

Proceedings of the 12th Conference of the  
International Committee for the Conservation  
of Mosaics, Sardinia, October 27–31, 2014

Edited by Jeanne Marie Teutonico, Leslie Friedman,  
Aïcha Ben Abed, and Roberto Nardi

# The Conservation and Presentation of Mosaics: At What Cost?



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*Actes de la 12e Conférence de l'ICCM  
Sardynie, 27-31 octobre 2014*

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Jeanne Marie Teutonico, Leslie Friedman,  
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# Contents

	xiii	Foreword
	xv	Avant-propos
	xvii	Acknowledgments
	xviii	Remerciements
	1	Introduction
	4	Introduction
		Keynote Address
<i>Simonetta Angiolillo</i>	7	The Mosaic Heritage of Sardinia in Light of Recent Acquisitions
<i>Simonetta Angiolillo</i>	16	Il patrimonio musivo della <i>provincia Sardinia</i> alla luce delle recenti acquisizioni
		PART ONE
		<b>Cost</b>
<i>Patrick Blanc</i>	27	Réflexions sur l'évolution de nos métiers: Alerte danger
<i>Antonietta Boninu</i>	33	Mosaici della Sardegna, mosaico della Sardegna, conservazione ad ogni costo
<i>Hamida Rhouma-Ghmari et Moheddine Chaouali</i>	40	Bulla Regia: La conservation des mosaïques à quel coût?
<i>Susan Fox</i>	48	Was It Worth It? The Display of Roman Mosaics in a New Civic Building
<i>Stefania Chlouveraki and Basem Mahamid</i>	54	Conservation of the Mosaics at Um Al-Rasas: High- and "Low"-Cost Solutions

- Despina Makropoulou and Electra Karagiannidou* 62 The Basilica of Panagia Acheiropoietos in Thessaloniki, Greece: Presentation of a Comprehensive Restoration Project on Early Christian Mosaics In Situ
- Maria Rita Ciardi, Fabiano Ferrucci e Elena Romoli* 72 I mosaici di Nora: Dal restauro alla manutenzione programmata

## PART TWO

**Methods of Survey and Documentation**

- Julia Burdajewicz* 87 The Use of metigoMAP Graphic Software for Survey, Conservation Planning, and Documentation of Mosaic Pavements
- Myriam Krieg, Noé Terrapon et Anjo Weichbrodt* 96 Des aquarelles du XIX<sup>e</sup> siècle au système d'information géographique (SIG): La documentation des mosaïques à Orbe-Boscéaz (canton de Vaud, Suisse)
- Vojin Nikolić, Nemanja Smičiklas, and Aleksandar Ilić* 106 Mobile Platform Usage in Creating Conservation and Restoration Documentation
- Juni Sasaki* 111 Material and Technique of Mosaics in Hagia Sophia, Istanbul: Reuse of Gold Tesserae and an Attempt to Estimate Age

## PART THREE

**Conservation and Management**

- Elisavet Anamaterou, Maria Deliprimi, Fotini Getimoglou, and Maria Krini* 121 The Mosaics of Daphni Monastery: A Discussion of the Dilemmas and the Decisions Made throughout the Ten-Year Conservation Program
- Vesna Crnoglavac* 129 History of the Conservation of the Mosaics at the Archaeological Site of Mediana
- Sílvia Llobet i Font, Montserrat Pugès i Dorca, and Anna Bertral i Arias* 136 Discovering and Safeguarding the Mosaics at the Pont del Treball Roman Villa in Barcelona
- Sandra Ricci, Barbara Davidde Petriaggi, Gian Franco Priori, Carlotta Sacco Perasso, Filomena Lucci, and Gabriele Gomez de Ayala* 145 In Situ Conservation and Presentation of Submerged Mosaic Pavements Located in the Underwater Archaeological Park of Baiae (Naples)
- Thomas Roby, Leslie Friedman, Hamida Rhouma-Ghmari, Mohedine Chaouali, Livia Alberti, Ermanno Carbonara, Cristina Caldi, Ascanio D'Andrea, and Daniele Sepio* 151 Conservation Planning for Excavated Mosaics at the Site of Bulla Regia, Tunisia: A Component of the MOSAIKON Initiative

<i>Elena Vasić Petrović</i>	162	Shelters of Mediana: The Great Challenges of the Moment
<i>Daniela Rovina e Chiara Zizola</i>	170	<i>L'opus sectile</i> della Villa romana di Sant'Imbenia: Dal frammento alla fruizione
PART FOUR		
<b>Case Studies</b>		
<i>Gabriella Gasperetti, Francesca Condò, Alba Canu, Maria Graziella Dettori, Giovanni Antonio Chessa e Antonino Secchi</i>	181	I mosaici delle Terme Pallottino a Turris Libisonis, Porto Torres (SS): Restauro e fruizione
<i>Bianca Maria Giannattasio e Elena Romoli</i>	190	Scavo, conservazione e protezione dei mosaici delle Piccole Terme di Nora
<i>Roberto Cassio</i>	198	La conservazione dei mosaici inseriti a pavimento nei Musei Vaticani soggetti a calpestio
<i>Maher Jbaee</i>	205	A New Mosaic from Ain El-Helwe in Latakia, Syria
<i>Jacques Neguer</i>	210	The Lod Mosaic: Discovery and History of the Intervention
<i>Évelyne Chantriaux, Marion Hayes, Christophe Laporte et Maurice Simon</i>	217	Conservation et présentation des mosaïques du site de Plassac (Gironde)
<i>Francesco Antonio Cuteri, Alessandra De Natale, Maria Teresa Iannelli, Flavia Gazineo e Giuseppe Mantella</i>	226	I mosaici Ellenistici nel <i>balineon</i> dell'antica Kaulonia (Monasterace M.–Calabria) dallo scavo al restauro: Modalità di documentazione e schedatura dei materiali, delle decorazioni e delle tecniche esecutive
PART FIVE		
<b>Education and Training</b>		
<i>Leslie Friedman, Jeanne Marie Teutonico, Thomas Roby, Martha Demas, and Demetrios Michaelides</i>	237	Conservation and Management of Archaeological Sites with Mosaics: A Training Program of the MOSAIKON Initiative
<i>Hande Kökten</i>	246	A Multilevel Preservation Directory for Archaeologists: How to Think Like a Conservator When Excavating Mosaics
<i>Roberto Nardi</i>	250	Mosaic Conservation Course (MCC) 2011–2016, a Program of the MOSAIKON Initiative: Mid-Program Review



## PART SIX

**Backing Materials and Techniques**

- |  |     |   |
|--|-----|---|
| <i>Beril Biçer-Şimşir and Ertugrul Taciroglu</i>   | 259 | Alternative Backing Methods for Lifted Mosaics:<br>A Project of the MOSAIKON Initiative                           |
| <i>Barbara Davidde Petriaggi, Carla D'Angelo,<br/>Daniela Gennari, Vincenzo Angeletti Latini,<br/>Adel El-Turki, Maria Laura Santarelli,<br/>Franco Bontempi, Stefania Arangio,<br/>Gaia Quattrocioni, and Martina Zuena</i> | 270 | Innovative Materials for Restoring Mosaic Pavements<br>of the Roman Villa of Silin (Leptis Magna, Libya)          |
| <i>Martina Lesar-Kikelj, Katarina Žagar,<br/>Sabina Kramar, Lina Završnik, Matjaž Bizjak,<br/>Maja Gutman, Katarina Toman Kracina,<br/>and Bernarda Županek</i>  | 278 | Conservation and Restoration of Mosaics from the Roman<br>Towns of Emona and Celeia (Slovenia)                    |
| <i>Elena Torok, Catherine Stephens,<br/>Robin Hodgson, and Carol Snow</i>  | 285 | Gerasa Mosaic Treatments at Yale University:<br>An Examination of Materials Used in Structural<br>Backing Systems |

## PART SEVEN

**Presentation and Display**

- |                                |     |  |
|--------------------------------|-----|--|
| <i>Dorica Manconi</i>          | 297 | Il mosaico di una casa romana a <i>Hispellum</i> (Spello)<br>— Umbria  |
| <i>Yael Alef</i>               | 302 | Changing Approaches to the Design of Shelters over<br>Mosaics: The Zippori Case Study  |
| <i>Gionata Rizzi</i>           | 310 | Shelters: The Point of View of a Practitioner  |
| <i>Paola Baldassarri</i>       | 314 | Mosaici e <i>sectilia in situ</i> e multimedialità: Il caso di Palazzo<br>Valentini (Roma, Italia)   |
| <i>Elena Kantareva-Decheva</i> | 322 | The Small Basilica Project: Conservation and Display<br>of the Mosaic Floor  |
| <i>Cécile Giroire</i>          | 328 | Le redéploiement de la collection de mosaïques romaines<br>du Proche-Orient conservées au musée du Louvre :<br>De la restauration à la présentation muséographique |

## PART EIGHT

**Posters**

- |  |     |  |
|--|-----|--|
| <i>Maria de Fátima Abraços</i>   | 336 | The In Situ Mosaics of the Archaeological Museum D. Diogo de Sousa (Bracara Augusta): Problems of Conservation and Maintenance   |
| <i>Ali Akin Akyol and Yusuf Kagan Kadioglu</i>                                   | 338 | Archaeometric Analyses of Byzantine Glass Mosaic Tesserae from Three Different Sites in Turkey   |
| <i>Olivier Bonnerot and Demetrios Michaelides</i>                                | 342 | Archaeometric Study of the Wall Mosaics of Yeroskipou Ayioi Pente (Cyprus)   |
| <i>Nissma Bouzoubaa et Abdelilah Dekayir</i>                                     | 345 | Élaboration d'une base de données SIG des mosaïques romaines du Maroc en vue de leur conservation  |
| <i>Stefania Chlouveraki and Theocharis Katrakazis</i>                            | 349 | Cost and Benefit as Decision Criteria for a Mosaic Conservation Project at the Museum at the Lowest Place on Earth, Jordan   |
| <i>Yanna Doganis and Amerimni Galanos</i>  | 353 | Conservation and Display of a Twentieth-Century Large Wall Mosaic  |
| <i>Sabah Ferdi and Chayani Mehdi</i>   | 356 | The Facsimile or Digital Model: Is It Useful to Heritage Professionals?  |
| <i>Ekaterini Ftikou, Panagiotis Theodorakeas, Eleni Cheilakou, and Maria Kou</i> | 358 | Nondestructive Techniques (NDT) as Rapid and Cost-Efficient Tools for Mosaic Conservation  |
| <i>Patrice Georges-Zimmerman</i>   | 361 | Darwin, les vers et les mosaïques: Approche taphonomique de la conservation des mosaïques <i>in situ</i>   |
| <i>Anne-Marie Guimier-Sorbets et Hana Tewfick</i>                                | 364 | Conserver, dérestaurer les mosaïques d'Alexandrie: Nouvelles problématiques, nouvelles découvertes   |
| <i>Mohamed Chérif Hamza et Frédérique Marchand-Beaulieu</i>                      | 367 | Dérestauration d'une mosaïque inédite dans les thermes de l'Est, Caesarea (Cherchell, Algérie)   |
| <i>Maria Krini, Kassiani Pantazidou, Georgia Sotiropoulou, and Ioanna Vitsou</i> | 369 | Seasonal Reburial of Mosaics: At What Cost?  |
| <i>Brigitta Maria Kürtösi</i>  | 372 | Copy at the Site, Original in the Museum: Sociopolitical Context, Circumstances of the Preparation and Display of the Mosaics, and Impacts, Villa Romana Baláca, Hungary |

<i>Fatma Naït Yghil</i>	374	Intervention d'urgence : Transfert d'une mosaïque déposée et exposée dans un édifice public à la maison de la Volière à Carthage
<i>Ewa Parandowska</i>	376	The Villa of the Birds in Alexandria after Fifteen Years of Presentation and Display
<i>Angela Pencheva</i>	379	Workshop for Conservation and Documentation of Roman and Late Roman Mosaics in Stobi (2012–2015): Approach to Sustainability and Rehabilitation
<i>Christos Pilalis and Dimitris Pilalis</i>	382	The Cost of Conservation of the “Musical and Athletic Games” Mosaic Floor
<i>Marijana Protić and Nemanja Smičiklas</i>	384	The Mosaics of the Archaeological Site of Feliks Romuliana
<i>Marijana Protić, Nemanja Smičiklas, and Vladimir Bulajić</i>	387	Conservation, Restoration, and Presentation of Two Mosaics from Room 16, Imperial Palace, Sirmium
<i>Erjona Qilla and Evjeni Thomagjini</i>	389	Presentation and Display of the Butrint Mosaics
<i>Marie-Patricia Raynaud, Agron Islami, Klejdi Zguro, Didier Dubois, and Astrid Maréchaux</i>	392	The Corpus of the Mosaics of Albania: The Conservation Challenge of Butrint
<i>Abdalsalam S. M. Sadoun, A. Bader Al-Beraiki, and Ashraf Sulaiman Bulkasim</i>	395	The Mosaic Pavement of the Four Seasons at the House of Jason Magnus, Cyrene
<i>Yasar Selçuk Şener, Orhan Bingöl, and Mesut Yılmaz</i>	398	The Conservation of an Opus Sectile Wall Decoration at the Latrine in Magnesia on the Meander (Aydın – Turkey)
<i>Eman Mohsen Ahmed Shahawy</i>	401	Conservation and Presentation of Mosaics at the Villa of the Birds in Kom el Dikka, Alexandria: “A Unique Place in Egypt”
<i>Branislava Lazarević Tošović and Maja Franković</i>	404	SEE Mosaics Project: From Survey to Professional Network, 2011–2014 Activities and Plans
<i>Branislava Lazarević Tošović, Maja Franković, Markus Santner, and José A. Alonso</i>	406	Lifted Mosaics: Analysis of Stability and Supports
<i>Dimitris Tsiptotas, Nektaria Dasakli, and Pavlos Triantafyllidis</i>	408	Fighting Agrosti, the “Mosaic Exterminator,” In Situ: An Interdisciplinary Cost Analysis on the Conservation and Presentation of the Early Christian Mosaic at the Apollo Erethimios Sanctuary in Rhodes

<i>Frédéric Veyssière et Carole Acquaviva</i>	411	Le balnéaire de Cornebarrieu (Haute-Garonne, France): De la fouille à la restitution
<i>Myriam Ziadé and Samar Karam</i>	414	Conservation of In Situ Mosaics at the Site of Eshmun, Lebanon
	417	Authors
	429	Conference Participants



# Discovering and Safeguarding the Mosaics at the Pont del Treball Roman Villa in Barcelona

*Sílvia Llobet i Font, Montserrat Pugès i Dorca, and Anna Bertral i Arias*

**Abstract:** *The construction of the high-speed rail line through the city of Barcelona, which began in 2008, made it possible to conduct an archaeological impact assessment on a 3.7-kilometer tract of land, the largest site ever excavated in the city. The construction of La Sagrera Station uncovered the remains of a Roman villa and several pavements, including an early fifth-century opus tessellatum. This paper reflects on the cost of progress at the expense of heritage conservation and illustrates the social dimension and positive impact the discovery could have for the district, despite its physical disappearance.*

It is safe to say that, nineteenth-century pioneers aside, modern urban archaeology in Barcelona emerged in the early twentieth century with the construction of Via Laietana, a street that traverses the medieval city and connects the port with the city's Eixample district. To build it, 2,200 houses along the 900 meters comprising the street were demolished. Construction also uncovered the Roman wall. Mindful of the magnitude of the destruction to part of the medieval city, there arose a "moral necessity" to preserve as many vestiges as possible: the first archaeological interventions involved fragments of historical buildings or even relocating entire medieval palaces, in accordance with a methodology and patrimonial objectives aimed solely at recovering and safeguarding remains of the past.

The origin of urban archaeology in Barcelona, the main premise of which is to study the city, dates to more recent times. The discovery of Roman remains under the Plaça del Rei in 1943 prompted the creation of the Barcelona City History Museum, where visitors can view layers of subsoil. This represents a pioneering work in museum displays. From the outset, the museum established a department to carry out archaeological research, the Archaeology Service.

Today the Servei d'Arqueologia de Barcelona is managed by the city council, under the Barcelona Institute of Culture. Its purpose is to study the origin and evolution of the city's territory through its material remains. The area of study encompasses all the land within municipal territory—90.4 square kilometers—though 80 percent of our archaeological interventions take place within the Ciutat Vella (Old City) district due to the potential for finding cultural remains and the intense urban development occurring there. Thus we regard the city as one single multi-strata archaeological site dating from prehistoric to contemporary times.

Internally, the Archaeology Service is divided into two areas: Prevention and Documentation, and Intervention. The latter includes the Department of Interventions in Heritage, which is responsible for preserving and conserving archaeological remains that fall within the Archaeology Service's area of activity. The department's work concerns both built heritage and activities subsidiary to archaeological interventions, such as the conservation and restoration of both movable and immovable heritage.

## **Construction of the High-Speed Rail and Excavation of the Pont del Treball Roman Villa**

The archaeological excavation in question is related to the construction of the stretch of a high-speed rail line through the northern sector of Barcelona. One of the most significant excavations in Barcelona in recent years, or rather, the most notable excavation in terms of duration and magnitude, regarding both expanse—40,000 square meters—and amount of earth moved, the project involves laying railway tracks and constructing a large central station that will become an interchange hub between several rail, subway, and bus lines.

In terms of organization, construction of the high-speed rail line has been taken up by the state-owned company Administrador de Infraestructuras Ferroviarias (ADIF), which is responsible for managing railway infrastructure (tracks, stations, etc.). ADIF subcontracts with external companies to execute the work or, in our case, carry out the archaeological excavation and conservation and restoration work, in accordance with plans drawn up by the Archaeology Service and authorized by the Government of Catalonia, our autonomous government.

Construction of the rail line began in 2008. As required under both Spanish and Catalan law, archaeological and heritage impact assessments were conducted on the 3.7-kilometer tract of city land, making it the largest site ever excavated in Barcelona. So far, roughly three million cubic meters of earth have been removed from the area, and numerous archaeological remains dating to a broad range of time periods, from the Neolithic Period to the twentieth century, have been discovered.

One of these sites is the Pont del Treball Roman Villa, from which the mosaics discussed in this paper were recovered. The mosaics and wall paintings have been removed, and all structures unearthed during construction of the rail line have been dismantled. Indeed all archaeological remains have been excavated and documented, and though some have been examined, the study of others are still pending. The archaeological levels at all sites have been exhausted, and all material remains have been dismantled and removed. For this reason, in the section on lifting the pavements, we refrain from

entering into ethical, social, or cultural considerations. We reserve our thoughts on the significance of losing archaeological remains for the conclusion. This incredibly important issue, which prompted an extremely difficult and traumatic debate within the neighborhood and city as a whole, represents the true cost we have had to pay for these mosaics—a cost that cannot be calculated in monetary terms but, in our case, has been compensated by the in-depth knowledge we have acquired on this part of the city.

### The Pont del Treball Roman Villa and the Recovered Mosaics

In the summer of 2011, during construction of the above-mentioned high-speed rail line (HSR), the Pont del Treball Roman Villa was discovered by archaeologists while monitoring the building of the new Sagrera intermodal station. The excavation was carried out in two phases: the first phase took place between July and November 2011, during which time roughly 1,100 square meters was excavated, and part of the villa's *pars urbana*, as well as earlier Iberian structures, were discovered (Alcubierre 2012: 76–79). The second phase lasted from June 2012 to December 2014 (fig. 1), during which 8,000 square meters was excavated. Additional areas of the *pars urbana* and part of the *pars rustica* and *fructuaria*, including a large wine-producing complex, were documented (Ardiaca and Alcubierre 2014: 99–102; Alcubierre, Ardiaca, and Artigues 2015). At present, work on the HSR is still under way, and part of the villa is yet to be excavated. The subsequent



**Figure 1** View of the site during the archaeological excavation, with the city of Barcelona in the background. Photo: Sílvia Llobet

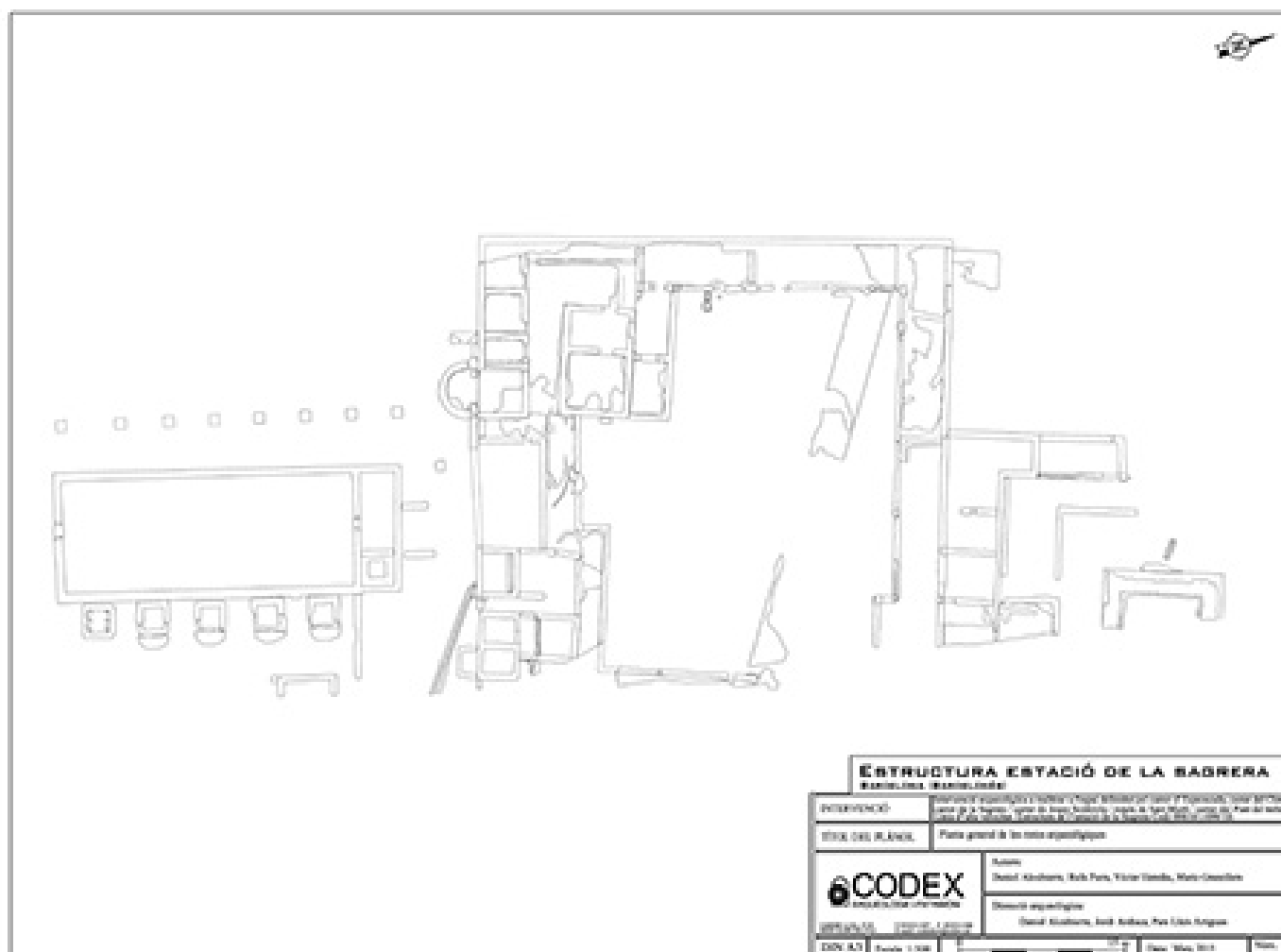
restoration and documentation work, among other tasks relating to the archaeological report, is also pending completion.

Based on the villa's chronological sequence, initial construction dates to the latter third of the first century BCE. Both residential and industrial structures dating to this period have been found. Toward the end of the first century CE, the wine-producing complex underwent a major transformation, leading to increased economic activity, a development reflected in a series of reforms and changes to the residential complex (Alcubierre, Ardiaca, and Artigues 2015: 78–80).

Between the first and fourth centuries CE, new living quarters were built and the central peristyle was embellished. None of the pavements lining the rooms during those phases have been preserved, having been destroyed during the early fifth century in a new building campaign. The only surviving

remnants are the almost fifteen hundred glass tesserae—green and blue, with some red—recovered from the destruction levels.

The villa's transformation culminated in the early fifth century when the residential complex was split into two distinct areas, one to the north and one to the south (fig. 2). In the northern section, the old chambers were transformed into a private area comprising a series of rooms paved in opus signinum, except for an area preserving the remains of an opus sectile mosaic. Of the latter, only the preparatory layers remain, consisting of marble and ceramic shards used to level and support the mosaic, which has not been found, likely stolen in ancient times. In this layer of the floor's preparatory substratum, the mortar presents traces of opus sectile panels, making it possible to partly reconstruct the floor's original layout, the perimeter of which was arranged



**Figure 2** Ground plan of the Pont de Treball Roman villa during the phase dating to the fifth century.

Drawing: Daniel Alcubierre



in a U-shape. From this layout, as well as other information, we can infer that this room was a triclinium. Aside from the pavement, we also managed to confirm that the skirting boards, traces of which are extant, also displayed this marble decoration.

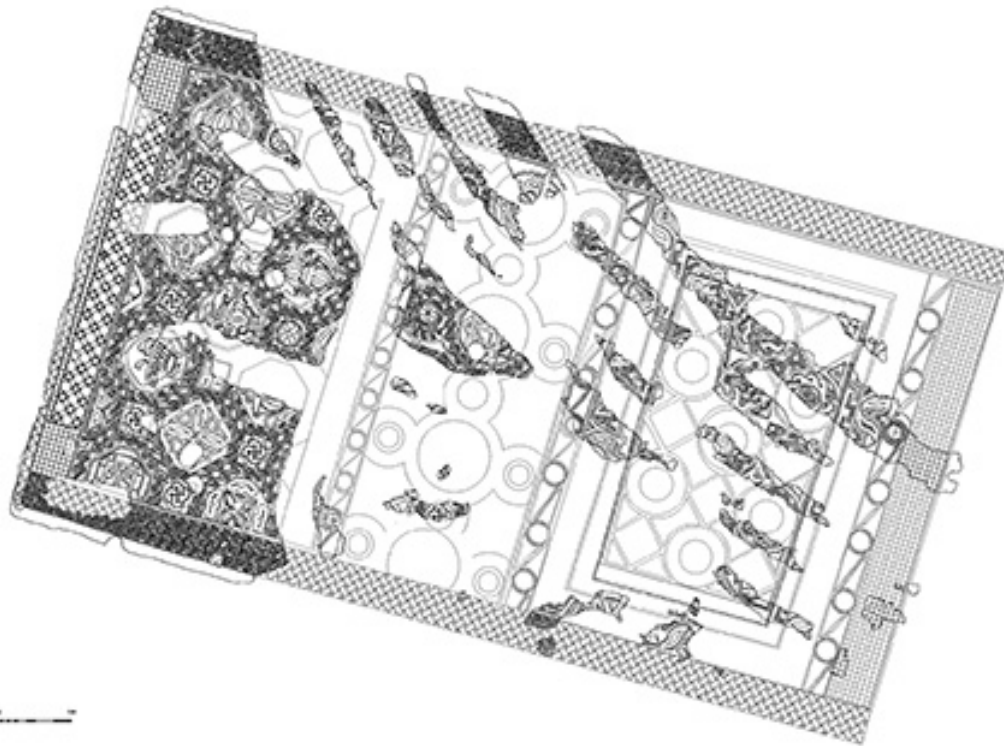
Our first course of action was to document the preparatory layers beneath the opus sectile floor. The remains of the walls and mosaic were scanned to create a 3D image and an orthophotograph was taken and subsequently used to number all remaining marble and ceramic shards; these records were used during the lifting and packaging stages. Back at the laboratory, we took detailed photographs and cleaned the surface of each shard, preserving their original mortar for later study. Last, they were stored in polyethylene boxes, pending completion of the lithological study.

Separated from this private area by a porticoed corridor, the southern part of the villa was transformed during the fifth century into a reception area (fig. 2). This area annexed land from the central courtyard, in which several *cubicula* (small rooms, often bedrooms)—all paved in opus signinum—and the villa's most opulent rooms were built. These included the baths, an apsidal reception room, or *oecus*, and a large hall, which was the only one paved in opus tessellatum and is easily the most significant of all the recovered mosaics.

The opus signinum floors were scanned to create a 3D representation, to which photogrammetric imagery were applied. Prior to producing the graphic documents, we performed cleaning tests to help support the archaeological research and collected samples for future studies. We also collected representative “macro-samples” from the villa's pavements and facings, for example, from the opus signinum paving the frigidarium of the baths. These samples were subsequently reset onto a rigid honeycomb support with a view to creating graphic material for possible exhibitions on the site.

### Opus Tessellatum: The Symbol of a Villa That No Longer Exists

Because of its singularity and historical, archaeological, and artistic relevance, the entire opus tessellatum from the large reception hall was lifted when it was determined that the building was to be dismantled. The eastern half of the mosaic is in precarious condition. It presents numerous lacunae that are almost certainly the result of plow damage sustained after the land on which the villa was built became farmland. Based on the original measurements, the pavement has a surface area of 55 square meters, of which, unfortunately, only about 60 percent remains (fig. 3). Nonetheless, what does remain is



**Figure 3** Original design of the opus tessellatum template.

Drawing: Àlvar Mailan

highly compact, and only the borders of the fragments damaged by plowing display any sort of significant alteration: loss of mortar supporting the tesserae and insignificant cracks and fractures. The tesserae, despite being in generally good condition, present a layer of encrustation that makes it difficult to distinguish the colors and see the mosaic's decorative motifs. Some ceramic tesserae are disaggregated.

The mosaic's color scheme features a combination of fourteen different types of tesserae, three of which are ceramic and eleven, stone. At the time this paper was written, the lithological identification of these tesserae was still under way. The predominant color is white, mixed with earth tones, grays, and reds, as well as black pieces. In terms of stratigraphy (fig. 4), the upper layer is composed of  $1 \times 1$  cm tesserae inserted into lime mortar containing a small amount of very fine-grained sand aggregates, forming a thin, even layer 0.06 to 0.08 cm thick. Beneath the bedding layer lies a 5 to 5.5 cm-thick layer of mortar of lime, sand, and crushed ceramic. We must note the good adhesion and compaction between these layers, as well as the quality of the mortar; despite the damage caused by farming, the extant fragments display remarkable cohesion and durability.

Though Roman mosaics were normally built atop initial preparatory and leveling layers known as the *rudus* and *statumen*, that is not the case here, as the bottommost pre-

paratory layer consists of an *opus signinum* pavement with a clearly distinguishable *rudus* and *statumen*. This has two possible explanations: either the mosaic was built atop an earlier pavement or the *opus signinum* was built as a preparatory layer for the mosaic. Lifting the tessellatum gave us broader insight into the underlying *signinum*. It also made it possible to document widespread signs of chiseling and a leveling layer of sand that had been applied to form an even, flat work surface. From such evidence, we can infer that they are two overlapping pavements.

As for decoration, the tessellatum presents three panels with different decorations (fig. 3). A guilloche mat, however, is common to all. The first panel features geometric motifs forming an orthogonal pattern of circles and squares tangent to the vertex, with Solomon's knots and quatrefoils inside. This central part is edged by several bands: undulating and twisted ribbons with a trifold calix, fractionated meanders, a simple guilloche, and a border featuring an orthogonal pattern of adjacent squares. The central band displays a pattern of intersecting circles with star- and flower-shaped motifs inside. The room also includes an octagonal honeycomb pattern, the center of which is decorated with quatrefoils and a group of five craters with birds and peacocks flanked by swastikas, as well as a vase with flowers.

**Figure 4** Detailed view of the stratigraphy of the *opus tesellatum* atop the earlier *opus signinum* pavement. Photo: Silvia Lobet



### Lifting the Opus Tessellatum: Fieldwork

Recovering something as unique and sizable as a mosaic is bound to interfere with the rate at which the archaeological excavation is carried out. And if the excavation takes place in an urban setting, with varying local sentiments, this interference takes on social dimensions that must be taken into account. Such was the case with this intervention. Yet, far from trying to hide it, we seized the opportunity to offer the press and local residents a glimpse at the archaeological and restoration work being performed during the lifting process. As we mentioned earlier, the site had been exhausted and dismantled, but on several occasions during the intervention the press was invited to visit the site and watch the work unfold firsthand. Our aim was to provide information about archaeology and the methodology being used. It was thus necessary to develop a visitation protocol—with clearly distinct hours and routes to the area housing the mosaic—as well as a work protocol ensuring that the process would be conducted in an orderly and effective manner.

The excavation and discovery of the mosaic was the result of a joint effort of the restoration and archaeology teams (Llobet and Mailan 2012: 153–56). The room was first divided into 1 square meter quadrants, which were excavated one by one in an effort to thoroughly clean the layer of encrustation covering the mosaic surface. The cleaning process, which was

much quicker immediately after the mosaic was discovered because the ground moisture made the encrustation easier to remove, also allowed us to monitor the drying process (fig. 5). During that time we recovered 32 fragments of different sizes, each of which was identified with a letter. The excavation also unearthed 140 fragments or groups of small fragments whose position had shifted—likely due to the plowing—each of which was assigned a coordinate. By sieving the soil from all the m<sup>2</sup> quadrants, we recovered approximately 25,000 detached tesserae, which were assigned the number of the quadrant in which they were found (Llobet and Molinas 2015).

Following the discovery and excavation phase, photogrammetry and laser scanners were used to produce the graphic documents. Based on aerial shots of the pavement and measurements taken using control points gathered during the topographic survey, the mosaic was digitally reconstructed using photogrammetric methods. Digital applications helped draw correlations between the digital model and the photographs, producing an orthophotograph with megapixel quality resolution (2 mm/pixel) that could be used to measure distances and calculate areas. A powerful graphic working document, this orthophotograph was used for collecting data relating to the mosaic's condition (fig. 6), numbering fragments, and plotting cut lines prior to lifting, among other



**Figure 5** Aerial view of the cleaning work on the part of the opus tessellatum excavated in 2014.  
Photo: Silvia Llobet

**Figure 6** Documenting the condition of the opus tessellatum on the ortho-photograph. Photo: Maria Molinas



**Figure 7** Lifting fragments of the opus tessellatum during the 2014 campaign. Photo: Daniel Alcubierre



uses. The elongated mosaic fragments discovered in 2011 and corresponding to the part of the mosaic damaged by the plow were mostly lifted in their original shape and hardly cut.

In terms of facing, polyester gauze was used instead of traditional cotton gauze because, while just as strong, it is also transparent, enabling the mosaic to be more easily observed and monitored. The gauze was adhered to the surface of the tesserae using polyvinyl acetate.

When lifting the mosaic, we made sure to also lift all preparatory layers, that is, the tesserae plus the layers of mortar, because all this was considered an integral part of the piece. To lift the mosaic, we cut between the last layer of mortar and the *opus signinum*, enabling us to examine this layer following extraction. We applied the normal protocol: steel rods were inserted into the interstices between the tesserae to open cut lines, then the mortar was undercut—which proved quite simple—by inserting chisels between the last layer of mortar and the *signinum* (fig. 7). Last, we used steel plates to lift the mosaic and placed each fragment (of mosaic) inside a custom-made, stackable wood box.

### The Opus Tessellatum: Laboratory Work

At the time this paper was written, only half of the mosaic lifted during the initial excavation phase had been treated in the laboratory (Llobet and Mailan 2014: 198–200). Nonetheless, we have cleaned and consolidated the mosaic, and reset each fragment onto new supports capable of ensuring adequate storage conditions until the entire mosaic is restored and a decision regarding the mosaic's final location is made. The decision about its location forced us to halt restoration during the reintegration phase. Due to the nature and characteristics of the volumetric reintegration of the lacunae, various factors must be taken into consideration; it is a large (55 m<sup>2</sup>), heavy piece presenting substantial losses and ornate decoration that will be displayed out of context. Still unknown are factors such as where it will be displayed, lighting, the distance at which it will be viewed, and whether or not it will be displayed on the floor or vertically on a wall.

The first step of the restoration process was to treat the reverse side of each fragment. Due to the weight of the fragments and to facilitate handling, the thickness of the tesserae—plus the original mortar and intervention layer—was limited to 2.5 cm, requiring us to remove some of the original mortar. The cracks, fractures, and damaged edges made it advisable to consolidate the reverse side of each fragment. To do so, we injected mortar made of 1 part slaked lime, 2 parts pozzolan, and 1 part ceramic powder. The weight of the frag-

ments forced us to reinforce the cracked and fractured areas by adhering fiberglass strips using a second type of mortar made up of 7 parts hydraulic lime, 2 parts crushed ceramic, and 5 parts marble powder.

Last, we created the intervention layer, that is, the stratum between the original mortar and the new support. This consisted of a fiberglass mesh adhered using a 0.3 to 0.5 cm-thick layer of mortar. The mortar was made with 7 parts hydraulic lime, 2 parts crushed ceramic, 5 parts marble powder, 7 parts river sand, and an acrylic emulsion added to the mixing water at 2%.

The fragments were stored at the Archaeology Service's headquarters for one month until the new mortar had set properly. They were then turned over, at which point treatment on the front side, that is, the tesserae, began. We used steam to remove the gauze facing and cleaned away any remaining soil or adhesive, as well as any leftover encrustation.

Prior to transferring the mosaic fragments to a new support, we had to create a design template for the mosaic (fig. 3). Using the orthophotograph of the mosaic as a basis, we established a hypothesis for the lacunae and replicated the missing decoration, obtaining a complete picture of the mosaic. A 1:1 scale copy of this sketch enabled us to correctly arrange the mosaic fragments and, where necessary, adjust the position of any fragments that may have shifted while underground. This was an extremely delicate process, since, as explained earlier, the mosaic fragments correspond to disjointed diagonal bands.

Parallel to this, we determined the shapes that the new honeycomb backing panels would have to have. Let us recall that at the time the mosaic was lifted we opted not to reshape the mosaic's irregular fragments. As a result, we were forced to transpose this irregularity onto the honeycomb panels, requiring us to carefully plan the order and sequence in which the panels would fit together so as to make them easier to assemble and disassemble in the future.

Once the panels were finished, the mosaic fragments were transferred to the new support and adhered by applying small dots of epoxy resin between the intervention layer and panels. Re-laying some fragments proved quite difficult, having been discovered out of context. Three factors played a key role in correctly arranging the fragments on the new support: information concerning the area in which they were discovered, the fragment's decoration, and the design template based on the orthophotograph.

The final step involved adding the detached tesserae to the mosaic. As a result of the large amount of lacunae in the first recovered mosaic fragment, in order to improve readability,



**Figure 8** Re-laying the fragments and tesserae recovered from the opus tessellatum onto the new honeycomb support. Photo: Silvia Llobet

we decided to fill small lacunae in between fragments and finish certain decorative lines with the tesserae, making the parts of the mosaic that had sustained substantial loss and the overall piece easier to understand. The entire re-laying process has been exhaustively documented (fig. 8).

### Conclusion: The Price of Resignation

In urban archaeology there exists an almost constant tug of war between developing and modernizing the city and commemorating the past. In the summer and autumn of 2011, the press caught wind of the findings after the area's residents raised concerns about the dismantling of the villa, lending the archaeological excavation a genuinely significant social dimension and, let's not be naive, a political dimension as well. The city and Catalan autonomous governments engaged residents, archaeological professionals, and site managers in efforts to find a solution to the problem. They arranged site visits and conferences, took part in radio talk shows, and ultimately, following a series of commitments on the part of the site developer, reached a consensus. The commitments included exhausting the site's stratigraphy, conducting a comprehensive analysis of the remains, and subsequently publishing or restoring and exhibiting all uncovered materials.

We should not, however, overlook the economic implications of conserving this mosaic.<sup>1</sup> Nonetheless, we feel that, in our case, the economic cost of restoring the mosaic was

never an issue, particularly when the cost of the construction project in question was estimated at millions of euros. The problem stems from the need not only to lift the mosaic, but to sacrifice the archaeological remains that lend it meaning. How do we calculate the heritage value of the villa that has been destroyed? How can this value be recuperated? Would it have been worth it to conserve the archaeological remains and decide not to build the station?

In this sense, conserving the walls does not ensure a heightened interest in history, nor would it remedy cultural, social, or urban planning deficiencies. In contrast, we feel the investment required to maintain the archaeological structures, which were in a poor state of conservation, would not compensate for eliminating the plans to build the station. Though attempts were made to modify the project, further archaeological remains could have been uncovered elsewhere, or the construction could have encroached on homes.

Nonetheless, if everything goes according to plan, the Sagrera neighborhood will soon see its mosaic gracing the entrance to the station—as emblematic as Miró's mosaic at the airport, and a testament to a villa that became the area's first industrial settlement. This is a day the residents eagerly await! The methodical dismantling of the site has enabled us to deepen our understanding of the villa, which, at present, is Barcelona's most well known site.

### Note

- 1 2011: €4,545.36 (Lifting the mosaic from the station's access points) / 2012: €56,621.71 (Restoring the mosaic from the station's access points) / 2013–14: €11,340 (Lifting the mosaic from the station).

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