

An underwater photograph of an archaeological site. In the foreground, a large, orange, textured object, possibly a piece of pottery or a large shell, is prominent. A small, striped fish is swimming near it. In the background, a diver with two blue and white scuba tanks is visible, working on the site. Various artifacts, including pottery and metal objects, are scattered on the seabed, some with identification tags like '1119' and 'P0092'. The water is clear and blue.

UNDER THE MEDITERRANEAN I

Studies in Maritime Archaeology

edited by

STELLA DEMESTICHA & LUCY BLUE

WITH KALLIOPI BAIKA, CARLO BELTRAME,
DAVID BLACKMAN, DEBORAH CVIKEL, HELEN FARR
& DORIT SIVAN



UNDER THE MEDITERRANEAN I

Studies in Maritime Archaeology

edited by

STELLA DEMESTICHA & LUCY BLUE

**WITH KALLIOPI BAIKA, CARLO BELTRAME,
DAVID BLACKMAN, DEBORAH CVIKEL, HELEN FARR
& DORIT SIVAN**

© 2021 Individual authors

Published by Sidestone Press, Leiden
www.sidestone.com

Imprint: Sidestone Press Academics

Lay-out & cover design: Sidestone Press

Photograph cover:

- Main image: Mazotos shipwreck, Cyprus (photo: Al. Erdozain © MARELab)
- Inset: Mandirac 1 near Narbonne France (photo: C. Durand, CNRS, UMR 7299–CCJ)
- Inset: *Ma'agan Mikhael II* before being launched in Haifa, Israel (photo: A. Efremov)

ISBN 978-90-8890-945-0 (softcover)

ISBN 978-90-8890-946-7 (hardcover)

ISBN 978-90-8890-947-4 (PDF e-book)

Series editor: Miranda Richardson

Copy editor: Alva MacSherry

Text preparation: Bob Holtzman

Contents

'Under the Mediterranean' in the 21st century: constants, trends, and perspectives in Mediterranean Maritime Archaeology	9
Stella Demesticha and Lucy Blue	
SHIPS AND SHIPWRECKS	
Editors: Carlo Beltrame, Deborah Cvikel and Stella Demesticha	
The Arduous Voyage of Underwater Research on the LBA Shipwreck off Modi Islet	23
Christos Agouridis and Myrto Michalis	
The Mazotos Shipwreck, Cyprus: a preliminary analysis of the amphora stowage system	
Stella Demesticha	
Final Report on the Remains of Four Vessels Found in the Ancient Harbour of Naples, Italy, Dating to the Late 2nd Century BCE and the Late 2nd-Late 3rd Century CE	59
Giulia Boetto, Chiara Zazzaro, and Pierre Poveda	
The Mandirac 1 Shipwreck, Narbonne, France	75
Marie-Pierre Jézégou , Patrick Andersch Goodfellow, Jonathan Letuppe, and Corinne Sanchez	
A late-12th-century Byzantine Shipwreck in the Port of Rhodes: a preliminary report	91
George Koutsouflakis and Eric Rieth	
The Construction of the <i>Ma'agan Mikhael II</i> Ship	111
Deborah Cvikel and Avner Hillman	

HARBOURS

Editors: Kalliopi Baika, David Blackman, Lucy Blue, Helen Farr, Dorit Sivan

Patara's Harbour: new evidence and indications with an overview of the sequence of harbour-related defence systems 127

Erkan Dündar and Mustafa Koçak

The Harbour(s) of Ancient Torone: the search for their location and reflections on Honor Frost's hypothesis concerning shipbuilding in the area 147

J. Lea Beness and Tom Hillard

The Hellenistic-Early Roman Harbour of Akko: preliminary finds from archaeological excavations at the foot of the southeastern seawall at Akko, 2008-2014 163

Jacob Sharvit, Bridget Buxton, John R. Hale, and Alexandra Ratzlaff

The Submerged Monumental Complex of the Roman Harbour of Fossae Marianae, Gulf of Fos, France: an overview of preliminary results 181

Souen Fontaine, Mourad El-Amouri, Frédéric Marty, and Corinne Rousse

The First Marine Structures Reported from Roman/Byzantine Ashkelon, Israel: do they solve the enigma of the city's harbour? 195

Ehud Galili, Baruch Rosen, Asaf Oron, and Elisabetta Boaretto

Fortified Crusader Harbours of the Syro-Lebanese-Palestinian Coast 205

Patricia Antaki-Masson

The Port of Ishbiliyya and its Shiphsheds: Islamic-period transformations of the Guadalquivir River, the port of Seville and the 12th-century Almohad dockyard 217

Carlos Cabrera Tejedor and Fernando Amores Carredano

MARITIME LANDSCAPES

Editors: Kalliopi Baika, David Blackman, Lucy Blue, Helen Farr, Dorit Sivan

Mariners, Maritime Interaction, and the 'Ritual' of Sea Travel in Early Neolithic Cyprus 239

Duncan Howitt-Marshall

The Effects of Coastline and River Changes on Anchorages, Harbours, and Habitation Patterns: the case of Akko 267

Michal Artzy, Harry Jol, Matthieu Giaime, Yossi Salmon, Amani Abu-Hamid, Gloria I. López, Christophe Morhange, David Kaniewski, Paul Bauman, and Anne K. Killebrew

Aegean Navigation and the Shipwrecks of Fournoi: the archipelago in Context 279

Peter B. Campbell and George Koutsouflakis

Istros, Black Sea Coast, Romania: a geoarchaeological perspective on the location of the harbour(s)	299
Alexandra Bivolaru, Valentin Bottez, Andrei Asăndulesei, Andreea Vladu, Tiberiu Sava, Matthieu Giaime, and Christophe Morhange	
Navigating Perceptions: Mariners and geographers of the Roman Levant	321
Carmen Obied	
The Rock-Cut Shoreline Features of Dana Island and the Maritime Landscape of the Taşucu Gulf, Rough Cilicia	343
Michael R. Jones	
Appendix: List of presentations and posters exhibited at the Under the Mediterranean Nicosia Conference	363

The Submerged Monumental Complex of the Roman Harbour of Fossae Marianaе, Gulf of Fos, France

An overview of preliminary results

*Souen Fontaine**, *Mourad El-Amouri***,
*Frédéric Marty****, and *Corinne Rousse*****

In the Gulf of Fos (southern France), lie the remains of one of the main harbours of the northwestern Mediterranean dating to the Roman period, ideally located at an entrance to the Rhone Valley. This *statio*, mentioned by ancient authors, is situated at the end of the Fossae Marianaе, a presumed canal dug by Marius to avoid the dangers of the Rhone river delta. Known since the 19th century, widely looted since the 1950s, and very partially studied, the port site, now submerged in 1-4 m of water, covers nearly 40 hectares. The resumption of fieldwork and multidisciplinary studies undertaken since 2014 have led to the identification of a large-scale monumental complex in the centre of Saint-Gervais bay.

Keywords: Ancient Mediterranean harbour, submerged buildings, Roman wetland construction, Fossae Marianaе.

* *French Ministry of Culture, Department of Underwater Archaeological Research (Drassm), Marseille, France, souen.fontaine@culture.gouv.fr*

** *Ipsos Facto Co-op, Marseille, France, mourad.el-amouri@ipsofacto.coop*

*** *Métropole Aix-Marseille Provence/Territoire Istres Ouest Provence/Direction du Patrimoine Culturel, Istres, France, Associate researcher under agreement – Aix Marseille Université, CNRS, Centre Camille Jullian, Aix-en-Provence, France, frederic.marty@ampmetropole.fr*

**** *Aix-Marseille University, CNRS, CCJ, Aix-en-Provence, France, corinne.rousse@gmail.com*

The Gulf of Fos is located on the French Mediterranean coast, on the eastern edge of the Rhone river delta. In the inner gulf, lie the remains of one of the western world's most important Roman harbours. Strategically located at the mouth of the Rhone, the harbour of Fos was the main gateway between the Mediterranean world and the northwestern inland provinces of Gaul, Germany, and Brittany, via the Rhone, Saone, and Rhine rivers. The current name of the town, Fos-sur-Mer, derives from Fossae Marianaе, referring to the canal dug by Marius at the beginning of the 1st century BCE. The canal and perhaps the *statio* established at its mouth are mentioned by several ancient authors, in particular, Strabo (*Geography*, IV, 1.8) and Plutarch (*Life of Marius*, XV), but also Pomponius Mela (*Geography*, V), Pliny the Elder (*Natural History*, III-34), and Ptolemy (*Geography*, II-10, 2-11), and both appear in the *Itinerarium Maritimum* and the *Itinerarium Antonini Augusti* (for a complete overview of ancient sources mentioning the Marius Canal and the harbour of Fos, see Leveau and Troussset, 2000; Tréziny, 2004). The canal, initially dug for military purposes by General C. Marius' troops to bypass the dangerous river mouth of the Rhone, permitted vessels loaded with troops or goods to reach the safe and navigable part of the river, to the south of Arles. Its management



Figure 1. Localization of the Fos Gulf on the Mediterranean south coast of France, at the eastern extremity of the Rhone river delta (Souen Fontaine, Imagerie 2018 TerraMetrics).

and profits, first entrusted to the autonomous city of Marseille (Strabo, IV, 1-8), were transferred to the young colony of Arelate (Arles) following the defeat of Marseille by the troops of Julius Caesar in 49 BCE. The harbour complex, implanted at the canal's seaward outlet into the Gulf of Fos, played the role of the maritime outer port of the city of Arles and the role of a redistribution port on the main trade route between Italy and Spain for at least three centuries. Whether or not the canal quickly silted up and vessels used the natural mouth of the river directly again (Long and Duperron, 2016),¹ the intensity of Fos harbour's commercial traffic is clearly attested until the beginning of the 3rd century CE by the very abundant ceramic corpus found in the port area (Liou and Sciallano, 1989). On the Peutinger Table, the *Fossis Marianis Statio* is indicated by a semi-circular horreum-shaped icon, similar to that indicating the port of Ostia. The geographical representation and mention of

1 The discovery of many ancient shipwrecks and of a large area of port dump, off Saintes-Maries-de-la-Mer, in front of the mouth of an arm of the Rhone, suggests there may be another port of Arles (Long and Duperron, 2016). The bulk of these wrecks, nearly 50, were loaded with cargoes of heavy raw and semi-raw material (marble and metals, for example). A recent study sees this as evidence of the specialization of port spaces at the mouths of the Rhone (Djaoui, 2017).

the place by Greek and Latin authors have captured the interest of scientists since the 16th century but, despite many hypotheses, the route of the *Fossae Marianae* has not yet been identified. And, despite many archaeological discoveries recorded in the Gulf of Fos since the 1950s that have made it possible to locate the Roman port, the organization, the topography of the port and the associated city, and the chronology of the facilities are still very poorly defined and, paradoxically, very little studied.

The gulf and its coastline configuration have changed considerably since Roman times because of its deltaic environment. Meanwhile, human occupation of the site has also undergone significant changes. Its commercial and strategic roles seem to have disappeared at the end of Antiquity, and during the Medieval and Modern periods the site was only a small village with no significant role in the economy and the political context of the region. Fos-sur-Mer became popular as a seaside resort in the first decades of the 20th century up to the 1960s and 1970s, at which time the government chose to install there the largest petrochemical and industrial port on the French Mediterranean coast.

Most of the Roman harbour-remains are now submerged to a depth of 0-4 m on the west side of the rocky headland of Saint-Gervais. Underwater archaeological investigations conducted by scientists and by amateurs

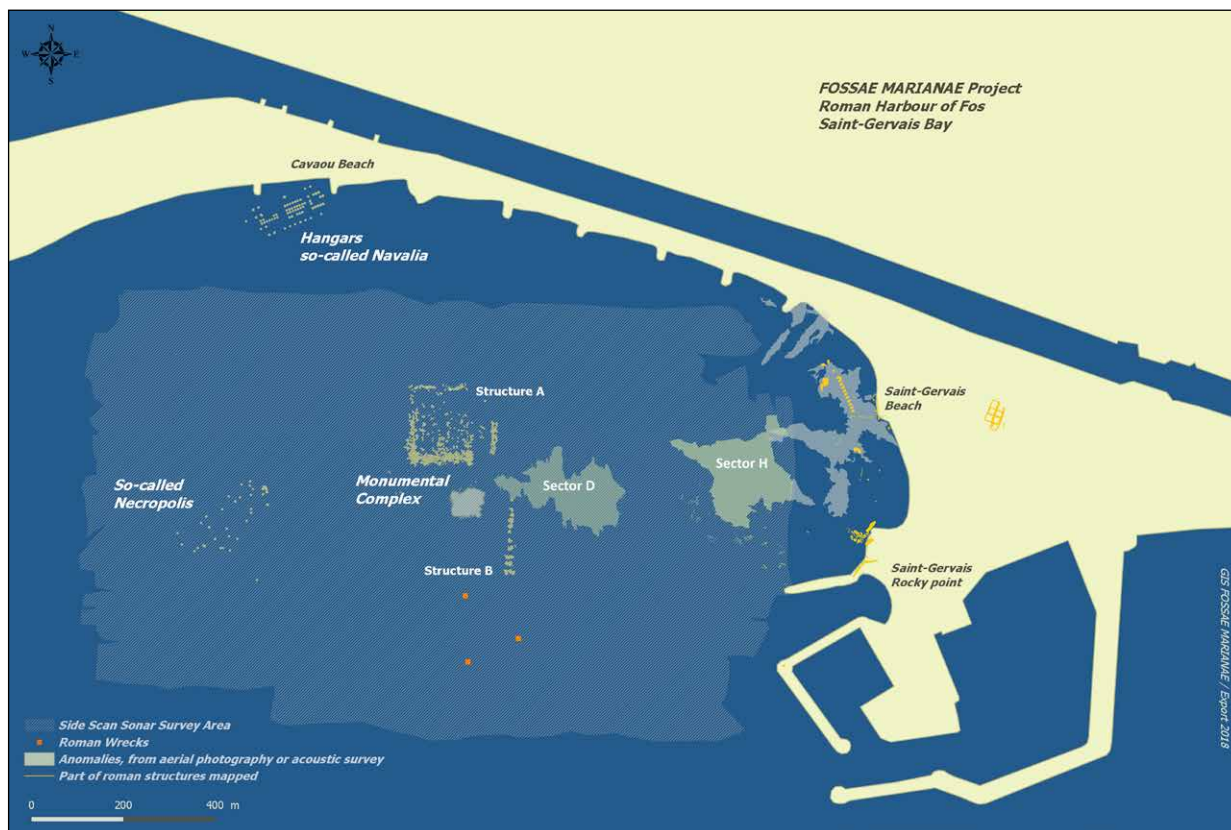


Figure 2. Map of the main remains known in Saint-Gervais cove at Fos-sur-Mer (GIS Fossae Marianaë, Souen Fontaine, DRASSM).

since the 1970s in the area of Saint-Gervais cove have identified various archaeological sites, among them: four Roman wrecks, several ‘hangars’ (two are the so-called *navalia*), a possible necropolis, and portions of walls.

These remains, sometimes reported by divers rather than archaeologists, with more or less accuracy, are spread over more than 40 hectares (Fig. 1).

The deltaic environment of the site generates very poor visibility most of the time, which makes any attempt at classic underwater survey difficult. This, combined with the difficulty of studying a submerged harbour spread over such a large area has discouraged archaeologists and so the potential of the site has remained scientifically under-explored for decades.

Since 2014, a multidisciplinary research group has taken up the entire ‘archaeological dossier’ of Fos harbour and the Fossae Marianaë. Since 2016, underwater and terrestrial field operations have been included in the framework of a research project called *Fossae Marianaë: Le système portuaire antique du Golfe de Fos et le Canal de Marius*, led by the Centre Camille Jullian (Aix-Marseille University and CNRS) and the DRASSM (French Ministry of Culture). This is the first large-scale interdisciplinary project carried out in this rich area and will probably be the first step in a long-term research

programme: the underwater campaigns have been used for the past four years as a field school for the students in the Master of Maritime and Coastal Archaeology (MoMArch) programme at Aix-Marseille University.

The monumental complex of Saint-Gervais cove

Some of the first underwater fieldwork carried out under the project, in 2014, was a wide sidescan sonar survey conducted in Saint-Gervais cove (Fig. 2) and in a sector in the eastern area of the gulf, on the site of La Marronède.² The resulting acoustic map revealed the presence of a monumental complex comprising different buildings, two of them more than 100 m long (Fig. 3). The three central monuments are built on the same orientation (north-south) and are probably contemporaneous. From three underwater survey campaigns carried out in this area at the end of the 1980s by Jean-Marie Gassend (IRAA, Aix-en-Provence), we knew that some sections of wall

² On the La Marronède site, an excavation was conducted by the project team in 2012, 2014, 2015, and 2016 revealing an important construction on piles dated to the middle of the second century CE. For more information, see Fontaine *et al.* 2019.

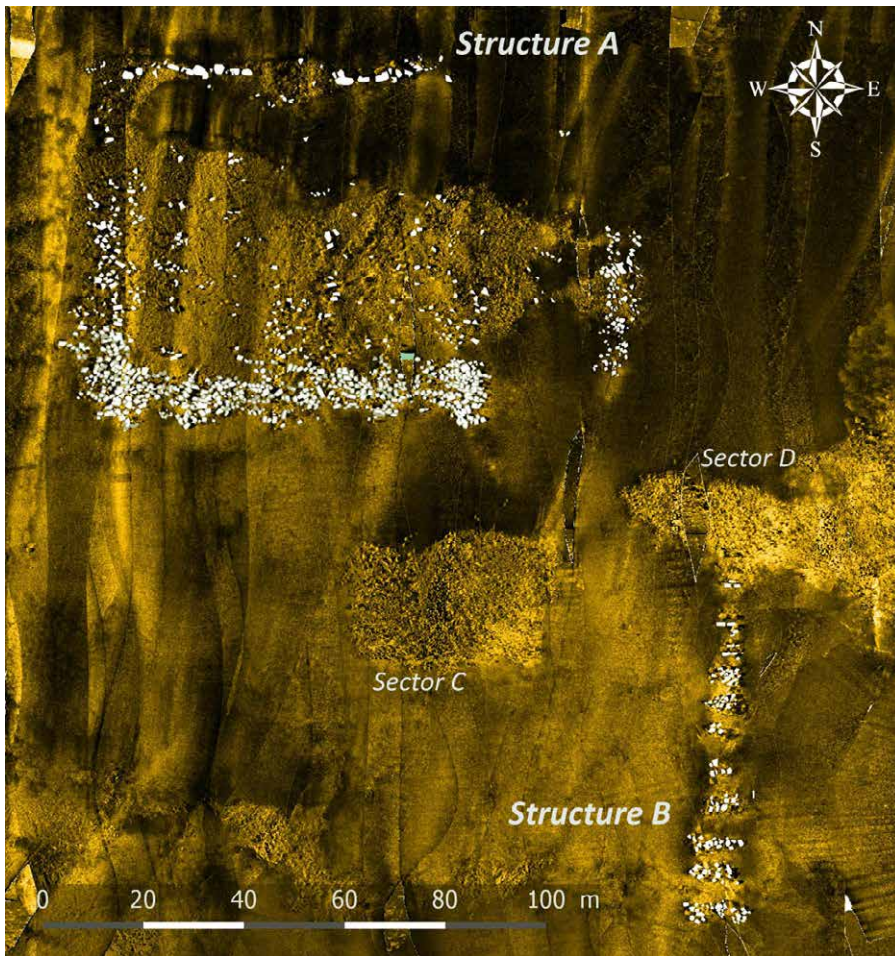


Figure 3. Acoustic map (sidescan sonar survey) and drawing of the main built elements (wall, ashlar blocks) of the monumental complex in the centre of Saint-Gervais cove (Map Denis Dégez, Adrien Domzalski and Souen Fontaine, DRASSM).

had already been recognized (Gassend, 1988; Gassend and Maillet, 1989). Most were disconnected and isolated and there was little in the reports to suggest that they belonged to *in situ* buildings, even though aerial photography in 1965 by L. Monguilan gave an overview of this square structure in the middle of the bay (Monguilan, 1977; Liou, 1987: 60-61, fig. 2).

The identification of built structures with connected walls of this size, preserved *in situ* in 3-4 m of water, revived the geoarchaeological questions posed by the submersion of the Fos harbour complex. This cannot be attributed only to the rise of the vertical sea-level, which has been no more than 0.6-0.7 m on this coastline area since Roman times. The primary aim of the archaeological studies of these buildings was, therefore, to define if they could have been built on land and then submerged or if they could have been originally built in shallow water. Supported by the recent archaeological results on this specific question (see 'Structure A', below), the second step of the study was concerned with the recovery of previously published geomorphological data for the period (Vella *et al.*, 1999; Vella and Provansal, 2000; Vella,

2002; 2004) combined with the analysis of cores taken in the previous two years, to try to reconstruct this complex and unstable sedimentary environment (probably lagoonal) and to understand the succession of events (of high or low energy) suffered by the site.

The past three years of fieldwork have focused on the two main structures of the monumental complex recognized in the centre of the cove: Structure A and Structure B.

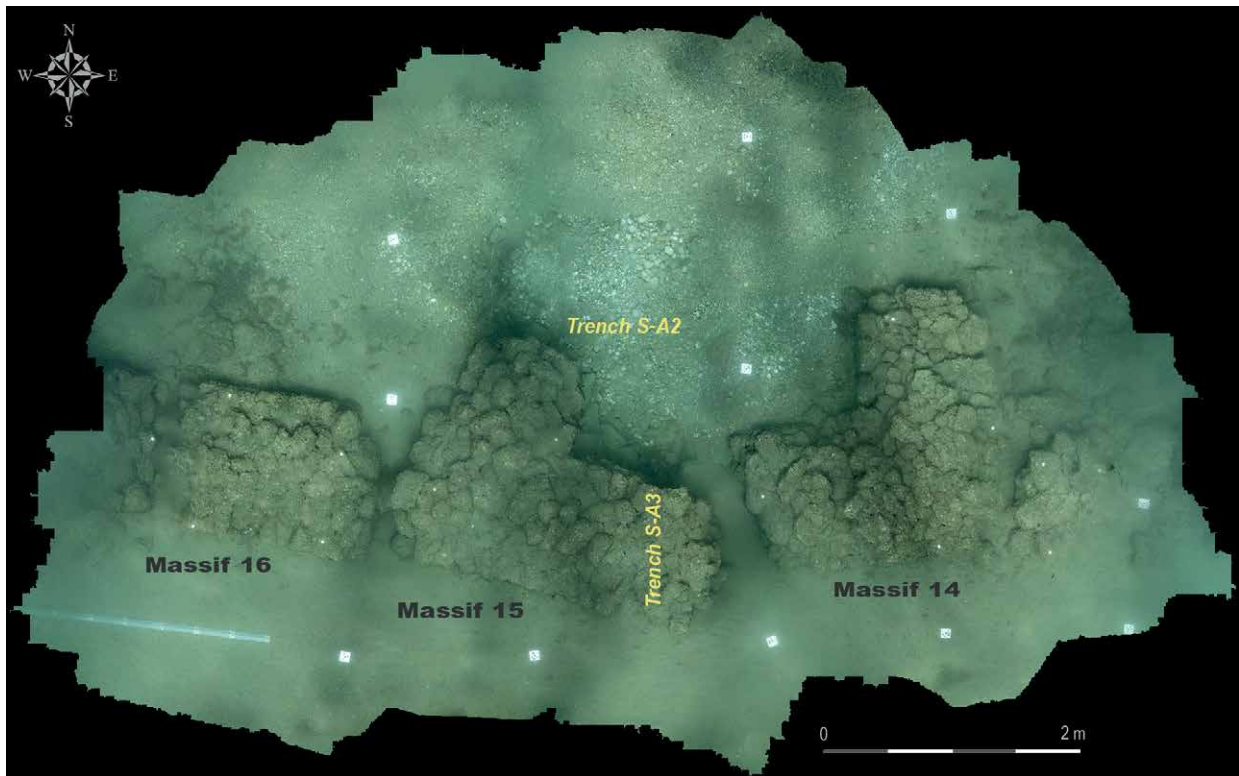
Structure A

The northern structure, the one closest to the current shoreline, is square with sides of more than 100 m. Despite the overall shape of the structure and the apparent connection between each side of it, we cannot be sure, for now, that it is a single coherent building as the north side is made differently from the others. The southern, eastern and western sides are composed of a huge number of ashlar blocks, some of them more than 3 x 2 m in size. In some parts, a heap of blocks is spread over an area more than 15 m wide. For now, we only have a global overview of this part of the structure,

Figure 4. Excavation in progress on the north wall of the Structure A (Massifs 7 and 8, Trench S-A1, campaign 2017) (Photo Loïc Damelet, CNRS-CCJ).



Figure 5. Ortho-photography of a portion of the Structure A north wall: Massifs 14-16. Localization of the trenches S-A2 and S-A3 (photogrammetry Laurent Borel, CNRS-CCJ; DAO Souen Fontaine, DRASSM).



provided by the acoustic map augmented by *in situ* observations (Fig. 3). Precise mapping of this huge pile of ashlar blocks requires extensive photogrammetric and topometric work, which will be conducted during the forthcoming campaigns.

On the north side, the frontage is made up of several segments of wall (each 3 m long), built of small stone rubble bound with mortar (Fig. 4). Between each wall

segment or ‘massif’, a space of c.500 mm is observed. These empty spaces may correspond to missing wooden elements or could be the result of a violent event that disrupted the wall. The photogrammetric restitution of the entire north frontage is still in progress. It is hoped that, when complete, it will help to check if it could have been a single wall broken, regularly, in several parts. The wall is preserved for three courses and comprises a very

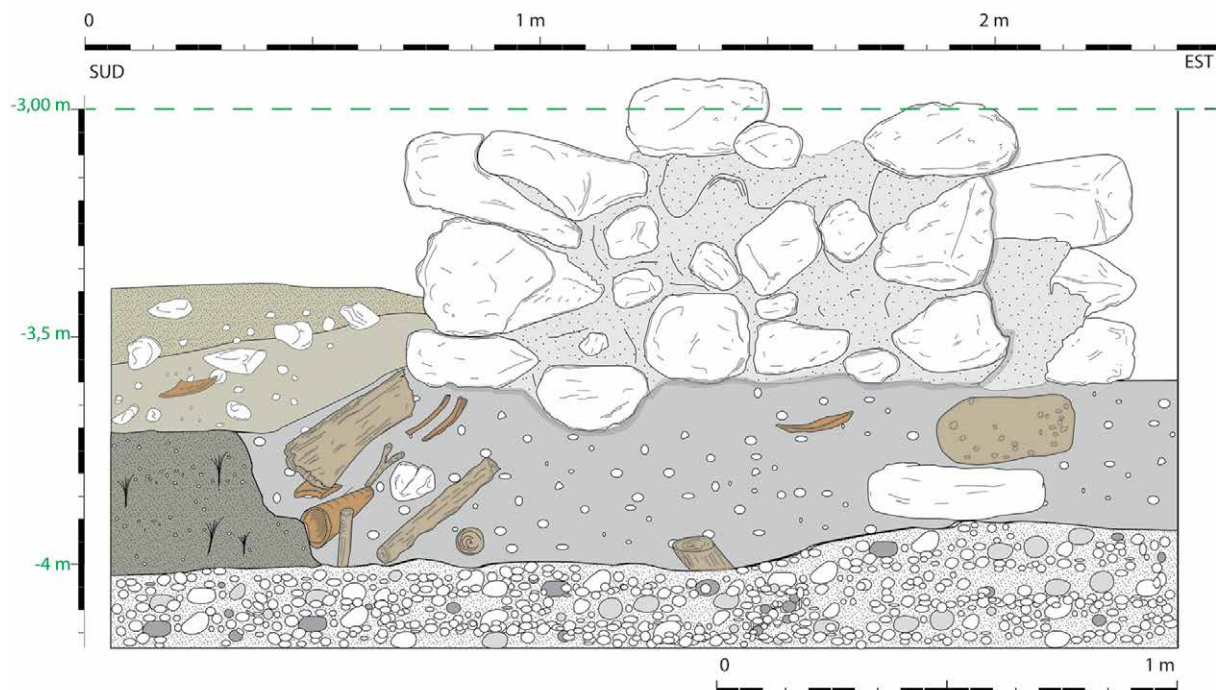


Figure 6. Stratigraphic section of the eastern part of the Massif 15 of the Structure A north wall (Trench S-A3, campaign 2018) (Mourad El-Amouri, Ipso Facto Co-op).

regular facing on each side. The filling is made of the same stone rubble and mortar.

The observation of the stratigraphy of two trenches excavated on different portions of the north wall, between Massifs 7-8 (Fig. 4) and on Massif 15 (Fig. 5), revealed several elements. The stratigraphic sequence is thin and the wall is not preserved under the sediment. Under the surface-level sand, a second layer is composed of sand, ceramics, and stone rubble from the wall: it is a destruction layer, more or less disrupted by the sea-currents in this shallow-water environment. Just under this layer and a very thin layer of organic material, the sediment layers have no further trace of anthropic presence. The natural layers include levels of sand and pebbles and a clearly visible level of silt in which remains of *posidonia* are preserved where they once grew. The last level reached in the trenches is composed exclusively of pebbles, well known in the area and called 'galets de la Crau', an ancient geological level formed by the overflow of the Durance river.

The last trench cut in 2018, on Massif 15 (Fig. 6), cut across the wall to observe a neat section of the building method.³ The organization of the stone facing and infill of the wall disallows the hypothesis of a wall built in water. Moreover, a trace of a foundation trench is

visible under the wall and this configuration confirms that this wall was built on dry land. Below the section where the wall starts, three wooden piles are preserved in place.⁴ Finally, a large piece of driftwood tree trunk was discovered lying just below the lower part of the wall. Its position cannot be the result of a storm, or any event capable of moving a trunk of this size. Although our first thought was that it could be a kind of *sablière* or *cil-beam*, a system often used to build in wetlands, radiocarbon analysis dating the wood to 2036-1889 BCE suggest it was 2000 years old when the wall was built: this led us to believe the trunk had been preserved in the wetland environment in which the wall's foundation trench was dug.

Regarding the composition of the mortar, a first analysis of the samples shows a low density of mortar and the presence of volcanic material that does not match sand local to Fos.⁵ The filling-mortar of the wall was sampled in 2018 and some complementary analyses are now in progress. Three small, well-preserved twigs were trapped

3 Fieldwork done under the scientific supervision of Laurent Borel, CNRS, CCJ.

4 Dendrological studies of these pieces of wood, by Sandra Greck of Ipso Facto research group, are in progress.

5 The analyses by P. Excoffon and P. Dubar aimed to compare the data of the ROMACONS Project (Oleson *et al.*, 2014) and the data of later research focused on the constructions of the Forum Iulii (Excoffon and Dubar, 2011).

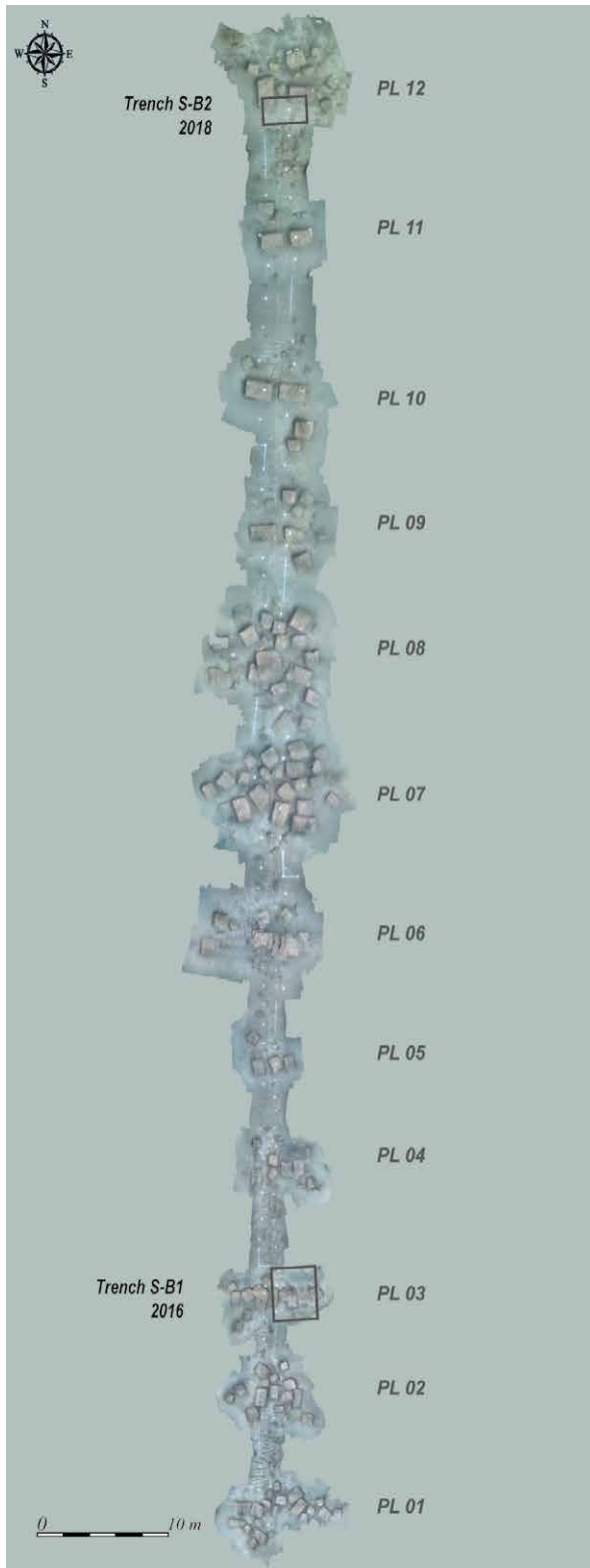


Figure 7. Ortho-image of the entire Structure B, from Pillar 1 (south) to Pillar 12 (north) and localization of the Trenches S-B1 (Pillar 3) and S-B2 (Pillar 12) (Photogrammetry Laurent Borel, CNRS-CCJ, DAO Souen Fontaine, DRASSM).

in these new samples, which should allow radiocarbon analysis to give a date for the building of the wall.

Structure B

Structure B is located 60 m southeast of Structure A and about 380 m from the current beach (Fig. 2). Of the monumental structures identified in the centre of the cove, it is the farthest from the coast and the closest to the Roman wrecks known in the bay (Marlier, 2018; Fontaine *et al.*, 2019, 37-43). Oriented North-South, it is composed of a succession of 12 built pillars (or *pillae*) emerging from the sand, distributed over a total length of 100 m. The spacing between the pillars varies from 3-6 m, some heaps of ashlar blocks being more extensive than others. The initial spacing is likely to have been more regular (Fig. 7). The structure emerges from the sand at a maximum depth of 4.5 m to the south, towards pillars (PL) 1 and 2, the farthest offshore. At the north end, towards the interior of the bay, PL12 is covered by less than 3.5 m of water. The junction of the pillar alignment with the large, scattered heap of blocks immediately to the north suggests a possible connection between PL12 and a destroyed building. Generally speaking, the pillars are in the form of a pile of fairly large ashlar blocks. The various traces of execution and assembly left on the hard limestone blocks testify to a high-quality architectural project. The blocks are regular and are of significant sizes (several formats are identified: the most common is about 1.5 m x 1 m). The pillars are preserved for one or sometimes two courses above the sand. No mortar has been identified as present.

Revealed by the first survey tests in 2013, it was very quickly identified as an arched structure and became the subject of several survey and documentation campaigns. The complete structure was the subject to a photogrammetric survey, which allowed a plan to be drawn up (Fig. 7). Two trenches were cut, one at PL3 (Fig. 8), towards the southern end, and one at PL12, the northernmost pillar, towards the coast. As this structure appears to have been connected to a building on land and it extends south into the water, towards the area where wrecks have been found, we hoped to distinguish different foundation methods used at each of its ends. Considering that this structure on arches probably depended on a construction on the ground to the north and advanced into the sea to the south, towards the sector where the wrecks lie, we hoped to be able to observe a difference in the mode of foundation between both ends of these pilae. The pillars are not preserved below the level of surface sand, which is mobile and moves during storms: the stratigraphy preserved is probably very much altered by the movements of the marine currents. The pillars, north and south, are simply blocks laid on a level of coarse sand mixed with fragments of ceramics.

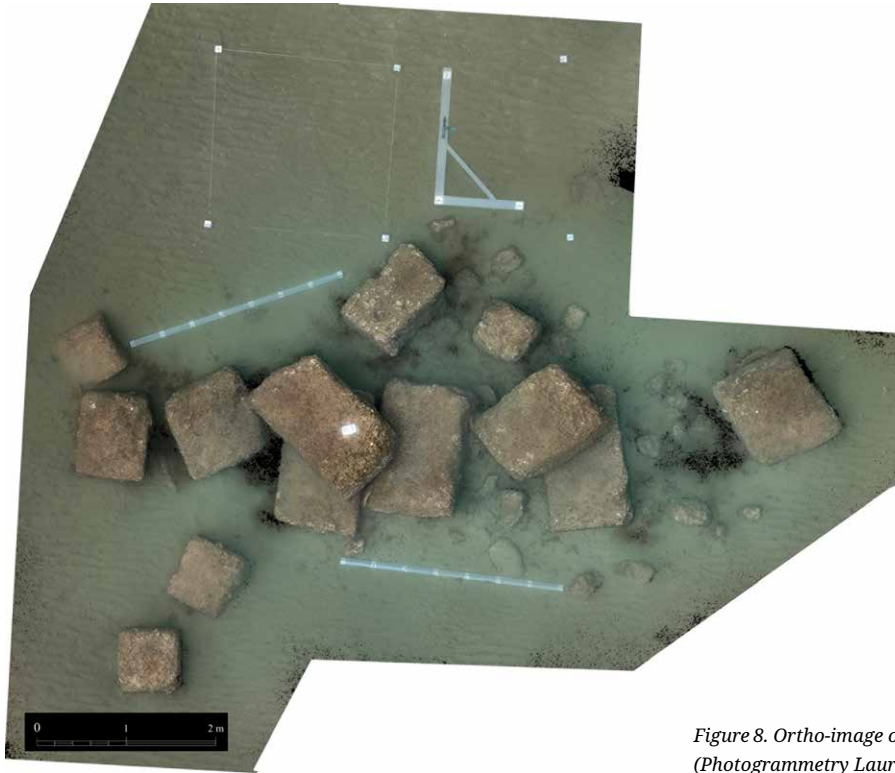


Figure 8. Ortho-image of Pillar 3, Structure B (Photogrammetry Laurent Borel, CNRS-CC).

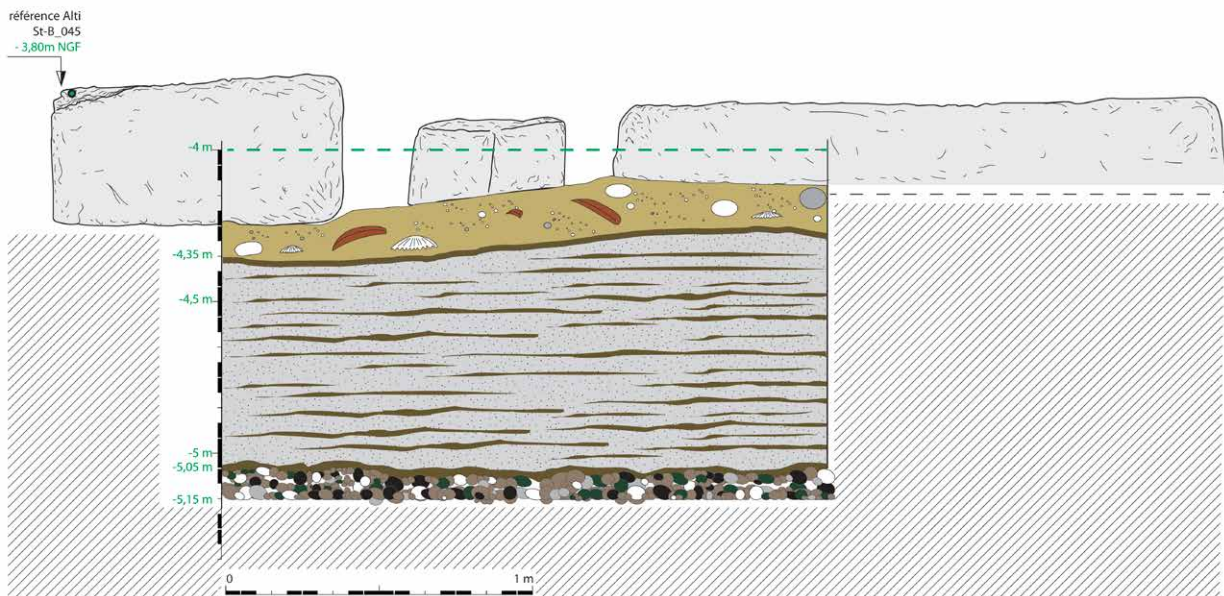


Figure 9. Stratigraphic section of Pillar 12 (east-west section of the south front of the pillar, Trench S-B2, campaign 2018) (Mourad El-Amouri, Ipso Facto).



Figure 10. Aureus (gold coin) found in the lowest anthropic layer in the trench at Pillar 3 of Structure B (Trench S-B1, 2016 campaign) (Loïc Damelet, CNRS-CC).



Figure 11. Roman fresco from Stabiae, probably representing Puteoli Harbour (ancient Pozzuoli). Museo Archeologico Nazionale of Naples (inv. 9514) (© Prisma Archivo/ Alamy).

Below this level, finer sand is largely mingled with dead *posidonia* and constitutes a sterile level without any anthropogenic elements (Fig. 9). As far as one can judge, no evidence excludes the pillars having been built with their foundations in water, nor any to exclude their construction on land. In the latter case, however, the function of this linear structure built on arches would be enigmatic.

The fairly abundant ceramic corpus found in the surface levels around the blocks of the pillars corresponds, in its composition, to the general facies of the harbour context of Fos-sur-Mer and was probably deposited by sea-currents when the structure was in operation or after its abandonment. It is composed mainly of amphorae dating to the 1st-3rd centuries CE.⁶ In the Area PL3 trench, at the foundation level of the pillar, an *aureus* was found, bearing the effigy of Domitian (Fig. 10). This relatively rare coin (only ten are now listed) was minted in Rome during the reign of Titus, in honour of Domitian, between the beginning of the year 80 and the end of 81 (Suspène *et al.*, 2017). Given its position in the trench, this coin cannot have had a votive function; its presence is more likely the result of a loss when the structure was in operation.

Like many other buildings identified or studied in Saint-Gervais cove, most of the stones of Structure B have been robbed out, probably for recycling. It is easy to imagine that the well-made, non-submerged, ashlar blocks were systematically recovered for new constructions sooner or later following the abandonment of the site, whether this was prompted by a violent event or not. This state of affairs, where only the lowest levels of the structures are conserved, complicates the interpretation and understanding of the structures. Be that as it may, the particular morphology of Structure B leaves little ambiguity about the restitution of the pillars, which is comparable to those that figure notably on the villa Stabieae fresco that probably represents the port of Pozzuoli (Fig. 11) and its jetty: the Pillae. This assumes that the northern part of Fos Pillae is connected to a building on land. An archaeological exploration of the vast accumulation of blocks, extending over 160 m east-west and about 80 m north-south (Sector D, Fig. 2) will be conducted in the coming years to determine if such a building has been preserved.

6 Studied by Daniel Rodriguez, MoMArch Student, Aix-Marseille University.



Figure 12. Altar or statue base (Musée d'Istres, inv. 8894), at the time of its discovery in 1994 on the site of the so-called 'Submerged Necropolis', 300 m from the monumental complex in the centre of the cove (Bertrand Maillet, Archives of Ministry of Culture/DRASSM).

A port site on the scale of Saint-Gervais cove

The monumental complex comprising Structures A, B, and C that occupies the centre of Saint-Gervais cove and probably extended eastward with one or more buildings in Sector D, is part of a much larger archaeological area that occupies nearly 40 hectares in Saint-Gervais bay between the beach of Cavaou in the west, Saint-Gervais beach in the east, and Saint-Gervais rocky point in the southeast (Fig. 2).

Some 300 m southwest of Structure A, more than 50 funerary stones (*stelae*, altars, part of a sarcophagus) and architectural elements (cut blocks) are scattered over about 7000 sq m. Several *stelae* and altars discovered in the 1970s have been brought up from the sea and are currently being re-studied (Courrier *et al.*, forthcoming), particularly the unpublished inscriptions on four of them. Most of the funerary stones are stylistically dated from the late 1st to 2nd century CE. In 1994, about ten trenches were dug under the *stelae* and an altar still in place (Fig. 12), but no burial could be identified and the research team, led by Gassend, has concluded that an erosion phenomenon leached the burials and sediment leaving only the stone elements *in situ* (Gassend and Maillet, 1994; Gassend and Maillet, 2004). Although this hypothesis seems plausible, various characteristics still suggest ambiguity over the actual presence of a necropolis (see Marty *et al.*, 2019), for example, the significant scattering of the funerary stones; the strong presence of architectural blocks that are not specifically funerary; and the existence nearby (at the Marronède site, on the other side of Saint-Gervais point) of an ancient structure in which some funerary and architec-

tural stones are re-used. Further *in situ* archaeological investigations will have to be carried out to map the distribution of funerary elements and non-funerary architectural blocks precisely. This being said, the recent confirmation of the terrestrial nature of the neighbouring monumental complex strengthens the possibility of another land site, funerary or not, in this area today submerged under 2-3 m of water.

Further northwest in the cove, along what is today Cavaou beach, two 'hangars' were identified in 1965, using aerial photography. Now buried under the sand, one of the two buildings was the subject of several excavation campaigns between 1989 and 1995 by a team led by Gassend (Gassend and Maillet, 2004). Until now, there is no consensus on their interpretation of the function of these buildings as *navalia* (shiphsheds). Marie-Britte Carre and Kalliopi Baika are currently revisiting the archaeological and architectural data as part of the Fossae Marianae Project (Fontaine *et al.*, 2019, 30-31; Baika and Carre forthcoming).

To the east of the monumental complex, beyond Sector D, a very large area of ashlar blocks is visible on acoustic cartography and aerial photographs. This area, Sector H (Fig. 2), extends almost to Saint-Gervais beach. To this day only partially surveyed, this area is undoubtedly a space where one or more buildings were erected (Fig. 2 and Fig. 13). Several concentrations of large ashlar blocks are observable and, on the southern periphery, towards the sea and the rocky Saint-Gervais point, a succession of four to seven clusters of ashlar blocks has been identified (only the four most eastern ones have been seen *in situ* by the Fossae Marianae project team). Spaced at 10-20 m, they are arranged in a



Figure 13. Map of Saint-Gervais beach area: main building remains as seen on archive and recent aerial photography (GIS Fossae Marianae, Souen Fontaine, DRASSM).

circular arc to the south of Sector H. About 30 m further south, fragmentary columns were discovered in the 1949 and were brought up. In aerial photographs from the 1960s, Sector H connects with the submerged structures of Saint-Gervais beach. Many discoveries have been made close to the beach since 1948: thousands of complete and fragmentary amphorae, ceramics, and other objects, barrels, wood and bone *instrumentum*, etc. Several structures are also known, including a probable warehouse (Structure J) formed by alignments of stones, some with deep, carved quadrangular mortises intended to receive support pillars.

In this sector (Fig. 13), the fieldwork of the Fossae Marianae project has mainly focused, for the moment, on a set of wooden piles 300 m north of the warehouse mentioned above, which were recently cleared of sand by the movements of the sea. Surface-clearance, carried out between 2017 and 2019, of an area about 100 sqm around this structure (T), uncovered at least 397 wooden piles still in place and occupying 30 sqm (Fontaine

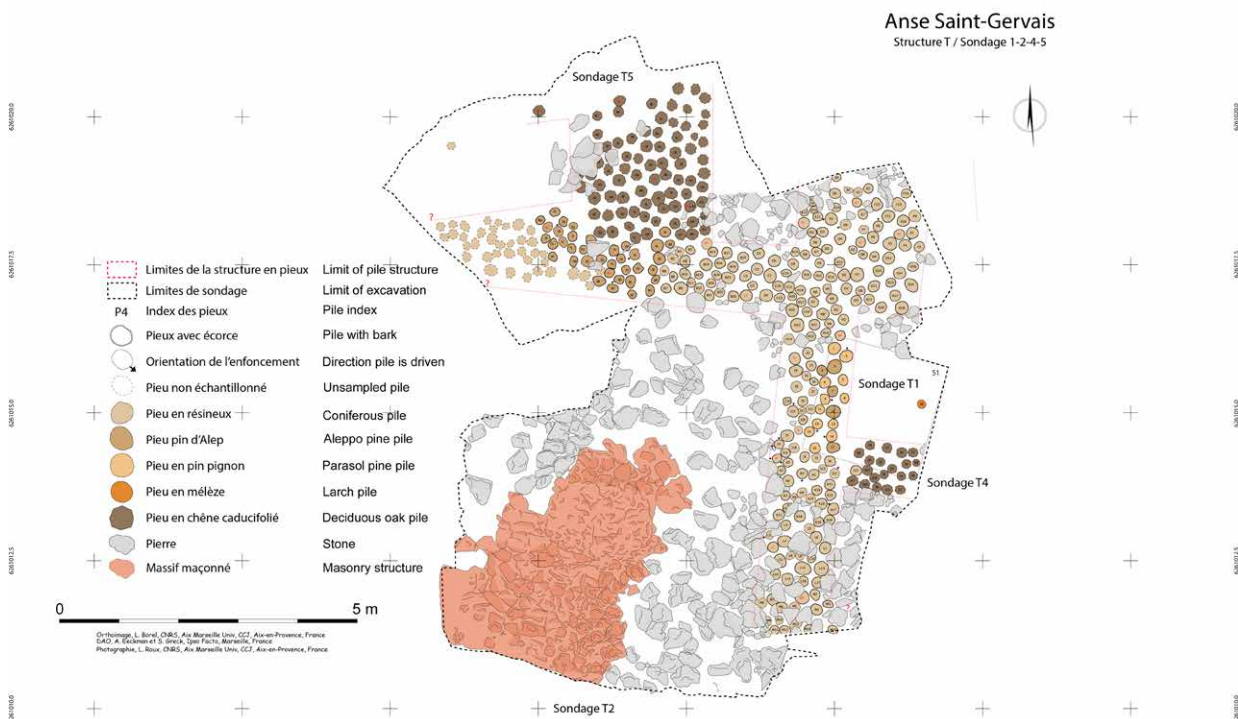
et al., 2019) (Figs 14-15).⁷ The piles, planted very close together, straight or at an angle, draw the foundations of probable walls that were about 1 m wide. Although we have only cleaned a small area of the structure, there is little doubt that it has a pile-foundation system intended to support a substantial building, built in a humid environment. The structure comprises mainly softwood piles – mainly Aleppo pine (*Pinus halepensis*) and stone pine (*Pinus pinea*), probably of local origin – shaped in a rudimentary manner, still with bark and thus placed while still green. In two distinct parts of the main structure, the piles made of pines stand next to several rows of oak piles the shaping of which is very different. The oak piles have regular octagonal cross-sections. In a trench opened in 2018 (sondage S-T3), 30 m further north of the main trench, under a thick layer of sand, the same structure continues and nearly 80 piles have been cleared in an area of 10 sqm, all made of oak. A combination of radiocarbon dating of two of the piles gives a

7 Excavation and dendrological studies conducted by Sandra Greck in collaboration with Axel Eeckman, Ipso Facto Co-op.



Figure 14. Excavation in progress on Structure T, a building with a pile-foundation system (Photography Loïc Damelet, CNRS-CCJ).

Figure 15. Map of the piles found in Trench S-T1, Structure T (Map Sandra Greck and Axel Eeckman, Ipsos Facto Co-op).



date in the mid 1st century CE (Fontaine *et al.*, 2019). The stratigraphy observed in the deep trench (S-T1) shows a well-preserved succession of layers characterizing a humid environment, even a nearshore lagoon, with the presence of layers of dead *posidonia*. It also reveals that the area was sanitized before the piles were set in place, as evidenced by a thick layer of lime (200-500 mm). This important layer of lime is also found in the area

of the neighbouring warehouse (Structure J) and on the wetland reclamation site (Estagnon) excavated, on land, a few hundred metres away (Fig. 13).

The use of a pile-foundation system is a common practice in Roman wetland construction, particularly in lagoonal contexts, and an excellent nearby parallel is provided by the example of the *circus* at Arles, built in the middle of the 2nd century CE in the humid context

of the Rhone banks (Sintès, 2011). This considerable building has a pile-foundation system with characteristics almost identical to those of Fos. A majority of softwood piles, still green and roughly cut, is supplemented by octagonal oak piles in some strategic locations requiring more mechanical strength. This analogy between the two constructions, at Fos and Arles, is perhaps not fortuitous and one can legitimately contemplate whether they were carried out within the same construction programme, or at least by the same builders. Although it is not yet possible to assess the size of the Saint-Gervais Beach building, it is assumed, given the construction method, that it is a large building.

Conclusion

The work of the Fossae Marianae project on this very rich area on the edge of Saint-Gervais shore is just beginning. This space, now submerged by less than 1 m of water or covered by beach sand and by current houses on the seashore, was undoubtedly a terrestrial, humid space occupied by a set of functional installations linked to the activity of the port when the Roman harbour was in use. With all the reservations that the very incomplete state of our knowledge demands, the outline of the layout of the port facilities and probably of the associated city are gradually being drawn by our investigations. By corollary, a complex natural environment, still poorly understood, is also being defined: the emerged lands remained wet and one or more lagoons extended – probably deep – into the terrestrial space. The port basin has not yet been localized. In addition to the continuing synthetic study of old data and new archaeological fieldwork on the various sites, both in the port space and on the canal, two major research activities will be carried out in the coming years: the resumption and continuation of the geomorphological study and detailed geophysical mapping, including under the sediments, sectors in very shallow waters that are still technologically problematic (sub-bottom profiler), and on the beaches and the peninsula of Saint-Gervais (GPR and ERT). The objective is to be able to propose a reconstruction of the harbour facilities and the possibly associated city, to understand their chronology and their organization, the evolution of the complex natural space which surrounds them, and the reason for their abandonment and their current submersion.

A better understanding of these elements should enable us to assess more precisely the importance and chronology of the port and, consequently, to place this *statio*, permanently or for a period related to the Fossae Marianae, in the wider harbour system of the Rhone river delta in which Arles, Marseille, Fos and the mouths of the river (at Saintes-Maries-de-la-Mer) are necessarily connected.

Acknowledgements

The project has received funding from Excellence Initiative of Aix-Marseille University – A*MIDEX, a French ‘Investissements d’Avenir’ programme. The project has also received funding from the French Ministry of Culture. In addition to the institutions to which the authors are affiliated, the project is also supported by the Cerege (Aix-Marseille University, CNRS), the IMBE (Aix-Marseille University, CNRS) and the Musée départemental Arles antique. We also thank the Portus Limen Project team (Southampton University) for their contribution and support. We would like to thank the entire project team and the eight MoMArch graduate students who contribute each year to the project’s fieldwork. Our thanks are especially to MoMArch student Alison Faynot for her reading of the English text of this article.

References

- Baika, K. and Carre, M.-B., forthcoming, Actes du XIII^e colloque Historique de Fréjus: Les ports dans l’espace méditerranéen antique.
- Djaoui, D., 2017, Les différents ports du delta du Rhône au Haut Empire: modèle économique autour de la circulation et la diffusion des produits. *Archaeonautica* 19, 123-142.
- Excoffon, P. and Dubar, R., 2011, L’emploi de tuff volcanique et de pouzzolane dans quelques constructions de Forum Iulii (Fréjus, Var). Eléments de réflexion sur l’utilisation et la diffusion de la pouzzolane en Méditerranée occidentale. *Revue Archéologique du Var* 2011, 171-181.
- Fontaine, S., El-Amouri, M., Marty, F., Rouse, C., 2019, Fossae Marianae, le système portuaire antique du golfe de Fos et le canal de Marius: un état des connaissances archéologiques. *Revue Archéologique de Narbonnaise* 52, 7-146.
- Gassend, J.-M., 1988, Rapport de fouille. Anse Saint-Gervais – Golfe de Fos (campagne 1987). DRASSM unpublished report.
- Gassend, J.-M. and Maillet, B., 1989, Rapport de fouille, Saint-Gervais (Fos), (Campagne 1989). DRASSM unpublished report.
- Gassend, J.-M. and Maillet, B., 1994, Rapport de fouille. Anse Saint-Gervais – Golfe de Fos (campagne 1994). DRASSM unpublished report.
- Gassend, J.-M. and Maillet, B., 2004, Structures immergées dans l’anse Saint-Gervais (Fos-sur-Mer, Bouches-du-Rhône), in C. Landuré and M. Pasqualini (eds), *Delta du Rhône. Camargue antique, médiévale et moderne*, *Bulletin Archéologique de Provence, supp. 2*, 2004, 151-163.

- Leveau, P. and Troussset, P., 2000, Les sources écrites gréco-romaines et l'histoire naturelle des littoraux. *Méditerranée* 94, 7-14.
- Liou, B., 1987, Les découvertes du golfe de Fos et le tracé du littoral antique, in *Colloque International du CNRS sur le déplacement des lignes de rivage en Méditerranée d'après les données de l'archéologie*, (Aix-Marseille, 1985), 59-65.
- Liou, B. and Sciallano, M., 1989, Le trafic du port de Fos dans l'Antiquité : essai d'évaluation à partir des amphores, in L. Rivet, *SFECAG, Actes du Congrès de Lezoux*, 1989, 153-168.
- Long, L. and Duperron, G., 2016, Navigation et commerce dans le delta du Rhone durant l'Antiquité : bilan des recherches sur le port fluvial d'Arles et ses avant-ports maritimes, in M.-P. Jézégou and C. Sanchez (eds), *Les ports dans l'espace méditerranéen antique, Narbonne et les systèmes portuaires fluvio-lagunaires, Actes du colloque de Montpellier (22-23 mai 2014)*, *Revue Archéologique de Narbonnaise* 44, 199-217.
- Marlier, S., 2018, Navires et navigations dans le delta du Rhône à l'époque romaine, in G. Boetto and E. Rieth (eds), *De re navali: pérégrinations nautiques entre méditerranée et océan Indien. Mélanges en l'honneur de Patrice Pomey*, 103-140. Paris, CNRS Editions: Archæonautica, 20.
- Marty, F., Courrier, C., and Fontaine, S., 2019, Un gisement de stèles et autels funéraires dans le port antique de l'anse Saint-Gervais (Fos-sur-Mer): étude documentaire, archéologique et épigraphique. *Revue Archéologique de Narbonnaise* 52, 55-83.
- Monguilan, L., 1977, Un port romain dans le golfe de Fos, in R. Chevallier (ed.), *Géographie commerciale de la Gaule*, Actes du colloque de Tours (1976). *Caesarodunum* 12, 359-370.
- Oleson, J.P., Brandon, C.J., Hohlfelder, R.L., and Jackson M.D., 2014, *Building for Eternity: the History and Technology of Roman Concrete Engineering in the Sea*. Oxford and Philadelphia.
- Sintès, C., 2011, Ingénierie et grands travaux. Les fondations du Cirque d'Arles. *Archéopages* 33, 28-31.
- Suspène, A., Fontaine, S., El-Amouri, M. and Marty, F., 2017, Un nouvel aureus pour Domitien (RIC II.1 Titus 265) découvert à Fos-sur-Mer en fouilles sous-marines. *Bulletin de la Société Française de Numismatique* 72, 2-9.
- Tréziny, H., 2004, Sources écrites grecques et latines, in C. Landuré and M. Pasqualini (eds), *Delta du Rhône. Camargue antique, médiévale et moderne, Bulletin Archéologique de Provence* 2, 93-104.
- Vella, C., 2002, Évolution paléogéographique du littoral de Fos et du delta du Rhône : implications archéologiques, in L. Rivet and M. Sciallano (eds), *Vivre, produire et échanger: reflets méditerranéens, Mélanges offerts à Bernard Liou*, 103-114. Montagnac.
- Vella, C., 2004, Le rôle de la mer: position du niveau marin et du trait de côte depuis 6000 ans, in C. Landuré and M. Pasqualini (eds), *Delta du Rhône. Camargue antique, médiévale et moderne, Bulletin Archéologique de Provence* 2, 79-90.
- Vella, C., Leveau, Ph., Provansal, M. et al., 1999, Le canal de Marius et les dynamiques littorales du golfe de Fos. *Gallia* 56, 131-139.
- Vella, C., and Provansal, M., 2000, Relative sea-level rise and neotectonic events during the last 6500 years on the southern eastern Rhône delta, France. *Marine Geology* 170, 27-39.