

Bar, Amir

The ballast stones from the Akko Tower Wreck, Israel

Ballast is a quite neglected subject in shipwreck archaeology. However, ballast stones can be a significant find, which may reveal answers to archaeological questions once evaluated and integrated with other information. An example for this research approach is the Akko Tower Wreck. This shipwreck is the remains of a 25-m-long merchant brig, dated to the first half of the 19th century, located inside Akko harbour. Underwater excavations were conducted on the site in 1975 by the late Professor Raban, and in 2012–2016 by Dr. Cvikel of the Leon Recanati Institute for Maritime Studies of the University of Haifa. The ship's timbers were covered with about 50 tons of dark grey marlstone to argillaceous limestone with white calcite veins, apparently ballast.

This would have been an adequate weight of ballast for a brig of this size. Petrographic studies of stone samples, including optical microscopy, X-ray diffraction, and scanning electron microscopy, showed the presence of calcite, quartz and clay minerals (illite and chlorite) in all samples, and small amounts of dolomite in about half of them. The results confirm the homogeneous composition of the stones, which are not of local eastern Mediterranean origin. Although a certain origin cannot be suggested for the stone cargo, rocky outcrops of similar morphology exist on several coasts along the northern Mediterranean and Black seas.



Diver recording the Akko tower shipwreck. (Photo: A. Yurman).

Bram, Moshe

Re-evaluation of the production method of the Khufu-1 sheer strake

Khufu-1(the Royal Ship of Cheops) was dated to the mid-3rd millennium BC. It was found in 1954, just south of the Khufu pyramid, as a kit from which the restoration team, led by Hag Ahmed Youssef Moustafa, assembled the ship over the following 15 years. This impressive ship, which is 43 m long, is now on display at the museum located at the site where it was found (*Figure 1*). There are two sheer planks, one on each side: 23 m long, and maximum 0.4 m wide and 0.14 m thick (*Figure 2*). These planks were cut from cedar (*Cedrus libani*) imported from Lebanon, some 320 NM of sailing along the eastern coast of the Mediterranean from Lebanon down to Alexandria in Egypt.

According to scholars who studied this ship, the sheer planks which have the shape of a twisted arc in order to fit the hull, were produced from the trunk by carving, not bending. Given that cedar wood was imported and expensive in Egypt, the choice of the carving technique was odd, and above all, would yield a plank weaker than one bent from a straight timber.

The two production techniques (carving and bending) were compared, and it was found that bending was superior. It is also suggested that towing of the beams in the sea was the method for preparation for bending the timbers.



Figure 1: Khufu-1 ship as displayed in the museum

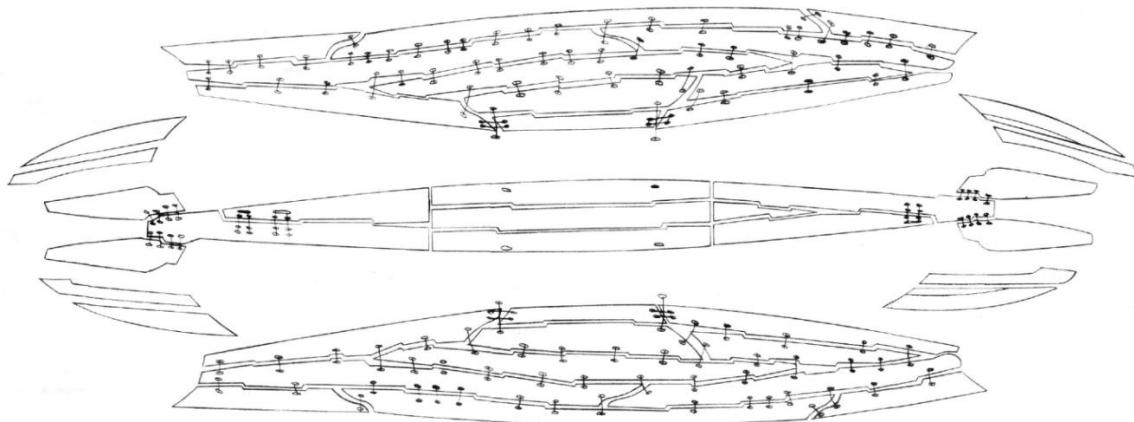


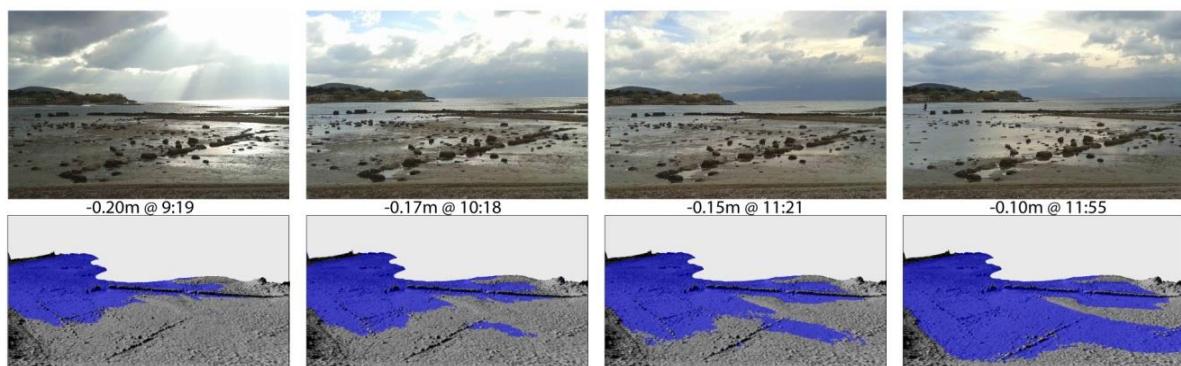
Figure 2: Plank diagram of Khufu-1

Cantoro, Gianluca; Papadopoulos, Nikos; Simyrdanis, Kleanthis and Oikonomou, Dimitrios

Rapid archaeological mapping in shallow water contexts: The contribution of low-end equipment and photogrammetry

The investigation of submerged archaeological contexts is not a trivial task, since it normally involves the use of expensive equipment and is often limited by practical issues (*i.e.* scuba diving equipment duration/capabilities, water turbidity, seabed nature, sea movements). New and technologically advanced entry-level equipment, combined with improved processing capabilities of average computers, constitute nowadays a good support in facilitating such routine operations that can offer chances to extract information from digital material acquired with low-budget devices or intended for mere documentation purposes. Even the required skills for operators are rapidly diminishing, making it possible for non-computer-experts to undertake the full flowchart from survey planning, data acquisition and processing, as well as output production.

The paper presents a number of applications undertaken in two archaeological sites in Greece in submerged contexts between the waterfront and 3 meters water depth. Here, archive materials, low-altitude photographs with compact camera and amateur RPAS, and underwater videos made with common action cameras have been exploited to produce extensive or localized 3D documentation of different seabed for the purpose of the ongoing research programs. Despite the low acquisition time on site and the non-professional equipment, the results open new frontiers in the rapid archaeological mapping of submerged contexts and stimulate the development of low-budget equipment or procedures to simplify and automate the processing in favor of operator's reduced skills.



Time sequence of ground photograph looking South-East of the area of investigation during water rising.

Cohen, Maayan (vorgetragen von Creisher, Michelle)

The Ma'agan Mikhael B Shipwreck, Israel

The Ma'agan Mikhael B shipwreck was discovered off the coast of Israel in 2005. It has so far been excavated for five seasons (2016–2018) by the Leon Recanati Institute for Maritime Studies of the University of Haifa. A significant portion – 19.6 m long and 4.9 m wide – of the wooden hull survived.

The shipwreck lies in 3 m of water, buried under 1.5 m of sand. The hull remains are in a good state of preservation, comprising the endposts, framing timbers, hull planks, stringers, bulkheads and a mast-step. The two main species used for the construction of the ship are walnut and fir.

The finds include rigging elements, wooden artefacts, organic materials, animal bones, coins, bricks, stones, ceramic sherds, and complete amphoras. The ship was dated by 14C AMS analysis and typological study of the ceramic ware to the 7th–8th century AD, the late Byzantine–early Islamic period in the region.

The process of the transition in ship construction from “shell-first” to “frame-first” has been a major topic in the research of shipbuilding for many years. It was widely accepted that the transition was completed by the beginning of the 2nd millennium AD. However, discoveries in recent years point to a significantly earlier date for the transition. The study of the Ma'agan Mikhael B shipwreck is revealing new information regarding its shipbuilding technique and tradition, leading to a better understanding of its place in the transition.

Dündar, Erkan

The Maritime Trade of Roman Patara

Preliminary Remarks on the Transport of Jars and Stamped Amphorae

Located on the Lycian coast in southwest Anatolia, Patara furnished merchant cargo ships one of the most sheltered harbors of ancient times. The archaeological finds unearthed at Patara demonstrate that the city and its harbor became an important node in the maritime commerce between the Aegean and the Eastern Mediterranean. During the Roman Era, Patara became the capital of the Roman province of Lycia et Pamphylia Province furnishing it with heightened commercial and political status. The commercial data for Roman-era Patara arises mainly from a large number of commercial amphorae and stamped amphora handles recovered during the excavations.

In this study, I will furnish some preliminary observations about Roman-era amphorae finds at Patara. Thus far we have identified commercial jars originating from 34 different regions and urban production centers at Patara. Particularly following Lycia's incorporation as a Roman province by the Emperor Claudius in 43 AD, Patara began to display commercial ties with distant production centers – in sharp contrast with its commercial ties during the Hellenistic Period. Like the Hellenistic era, Patara remained primarily connected with commerce in the Aegean Basin. However, during the Roman era, Patara supplemented this trade with imports from Cilicia, Palestine and Egypt to the east and Tyrrhenia, Narbonensis, Baetica, Lusitania, Mauritania Caesariensis, Tripolitania and North Africa to the west. The range of these contacts reflects the settlement's new status as a provincial capital during the era of the Pax Romana.

Erič, Miran; Puhar, Enej Guček and Solina, Franc

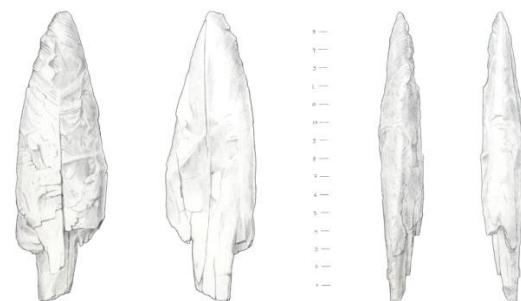
The necessity of changing methodology of preserving waterlogged wooden object: The case of a Palaeolithic wooden point from Ljubljanica River

In the last decade, we have witnessed a revolutionary development of digitally supported information and computer technologies that enable us to acquire highly accurate models of different aspects of the environment. Through advanced technology of three dimensional (3D) printing, it is now possible to reproduce small and large artefacts with high precision and hence reproduce objects at a user selected scale.

The article describes the case of comparison and analysis of five 3D models of the hunting tool from the Ljubljanica River found near Sinja Gorica. The 40,000 years old Palaeolithic point, was made out of yew wood. Five 3D models of the point were taken throughout ten years, two before and three after the conservation process. The comparison of the 3D models serves two purposes. The primary goal is to evaluate the changes of the artefact that occurred during this period and, accurately, to compare its shape before and after the treatment. Conservation of waterlogged wood is still a delicate and somewhat uncertain process in regards to the long-term survivability of such artefacts.

The second goal is to asses which software tools are currently available for such comparison, what are technical problems, that need to be addressed and how to effectively present or visualise the sometimes small but critical changes of shape.

To educate the general public about the technology and objects used in the past, a certified copy of the object based on available 3D technology can provide a convenient and less expensive way to reach the same goal. At the same time, it is not necessary that the owner of valuable objects give up the possession of those objects which reduces the risk of their damage. Most importantly, it allows the primary object to stay in the original place which gave in the past the necessary environment for its preservation and enables further scientific study on unperturbed objects. We must rethink therefore the philosophy and ethics of conservation and implement new concepts of preservation and presentation of wooden artefacts for educational purposes which remains the mission of any museum.



Archaeological drawing of Palaeolithic wooden point from Ljubljanica river (Draw by Iva Patarčec; Arhos).

Erič, Miran and Gorica, Sinja

The significance of a detailed analysis of the cloud of points from the 3D model which stores the data that the human eye can overlook:

The case of a flat-bottomed ship from Ljubljanica river

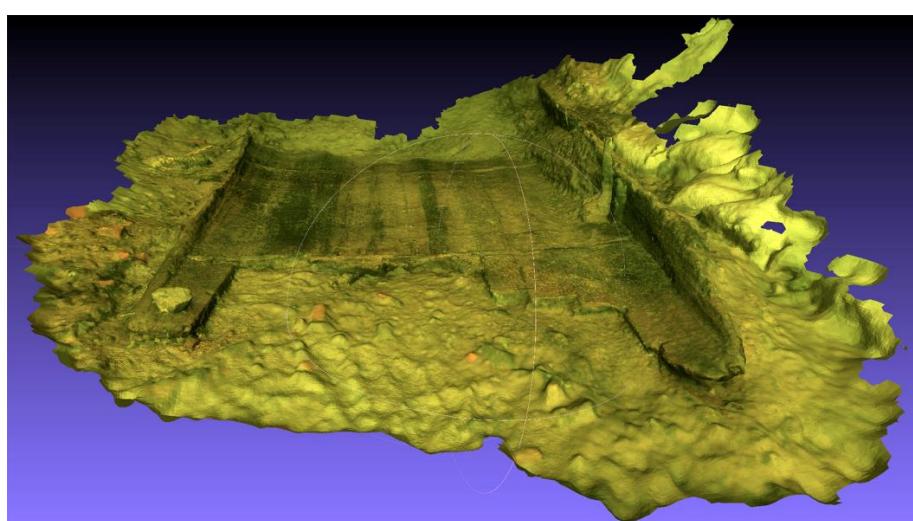
Ljubljanica river near Sinja Gorica (Vrhnik, Slovenia) keep in situ a partially researched (2008, 2012) extraordinary Roman flat bottom cargo ship from the first half of the 1st cent. AD. To the common knowledge of navigation on rivers during the Roman Empire in contrast to the most other flat-bottomed Roman ships around Europe, the ship from Sinja Gorica contributes an extraordinary, particularly interesting, solution to the strengthening of the ship's construction.

In that time it is an entirely unknown solution of the structure in the form of slender bottom timbers hidden in a cross-section groove in bottom planks and continuing through the chine-girder of the ship. Another feature of the ship is that it was almost entirely constructed of beech wood, which is rarely used at this time. The documentation that was carried out during the research is based on 3D photogrammetry with a range of 900 images.

After the publication (Erič et al., 2014), an accurate comparative and research analysis

of the 3D model has performed again, to find out through the point cloud it is possible to expect information on the construction that was or could be overlooked during the fieldwork. Through the majority of filters used, we discovered on the 3D model very unexposed bottom slide on the surface of the wood that could not be detected during the fieldwork. Between two bottom timbers, 180 cm (6 Roman PES) apart, we discovered a very shallow, no more than 2-3 mm transverse edge of the depression in the wood at a distance of ~28 cm from the timber. The area of the depression on the surface then continues ~125 cm to the next timber.

From the recognised mark in the point cloud, could be concluded that the wooden surface of the bottom planks was heavily overweighed. Therefore, it can be concluded that the wooden container for the bulk cargo was the permanent equipment of the ship from Sinja Gorica. The purpose of the shipping container, therefore, be compared with some similar solutions, such as Arles Rhone 3.



3D model of the flat-bottomed Roman Age ship from Ljubljanica river produced 2012.

Friedman, Zaraza

Contact Zones: Activities carried out nearby river bank, sea shore and inner harbor

The sea, lakes and rivers are vital contact zones between overseas trade, cultural diffusion, exchange of people and ideas.

The present paper will bring into discussion pictorial evidence of contact zones and the related activities carried out in these zones. The Nile River is a major line of contact zones as evidenced by the diversity of activities carried along the river and its Delta, and the Mediterranean Sea. These activities will be shown through some mosaic surfaces dating from the end of the 2nd century BCE to the 6th century CE.

Some activities carried out in varied contact zones will be referred to: the symbolic representation and vital importance of the nilometer to indicate the optimal flood level of the Nile, water transport of people, hunting and fishing, and trade in the Delta during the flood period, are represented in the Palestrina mosaic, Italy; Beit Leontis at Beit Shean, Israel and Haditha mosaic, Israel. The contact zones of the seashore and the inner harbors are represented in some mosaics from Sousse, Tunisia; Rimini, Italy; Kelenderis, Turkey; Ostia, Italy; Piazza Armerina, Sicily.

More is to be learned about contact zones and its diverse aspects.

Gerasimov, Vyacheslav and Reyda, Roman

Forschungen der Internationale Unterwasserarchäologische Schwarzmeer Expedition in der Ukraine in 2018.

Entdeckung von antikem Schiffswrack aus dem späten 4. anfangs des 3. Jahrhunderts v. Chr.

In der Saison 2018 führte die Internationale Unterwasserarchäologische Schwarzmeer Expedition des Instituts für Archäologie der Nationalen Akademie der Wissenschaften der Ukraine (Kiew) und des Instituts für Archäologie der Warschauer Universität (Polen) Unterwasserarchäologische Forschungen im Schwarzen Meer um die Tendra -Nehrung in Kcherson Gebiet und um die Kinburn-Nehrung im Mikolaiv Gebiet in der Ukraine durch.

Im Wasserbereich der Tendra -Nehrung enthüllte die Expedition vier Unterwasserarchäologische Objekte in Tiefen von 3 m bis 12,5 m.

Im Bereich der Kinburn- Nehrung wurde ein antikes Schiffswrack aus dem späten 4. anfangs des 3. Jahrhunderts v. Chr. entdeckt und erforscht.

Man konnte einen gut erhaltenen hölzernen Schiffsrumph von 9,45 Metern Länge mit Ballaststeinen und Keramischem Material von der Ladung, Fragmente der Bleihülle und Elemente der Konstruktion des antiken Segelboots dokumentieren und teilweise heben.



Gorbunov, Pavel and Tsarenko, Sergey

Underwater archeology in the water area of medieval Kaffa and Sugdeya.

The Black Sea coast was a place of political and commercial interests a lot of states in the Middle Ages. The maritime trade in the Black Sea was almost entirely under control of Italian merchants by the 13th century.

One of the most interesting and perspective regions for underwater archaeological researches in the Black Sea, is the south-eastern coast of Crimea. The city of Sudak (Sugdeya, Soldaya) located in this region, experienced a period of prosperity in the 12th–13th centuries and actually was the main trade city of the Crimea. The Genoese established their trading post at Caffa (Theodosia), as opposed to the Venetian Soldaya, at the end of the 13th century. After that, the center of trade has gradually moved to Kaffa. Medieval Kaffa became the largest city in all of Eastern Europe, and had a harbor closed to the north and west winds, which could accommodate up to 200 ships at once.

Various underwater archaeological expeditions have been fruitfully working in the shelf zone of these port cities since the 1980's.

An archaeologist have determined the boundary of archaeological material in the port area of the Genoese fortress of Sudak, and also they have discovered and investigated two medieval shipwrecks nearby.

The water area in the Koktebel's Bay was interested of underwater archeologists in the reason of the search for location of ancient Athenaeum, medieval Full, and the Venetian harbor of Callier. The port's water area under the Tepseny hill gives finds of ceramics of the 9th–13th centuries.

Underwater archaeologists are also actively exploring the port area of the medieval Kaffa and its environs.

Annual underwater archeological research allows us to find sources confirming active trade of Crimea with the countries of the Mediterranean and the Black Sea area in the Middle Ages, and also it is make a feasible contribution to the protection of the underwater cultural heritage and the compilation of the archaeological map of this region.



Held, Winfried; Özdaş, Harun and Kızıldağ, Nilhan

Coastal Survey at the Karian Chersonesos

The paper presents the results of a preliminary season of the new project “Coastal Survey at the Karian Chersonesos”. It focusses on the transitional zone between land and sea, and combines methods and specialists of land archaeology, underwater archaeology and physical geography in a new interdisciplinary research concept.

During a two-week-season in 2018, several ancient sites in the area have been visited. The paper focusses on one of the sites, the area of Söğüt-Ortaca. One find place consists of five large piles of rooftiles, amphorae and other pottery of the 3rd c. BC located close to each other in shallow water. They could be interpreted as submerged storing place for pottery which was produced in the northern part of the Chersonesos, or sunken ships. The latter interpretation would point towards a catastrophe which caused the contemporary wreckage of five ships, perhaps through a large landslide.

The second find place is part of the necropolis of ancient Thyssanous where the tombs were aligned along the shoreline which according to ancient tradition of the placement of tombs characterizes the shore as line of traffic to the ancient town. Here we can trace close to each other two Hellenistic grave terraces, one Roman built tomb, and a Byzantine church.

All findplaces give evidence on ancient sea level change and/or depend on this knowledge for the interpretation of the findings and context.

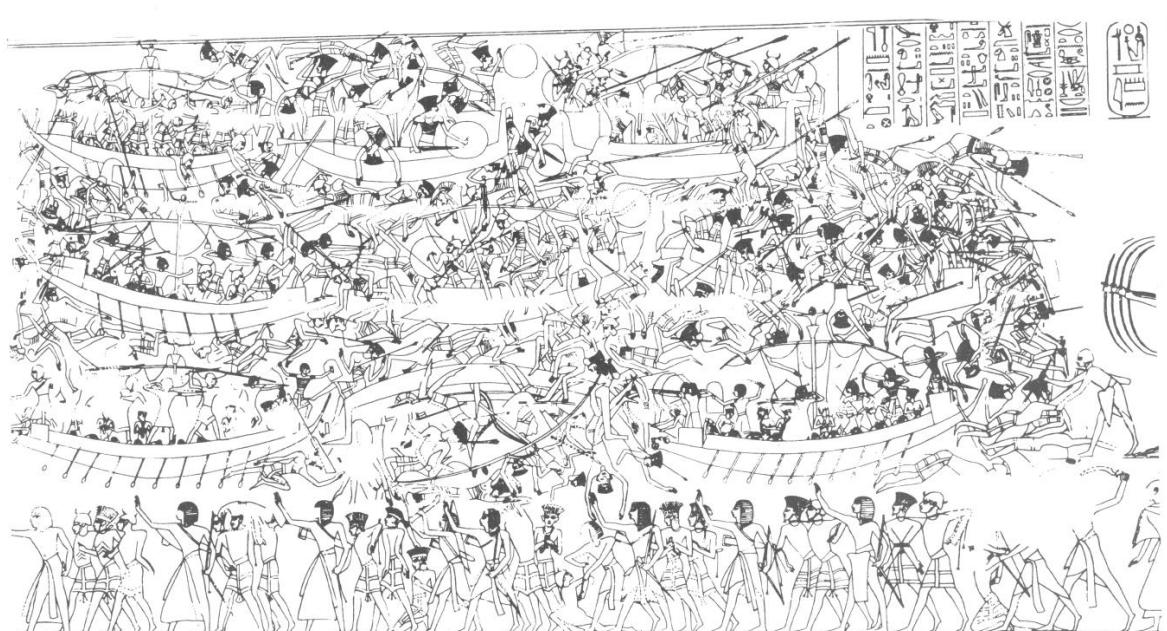
Hristov, Hristomir

Die Seevölker. Überlegungen zu ihrer Herkunft.

Die Angriffe der Seevölker führten zu vielfältigen Umwälzungen in der Welt des Ostmittelmeeres an der Wende zwischen der Spätbronze- und der Früheisenzeit. Neuere Forschungen haben schon darauf hingewiesen, dass es sich dabei eher nicht um Piratenzüge, sondern vielmehr um eine planmäßig ausgeführte Expansion gehandelt haben könnte, die entsprechende Erfahrungen und Eigenschaften im Kriegswesen voraussetzt und zweifelsohne im Kontext des allgemeinen Umbruchs im Ostmittelmeer um 1200 v. Chr. zu betrachten ist.

Obgleich über die Identität mancher Seevölker in der Forschung schon weitgehend Einigkeit besteht – so stellen beispielsweise die Lukka die Lykier dar –, ist die Identifizierung anderer immer noch heftig umstritten.

Im Vortrag werden die Ergebnisse der neuesten interdisziplinären Forschungen des Autors über die Herkunft der Seevölker dargelegt, die sowohl die sprachliche als auch die archäologische Überlieferung einbeziehen, und zur Diskussion gestellt.



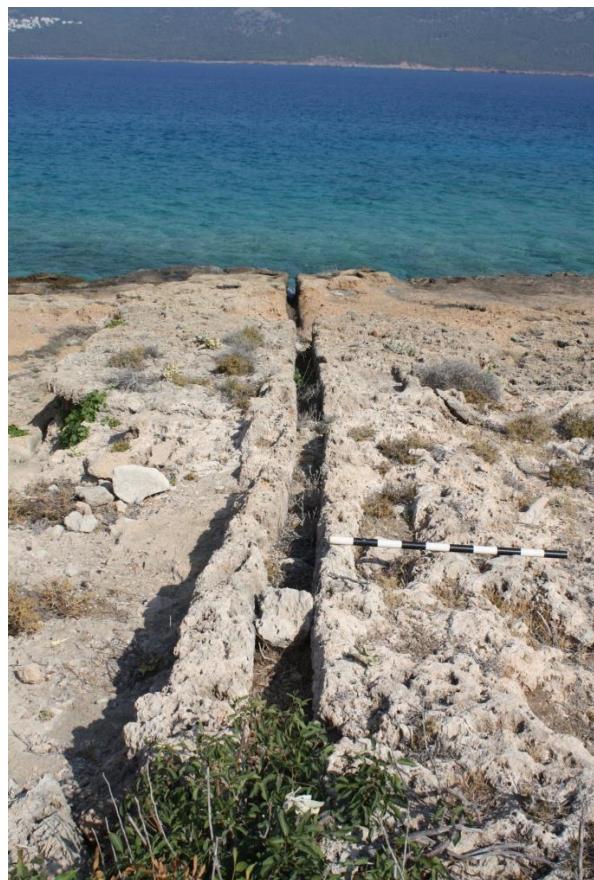
Jones, Michael R.

Evidence for Coastal Quarrying Documented by the Boğsak Archaeological Survey (BOGA) in Eastern Rough Cilicia, 2016-2018

The Boğsak Archaeological Survey (BOGA), directed by Günder Varinlioğlu of Mimar Sinan Fine Arts University, focuses on a 20-km long section of the coast and hinterland of the Bay of Taşucu southwest of Silifke (Mersin province, Turkey). The survey area's mountainous coastline includes several mainland harbors and four islands with significant archaeological remains; while pre- and post-Roman architectural remains consist primarily of fortifications, dense coastal settlements were constructed in the late antique period at several sites, particularly on the islands of Boğsak and Dana. Since 2016 the project has investigated rock cuttings and coastal remains at Dana Island, Boğsak Bay and Boğsak Island, and other locations in order to document evidence for ancient maritime activity. This paper presents a brief overview of rock-cut shoreline features in the survey area at two sites, Dana Island and Boğsak Bay, based on three seasons of fieldwork (2016-2018).

Although this evidence presents difficulties in dating and interpretation, quarry faces, trenches, and other rock-cut features along the shores of Dana Island and Boğsak Bay suggest that the export of limestone blocks by sea was a significant local industry, particularly during the 4th to 6th centuries AD when coastal settlement activity peaked in the region.

This boom in economic activity may be related to a number of factors, ranging from local and regional demand for building stone to increased traffic related to the *annona* trade with Constantinople.



Kocak, Mustafa

Remains of Possible Ship Sheds in Patara.

In the spring of 2018 few inconspicuous column shafts have been discovered on the flat promontory which was limiting the inner harbour of Patara from the west. The setting of these *in situ* column shafts on that area – in particular their relationship to each other – leads to assumption they must be the remains of ship sheds. If this assumption is true, it is a very good evidence for the thesis of earlier archaeologists like Max Kunze who considered the inner harbour as “*Militärhafen*” (military harbour).

Furthermore, it sheds new light on the architectural situation in that area. Now, in consideration of other architectural remains in the vicinity (especially recently discovered tower at the entrance of the inner harbour), this paper wants to discuss the defence system of Patara harbour from the Hellenistic to the middle byzantine time.



One of the before-mentioned column shafts.

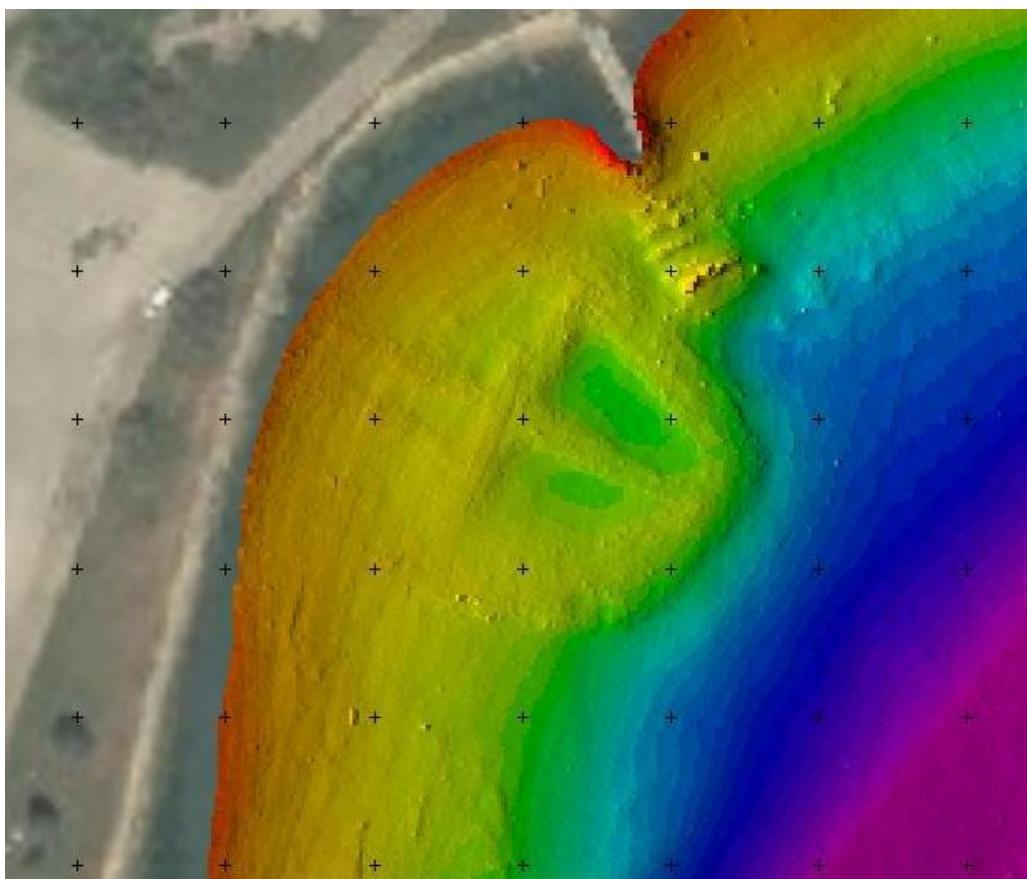
Koncani Uhač, Ida; Carre, Marie Brigitte and Uhač, Marko

Aquaculture structures in Roman Histria

In the Istrian underwater (Istria, Croatia) several Roman archaeological sites related to the exploitation of marine resources have been documented. Along with the previously known data on the existence of several fishponds on the western coast of the region, mostly discovered by archaeologists up until the middle of the 20th century. The extensive underwater investigations conducted over the last two decades pointed to the existence of an even greater number of structures linked to aquaculture. Some architectural complexes have been detected with the use of digital aerial photographs while sites with poor underwater visibility were mostly detected by non-invasive methodology (multibeam survey and other techniques).

In this group, several facilities have been archaeologically investigated (Kupanja, Busuja and Bijeca), which provided new insights into this type of economic activity in the ancient Histria, in terms of typology and technical characteristics.

The collected data highlights the activities of aquaculture along the coast of Histria, which is important for the better understanding of the economy and hydrological features of the region in Roman period.



Multibeam fishpond

Kotula, Andreas

The Stone Age site Dąbki, Poland

Structure and taphonomy of a lake shore settlement zone

The site of Dąbki in northern Poland close to the Baltic Sea is crucial for the understanding of the introduction of pottery among hunter-gatherer societies and the development of the Funnel Beaker Culture in Northern Europe. The settlement was situated close to the shore on an island in a palaeolake that later developed into a peat bog environment. The site is characterised by rich find layers in the bog close to the former lake shore. During a Polish-German project the documentation of site research since 1979 was integrated into a GIS to examine the structure and use of the lake shore zone by the settlers.

Due to the importance of the site chronology with settlement from the Late Mesolithic into the Neolithic Funnel Beaker Culture, the peatbog stratigraphy was also closely examined by GIS-analyses (Fig. 1). Spatial analyses of different find materials helped characterise the utilization of the shore zone and address taphonomic agents affecting the archaeological record (Fig. 2). The methods and results are of importance for the interpretation of Stone Age lake shore settlement research targeting settlement structure and site taphonomy.

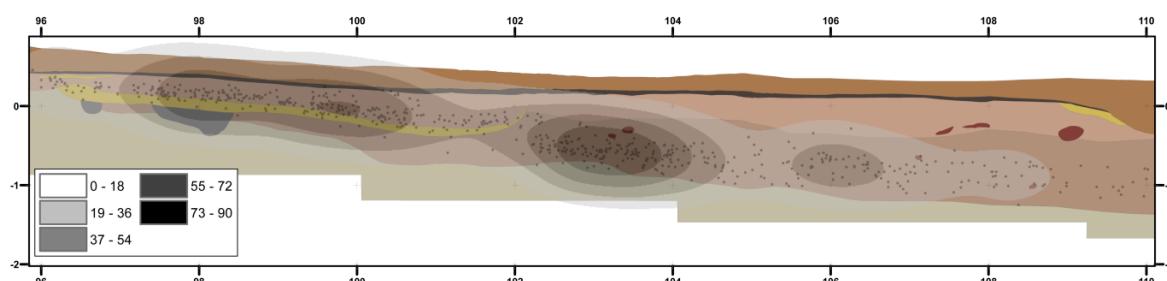


Fig. 1. Profile projection of pottery in the former lake shore zone.

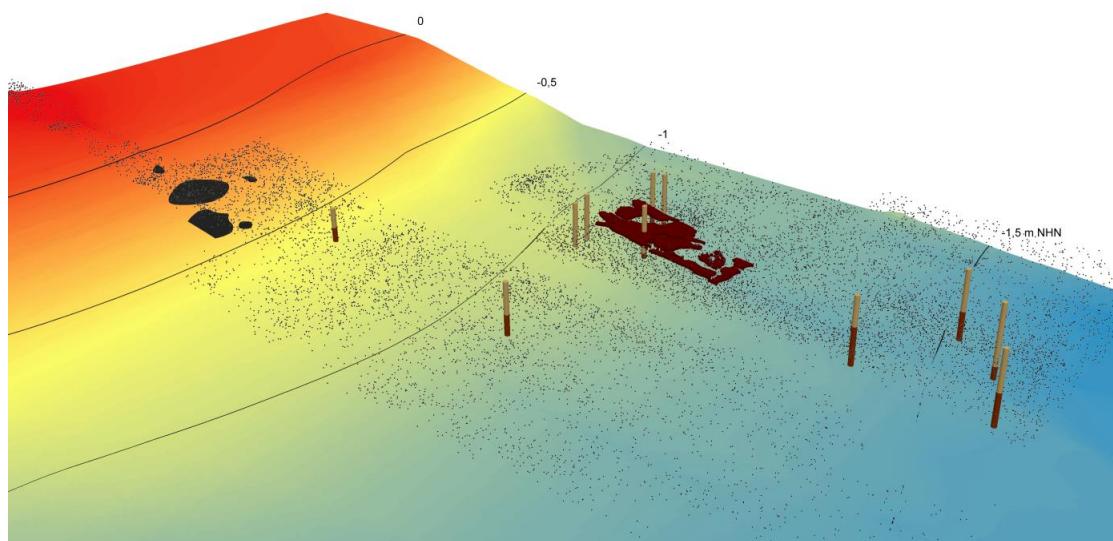


Fig. 2. 3D model of former lake shore zone (lake bottom sediment) with wooden finds (dots), beach features (black), vertical sticks (brown/grey) and bark boat (brown). View from the north.

Ktori, Maria

The Intangible Maritime Cultural Heritage Project: Recording and interpreting the role of maritime professions in Cyprus

Maritime cultural heritage transcends the underwater realm, and includes both tangible and intangible cultural elements. From traditional crafts directly related to the sea and its people, to maritime professions, these classic examples of the merged tangible and intangible heritage provide adequate proof to consider them as part of the Intangible Maritime Cultural Heritage. Although some suggest studying these via Maritime Ethnography, the level of complexity and convergence of intangible and tangible elements expressed in vessels, tools and human activities taking place in an aquatic environment, require a holistic approach.

Maritime professions are still being practiced and have undeniably contributed to the formation of Cypriot maritime tradition from the 18th century onwards. The fluctuations in local economy over the years combined with industrial and building development of coastal towns have imposed tremendous stress on the survival of these practitioners, which are dying out. They possess a wealth of knowledge which will cease to exist as they have nobody to transmit it to, increasing the existing vulnerability related to intangible cultural elements.

The project functions both as a research and Cultural Heritage preservation effort, since until now nobody recorded these professions and contextualised their connection with local maritime communities. The preliminary results are further used in educational programmes, aiming at the creation of a maritime consciousness to the public.

Miller, Ayelet; Cvikel, Deborah and Me-Bar, Yoav

The Holding Power of Bronze Age Stone Weight Anchors

Stone weight anchors are among the earliest evidence of seafaring in Antiquity. They have been found scattered on the seabed, on shipwreck sites, and in terrestrial archaeological sites. They have been studied typologically and classified by origin. However, much about the use of stone anchors on ancient ships is still unknown.

This research is aimed at shedding light on this subject by performing experiments on the holding power of stone weight anchors. Experiments were conducted using stone models of a 170 kg anchor found in the Uluburun shipwreck (14th century BC), of the same type of sandstone at different scales, about 1:5.3, 1:2.4 and 1:1.4.

The holding power experiments compared different types of seabed strata (sand, rock) and different angles of the hawser. This was done by a controlled dragging of the anchors while measuring the force needed to move them at a constant speed. Information was obtained on the holding power, friction, static and dynamic forces and from video recordings.

Preliminary results show that the initial dragging force increases linearly with the anchor weight. However, with the larger models, it seems that the force increases significantly more than linearly, probably due to the piling up of sand in front. This suggests that a single heavy anchor is more effective than several light anchors of the same total weight. This finding could be an explanation for the use of heavy anchors found in some underwater archaeological sites.

Nakas, Yannis D.

“Gain overcomes everything”: A mariner’s perspective on the use of harbours and anchorages in Hellenistic and Roman Mediterranean

Contrary to the popular belief, most of the harbours of the late Hellenistic and early Roman Mediterranean were far from hospitable and safe for every ship, notwithstanding the great improvements in harbour construction technology and the great funds employed for their construction and maintenance. Literal and archaeological sources show that, although ships were become more numerous and larger, serving an increasingly larger sea traffic within the pax romana, many harbours remained shallow and unprotected.

Yet, “gain overcomes everything”, as Strabo described the solutions employed by merchants and mariners when using the silted harbour of Ostia. Harbours flourished, becoming important exchange and shipping hubs and serving as contact zones between the outer world and the adjacent metropolis like Rome, Corinth or Delos. This paper will present the challenges and adversities the mariners of the period faced when in need of approaching a harbour or an anchorage and the solutions they employed to approach the coast and make the best use out of it.

Negueruela, Iván

Underwater Archaeological Survey of the cost of Spain.

First Campaign: Cartagena - Cabo de Palos. 5th – 13th October - 2018.

The 2018 campaign has been the first of a new Project of the National Museum of Underwater Archeology whose ultimate goal is to make the Underwater Archaeological Chart of the Spanish coast. In 1997, the Museum presented the same Project to the Ministry of Culture but done exclusively with human diving. It was estimated that it would be completed within a period of about 10/15 years: 1997-2012.

But of that Project only the first Campaign was authorized in 1997-1998, in the surroundings of Mazarrón. The depth we worked was from 0 to 20 meters. We dived exhaustively six million square meters. On the contrary, the Project initiated in 2018 (“CARTASUB”) is mainly remote sensing: Side Scan Sonar, Multibeam, Subbottom Profiling and eventually proton magnetometer. The objective is organized for each Zone of the coast in Three Phases: the First, to carry on an exhaustive Chart of “contacts”; the Second, discrimination of the contacts in the laboratory; the Third, ROV inspection of the selected wrecks and, where appropriate, human diving.

Between the 5th and the 12th of October-2018 the First Campaign of the Project has been carried out, counting with the resources of the Spanish Institute of Oceanography. In this first attempt we have worked only 7 days to check the different aspects of the project. We've worked between 10 m and 120 m depth in the area Cartagena-Cabo de Palos: about 30 km distance.

We are currently in the Second Phase: selection and discrimination of the objectives. In October 2019, the second Campaign will be held with duration of 23 days. We hope to map all the remaining littoral of the Region of Murcia.

[Olkovskiv, Sergey](#)

Complex geophysical surveys of Phanagoria' water area

One of the main areas of underwater archaeological research in Russia is the Taman Gulf of the Azov Sea. The main local site is the flooded part of Phanagoria, the capital of the Asian Bosporus. The coastal part of the city and the port facilities were built during the period of the Black Sea level regression. But a few centuries later the reverse process began: the sea level increased by at least 2,5-3 m, the area of the flooded part is up to 10 hectares. There are no any remnants of buildings on the sea bottom: the local population used the ancient ruins as a source of building material for a long time and dismantled all stone structures, including a large pier that still towered above the water surface in the XVIII century.

In 2012 we have begun to test geophysical methods for localization of archaeological objects in Phanagoria' water area. We have created convenient conditions for this: a navigational GNSS base station with RTK broadcasting; a number of already studied stone, wood and metal objects, suitable for calibration of geophysical instruments; a possibility of operative excavation and identification of localized anomalies. Since 2012 we performed a lot of surveys by different acoustic profilers and magnetometers. As a result of these surveys a detailed map of acoustic and magnetic anomalies was made. Many anomalies detected by remote methods have been found and identified. In fact, now underwater studies in Phanagoria are conducted not only for explore of this site, but as a main testing ground for the development of a new method of archaeological research in Russia.

Özdas, Harun and **Kızıldağ, Nilhan**

The discovery of two lost Venetian shipwrecks from the Battle of Oinousses, 1695

Or: The preliminary survey results of the Oinousses naval battlefield (Turkey)

Two important historic shipwrecks were discovered during the survey of the Shipwreck Inventory Project of Turkey off the coast of Çeşme. The shipwrecks were initially located and imaged by side-scan sonar on the R/V K. Piri Reis. The research vessel was then anchored at the top of the wreck site, and a remotely operated vehicle (ROV) was deployed in order to further image the remains. After the ROV operation, the sites were checked by professional divers who utilized trimix gases.

The shipwreck site, which lies on a flat sandy seabed at a depth of 65 m, yielded 30 bronze cannons with a length of approximately 3 m. Several cannon balls, iron anchors, kitchen pottery, and one large copper kitchen cauldron were found during the preliminary survey of the site. The wreck site lies in an area of 40 m x 20 m.

The second wreck, which is located 70 m to the northwest of the first wreck, yielded more than 20 cannon and two large iron anchors, in addition to kitchen pottery and other similar findings, much like the first wreck. The area of this wreck site is 30 m. in length and 15 m in width.

Preliminary research of the literary sources directed our attention to the Ottoman and Venetian naval battle at the Oinousses Island in 1695, which ended with an Ottoman victory. These wrecks are likely those of the Venetian galleons named Stella Maris and Leon Coranado

According to written sources, the Venetian fleet consisted of 12 galleons and 17 galleys, and 6 of them were lost during the battle. We were able to locate two of them in Turkish waters. We mapped the battle site with side-scan sonar, but we were not able to find any other evidence related to the battle.

This new discovery represents the deepest shipwreck ever found in this project. Further detailed surveys will provide more information on the 17th century galleons.

Öniz, Hakan; Aydingün, Sengül; Kaya, Hakan and Özdemir, Oktay

Between the Sea, Lake and River: Athyras, Melantias and Episcopia

Büyükçekmece Lagün Lake, located in the Thrace section of the western part of Istanbul, has been used as a drinking water dam by separating it from the sea with a set created in front of it since 1983. Thus, the old water reservoir of the lake was expanded by spreading more than 2 times. It has been inhabited since prehistoric ages around the lake. It is known from ancient sources that there are some settlements around the lake in Roman and Byzantine periods.

The names of these settlements are as Athyras, Melantias and Episkopia. However, the localization of the settlements around the lake, which was spread over an area of 43,000 km², could not be made nowadays.

The drought that occurred in Istanbul in 2014 at the end of the summer months has caused a retreat of up to 1 km in Büyükçekmece Lagoon Lake. In the researches carried out in the lake bed where the water was drawn, many prehistoric stone tools, ceramics, steles and ornaments from the prehistoric age to the Byzantine period were found in the claymud. It is understood that the Büyükçekmece Lagoon Lake, which is known Athyra in the Hellenistic, Roman and Byzance Periods, is the scene of commercial activity experienced in sea, lake and river lines since prehistoric times. The Büyükçekmece Lake, which has been considered only as a lake until recently, and whose role in the maritime transportation networks of the Mediterranean-Black Sea region experienced in antiquity has not been taken into consideration, will be introduced to the world of science.



Öniz, Hakan

New Discoveries from the Turkish Mediterranean in 2018

During the underwater survey at the coast of Turkish Mediterranean from the east coast of Adana to the west coast of Antalya, totally 41 shipwrecks have been found in the summer season of 2018. One amphora and one plate wreck are found at the harbour of Yumurtalık of Adana. 10 wrecks which have been found of the coast of Mersin are mainly loaded with amphorae from different periods. 25 of 29 ancient shipwrecks of Antalya are also loaded with different amphorae from 7th Century BC to 12th Century AD.

Two ships were probably sunk without any cargo because only balast stones have been seen. One of the other shipwrecks has been dated to 16th-15th Century BC because of its valuable cargo with pillow type copper ingots. Another wreck is an Ottoman trade ship which is dated to +1704. Many other archaeological remains include Bronze Age stone anchors, Iron Age stone stocks of wooden anchors, iron anchors also will be shared during the presentation.

Oron, Asaf; Galili, Ehud and Hadas, Gideon

Maritime activity on the Dead Sea – local traditions and global interactions

The continuous drop in the water level of the Dead Sea - an inland hyper saline lake located at the outskirts of the ancient Levant - revealed numerous maritime cultural remains. These include ship cargo remains, anchorages and several anchor types some of unique design unknown previously. Altogether, these finds shed new light on the history and nature of maritime activity on the lake and facilitate a broader view of its ancient maritime cultural landscape.

Technical analysis of off shore anchorages alongside portable finds from the lake shore – primarily anchors – attests to the presence of local maritime traditions on the lake over a period of at least 2500 years. These traditions seem to derive from the lake's specific geo-climatic settings and its continuous use as a conduit of connectivity and a source of minerals such as salt and bitumen.

Placing the well dated finds from the lake shore on a time-line allows a reconstruction of the evolution of maritime activity and technology on the lake. Combined with written accounts, these finds make it possible to trace the interaction of local maritime traditions on the lake with global maritime trends. The study suggests a specific point towards the second century BC as the moment of introduction of these new maritime cultural trends. While this point in time represents a shift in the lake maritime tradition, later finds show that local trends on the lake prevailed and likely co-existed alongside new and more global traditions throughout the Dead Sea long maritime history.

Papadopoulos, Nikos; Simyrdanis, Kleanthis; Cantoro, Gianluca and Oikonomou, Dimitrios

Archaeological Prospection on the Transition Zones: Examples from shallow submerged sites in eastern Mediterranean

Archaeological prospections, including geophysical imaging, low altitude aerial photogrammetry, 3D laser scanning and GNSS mapping, have been extensively used for the non-destructive documentation of onshore-buried antiquities, thus contributing substantially towards the management and promotion of the concealed cultural resources. The complexity and constantly evolving environmental regime encountered in transition zones limited so far the implementation of these technological advancements for reconstructing the archaeoenvironment in littoral sites.

The exploration of the resolving capabilities, the spatial limitations, and the actual applicability of these technologies in mapping submerged cultural assets in shallow depth marine environments were made possible through laboratory numerical modelling approaches and extensive *in situ* testing of diverse techniques in coastal and

submerged archaeological sites dating from prehistory to Byzantine times in Eastern Mediterranean.

The possibility to apply well-known methods to un- (or 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 Eastern Mediterranean.

Ultimately, the results of this work – presented as case studies in this paper – can be regarded as a first step towards the development of an effective interdisciplinary research model that could be applied to similar archaeological surveys in coastal or shallow-water environments.

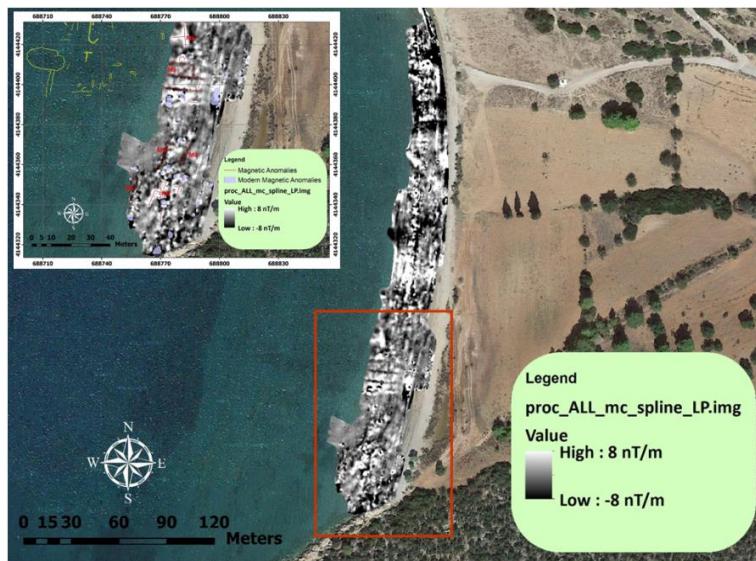


Figure 2: Magnetic gradiometry map of the features buried below the sea bed in the prehistoric site of Lambayanna.

Parica, Mate; Radić Rossi, Irena and Ilijanić, Nikolina

The Pašman Channel through Ages. Current knowledge and future plans.

The Pašman Channel is located South of Zadar in Northern Dalmatia, between the mainland and the island of Pašman. Intense exploitation of the area since prehistoric times is attested by great density of sites above and under water.

The complex morphology of the Channel suggests that it was created during Neolithic period, by flooding the barrier between the two deep bays. During the Bronze Age, it probably started to act as a controlled seafaring route towards strategically positioned Iader (later Zadar).

Many settlements from Prehistory and Classical Antiquity, once situated on the coast, are today completely or partly submerged, while a number of small islands located in the Channel, bare the evidence of human presence.

In the nearby vicinity of the Channel lies a fresh-water Lake of Vrana, whose creation was reconstructed based on geological coring. The area abounds with fresh water, which in Roman times supplied the colony of Iader. Over 200 brackish “wells” on the Pašman side of the Channel testify to the presence of anchialine caves which through centuries complemented the lack of surface water.

Several surveys and documentation campaigns, performed in 1970s already pointed out the archaeological potential of the area, but the more systematic approach initiated just during last decade. The paper presents an overview of the results of archaeological and geological research carried out until 2018, and identifies the key issues to be approached in the future.

Popek, Mateusz and Pydyn, Andrzej

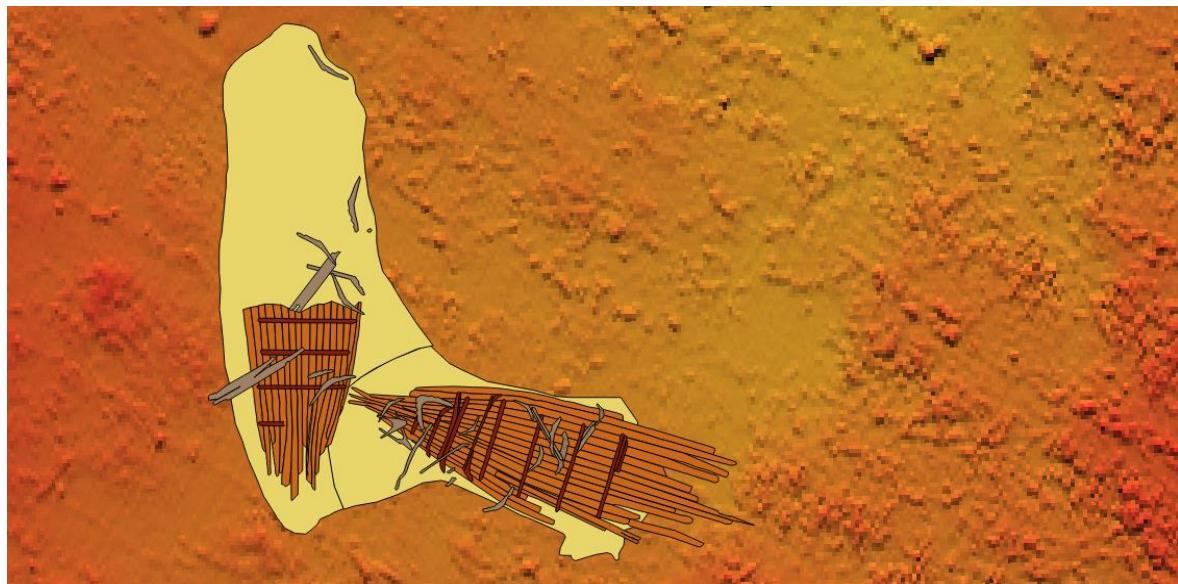
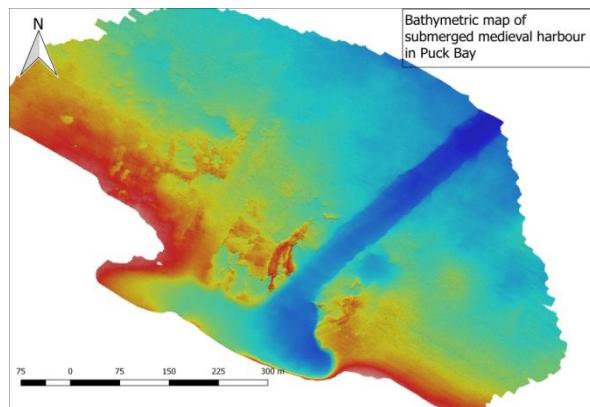
On the border of land and the sea - submerged settlement in Puck Bay

Submerged archaeological site in Puck Bay is a very good example of site disposed on the border between land and the sea. First research of this settlement started at late 70' and last until today. Very shallow water, large area of this site and thousands of remains cause difficulty in interpretation. The main element of the remains are piles, horizontal construction elements and also five wrecks. Most of this objects come from Medieval times but there are some much older. There are a few big questions about this site. How the water level changed during the centuries and why this site is underwater a few hundreds of meters from shore? Also why the so-called harbour is placed about one kilometer from Puck Medieval town.

Thanks to project “Virtual Arch - For better utilization of hidden archaeological heritage in Central Europe” Department of Underwater Archaeology team collects many of archive documentations made by many scientists.

Also during this project hydroacoustic, aerial and photogrammetric survey was conducted.

In this presentation, we would like to present a recent result of research and try to propose some solution to earlier mentioned questions.



Reinfeld, Michaela

Escape – Expulsion – Submergence.

New research at the harbor of Karantina Adası (Urla, Izmir/Turkey).

The ancient city of Klazomenai is best known for its local production of painted clay sarcophagi and black-figured pottery, which has been negotiated throughout the Mediterranean and the Black Sea. However, it is less well known that during the Ionian Revolt, the inhabitants of Klazomenai left their settlement on the mainland for fear of the Persian attacks and founded a second settlement on the nearby island of Karantina. In the following centuries, the inhabitants of Klazomenai and Karantina alternately settled on the mainland or the island, which was connected by a causeway to the mainland under Alexander the Great.

The remains of the Hellenistic city of Karantina have been explored under Greek, Dutch and Turkish direction since the 1920s. In addition, since 2016, the Ankara University V. Koç Research Center for Maritime Archaeology (Anküsam) has been conducting underwater archaeological research on the ancient harbor of Karantina. These investigations resulted in new insights on the appearance and fate of the harbor in Hellenistic and Roman times.

Rey da Silva, Arturo

Marine Spatial Planning and the Protection of Maritime, Coastal and Underwater Cultural Heritage.

Marine and coastal environments are suffering an increase of development activities and urban expansion that result into pressures over its sustainability and long-term preservation. The overloading use of the sea space as well as the exploitation of its resources can lead to potential conflicts between stakeholders and different national and international interests, as well as it threatens the preservation of cultural heritage if appropriate planning and management between all those concerned are not put in place.

Over the last years, coastal and marine spatial planning (MSP) has become a tool to be used by governments, agencies and institutions at regional and national level to address specific ocean management challenges, while achieving their goals and fulfilling their international commitments. MSP is the “*public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that have been specified through a political process*”, as defined by UNESCO’s Intergovernmental Oceanographic Commission (COI). It serves to coordinate activities among all coastal and ocean interests, avoiding disagreements while engaging with affected communities and stakeholders, and preserving the ecosystem. It should be a process that takes all interests into account, with a participatory and adaptive approach, balancing the ecological, economic and social goals toward sustainable development.

At the same time, it is well recognised that culture is a key element, a driver and enabler, to achieve sustainable development. Cultural heritage, in all its forms and expressions, evolves from the historical interaction among human societies and their environments, being a strategic feature for the preservation of ecosystems. This happens similarly in marine and coastal areas where numerous cultural and archaeological sites are witnesses of our past and indispensable in the construction of current identities, being an indivisible part of our cultural and social landscapes.

Drawing attention to the international legal frameworks, recommendations and practical guidelines, and illustrated by specific case studies, this presentation will review the current importance of MSP. It will also analyse how far cultural elements, like underwater archaeological sites or intangible coastal traditions, are considered in their elaboration, implementation, monitoring and evaluation. It will conclude that maritime, coastal and underwater cultural heritage management policies should be regarded as an essential element to be considered when coordinating the appropriate and sustainable use of coastal and marine areas.

Rioo, Maili

Researching submerged archaeological sites in Lake Peipsi.

Lake Peipsi is the largest transboundary lake in Europe, lies on the border between Estonia and Russia. The lake is the fifth-largest in Europe and represents a remnant of a body of water which existed in this area during the Ice Age. The Stone and Bronze Age in the area of Lake Peipsi have been studied relatively poorly. Knowledge about the northern and north-western shores of Lake Peipsi was limited only to stray finds. The first of those finds reached the collections of museums already in the end of the 19th century.

Since 2012, archaeological survey has been conducted in the northern and north-western parts of Lake Peipsi. The sites were revealed due to low water level, erosion, or as the result of former dredging operations.

The majority of the material was found in autumn 2015, when dredging operations were conducted in the lake near the mouths of several rivers. During the survey, Stone and Bronze Age bone artefacts, refuse of bone working industry, as well as unworked animal bones, fish and bird bones, some human bones, and sherds of pottery were found. On the basis of the pottery types (Narva Ware, Comb Ware, Corded Ware and Early Textile Ware) the sites could be initially dated to approximately 5200–1100 cal. BC. Each site requires an analysis and radiocarbon dating in order to determine the time spans of the use of the settlements, a localised paleogeographic reconstruction, and to be connected to the geological development history of Lake Peipsi.



Artefacts from the area of Lake Peipsi.

[**Rutter, Anja**](#)

So close, so far – how near is a neighbour?

Seljuk political architecture in the harbour of Alanya.

One of the possible ways to include various views on and approaches to a site is to perceive it not as a single place but as part of a network. Network analysis is increasingly being used also in archaeology as a means of placing a site into a larger context and interrogate the data with mathematical models. It is particularly suited for interdisciplinary research as it enables us to include a number of parameters, such as a combination of physical and social spaces.

For maritime archaeology, often concerned with landscapes and seascapes, network archaeology is a way of spanning land and sea and the liminal places in between as well as the routes connecting them.

Popular though it becomes, the method has its pitfalls, especially so in its model-based form as derived from mathematics. Archaeology today does, of course, use scientific methods but it cannot be an exact science itself – the untidiness of life itself will interfere.

Using Alanya's Seljuk harbour as an example, this paper will look at places as nodes and at the routes connecting them. It will illustrate the potential of perceiving the built environment and its use as a network. More importantly, it will also seek to demonstrate the necessary adaptions archaeology needs to make to network analysis. To measure the metric distance between two nodes might be enough for a model but it does not necessarily reflect the reality of life in the neighbourhoods of Seljuk Alanya.



Shipsheds & fortifications, Alanya

Sayar, Mustafa H.

Tarsos, Magarsos/Mallos and Aigeai

Three harbors and Three rivers in the Cilicia Plain

Eastern Cilician Coast and the navigability among the cities

in the basin of the rivers Saros and Pyramos.

The coast of Eastern Cilicia is flatter than the coast of Western Cilicia, and its coastline has changed over the centuries with the alluviums carried by the Saros, Pyramos and Kydnos rivers. The soils carried by the rivers not only lead to the shoreline but also frequently changed the river beds. This situation has caused many settlements to remain under the alluvium and has largely restricted the accessibility to the Cilicia plain through these rivers.

The ports near the mouths of these rivers and the cities close to the shore were also significantly affected by the changes of these rivers' beds. In the scope of this paper, position of Tarsos on the mouth of Kydnos, and positions of Aigeia and Mallos and the sanctuary of Magarsos on the mouths of Saros and Pyramos from the beginning of 2nd century BC till the end 2nd century AD will be assessed through finds and it is aimed to focus on the effects of reaching the cities on the basin of these rivers from the Mediterranean Sea over centuries.

Schmidts, Thomas

Ainos and the mouth of the river Hebros

The river Hebros (today Meriç or Evros) empties into the Northern Aegean. It is one of the few rivers of the Eastern Mediterranean that is navigable on al long distance. Ainos (today Enez) is situated in its estuary. Founded as a Greek colony in the late 7th or early 6th century BC, the city was a hub in Archaic and Classical times. Trade goods from the Aegean were transported to the Thracian hinterland and vice versa. The distribution of wine amphorae of the 5th and 4th centuries BC along the Hebros proves the way of transportation. The importance of Ainos is also obvious in the Byzantine era, but unknown between the Classical and Early Byzantine period.



Fig. 1 Enez and ist enriornment. The city is surrounded by lagoons and the silted former harbor bay (Google earth).

An interdisciplinary project that was funded by the German Research Foundation (DFG) had a focus on the Roman Imperial and Byzantine eras. Also, the change of the landscape was investigated. Due to a siltation process, which was mainly caused by sediments of the river Hebros, the city is now ca. 4 km away from the sea. The paper presents the main results of the project in the context of the development of the southern Thracian coast and the mouth of the river Hebros. Especially the role of Traianoupolis will be discussed. The city was founded in the early 2nd century A.D. west of Ainos in the estuary of the river.



Fig. 2 Byzantine fortifications, view from the western lagoon (Photo Th. Schmidts).

[**Tymoshenko, Mariia**](#) and [**Valentyrova, Kateryna**](#)

**Metal artefacts from the 13th century shipwreck near Sudak,
Crimea in the cultural-spatial context of the region**

The exploration of sunken ships has a lot of peculiarities. The ship was not static object before wreck. Therefore, the archaeological material deposited on the sites of this type has a special character. Its geographical and cultural affiliation may be heterogeneous. If the ship sunk near the coast, it is very important to understand how they are related.

The main object of our research is the artefacts made of metal from the 13th century shipwreck near Sudak, Crimea. Artefacts can be divided into some groups according to different characteristics. These comprise numismatic findings, weapons, kitchen utensils, miscellaneous for individual use, implements for fishing, structural units of the ship and items for repairing practice on board. The artefacts document the order of the everyday life of the ship crew and concern with the cultural context. It could be very informative to compare these finds with material culture which was inherent to territory of Crimea in the Middle Ages. It makes possible to verify the assumptions about the causes of the location of the shipwreck and to determine the ship place in the wide cultural-spatial context.

Vakhoneev, Viktor and Solovyov, Sergey (vorgetragen von Pavel Gorbunov)

The ancient submerged city of Akra in the Bosphorus Cimmerian

The ancient city of Akra was one of the cities of the Bosphorus. It was founded in the 5th century BC and existed until the beginning of the 4th century AD. The city was located on a low cape. In the course of the Nymphion transgression of the Black Sea, which began at the end of the first millennium DC, the cape with the city located on it was flooded at a depth of 4 m.

Unlike other cities in the Bosphorus, whose coastal parts were also flooded, Akra is distinguished by the preservation of its cultural layers and building remains. The destructive actions of wave processes destroyed only the layers of the Roman and Late Hellenistic time under water. At the same time, the lower beddings of the early Hellenistic and Classical periods were intact.

The defensive wall of the city, built in the middle of the 4th century BC, was perfectly preserved under the water.



Defensive Wall of Akra

The powerful tower was attached to it at the end of this century. The stone walls of the tower rested on large wooden beams. During the excavation of cultural layers below the base of the tower, it was established that it was built on a thick layer with traces of a strong fire.

In 2011–2018 during underwater research, a study of residential buildings in the city was also conducted. During this time, the remains of six building complexes, represented by a section of the quarter of the ancient city, were revealed under water.

In general, underwater research in recent years has allowed us to expand our knowledge of the Southern part of European Bosphorus, including territory of Akra. It should be particularly noted that in recent years, the visual reconnaissance of the 1980–90s has been replacing on systematic stationary archaeological excavations.



Tower

Žulkus, Vladas

Flooded prehistoric shores and management of maritime cultural assets. The case of Lithuanian waters in the Baltic Sea

The activities of archaeologists of the University of Klaipėda (Lithuania) are aimed at exploring the Early Holocene settlements on the coast, finding and exploring elements of the natural and cultural landscape that are now lying on the seabed.

The underwater studies carried out in 2010–2018 revealed flooded landscape of the Early Holocene with relict trees and peat deposits as well as the first findings of human habitation sites at a depths between 11–31 m. The 14C age of peat, trees and a possible fishing weir is dated from 11000 cal. BP to 7700 cal. BP.

Interdisciplinary exploration of submerged natural and cultural landscapes enables to form an exceptional methodology that could be used in the searches of prehistoric human activities remains that nowadays lies on the seabed. It also helps to reconstruct prehistoric vegetation and fauna of the former coastland area.

In the investigated area RF-I more than 100 objects were identified as possible trees “*in situ*”, and up to 2018 nine ship wrecks were registered in this area as well. This case contains co-occurrence of marine nature values and the underwater cultural heritage. It is necessary to save and protect this heritage in a long-term view, however it must be made available for public access. The recommendations to use these values for underwater tourism purposes at this area will be prepared.



Poster

Albertson, John A. & Morozova, Yana

Submerged Stone: An Overview of Worked-Stone Assemblages off the Crimean Peninsula

Submerged in the waters along the Crimean coast lie several assemblages of worked stone, discovered over the past several decades. These assemblages can be divided into three groups according to their function, including: (1) stone anchors; (2) weights for fishing nets; (3) millstones (both whole, broken, and re-purposed). Some researchers have interpreted these worked stones as ballast piles connected to medieval shipwrecks, but others consider them to be trade goods if found in significant quantity. Single examples, which have been found on almost every known shipwreck, have been considered as individual elements - shipboard tools for grinding grain into flour. In addition to being of archaeological significance themselves, these submerged worked stones provide valuable information regarding the logistics of local and regional maritime trade.

According to extant literary evidence, quern stones were produced in the environs of the Sudak fortress during the medieval period. Assemblages with such stones have been found at shipwreck sites off Novy Svet and Alushta. These data may indicate the initial port of embarkation and means of transporting these stones. Ports of call can also be of regional importance. Submerged stone anchors are widespread on anchorage sites and ports along the Crimean coast – Koktebel, Sudak, Cape Plaka, the Adalary Rocks and Chersonesos, where stone net-weights were also found during underwater surveys. In terms of the maritime distribution of stone, the provenience and purpose of these artifacts present an important question, not only for long distance trade, but regarding localized marine environments and maritime landscapes as well.



Baika, Kalliopi; Kalamara, Paraskevi and Koutsoumba, Despina

The ancient harbour-city of Aigina, Greece: The 2018 archaeological mission

The paper presents the results of the 2018 archaeological mission on the harbour and coastal installations of the ancient harbour-city of Aigina in the Saronic Gulf, Greece. The 2018 mission was undertaken by the Ephorate of Underwater Antiquities of the Hellenic Ministry of Culture with the technical support of the Centre Camille-Jullian, CNRS-Aix-Marseille University.

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 warfleet of triremes. The prosperity and naval supremacy of the city provoked the rivalry of Athens that besieged Aigina at 456 B.C. The submerged and coastal remains date from the 6th c. BC to the medieval period.

The 2018 mission focused on defining the main research issues for initiating a wider interdisciplinary project for studying the maritime facade of the city diachronically. 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 man-made fortification works. It is noteworthy that this particular ancient harbour infrastructure seems to have no parallel among the Mediterranean harbour-cities.



General plan of the submerged and coastal archaeological zone of the harbour-city of Aigina. View of the north breakwater (@Lionel Roux 2018, CCJ-CNRS)

Creisher, Michelle

Maritime Trade in the Early Islamic Period: the Ceramics from the Ma'agan Mikhael B Shipwreck as a Case Study

The Ma'agan Mikhael B shipwreck, buried beneath 1.5 m of sand, 70 m off the Israeli coast, yielded a large, mixed cargo of amphorae and other ceramics, both fine and coarse wares. The ship is dated to the 7th–8th century CE, by 14C analysis and the typology of the pottery. The 20-meter-long shipwreck is one of the largest from this period in the Levant, with a cargo which is unparalleled in the region. Seven different types of amphorae have been found, which indicate diverse coastal trade along the Levantine shores. Many of the amphorae still contain their original content, suggesting a wide range of produce from various sources from around the Eastern Mediterranean which would have been brought to the coastal commercial centers for export. The Ma'agan Mikhael B was likely a merchant ship engaging in local and interregional tramping.

This study deals not only with the continuity of trade during the transition from the Byzantine period to the Early Islamic period, but also with the wealth of foodstuffs and produce found onboard and the economy of the time. The information which can be gained concerning active maritime trade routes, production centers and commodities, as well as the quantity and variety of the cargo, indicates a more diverse network of maritime trade than has previously been seen from this period. Current studies on the ceramics from the Ma'agan Mikhael B shipwreck could shed light on the nature of maritime trade during the early Islamic period in the region.

Ktori, Maria; Zannetou, Marilyn and Gkaloufa, Maria

The Intangible Maritime Cultural Heritage Project, Cyprus: educational programmes and the creation of maritime consciousness

The vernacular shipbuilding tradition has been documented for the first time through the Intangible Maritime Heritage Project. The historical and ethnoarchaeological data share an intrinsic bond with Maritime Archaeology and the sea, yet remain unknown to the public as remnants of an obscure past.

Shipbuilding and other maritime professions have a strong impact on the development and local history coastal communities, which needs to be communicated to the public in order to engage everyone in safeguarding their heritage. The authors reviewed international practices and scholarly research, to propose a series of educational actions aiming to improve the current situation.

Loizou, Evgenia

Looking for Prehistoric Harbours - Landscape Evolution in the Aegean

During the last decades, Mediterranean Archaeology developed an advancing interest on the study of harbours, using new tools, incorporating theoretical frameworks and opening up to interdisciplinary research. This evolution led to the direction on studying the ancient and byzantine harbours into a context characterized by the duality culture-nature. However, research on the infrastructure and the usage of the prehistoric harbours or ports in the Aegean is still a matter of investigation; even their generic existence is questioned by significant scholars.

In order to cover this hiatus, this poster aims to present the evidence “harbourtowns”, a term highly used in the aegean archaeological literature, with implication to the presence of harbours and connotation to a margin area; a transition zone where sea and land meet and various cultural, social and economic activities take place.

Well protected bays, favourable anchorages, shipsheds and other maritime related features in the so called “harbour-towns” are being studied and put into an environmental frame. Moreover, both the natural characteristics of the landscape of a harbour or port and the environmental transformations of the coastal landscape are studied.

Data are largely based on the collaborative work of archaeologists, geoarchaeologists and other scientists to present a holistic view.

Through this primary study, it is anticipated to answer questions about the landscape and the environmental features that affect a harbour-site, and, consequently to come to a better understanding of the structures of a harbour, the needs of the maritime community and the ships’ capabilities during the Aegean Bronze and Iron Age.



Pavlopetri, Laconia. Submerged building (After: Henderson et al. 2009. The Pavlopetri Underwater Archaeology Project: investigating an ancient submerged town).



Poliochni, Lemnos. The coast near the EBA town (Courtesy: Evgenia Loizou, 2015).

Piele, Anne-Kathrin

**Conference Report: Underwater Cultural Heritage Forum
4th of December 2018 German Federal Foreign Office Berlin**

On the 4th of December 2018, the Underwater Cultural Heritage Forum took place in the Europe Room of the German Federal Foreign Office in Berlin. An official invitation was extended by the Ministry of Foreign Affairs and the General Delegation of Flanders.

In the context of the European Cultural Heritage Year 2018 the organizers wanted to use this conference for discussions about current questions on how the Underwater Cultural Heritage can be protected and how this request can be conveyed to the public.

After some introductory welcoming words spoken by Irmgard Fellner, Director for Cultural Relations Policy and Deputy Director for Culture and Communication at the German Federal Foreign Office, Dr. Martina Münch, President of the German Cultural Commission Heritage Committee (DNK), as well as Carl Delaluwé, Governor of the Province West Flanders and Bernhard Schnittger, Deputy Head of the European Commission's Representation in Germany, lectures about the handling of the Underwater Cultural Heritage in Germany, Switzerland, Great Britain, Ireland and Belgium followed.

Sukachev, Evgeniy and Tereschenko, Alexander

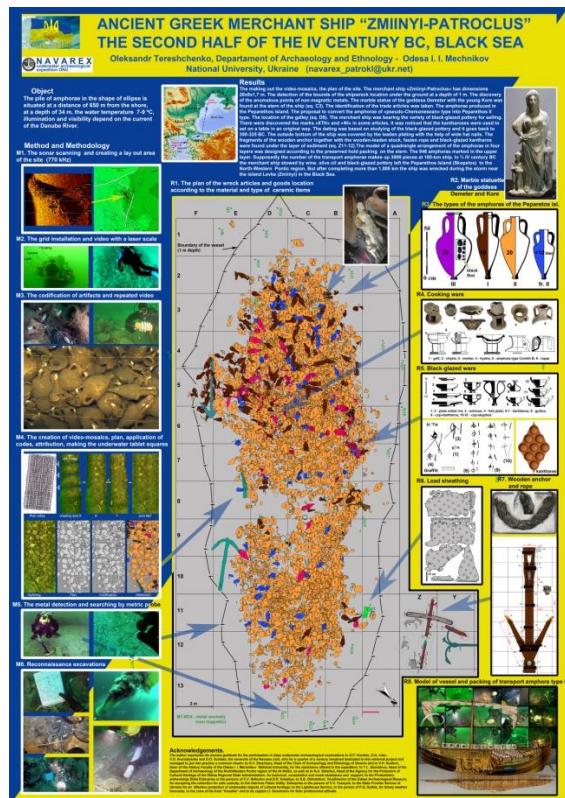
Zmeiniy-Patroclus

Since 1988 and for the last 30 years, the Underwater-Archeological non-profit organization "NAVAREX" under the leadership of Alexander Tereshchenko, has explored the water area of Island Zmeiniy, in Black Sea, Kiliya district of Odessa region, Ukraine.

Since ancient times, Levke Island has played a significant role in the Greek colonization of the Northern Black Sea region.

In 2011, Underwater Archaeology Expedition NAVAREX with association Odessa National University I.I. Mechnikova discovered the sunken wooden merchant ship "PATROCLUS – ZMEINIY" [mid-IV BC] in the waters of the Zmeiniy Island at a depth of 34 m. The following underwater work was carried out at the sunken Object: an acoustic scan of the accident site, a plan diagram based on the video mosaic was drawn up and the metal detection of shipwreck remains was provided. A square description of the piling up of amphorae (Peparet), ceramic crockery for the crew, black-glazed crockery, a marble statuette and a preserved part of the vessel's rig – a steering oar and wooden anchor were given.

The expedition "NAVAREX" used the most modern methods and technologies of underwater archeology, which are used today in the world. Thus, a unique photomap of the object was created, which allows to fixate the position of each artifact with extraordinary accuracy.



Wagener, Sieghard

Can a damage pattern at a ram tell the whole story of the sinking of a ship?

A special exhibition at LVR Museum Bonn took place from Oct. 12, 2017 to June 24, 2018. The theme was “Im Meer versunken” (Sunken in the sea). In one of the show rooms, the sea battle at Egadi Islands Sicily in 241 B.C. was presented among other items by three rams. A Punic ram showed at its head 3 sharp dents all aligned on top of each other at the fins. Thinking about the cause of the dents, the only conclusion would be a crash ram to ram.



To prove this assumption, a method of physics has been developed. It based on the impact “theory of colliding spheres”. The potential energy of the ship is split up describing 4 phases of the accident.

For the calculation one needs values. These are taken from the data of the replica of the Athenian Trireme “Olympias”.

The calculated energies give a clear picture what happened in detail. Accelerations and loads can be determinate. Failures happened to the boat and casualties of the crew can be described.

The boats finally sunk.



Zelenko, Sergii and Kulagin, Andrey

Amphorae assemblages on medieval shipwrecks from the Northern Black Sea region, Crimea

Dynamic and mutually profitable trade was kept in the Mediterranean region, inclusive of the Black Sea during the Byzantine period. Valuable information is retrieved from the medieval shipwrecks discovered near Sebastopol, Yalta, Partenit, Sudak and Koktebel in the Black Sea.

The statistic of distribution the ceramic vessels, which used as shipping containers or directly being goods, is a main indicator of the maritime trade for researchers who study economics of the Ancient Word.

In the Middle Ages has been being the main type of containers for sea shipping of vine, oil, etc.

Medieval amphorae vividly reflect the existed realities of the trade exchange. They are easily identified according their types; they are bulk material for many excavations of medieval sites and they allow to conduct statistical analyses which gives the reliable picture of the trade relations between medieval states in the Black Sea region. Historians use amphorae as significant and sometimes single witness of the different socioeconomic aspects of medieval history. Ceramic stamps, from the closed complexes (for instance in the shipwreck), bear additional information.

Currently the relevant objective is to find and study amphorae production centers, to develop their accurate chronology and to elicit typological changes during the certain period of thier activities.

The presentation gives the overview of the medieval shipwrecks discovered in the Black Sea, along Crimean coast, and analysis of amphorae assemblage from these sites.