as bioclast filling.	Berriasian, Maiolica Formation (<i>Biancone</i>)	DOM	1
	Mudstone with rare ghosts of foraminifera, algae and thin-shelled bivalves.	Trieste Karst region	TRS	1

Tab. 1 (*continued*).

Notes

¹ Guimier-Sorbets – Nenna 1992; Delaine 1997; Boschetti 2011; Salvadori – Boschetti 2014; Wootton 2015.

² Bertacchi 1963.

³ Bueno et al. 2011; Bridi et al. c.s.

⁴ Marano 2009.

⁵ Both the mosaics have been entirely documented through detailed 3D models acquired with the “structure from motion” technique integrated with drawings of exposed bedding prospects from robbing trenches of wall structures.

⁶ Secco et al. 2018; Dilaria et al. 2016. The complete list of analysed samples is in Secco et al. 2018; samples of the *pseudoemblemata* mosaic are: CBF_29-N; CBF_29-O; CBF_29-ENE; CBF_29-ENO; samples from the Mosaic with Wounded Beasts are: CBF_2; CBF_5.

⁷ Bueno – Rinaldi 2016.

⁸ Guimier-Sorbets 2004.

⁹ Bueno – Rinaldi 2016, 372–376; Boschetti 2017b, 68–69.

¹⁰ *Sigma*.

¹¹ Boschetti 2017a, 52–55.

¹² Secco et al. 2018, 200.

¹³ Adam 2005, 475; Giuliani 2012, 181.

¹⁴ cfr. Ginouvès – Martin 1985, 51.

¹⁵ On granulometric size distribution, we refer to Wentworth scale (Wentworth 1922).

¹⁶ As confirmed by petrographic analyses (cfr. *infra*, tab. 1). This demonstrates that the cut of *tesserae* was performed *in situ*; discarded chips were progressively reused in the mortars while the paving was going on. A similar procedure has been recognized in the construction of the Hellenistic mosaic of Tell Dor (Wotton 2012, 219 and fig. 2, 214).

¹⁷ cfr. Ginouvès – Martin 1985, 51.

¹⁸ On the function of this layer cfr. Moore 1968; Dunbabin 1999, 282.

¹⁹ Boschetti et al. 2016, p. 43. Proper *emblemata* are laid on wood, terracotta or stone trays used for the transport of prefabricated figural panels (Guimier-Sorbets 2001, Guimier-Sorbets 2001–2002; Boschetti 2011, 62–63; Wootton 2012, 212).

²⁰ As referred by K. M. D. Dunbabin (1999, 288–289), our figurate panels could also be defined as “disguised *emblemata*”.

²¹ Secco et al. 2018, 198. 202–203.

²² Vitr., VII, 1, 1; VII, 3–4.

²³ These proportions are suggested only in the case of *ruderationes* realised *ex novo* (Vitr. VII, 1, 3).

²⁴ Cagnana 2000, 129.

²⁵ Giuliani 2012, 182.

²⁶ Bueno 2017.

²⁷ The use of painting is a characteristic originating in the Hellenistic mosaic tradition: Guimier-Sorbets – Nenna 1992, Guimier-Sorbets – Nenna 1995, Boschetti et al. 2008.

²⁸ Salvadori – Boschetti 2014.

²⁹ Bonetto – Previato 2013, 150–158; Previato 2015, 415–434.

³⁰ The quarries in the Apennines have been exploited in Roman times as revealed by the analysis on “Scaglia Rosata” and “Rosso Ammonitico” *tesserae*, as well as slabs employed in mosaics and *opus sectile* pavements in the *Domus dei Coiedii* in Suasa (Capedri et al. 2001).

³¹ Bugini – Folli 2009, 555; Bugini – Folli 2013, 127.

³² Bonetto – Previato 2013, 150–158; Previato 2015, 442–446.

³³ Maritan et al. 2003.

³⁴ Portulano et al. 2002, 639–640.

³⁵ Šmuc et al. 2017.

³⁶ Šmuc et al. 2017, 209 and fig. 3a, 208.

³⁷ Flügel – Flügel 1997, 32–36 and pl. 10, 5–6.

³⁸ Cet. Fav., 18.

³⁹ Maltoni – Silvestri 2018.

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Fig. 1. 2b–c. 3b–c: Simone Dilaria. – Fig. 2a. 3a: Paolo Baronio. – Fig. 4: photos Claudio Mazzoli, layout Simone Dilaria. – Fig. 5: Cristina Boschetti. – Fig. 6. 7: Claudio Mazzoli.

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