



UNIVERSITATEA
LUCIAN BLAGA
— DIN SIBIU —

“Lucian Blaga” University of SIBIU
Doctoral school of PHYLOLOGY AND HISTORY
PhD field: HISTORY

PhD THESIS ABSTRACT

PORT FACILITIES AND TYPES OF VESSELS DISCOVERED IN THE WESTERN PONTIC BASIN, DURING THE 4th century BC – 7th century AD PERIOD

PhD Student:
Vitalie BODOLICĂ

PhD coordinator:
Prof. dr. Karl Zeno PINTER

Archaeological research has focused, at least on the territory of our country, more on the land area and less on the depths of the Black Sea and its shores. The port facilities on the western bank have been studied contextually, but there has been no work dedicated, specifically, to them. For this reason, the present paper proposes a synthesis and systematization of the available data regarding the evolution of the port facilities on the west Pontic coast, the importance of submerged archaeological remains, in the context of the history of the Black Sea, the identification of techniques and a technology specific to underwater archaeology, as well as framing the findings in current legislation. The approach of the work is a critical one, based on literary and epigraphic sources, as well as on the results of underwater archaeological research as far as they are accessible to us, and on interdisciplinarity, without which a complete image cannot be created.

Current information allows us to paint a picture of the important role of the Black Sea throughout history in the evolution and development of human communities through trade. In this work I used original material from underwater research within the limits of their accessibility. Until now, there is no synthesis work, which includes a thorough study regarding the port facilities on the west Pontic coast specific to the 4th century BC – 7th century AD interval.

Synthesizing the information available up to this point, we believe, will be an important working tool for researchers of the period and will be able to provide a starting point for understanding the complex historical process of the west Pontic coast through the lens of the evolution of port facilities and ships from the above-mentioned period.

The general objective of this thesis is to systematize the research related to the port developments on the west Pontic coast, but also to synthesize the information dispersed in several research fields. As part of our research, we aimed to analyze the bibliography that presents the military and commercial maritime navigation on the west Pontic coast during the 4th century BC – 7th century AD period. A secondary objective was to access historical and epigraphic sources, specialized archaeological and historical literature, historical and modern maps, etc. Another objective was to identify the techniques and methodologies used in underwater archaeology. We presented strategies, approaches, and study methods in this field. In this regard, I explained the acoustic and bathymetric systems of echo sounders and multibeam systems. An important objective of the work was related to the establishment of the main legislation regarding underwater heritage, as well as the identification of official governing bodies for this field.

The first name of the Black Sea was given by the Greeks, *Pontos Axeinos* (dark or gloomy sea). It is not known for sure how this name became *Pontus Euxinus* (the welcoming sea), a name used by both ancient Greek and Latin writers. When and how this name changed to *Pontus Euxinus* has not been identified. Depending on the groups that dominated the shores, different names appear: the Sea of the Sarmatians, the Sea of the Scythians, the Sea of the Kazakhs, the Reds, the Bulgarians. In the Middle Ages the toponym knew different forms in the Italian world *Mare Maius* and *Mare Maggiore*, after the 18th century the similar names in translation are: Karadeniz, Maure Thalassa, Cerno More. *Mare Nigrum* is the Latin name most often used in the medieval period, hence the Romanian name Marea Neagră.

The western Pontic basin has represented since the beginning of antiquity the intersection of influences and contacts between the civilizations of the Mediterranean and the Far East, (...) a region among the most interesting and with a position of capital importance in the general development of facts and historical conditions, as stated by Gh. I. Brătianu in his work *The Black Sea from its origins to the Ottoman conquest*. The studies related to the research of the Black Sea, are not only historical, archaeological, or geographical, but also oceanographic with interests related to geology, hydrology, ecology, and marine biology. As evidence, the concerns are diverse and found in different fields of research, which demonstrates the need for an interdisciplinary approach to the study of the western Pontic basin.

Our research, within the doctoral thesis, was developed in five chapters and is intended to be an important contribution for those who wish to deepen the subject, both regarding the historical information, already known, as well as about the established technique and methodology underwater archaeology.

In the first chapter History of research, the investigation started from the first written mentions of ancient authors, about the western Pontic space, such as Strabo - *Geographia*, Herodotus - *Histories*, Homer - *Iliad*, Aristotle - *Meteorology*, Plato - *Phaidon*, Xenophon - *Anabasis*, Ovidius – *Tristele and Pontice*, Plinius the Elder – *Naturalis Historia*, Arian – *Euxine Pontus Periplus*, Pseudo Skymnos, etc. A good example would be Strabo, who in his work *Geographia*, deals with the Black Sea region, he divides the Euxine Pontus area into four subregions: from the Thracian and Getic coasts to the west, to the Scythian land to the north with Taurica and Sindike, the Caucasus with the eastern plains of Colchis, and the southern land with Paphlagonia and Cappadocia.

There follows a long period in which the Black Sea is roamed by Greek, Venetian, Genoese, Turkish navigators who left documents related to the configuration of the shores, the geographical position of the ports and the navigation conditions.

With the development of the main ports in the western basin of the Black Sea, the buds of research related to bathymetry, chemical measurements, or current determinations, from the 19th century, carried out under the auspices of the European Commission of the Danube, also appeared then the first stations of maritime research.

The national historiography related to the topic under discussion is not very rich in monographs or articles dedicated to a specific site, whether we are talking about ports or ancient wrecks, perhaps also because the field research was haphazard. However, the research of the bottom of the Black Sea on the Romanian coast, of the underwater sites, began with the first pioneering activities of Commander Constantin Scarlat who, since 1953, studies and maps the submerged vestiges in the Romanian waters.

In 2016, the Bureau of Underwater Archeology was established, as an integral part of the Research section within M.I.N.A. Constant. He started the first field evaluations in the Black Sea, with the working methodology of historical documentation, consultation of bathymetric data, seabed scanning (Side Scan Sonar, Substratum Profiler and Multibeam) and its interpretation, photo-video recordings, measurements and GPS coordinates.

The Office of Underwater Archeology within the Museum of National History and Archaeology, Constanța, the Research-Development and Projects Section has side-scan data, collected between 2016 – 2020, on several hundreds of km² of seabed, most of them in evaluation exits of the field (archaeological diagnosis). Based on some of these investigations, passim, rolled artifacts (amphorae, laps, stone anchor, metal anchor with four arms, cast iron cannonball, ballast, etc.), as well as wooden wrecks, were recovered.

Research outside Romania's borders is expanding with the evolution of technology using Side Scan Sonar, which allows the scanning of the seabed. The most relevant project would be the one in Bulgaria, where researchers from the Center for Maritime Archeology (CMA) of the University of Southampton in collaboration with the Bulgarian Institute of Archeology with the Museum and the Bulgarian Center for Underwater Archeology (CUA) managed to investigate over 60 wooden wrecks. Other partners were also part of this project: the Maritime Archaeological Research Institute from Södertörn University, Sweden; University of Connecticut, USA; Hellenic Center for Marine Research, Greece; and MMT, the company whose founder Ola Oskarsson designed the Surveyor Interceptor. The project operations are controlled by the Ministry of Culture and the Ministry of Foreign Affairs of Bulgaria, in strict compliance with the UNESCO Convention on the Protection of Underwater Cultural Heritage (2001).

This project demonstrates good cooperation between multinational and multidisciplinary teams, but especially how the offshore industry can collaborate with the academic environment, in support of the protection of underwater cultural heritage.

Our research tried to systematize the existing studies, both on land and underwater, related to the ancient port facilities on the west Pontic coast from the century. IV BC – VII BC. In addition to the bibliographic materials, the epigraphic sources, and the existing submerged archaeological material were investigated. The study tried, as much as possible, to synthesize the information scattered in different research fields.

The second chapter of this thesis explains the geographical and oceanographic context during the studied period, compared to the current context, but also the influence of natural factors on maritime traffic around the west Pontic coast. The consequences of environmental, geographical, and oceanographic factors on the location of port facilities were analyzed. Data related to the hydrographic basin, the continental shelf, but also risk factors regarding navigation in the Black Sea were brought to the fore.

The Black Sea is an inland sea, located on the border between the European and Asian continents, between Southeast Europe, Asia Minor and the Caucasus. Basin morphometry and seafloor topography are important oceanographic properties that determine major features of thermohaline structure and water circulation.

The Black Sea is the largest semi-enclosed body of water, with an area of 422,000 km², a maximum depth of 2,212 m, and a volume of 534,000 km³ of water, most of which lies below the 100 m isobath (about 85% of the total volume). It is connected to other large bodies of water at only two points: the Bosphorus Strait (narrow and shallow) which connects via the Sea of Marmara to the Aegean and Mediterranean Seas, and the Kerch Strait which connects it to the Sea of Azov (brackish). The only source of salt water in the Black Sea is the exchange ensured from the Mediterranean Sea through the Bosphorus Strait. The salinity of the deep areas reaches a maximum of 22.3 ppt, while the salinity at the surface is strongly influenced by the flow discharged by the rivers: Danube, Dniester, Dnieper, Don and Kuban. The drainage basin of the Black Sea is more than 2 million km², representing a good part of the European territory (minus the extreme western territories). The surface salinity in the center of the Black Sea basin is 18-18.5 ‰, as opposed to 35 ‰, the average salinity of the planetary ocean.

The subject of this doctoral thesis proposes the study of human history and culture from the perspective of maritime and underwater archaeology, as a result of human interaction with the sea, with the areas adjacent to it, or carried out in the submerged environment, both fields

being interdisciplinary, involving collaboration with experts in various disciplines such as history, archaeology, geology, geophysics, marine biology, anthropology, climate change, etc.

Chapter III presents the interdependence between maritime and underwater archaeology, as well as the methods, techniques and tools used. Maritime archeology is a vast field that involves the study of shipwrecks, ports, maritime shelters, maritime trade routes, terrestrial (on-shore) and maritime (off-shore) sites. On the other hand, underwater archeology is a sub-discipline of maritime archeology that is specifically interested in the investigation of submerged archaeological sites. Underwater archeology exclusively studies submerged contexts whether fresh, brackish, or marine.

Regarding the methods used, maritime archeology envisages a combination of techniques including here underwater and terrestrial excavations, technologies involving remote data acquisition (different sonars, magnetometry, etc.) and archival research, targeting both coastal and submerged sites. On the other hand, underwater archeology uses diving and other specialized techniques for direct or remote examination of submerged sites. In this discipline, geophysical techniques adapted for use in the underwater environment are used.

Like maritime and underwater archaeology, it is also a highly interdisciplinary field, requiring specialized expertise in underwater surveillance techniques, the preservation of artifacts recovered from the submerged environment, and the development and standardization of new archaeological methods. Thus, collaboration with various other specialists involved in studying the marine environment contributes significantly to the understanding of ecosystems and geological processes that influence underwater archaeological contexts.

The beginnings of archeology "under water", underwater archaeology, as a sub-field of archeology as it is known today, take shape in the early 1960s in conjunction with the research work of G. F. Bass at the University of Pennsylvania, where he obtained the title of doctor in 1964 and at the Museum of Archeology and Anthropology of this university where he participates in the codification of ethical norms set forth in the Pennsylvania Declaration of 1970, the precursor to the 1970 UNESCO Convention on Combating Illicit Trafficking in Cultural Goods. His scientific and research interests materialize through the establishment of the Institute of Nautical Archeology (INA) which migrates, together with G. Bass to Texas A&M University, in 1976. Over time, through the graduates trained within the institute, the discipline of "underwater" archeology is gaining momentum, developing into institutions and groups that now operate all over the world.

In the following period, the complex of archaeological sub-disciplines related to the sea: maritime archaeology, nautical archaeology, underwater archeology, and "underwater"

archeology develops in the form of a diversity of projects involving the study of different types of ships, port structures, or artifacts connected with the maritime environment, belonging to a multitude of eras and archaeological contexts, through the use of continuously evolving techniques. With the evolution of working techniques and the standardization of methodological approaches, research in these fields of archeology is becoming more and more complex. On the other hand, the diving technique, the materials, and equipment used, the work methodology and the safety norms are also evolving, allowing today, in underwater excavations, quality standards like terrestrial excavations. Thus, acoustic, and bathymetric systems are used in archaeological investigation in the marine environment and bring together: echo sounders, multibeam sonar, side scan sonars, substrate profiler and substrate classification systems.

On the other hand, magnetometers are instruments that can measure the strength of the earth's magnetic field and can detect its variations caused by the presence of iron-rich artifacts or geological structures with a ferrous composition. The most sensitive magnetometric systems can also detect weak magnetic signatures generated by ancient hearths and pottery agglomerations. The degree of variation in the native magnetic field that a metallic object induces is in direct correlation with the metallic mass of that object, as well as its orientation.

Regarding one of the novelties brought by the present work, we believe that until this moment no exhaustive study has been carried out regarding the classification and description of the techniques, methods, and work tools in the field of underwater archeology from the perspective of applied research in the field.

In the fourth chapter I presented a history of the construction techniques of the port facilities, including their infrastructure, as well as a catalog of the north-western ports on the Black Sea coast, from their establishment until their abandonment or until the 7th century BC. A new element of the work is the creation of a catalog of the ports and trade links between them, as well as the latest underwater research undertaken. The port catalog contains information about: Olbia, Berezan, Tyras, Nikonion, Histria, Tomis, Callatis, Dionysopolis, Odessos, Mesambria and Pontic Apollonia. The research included not only the port facilities, but also the main types of ships from the Greco-Roman period and their classification according to the method of construction and utility.

The study of port facilities offers the possibility of creating an overview of human life through their location, development, and utility. The port became, over time, a landmark in the devotion of society, being used both for trade and as a military base. The existence of ports and knowledge of the art of navigation provided unsuspected advantages for certain communities

that developed economically and militarily, which led to the emergence of empires. The present work aims to trace the evolution of ports from simple shelters, port facilities to real infrastructures provided with jetties, wharves, quays, or warehouses. If at the beginning the harbors were natural, located in sheltered bays near capes or peninsulas, at river mouths, inside lagoons or deep bays, where short breakwaters were often sufficient to complete the natural protection, along the way they are also developed in areas less friendly Ports were also built on islands along the sea coast to serve a large hinterland and were often closely linked to city sites. The port basin was often enclosed in fortifications, even close from the sea. Most of the time the port was separated from the city sometimes for security reasons (military ports), sometimes for cargo and passenger control.

We have paid special attention to the appearance of the first artificial port facilities in the Mediterranean Sea, these dated to the Middle and Late Bronze Age by the appearance of piles of sunken boulders. Such arrangements are attested at Yavne-Yam, a Middle Bronze Age site on the coast of Israel; they suggest a deliberate human enterprise to improve the quality of the natural anchorage. Recent geoarchaeological work at Sidon (Lebanon) has revealed a semi-sheltered port with a sedimentological unit dated to the Middle Bronze Age to the Late Bronze Age. The port layout at Sidon is considered a protoport where small boats were brought onto the beach and larger ships were anchored in the outer harbor.

We also recorded the appearance of the first walls built in the sea like dikes dated in the 9th-8th centuries BC. Such a technique can be found at Tabbat in Syria, Tyr in Lebanon, or Athlit in Israel. The method used belongs to the Phoenicians who used the local stone, called kurkar, for the construction of dikes with the stone blocks placed with the short end facing outwards to cope with erosion. In the beginning, piers were used to increase the protection offered by nature through bays or reefs, later port constructions appeared in less favorable areas as well. Van Beek in 1981 suggested that the dyke is of Levantine origin and that it spread from the Late Bronze Age to the western Punic colonies, Greece and North Roman Africa, where it can be found until the 6th century AD.

In this chapter, we followed the evolution of port facilities and construction techniques starting with the first shelters, as well as during the Greek or Roman domination. The Greeks are known as some of the most skilled navigators, for this reason, the port construction in the Aegean Sea area in the 7th to 6th centuries BC became common. They used natural ports created by bays or mounds of rubble, as is the case of the port of Samos during the time of *Polikrates*, ruler from 530 BC. In the classical era, according to the Greeks, a port - limen - had strong moles - *chomata* - to ensure a quiet and safe anchorage; it was equipped with the wharves, open

hangars, and warehouses necessary for a commercial port - *emporion* - or warehouses for equipment, the naval base - *neorion* - had massive defense towers. However, for a long time, the Greeks used natural harbors, in ready-made bays or coastal areas without currents. An example, of a port with several basins, is the port of Rhodes which also featured warehouses and buildings dedicated to the harbor activity, as well as a symbolic bronze statue of the Colossus of Rhodes, which depicted Helios.

In the Hellenistic era, the port infrastructure was part of an integrated plan that characterized the architecture of the time. A feature of the Greek world seems to have been the construction of cities inland, as Thucydides remarked, to be sure that attacks from the sea would not affect them. Notable examples of such cities, from the interior, are Athens, Corinth, Megara, and Argos, and one might add Sparta and Thebes; in Asia Minor Colophon and Pergamum; in Crete Gortyn, Cnossus itself and more. The outer ports were not independent of the inner city which thus became a coastal fortress.

The Greeks also prove to be skilled builders of port infrastructure. They not only find a favorable place for port construction but try to improve what nature has given them. They built multiple safe harbors with harbor layouts where they used masonry blocks joined together without mortar, but often with clamps, to form the quays; the piers were built of rubble, but sometimes the upper surface and inner side were covered with stone.

Thanks to navigation and the development of port facilities, the Greeks were able to establish settlements far from their home, in new environments, in North Africa on the shores of the Italic or Iberian Peninsula, as well as on the shores of the Black Sea. Greek colonization was the driving force behind the development of unknown territories. The Greeks brought with them their culture, traditions and customs that intermingled with the local ones, shaped each other in new and specific ways resulting in the foundation of modern European civilization.

We also focused on the port infrastructure from the Roman period that improved and modernized the already existing Greek ports. As for their location, most of them were on the sea coast or at the mouths of rivers. There were also rivers that could hardly be ventured, but the river's headwaters were of considerable commercial and strategic importance. Ports built at or near the mouths of major rivers have, however, experienced continuing difficulties with the accumulation of river-borne sediments and silt.

In port constructions, the Romans used hydraulic mortar around 200 BC. The composition of the standard mortar was made of quicklime, brought from rivers or from beaches with water and sand. It was used in the Mediterranean world from 600-700 BC. The difference between hydraulic mortar and standard mortar was the silicon-rich sand from a volcanic area

in Italy. Pliny the Elder in *Natural History* specifically identified the Puteoli area as a source of volcanic ash, which, as soon as it encounters the waves of the sea and is submerged, becomes a single mass of stone, resistant to the aggression of nature, especially if it is mixed with stones quarried at Cumae.

We have defined the term *pozzolana* which defines a cement-like material and is a volcanic ash that is part of the composition of the mortar with the purpose of joining – gluing the building elements. *Pozzolana* gives the mortar underwater resistance. The Romans used *pozzolana* mortar in the construction of bridges, ports, or hydraulic installations. This technology was first used in the port of Puteoli in the northern Gulf of Naples for the construction of a breakwater.

The fifth chapter was devoted to a history of submerged heritage legislation. In this sense, terms such as: zone, baseline, territorial sea, contiguous zone, exclusive economic zone, continental shelf, free sea were defined. Like the heritage discovered following archaeological research on the surface also the submerged finds are an important part of our existence, for this reason, knowledge of European and world legislation regarding the conservation and protection of underwater cultural heritage is necessary.

This thesis introduces some of the first archaeological investigations using geophysical and acoustic remote sensing techniques in the Romanian continental shelf region, as well as their results. It thus has the potential to contribute to the expansion and deepening of the field of maritime archeology in Romania, which is still emerging here, and to the knowledge of the submerged cultural heritage of this region.

Among the workstations presented in this thesis there are new work points and new discoveries for the archeology of the western shore of the Black Sea. The continental platform in the region of the Romanian coast of the Black Sea has a special status, as a continuous archaeological site. The size of this archaeological site, the advanced techniques required to study it, indicate that any discovery in this area has scientific value, coming to complement and clarify previous discoveries.

The cultural and historical contexts that the discoveries, facilitated by the geophysical techniques of archaeological surveying, bring to the surface are diverse and can inform the researcher about the maritime trade networks of different historical periods, about the techniques of navigation and shipbuilding, and about the interaction of different cultures in this space.

This thesis paves the way for future collaborations that highlight the trans- and interdisciplinary nature of maritime archaeology, in which the data from physical and chemical

oceanography, hydrology and hydrography, geophysics and environmental science converge to reconstruct past cultural landscapes.

Along with the discoveries of submerged archaeological contexts, their educational and training value must be considered, the thesis revealing the need for training programs for specialists in fields such as: maritime archaeology, underwater archaeology, conservation of submerged heritage, etc. Moreover, the thesis emphasizes the need to adopt legislative regulations that support the training of specialists, the protection and promotion of submerged heritage, as well as its scientific exploitation to the true potential created by the techniques available today.