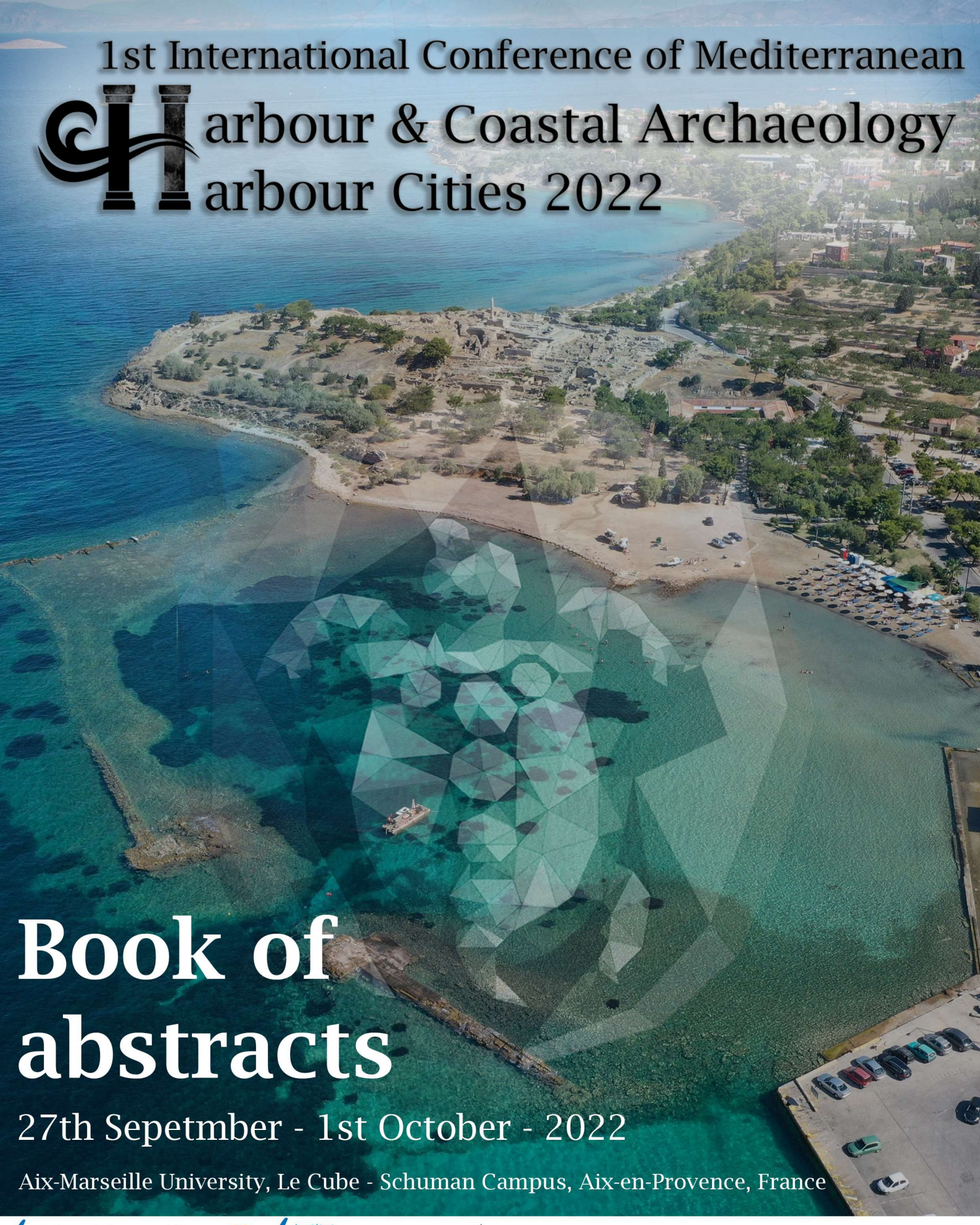
1st International Conference of Mediterranean Harbour & Coastal Archaeology Harbour Cities 2022



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1st International Conference of Mediterranean Harbour & Coastal Archaeology Harbour Cities 2022

Edited by:

Labrini Tsitsou
Dimitra Voutyrea
Judith Gatt
Jafar Anbar
Kalliopi Baika

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AIGINA
Harbour city Project
2019-2023

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PAPER SESSION

AHCP 2019–2023

Aigina Harbour City Project 2019–2023: Methodological Approaches for the Study of an Exceptional Harbour System in the Aegean Sea

Kalliopi Baika[1], Pari Kalamara[2], Despoina Koutsoumba[3]

1. Aix-Marseille University, Recherche Centre National de la Recherche Scientifique (CNRS), Centre Camille Jullian (CCJ), Aix-en-Provence, France
2. Director of the Byzantine and Christian Museum, Athens, Greece
3. Ephorate of Underwater Antiquities, Hellenic Ministry of Culture and Sports, Greece

The paper presents the main research issues and methodological approaches of the study of the harbour and coastal installations of the ancient harbour-city of Aigina in the Saronic Gulf, Greece.

The Aigina Harbour City Project (2019–2023) is a collaboration between the Ephorate of Underwater Antiquities of the Hellenic Ministry of Culture and the French School of Athens, and Aix-Marseille University (Centre Camille Jullian, CNRS/ MoMArch and Institute of Mediterranean Archaeology – ARKAIA). The main objective is the interdisciplinary study of the maritime facade of the city diachronically. Thus, the interdisciplinary project is supported by five research institutions of four European counties, specialising on marine geology, oceanography, coastal geophysics, underwater conservation and archaeometric analysis.

The harbour-city of Aigina presents an exceptional harbour and coastal infrastructure developed at the end of the 6th century BC in order to serve the thriving commerce of the archaic thalassocracy, as well as a powerful war fleet of triremes. The prosperity and naval supremacy of the city provoked the rivalry of Athens that besieged Aigina in 456 B.C. The submerged and coastal remains date from the 6th c. BC to the medieval period.

The archaeological remains are today submerged, silted and/or eroded, severely affected by geomorphological and anthropogenic impact. However, their state of preservation and their extent is impressive. The maritime and coastal archaeological zone is exceptionally large, consisting of harbour installations and associated fortification systems, coastal settlements and shoreside buildings, as well as of a dense network of human-made fortification works. It is noteworthy that this particular ancient harbour infrastructure seems to have no parallel among the Mediterranean harbour-cities.

A coastal Industrial Installation at Kolona Bay in Aegina: A First Approach Based on the Excavation Data of the Period 2020–2022

Pari Kalamara - Director of the Byzantine and Christian Museum, Athens, Greece

On the beach of Kolona in Aegina, north of the sanctuary of Apollo which is inextricably linked with the history of the ancient city-state of Aegina, and very close to the northern jetty of the port of the ancient city, walls parallel to each other in the direction of the sea are visible. The sea has now destroyed part of them. Based on their masonry, these walls can be traced back to the early Byzantine period. Also, in a part of the beach, already before the start of the excavation research within the framework of the "Aegina harbour City project", sections of pithoi were visible. Thus, in 2019, the excavation began first in a position where walls and pithoi coexisted, in order to investigate the use of this coastal zone during the Byzantine period but also earlier, if the findings would allow it.

In the first year (2020) the investigation brought to light an array of three open basins, which had been constructed from the lower part of pithos in second use and from stones suitably hewn and were a part of a wider single construction within one of the rooms that were developed at the level of beach. Both the interior of the basins and the surface of the unitary structure where they were incorporated were coated with an extremely fine-grained white coating, the analysis of which provided evidence of their use. The survey of the area east of the array of basins (2022) also supports the hypothesis that this is an important industrial facility in the coastal zone of medieval Aegina before its abandonment and the transfer of the urban center to the interior of the island in the 9th/10th century. Also, the building where the basins are included is related in its constructional features to others in the same area excavated (2021) as well, although the function of all the spaces is not so clear.

In this announcement, the data of the excavation research during the three years 2020–2022 will be presented, and

an attempt will be made to date and interpret the identity of the said coastal industrial installation, but also to document the coastal landscape in the area of the ancient port.

Tyrrhenian Sea

A Multidisciplinary Project for the Study of Ostia's Coastal Environment

Marcello Turci[1], Emmanuel Léger[2], Albane Saintenoy[2], Pierre-Etienne Mathé[3], Ferréol Salomon[4], Minoru Uehara[5]

1. Post-doc, Graz University, Graz, Austria
2. Maître de conférences Université Paris Saclay, Centre National de la Recherche Scientifique (CNRS), Geosciences Paris Saclay (GEOPS)
3. Maître de conférences Aix-Marseille Université, Centre de Recherche et d'Enseignement de Géosciences de l'Environnement (CEREGE)
4. Chargé de recherche Centre National de la Recherche Scientifique (CNRS), Laboratoire Image Ville Environnement (LIVE)
5. Ingénieur de Recherche Centre National de la Recherche Scientifique (CNRS), Centre de Recherche et d'Enseignement de Géosciences de l'Environnement (CEREGE)

Starting in 2018, the CCJ and CEREGE have been coordinating an international research project in the coastal sector of the city of Ostia in which Sapienza University of Rome, the University of Strasbourg, the CNRS and the University of Paris–Saclay are involved. This project is also integrated within a post-doctoral research program of the University of Graz entitled: *Imperial construction activity in Ostia after the Severans: continuity, transformation, and a new urban center in the coastal district. A comparative study between archaeology and epigraphy.*

The geophysical survey program, which involved the integration of the most significant technologies employed in archaeology (magnetometry, electrical tomography, electromagnetism and georadar), will be completed in June 2022.

The non-invasive investigations carried out over the course of three campaigns have confirmed the presence of a large architectural complex (ca. 15,000 m²) structured in several sectors. Thanks to these results, we have proposed to identify this complex with Aurelian's forum and the *praetorium publicum* of Ostia, known from a passage from the *Historia Augusta* (see Turci–Uehara–Mathé 2020 *contra* Heinzelmann 2020 who considers it as a suburban villa).

The frame outlined so far opens up new perspectives and reflections on the role of Ostia's coastal district in Roman and late antique times.

The results of the first three years of research will be presented at the conference, integrating the first scientific information from archaeological excavations and geomorphological investigations (core drilling) planned for the summer 2022.

Our contribution will focus on the study of the evolution of the ancient coastline, integrated with the study of coastal infrastructures (wharves, coastal protection structures and roads) and public buildings, over a time span from the second half of the 1st century BC to the beginning of the 6th century AD.

Additionally, this work opens new insights in terms of inter-calibration of methodological approaches to elaborate local proxies enabled to monitor the preservation of coastal archeological sites with regard to soil saltation predicted by global climate modeling.

Puteoli and the *Ripa Puteolana.* New Underwater Research in the *Portus Annonarius*

Michele Stefanile[1], Michele Silani[2], Maria Luisa Tardugno[3]

1. Scuola Superiore Meridionale, Naples, Italy
2. Università degli Studi della Campania "Luigi Vanvitelli", Italy
3. Soprintendenza Archeologia, Belle Arti e Paesaggio per l'Area Metropolitana di Napoli, Italy

On a coastline of almost 2 km, between the center of the port of *Puteoli* and the *Portus Julius*, the submerged districts of the *ripa Puteolana* constitute an underwater archaeological area of extraordinary importance, gravitating around the *vicus Lartidianus* and the *vicus Annianus*, the headquarters of merchants and pilgrims from every corner of the Mediterranean, the endless rows of *horrea* at the service of the fleets of Rome.

For a long time, this exceptional context was only scarcely explored, due to the heavy and impactful presence of the

industries that for most of the twentieth century characterized the west coast of modern Pozzuoli.

With the project *Between land and sea. Studies and research in the coastal areas of the Campi Flegrei,* born in 2021 from an agreement between the SABAP for the metropolitan area of Naples and the University of Campania Luigi Vanvitelli, with the collaboration, for the submerged areas, of the Scuola Superiore Meridionale, a systematic documentation program of the *ripa Puteolana* has finally been launched. In 2022 aerial and underwater surveys have been performed on a surface of 11 hectares, allowing to recognize a complex series of harbour structures, including *horrea*, *tabernae*, roads, administrative and sacred buildings, together with a huge amount of architectural remains, marble, columns, pottery and metals.

New Data from Integrated Geophysical and Archaeological Investigations in the Baia Marine Protected Area and Submerged Park, Pozzuoli Bay, Italy

Crescenzo Violante[1], Nicola Masini[1], Fabio Pagano[2], Enrico Gallocchio[2], Aleksandra Kruss[3], Nicodemo Abate[1], Daniele Ferdan[i1]

1. Istituto di Scienze del Patrimonio Culturale (ISPC_CNR), Naples, Italy
2. Phlegrean Fields Archaeological Park (PAFLEG), Pozzuoli, Italy
3. Norbit Subsea AS, Trondheim, Norway

In this work, we use ultra-high resolution marine geophysical investigations and underwater archaeological data to characterize and map the seabed and shallow subseafloor built and natural environment features in the Baia submerged park (Pozzuoli Bay, Italy). The selected case study is part of an active volcanic complex, the Campi Flegrei caldera, which is characterized by frequent earthquakes, hydrothermal manifestations and short-term deformations of slow uplift and subsidence in the range of several meters to several tens of meters, known as "Bradyseism". Consequently, Roman artifacts and structures dating from 1st century BC to 4th century AC, including Villas, luxury buildings and landing ports are now below the seawater surface up to a depth of ca. -15 m, and partly buried within marine sediments. In this area, the occurrence of marine habitats of community importance coexisting with the above-mentioned submerged archaeological remains led to the establishment of the Baia Marine Protected Area (MPA). This is of particular relevance as it recognizes *de facto* the importance of the interrelations between cultural and natural resources in marine setting.

Marine geophysical investigations included ultra-high resolution swath bathymetry and parametric sub-bottom profiler investigations. Preliminary results include a map of the Pisoni's Villa and surroundings (area A of the Baia MPA) based on a grid with a bin size of 10 cm and, for the first time, a detailed (decimeter-level) imaging of the subseafloor stratigraphic organization of the submerged archaeological area. In particular, buried artificial structures including possible dock areas and piers, and palaeotopographies were detected in the upper layers of the subseafloor while swath bathymetry data revealed new seabed archaeological structures. Future investigations include ground truth archaeological and benthic data. The main aim of this integrated approach is to implement non-destructive methods for the preservation and monitoring of the archaeological setting and associated environmental features in the Baia MPA.

Pisa San Rossore: New Perspective of a Riverine Site

Cristina Laurenti[1], Gloriana Pace[2], Teresa Tescione[3]

1. PhD candidate, University of Oxford, Oxford, England
2. Archaeologist, Independent Researcher
3. Research fellow, University of Naples Federico II, Naples, Italy

The discovery of the 'Ancient ships' of Pisa San Rossore, near the city centre and the Leaning Tower, has provided innovative information on fluvial trade in Roman times. Catastrophic floods affected an intricate network of rivers and canals in close communication with the sea from the 3rd century BC to the 6th century AD. These large-scale flood events were caused by a concatenation of natural and anthropogenic factors, including hydrological instability, climate change, and land use changes.

The inter-flood phases, recorded by thin mud layers, and documented by the most recent archaeological material from the southern to the northern areas, indicate the reuse of the canal up to the definitive burial during the Late Roman period.

The discovery of Pisa San Rossore has made possible to clarify how the transport between the Tyrrhenian coast and the city of Pisa were managed.

This paper aims to highlight this trade system and show how a constant hydrogeological turmoil has caused the sinking of several boats and ships.

The riverine network around Pisa allowed transport to and from the sea using river boats and small tonnage cargoes. This analysis will focus on differences and similarities with other river systems (e.g., Ostia-Tiber-Rome, the mouth of the Rhône, Comacchio). In Pisa, due to the presence of a composite geological and hydrographic system, this type of transport was used even in absence of a large-structured harbour at the mouth of the two main rivers of the area, Arno and Auser.

As an attempt to provide insights pertaining to the Pisan trade system, this paper will present the role of the site within the complicated Pisan harbour system, and its involvement inside the Mediterranean trade routes will be highlighted through an inter and multidisciplinary approach.

Adriatic Sea

New Evidences on the Roman Harbour of Altinum (Venice lagoon, Italy) through Non-Invasive Investigations

Carlo Beltrame – Università Ca' Foscari Venezia Dipartimento di Studi Umanistici, Università ca' Foscari Venezia, Italy
Paolo Mozzi – Università degli studi di Padova, Italy

The harbour of the Roman city of Altinum was known from remote sensing and few control cores as being an L-shaped basin of about one hectare located on the south-eastern side of the ancient city and connected to the lagoon by an artificial canal (Ninfo et al., 2009; Mozzi et al., 2016). A joint project by the Dipartimento di Studi Umanistici of the Università Ca' Foscari of Venice and the Department of Geosciences of the University of Padova is carrying out new field investigations on the harbour through systematic archaeological survey, typological study of the collected artefacts, coring, analysis of exposed sections, radiocarbon dating and geophysical survey. The magnetic gradiometer survey produced a very detailed picture of the basin and new evidence of previously unknown buildings located nearby. These buildings, possibly harbour infrastructures, are partly covered by later lagoon deposits and, thus, only scantly visible through remote sensing. The analysis of an exposed section and some cores have allowed to reconstruct the geometry of the canal connecting the harbour basin to the lagoon, possibly via the final stretch of a local groundwater-fed river, the Sioncello river. The estimation of the original water depth of the canal allows discussing the size and typology of the ships that could be hosted inside the harbour. Radiocarbon dating of the poles that reinforce the canal banks, and the pottery found at surface, confirm that the harbour was built in the Augustan period, most probably as part of the Imperial reshaping of the urbs, with which it is perfectly integrated and aligned.

References:

Ninfo et alii, 2009. The map of Altinum, ancestor of Venice. Science, DOI: 10.1126/science.1174206

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paper session

Portus Salonitanus; In Search of the Port of Ancient Salona

Irena Radić Rossi – University of Zadar, Department of Archaeology, Zadar, Croatia

Ancient Salona was situated at the eastern end of the Gulf of Kaštela, in the area of the present-day Solin near Split. It was first mentioned in 119 BC, but it certainly existed long before. In the time of Caesar, it was raised to the rank of colony, and became Colonia Martia Julia Salona. It was one of the most important cities on the Adriatic coasts, and the capital of the Roman province of Dalmatia. It was destroyed by the Avaro-Slavic invasion at the beginning of the 7th c. AD.

As the great maritime city, it was certainly provided with port, which could be recognized among the reliefs on the Traian's Column in Rome. On Tabula Peutingeriana it is mentioned as Portus Salonitanus, and the name apparently refers to the whole eastern part of the Gulf.

Even if the port must have been of significant size and importance, its remains have not been uncovered until the present day. The inscription mentioning Praefactura phariaca Salonitana indicates the probable existence of lighthouse(s), and the bibliography from the end of 19th c. mentions some ancient mooring rings, discovered in the area west of the mouth of river Jadro.

Recent rescue archaeological excavations in the nearby Vranjic supported the idea about its importance since the prehistoric times, and reconsidered the presumption about the existence of the lighthouse, already proposed by Frane Bulić, over a century ago. Layers that indicate the intense wood-working activity point to the possible location of shipyard(s). The paper aims at discussing the possible location and organization of the Portus Salonitanus, and suggesting the methodology of further research.

This paper deals with the relationship between the sea and ancient Salona, an issue in maritime history that has not previously received any scholarly attention. The paper first takes up the basic geography of the Bay of Salona (ancient Portus Salonitanus – today known as the Bay of Kaštela) an elongated oval oriented E-W, approximately 10 nautical miles long and 3 nm wide. It is noteworthy that while for sailors the Bay of Split is much more favourable than the Bay of Salona, Salona's location has certain particular advantages. Situated on a river mouth, well protected, with abundant land (later the very productive Ager Salonitanus) as well as significant fish and shellfish resources, Salona has a better approach to the hinterland and to its immediate environs, including Split. Moreover, although the transport of goods from Split to Salona is twice as long by sea as by land (and consequently more dangerous), maritime transport is still more profitable, especially in the case of big, heavy cargos. An examination of maps from the late 17th century and onwards makes it clear that the harbour of Salona is today buried by silt deposited by the river Jadro (ancient Salon). Upon these sediments there are now railroad tracks, roads, and bridges, as well as industrial and private buildings. It is estimated that the port's wharves were some 1.5 km long and that warehouses (horrea) and shipyards were probably located on the opposite (south) side of the river's delta. Salona's harbour is well protected from the highest waves. Strong winds come only from the northeast – the bora – mainly in colder periods, blowing down from the Dinaric Alps and the Klis pass (between Kozjak and Mosor mountains). This incidentally was the location, possibly, of a stronghold of the Delmatae in the 2nd and 1st centuries BC. Wind patterns in the Bay of Kaštela are presented in Fig. 7, which lists measurements taken over the last 29 years from stations at Kaštel Stari (near the sea) and Marjan hill above Split (176 m asl). These data indicate that during the ancient sailing season only modest winds blow in the bay; most of the time, sailors could expect calm seas there. The most dangerous part of any voyage from Salona starts at Vranjic peninsula (half a mile west of Salona) and some two miles towards Cape Marjan. This area is scattered with isles, underwater reefs and shallow waters that can be dangerous for slow, heavily-laden trade ships. The same is true when sailing to Salona. Thus, it is not surprising that as early as the start of the 1st century AD Salona had a lighthouse service, the praefectura phariaca Salonitana (fig. 8), and may also have had some kind of pilot service that would tow boats in and out of the port. There are two entrances to the Bay of Kaštela. One is through a 1-mile-wide passage on the south side of the bay between Cape Marjan and Cape Glava on Čiovo island, and the other entrance is via the narrow channel at Trogir (ancient Tragurion) on the west end of the bay. Depending on wind and destination, either entrance could be traversed. The Trogir entrance was used mostly by ships coming or going towards the north Adriatic or towards the island of Issa (Vis), while ships bound for Narona, the central Dalmatian islands, the south Adriatic or other, more distant ports used the bay's southern entrance. Cape Marjan constitutes the most important position in the Bay of Kaštela. From as early as the 17th century, the cape was thought to have been the location of an ancient sanctuary of Diana; it is mentioned and illustrated in the Tabula Peutingeriana. However, excavations of the early medieval church of St George and a building next to its south side on Cape Marjan's crest (20 m asl) do not provide much reliable evidence of any Roman sanctuary. It should be noted, though, that the masonry blocks are of Roman style, which indicates that the church was built with stones from an earlier building. The prevailing opinion to the effect that the Cape Marjan sanctuary had to do with Diana, huntress and protector of wild animals, is questioned here. It is argued instead that, due to the position of the Cape — vital for mariners — and due to the fact that Issa in the Hellenistic period played an important commercial and political role in the area, the sanctuary played a different role. It is more plausible to believe that the sanctuary was built by the Isseians in the late 3rd/mid–1st century BC who dedicated it to Artemis the protector of the harbours, sailors, and fishermen, and that later the sanctuary was maintained by Salona-based Romans. The paper concludes with a description of how a boat with square sails might cross the sea from Issa to Salona and back under different wind conditions.

The Roman port of *Parentium* (Poreč/Parenzo, Croatia)

Klaudia Bartolić[1], Gaetano Benčić[1], Marie-Brigitte Carre[2], Ida Koncani Uhač[3], Giulia Boetto[2]

1. Zavičajni muzej Poreštine, Museo del territorio parentino, Poreč-Parenzo, Croatie
2. Centre Camille Jullian (CCJ), Centre National de la Recherche Scientifique (CNRS), Aix-Marseille Université, Aix-en Provence, France
3. Arheološki Muzej Istre, Pula/Pola, Croatie

In 2020, an emergency excavation on the northern shore of the Poreč/Parenzo peninsula (Istria, Croatia) revealed the presence of a large Roman quay dating from the beginning of our era. The site was rehabilitated in the second half of the 1st century: the wreck of a sewn ship, sunk at its foot, served as a foundation for a fill made up of building material and ceramic furniture. This reorganisation was intended to facilitate access to the sea, which had retreated with the filling in of the seashore following the development of urban activities. The study of the material has made it possible to extend the use of the port to late antiquity, when other structures and a medieval tower are superimposed on the quay.

A very large, submerged structure in front of the northern shore of the peninsula, the *Porporella*, was also the subject of investigations in 2019 and 2021. It consists of a pile of stones thrown over 400 m long and a width of between 4.5 and 12 m.

This research is part of new studies on the port of *Parentium*, about which little or nothing is known because the construction of the modern quays has sealed off the ancient levels. This port, with its excellent nautical qualities, must have played a major role in ancient times for the export of the territory's products. Even in the Venetian period, Poreč was an outport of Venice. The excavation of the Porta de Mar confirms that the Roman port must have been located to the south, on the site of the medieval and modern port, while the *Porporella* is a breakwater designed to protect the northern shore of the city. The fieldwork was accompanied by a review of the archival documentation.

Bigovica Bay: Identifying a 'Port' within the Mare Incognita of Southern Montenegro

Athena Trakadas[1], Petra Zdravković[2], Lucy Blue[3]

1. Environmental Archaeology and Materials Science, National Museum of Denmark, Denmark
2. Republican Institute for the Protection of Cultural Monuments, Cetinje, Montenegro
3. Archaeology, University of Southampton, Southampton, UK

Within the archaeological –historical studies of the Adriatic, there is a comparative lack of information on the central and south-eastern coastline. Informing this lacuna was one of the main research objectives of the Montenegrin Maritime Archaeology Rescue Project (MMARP, 2010-–2012). The MMARP was a multi-disciplinary coastal landscape project that employed maritime and terrestrial archaeological survey techniques and geomorphological investigations to address a series of objectives, primarily focused on the Bar region. The findings from the project reveal where ships may have sought shelter or put into land to on- and off-load goods and people; The findings also contribute specific diachronic data points to our knowledge of the area's coastal navigational routes.

Importantly, the findings of the MMARP also suggest archaeological signatures for 'ports' along the Bar coastline that are different than those usually presented in other regions of the Adriatic. By focusing on the case-study of Bigovica Bay, this paper will address how a point of land-sea interface can be identified from a combination of archaeological finds under water (debris fields, anchors, shipwrecks), as well as associated facilities on land such as defensive structures and links to roads and urban centres, as well as likely navigational routes and trade networks. The overall aim of this paper is to ascertain that in many cases, due to the nature of the coastal topography, marine environment, and socio-–political conditions, sometimes little or no built infrastructure is needed to facilitate the transfer from ship to shore or vice versa. This does not diminish their potential importance and frequency of use from Antiquity to the medieval period. In essence, the findings from Bigovica Bay impact how we should consider the differences between "hard" and "soft" spaces in Adriatic 'port' studies.

Aegean Sea

The Harbours of Rhamnous

David Blackman – Senior Research Fellow, Centre for the Study of Ancient Documents (CSAD), University of Oxford

Our study of the ports of Attica showed that Athens was able to exploit the coastline of Attica. Sounion is well known; but important too was a port at the northern extremity of Attica, Rhamnous, whence ships could monitor the channel between Attica and Euboea, and the crossing from Euboea on a crucial supply route for Athens. Our survey was carried out under the aegis of the Archaeological Society of Athens and the direction of Dr Vasileios Petrakos. Prof. Dermitzakis represented Athens University, and provided funding. Sadly, the financial situation after 2009 made it impossible to carry out the proposed test excavation. Preliminary reports by Blackman appeared in the *Praktika* of the Society from 2003 to 2011. The first final report has just appeared [April 2022] in the Society's journal, the *Archaiologiki Ephemeris* (on the historical evidence and the archaeological work on land); and the second is now in preparation (on the underwater work, and the geological and maritime survey).
We had hoped with trial trenches to answer some questions raised by our survey, coring, and geological trenching. First, to test our hypothesis for the location of the slipways, for which our evidence is an inscription found on site. We proposed a test trench in the west corner of the West Harbour: a positio, protected from the north wind.

Secondly, in the East Harbour we proposed a test trench to define the west edge of the harbour basin: a beach or a quay? – with possible SLIs.

Thirdly, a trench across the line of the beach and the beachrock in order to ascertain whether an east/west mole ran across to the tower and breakwater at the harbour entrance. Proposals for future work, we hope!

We think that we have defined the harbour floor. Defining harbour floors has been a major contribution of recent harbour research.

A final, cautionary tale from Rhamnous: samples from our 'geological trenches' in the West Harbour produced very satisfactory C14 dates. But results from the East harbour were much less satisfactory. Now the Oxford Laboratory has recalibrated all the results to take account of the 'marine reservoir effect'. So, we are now reviewing our conclusions.

The Themistoklean Building Program in the Piraeus – The First Secure Evidence

Bjørn Lovén – Senior Researcher, The Danish Institute at Athens, Greece

This paper will present new evidence of late Archaic to early Classical period harbour fortifications and shipsheds at the Athenian naval base Mounichia (modern Mikrolimano). Shipshed 1(α) in the northern side of Mounichia Harbour represents the earliest securely dated building in the Athenian naval bases in the Piraeus, and the earliest identifiable trireme shipshed found in the ancient world. Furthermore, the paper will discuss a building phase in the monumental harbour fortifications at Mounichia in all probability also associated with the Themistoklean building program in the Piraeus.

The Zea Harbour Project operates under the auspices of the Danish Institute at Athens and is directed by Senior Researcher Dr. Bjørn Lovén. The project is supervised by the Ephorate of Underwater Antiquities and Ephorate of Antiquities of Piraeus and the Islands. The Carlsberg Foundation has been the project's principal sponsor since 2004.

The Unknown Roman Harbour-Site at Minoan Palaikastro

Theotokis Theodoulou[1], Carl Knappett[2], Alexandros Tourtas[3], Georgios Tsimpoukis[4]

1. Archaeologist (PhD), Ephorate of Underwater Antiquities, Greek Ministry of Culture and Sports
2.Professor of Aegean Prehistory, University of Toronto, Canada
3.Archaeologist, Postdoctoral Researcher at the University of the Aegean, Greece
4.Archaeologist (PhD), Ephorate of Underwater Antiquities, Greek Ministry of Culture and Sports

In the last twelve years, the Ephorate of Underwater Antiquities (Greece) inaugurated a new Department in Crete in an attempt to service more effectively the

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administrative needs of managing the island's underwater cultural heritage. Consequently, it has been able to survey, map, record and promote the assemblages and remains of past nautical activity, submerged sites and harbour structures. Within this framework, several projects have been conducted all around the island. Last year (2021) a new three-year collaborative project was initiated between the Ephorate of Underwater Antiquities, the University of Toronto through the British School at Athens, and the Ephorate of Antiquities of Lasithi. Its aim is to target ancient coastal occupation and marine activity in the area of Palaikastro bay, eastern Crete.

The high promontory of Kastri, with its refuge site, divides Palaikastro bay into two coves: Kouremenos to the north and Chiona to the south. The area of Palaikastro has been excavated and studied for more than a century. Its extensive Bronze Age town and cemeteries at Roussolakkos are overlooked by the peak sanctuary of Petsophas. Back in 1985 a submerged mole had been located at the north side of Kouremenos cove attributed to Roman times. Yet little else in the area suggested much Roman "presence". On the other hand, Palaikastro bay was the first "real" gulf of Crete on the sea-route coming from the East and following the safer, southern side of the island. Some kilometers to the north the urban center of Itanos was situated on the coast, with Greek, Roman, and Byzantine occupation. Further south, important Roman presence is known from the islets of Leuke (Koufonisia) and Chryse (Gaidouronisi), as well as along the southern coast to Makryialos, Ferma, Koutsounari and finally the big Roman harbour city of Hierapytna (Hierapetra).

During the first mission of the project the entire flat sandy shoreline of Palaikastro was mapped with aerial orthophoto maps, and the accompanying zone of shallow waters was surveyed. As a result, we located or re-located and recorded buildings and pottery belonging to the Minoan period, both at the seabed of Kouremenos and the coast of Chiona. Meanwhile, apart from the Roman mole at the northern side of Kouremenos, which was thoroughly recorded and mapped, we located in the neighbouring area submerged, collapsed walls of Roman structures, as well as foundations and building elements like ashlar blocks and columns. Similar remains were also re-located and recorded at the northern side of Chiona cove, attributable to Roman buildings on the basis of their building technique and materials. Both sites are clearly anchorage sites, situated at the lee sides of the adjacent land, protected from the prevailing northwestern winds that blow during the navigation season. Furthermore, we had the chance to survey some deeper areas around the islets of Grandes that protect Palaikastro bay from the east, as well as the capes forming the bay. At the broader area of the southern cape, Kavo Plako, we located a cargo belonging to a Roman ship loaded with amphorae from Baetica, Spain.

The results of the mission show a new configuration for the ancient Palaikastro coast and indicate that the bay was in use as a navigational station during Roman times with some kind of harbour facilities, quite substantial judging from the remains of the submerged buildings. Though this is reasonable, especially considering the crucial position of the bay in sea routes east and south of Crete, which gained a special importance during Roman times, along with the proximity of the bay to the sanctuary of Diktaian Zeus, the mission revealed some of the first substantial evidence for such a presence. More results are expected during the second mission this July (2022) and are going to be presented along with the abovementioned.

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In Search of the Harbour of the Greek City of Itanos (Eastern Crete)

Nadia Coutsinas – Scientific Collaborator, CReA-Patrimoine
Max Guy – Professor Emeritus, Institut Français du Pétrole (IFP School)

Itanos was a Greek city-state situated at the extreme eastern tip of Crete. Located close to Cape Samonion, it occupied a strategic position at the crossroads of maritime routes. The city had always maintained contact with Africa and the eastern Mediterranean, to which it was more easily connected than to the rest of Crete. In the Hellenistic period, the close political and economic contacts with Egypt are evidenced by the foundation of a garrison sent by Ptolemy II Philadelphus. Whether the fortification is still visible on the south hill, the place where the fleet could have been moored, is still uncertain.

The city of Itanos has been the subject of research under the auspices of the French School at Athens by an international team (to which the presenting authors belonged) since 1994, with excavations and surveys conducted between 1995 and 2005. One of the key aims of the research was the location of the harbour of the city, since there are three possible anchorages at the urban centre, and the eastern part of Crete (and thus the town of Itanos) was partially submerged due to the abundant seismicity of the Roman period.

A summing up of all information is sorely needed, as no preliminary report has ever been published and some evidence still remains unknown. This paper intends to present all evidence available to date, to trace the probable location of Itanos' harbour. Our review will not only include historical, textual, archaeological and geographical data (including the latest studies on sea level changes along Crete), but will also include data from the geophysical survey conducted in one of the bays, and underwater data gleaned from aerial photographic studies and exploration by the authors.

Harbours and Coastal Installations in Roman Crete

Dimitris Karampas – DPhil candidate, University of Oxford, Oxford Centre for Maritime Archaeology, Institute of Archaeology, England

Following the Roman occupation of Crete, several changes occurred in the island's cultural landscape, including the undisputed economic growth of the coasts. Specifically, the coastal sites and harbours of Crete provided immensely to the island's prosperity, by participating into the Imperial trade, thus serving as an important connecting node for the passing by ships. To accommodate the increasing demands, several safe anchorages started being used. Additionally, older harbour installations were upgraded and reused, leading the island into the new Roman era. According to the archaeological record, imported ceramics and commodities from all over the Empire were reaching the island while local products, especially the wine, were vastly exported and transported within the renowned Cretan amphora. Except from the aforementioned evidence, an important number of ships wrecked all around Crete offer deeper insights in this discussion.

It is worth noting that more and more people seem to abandon the mainland Crete, relocating to the coasts. They opted to shed their accustomed way of life and adopt a new one in order to adapt to and take advantage of the newly established circumstances. The ensuing population boom and the new sources of income're-shaped' the cultural landscape with the introduction of building projects in most of the Harbour-cities. This presentation aims to provide a comprehensive image of the harbours and marine installations scattered throughout the island and their potential uses during the Roman times. Through the study of the available marine installations, such as moles, quays, breakwaters, shipsheds and slipways as well as the interpretation of the activities that were taking place there, a different perspective of Crete's Roman identity will be offered and the implications in the local idiosyncracies. Ultimately, this endeavour aims to discuss the harbours as an integral part of the cities they served alongside the archaeological evidence around each Polis, in order to provide a theoretical reconstruction of the Crete's Maritime Cultural Landscape.

The Harbour of Lechaion in Corinth, Greece: Data-driven Research and Site-specific Methodological Approaches

Panagiotis Athanasopoulos[1], Dimitris Kourkoumelis[2], Bjørn Lovén[1], Paraskevi Micha[2]

1. The Danish Institute at Athens, Greece
2. Ephorate of Underwater Antiquities, Greek Ministry of Culture and Sports, Greece

The ancient city of Corinth is located in south Greece, on the northeastern part of the Peloponnese peninsula. From very early in time, the city developed a profound interest in maritime affairs and has been credited with a strong maritime tradition. The necessity for adequate harbour infrastructures in order to meet the constantly growing needs of the city led the Corinthians to develop a large harbour building scheme that resulted in two harbours, Kenchreae and Lechaion.

The harbour of Lechaion, on the shores of the Corinthian Gulf, has served as the main port for the city of Corinth for more than fifteen millennia. Throughout its long history, the harbour area of Lechaion varied greatly in size and use and went through many topographical and architectural transformations. From 2013, the Lechaion Harbour Project has been the research vehicle by which those transformations were documented, studied, clarified, and eventually disseminated. This lecture will attempt to present a synopsis of the results of the interdisciplinary study of the Lechaion harbour. The decennial research, on what is undoubtedly one of the most important harbours of the Greek, Roman, and Byzantine world, has yielded significant results; this paper will aim at highlighting the most important of them, answer research questions that have risen over the years and suggest future research questions.

Marine Geoarchaeological Investigations of the Ancient/ Medieval Harbour of Kyllini/Glarentza, NW Peloponnese, Greece

Maria Geraga[1], George Papatheodorou[2], Kalliopi Baika[3], Dimitrios Christodoulou[4], Elias Fakiris[4], Margarita Iatrou[4], Michalis Prevenios[4], Stauroula Kordella[4]

1. Professor, Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras, Greece
2. Professor, Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras, Greece
3. Associate Professor in Mediterranean Maritime Archaeology, Aix-Marseille University, Scientific coordinator of MoMArch (Master of Maritime and Coastal Archaeology) – Institute ARKAIA, Centre Camille Jullian (AMU– CNRS–INRAP)
4. Phd, Researcher, Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras, Greece

The harbour of Kyllini is located in the north-western part of the Peloponnese. Due to the important geostrategic location of the site, Kyllini was the principal port and an important naval base of the ancient Elis in the 5th century BC. During the medieval times, the Franks developed at the same site and upon the ancient harbour, the city of Glarentza which served as one of the major ports during the Crusaders' period. The objective of the present study was to assess the coastal geomorphological evolution of the site through time. For this we have combined various data sets established from archaeological and topographic datasets, as well as marine and coastal geophysical investigations.

The Kyllini Harbour Project was a joint project of the Finnish Institute at Athens and the Ephorate of Underwater Antiquities (2007-2017), conducted in collaboration with the University of the Peloponnese, the Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras (supported by "K. Karatheodoris" program, Research Committee of the University of Patras) and the Institute of Geography of the University of Mainz.

Primary role in the development of the coastal configuration of the site through time played the evolution of the relative sea level change. The relative sea level changes seem to have been affected by the eustatic sea level changes, local tectonic instability and diapirism, the sediment supply and the anthropogenic impact. Today, ancient coastal installations and harbour infrastructure (moles, quays, breakwaters and towers) are at least partially submerged. Therefore, emphasis was given to underwater archaeological investigations and marine geophysical prospections.

The marine geophysical surveying acquired bathymetric, seismic profiling, seafloor geomorphological and marine magnetometer data sets from a wide offshore area. In the shallow depths, the bathymetric data was combined with the topographic data acquired from high resolution measurements utilizing total stations. The seafloor appears uneven and elevated up to around 6 m water depth, where at least two ribs of the seafloor of promontory-like shapes with variable length and width, compose the main configuration of the seafloor. These morphological features represent the harbour remains at the shallow waters. The profiling data used to depict the seismic stratigraphy of the seafloor. The profiles revealed seismic facies attributed to sedimentary sequences. The profiling data combined with the bathymetric data led to the mapping of the sediment accumulation. Though the sediment thickness is in general low in the shallow water depths, small scale sites with increased sediment accumulation point to the existence of seafloor depressions in the past. These seafloor depressions seem to be related to the submerged harbour installations.

Moreover, the marine magnetometer surveying revealed areas of high magnetic intensity. High magnetic intensity depicted in (a) a wide area almost parallel to the present coastline containing the submerged harbour remains and (b) a series of small-scale sites scattered in deeper water depths. The former wide area most possibly corresponds to the shallow appearance of hard material of the submerged harbour remains, in line with the topographic configuration of the seafloor and the low sedimentary thickness. However, an inversed polarity of the magnetic signal recorded between the northern and the southern sites of the investigated area which maybe corresponds to different petrographic material and/or different ages of the ancient harbour materials.

The Ancient Slipways of the Aegean: Accurate Indicators of the Relative Sea Level Change?

Eleni Kolaiti[1], Nikos Mourtzas[2], David Blackman[3]

1.Dr, Geologist NTUA, Independent Research Scholar, Society for the Study of Ancient Coastlines - AKTES NPO; Chalandri, Athens, Greece

2.Dr, Mining Engineer NTUA, Ext. Collaborating Researcher, Institute of Historical Research, National Hellenic Research Foundation; Society for the Study of Ancient Coastlines - AKTES NPO; Chalandri, Athens, Greece
3.Professor, Senior Research Fellow, Centre for the Study of Ancient Documents (CSAD), Faculty of Classics, University of Oxford, Oxford, UK

Ancient slipways are spread throughout the Greek coastline, geostrategically located on important sea routes. They not only constitute an important part of the Greek naval history and maritime tradition, but also provide valuable evidence of the relative sea level (rsl) change from the period of their construction and use, since their function required them to be situated at the water's edge. Slipways, covered slipways (shipsheds), neosoikoi, neoria, naval dockyard, base or station, naustathmos, or even carenaggio, regardless of their function, capacity and other - monumental or not - superstructures: they may have all used a sloping track for hauling out and launching various types of vessels. Geoarchaeological surveys of the rsl changes in several coastal sites (Peloponnese, Cyclades, Crete), either revealed unknown slipways or offered some fresh insights into the functional features of sites previously published. The slipways here presented, albeit covering a wide chronological range from the Classical period to Modern times, follow more or less similar construction and functional principles. The rock-cut ramp of a slipway in most cases is well- preserved as no later additions or modifications have been made, and is therefore an indisputable evidence of the slipway's position relative to the sea level at the time of construction. The contemporary measured depth/elevation of the seaward ending part of the rock-cut sloping floor is interpolated into the curves of rsl rise for the Aegean, which are differentiated between the study areas due to the different regional geotectonic setting. This correlation allowed us to come to the conclusion that slipways are good sea level indicators and suggest their functional height with an uncertainty not exceeding the tidal range. The contribution of slipways to the rsl change history of an area is of particular value, both in confirming and/or determining former sea level stands and their dating or conversely in the archaeological dating of harbourworks of unknown age.

The Submerged Prehistoric Settlement in Pavlopetri, Elafonisos: An Approach for the Promotion of the Site aiming at Combining the Natural Environment, the Protection of the Archaeological Site and Raising Awareness.

Despoina Koutsoumba[1], Foteini Vlachaki[2], Angelos Manglis[3]

1. Ephorate of Underwater Antiquities, Greece
2. Architect Engineer, MA in Restoration of Monuments
3. Founder of Atlantis Consulting S.A.

The submerged prehistoric settlement in Pavlopetri (Elafonisos) in Laconia, is the first prehistoric settlement in Greece where land and underwater signage has been placed to facilitate visiting snorkelers.

It is an important settlement that flourished between the 3rd millennium BC and the end of the Mycenaean years on the south coast of Laconia, as it was on the sea route that connected Crete with the Peloponnese. Most of the buildings of the settlement are currently submerged at a depth of 1-3 m. with only the lower part of the masonry preserved. The cemetery extended on the hill that surrounded the settlement and is now found partly on the coast or underwater. The area surrounding Pavlopetri is an important wetland (Lake Strongyli) and a protected area NATURA 2000.

Following years of observation and considering the needs of the visitors of the site, signage was placed in Pavlopetri (informative on land signs, direction signs for snorkelers, underwater buoys) under the INHERIT project as part of an integrated Management Plan that includes the submerged settlement and the surrounding natural environment.

In this context, Pavlopetri was awarded as an INHERITURA area for combining the protection and promotion of both Underwater Cultural Heritage and the natural environment.The paper aims at presenting the activities undertaken in Pavlopetri in the frame of the INHERIT project and the prospects of the promotion of the site in terms of protection of the archaeological site and the natural environment, and raising awareness among the visitors.

paper session

Aegean/Black Sea

Ships, Amphorae and Rubble. A Maritime Perspective of the Roman Harbour of Kenchreai

Ioannis Nakas – Independent Researcher and Freelancer

During the Roman Imperial period, Kenchreai developed into one of the most important harbours of the Northern Peloponnese. It operated as the main gateway of Corinth and Corinthia towards the east and a key hub on some of the most important commercial routes of the period, as documented in written sources and in archaeological finds. The settlement was equipped with a deep harbour basin, ashlar quays, and a vast warehouse complex, whereas two massive and monumental rubble breakwaters protected the harbour from the sea. Based on my doctoral thesis research, this paper aims in examining Kenchreai as a maritime city and a harbour. By using data from a long series of surveys and excavations, both on land and underwater, it focuses on the practical matters related with the operation of the harbour: its capacity to accommodate, protect, and serve ships of different types and tonnage, the handling, storage and circulation of cargoes, and in general the impact maritime economy had in the existence and evolution of the settlement.

Underwater Archaeological Surveys of Submerged Coastal Sites in Turkey

Harun Özdaş, Nilhan Kızıldağ
Dokuz Eylül University, Institute of Marine Sciences and Technology, Izmir, Turkey

As part of the Shipwreck Inventory Project of Turkey (SHIPT), which has been documenting the underwater cultural heritage since 20 05, marine geoarchaeological surveys have been carried out on submerged coastal sites along the coast of southwestern Turkey. Due to its strategic location on ancient trade routes between the Aegean and the eastern Mediterranean, many coastal and harbour settlements from the Bronze Age to the early Byzantine period are situated in this region. Among these, Kekova, Fethiye, and Bozburun are the well-known sites with the submerged remains from the Late Antiquity. The installations (e.g. breakwaters, moles, quays and public buildings) in these sites are now totally or partially submerged due to relative sea-level changes. The results from geoarchaeological studies on these sites demonstrated that vertical tectonic movement has been the primary cause of relative sea-level changes for this coastline since the Bronze Age. Effort was made with a particular focus on mapping and documenting the submerged archaeological remains with their surrounding geomorphological features by collecting high-resolution data. All data from remote sensing, diving, and DRON surveys were integrated to a GIS database. Acoustic and photogrammetric documentation of the sites provided high-resolution map of wide areas. This multidisciplinary approach to submerged archaeological sites allowed us to understand the landscape evolution and human adaptations to the coastal changes. These coasts that witnessed busy maritime activity since the Bronze Age have suffered from the relative sea-level changes in the past and are still under the influence of natural hazards and climate change.

The Multifaceted Port System of Pergamon's Sea Front: Elaia, Pitane, Kane, and Beyond

Stefan Feuser[1], Anca Dan[2], Eric Laufer[3], Bernhard Ludwig[4], Felix Pirson[4], Martin Seeliger[5]

1. University of Bonn, Institute for Archaeology and Cultural Anthropology, Department of Classical Archaeology, Bonn, Germany
2. Recherche Centre National de la Recherche Scientifique (CNRS) -Paris Sciences Lettres, Archéologie et Philologie d'Orient et d'Occident Ecole Normale Supérieure, Paris, France
3. German Archaeological Institute Athens, Greece
4. German Archaeological Institute Istanbul, Istanbul, Turkey
5. University of Greifswald, Institute of Geography and Geology, Greifswald

The Kane Peninsula situated at the Turkish Aegean coast is a promontory separating great parts of the Kaikos valley from the sea. Within a coastline of approximately 45 km, at least three harbour cities were located in antiquity: Elaia, Pitane, and Kane. Despite their long history and their major role in making Pergamon one of the greatest centres of the Hellenistic and Roman world, these sites are still unknown to the historians and (geo-) archaeologists of the Mediterranean. To reconstruct the palaeo-

environment and to understand the various ports, anchorages, and landings along the Kane Peninsula and the Bay of Elaia, the Kane Regional Harbour Survey has been conducted since 2014 (DAI Istanbul – University Cologne – ERC RomPort). The project was conceptualised as a multi-disciplinary archaeological project, including geophysical and shallow-water geoarchaeological prospections. The main aim was to study Pergamon's connectivity, at the interface between the Aegean and Asia Minor, by identifying the major and minor harbours and anchoring points and their articulation with the river and road network of Aeolis in the longue durée. Moreover, this region is also a good example to investigate the changes in the location, the maritime infrastructure, the economic and political importance as well as the frequentation of harbour sites during the Roman period compared to the Classic and Hellenistic age.

In this paper, we outline the development of Pegamon's sea front in a diachronic perspective from the Classical to Roman Imperial period, based on the latest research along the coast of the Kane Peninsula and the Bay of Elaia. On the one hand, we concentrate on the historic development and maritime infrastructure of the major port cities of Kane, Pitane, and Elaia. On the other hand, we introduce minor anchorages and coastal sites and ask for their significance within the local harbour networks. Key questions are: How did the different port cities and anchorages relate to each other? How did the harbour infrastructure and facilities develop from the Classical to the Roman Imperial period? What were the driving factors that changed the local maritime networks and the relevance of the different port cities?

City-harbours of the Byzantine Taurica

Mariia Tymoshenko – Centre for Underwater Archaeology and Archaeological Research, Taras Shevchenko National University of Kyiv, Ukraine

The maritime communication along the Crimean coast was active throughout the centuries. In the medieval period the system of coastal policy was supported by the Byzantine government for trade, diplomatic, and military purposes. Ports become the main city-forming factor and are decisive in urbanization processes of the region.

The paper deals with the port organization of the main centers of Byzantine period Crimea on the basis of correlation of the data of written sources, terrestrial and underwater archaeological sites.

Natural protection of the harbour basin had been the designative criterion for the location of the port facilities. The artificial installations in the harbour basins of the Crimean coast are rarely observed. In most cases the network of the functional bays had been used for the definitive purposes of roadsteads, shelters etc. The city harbour was closely connected with defense and commercial facilities on the level of the spatial organization of the urban landscape. Noteworthy are the sigillography collections of Cherson and Sugdaja coming from the underwater assemblages.

Eastern Mediterranean

Reassessing the Harbour structures of Amathus

Judith Gatt – PhD candidate and Honor Frost Foundation (HFF) Scholar, Centre Camille Jullian (CCJ), Aix-Marseille University and University of Cyprus, Cyprus

The harbour of Amathus was surveyed and excavated in the 1980s by the French school at Athens. Its recent publication (Empereur et al. 2017) revived the interest in this well-preserved site by rising debates on its purpose of construction as well as on the function of the harbour basin and the connection of the harbour structures with the fortifications of the harbour-city (Ginalis 2018; Aupert 2020; Demesticha 2021).

This paper focuses on the monumental harbour structures of Amathus and more specifically on their construction techniques, a key element that will contribute to the above-mentioned discussions in the future. Although the documentation of the harbour structures conducted in the '80s remains important, new data regarding the harbour structures is now available thanks to the ANDIKAT project in Amathus (MareLAB 2020) and a recent topographical survey of the site conducted in the framework of the PhD thesis. This new corpus of information permits a more detailed study of the construction of the west and east mole and the south breakwater-mole, thus contributing to our knowledge on harbour construction techniques in the Hellenistic period in the Eastern Mediterranean. Preliminary observations regarding the construction of the south breakwater-mole and the northern limits of the east and west mole along with the future perspectives of the research will be presented.

Reconstructing the Complex Story of the Dreamer's Bay Port in Cyprus

Maria Michael – Independent Researcher and Honor Frost Foundation Scholar
Lucy Blue – Maritime Archaeological Director of Honor Frost Foundation, University of Southampton, Southampton, UK

Since 2015, the Ancient Akrotiri Project, led by Prof Simon James of the University of Leicester, has conducted several seasons of excavation and survey of Roman/early Byzantine remains at Dreamer's Bay. Dreamer's Bay lies on the southern coast of the Akrotiri Peninsula in Cyprus. The peninsula comprises a rocky former island, 9.6 km long from Cape Zevgari in the west to Cape Gata in the east, and about 3.5 km north-south.

As one of the main aims of this project was the comprehensive study of the ancient port, an underwater survey, led by Dr. Lucy Blue of the University of Southampton, has been also conducted from 2018 to 2019. These two seasons confirm the existence of an anchorage in the form of a c. 140 m long breakwater, and a shipwreck, the latter of which consists of a concentration of largely homogenous ceramics located on an elevated rocky outcrop to the east of the breakwater and the sheltered channel. The shipwreck dates to the end of the 6th or the 7th century AD based on the ceramic types. Furthermore, another wreck, which carried roof tiles and ceramics, has been identified to the south, but further investigation is needed to determine its nature and extent.

In this paper, the results of these two seasons will be briefly presented. Furthermore, plans for the next season in 2023 will be discussed, in order to highlight the importance of the continuation of this survey for the analysis and better interpretation of the breakwater, its connection to the identified wrecks, and its complex maritime cultural landscape.

Archaeological and Topographical Documentation of the Ancient Harbour of Amrit (Marathos), Syria: Mission 2022

Jafar Anbar – PhD candidate and Honor Frost Foundation (HFF) Scholar, University of Aix-Marseille, France, and National and Kapodistrian University of Athens, Greece

The paper presents the preliminary results of the 2022 archaeological survey on Amrit, Syria, undertaken in the framework of my PhD research.

The PhD research concerns the maritime geoarchaeological study of a number of important harbour settlements on the southern part of the Syrian coast from the modern city of Tartous to Tabbat Al-Hammam - along the submerged reef of Arwad. Arwad constituted a navigation landmark of the Syrian coastline, located at the crossroads of major trade routes between the Egyptian, the Hittites, and the Mesopotamian civilisations. According to literary sources, the island functioned in a maritime network connected with harbour-cities on the mainland and the islands nearby (Antarados, Marathos (Amrit), Tabbat Al-Hammam, Machroud and Al-Abbas). The archaeological sites under study possess several built and rock-cut archaeological structures (harbour infrastructure, breakwaters, coastal fortifications, quarries, etc.) as well as open anchorages.

The 2022 fieldwork survey focused on the systematic documentation of the harbour quay of Amrit. It consisted of systematic 3D topographical survey, architectural documentation, and aerial drone photogrammetry of the coastal archaeological remains. The collected data, today under study, were integrated in a GIS database whose architecture is under construction for the optimum analysis and management of all published and new interdisciplinary information from the southern part of the Syrian coastline.

Slipways and Landing Places: An In-depth Look at the Harbour System at Anfeh, North Lebanon

Lucy Seaman – Lead Maritime Archaeologist of Honor Frost Foundation (HFF), Lebanon

Current scholarly studies in ancient Mediterranean harbours consider the holistic approach of harbour-systems comprising the physical settings of harbour interfaces, their spatial organisation around a settlement, and their associated infrastructure (Carayon 2008). This concept is built on Frost's hypothesis that studying harbours can only be understood through a study of their mechanisms impacted by natural and cultural processes. This paper adopts the conceptual approach of harbour-systems to understand the wider maritime cultural landscape at the coastal site of Anfeh, North Lebanon. The

site has been excavated and thoroughly surveyed since 2011 by Nadine Panayot-Haroun, and its underwater and maritime potential explored through the works of the present author as part of her three-year postdoctoral fellowship at the University of Balamand and the University of Southampton.

Geomorphological and archaeological coastal and underwater studies at Anfeh have indicated the existence of a de-centralised harbour system composed of natural havens that are of a diverse nature: from offshore shallows and reefs, to bays, coves, landing places and river mouths. These simple harbours surely were connected with the agglomeration on land, where people would find shelter for their boats. Meanwhile, the rocky coastal interface of Anfeh made its maritime approach quite challenging, but people managed to modify the landscape to their needs by producing sea walls, slipways, and ramps of access.

Using Satellite Imagery and GIS in the Assessment of the Sarepta harbour Area

Hassan HajjAli – Lebanese University, American University of Beirut (AUB), Honor Frost Foundation (HFF)

Sarepta is a Romano-Byzantine harbour city located in the modern town of Sarafand, 64 kilometers south of Beirut. From 1969 to 1974, the University Museum of Pennsylvania excavated two main areas of Sarepta: the settlement area at Ras El-Shiq, and the harbour installation at Ras Al-Qantara. However, all archaeological work at the site was halted due to the Lebanese civil war (1975-1990), and the site was subsequently abandoned. Since then, the harbour site has been severely damaged and exposed to urban expansion, looting, and a lack of protection and conservation. An assessment of the site's present condition and the extent of past damages remain unknown. Therefore, this paper considers a spatial analysis as a preliminary method to start an evaluation of the harbour site at Sarepta and its adjacent coastal zone. This will be done through integrating both satellite imagery of the harbour area in GIS and geo-referenced 1970s maps that were created by the excavators. The extent of coastal changes and natural and anthropic impacts on the area will be determined by analyzing the difference between the two layers. This preliminary remote assessment will bring us one step closer to developing a strategy for assessing, monitoring, and preserving the coastal cultural heritage of the harbour site of Sarepta.

Integrated Management of the Coastal Zone

Naseem Raad – American University of Beirut (AUB)

Beirut, located along the central Levantine coast, is one of Lebanon's most extensively excavated, surveyed, and published coastal archaeological sites. On August 4th, 2020, one of the largest non-nuclear explosions in history caused irreparable damage not only to the modern city and its inhabitants, but also struck at the heart of Lebanese cultural heritage. The ancient maritime landscape, historic coastal buildings and structures, and archaeological features in and around the port all sustained significant harm and are in dire need of restoration, preservation, and proper management.

For this reason, the Honor Frost Foundation envisioned the Beirut Port Project (BPP) to support the management and monitoring of archaeology in the city. In collaboration with the Directorate General of Antiquities of Lebanon (DGA), the BPP team undertook a thorough overview of all archaeological data of the historic port site of Beirut and developed a digitization system to process and archive this data based on the Endangered Archaeology in the Middle East and North Africa (EAMENA) database. The team also conducted condition assessments based on the EAMENA system and digitized results to establish the regular monitoring of Beirut's archaeological sites in the future.

This paper discusses the methodology developed and applied in the BPP and details the structure of the partnership between the HFF and the DGA of Lebanon in this endeavour. The BPP has the potential to serve as the foundation of a nationwide digitization effort of all archaeological data, and provide an effective tool for the Lebanese government to regularly monitor sites.

Going Basic, Going Grand – the Effects of Sea-level Changes on Harbour Facilities in Antiquity

Gil Gambash – Professor of Mediterranean History, Department of Maritime Civilizations, Recanati Institute for Maritime Studies, Director, Haifa Center for Mediterranean History University of Haifa, Israel

Despite history's repeated warnings, scholarship in various fields of the humanities still contains distinct aspects of progressional bias, setting to seek constant development within human societies, and often finding it on a resolution which disregards stagnation and setback. The phenomenon is particularly acute in the study of ancient technologies, where later forward leaps are ever available towards teleological analysis. Such is the case of the Roman concrete harbour of Caesarea Maritima, still considered by many to be the pinnacle of a millennium-long effort to develop harbour technologies by Mediterranean societies. The suggested talk will highlight instead the techn ological vacuum from which Herod's creation emerged, following long centuries of little interest by local societies to engage in developing elaborate coastal logistics. For explanation, the talk will relate to recent research on relative sea-level change in the Hellenistic period, and consider its impact on coastal Levantine societies.

Caesarea Maritima and the harbour of Sebastos: How an Ancient Archaeological Site is Informing Modern Coastal Planning and Management in a Time of Climate Change

Beverly Goodman Tchernov – University of Haifa, Department of Marine Geosciences, Leon Charney School of Marine Sciences

Coastlines are well known as dynamic, changing landscapes. Caesarea Maritima, located in the eastern Mediterranean along the Levantine basin between the modern cities of Haifa and Tel Aviv, was a continuously active ancient harbour settlement for more than 1400 years from the 2nd-3rd century BCE to the 13th c. CE. During those years, its builders and inhabitants utilized the advantages of its strategic coastal position, lucrative port facilities, and inland and seaward connectedness. Coastal living, however, also presented challenges in the forms of shifting environments driven by the combined effects of anthropogenic alteration of coastal geomorphology and natural coastal changes (erosion, tsunamis, storms). In the past two decades, data has amassed providing more details from both ancient and more recent geological and archaeological markers that support the presence of both gradual and punctuated changes that are critical for anticipating future trends. Also, the area surrounding the archaeological park is developing exponentially in recent years. Construction of new neighborhoods, multi-stored buildings, expansion of critical infrastructure, such as natural gas processing facilities, and a combined power station and desalination plant. The majority of the population in Israel and neighboring countries is heavily concentrated on a relatively narrow coastal plain. Already, Caesarea has contributed to national emergency preparedness policy in light of tsunami risk, but there are many other forms of evidence that will enrich coastal management knowledge regarding observed sea-level change, warming, erosion, earthquake vulnerability, storm intensification, and more. Archaeological data can be a prime form of information for policy building and responsible climate change adaptation decision making.

North Africa

Recent Fieldwork on Byzantine Port Facilities at Taposiris Magna (Mareotis, Egypt)

Marie-Françoise Boussac – Co-director of Taposiris Magna French Excavations, *Emeritus*, Paris Ouest Nanterre University
Joachim Le Bomin – Archaeologist, Field Director of Taposiris Magna French Excavations, Head of the Archaeology Department, Ifao, Cairo
Lyubomir Malinov – PhD Candidate, Archaeologist, Montpellier Paul-Valéry University/UMR 5140
Julie Marchand – Ceramologist, MRAH-KMKG & ULB, Brussels
Maël Crépy – Geographer, Ifao, Cairo

Taposiris Magna (Egypt, Mariut region) developed from the 3rd c. BC onwards on the taenia, a ridge which separates the Mediterranean Sea from its hinterland. The site, occupied until the early 8th c. AD, owes its prosperity to its location, 45 km west of Alexandria, in the Mareotis region, and became an active harbour since the Early Roman Empire.

The French archaeological expedition recently undertook new investigations on the Byzantine phase of the lake harbour area: from the 6th c. AD, the site underwent a major reconfiguration of its urbanism, linked to imperial decisions and the flourishing of the local economy. New areas were developed (from baths to residential sectors) and harbour infrastructures were reconfigured with warehouses, pier, and public buildings.

In the western harbour area, at the end of the main road going up to the Osiris Temple (at the top of the taenia) and close to a Roman bridge, an impressive building with monumental architecture (the "New Building") has been excavated since 2021. Across the road is another enigmatic structure, the "Platform Building", whose initial exploration by an American expedition in 1975 has been resumed since 2019 by the French team. Their layout and strategic location as an interface between city and port, suggest that both were public buildings associated with the functioning of the latter (harbour authorities office, customs house?). According to current investigations, the last period of occupation of this district started during the second quarter of the 7th c. AD.

This paper aims at 1) presenting the architectural and archaeological recent discoveries in this area, especially on the "New Building", 2) explaining the regional economic and political context of Mariut at the dawn of the Arab-Muslim conquest in the specific environment, 3) highlighting the key role played by Taposiris Magna in the movements of goods and people.

The Archaeological Evidence for Slow and Fast Subsidence in Thonis-Heracleion and Alexandria, Egypt

Damian Robinson – Associate Professor, Director, Oxford Centre for Maritime Archaeology, School of Archaeology, University of Oxford, Oxford, England
Franck Goddio – Président, Institut Européen d'Archéologie Sous-Marine, Paris, France

The now submerged port-cities of Egypt's Canopic coastline were founded in dynamic environments. Their inhabitants needed to cope with the effects of subsidence that were both gradual and insidious, as well as fast and catastrophic: the slow rise in sea level and the rapid failure of sediments with the destruction of anything built upon them. In this paper, the archaeological results from the work of the *Institut Européen d'Archeologie Sous-Marine* (IEASM) will be used to set out the archaeological evidence for slow and fast submergence events through case studies of the deconstruction and destruction of four temples. In the port of Thonis-Heracleion during the Saite period, both the temple of Khonsu-Thoth and the temple of Amun were systematically dismantled as the inhabitants of the city sought to cope with the rising sea levels at the edge of the Nile delta and the flooding of their city. Coupled with the silting up of its entrance channel to the river, this resulted in the abandonment of the Saite settlement and its port and the refoundation of its major temple, that of Amun-Gereb, on an island slightly further to the south. Less than two centuries later, however, in the Ptolemaic period, this temple itself was destroyed in an episode of bank failure and sediment liquefaction that was most likely triggered by an earthquake, sending its remains into the surrounding waters, sinking ships tied up at its quaysides. A similar fate also struck the temple of Isis on Antirhodos island in the *Portus Magnus* of Alexandria in the early years of Roman rule. Together, these case studies will demonstrate both how we recognise the archaeological signatures of these different types of events and how the inhabitants of these port-cities resiliently coped with life in an ever-changing environment.

Mooring in the Ancient Egyptian Harbour of Thonis–Heracleion

Franck Goddio – President, Institut Européen d'Archéologie Sous-Marine, Paris, France
Alexander Belov – Researcher, Institut Européen d'Archéologie Sous-Marine, Paris, France

The Institut Européen d'Archéologie Sous–Marine (IEASM) conducts the surveys and excavations of the submerged port-city of Thonis–Heracleion on the Mediterranean coast of Egypt for more than 25 years. IEASM has already identified 116 ancient ships and about one hundred more, detected by means of a sub bottom profiler, are still hidden under the thick sediments of the Nile. The rich material culture from Thonis–Heracleion and more than 700 ancient anchors attest to a permanent and intense activity of this port in the Late Egyptian Period (664–332 BC). Intensive shipping suggests well–developed harbour facilities and an elaborate system of anchorages and moorings. The traditional Ancient Egyptian mooring procedures on the Nile are attested by iconography and some rare archaeological record. The excavations in Heracleion brought to light the remains of quays, hypothetical heavy sinkers for permanent moorings, and well–preserved hawsers that are associated with several shipwrecks. Massive pierced stones were discovered along the quays in the central part of Heracleion and they may be interpreted as a kind of bollards. Heracleion was located in the coastal lagoon, and environmental conditions within its harbours were very different from those of the Nile. Thus, the mooring procedures were equally different, and the paper proposes their

comparative analysis. The study of moorings provides important information on the depth of the harbours and the draft of the ships that came to Heracleion from different parts of the Mediterranean.

Ocean Decade and Sustainable Future for Coastal Archaeological Sites in the Eastern Mediterranean Region

Mirette Abdelnour – Alexandria Centre for Maritime Archaeology and Underwater Cultural Heritage (CMAUCH), Alexandria, Egypt

Climate change is one of the greatest issues facing coastal archaeological sites globally. Sea level changes due to anthropogenic or natural interventions are documented causing coastal erosion and flooding. Unfortunately, sea level changes have resulted in a global change in the inundation of low-lying coastal archaeological sites, and the situation is predicted to worsen in the near future.

In fact, this problem was also common in ancient times. Several coastal archaeological sites are found totally or partly submerged under the seawater or buried by sediment as result of these climate collisions. For example, Eustatic Sea Level (ESL) along the Mediterranean basin is calculated approximately 0.5 m below sea level during the last 2000 years. These changes affected the Mediterranean coastal archaeological sites in different ways. Local changes, such as land subsidence, tectonic uplift, coastal erosion, sedimentation processes, earthquakes, and tsunamis play a fundamental role in this situation. However, since the 19th century the climate became warmer, due to the increasing use of greenhouse gases, such as carbon dioxide and methane, in addition to industrial activity and deforestation which affect the atmosphere, hence, accelerating these risks.

This paper pinpoints the challenges facing the coastal archaeological sites along the eastern Mediterranean in the past and present, trying to predict the future directions of these changes using GIS and suggesting preservation models. The paper will look at coastal archaeological site in five different countries from the eastern Mediterranean, which are Cyprus, Egypt, Greece, Lebanon and Turkey within the framework of the main goal of the United Nations Decade of Ocean Science for Sustainable Development “The Science We Need for the Ocean We Want”.

Nile’s Holocene Waterscapes at Giza Harbour Revealed by Pollen Analysis

Hader Sheisha [1,2] – PhD candidate

1. Aix Marseille Université, Centre National de la Recherche Scientifique (CNRS), Institut de Recherche pour le Développement (IRD), INRA, Collège de France, CEREGE, Aix-en-Provence, France
2. Europôle méditerranéen de l’Arbois, Institut Méditerranéen de Biodiversité et d’Ecologie - IMBE (Aix-Marseille University, Avignon Université, CNRS, IRD), Aix-en-Provence, France

Towering over the farming land from the plateau west of the Nile, Giza pyramids immortalize the power and prosperity of the Old Kingdom. The Old Kingdom was the first great era of Egyptian civilization, which is thought to have come after episodes of social complexation, driven mostly by mid-Holocene climatic transformations in North Africa. We used palaeoecological approaches to reconstruct 8000 years of fluvial level variations for the Khufu channel, the west branch of the Nile, a now extinct arm of the Nile that bordered the Giza Plateau. The taxa found were grouped into seven PdV pollen-derived vegetation groups based on their ecological affinities: Cyperaceae, tropical Nilotics, helophytes, date-willow, cereals, and ferns. Our reconstruction, based on PCA-Axis1 scores using smoothing with a LOWESS algorithm, shows that the water level of the Khufu branch was higher during the African humid period, with an estimated local termination at 3550 ± 80 BCE (5500 ± 80 BP). The largest negative fluctuations in Khufu Branch levels during the period 8,000 to 5,500 years ago are correlated with volcanic forcing resulting in decreased summer flooding of the Nile. Our scores show that Egypt’s Early Dynasties appeared during a major Nile fall, as evidenced by the Khufu branch from 2970 ± 80 to 2690 ± 80 BCE, consistent with a hydrological shift at Lake Tana and the onset of Nile Delta degradation due to decreased sedimentation. In addition, we find that during the first half of the Old Kingdom of Egypt (2686-2440 BCE), the level of the khufu branch of the Nile remained relatively constant, characterised by a level at about 40% of that reached during the African wet season. This relatively stable phase clearly provided an environment conducive to the emergence and development of the pyramids site, helping the builders to deliver the stone and other construction materials by boats.

Current Research on the Ancient Harbour of Hadrianopolis (Driana, Libya)

Jamal Khalid – Benghazi University, Libya

The coast of Cyrenaica was considered as part of the important Mediterranean trading routes since the Greek civilization. Along the coast, many ports and harbours developed such as Apollonia, Tolmetha, Tochira, and Euesperides, which were used by ships during their voyages East and West. This type of maritime trade during the Greek and Roman era has been confirmed by many archaeological finds on land and under the sea.

During the underwater project conducted along the beaches of Hadrianopolis (modern day Driana), research was carried out in an area called Al-Aseela, which is quite a fascinating landmark due to its structure and the strategic port shape of the dock where ships sat immaculately. This could be an indication of the presence of a port due to the close resemblance to its residing pieces of scattered cornerstones that were found in the Vicus area -located west of Cyrene- and in which a port related to Cyrene was discovered.

Furthermore, Al-Aseela was about 2 km away from the main ancient site, and a contiguous concrete floor was found at a depth of 1.5 meters. It was noted that there were many rock features or cornerstone blocks scattered throughout the site, but unfortunately the site was sabotaged by fishermen using prohibited fishing tools, such as dynamite, which led to the visible disruption of the natural shaping of the location. However, one important question is why there were little to no discoveries of remnants of different buildings on land.

The archaeological evidence that was found inside the sea do not give us a complete impression of the ancient port city, but gives an indication that needs further investigation and research using modern tools and an integrated teamwork.

The Harbour of Apollonia at the Crossroad of Historical and Archaeological Research

Saad Mohamed Abdulsalam Saad – Omar Mukhtar University, Libya

The coastal areas of Cyrenaica witnessed the emergence of many ports and harbours since the early settlement period. Archaeological remains that exist to the present time testify to the greatness of the ports of the past. Perhaps the two most important sources that mentioned the region's ports in detail were the Greek geographer Scylax, who wrote in the fourth century BC, followed by Astademus in the second century AD.

Apollonia's submerged port structures represent one of the most important remnants of ancient ports in the region. One of the most important studies that tried to match the ancient ports in the region with historical sources was that of Jones and Little. The first study conducted on this port was during 1958–1959 under the supervision of Nicholas Fleming. In the light of this study, a detailed map was drawn for the remains of the submerged port, and underwater excavations resumed during 1978–1997 by the French archaeological mission under the supervision of André Laronde.

The port has several unique features, including an early construction that dates between the seventh and sixth centuries BC. Most of the port facilities are completed in a relatively good condition, such as the berths, as well as a complete system of marine fortifications and breakwaters built with stone blocks, which despite their collapse maintain their shape. It also contains various buildings, some of which are interpreted, and some that need interpretation. It also preserves the context of the stratigraphic sequence of the site from the early settlement period 620 BC to the Hellenistic and early and late Roman periods, but unfortunately large parts of the port were destroyed due to sea currents and overfishing with dynamite. If this port is not properly protected, we will witness an actual disaster.

Thalasso-philia: Living by the Sea in Leptis Magna

Nicolò Masturzo – Università di Torino, Dipartimento di Studi Storici, Laboratorio di Rilevamento e Documentazione, Italie

The study examines the situation of the houses built along the coast of Leptis Magna, and takes as a significant case study the dwellings found in the city. Leptis Magna is notoriously a city that, since the Augustan age, has combined Phoenician and Punic background structures with models of public representation that are more or less directly related to Rome. Within a few decades, buildings of great urban and architectural impact were constructed by the city's elites: the market, the theatre, the Calcidicum and the amphitheatre. In the same years, the urban layout was rebuilt with the construction of new defences based

on a double circuit of walls, and work began on the harbour during the reign of Nero. The architecture of dwellings has not been investigated as extensively as collective buildings. In fact, old Italian excavations are unpublished and only a few but significant investigations have been conducted recently.

The study will focus on dwellings closely connected to the marine landscape due to their location on the coast. Some dwellings that express an average level of luxury are flanked by others that are of a very high standard, comparable to the great palaces of the Hellenistic age. The region's housing system entered a crisis between the end of the 3rd and 4th centuries AD, due to probable social changes triggered by environmental changes caused by uncontrolled land exploitation.

The examination of the topographical situation of the dwellings is based on archive documents and reconnaissance, which made it possible to identify more than fifteen *domus* built along the city›s coastline.

Western Mediterranean

New Interpretations on the Occupation of the Coast of Tipasa During Antiquity

Rafik Khellaf, Youcef Bensaidani, Donia Bourai
LEHA Laboratory, University centre of Tipasa, Algeria

The region of Tipasa has experienced maritime activity since the Punico-Numidian period, which witnessed the birth of many coastal cities, including the city of Tipasa. The Roman period will be a period of prosperity and wealth for the city, by its proximity to Caesarea of Mauretania on the one hand and by its geographical location and its geomorphological and geological aspect on the other hand. This wealth will extend to its rural region, whether inland or more particularly the coastal one.

The new surveys and excavations carried out over the past three years by our research team, along the coast of the Tipasa region, bring us a new vision of the occupation of the coast and the exploitation of natural resources, combining the land and sea through a range of Villae, some rich, others modest.

Indeed, the two projects registered by the research team in coastal and maritime archaeology of the laboratory of historical and archaeological studies, affiliated with the university center of Tipasa, namely an archaeological prospecting project of the east coast of Tipasa, and the excavation of maritime villae located about 3 km east of the ancient city of Tipasa, have brought to light a good number of unknown sites and unpublished material culture.

We will try, in our contribution, to bring a new interpretation to the coastal sites of the Tipasa region, and to have a vision on the exploitation of the rural and maritime environment.

The Roman Harbour of Frejus: A New Scientific Project and Methodology

Pierre Excoffon[1], Emmanuel Botte[2], Nicolas Carayon[3]

1. Direction de l'Archéologie et du Patrimoine, Ville de Fréjus, France
2. Aix Marseille Univ, Centre National de la Recherche Scientifique (CNRS), Centre Camille Jullian (CCJ), Aix-en-Provence, France
3. Ipso Facto Scop-Arl / Marseille, France

Since 2020, a collaborative scientific project dedicated to the Roman port of Fréjus (ancient Forum Iulii, France) undertook transdisciplinary field research in order to re-examine old data, acquire new information, and reinterpret the whole area of the ancient harbour basin. If old publications have been able to understand the general organisation of the famous Roman port and its evolution, several points remain to be understood. This is particularly the case of the location of the ancient coastline, the depth of the harbour infrastructures, and their chronology. Using systematically the combination of geophysical tools (GPR, ERT, and Magnetometry), geoarchaeological coring, geochemical measurements using pXRF, photogrammetry and more classical archaeological investigations, we are able to develop hypotheses that change considerably our knowledge of the port. In this presentation we will mainly focus on the method specifically developed at Fréjus within the framework of our new Collective Project of Research and present the first data and new hypotheses.

New Investigation and Results at the Olbia-de-Provence (France, Var, Hyères) Harbour Structures

Laurent Borel – Centre National de la Recherche Scientifique (CNRS), Aix Marseille Univ, Centre Camille Jullian (CCJ), Aix-en-Provence, France
Alex Sabastia – Inrap, Aix Marseille Univ, Centre National de la Recherche Scientifique (CNRS), Centre Camille Jullian (CCJ), Aix-en-Provence, France

Founded during the 4th century BCE, Olbia-de-Provence, a colony of Massalia (Marseille), features submerged structures that have been known since the 1970's. The 2019-2022 campaigns held on the site produced a new, full documentation of these hundred meters long structures in particular thanks to photogrammetry. The interpretation of this documentation, the architectural and archaeological study of the structures preserved will lead to a series of new interpretations regarding the dating and the function of these remains.

The field campaigns brought some of the data missing for the global understanding of the harbour. The dating of those remains can be approached thanks to the discovery of a small amount of amphora pieces caught in the masonry. Trenches in the center of the main construction show some of the construction techniques employed. Test-trench on both sides complete the observations made in the past on the harbour basin, and its localization.

Thus, this proposal aims to discuss the documentation and the data collected, present new hypothesis on the construction the main structures and show evidences of its dating.

Roman Harbour Structures and Wrecks in the "Anse des Laurons" (Martigues, France): A New Study and New Data

Franca Cibecchini[1], Mourad El Amouri[2], Laurent Borel[3], Tiffany Kerschenmeyer[4], Dimitra Voutyrea[5], Fabienne Marty[6], Pierre Poveda[3], Sabrina Marlier[7]

1. Drassm-MC
2. Ipso Facto
3. Centre Camille Jullian (CCJ) - Centre National de la Recherche Scientifique (CNRS)
4. Aix-Marseille University – Centre Camille Jullian (CCJ)
5. Aix-Marseille University
6. AMP Metropole
7. Musée Départemental Arles Antique (MdAa)

Located to the east of the Gulf of Fos, about 11 km from the well-known Roman harbour of Fos-sur-Mer, the Laurons cove is a small, protected area made up of three creeks that has yielded important archaeological remains, including ancient port facilities associated with a dozen wrecks. This complex of remains was the subject of surveys as early as 1977, which were very quickly followed by surveys and excavations directed by Serge Ximenes and Martine Moerman (GRASM) in the 1980s and early 1990s. Since the 1990s, the wrecks have been reopened from time to time, notably as part of a dendrochronological programme led by P. Pomey and F. Guibal in 1994.

The archaeological remains of the Anse de Laurons have been the subject of uneven documentation and studies, which have produced an important bibliography, particularly on a series of submerged structures (mainly Quai E, dumps and North and South breakwater) interpreted as belonging to an ancient port area used from the 3rd century BC to the 6th-7th centuries AD (Moerman 1994, Fontaine et al. 2019, pp. 21-22). However, and despite an abundant scientific literature, the available data presented many obscure points, both for the dating of certain structures - in particular Quai E and the vast dump - and for their interpretation.

We took up the "port structures and wrecks" dossier of the "Anse de Laurons" in the framework of the MoMArch Master's school project (AMU-Drassm), in the continuity of previous research in the Gulf of Fos and with the desire to answer questions that remained unresolved in spite of the numerous archaeological campaigns of the 1980s. After two archaeological campaigns (2021 and 2022) we have had a series of answers, but not exactly the ones we were expecting, especially concerning the submerged structure known as 'Quai E', which we can no longer link to the Antique period. The aim of this talk is to present the preliminary results of these two campaigns, which already provide important news both on the chronology and on the interpretation of the structures in the Laurons cove.

General session

Maritime Interconnections Between Aegean and Central/Eastern Mediterranean People in the MBA/LBA: A Perspective of the MBA/LBA Aegina harbour

George Ferentinos[1], Lilian Karali[2], Walter Gauss[3]

1. OCEANUS-Lab, Geology Department, Patras University, Greece
2. Histeory and Archaeology Department, National and Kapodistrian University of Athens, Greece
3. Athens branch of the Austrian Archaeological Institute, Greece

The present work aims at sketching a general outline of the prehistoric Kolonna settlement, on the Aegina Island, involvement in the eastern Mediterranean maritime trade networks. The prehistoric Kolonna settlement is viewed by many scholars as: (i) the earliest first-generation state-like community with a ranked society in the Aegean Sea, outside Minoan Crete, (ii) having the most impressive fortifications in the Aegean world after those of Troy, during MBA and the Early Mycenaean period, (iii) mediator of goods and ideas to nascent elites at Mycenae and possibly as a direct competitor, (iv) connected to the Aegean Sea and eastern Mediterranean trade networks during the Minoan and Mycenaean dominance and, as our research indicates, (v) having the largest harbour, which could have accommodated about 65 ships of an average of 25 m length. However, the role of the Kolonna harbour and the involvement of the Aeginetans as traders, merchants, and sailors have hardly presented in research papers on maritime trading business. The prevalent current view is that the maritime trade was conducted by Minoans, Mycenaeans, Cypriots and Canaanites who served as mediators.

Taking into consideration that: (a) the Aegina harbour is considered as the first human made marine structure with large berthing capacity in the MBA and LBA period and its strategic position between the Levant to the east and Italy to the west, (b) the archaeological evidence that there were not eastern Mediterranean harbours of the abovementioned carrying capacity, (c) the geographical distribution of pottery and other goods in the eastern Mediterranean and (d) the principal trade networks and sea-routes within the Aegean Sea and eastern Mediterranean, then, it may be assumed, the Aegina harbour was one of the main trans-shipment centers within the Aegean scale networks but also in the larger eastern and central Mediterranean networks.

'Emporia' and Their Archaeological Remains. A New Approach to the Problem

Aylin Güngör – Institute of Archaeology and Cultural History of the Ancient Mediterranean, University of Hamburg, Germany

When approaching ancient harbours and harbour-cities the discussion of maritime hotspots, the so-called '*emporia*', takes a special position within harbour research and the scholarly debate. However, the phenomenon *'emporion'* remains unclear in the current theoretical discourse and lacks a coherent definition. In particular, the term which is generally understood as a landing and trading site stays incomprehensible regarding structure and layout. Nonetheless, *'emporia'* functioned as central elements in the organisation of trade and the exchange of goods in the Mediterranean, and can be considered as a success story.

The previous research and attempts to classify these sites primarily dealt with economics, politics, and society on a theoretical basis. Recently, these maritime hotspots have been identified as playing a major role in cross-cultural exchange. However, a systematic study of the harbour structures of these settlements with a focus on topographical and architectural factors in the archaeological record has not yet been undertaken. At the outset, this paper outlines a classification and differentiation of maritime hotspots on the basis of a systematic study, and acknowledges the importance of harbour research as integral part and parcel of *'emporia'* studies.

An incomplete or intentional record has been observed in the written tradition of the ancient sources regarding *'emporia'* in the ancient Mediterranean. It is interesting to note that for some areas the sources mention several *'emporia'* while only a few for others. In response to this problem, it will be discussed if and how the application of the developed criteria could be transferred to other sites that are not explicitly mentioned as *'emporia'* in the sources, and hence adapted to other regions.

A meeting of Requirements: Overlapping Interests in Mariner and Mercantile Engagement with Terrestrial Landscapes

Linda Hulin – Oxford Centre for Maritime Archaeology, Institute of Archaeology, Oxford, United Kingdom

The location of ports in the Late Bronze Age eastern Mediterranean are viewed as those points in the landscape where coastal morphology and terrestrial economic networks best coincide. Multiple interests will have been at play, depending upon the scale of the interests involved: to be a port at all implies warehousing capacity, transport links, the presence of merchants and, in larger facilities such as in Ugarit, institutional authority. Clearly, the more investment in the tangible and intangible infrastructure of a port, the more maritime and terrestrial merchants were drawn to use it.

However, this 'build it and they will come' lens obscures the realities of mariner —rather than merchant— requirements. Ports that are advantageous to merchants are not necessarily the best equipped for making repairs to ships, and in this paper known harbours will be assessed according to their proximity to natural resources such as water, timber, and stone and the capacity of the local economy to produce and repair ships' equipment.

Furthermore, the needs of sailors to rest overnight, to take on water, or to revictual, follow rhythms that are not necessarily met in established ports, either because such ports are too far apart, or because the use of established ports may involve unattractive costs. I suggest that such revictualling and resting places are identifiable by the presence of small quantities of non-local material in coastal areas between major ports: the residue of petty trade. By paying as much attention to interstitial zones as to major coastal sites, it is possible to map these two overlapping systems of mariner and mercantile requirements on to the Late Bronze Age Eastern Mediterranean system as a whole.

FemiNetworX: Mapping Female Maritime Mobility Patterns from Sea to City

Lana Radloff – PhD, Department of Classical Studies, Bishop's University, Canada

While scholarship on ancient seafaring and maritime networks has grown substantially since the new millennium, the role of women in the creation and maintenance of these networks remains underexplored. Women were important contributors to the domestic economy and key agents of religion, nested within overlapping and multiscalar Mediterranean-wide networks. They were also, as commodities themselves, part and parcel of forced migration through armed conflict and – willingly or not – marriage and motherhood. In this paper, I will examine the agency of women as drivers of mobility networks at ancient Miletus in the southeast Aegean, which was well-situated to benefit from the expanding networks of the period due to its location on the sea-lanes to the Black Sea and Eastern and Western Mediterranean and the overland and riverine transportation routes to inland Anatolia and the east. To do so, I will draw upon feminist geography, mobility and migration theory, and Indigenous gynocentric methodologies, and integrate them with traditional approaches to maritime navigation, such as GIS and network theory. Although temples, altars, and sanctuaries to female deities situated on conspicuous promontories and coastlines within the maritime landscape have traditionally been viewed as functions of the male sphere, I contend that there is a second, double-reading: the preponderance of female, foreign and domestic maritime deities suggests that they are also reflective of the condition of mobile women and the liminal moment of transition from childhood to marriage and motherhood and/or from relative freedom to slavery.

Ancient Port Structures - Parallels Between the Ancient and the Modern

Arthur de Graauw – Research Associate Ancient Ports, University Lyon 2, Centre National de la Recherche Scientifique (CNRS) - Archéorient, MOM, Lumière, France

This paper aims to compare ancient and modern port structures, hoping that the modern can help us in a better understanding of the ancient, with special focus on breakwaters and quay walls. The oldest known port structures are briefly presented. Vertical breakwaters and quays, large concrete blocks, pilae and arched breakwaters, piling walls, cofferdams, rubble mound breakwaters and river training walls are described in the ancient and in the modern world. A few geomorphological aspects of coastal harbours are also reviewed. It is concluded that most natural shelters were used in Roman times and that some major ports have been built in places

without any natural shelter, for strategic or economic reasons. Most of today's concepts for maritime structures were already existing in Roman times, and it seems that little progress was made until the 18th c. when large maritime structures started to be built again. The combination of concrete and steel enables modern engineers to build higher, deeper, and larger than Roman engineers could dream of, but some modern structures may not last as long as some Roman structures, especially in salt water.

Imaging Seen and Unseen Cultural Material in Transition Zones with Geoinformatics: Examples from Eastern Mediterranean

Nikos Papadopoulos – Laboratory of Geophysical-Satellite Remote Sensing and Archaeoenvironment (GeoSat ReSeArch Lab), IMS-FORTH, Rethymno, Greece

Recently, geoinformation technologies integrating low altitude aerial photogrammetry, 3D laser scanning, and geophysical imaging technologies have been extensively tested for the non-destructive documentation of littoral and shallow off-shore cultural material either visible or buried below the sea bottom. The complexity and constantly evolving environmental regime encountered in the transition zones posed limitations to implementing efficiently such technological advancements in order to reconstruct the archaeoenvironment in these archaeological sites.

The resolving capabilities, the spatial limitations, and the actual applicability of these technologies in mapping submerged cultural assets in shallow-depth wetland environments was thoroughly investigated through laboratory numerical modelling approaches and extensive in situ implementation in coastal and submerged archaeological sites, dating from prehistory to Byzantine times in Eastern Mediterranean.

The possibility to apply well-known methods to under-explored archaeological shallow-water contexts was very important from the methodological point of view and for the obtained results. Although the adaptation of commonly used tools to ultra-shallow depths presented some challenges and required the creation or customization of equipment, the final results support such efforts and provide useful information for the understanding of complex archaeological sites encountered in the Eastern Mediterranean.

Ultimately, the results of this work can be integrated in the strategic framework of developing an effective interdisciplinary research model that could be applied to similar archaeological surveys in coastal or shallow-water environments, thus contributing substantially towards the management and promotion of the concealed cultural resources.

Best practices for Coastal Mapping and Change Detection with Remote Sensing

Konstantinos Karantzalos – Remote Sensing Laboratory, National Technical University of Athens - ATHENA Research Center

Coastal regions are tremendously important ecosystems, hosting the majority of human population, of the global trade and GDP generation. However, coastal cities and human activities such as shipping, resource extraction, tourism, transportation, logistics, renewable energy, and fishing are all putting pressure on marine and coastal areas, while climate change makes coastal regions, societies, assets and infrastructures far more vulnerable to habitat loss, pollution and accelerated coastal erosion. Therefore, accurate mapping and continues monitoring of coastal zones is of significant importance in order to survey, observe, document, surveil, track deformations and changes in 4D (space and time) concurrently onshore and offshore. To this end, in this short communication we will review state-of-the-art satellite, aerial, terrestrial, marine, submarine data acquisition systems including both robotic and manned systems, while we will refer to the cutting-edge instrumentation that can offer optical, multispectral, hyperspectral, radar, sonar, multibeam, lidar data of high geometric and radiometric quality. Moreover, we will discuss the best practices in data calibration, preprocessing, geospatial data analytics and machine learning towards accurate, high-resolution geospatial products in 2D and 3D for seamless mapping and monitoring of onshore/offshore assets. Last but not least, global mapping and change detection initiatives and products will be reviewed like those coming for the EU Copernicus Services disseminating openly land cover maps and coastal zone changes.

POSTER SESSION

The "hangars du Cavaou" (Fos sur Mer, Bouches-du Rhône, France): The First Images Conserved in the Aerophototeca's Archival Collection of the CCJ

Alessandra Dell'Anna – National Superintendence for Underwater Cultural Heritage, Italy

The importance of the Gulf of Fos, as an outpost of the city of Arles, between the Late Republican and High Imperial Age, is well known thanks to the many discoveries of submerged port structures, wrecks, and archaeological material that have been found during scientific research carried out over the year. In particular, it has resumed the study of two large buildings now called "hangars du Cavaou", which are identified in the 1960s following photographs taken from helicopter flights. In fact, the images clearly show the parallel alignments of the stone dice supports that made up the skeleton of "hangars". Although there are no structural parts, these evidences still provide the overall encumbrance of the structures. Through an in-depth study of the sources, it was possible to find unpublished images belonging to the RAF archival collection (1943-1945) of the Aerophototeca of the Center Camille Jullian (Université d'Aix-Marseille, CNRS, Aix en Provence) that had never been examined before. The information that can be obtained from the photointerpretation of these shots, made during the Second World War for non-scientific purposes, are additional data aimed at finding the still dubious function of these structures.

Chronological challenges to determine the presence of palaeochannels and the Canal of Marius in the eastern part of the Rhône delta

Joé Junker[1], Ferréol Salomon[1], Iscia Codjo-Mabic[1], Corinne Rousse[2], Grzegorz Skupinski[1], Nicolas Carayon[3], Yoann Quensel[4], Minoru Uehara[4], Claude Vella[4,] Benoît Devillers[5]

1. Laboratoire Image Ville Environnement (LIVE, UMR 7362, UNISTRA/CNRS)
2. Centre Camille Jullian (CCJ, UMR 7299, AMU/CNRS)
3. IPSO FACTO, Bureau d'étude et de recherche en océanographie et en archéologie subaquatique et sous-marine
4. Centre Européen de Recherche et d'Enseignement en Géosciences de l'Environnement (CEREGE, UM 34, AMU/CNRS/IRD/Collège de France)
5. Archéologie des sociétés méditerranéennes (ASM UMR 5140, Université Paul-Valéry-Montpellier 3/CNRS)

In 2013, the discovery of a linear feature in the Vigueirat marshes associated with archaeological findings from the Roman period renewed the debate regarding the canal of Marius, a structure dug in 104/103 BCE between a channel of the Rhône and Fos-sur-Mer, then one of the main outports of Arles. The linear feature was confirmed and followed by magnetic and tomographic surveys results. In the context of the AMU-funded Fosphora project, two geoarchaeological fieldworks were conducted in 2020 and 2021 in the Cassaïre sector to collect cores from the anomaly (Cores CAS-C1 and C2) and outside (CAS-C3). These cores were analysed at a fine scale using a multiproxy methodology and different type of materials were dated by complementary chronological methods (14C, OSL, portable OSL). These new data lead to new considerations about the landscape during the first millennium BCE. First, the results show high fluvial hydrodynamic conditions between the 9th and 3rd century BCE suggesting the presence of Rhodanian palaeochannels in the eastern part of the delta during this period. Second, the linear feature observed corresponds to a palaeochannel filled with very fine sediments from the Roman period between 355 BCE and 69 CE, possibly a canal.

Archaeological remains from the Mistras Lagoon (Sardinia, IT), harbour of Tharros during the Archaic and Punic period (7th-3rd c. BC)

Maria Mureddu – University of Cagliari, Italy

The Mistras Lagoon, in Central-West Sardinia (IT), has been identified as the harbour of the city of Tharros during the Archaic and Punic period (7th-3rd c. BC), thanks to archaeological and geomorphological investigations. The archaeological excavations, held on a sandy barrier present in the middle of the lagoon, revealed the presence of a natural stratification, typical of a marine palaeobeach. The different layers were characterised by the high presence of scattered archaeological materials including ceramics, mostly transport amphorae, archaeozoological remains, and a huge amount of vegetal remains, preserved thanks to the waterlogged and anoxic conditions. The ceramics reflect the importance of local productions, as these represent the great majority of the recovered fragments, but also the variety of imported productions arriving to Tharros from other Punic regions as well as from the Greek world. Between the vegetal remains the carpological ones,

seeds and fruits, highlight the presence of a diversified agriculture, and testify the introduction of new species. Furthermore, some of the xylological remains can be attributed to manufactured wood, attesting the use of this material for objects usually known in the ceramic repertoire, as in the case of a wooden dish, as well as the presence of rare fragments that could be attributed to boats.

The ports, a life insurance for the Greek cities? – Historical and archaeological evidence in Metaponto, Patras and Thasos

Marc Duret – Postdoc, the British School at Rome, Italy

The Greek cities around the Mediterranean were often founded on sites that were favourable for the establishment of ports. The Greek foundations of the Archaic and Classical periods thus lasted for several centuries, despite periods of crisis, warlike episodes, and strong changes in geopolitics. This study examines the very diverse economic and political fate of three Greek port cities during the Hellenistic period: Metaponto, Patras, and Thasos. To this end, the port assets of these three cities will be analysed, in connection with the organisation of their territories in the hinterland (natural resources, typology of commercial infrastructures, communication routes to the ports, etc.), which are sometimes slightly forgotten in port studies. On a broader scale, the question of maritime and land relations with neighbouring regions will also be discussed. These archaeological data will be compared with ancient textual sources and, more historically, with the political and cultural relations between these cities and the various forces at work in the Mediterranean. The guiding idea of this presentation is therefore to understand if and why the port assets of these three cities influenced their history in a Mediterranean that was in the midst of political change between the 3rd century BC and the beginning of the imperial period. Did a good port guarantee that a city would survive or regenerate despite conflicts? If not, are the causes of the decline related to port aspects (such as silting), or territorial, and/or economic questions? Should we rather look for political reasons? By adopting a diachronic and comparative approach that mixes archaeology, geography, and history, it will be possible to answer some of these questions.

The submerged MBA/LBA Aegina polis-state harbour in the Aegean Sea: The first purpose-built harbour in the Mediterranean Sea

George Ferentinos – OCEANUS-Lab, Geology Department, Patras University, Greece
Lilian Karali – History and Archaeology Department, National and Kapodistrian University of Athens, Greece

The aim of this research is to elucidate the status of the Aegina polis-state harbour in the Aegean Sea from ca. 2100 BC to 1100 BC. The harbour was most probably built in 1800 BC, when the sea level was at -3.8 m bpsl. It stretches along 1600 m of coastline and is delimited by two moles and a breakwater consisting of an array of 53 cone-shaped rubble piles with a total length of 1780 m (Fig. 1). The moles and the cone-shaped piles were about 4.5 and 8 m high, respectively. The cone-shaped piles were built parallel to the shoreline at an average distance of 250 m. at water depth of 10 m. The harbour consists of the internal harbour used for berthing and the external one used for anchoring. The former covered an area of 50,000 m^2 and could accommodate about 11 ships and the latter covered an area of 400,000 m^2 and could accommodate about 50 ships. None of the Minoan and Mycenaean harbours in the Aegean Sea or the Phoenician in the Levant had human-made structures of the above-mentioned dimensions. Therefore, it may be suggested that: (i) the Aegina harbour was an iconic human-made structure and (ii) that the Aeginetan engineers were the first to develop the "know-how" for the building of such structures.

Attic black-glazed pottery as a research source of economic relations between Olbia Pontica and Athens in Classical age.

Iryna Checulina – Institute of Archaeology, National Academy of Science of Ukraine

Trade has played a significant role in the history of the Northern Black Sea Coast since the establishment of the first Hellenic colonies on the Black Sea coast.
Olbia Pontica was located at the intersection of land and sea trade routes, so its port was a principal strategic object of the Black Sea region, as well as the destination of a significant volume of imported goods.
Olbia's foreign trade began with the founding of the earliest settlement, the emporium of Borisfen in 646 BC. Borisfen and Olbia have long been an important point on the way to other northern Black Sea ancient cities, both as a transit port and a point of further distribution of goods. The

presence of developed port facilities in both Olbia and Borisfen played a major role in this.

The emergence of systematic trade between Athens and the northern Black Sea coast took place during the first - second quarter of 6th century BC. The earliest finds of Attic vessels in Olbia and Berezan date back to approx. 580-570 BC.

Tableware, in all techniques, was part of the big cargo supplied to the North Black Sea market during all periods of time. Attic blackglazed pottery, as one of the most mass materials in Olbia, without any doubts was one of the most important groups of the pottery which were transported to the region.
For a long time, tableware was a luxury item delivered to the North Black Sea market sporadically. But over time, these ceramics became a mass-produced item, which was a separate object of trade relations.

Thus, in these terms, attic black-glazed ware played an essential role in the study of trade and economic relations of Olbia and Borisfen with Attica. Scientific research of pottery of this type allowed to demonstrate periods of increases and decreases of import level to the Olbia Pontica, which surely correlates with the period of historical development of the poleis and its connections with Athens and Attica in general.

The Missing Structure of the Al-Mina harbour

Vanessa Ayoub – M2 Student at the Master OF Maritime and Coastal Archaeology (MoMArch), University of Aix-Marseille, France

The Lebanese harbours provided the transition of merchandise between the East and the West, and the South and the North, all along the Mediterranean ancient world (Carayon 2012-2013). While Lebanese harbours, such as Tyre and Byblos, have been sufficiently studied, there still exist other harbours known all along history that have not been as thoroughly exploited. Tripoli is a city located on the Eastern Mediterranean coast, in the North of Lebanon. The name of the city 'Tripoli' first figures in Diodorus' writings, but even earlier the city was mentioned in texts that go back to the Bronze Age. Similar to other coastal cities in the Levant, Tripoli has shown signs of sea-level changes. Archaeological evidence of the ancient existence of Tripoli are scattered all around the city, especially in the Al-Mina area. However, since this city has been subject to high rates of cultural looting, exploring what we still have access to remains a necessity. Archaeological research on the coast and in the waters of Al-Mina, dating back to at least a decade, testify to a high maritime affordance of the area (See Salamé-Sarkis 1971, 1973, 1980; Amadouny 1973, 1999; and Viret 1999-2000 and 2005).

Aerial photographs of the Al-Mina peninsula from Father Antoine Poidebard in 1936 reveal an ancient portuary structure, a jetty, beneath the modern one. These structures are now invisible. However, dating harbour installations at Tripoli is quite challenging in the absence of further archaeological investigations. From comparative examples of built jetties in the Mediterranean, Viret (1999-2000: 136) suggests the 6th century AD as terminus post quem and the 13th century as terminus ante quem.

In the poster I present, I will focus on the jetty-like structure visible in the aerial photographs of 1936 by Father Antoine Poidebard, as I will highlight its former use, its possible dating as well as the causes of its gradual disappearance.

The evolution of harbours in the Eastern Mediterranean during the Classical era

Aya Helmy – Cultural Heritage (CMAUCH), Alexandria University, Egypt

Sea and seafaring had played an extensive role in building civilizations, as the sea was an essential maritime highway, particularly for the Mediterranean people. Therefore, the maritime installation sites, such as harbours, reveal a lot of information about cities and their conditions that reflected in different aspects such as trade, the powerfulness of fleets, and ships construction. Thus, by tracing the evolution of harbours on the coast of the Eastern Mediterranean, we can get evidence on the development of the cities and their powerfulness.

The Classical era indeed is an influential time in ancient history, when maritime activity was very wide and wealthy. As transportation by sea had become more important for the Mediterranean people since the 5th century BC, consequently, it reflected on the evolution of both the merchant and military harbours facilities and construction, in addition to other military sites, such as shipsheds and naval stations.

As the key theme of the conference is ancient Mediterranean harbour cities, this paper aims to present the relation between the harbours and the powerfulness of

cities on the coast of the Eastern Mediterranean during the Classical era, as well as the relation between the fleets and the gradual evolution of military harbours construction —in addition to presenting examples of military sites, such as shipsheds and naval stations. The methodology used in this study mainly depended on the excavated sites and the archaeological remains that reveal evidence on harbours and maritime installation sites, in addition to written sources (literary and historical) that complement the study of the excavated sites.

The Magdala's Harbour system: New Evidences from Cores Analysis

Andrea Bonetti, Anna Lena – University of Bologna (ALMA MATER), Italy

The ancient harbour of Magdala/Taricheae, facing the Galilea Sea (north of Israel), is the first example of a successful application of the Ancient Harbour Parasequence by Marriner and Morhange (2006) on a lacustrine coastal succession. In this work we firstly analysed the main historical sources (Flavius Jusepus, Plinius the Elder, and Stephanus of Bizantium) along with the works of Mendel Nun and Avner Raban in order to better constrain the historical interpretations of the site. Secondly, on the basis of the integration of historical interpretations with the geo-archaeological synthesis published in previous works (Lena 2013, Sarti et al. 2013, Rossi et al., 2015) we focused on the northern and eastern part of the site, believed by Nun (1989) to be protected by an ancient basin. In this still non-excavated area there have been taken two drilled cores (MVI and MVIII), from which 16 samples from different lithofacies have been chosen. The aim was to better understand the palaeoanvironment by analysing the presence of ostracodes. All the samples were prepared following a standard methodology and the fraction > 125µm was quantitatively analysed under an optical microscope. The only ostracod species founded was Cyprideis torosa (Jones 1850), and the use of bar graphs and pie charts highlight the greater presence of nodded specimens (between 60% and 88%) in all the taken samples, regardless of depth. A similar percentage ratio occurs in the current surface of the lake (Rossi V., personal communication). Through a comparison between the two stratigraphic logs, we noticed that a sedimentary facies comparable for sedimentological characteristics and ostracods content to the one found in the southern part of the site have not been found in the northern non-excavated area.

Exploitation of Different Marine Shells at the Archaeological Site of Meninx (Tunisia)

Ben Dhia Wafa – Institut Supérieur des Langues Appliquées (ISLA), Moknine, Tunisia

The poster presents the archaeological and malacological study on the development of the use of sea shells (gastropods and bivalves) and the various fishing activities (garum, salsamenta, purple dye, lime manufacturing from sea shells …) identified on the south coast of Tunisia and especially in Meninx. Meninx is an important Mediterranean town of Tunisia that has known the occupation of several civilizations since the Punic, the Roman, and until the Byzantine period.

The Oued Loukkos Survey

Athena Trakadas – National Museum of Denmark, Denmark

The Oued Loukkos is one of the largest tidal rivers on the northern Atlantic coast of Morocco. Situated presently 4 km upriver is the site of Lixus, which, during the Phoenician, Punico-Mauretanian, Roman and early Islamic periods (8th century BC-8th century AD), served as a transit point in regional marine and terrestrial communication and trade routes. Roman texts note that there was "a port" at Lixus, but whether this indicates a natural harbour, anchorage area, or built maritime infrastructure on the shore or riverbanks is far from clear. Until now, the location of possible ports and/or zones of land-marine interface at Lixus have only been hypothesised. These theories, however, assume the present location of the Oued Loukkos and do not consider almost three millennia of riverine migration and coastal progradation. In order to contextualise the topography of the site, and further understand the nature of this ´port´ within a dynamic riverine context, the Oued Loukkos Survey (OLS) investigated the lower Loukkos basin between 2009 and 2015. Using a multidisciplinary methodology of archaeological, terrestrial/marine geological, and hydrographic survey, the project sought to address the following questions:

- What was the past coastal and/or riverine environment of the region, and where were land/marine interface activities?
- Were there anchorage and/or beaching zones or built port/dock facilities?
- How has the environment changed over time?

This poster will present the methodologies applied, and the survey's findings. Characterising the Loukkos river basin's environmental history greatly contributes to the understanding of the rise and abandonment of the site of Lixus, and also provides a picture of the human place within the changing riverine-maritime landscape.

Trade contacts between the Mediterranean and the Black Sea in the late Byzantine period according to the glazed pottery distribution routes

Yana Morozova, Mariia Tymoshenko, Sergii Zelenko – Centre for Underwater Archaeology and Archaeological Research Taras Shevchenko National University of Kyiv, Ukraine

Glazed ware is one of the important indicators of international trade because it has been found on almost all archaeological sites of the Byzantine era.
The presentation offers the results of the study on the archaeological assemblage of glazed ware from the cargo of the 13-century shipwreck "Novy Svet", found in the coastal waters of the south-eastern Crimea.
An outstanding feature of this assemblage is the wide range of vessel classes, types and styles, including rare and unique samples that constitute the corpus of the imported ceramic from many Mediterranean regions. The phenomenon of the Novy Svet glazed pottery assemblage makes it significant for studying the late 13th-century large-scale sea trade and distribution of ceramics in the Black and Mediterranean regions.

The main goal of this research is to show the distribution of glazed pottery over the Black Sea region in the 13th century by sea, and correlate it with known production and consumption centres in the Mediterranean region. Where the glazed ware from the Novy Svet shipwreck could originate from? What could be the ports of its destination?

Re-assessing the submerged harbour-city of Plytra, South Peloponnese

Vassilis Papadakis[1], Despoina Koutsoumba[2], Jafar Anbar[3], Judith Gatt[4], Kalliopi Baika[5]

1. Maritime Archaeologist, Research assistant - H2020 NEANIAS project, Master of Maritime and Coastal Archaeology (MoMArch), Aix-Marseille University
2. Ephorate of Underwater Antiquities, Greece
3. PhD candidate in Maritime Archaeology – CIVIS joint PhD degree, Aix-Marseille University and National and Kapodistrian University of Athens, Honor Frost Foundation scholar
4. PhD candidate in Maritime Archaeology – Joint PhD, Aix-Marseille University and University of Cyprus, Honor Frost Foundation scholar
5. Associate Professor in Mediterranean Maritime Archaeology, Aix-Marseille University, Scientific coordinator of MoMArch (Master of Maritime and Coastal Archaeology) – Institute ARKAIA, Centre Camille Jullian (AMU-CNRS-INRAP)

The research examines the archaeological site of Plytra, a semi- submerged harbour city in the SE of Peloponnese, in Laconia Gulf in Xyli Bay. Pausanias is the first who referred to this site, defining the location of it, as being part of the free Laconian League, which aimed to achieve economic freedom and prosperity. A thriving community, with intense religious and commercial life created from the Hellenistic times, flourished during the Roman period, while the use of the site continued during the Byzantine period, mainly as a burial area. Until now, the location of possible port(s) zones has only been hypothesised, with some architectural remains suggesting the potential location of them. Furthermore, natural and anthropogenic factors have caused significant changes in the current shoreline. In order to clarify and approach the nature of this site, a preliminary study was initiated in 2022, focusing on the study of the evolution of the maritime landscape of the site, as well as the mechanisms of coastal erosion and local tectonic activities through the use of new documentation techniques. This poster will present the first results of this survey, which complement the first observations, carried out mainly, in the coastal area. Future research in the area may shed light to the importance of the ancient Asopos in the commercial activity of the Peloponnese, as well as the reasons of the decline of the harbour site after the Roman period.

Shipbuilding and Repair Tools as an Understanding-key of the Evolution of Ancient Mediterranean Shipbuilding and Craftsmen Gestures

Manuel Berenguel – PhD Candidate, University of Le Mans, CReAAH (UMR 6566), Department of History, University of Haifa, Israel, Department of Maritime Civilizations, Rennes, France

Although shipbuilding was a recurring activity of the ancient harbours, only few archaeological structures have been interpreted as shipyards, such as the remains of a boat

construction facility from the 4thcentury BCE which was found in Marseille (Hesnard 1994, 203–4). Shipwrecks itself as the structure, the repairs and tool marks, but also their on-board equipment, such as repair tools, therefore constitute the main source of knowledge for the shipbuilding practices and evolutions.

The comparison of architectural characteristics of the shipwrecks is precisely the key of the actual classification of ancient shipwrecks, as the evolution groups defined by P. Pomey, and which describe the progressive shift from sewn fastening system to the pegged tenons and mortises fastening system (Pomey 2009; 2010). Furthermore, to improve this knowledge, the study of iconographic and literary sources describing ship construction scenes can be very instructive, especially by their ability to help filling the archaeological gaps especially since shipwright's tools have rarely been studied as a whole, a toolkit, with the exception of the work of E. Maragoudaki (i 2010; 2017) As part of a PhD carried out since 2020, a synthetic and multi-source study of the ancient shipbuilding tools, it was highlighted not only the specificity of shipwright toolkit in comparison to the "land" carpenter, but also some geographical and/or chronological patterns in the composition of the toolkit of the shipbuilders, which are related to the evolution of
shipbuilding techniques. In addition, this study also provides valuable data to conduct further experimentations to better understand the tools found in shipwrecks, as well as information concerning the specialization degree both involved during construction and depending on the different types of repairs made through the live of the ship.

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Shipwrecking probability and coastal attractiveness: a GIS-based predictive model

Manuela Ritondale – Postdoctoral Research Associate, The Glasgow School of Art, School of Simulation and Visualisation, Scotland

poster session

This thesis presents a formal approach and a GIS-based methodology for the assessment of the shipwrecking probability in Mediterranean territorial waters, thus addressing the underdevelopment of archaeological predictive models in the maritime domain, particularly in the Mediterranean region. As archaeological predictive models are often criticised for oversimplifying complex historical phenomena to produce quantifiable outcomes, this study focuses on two different scales of analysis to meet the need for both a general tool applicable to spatial planning and a more detailed one providing insights for historical and archaeological research. First, a regional-scale model is developed, which focuses on navigation dynamics in the area between Cap Bon (present Tunisia) and Alexandria (present Egypt) in Roman times. Then, this model is extended to all Mediterranean territorial waters in a simplified version and without chronological limitations. At both scales, the criteria for selecting the input factors are formalised. In order to identify areas with higher shipwrecking probability than others, two sub-questions are addressed that correspond to separate model components: 1. Where would ships be more likely to transit? 2. Where would ships have a higher risk of sinking? Grounding the theory-building on a systematic screening of accounts by primary sources, the first model component derives transit probabilities by considering multiple, oftentimes competing, criteria that trigger and affect mariners' movements, including in particular the effects of risk perception - thus rejecting the idea that sailors would necessarily choose the optimal or most efficient route. The

second model component includes environmental hazards objectively increasing the risk of sinking. Given the many elements of uncertainty and subjective reasoning behind the model building - a problem often unheeded in archaeological computational modelling - an entire chapter is devoted to a sensitivity analysis of the model and the exploration of diverse model scenarios. The overall methodology attempts to overcome some of the main pitfalls of current modelling approaches to seafaring and to shipwreck locations, namely the inductive use of shipwreck data without a formal exploration of data biases, and the predominant reliance on environmental and economic input variables to the detriment of cultural and cognitive factors. This study suggests that by explicitly differentiating between actual and perceived risks, and accounting for the effects this difference produces in terms of variations from the optimal navigation corridors, the predictive ability of the model increases. While constituting a valuable tool for optimising maritime spatial planning and archaeological investigations, this model also offers insights into the biases in current shipwreck data. The model furthermore provides an adaptable toolkit applicable to other geographical contexts and chronological periods, and a suitable basis for expansion with a future component by modelling post-depositional dynamics that affect the preservation and detectability of wrecks at local scales.

Harbour studies along the Firuzköy Peninsula, Istanbul. Traces of Early Ottoman activities in the surroundings of Constantinople

Alkiviadis-Alexandros[1] Ginalis – Curator for Late Antique and Byzantine Archaeology-Head of Photograph collection and Institute's archive - German Archaeological Institute
Şengül Aydıngün – German Archaeological Institute

Since 2021, the Istanbul Department of the German Archaeological Institute (DAI) is investigating the coastal zone of the Firuzköy peninsula in order to illuminate the maritime connectivity of the Küçükçekmece Lake within the wider harbour network along the Thracian coasts.
As such, in cooperation with Kocaeli University a first field campaign was carried out at the small harbour area, the so-called Küçük Liman. The investigation focused particularly on a detailed archaeological and architectural examination of a 15 m long and 2.65 m wide central jetty that leads into the lake. In the course of excavation works its entire profile was uncovered, which offered detailed insight into the construction technique of the mooring facility. Similar to the descriptions of Vitruvius and Procopius on harbour architecture of the Roman Imperial and Byzantine periods, the remains of wooden posts as well as parts of wooden planks indicate the existence of a caisson that framed a solid and homogeneous foundation for the superstructure of large ashlar blocks. However, both the archaeological material used for the filling of the wooden formwork, and C14 analysis of the wooden posts provide a terminus post quem of the Early Ottoman period.

The site thus provides rare evidence for the continuation of Roman traditions in harbour construction beyond Byzantine times.

Harbours of Lavreotiki, the silver-mine area of Attica, Greece: Recent underwater research

Kalliopi Baika[1], Despoina Koutsoumba[2], Jafar Anbar[3], Labrini Tsitsou[4], Tiffany Kirschenmeyer[5], Marina Papanikolopoulou[6], Vassilis Papadakis[7]

1. Associate Professor in Mediterranean Maritime Archaeology, Aix-Marseille University, Scientific coordinator of MoMArch (Master of Maritime and Coastal Archaeology) – Institute ARKAIA, Centre Camille Jullian (AMU-CNRS-INRAP)
2. Ephorate of Underwater Antiquities, Greece
3. PhD candidate in Maritime Archaeology – CIVIS joint PhD degree, Aix-Marseille University and National and Kapodistrian University of Athens, Honor Frost Foundation scholar
4. PhD candidate in Coastal Geoheritage – Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement (CEREGE), Aix-Marseille University
5. Master of Maritime and Coastal Archaeology (MoMArch) Alumna
6. Master of Maritime and Coastal Archaeology (MoMArch) Alumna
7. Maritime Archaeologist, Research assistant - H2020 NEANIAS project, Master of Maritime and Coastal Archaeology (MoMArch), Aix-Marseille University

In 2019 and 2020, an underwater archaeological investigation was initiated at a series of harbour sites of Lavreotiki by the Ephorate of Underwater Antiquities of the Greek Ministry of Culture in collaboration with Centre Camille Jullian (Aix-Marseille University-CNRS-INRAP).

The objective of this recent underwater research was the systematic archaeological documentation of the visible submerged remains of harbour-cities of the Lavreotiki area. The starting point of the research was the rescue documentation survey at Palaia Phokaia (mod. Anavyssos, probably the ancient *Anaphlystos*) that was initiated in 2015 by EUA. The submerged antiquities are lying today under the modern fishing port, while plans for further extension of the modern port facilities are now under consideration.

More sites were investigated around the Attica coastline at the urge of immediate documentation, as the sites are under anthropogenic pressure, such as
heavy touristic activities and anthropogenic impact. These included Passa Limani bay at Lavrion (probably ancient *Poseidonia*), Pounta Zeza bay (probably ancient *Porthmos*), the submerged fortification of *Thorikos* at the peninsula of Aghios Nikolaos, and Sounion Bay.

In a wider perspective, the research aims at the reassessment of the role and importance of the harbour-cities that served the silver mine area of Lavreotiki; how their industrial role influenced their design and function at the Attican maritime landscape and their diachronic evolution.

Finally, the research aims to feed the continuous study on the relative sea-level change in the Attico-cycladic massif.
Methodologically, after the creation of a DGPS network at all harbour cities, the study focused on the detailed 3D documentation of all visible underwater structures with Total Stations and underwater and drone aerial photogrammetry (by the Laboratory of Remote Sensing of the National Technical University of Athens), as well as marine survey of the seabed by robotic systems conducted by the National Kapodistrian University of Athens. For each site a GIS database was created where all information was integrated (QGIS software).

The documentation performed for all sites was not completed. Thus, all observations and conclusions are preliminary.

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