CULTURAL STUDIES
IN MARITIME AND
UNDERWATER
ARCHAEOLOGY

VOLUME 6

Delivering the Deep

Maritime archaeology for the 21st century: selected papers from IKUWA 7

EDITED BY KRISTIN ILVES,
VERONICA WALKER VADILLO
& KATERINA VELENTZA

BAR INTERNATIONAL SERIES 3170 | 2024

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Foreword

This peer-reviewed edited volume is based on research presented at the 7th International Congress for Underwater Archaeology (IKUWA 7), which was organised by the University of Helsinki, the Finnish Maritime Archaeological Society and the Finnish Heritage Agency and took place 6–9 June 2022 in Helsinki, Finland. This was the first time an IKUWA conference had been planned to convene in one of the Nordic countries, and it had to be postponed twice from its original date of June 2020 due to the COVID-19 pandemic. Only after most of the obstacles of the pandemic had been overcome were around 250 maritime archaeologists from different continents and countries able to meet in June 2022 in Helsinki to participate in the seventh IKUWA-series conference.

The theme of IKUWA 7 was *Delivering the Deep—Visions for the Future of Maritime Archaeology*. This thematic choice envisioned a productive amalgamation of underwater and maritime cultural heritage studies with research on the challenges the world faces at present, including climate change, erosion threats, water pollution, mismanagement and other types of human-related activities that make the future of maritime archaeology and the conservation of maritime resources uncertain. Overall, the theme urged participants to engage in discussions about the potential for our field to help shape a more promising future for all members of society.

The scientific program consisted of three days and nearly 130 presentations, along with a two-day poster session. The presentations explored maritime perspectives on topics such as climate change, trade, inland waterways, lake and wetland dwelling, war, material reuse and ritualistic and cognitive signs, as well as maritime cultural landscapes. Additionally, maritime cultural heritage was examined as an integral part of 'Blue Growth' and marine science, for generating new knowledge on historical use of marine resources and human relationship with the sea. Subsequently, maritime archaeological research was signified as extremely relevant on an international scale at present, particularly because the United Nations recently proclaimed the 2021–2030 period as the Decade of Ocean Science for Sustainable Development. This edited volume embodies that relevance by displaying the diversity of research topics and approaches as presented during the conference and highlighting the versatility of our field and its relevance to the wider field of archaeology and heritage studies.

Besides the scientific program, one of the objectives of IKUWA 7 was to accentuate the importance of the United Nations Educational, Scientific and Cultural Organization (UNESCO) 2001 Convention for the Protection of Underwater Cultural Heritage (CPUCH), which Finland has not yet ratified. A panel discussion organized by the UNESCO CPUCH Secretariat at the beginning of the conference highlighted the responsibility for protecting and researching maritime heritage beyond national borders. The Baltic Sea region, with its unique preservation of shipwrecks from various time periods and origins, and our small group of experts dedicated to their protection and research, present an opportunity to utilise international agreements such as the UNESCO 2001 Convention for preserving a rich heritage which largely lies on the seabed hidden from view. A glimpse into the remarkable underwater heritage of Finland was provided to all conference speakers through Pekka Tuuri's book *Vedenalainen Suomi [The underwater world of Finland]*, which was gifted to them as a memento of their visit and a thanks for their contributions.

IKUWA 7 was made possible thanks to the infrastructure set up between the Finnish Maritime Archaeological Society, the Finnish Heritage Agency and the University of Helsinki. The conference received vital financial support from the Federation of Finnish Learned Societies, the Weisell Foundation and the Finnish Cultural Foundation. The University of Helsinki provided the conference facilities, while the Finnish Heritage Agency and the University of Helsinki also contributed through their staff's working hours. The volunteer support from student assistants and members of the Finnish Maritime Archaeological Society also contributed significantly to the success of IKUWA 7, and we are very grateful to them. Our most sincere thanks also go to our colleagues in the IKUWA Steering Committee, who were always ready to assist and advise us in the challenges we encountered.

In any conference, the opportunity for networking and getting together with colleagues is crucial. On this point, the feedback from the conference has been overwhelmingly appreciative. As we say in Finland, 'guests make the party,' and we believe this holds true for scientific conferences as well. We extend our most heartfelt gratitude to all the participants of the conference for the unforgettable encounters. We look forwards to seeing everyone again at the upcoming IKUWA 8 in Belgium!

On behalf of the organizing committee,

Vice-chair of the committee — Chair of the committee

Minna Koivikko — Kalle Virtanen

The many facets of maritime archaeology

Kristin Ilves, Veronica Walker Vadillo and Katerina Velentza

In June 2022, about 250 maritime archaeologists gathered in Finland's capital of Helsinki by the Baltic Sea for the 7th International Congress for Underwater Archaeology (IKUWA 7) to celebrate our academic field after two postponements and almost three years of social distancing and academic isolation. It was a week of joyful reunions and new meetings, excited conversations and intellectual discussions with all-things-maritime taking centre stage. The event, in its seventh iteration, called upon maritime archaeologists to think about the future of maritime and underwater archaeology under the title *Delivering the Deep—Visions for the Future*. In the 22 sessions of the conference, central, fundamental and classic themes related to shipwreck analysis and interpretation, maritime trade and commerce and the management of underwater cultural heritage were presented. Newer topics emerged, such as the links between climate change and maritime archaeology, as well as the utilisation of creative citizen science in maritime archaeological initiatives. Themes connected to theoretical frameworks, especially those focussing on maritime cultural landscapes, were expanded from previous conferences, a sign of the growing theoretical insights and maturing research paving the way for a more nuanced understanding of past societies, their behaviours, technologies, economies, beliefs and interactions with their watery environments.

The wide range of themes discussed at the conference underscored the changing nature of maritime archaeology, which has expanded from a subject area originally focussing on underwater archaeology and the study of nautical technology to a dynamic and interdisciplinary field encompassing all tangible and intangible elements of culture related to human activities on, in and around aquatic environments—inland waters and wetlands, as well as seas and oceans. Maritime archaeology is highly interdisciplinary, frequently using and borrowing methodologies and approaches from fields such as oceanography and marine sciences, engineering, geography, anthropology, ethnography and history, to state but a few (Muckelroy 1978; Adams 2002; Bass 2011; Catsambis *et al*. 2011; Ford *et al*. 2020). This interdisciplinarity, as coupled with the continued evolution of the theoretical frameworks applied (*e.g*. Westerdahl 1992, 2011; Tuddenham 2010; Campbell 2020), has yielded a progressive knowledge base equipped with a wide set of tools with which to pursue ambitious academic enquiries. In a fashion similar to archaeology, the openness of maritime archaeology and the internationality of the field (Martin 2011; Maarleveld 2012) allow limitless possibilities of research, as well as the participation of scholars from any disciplinary backgrounds studying cultural elements of human activities within the context of watery environments.

In this edited volume, rendered from the work presented at IKUWA 7, we want to set forth the multifaceted nature of maritime archaeology and underscore the significant role which maritime scholars should play within the broader field of archaeology. Having transcended the techno-functional studies that characterised maritime archaeology for the most part of the twentieth century, the sample of work contained in this book aims to put to rest that now-outdated idea of maritime archaeology as we showcase the ways in which our sub-field can be used to understand how human societies interact and have interacted with their watery environments. While most contributors to this volume would call themselves maritime archaeologists, the definition of this label can vary down to individual levels due to the wide breadth of the field and the unique path through which each scholar has approached the discipline. Concurrently, some contributors may also characterise themselves with additional academic identities, including Stone Age archaeologists, Nordic archaeologists, Classical archaeologists, field archaeologists, maritime historians, historic environment specialists and heritage specialists, to name just a few. What characterises and unites us as maritime scholars is a desire to view human societies from the water (*e.g*. Cooney 2004; Ilves 2004; Adams 2006; Tana 2006; Fleisher *et al*. 2015; Fowler *et al*. 2015; Trakadas and Corbin 2015; Mylona 2020), and by doing so, to extract past maritime cultural landscapes. Our work offers a counterweight to land-oriented research, where the role of maritime communities is often obscured, and it becomes particularly important in regions of the world where societies have developed ways of life deeply entangled with watery environments. Water has provided unique resources and opportunities to humankind along with intricate challenges. Uncovering and understanding the delicate balance of bridging the natural environment with the complexity of the human social environment through the documentation of maritime histories, tangible and intangible heritage, along with contemporary attitudes, and values of maritime communities are key outputs of our field. The examples from the human–environmental past, our insights into the impact of aquatic environments on material culture, and our ability to unveil local, traditional and indigenous knowledge can play a fundamental role in reshaping humanity's relationship with the water, in the present and the future (Trakadas 2022; Velentza 2023). Through immersive and participatory, place-based and historically-informed heritage approaches maritime archaeology has already revealed its contribution to assisting communities reconnect with maritime and watery localities to restore the equilibrium between nature and culture (*e.g*. Kelly *et al.* 2023; McDonagh *et al.* 2023; Buchan *et al*. 2024).

With this in mind, the book has been organised into five thematic sections which capture the current trends and directions of maritime archaeological research. Through the varied range of perspectives and methodological approaches presented in each section and contribution, this volume shows the inherent strengths of maritime archaeology. It serves as an example of the discipline's unique academic position, fostering a deeper humanistic understanding which bridges the realms of nature and culture within the maritime spectrum.

Special mention should be made to new generations of maritime archaeologists, represented here by a healthy balance of postgraduate students and early career researchers. We hope their work as presented here is seen to exemplify what the turn from techno-functional studies to more theoretically aware and socially focussed concerns can look like. Through thorough reviewing and mentoring, we have provided a productive scholarly space for the next generation of maritime scholars, where they could experience the process of academic publishing. The importance of peer support and mentoring for early career researchers and their publishing efforts has been pointed out in several recent studies (*e.g*. McAlpine *et al*. 2018; Nicholas *et al*. 2017; Merga and Mason 2021), and we have striven to ensure their voices are heard. This is particularly important in the post-COVID-19 era, during which major systemic problems of academia have been amplified, making early career researchers especially vulnerable (Gibson *et al*. 2020). By giving the opportunity to up-and-coming scholars to publish their research findings in this book, we hope to create significant momentum and set an example for improving research culture and practice in the field of maritime archaeology.

Maritime cultural landscapes and maritime communities

As maritime scholars, our interest rests squarely on the broader ways in which watery spaces (*i.e*. seas, lakes, rivers and wetlands) and the maritime worlds created around them have shaped societies and cultures throughout history. This can only be achieved if the lens through which we see the past is broad enough to explore the meshwork that connects land and water. This is what Christer Westerdahl postulated in his paradigm-shifting framework 'the maritime cultural landscape' (1992; 2011), and in the first section, the book draws attention to studies which apply this perspective. The distinct geographical regions covered here, ranging from Ireland to the eastern Mediterranean and the Black Sea, highlight the relevance of this perspective to the study of any site, culture or community living in the proximity of watery environments.

Moving from previous typologies and technological studies, Karl Brady's chapter demonstrates the significance of dugouts in Ireland's prehistoric past, offering insights into early watercraft development and how boats were vital in facilitating travel, trade and the transportation of goods and animals within the island's freshwater environments. Through the discussions on the deliberate deposition of logboats, this chapter also highlights how their study is shedding light on a variety of complex social activities. The study emphasises the changing perception of logboats from simple vessels to valuable archaeological artefacts and underscores the need for continued research and preservation efforts to understand their significance and broader historical context. His work is followed by that of Sebastian Adlung and Martina Seifert, who provide new insights on maritime communities living on the islands of the Adriatic Sea during ancient Greek and Roman times. By investigating the role of islands as important landmarks, trading centres and stopovers in maritime interactions, this contribution examines how local communities and traders utilised islands for settlement, trade, and transportation, highlighting the significance of ports and harbours, as well as coastal settlements in shaping the economic and cultural dynamics of the region. This study challenges previous interpretations of colonisation and Romanisation, emphasising the need for a broader perspective on settlement history, migration processes and interactions among island communities, ultimately contributing to a better understanding of the complex historical landscape of the Adriatic region.

Maria M. Michael's contribution, on the other hand, presents an innovative holistic approach to understanding fishing as a way of life beyond its material aspects. Michael highlights the multifaceted character of fishing, discussing technological, social, economic and environmental factors. She suggests that fishing is a lifestyle which encompasses various elements of the maritime cultural landscape. The research she presents, which is focussed on the island of Cyprus, is comprehensive in analysing archaeological evidence, ethnographic data and environmental factors as relevant aspects needed to reconstruct ancient fishing practices and perceptions. This type of integrated study sheds light on the complex relationship between humans and the sea, and it allows us to examine fishers' knowledge of the landscape and seascape. In the final chapter of this section, Kalin Dimitrov and a team of co-authors explore the underwater cultural heritage of the Ropotamo River Bay on the southern Bulgarian coast of the Black Sea to uncover local adaptations to the watery landscape. Pioneering in the use of modern techniques for documentation and post-excavation processing in the framework of maritime archaeological investigations conducted in the Black Sea region, this study offers empirically grounded insights into the history of Ropotamo pile-dwelling communities, provides evidence of sea level changes and contributes to understanding the ecological and cultural dynamics in the region over a span of 7,000 years.

Collectively, these studies highlight how broadening our research to explore maritime communities from a holistic perspective which integrates material from land, as well as from underwater sites, can provide nuanced views of the past when applying the maritime cultural landscape framework. These studies also serve to accentuate the importance of interdisciplinary perspectives in maritime studies, a theme which permeates the rest of the contributions, albeit with different foci.

Interpreting maritime objects and representations

As part of broader cultural landscapes, maritime realms have found their way into social imaginations in various forms, from rock art to votive offerings and symbolic associations. Each is represented in the second section of this volume, giving the reader a very broad overview of the ways in which maritime archaeology can be studied. Boat and ship motifs can be found represented in different artistic media all across the world and throughout time as symbols of deeper cultural meaning. The first example in this volume comes from the north. Through the study of rock art, Ekaterina Kashina, Ville Mantere and Evgeniy Kolpakov explore the use of watercraft by prehistoric hunter-gatherer-fishers in northeastern Europe, focussing on the territory of modern northern Russia. The authors discuss the scarce attention given to early water transport in archaeological investigations due to limited archaeological finds and analyse the significance of Stone Age rock art as a source from which to learn about early watercraft, discussing the various boat types depicted and their potential functions. The study highlights the challenges of interpreting rock art images, nevertheless suggesting the presence of both logboats, skin boats and bark boats. A ceremonial aspect is suggested in relation to the use of boats with elk-head sculptures, highlighting the role of the waterworld in early cultures of the region.

The symbolic attributes of ships are further explored by Marina Maria Serena Nuovo and Stefania Tuccinardi, but this time, through the analysis of two Roman sculptural reliefs of the second-third century AD from Italy. The study compares the artistic style, symbolic representations and features of seagoing vessels and maritime landscapes as depicted in the large monumental relief from Fucino Lake and the small relief uncovered during the archaeological excavations at the harbours of Claudius and Trajan in Portus, Rome, Italy. Through an iconographic and contextual analysis, the authors interpret the iconography of the two reliefs as a celebration of the extraordinary feat of engineering undertaken during the construction of the artificial outlet of the lake. Furthermore, the authors contend the ships depicted in the reliefs should be interpreted in connection to the works, and the overall iconography should be considered as the celebration of Rome and of the greatness of its emperors. Hence, the symbolic nature of ships stand here for the great achievements of the state, an example of the versatile nature of ship symbolism and the need to use holistic approaches in the study of this type of material.

Focussed on symbolism and iconography, but in a religious context, we next find an innovative study by Rafail Papadopoulos, who examines the iconography of marine vessels and their connection of Christian saints. This preliminary study, part of the author's master's thesis, opens an exciting new avenue for research examining the connection between Christian saints and maritime material culture. With a focus on prominent examples from early Christianity, and especially the eastern Greek Orthodox Christian tradition, Papadopoulos illustrates how in Christian spirituality, faith has been associated with material realities from its inception. Presenting a series of examples on how water is conceived and integrated into Christian stories, as well as the use of maritime-related metaphors to explain crucial elements of the faith like equating the Church to a ship, the author introduces the reader to key 'maritime' saints, their lives and miracles, and how these are entangled with local beliefs and spiritual practices which take tangible form as votive icons. The ideas put forth in this contribution add to the examples presented in the volume on the importance of applying holistic approaches to the study of the maritime cultural landscapes of past communities, and the need to incorporate interdisciplinary approaches—in this case, mixing archaeology with theological and art historical research.

Katerina Velentza's work, on the other hand, presents an intriguing case for the maritime archaeology of shipwrecks and public perceptions throughout history. In her contribution, she constructs a narrative of loss and discovery at sea, examining ancient sculptures found underwater from Classical Antiquity to nowadays. This long-term approach allows Velentza to tap into a world of shared emotions and reactions when the public is confronted with the recovery of a lost sculpture. This sense of wonder and mystery—and of catastrophe and fear—has had an impact on the way the field of maritime archaeology is perceived, not just by academics but also by the general public; a continued effort to educate the public on the relevance of good practice in the recovery of material from underwater sites, she reckons, will ensure the protection of this unique archaeological material. Hence, in Velentza's world, one can perceive a different type of symbolic attribution of shipwrecks, and through this, perhaps, we can begin to understand how moments of tragedy at sea can permeate people's imagination.

By exploring the diverse perspectives presented in this section of the volume, we gain insight into the various manifestations of symbolic associations. These insights not only highlight the wealth of research opportunities, but also underscore the necessity of employing holistic approaches to study the symbolic, artistic, religious and societal dimensions contained within maritime cultural landscapes which span diverse historical and geographical contexts.

The archaeology of ships and boats

The study of ships and boats undeniably sits at the heart of maritime archaeology. They are the means by which maritime communities make use of aquatic resources, how they harness the winds and connect distant places. But ships too can be studied in various ways. In the first contribution of this section, Stephen Wickler conducts a comprehensive analysis of the Iron Age boat finds from bogs in northern Norway, through which he is able to piece together local boat-building traditions. The author postulates the existence of specialisation and adaptation to challenging local conditions, providing grounds for critiquing previous assumptions of cultural conservatism and underdevelopment due to marginalisation. The study sheds light on boat construction variation, continuity and maritime innovation in northern Norway during the Nordic Late Iron Age and Mediaeval period, challenging misconceptions and highlighting the shared Sámi-Norse boat building tradition. But beyond techno-functional analyses, Wickler explores the ritual aspects of boat deposition and the significance of boat burials in the context of both mundane and spiritual life, revealing insights into the connection between boats and northern maritime communities. This way of understanding watercraft—outside of the constraints of their function and into the spiritual realm—highlights the ways in which societies can be understood through the holistic analysis of ships and boats.

Brendan Foley and Martin Hansson, for their part, further contribute to the contextualisation of ships and boats in society by reflecting on the way in which nautical design is affected by social organisation. In their contribution on the *Gribshunden*, a royal Danish-Norwegian flagship launched in 1485 and sunk just ten years later enroute to a political summit in Kalmar (Sweden), Foley and Hansson depart from other studies which often focus on the technological aspects of shipbuilding to explore the connection between the ship's design and social stratification in late Mediaeval times. The authors extrapolate the physical arrangement of *Gribshunden* to monumental architecture on land, especially that of Glimmingehus castle, successfully drawing parallels between the two which define the social division known from this period. Like Wickler's contribution does, Foley and Hansson open a door to understanding ships in context, not just as technological advancements, but also as places and spaces which implement the cultural ideations of societies. This approach, which was first introduced by Adams (2003) and follows the holistic approach promoted by the maritime cultural landscape framework, is shown here to provide a new layer of meaning to the study of nautical technology.

From a technological perspective, however, there is still much to be learned, especially when considering the longevity of ships and the necessary repairs they underwent during their lifetime or the transformations they underwent through repurposing processes. The last two contributions of this section of the volume are excellent examples of the difficulties maritime archaeologists encounter when studying ships, especially when faced with the cumbersome task of distinguishing the original layout of the ship from later repairs or transformations. Hendrik Lettany makes a compelling case for the re-evaluation of the seventeenth-century shipwreck *Scheurrak SO1*. Previous interpretations have argued for the existence of a second layer of hull planking, known as the 'double Dutch' solution, which was thought to be part of the original nautical design. The author's re-evaluation of the ship's keel, stem and construction sequence indicates this outer layer of planking might have been added during a modification or repair phase, rather than being an integral part of the initial design. Through a meticulous analysis of the hull remains, Lettany shows the difficulties encountered by nautical archaeologists when studying shipwreck remains, and brings forth the implications of this new interpretation in the context of construction sequences. Further research is planned to understand the meaning of these changes, but Lettany has already made a substantial contribution to the field by highlighting the importance of understanding construction sequences when attempting to separate original features from later modifications.

Further insights into the practice of ship repairs and maintenance is presented by Michael R. Jones through the Yenikapi ships. These were found during the excavations of Constantinople's Theodosian Harbor, which was built during the reign of the Byzantine emperor Theodosius I (379–395 AD) and used until the eleventh century AD. During the 2004–2013 excavations, archaeologists uncovered 37 exceptionally well-preserved shipwrecks of fifth- to late tenth- or early eleventh-century AD, providing archaeologists with an unparalleled source of information for the study of Byzantine ship construction and maritime trade. This data enabled Jones to present a cohesive argument on hull maintenance and repairs practise in the Mediterranean, shedding light on ship longevity beyond textual sources. The discussion on the identified hull repair methods and timber recycling seen in the Yenikapi shipwreck assemblage provides new considerations and perspectives on the interpretation of generally Mediaeval shipwrecks documented underwater across the Mediterranean, emphasising for example, the real concern which wood rot posed to the survival of oak timber. Evidence of re-use of ship timbers was documented, as well as the use of new planks for repair; the author argues that this, together with other finds extracted from the excavations, can be used to gain new insights into the working methods and everyday conditions of maritime industries. Hence, despite the long-standing tradition of nautical archaeology within the field of maritime archaeology, there are still innovative ways of understanding ships in their context, as well as new ways of interpreting their remains through multiple layers of evidence.

In unveiling the multifaceted layers of boat and ship interpretation, these studies of water vessels delve into the technological details, while underscoring the challenges faced by maritime archaeologists in discerning the nuanced historical narratives embedded within shipwreck remains, often compelling a re-evaluation of construction sequences and repair practices.

Interpreting underwater archaeological sites

The interpretation of archaeological sites is also dependent on the research questions which we bring to the table and the tools we devise for their performance. Each time we define the confines of a site, we are making decisions which will impact our conclusions. Therefore, the act of interpreting an underwater site needs to come from a point of reflection and a recognition of the situational knowledge which to a certain degree denies objectivity. One can focus on the landscape as a whole, or the links traced by objects through their provenance; the focus can then be used to argue for the defence of a type of underwater site, or help bring light to an industrial past which is often overlooked.

In the first contribution to this section of the volume, Carlos Del Cairo Hurtado and Jesús Alberto Aldana Mendoza present a compelling case for the use of interdisciplinary approaches for the interpretation of underwater archaeological sites, focussing on the case of Cartagena and the 1741 naval battle which took place on its waters. During that fateful year, the British launched an ill-fated attempt to capture the enclave through a combined naval and land attack. The confrontation resulted in a British defeat, along with a sea floor littered with remnants of the fray. These are treated by Del Cairo Hurtado and Aldana Mendoza as an underwater landscape which needs to be studied in its entirety, from the archaeological material to the environmental conditions at play in the area. By applying multiple interpretative frameworks, the authors demonstrate the vessels' tactical moves, the troops and the arrangement of defensive and offensive systems were directly related to winds, sea currents, mangroves, mosquitoes and the area's geomorphology. The result highlights the importance of not only engaging with the archaeological material, but also contextualising its location with environmental data to better understand the morphology of the site in the context of warfare.

The type of material available to Del Cairo Hurtado and Aldana Mendoza is not always present for all sites, and interpretive methods sometimes depend on partial hull remains and the few items found inside or scattered around them. This was the situation for the *Paal 27.1* shipwreck, which was found adrift by a bird watcher in the Frisian coast of The Netherlands. Only a section of the hull was left with some items still inside. By the time the floating woods were pulled ashore, some items had been rescued by the bird watcher, and others had fallen off into the sea. The interpretation of the material was a significant challenge for the authors of the second contribution of this section. Through the analysis of the material, Heidi E. Vink and Tobias B. Slowronek were able to trace the ship to the eighteenth century and start unfolding its history, which is connected to the transatlantic slave trade. Using archaeological, historical and scientific approaches the authors were able to contextualise the items found inside the hull to the history of trade goods exported from Europe in exchange for slaves. An important portion of the recovered material consisted of brass rods and cauldrons. The scientific analysis of the brass, a metal composed of copper and calamine (zinc), allowed Vink and Slowronek to trace the copper to Falun (Sweden) and the calimine to Stolberg (Germany). This, the authors contend, highlights the way in which the networks of the slave trade were widely extended through Europe in response to supply and demand. Further historical studies have allowed the authors to explain the use of brass rods in a historical perspective, as the material has been used as an exchange currency in Africa since Mediaeval times. Vink and Slowronek show it is possible to engage meaningfully with archaeological material through a combination of approaches, even when the site is composed of decontextualised hull remains.

The following two contributions engage with a type of material which is not often recognized as relevant for archaeology, thus shifting interpretation from historical contextualisation to the legitimacy of the site as archaeological material. Julie Satchell presents the results of a recent study of the large numbers of merchant vessels lost off the south coast of England during the First World War. Through the analysis of the archaeological and historical data, Satchell aims to understand how this large corpus of shipwrecks contributes to understanding the warfare, ship technology, international trade and personal experiences of people during WWI. Through the review of selected case studies of cargo and passenger vessels which wrecked during that period, this study brings forward debates on the lack of protection by heritage legislation of most non-military shipwrecks of the late nineteenth and twentieth centuries, despite their international significance and commemorative importance. In creating meaning for the site, Satchell raises our awareness of the need to protect such sites.

Alistair Byford-Bates, Ben Saunders and Euan McNeill, on the other hand, turn our attention to the emerging sub-field of aircraft archaeology through the analysis and recovery of a Fairey Barracuda, an all-aluminium high-winged monoplane of the Royal Navy's Fleet Air Arm, which was discovered submerged in the sea close to the end of the runway at the former Royal Navy Air Station (RNAS) Daedalus in Hampshire, England. Through evidence collected during the recovery of the aircraft from under the water and through archival research, the authors discuss the identification of the aircraft and its significance as an example of the technological advances in aircraft design and development in the 1930s and 1940s in the United Kingdom. The study also reveals insights into wartime production contingencies across aircraft manufacturers in Britain, and the human stories of the individuals involved in each production and operation. As the authors point out, aircraft found underwater often have ties to personal stories which lie within the reach of archaeological and historical inquiry, opening an intriguing path to a combination of archaeological analysis and oral history. The object becomes a tangible link between past and present, allowing archaeologists to work at an individual level which we can expect to become more meaningful as years go by and events pass out of living memory.

The contributions exploring the interpretation of underwater sites underscore the multidimensional avenues available for studying submerged sites, encompassing environmental, technological, historical and socio-cultural perspectives. In line with the other contributions to the volume, all of the studies in this section highlight the need for and usefulness of interdisciplinary methodologies and nuanced, reflective approaches. Maritime archaeology, whether it is focussed on shipwrecks and underwater sites or maritime landscapes and symbolic manifestations in the study of human activities within the context of watery environments, navigates between the tangible nature of material artefacts and the contextual richness they offer.

Underwater cultural heritage management and public engagement

Lastly, the protection of underwater cultural heritage is an unavoidable topic for maritime archaeology. Numerous threats affect the integrity and survival of underwater sites, not just treasure hunting and looting, but also other, less obvious elements such as the construction of offshore infrastructures, some fishing techniques and the high-energy storms which are becoming increasingly severe due to climate change (Velentza 2023; Westley *et al*. 2023). Faced with these and other threats, maritime archaeologists have been developing and implementing different strategies to protect underwater cultural heritage; these range from supporting legislators to improving management at a state level, to raising the awareness of the value of underwater cultural heritage in the general public. In this section of the volume, we draw attention to four of these topics: the challenges of underwater cultural heritage protection in times of climate change, the role of preventive archaeology in protecting maritime heritage, the importance of devising outreach tools for contextualising underwater sites for the general public, and finally, the potential for exploring the inspirational and evocative dimension of shipwreck sites through poetry.

With growing concerns from environmental scientists about the increasing frequency and force of storms due to climate change, maritime archaeologists are becoming more and more aware of the need to evaluate the impact of environmental events on underwater and coastal sites in order to devise ways of protecting the maritime cultural heritage for the future. In the first contribution of this section, Sandra Henry and her co-authors discuss the approaches followed by the CHERISH project in Ireland for investigating the impacts of climate change on wreck sites exposed to different environmental conditions. With the use of remote sensing and archaeological recording methodologies conducted in selected shipwreck case studies, these authors have created substantive site records, as well as baseline and monitoring datasets, which have been analysed and evaluated through a collaboration of maritime archaeologists, geologists, divers, surveyors and geophysicists. This multidisciplinary approach is presented as an effective way to increase our understanding of climate change impacts on coastal and underwater cultural heritage sites. The contributions of the chapter are twofold, as it both raises awareness—backed by data—of the impact which climate change is having on underwater sites and offers a way of monitoring and evaluating this impact in order to take preventive measures for the protection of this type of sites.

The need to invest public time, effort, and funds to protect underwater sites can only be justified if a certain degree of social consensus is achieved on the worthiness of saving this type of cultural heritage. The ICOMOS 1996 Charter on the Protection and Management of Underwater Cultural Heritage (Sofia Charter 1996) recognises that ‘underwater cultural heritage contributes to the formation of identity and can be important to people’s sense of community’. Through the ethical and sensitive promotion of underwater cultural heritage, these sites can play an important role in sustaining socioeconomic growth around the world. Therefore, finding ways of engaging the public and increasing the accessibility of underwater sites is an important step in securing and improving the social impact which underwater cultural heritage can have in local communities. In the second contribution of this section, Eike Falk Anderson and Thomas Cousins do just that by presenting an innovative and engaging way to enhance public engagement with archaeological sites through the creation of a virtual heritage experience which allows the user to contextualise the archaeology in a meaningful way. The project, called ‘Exercise Smash’, focuses on the WW2 D-Day landings in Normandy and offers a two-step activity where the user is first tasked with landing an amphibious tank before exploring the underwater remains. This virtual tool not only makes underwater sites accessible to non-divers, it also contextualises in-situ remains in the history of the region. Furthermore, it establishes strong links between tangible and intangible cultural heritage, combining stories about and memories of a historical event with archaeological finds directly linked to the event. The work of Anderson and Cousins exemplifies the way in which technology can help raise awareness of the importance of this type of archaeological site, while supporting the socioeconomic growth of the local community in light of the tourism industry it attracts. Advances like this add value to underwater cultural heritage beyond academia and into society, and contribute to changing the public’s perception of maritime heritage.

Earning a place in public life is vital, since public opinion can persuade legislators and create momentum for actions or activities which will protect underwater cultural heritage. Advances on public policy and the management of maritime heritage sites is uneven throughout the world, so examples of good practice and lessons learned are important to set a baseline which others can follow. In the third contribution, Nicolas Birgourdan takes a long dive into the history of maritime cultural heritage management in France to discuss how preventive archaeology has been able to evaluate and mitigate the impact of development on this type of sites. He makes a good point in noting the work of preventive archaeology has developed as a mitigation strategy to protect maritime cultural heritage while supporting industrial development; as a result, target areas for intervention and ensuing collected material do not respond to archaeological interests, but rather, to the locations of industrial projects. The model is nonetheless one which facilitates the protection of maritime cultural heritage and ensures its survival for future generations; it is presented here as a case study for others seeking to develop or improve their government's approach to underwater cultural heritage management.

Last but not least, we close the volume with a most unusual contribution, one which delves into public perceptions of shipwrecks and the creativity nurtured through senses of loss, awe and mystery as liberated by the tragic fate of these ships. We have already seen in Velentza's contribution how this fascination with shipwrecks and the tragedy which results from sinking ships can be traced. In the final contribution of the volume, Katariina Vuori taps into her own interest in maritime archaeology and her love of poetry to access shipwrecks as sources of inspiration. She introduces a poetic approach to exploring maritime cultural heritage, focussing on the *From wreck to poetry* workshops held at the IKUWA 7 conference. Based on the workshop outcomes, Vuori examines the impact of combining archaeology and poetry on how wrecks are perceived. Through a three-stage metaphor analysis and free association, she shows that structured poetry exercises can enrich descriptive vocabulary and bring new insights to the interpretation of material culture. This out-of-the-box thinking is proposed here as a way for experts in maritime heritage and archaeology to look at their material from a completely different perspective (see also Marila and Ilves 2023), something which can serve to enhance the understanding and appreciation of the cultural heritage among diverse stakeholders.

Learning how to communicate—in different ways, at different levels and with various objectives in mind—is something the maritime archaeologist needs to nurture. As seen in this section of the volume, the very existence of maritime archaeology depends at least in part on our ability to communicate the vital importance of our work and of the maritime heritage which we study. In a world where social media has become the meeting point for most social actors, we need to recognise the importance of engaging the public on multiple levels, but also of finding new ways of explaining our work and expressing our passion for the maritime realm and the many wonders it contains. Our ability to think and write creatively about our work will have an impact on the management and protection of our maritime heritage.

In compiling this volume, we aimed to showcase the up-to-date state of the field in the twenty-first century. Through the interdisciplinarity and diversity of the maritime archaeological work taking place in the present, we hope to demonstrate the ways in which the discipline is moving forward to advance the study of the past, but also participate in discussions addressing the challenges of the present and the future. Through a broad methodological, geographical and chronological spectrum, the 20 chapters in this volume provide a sizable sample of the current trends in maritime archaeological studies and the direction of the field as we approach the end of the first quarter of the 21st century. We hope readers will find themselves immersed in worlds unlike any they have ever found on land, and for which a view from the water is essential if we are to understand the ethos that affected their decisions and structured their behaviours.

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Maritime cultural landscapes and maritime communities

1

The contribution of logboats to understanding our past: evidence from Lough Corrib, Ireland

Karl Brady

Abstract: The study of boats is integral to understanding how societies lived and moved on and around lakes and rivers throughout time. This paper discusses the discovery and investigation of a number of newly discovered logboats from Lough Corrib. These are greatly adding to our knowledge in this area and providing new and exciting insights into the use of boats in the inland waterways, as well as providing a greater understanding of the wider lacustrine cultural landscape. This chapter provides an overview of work carried out by the Underwater Archaeology Unit of the National Monuments Service investigating over 30 logboats dating from the Neolithic to Mediaeval times. An overview of how these discoveries are enhancing our knowledge of the wide range of social practices taking place on the lake including raiding, hunting, warfare, travel and communication is presented. Particular focus is applied to a number of logboats which can be argued to have been deliberately sunk as part of ritual deposition.

Introduction

It is not surprising that, as an island subject to a damp, temperate climate and influenced by a seemingly never-ending cycle of Atlantic weather systems, large areas of the Irish landscape are dominated and delineated by water in the form of numerous rivers, lakes, bogs and streams. This network of waterways and wetlands has not only shaped and moulded the landscape, but also strongly influenced settlement patterns, land use, political developments and social practices, while also influencing the shape of ancient tribal and territorial divisions which still form the basis of many of the administrative boundaries today.

In recent centuries, the drainage of these waterways has resulted in the discovery of thousands of important artefacts, many of which now make up a large parts of the significant collections in the National Museum of Ireland in Dublin, the Ulster Museum in Belfast and many smaller designated museums around the country. Logboats form an important part of these collections, with over 560 recorded to date throughout Ireland (MacDowell 1983; Gregory 1997; Fry 2000; Wreck Inventory of Ireland Database (WIID)). Unfortunately, many of the boats found in earlier times were destroyed, broken up for fire wood, reused for farm buildings or removed from their anaerobic environment and left to dry out, resulting in their rapid deterioration and ultimate destruction. As a result, very little information is known about the early finds. Very often, these older finds were made when lake levels dropped in the summer months and the logboats were identified close to shore, having probably been exposed time and again over the centuries. The identification of logboats in deeper lake and river waters in recent times has created the possibility for developing a better understanding of the nature and significance of these vessels.

In Ireland, logboats have traditionally been considered simple or crudely made vessels with very little to contribute to mainstream archaeology and seen to be of interest only to early watercraft specialists. This has led to mainstream archaeology largely ignoring these finds, with only occasional passing mention in the principal archaeological textbooks. In recent years, however, this narrative has changed somewhat as result of targeted research and interventions by heritage authorities to record, research and at times save logboats under threat of being damaged or destroyed. In this regard, archaeological investigations carried out by the Underwater Archaeology Unit of the National Monuments Service in Lough Corrib have resulted in a remarkable range of finds being revealed, not only ancient logboats, but also the artefacts associated with the wrecks themselves (Brady 2014: 34–38, 2015: 20–21). These finds have begun to highlight the value and importance of such watercraft by providing new insights into how early watercraft changed and developed over time, while also highlighting the importance of such craft in their own right. Additionally, the role boats played in the domestic, industrial, social, ritual and martial lives of the past societies who lived and moved on and around the lake over several millennia is becoming clearer, thereby also highlighting the rich archaeological potential of our inland waterways, and lakes in particular.

Lough Corrib Location and historical background

Lough Corrib is located in County Galway in the west of Ireland. It is the second largest lake on the island of Ireland with a surface area of approximately 176 km². It is an irregularly shaped lake which measures 44k m in length by 17 km at its widest, but it narrows to only 600 m near its central point. It is a relatively shallow lake dotted with well over 1,000 islands and islets. The Lough is generally

Figure 1.1. Archaeologist from the Underwater Archaeology Unit carrying out a metal detection survey at the bow of Kilbeg 3 logboat. Metal detection surveys are carried out by the UAU to help uncover any hidden artefacts concealed under layers of silt both within and outside of the boat. Photo by Barry McGill, copyright National Monuments Service, Government of Ireland.

considered to have depths generally not exceeding 10 m; however, there are areas of deeper water at the northern end of the lake which reach 50 m plus. The lake has lots of folkloric associations, with its origin story probably being the best known.

The name Corrib is thought to be a corruption of Orbsen or Oirbsen, which is another name for Manannán Mac Lir, the mythical mariner who ruled the other world (Ó hÓgáin 1990: 286–289). Manannán has many watery associations, including being god of the sea (mac Lir literally meaning 'son of the sea') with a boat called *Wave Sweeper* in which he could travel over land and water (Kelly 2019: 34–41). Kelly has also suggested Manannán was protector of the solar boat on its nightly journey through the Underworld and should be regarded more as a solar deity than a sea god (Kelly 2019). In Irish tradition, Manannán was reputedly killed at the legendary battle of Moycullen (located on the west side of the lake), and when his grave was being dug, a great torrent of water poured from the hole to form the lake now called Lough Corrib. Given Manannán Mac Lir's association with the origin-legend of the lake and boats, it is not unreasonable to put forwards the possibility that some of the boats, which were ritually deposited in the lake (see below) may have been dedications or votive offerings to Mac Lir himself.

The earliest representation in the literary sources of the Lough Corrib area may come from Ptolemy's second-century AD *Geography* or *Atlas*, which provides a list of places, tribes and co-ordinates for the known world including Ireland. Orpen has suggested that *Ausoba* may represent Galway Bay or the 6 km-long River Corrib, which drains Lough Corrib and the wider area (Orpen 1894: 118). Ptolemy lists a tribe in the area known as the *Auteini,* which would indicate that in the later Iron Age, the area was one of a handful of locations known to merchants and mariners travelling along the Atlantic fringes important enough to be mentioned in Ptolemy's map and *Geography*. As some of the logboats investigated so far date to this period, it is tempting to think we can associate these boats with a named Iron Age tribal group for which we have no other literary evidence. Over time, the lake was an important defining boundary between the surrounding ancient tribal territories, which by later Mediaeval times became the baronial districts which are extant today.

Background to the logboat discoveries and follow-up investigations by the Underwater Archaeology Unit

The logboats came to light during hydrographic surveys of the lake undertaken by Trevor Northage, a master mariner who mapped the lake from 2008–2014 in order to produce navigation charts for recreational use (Northage 2014). In addition to the detailed charts produced of the lake, side-scan sonar data collected during the survey has revealed and imaged important new information regarding the bathymetry, geology, ecology and make-up of the lakebed, as well as imaging a large number of previously unrecorded logboats and wreck sites. As part of its wider statutory brief to manage and regulate activity on underwater archaeological sites in Ireland, including the inspection of new discoveries, the Underwater Archaeology Unit (UAU) of the National Monuments Service (NMS) liaised with Mr Northage on his discoveries, following his reporting of new finds to NMS. The UAU then began to undertake its own surveys of the lake, as it clearly retained further extensive and significant underwater cultural heritage. Since 2012, the UAU has been carrying out a systematic programme of surveys and investigation in Lough Corrib identifying, documenting and analysing these sites, while also recording them in the WIID.

During the course of our work, a number of threats to these sites have been identified, highlighting the need for more proactive investigation and rescue work to ensure that some of the more fragile, vulnerable and archaeologically significant sites are protected. This has led to a number of important artefacts being recovered from the lake to ensure their long-term protection. The threats to these sites vary and include unregulated diving activity on a number of logboats (all diving on archaeological wrecks over 100 years old requires a licence issued by NMS), accidental damage as a result of anchoring by boating traffic and increased storm activity as a result of climate change, an issue which is only going to increase with time (Daly 2019; Harkin *et al*. 2019). Damage as a result of the spread of invasive species to the waterway such as *Dreissena polymorpha* (zebra mussels) and *Lagarosiphon major* (curly waterweed) are also identifiable threats.

In addition to the anthropogenic threats, the normal range of erosive and biological forces are also evident in the lake, with wood borers and chironmonid larvae degrading the boats over time and destroying important evidence such as original features and tool marks. To date, over 60 potential sites have been dived and investigated by the UAU, of which 30 have been confirmed to be ancient logboats, with a further four sites being confirmed as wooden lake boats dating to between the eighteenth and twentieth centuries. There are a further 15 potential logboat sites and geophysical anomalies still to be investigated, and when combined with the previously documented historic finds, there are potentially 53 logboat

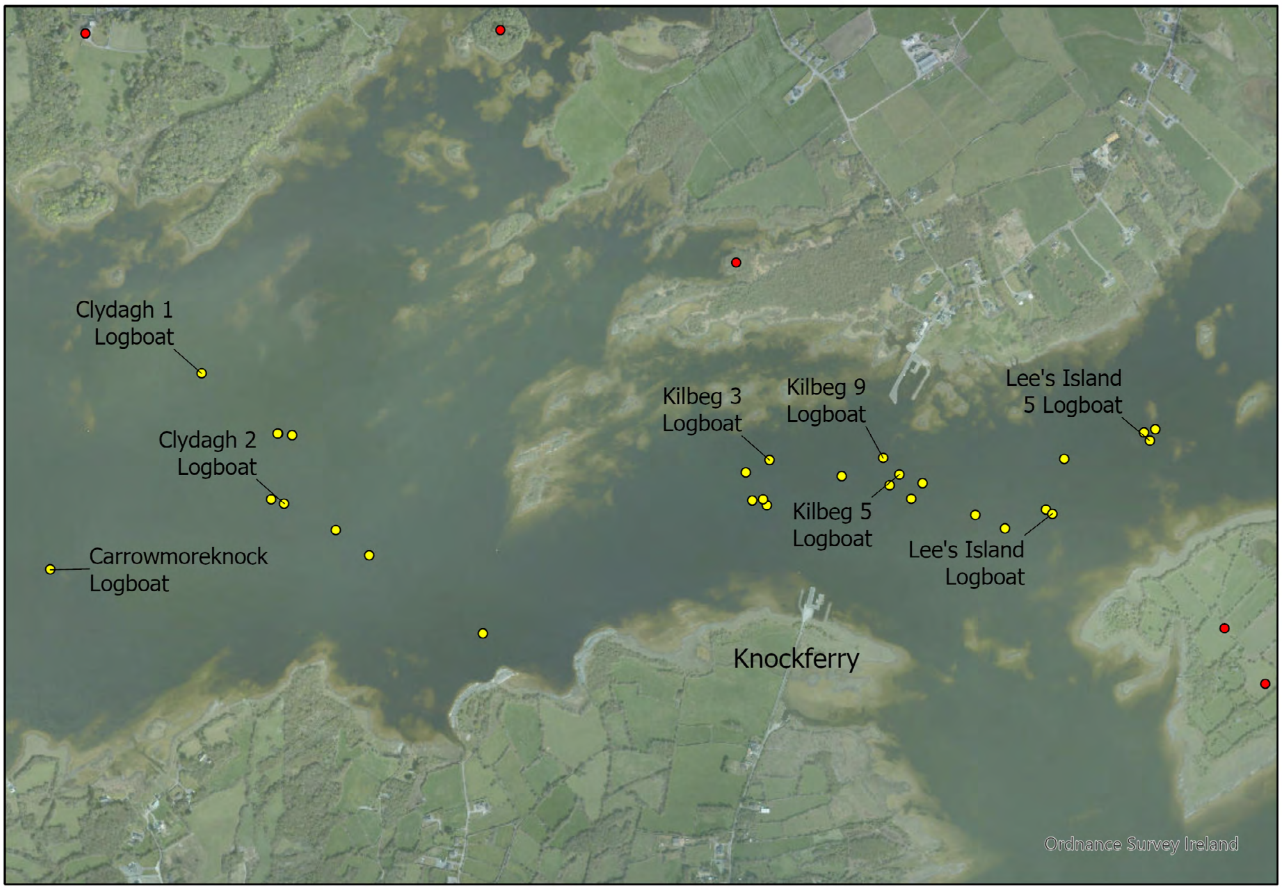

Figure 1.2. Distribution of known logboats at Kilbeg and Knockferry represented by the yellow dots. Known archaeological monuments on land are represented by red dots. Ordnance Survey Ireland License No OSI-NMA-014, reproduced courtesy of Tailte Éireann, Government of Ireland.

sites located in the lake, with the possibility that many more will be discovered.

Ferrying point

Most of the boats identified during the hydrographic surveys are located within a 6 km stretch of the central part of the lake where the waters are shallowest and the lake is narrowest. Mr Northage focussed his surveys primarily in this area. The number of logboats now known from here, as identified during the surveys, may indicate a certain bias in the strength of the concentrations recorded, but this may be explained by the intensity of survey specific to that stretch of water. There may certainly be similar concentrations elsewhere awaiting discovery. This middle section of lake, however, is also the narrowest part of the waterway through which all traffic travelling from the lower lake to the upper lake must pass. It is also a known ferry point between Knockferry and Kilbeg, which would have served to link the ancient tribal and political boundaries on either side of the lake. This narrow stretch of water would have provided a more sheltered and therefore safer crossing point than the wider and exposed expanses of water to the north and south, which can become extremely choppy and difficult to navigate during any sort of windy weather. It is therefore not surprising that a number of ferrying points were used during the nineteenth and twentieth centuries in this area, as was also the case in earlier times, at different locations (Spellissy 1999: 258, 420).

The concentration of 16 logboats all within 1 km of each other and all within 600 m of the Knockferry/Kilbeg crossing point only serves to confirm that this area was an important ferrying point from at least the Middle Bronze Age onwards. Many of the logboats found here would have been eminently suitable as ferries, such as the 10 m-long Late Bronze Age Kilbeg logboat dating to the tenth century BC. Its spacious floor would have been ideally suited for carrying people, animals or cargo. Equally so, the 10.25 m-long oak logboat (Kilbeg 3), which is subdivided into four sections by three low transverse ridges, could have performed a similar function (see Figures 1.1 and 1.4). Apart from serving as a crossing point, this area would also have been an important waterway through which all north-south traffic travelled and, therefore, an important location from a strategic point of view, where movement of boats, people and goods could more easily be monitored and controlled.

The logboats investigated by the UAU thus far have a date range from the middle Neolithic to the sixteenth century AD. As would be expected with a collection of boats spanning such a long time period (5,000 years), they vary in size, style, construction, complexity, function and level of preservation. The earliest boat, the Callownamuck logboat, is the longest logboat found in the lake, measuring 15.67 m. Unusually from an Irish perspective, the Callownamuck logboat was fashioned from a pine tree. In Ireland, the majority of boats are constructed using oak, with only 1% of Irish examples constructed from other species such as alder or poplar (Gregory 1997: 162–163; Holtzman 2019).

Evidence for communication, transfer of ideas and technological advancement

The broad range of logboat types are providing evidence for communication, technological advancement in boat construction and design over time, including the introduction of new repair techniques in line with technological advances which were taking place in Britain and on the Continent at the same time. For example, the floor of the poorly preserved Lee's Island logboat had developed a split along its centreline for over half its length; it was subsequently repaired using the same techniques used to build the Bronze Age plank-built boats known from England and Wales (see Wright 1990; Clark 2004 for example). The spilt was sealed using moss caulking covered by a longitudinal lath which was lashed in place using withies. A number of wooden cleats were inserted into the floor of the boat, through which rods were inserted to help stabilise the split sides of the logboat and provide structural strength. The Lee's Island boat has been dated to 3023 ± 27 BP (1390–1134 cal BC, 2-sigma) and, whilst it is still a logboat, the use of similar sewn plank boat technology to repair the splits provides the earliest evidence for the existence of such technology in Ireland during this period. The emerging evidence for the wider use of plank built boats outside of Britain is also being highlighted (Crumlin-Pedersen and Trakadas 2003; Kastholm 2015; Wickler 2019), with a number of Bronze Age and Iron Age examples from Denmark and Norway now identified. Consequently, the plank boat technology observed in the Lee's Island logboat can also be viewed as an 'indicator of a broader interregional tradition of plank-building in Western Europe' as noted by Kastholm (2015: 1369). Nevertheless, this raises an intriguing question: if sewn plank boat building techniques were known, why did they not supersede logboats? It is possible that future discoveries will uncover evidence of sewn plank boats being more widely used on the lough and beyond. However, based on current findings, it appears that the logboat remained the preferred and prevailing style of boat in use until Mediaeval times, despite plank boat techniques being known at the time.

Other technological advancements include the introduction and changing style of seats over time and a change in method used to propel the boats. As McGrail (1978: 320) and Gregory (1997: 119–120) have noted, the method used to propel a boat can leave very little evidence, and rowing can be particularly hard to detect, unless features such as footrests, thwarts, oars and thole pins are preserved. In the absence of these features, it can only be assumed all other logboats were propelled by paddling. There is no evidence for the use of seats in the Neolithic or Bronze Age logboats so far discovered in Lough Corrib, and it is likely that paddling was the main method of propulsion for these vessels. Two of the Iron Age vessels have seats but are presumed to have been paddled in the absence of any direct evidence for rowing. For example, the Lee's Island 5 logboat (circa 200 BC) had two seats, which were made by inserting 7 cm-wide roundwood poles into the sidewalls of the boat near either end to form seats 5 cm below the top edge (see Figures 1.5 and 1.6). The Clydagh logboat, which is of a similar date, had at least three sets of parallel rectangular slots on its top edge for receiving three narrow flat plank seats; the vessel originally could have had more, but further investigation is required to confirm this. In the Mediaeval period, there is evidence for further development with Lee's Island 3 logboat, the Illaunaconaun 1 logboat and the Carrowmoreknock logboat (see Figure 1.3), all constructed with footrests, oarlocks and plank seats which give direct Irish evidence that by the fifth century AD, rowing had become a common method for propelling vessels on the lough. The Carrowmoreknock logboat also contained the remains of the fragments of two oar handles. Rowing was certainly in use in Ireland by the first century BC with the exquisite gold model known as the Broighter boat, now on display in the National Museum of Ireland, having 15 oars represented and providing representative evidence for this method of propulsion for vessels. It is likely that some of the Iron Age vessels from Lough Corrib were rowed, but evidence has not survived due to the poor preservation of some of the boats from this period.

Logboat size, availability of suitable trees, and depletion of forests

Over time, the boats become more refined: lighter in construction with thinner walls and floors indicating technological advancement in boat construction techniques due to the use of better tools and the development of a better understanding of the basic principles of hydrostatics and hydrodynamics. In tandem with this, there is a general trend for the logboats to decrease in size over time; the Neolithic boat is the longest, measuring 15.79 m in length. The Bronze Age logboats, while still impressively large vessels, are slightly smaller in overall size, ranging from 13.00 m to 6.20 m in length (Lee's Island 2 logboat has a surviving length of 6.20 m, but its original length would have been at least 1 m longer, based on its current dimensions). Overall, the Iron Age logboats are slightly smaller again and range from 11.3 m to 7.54 m in length. There is a notable reduction in the size of Mediaeval vessels, with all five examples investigated by the UAU being less than 6.50 m in length. The Carrowmoreknock vessel is the longest, measuring 6.30 m, whereas the one-man canoe from Rinnaknock measures 3.30 m long, although its bow and stern are not intact, and its original size is estimated to have measured just under 4 m. The gradual decrease in size of the logboats over time appears to reflect the gradual decrease in woodland cover, with forests being cleared for cultivation, development of human settlements and as a resource for everyday living, which would have included the building of boats. Continuous forest clearance resulted in younger, smaller trees being cut down and used before they had a chance to grow large enough to be fashioned into large-sized boats, which were more common in earlier times.

This depletion of woodland in the area is also reflected in the pollen evidence taken from a core from Mám Éan (Maumeen), a corrie lake located approximately 8 km to the west of Lough Corrib (O'Connell 2021). The pollen evidence shows that there was a major reduction in woodland cover from the Neolithic onwards, stemming from the increased farming which continued throughout the Bronze Age and Iron Age. By the end of the twelfth century AD, the surrounding landscape has been largely depleted of forests. The pollen evidence indicates a near total collapse of oak coverage around 1200 AD (O'Connell 2021), which may explain why, out of the 50 plus logboats currently known from Lough Corrib, only one logboat dates to the thirteenth century or later. There were simply very few oak trees of suitable size left to make the logboats, and it is possible there was a switch to the use of skin boats on the lake at this stage. Skin boats or currachs/coracles required far less wood and were made using hazel rods (still growing in the area at the time) and ox hides. A vessel of this nature from this period has yet to be found, but their widespread use from prehistoric times onwards in Ireland has been well documented in the sources (O'Donovan 1856; Breen and Forsythe 2007). However, this is not to say large logboats were not being made in later times in Ireland, but evidence to date from Lough Corrib would suggest they were largely absent from the lake area. However, there are examples from other parts of the country, including the 13.72 m-long Mediaeval logboat from Bartins Bay, Lough Neagh, which is estimated originally to have been over 15 m in total length, being a rare example of an extremely long Mediaeval vessel (Fry 2000: 60–61).

Evidence for raiding and warfare

Also reflected in the logboat discoveries and their contents are other activities that were taking place on the lake. The discovery of a range of weapons in the boats, such as iron, bronze and wooden spears and iron axes, are providing valuable insights into how these weapons were possibly used for raiding, hunting, warfare and for protection (Brady 2014, 2015). In this regard, the Carrowmoreknock logboat is probably the finest Irish example of a boat built as a war canoe during the Viking period, a turbulent time in Ireland with Irish and Vikings vying against each other for power. The 6.3 m-long canoe-shaped logboat is well-designed, finely crafted, built for speed and virtually intact, providing rare evidence for a high-status vessel dating to the eleventh/early twelfth centuries AD. The boat has a rounded transverse section, a rounded stern in all three planes and a bow which terminates in a rounded-point. The boat originally had five thwarts/seats made from willow, with one located at the stern comprised of a short, narrow, thin willow board which slotted into recesses on either side of the boat and was used by the helmsman or steersman or possibly even by a passenger. There are positions to accommodate additional seats, as indicated by four pairs of thwart rests, which survive as blocks, carved in the solid that project out from the internal sides of the boat and which supported the seat. These thwart rests are regularly spaced along the main body of the boat, with three of the plank seats found in place. The remains of two thole pin holes (sockets in the gunwale to receive a pin, which projects upwards to provide a pivot for an oar) also survive on the top edge, although there originally would have been four sets of corresponding thole pin holes. The presence of seats, thole pin holes and two fragments of ash oars illustrate clearly that this boat was rowed, rather than paddled. Within the boat, some of the original contents and belongings of the crew were also found, including three Viking style battle-axes with attached cherry wood handles, an ironwork axe, two iron spear heads, a fossil rich stone and a carved red sandstone slab. The red sandstone slab has the appearance of a rough out for a grave slab, or perhaps it was planned to be used as a decorative or architectural feature on a stone church. If this is the case, it is probable that the slab was being transported to one of the nearby ecclesiastical sites, like Inchagoill, which are located on islands within the lake when the vessel sank.

The boat likely belonged to a high-status individual, such as an important ecclesiastical figure, one of the ruling elite or a local chieftain with his warrior crew. They may perhaps have been escorting him across the lake on tribal business, such as gifting a carved stone slab to one of the local churches or engaging with rival ruling chieftains and thus bringing gifts to support dialogue. While the boat may have sunk while transporting the red sandstone slab, it is evident from the vessel's overall design and the presence of weapons on board, it was not primarily intended for everyday transportation, ferrying or fishing. Instead, this boat displays characteristics more akin to a war canoe or raiding vessel, suggesting its purpose was to serve as a means of maritime warfare. Manned by a crew of five well-equipped warriors, it provided the ability to traverse the Lough swiftly and patrol boat movements, exercise political control or engage in raids. Such maritime activities, including numerous attacks, raids and naval encounters, are frequently documented in Irish historical annals (O'Donovan 1856; Freeman 1944). While Viking fleets in the ninth and tenth centuries raided inland from the coast using the river Corrib to access Lough Corrib and further beyond, by the eleventh and twelfth centuries Gaelic Irish families like the O'Flaherty's and the O'Connors were in control of the lake and had their own fleets of boats and were well able to defend their territory as a result. Subsequently, the Norman de Burgos who established a base in Galway also sought to control activity on the lake (O'Donovan 1856; Freeman 1944).

Figure 1.3. View of a diver hovering over the 6.30 m long Carrowmoreknock logboat, which is viewed from the bow end. Four of the five thwarts/seats (only three visible in the photo) were still fixed in their original positions when the boat was excavated. Photo by Connie Kelleher, copyright National Monuments Service, Government of Ireland.

Accidental loss, deliberate deposition, or killing of boats?

A regular question which arises in regard to the logboats is why did they sink? Undoubtedly, most can be deemed to be accidental losses, but there are a number of logboats from the lake for which it can be argued they may have been deliberately sunk as part of ritual deposition. The Lee's Island 5 logboat, along with its contents, is probably the most convincing example of deliberate sinking. It may have been scuttled as a votive offering, possibly to appease a deity, or as a boat burial; the latter is discussed below. It can be argued that other boats too from Lough Corrib were ritually deposited, while others could have been deliberately sunk for other reasons, including the deposition of spoils of war or war-booty or even ritualistic 'killing' of boats.

Both Van de Noort (2011: 217–221) and Prior (2004: 32) have suggested that there is good evidence in Britain during the Bronze Age and Iron Age for the practice of ritually killing boats. Prior (2004: 32) has argued that one way to 'ritually destroy a boat is to sink it', and that the Hanson logboat found in a gravel pit in Shardlow (Nottinghamshire) dating to *c.* 1500 BC with a cargo of sandstone blocks was a deliberate deposition. The Iron Age logboat found at Fiskerton also appears to be a ritual deposition, being fastened to the riverbed using wooden posts (Field *et al.* 2003: 24; Prior 2004: 32; Van de Noort 2011: 217–221; Markoulaki 2014: 114–118), and therefore considered also to represent a ritually 'killed' vessel. Clark (2004: 279) has suggested the Brigg Raft was ritually 'killed' after a post was driven through a hole in the boat's floor, fixing it to the riverbed and thus preventing it from doing what it should do, which is move in water. Champion (2004) has hypothesised that a number of the British sewn plank boats were connected to ritual deposition while also arguing that the Dover Boat was deliberately partially dismantled and abandoned as part of ritual killing in tidal waters of the River Dour at Dover.

When the Clydagh 2 logboat was discovered, it was initially thought this logboat may have been deposited on the lakebed as part of a prehistoric ritual deposition. This logboat is unusual in that it was deliberately cut into two sections which now lie 3 m apart and perpendicular to each other on the lake bed in 6 m of water. One section is orientated east to west, is 3.56 m long with a 47 cm-wide stern, and is 66 cm wide at its broken/open end. The second section lies 3 m to the south but is orientated north to south, with its open end facing away from section one. It is similar in size to section one, being 3.50 m long, 45 cm wide at its complete end, and 62 cm wide at its broken/open end. The original logboat was carved from oak, rectangular on all three planes and roughly finished. It is possible too that it was unfinished, given the rough surface and regularity of overcuts and tool marks visible on the logboat. The deliberate cutting of the boat into two halves near its mid-point is evidenced by tool marks at the severed edges of both ends as a result of the cutting process. As the width of the two broken ends do not match exactly, there being a 4 cm-difference in width, it is clear that a small middle section of the logboat was lost when the boat was cut in two. The logboat's location, almost centrally placed in Clydagh Bay, over 430 m from the nearest shoreline, indicates that the two parts of this vessel did not accidentally drift from the shoreline to this location. Instead, the logboat was cut carefully into two on the lakeshore and then floated out to a central location; this must have been pre-planned and would have taken a significant amount of effort. The two parts were then deliberately and carefully submerged on the lakebed in close proximity to each other. The initial interpretation for this act, when the logboat was first discovered by the UAU, was that it was deposited as a part of ritual activity, possibly in the Bronze Age. Champion (2004) suggests that when the British Bronze Age sewn plank boats were dismantled and deposited, they were being deliberately decommissioned, rendered useless and therefore ritually or symbolically 'killed'. It appeared this theory could apply to the Clydagh 2 logboat. However, recently obtained radio carbon dates of each end of the boat have revealed that the logboat is not Bronze Age in date, as initially believed, but rather, hails from the ninth or tenth centuries AD. This new information makes it is highly unlikely the boat was destroyed as part of a ritual act. Instead, a more plausible explanation would appear to be it was destroyed during or after a military engagement. As mentioned earlier, naval battles were common on the lake, and the Viking raids on Lough Corrib in 927 and 928 AD (O'Donovan 1856; Freeman 1944), for instance, could have led to the destruction of an enemy's boat by either side in an attempt to reduce their adversary's naval power and influence.

Stone laden logboats

This author suggests three logboats from Lough Corrib provide evidence of being symbolically or ritually 'killed'. A number of boats from Lough Corrib carried stones of varying sizes, but three contained large cargos of limestone blocks, including Kilbeg 3, Kilbeg 5 and Kilbeg 9. These three boats date to the mid-late Bronze Age, with Kilbeg 3 dating to 1202–1008 cal BC, Kilbeg 5 dating to 1415–1233 cal BC and Kilbeg 9 having a similar date of 1419–1280 cal BC. Kilbeg 3 is a 9.90 m-long oak logboat with five transverse low ridges creating six separate spaces in the boat, with the cargo of stone mainly concentrated in the middle two sections. The stones appear to have been carefully placed in the boat, lying on a thick layer of moss to prevent damage to the boat. A few random stones have scattered towards the stern, and a few loose stones appear to have fallen outside the boat. Kilbeg 5 is poorly preserved and smaller in size, measuring 6.80 m in length with just its floor surviving. Nine small stones and a larger boulder are located at the vessel's stern, and there appear to be patches of clay or degraded limestone cobbles spread along the floor of the boat to its midway point; its forward end is largely devoid of stone. Kilbeg 9 is also poorly preserved, with just its 9.20 m-long floor surviving, although broken in several places. This vessel carried two piles of stone, a group of three large boulders at the stern, a smaller pile of ten stones at the bow and a scattering of stones also in the midship area of the boat.

It is possible there is a more prosaic explanation for the cause of sinking of these boats. One such scenario is they may have been inadvertently lost while navigating the lake due to the heavy loads of stone they were carrying. It is not unreasonable to consider these vessels could have become destabilised and swamped during bad weather, resulting in their ultimate demise on the lakebed. However, considering the close proximity of the three boats in a sheltered and relatively calm section of the lough, this explanation seems unlikely. There are other potential scenarios which could have resulted in them becoming submerged on the lakebed, including deliberate sinking. The wet storing of logboats to prevent them from drying out must be considered, and in 1966, Kunze (1968: 168–169) documented the wet storing of a logboat in Lake Mondsee, Austria. The boat was submerged in 2 m of water so that its upper edge was at least 1 m underwater. The boat was weighted and held down using stone and long poles to prevent the boat moving. Kunze also noted that this practice was also being carried out in the nineteenth century too. According to Kunze, the storing of the boat under water prevented the boat from drying out and cracking, increased its durability while also preventing splinters which could catch nets developing on the floor of the boat. The practice is still used today, with a team at the Kuratorium Pfahlbauten successfully wet storing a replica Bronze Age logboat underwater for an 11-year period before it was lifted to participate in a logboat race in 2016 (Cyril Dworsky, personal communication). Whether this practice was used in more ancient times, we do not

Figure 1.4. Cargo of stone blocks sitting in the mid-section of Kilbeg 3 logboat, which was hewn from oak and measures 9.90 m long. Photo by Barry McGill, copyright National Monuments Service, Government of Ireland.

know, and so far there is no evidence for this in Ireland from any period.

Arguments against these theories applying to the three Kilbeg logboats is that they are all currently submerged in 6 m of water, and lake levels were previously 1 m higher prior to drainage works in the mid-nineteenth century. It would have been impossible to remove all the stone and re-float the boats, given the depth of water. A further argument against this is their distance from the shoreline, begging the question as to why, if they were deliberately submerged for practical purposes, were they not submerged closer to shore where they could more easily be retrieved? Locating the boats would have been difficult, given they are all more than 250 m offshore. It is possible lake levels were lower at the time of their sinking, but there is no evidence for this. Additionally, the close proximity of the three boats together would indicate these were boats were not forgotten about after sinking and left on the lakebed, but rather, their deposition was an intentional act, and they were deliberately and permanently deposited on the lakebed. If this is the case, then it seems logical that the boats were deposited as part of ritual deposition. Another consideration is that all three boats were deliberately sunk by being loaded with boulders and stones to help ensure they sank and stayed submerged on the lakebed. Why this was done, we do not know, but maybe when a boat had reached the end of its useful life, it was decided to sink it as a votive offering. It therefore could be argued these boats were put beyond any further meaningful use and were ritually ‘killed’. The possibility they were associated with recently deceased individuals connected with the boat, possibly a drowning, might also be considered as a reason for their deposition.

War offerings?

The Rabbit Island logboat is another vessel which might be considered as a votive offering, but this argument is not as convincing as is for some of the other logboats. Only the base of the 8.2 m log oak boat survives, in which four iron spear heads and fragmentary remains of their hafts were found. Along the starboard side near the bow of the logboat lie two loose pieces of wood with a series of circular holes and rectangular recesses positioned along their edges. It is unclear if these pieces of wood represented side planking which has fallen off the boat or the actual side walls had collapsed, and further investigation is required to confirm this. If this is side planking, then this vessel is an extended logboat, and only one of a few examples known in Ireland. The boat has been dated to *c*. 300 BC.

As highlighted above, the deliberate deposition of vessels in watery environments is well documented on the Continent with the Hjortspring boat (Crumlin-Pedersen and Trakadas 2003) being one of the best known examples. This Iron Age (*c*. 350 BC) warship was sunk as part of a ritual offering along with its contents, 138 iron spear heads and many other items which are interpreted as a sacrifice of the spoils of a battle or war (Kaul 2003: 141–185). Is it thus possible the Rabbit Island logboat was also a deposition representing spoils of war following a victory, or was perhaps sunk as a votive offering seeking to invoke the favour of a deity in advance of a military engagement? Such scenarios are extremely difficult to prove, and it may also represent the accidental loss of a vessel carrying a hunting party or a crew just armed for self-defence purposes.

Ritual deposition of the Lee's Island 5 logboat

The Lee's Island 5 logboat is probably the most convincing and most remarkable example of the ritual deposition of a boat in water, and this is largely due to its high level of preservation, almost perfectly preserved to its top edge. The 7.54 m-long ash boat is parallel sided with a rectangular bow and stern in plan, both of which have inclined profiles. The boat has a maximum width of 70 cm and a maximum internal depth of 34 cm. While most of the logboats from Lough Corrib still have random patches of sapwood remaining in their hull structures, sapwood was generally removed during the construction process, as it is weaker and less durable than heartwood. However, Lee's Island 5 is unusual in that its top edge is entirely formed of a thick layer of sapwood. Apart from indicating the bole of the parent tree was not much wider than the recorded width of the boat, it also demonstrates that ash trees of a larger size could not be sourced locally. This is supported by the analysis of pollen cores retrieved by O'Connell (2021) from Mám Éan (Maumeen) corrie lake, which confirms deforestation in the wider area. The upper works of the boat would therefore have been weaker and subject to damage, and this possibly explains why the side wall is thicker than most other logboats, being up to 8 cm in places.

The logboat had two seats or thwarts still in place, located 2.30 m and 1.60 m from the stern and bow, respectively. The seats are carved roundwoods measuring 7 cm in diameter. The stern seat was originally integrated into the side walls and held in place through a circular perforation on either side, into which the seat was fixed. The forward seat would originally have also been integrated into the side walls, but this end of the boat is slightly more worn, resulting in erosion of the original circular slots in the sidewalls which held the seat. As seats are located towards either end, a 3.60 m-internal space was left clear in the middle of the boat, which may have accommodated cargo while travelling or carried animals or other travellers/ crew. The boat was flat bottomed with two thickness gauge holes, one slightly forward of amidships with its dowel still in place and a second one 40 cm aft of the stern seat with its dowel/ plug missing. Another feature of the boat is that it developed a 4 m-long crack at the turn of its bilge on the port side. This is not surprising, as this is one of the thinnest parts of the boat, and a large component of the exterior of the boat is made up of sapwood. Two radiocarbon dates were obtained from the sapwood (754–409 cal BC (2 sigma) UBA–24534) and a cut piece of brushwood (375–171 cal BC (2 sigma) UBA–27785) found in the boat; all dates securely place the logboat in the early Iron Age period.

Much of the boat's contents survived in situ, including an iron spearhead with a fragment of its wooden haft located under the forward seat. A 2 m-long oar, carved from ash, also formed part of the cargo and was located in the forward half of the boat. The oar's proportions are important with regard its function, having a blade length matching the handle length and closely resembling the portions of the steering oar from the first-century BC gold model from Broighter, Co. Derry (Farrell *et al*. 1975). This resemblance suggests that the oar in question could indeed be a steering oar. Furthermore, the oar is significantly oversized for a 7.54 m-long logboat, indicating that it was likely crafted for a larger vessel, further reinforcing its potential role as a steering oar. Integrated into the stern seat was a socketed and looped iron work axe, complete with its wooden haft. Remarkably, it looks as if the axe was purposely fixed to the boat with the intention of making it a permanent feature. In order to do this, a slight recess was carved into the side wall of the boat to accommodate the upper end of the axe handle so it could lean against the recess to help secure it in place. The seat was also lowered to the level of the axe handle, locking it firmly between the logboat floor and seat and against the side wall. In order to lock the axe in place, a semicircular notch was carved out of the

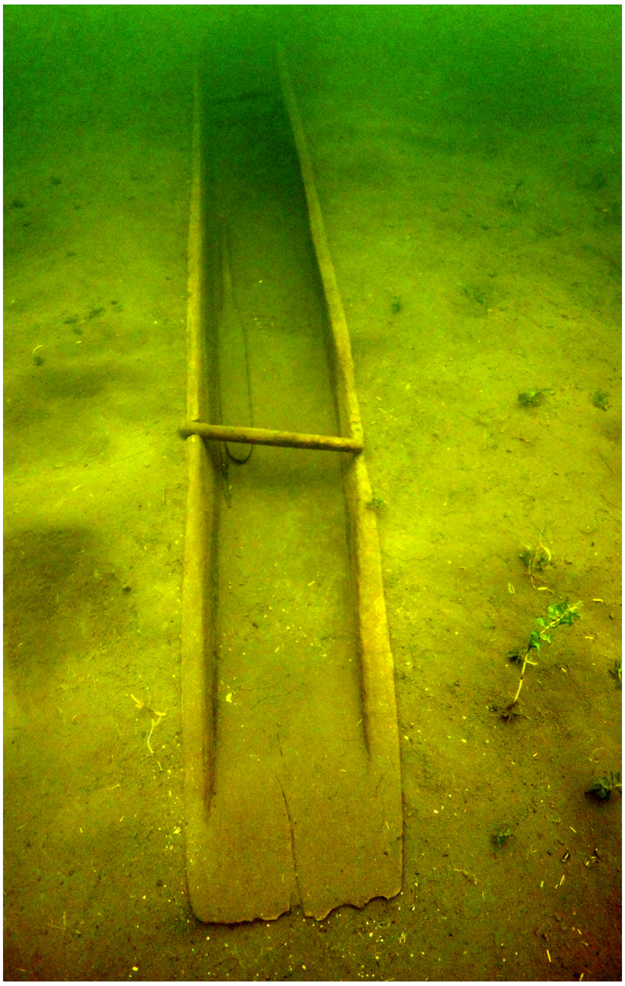

Figure 1.5. View of 7.54 m long ash logboat, Lee's Island 5, from the bow end. The steering oar and iron spear head are visible under the forward seat. Photo by Karl Brady, copyright National Monuments Service, Government of Ireland.

upper side of the axe handle so that the seat's round profile would neatly fit into the notch on the handle, ensuring it was locked in place. This rendered the axe redundant as a working tool by making it a permanent part of the boat and critically weakening its handle, resulting in the loss of its structural integrity and strength. The repositioning and lowering of the seat created voids in both sides of the boat near the waterline, which appear not to have been sealed or plugged and would have helped cause the boat to flood.

The reason why they went to such trouble to alter the axe and integrate it into the fabric of the vessel itself is open to interpretation. While we can only speculate about this, it seems that it was done as part of a process undertaken to deliberately sink the boat along with its contents—perhaps as a votive offering forming part of a ceremony connected to the ritual deposition of the boat at the bottom of the lake. The boat had clearly reached the end of its useful life, as evidenced by a 4 m-long crack that had developed along the chine of the port side with no visible attempts at repairs. The aft thickness gauge treenail is also missing, which could have been a deliberate act and would have facilitated the rapid ingress of water, and this, combined with the lack of any apparent effort to plug the voids left as a result of lowering the aft seat, would have led to additional water entering the boat if further use had been attempted.

If the boat was deliberately sunk as part of a votive offering, the question again arises as to the reason behind it. Iron was an extremely valuable commodity in the early Iron Age, and both the spear and axe would not have been placed

Figure 1.6. Top: Early Iron Age hafted looped and socketed iron axe integrated into the stern seat of the Lee's Island 5 logboat. Photo by Rex Bangerter, copyright National Monuments Service, Government of Ireland. Below: The iron axe after being recovered from the logboat. Note the semi-circular notch which was cut out of the axe handle so that the round profile of the thwart, when lowered, would fit neatly into the notch on the handle ensuring it was locked in place. Photo by Con Brogan, copyright National Monuments Service, Government of Ireland.

within the logboat without due consideration. The boat and its contents do not appear to be a deposition connected with war. Evidence for war deposition weaponry can be seen from the Hjortspring boat, Nydam boats and other Iron Age boats known from Denmark (Crumlin-Pedersen and Trakadas 2003; Van de Noort 2011: 217–221), but the contents of Lee's Island 5 logboat are a mix of utilitarian objects (work axe and oar) and only a single weapon (spear). Again, there are several suggested reasons that can be considered for the deposition, including to appease a deity and possibly even to honour Manannán Mac Lir, the mythical mariner who ruled the Otherworld and after whom the lake is named. The boat appears to have also reached the end of its useful life and perhaps needed to be disposed of and maybe ritually killed, as is seen with the Kilbeg logboats mentioned above. It may also have been an important boat to the people who made and used it and deserved special attention to mark a long or notable career operating on the lake. Perhaps it was associated with an important event or battle which occurred on the lake, or a tragedy such as a drowning. Another reason could be the boat was deliberately sunk to mark the passing of a person, perhaps the owner of the boat, one of its crew members or possibly a master craftsman or boat builder who made the boat. The axe integrated into the fabric of vessel may have been the very axe which cut down the tree and helped shape and maintain the boat over time, ultimately to be used as a key component of the ritual deposition of the boat.

There is also, of course, the possibility that the site represents a boat 'burial' in water, even though no human remains were found in the vessel during the archaeological excavation. Grinsell (1941) and Van de Noort (2011: 201–221) have both discussed the importance and widespread custom of boat burials in Europe during the Bronze Age, Iron Age and in later periods. Whilst there is no widespread evidence for this practice in Ireland, there is no reason to exclude the possibility for such practices here either. One can therefore ponder if Lee's Island 5 represents the burial of an important individual who was laid to rest in the boat and submerged in the lake to aid their safe passage to the afterlife accompanied by some of his/her personal or prized belongings. Until these boats were discovered and archaeologically investigated, evidence for the ritual deposition of boats as votive offerings in Ireland was rare, with only a handful of examples known, an example being the deposition of the 15.24 m-long Early Bronze Age logboat in a bog in Lurgan, Co. Galway (Robinson *et al*. 1999).

Conclusion

The suggestions and ideas presented here by the author require further development and consideration, and those pertaining to ritual deposition highlight that the practice may have held greater significance and widespread prevalence within late-prehistoric societies in Ireland than previously thought. The logboats found in Lough Corrib give rise to numerous questions, and recent specialised publications by Strachan (2010), Goodburn (2019), Tanner (2019) and others, underscore the potential that can be revealed about each individual boat when subject to detailed specialist analysis. Moreover, it is evident that the study of the boats is integral to our understanding of how the local societies functioned and moved on and around the lake throughout time. This in turn can shed further light on activities which may have transpired on other lakes and rivers too, with logboats, sewn plank built craft and probably hide-covered boats in later periods playing vital roles in facilitating travel, trade and the transportation of goods and animals within Ireland's freshwater environments.

The Lough Corrib logboats, in all their diversity, distribution and density, are of national importance, adding to our record for wrecks and expanding our understanding of the wealth of underwater cultural heritage which remains in the waters around and within Ireland. They are also of international significance. They now form part of a corpus of archaeological discoveries which assist with comparative studies on similar boats from Britain and on the Continent. Due to the number of wrecks in one lake so far discovered, they provide invaluable information on construction techniques, technological changes, boat building skills, function and resource availability. As the range of tools at their maker's disposal increased in sophistication over the millennia, it allowed for the construction of highly crafted vessels, which no doubt were much prized and cared for, while also reflecting the wider cultural advances in society as whole.

Threats have been identified that could negatively impact or indeed destroy the logboats and their associated artefacts. Surveys and investigations by the UAU are continuing on Lough Corrib, to address the threats but also continue to expand our knowledge of these amazing craft. More extensive study of the wider landscape during all periods represented by the collection of boats is also being done to place the logboats within their wider cultural landscape, and this will be the subject of a series of articles and monographs currently being compiled. More questions will emerge, but it is hoped that so too will more conclusive evidence which will help to clarify many of those questions emerging about the logboats in the lake.

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2

More than 1,200 islands: narratives of Small Worlds in the Adriatic Sea in Greek and Roman times

Sebastian Adlung and Martina Seifert

Abstract: In the Adriatic Sea, there are more than 1,200 islands of different size and geomorphology between the western and eastern coastal areas. Over time, local communities and traders from different places in the Mediterranean built settlements or *emporia*, mainly on the larger islands, while smaller islands served as stopover points for maritime transport and trade. In ancient times, for example, the islands Vis, Korčula, Hvar and Palagruža became important through transport, geomorphology and natural environment. Within the context of the settlement of the Adriatic east coast, there is intense debate regarding the role of island communities and their identities as maritime societies in relation to the process of Greek and Roman migration. According to Wilkes, the common narrative includes top-down Romanisation and Roman centralisation, the establishment of the province of Dalmatia by Augustus and the decrease of piracy caused the Italic expansion to eastern Adriatic coastal areas. Aquileia, Pola and Salona were main port cities, with settlers and tradesmen arriving by maritime, fluvial or land routes. This chapter contributes to this topic by addressing the dynamics of settlement development and the interplay of the local communities on Adriatic islands. After a brief overview of selected findings, we consider which concepts of communication and connectivity could be used to describe regional and interregional places and players in more detail in the future.

Introduction

In the Adriatic Sea, more than 1,200 islands of different size and geomorphology are located between the western and eastern coastal areas. Local communities and traders from different places in the Mediterranean built settlements or trading places, mainly on the larger islands, while the smaller islands served as stopover points for maritime transport and trade.

Islands were important as visual landmarks, marketplaces and stopovers, and in Roman times there were probably some major port cities on the islands of the Adriatic Sea, as for example, within the bay of ancient Issa on Vis (Faivre *et al.* 2012). Presumably, due to location, accessibility, navigability and local supply situation, smaller areas of human interaction emerged. These include the northern archipelago reaching from the islands of Cres and Krk to Trogir, the central southern archipelago off Salona to Dubrovnik, and the central western archipelago reaching west from Vis to Vieste and Sipontum on Gargano. In terms of size, number and topography, islands off the coast (*e.g.* Vis, Hvar, Korčula and Brač) differ from islands in the middle of the Adriatic Sea (*e.g.* Sušac, Palagruža and Tremiti). The islands near the coast provided diversified settlement areas because their numerous small bays could protect ships from winds or currents. For reasons of navigation and safety, they enabled the creation of shipping routes which generally ran from the Strait of Otranto and reached as far as the Venetian lagoons (Wasmayer 1976). Considering the state of nautical science, sailing along these coasts was a risky venture until recent times (Wasmayer 1976: 200–202). Sea routes of the Adriatic in northern and southeastern directions run along the eastern coast rather than the western one due to various stopping places, as well as a network of lighthouses and coastal lights. In addition to this widely navigable route, island landscapes also offered varieties of smaller routes, both between islands and between islands and the opposing mainland. Numerous ancient shipwrecks with their cargoes at or near the various islands provide valuable information about actors, travel routes and connections between settlements (*e.g*. Jurišić 2000; Kirigin *et al.* 2006).

The study presented here contributes to the understanding of human life by linking port research with human activities along the coasts of the Adriatic Sea. Ancient harbours and landing sites along coasts and at rivers or canals of the Adriatic region were critically important to maritime trade (Zaccharia 2001). Here, next to lagoons, plains and mountainous coasts, diverse landscape conditions influenced human activities, for example, in agriculture and crafts, and harbours and landing sites served as locations of departure or destination for sea routes as well. Our study illustrates the need to consider the Adriatic space in a holistic perspective when dealing with maritime trade. It aims to strengthen this perspective by expanding existing discussions about the origins of *amphorae* as products of human craft activities, by incorporating research on harbours and landing sites to create a multifaceted study (Pesavento Mattioli and Carre 2009; Lipovac Vrkljan *et al.* 2017).

In this research field, an Italo-centric view has long prevailed in questions concerning the production areas of *amphorae*, based on an imbalance of research results. This imbalance has been tackled in recent decades, especially through research conducted in many areas of the Adriatic east coast (*e.g.* Lamboley *et al.* 2018; Lipovac Vrkljan *et al.* 2022). The fact that human activities took place near the coast makes the links between ports, landing sites and the hinterland obvious (*cf.* Westerdahl 2011: 745). This assumption is strengthened by the fact that *amphorae* as craft products were mass products in maritime trade. If we look at the economic processes behind the production of *amphorae* in relation to their importance for maritime trade, ports and landing sites are seen to play vital roles as places for exporting and receiving goods (Lipovac Vrkljan *et al.* 2017). The study of the Adriatic, through the investigation of archaeological finds and features on land and underwater on the coasts, thus show economic processes in diverse coastal areas. Even today, the coastal regions of the eastern Adriatic with their offshore islands play an important economic role for the riparian states. Goods for local supply find their way across the Adriatic, and important modern cities such as Pula, Split, Zadar and Dubrovnik are coastal towns which were settled in antiquity (Pavić 2018). An important economic resource is the tourist development of the coastal areas and especially of the islands. It was therefore appropriate to investigate how ancient communities created and used communication routes across the islands, as well as the roles of geographical ranges in trade, transport and formation of settlement communities.

The objective of this chapter is to review how previous interpretations of findings—for example, on the Islands Vis, Korčula, Hvar and Palagruža off the eastern Adriatic coast—fit into common narratives of Greek migration and Romanisation in the Adriatic. The chapter contributes to this topic by addressing dynamics of settlement development and the interplay of local communities on the Adriatic islands. It argues that concepts such as Small Worlds and micro-regions provide an approach which can gain a better understanding of the settlement history due to the specific geographic and topographical situation and the historical setting of the Adriatic region.

A 'completed' study and consequent new research questions

The idea for this chapter evolved from the project 'The Adriatic communication area' carried out between 2016 and 2019 (principal investigator: Martina Seifert; scientific researchers: Sebastian Adlung and Julia Daum), and it is closely linked to some early results. The project was part of the programme 'Harbours from the Roman period to the Middle Ages' set up by the German Research Foundation in 2012 (https://www.spp-haefen.de/en/priority-programme-1630/). Based on desktop studies, our research dealt exclusively with Roman harbours and landing sites for non-military use in the Adriatic area and aimed to analyse Roman harbour building strategies, as well as the role of their initiators, in order understand the economic significance of these ports for regional and long-distance trade. The societies located at the port sites were regarded as relevant players in urbanisation processes, as were the highly functional, networked communities in the micro-regions which were socially, politically and economically relevant to them (Daum and Seifert 2018, 2020; Adlung 2022).

The starting point for this chapter includes structural considerations of Roman ports and landing sites on the Adriatic coasts, as well as some preliminary results and several open questions from the project. It is necessary to outline this framework briefly. As a first step, we classified ports according to their range as short-range, middle-distance or long-distance, using the categories proposed by Rickman (1988). The terminology and port nomenclature used is based on the results of the Terminology Working Group of Special Research Programme (SRP) 1630 (Kröger 2018; Werther *et al.* 2018). Roman terms such as *provincia*, *regio*, *municipium*, *conventus*, *villa*, *gens*, *familia*, *etc.* followed a discussion of the respective state of research (*e.g.* Rothe 2018). The terms 'city' and 'hinterland' played a subordinate role for this study within the SRP 1630: on the one hand, insufficient demographic data were available for our research area, and on the other hand, the findings situation did not permit the estimation of settlement sizes (for a general discussion of the city concept, see Kolb 1984; Zanker 2014). When addressing and classifying settlements, we used their Roman legal status of the time (*e.g. colonia*, *municipium*, *oppidum*, *civitas*, *vicus* or similar), if it was known.

The impact and formative capabilities of people and their involvement in larger networks of economic redistribution seemed to us to be the most significant (Horden and Purcell 2000: 369–371; Harris 2005: 29–34). Evaluating a heterogeneous body of material in a dynamic, regionally huge research field was a significant challenge for a purely desktop study (Haeussler and Webster 2020: 3–5). This preliminary attempt to identify communication spaces based on tentatively identifiable fields of interaction resulted in a small-scale division of sub-areas. On the one hand, the size and geographical extent of the study area with its western and eastern Adriatic coasts corresponds to the territorial framework of Roman *regiones* and *provinciae*. On the other hand, identified fields of human activity appeared to be partially congruent. The province of Dalmatia, for example, consisted of three judicial districts (*conventus juridicius*) which had their seats in Salona, Scardona and Narona (*e.g.* Marin 2006; Jeličić-Radonić and Torlak 2019: 1921–1993). The availability of agricultural farmland, natural resources, traffic routes and river connections to the inland characterised the coastal settlement areas in the three *conventus*. Pliny (Plin. Nat. 3, 139; 142–143) provides the most comprehensive information about the *civitates* of the *conventus*, enumerating in detail the autochthonous *civitates* in Dalmatia (Džino 2014: 222–224). However, it is unclear whether boundaries of administrative districts correspond to boundaries of municipalities and provinces in all periods, as well as to geographical or cultural regions (Šašel Kos 2014: 163–164, 2022: 61–70; Džino 2014: 221).

The regional development of boundaries and settlement areas is also connected with a common narrative on settlement history, which sees it as a process of top-down Romanisation, as for example, the establishment of the province of Dalmatia by Augustus and a decrease in piracy led to Italic expansion in the eastern Adriatic coastal area (Bracchesi 2004; Pitassi 2009: 144–156). Wilkes assumed that from Aquileia and Salona, settlements of Italians took place first along the coast and later in the hinterland (Wilkes 1969; for critical aspects and new discussion, see Šašel Kos 2022). In fact, archaeological, literary and epigraphic evidence confirm the role of Aquileia, Pola and Salona as port cities, where settlers and tradesmen arrived by maritime, fluvial or land routes (*e.g.* Broekaert 2013: 46–48, 58–59, 89–90, 94–95, 166–167). By looking at some *gentes*, including members of the *Statii* in Aquileia, many freedmen were active in commerce and the manufacture of bricks (Šašel Kos 2017: 172). The list of comparable coastal locations where similar processes are to be reconstructed could be extended, as for example, to ancient Risinium (Šašel Kos 2017: 174).

Geomorphological features of the natural environment, traffic route connections along the coasts and to the inland and crafts and products, as well as assumed short distance and regional trade, indicate a subdivision into different regions embedded in networks and entanglements (Fioriello and Tassaux 2019). The following regions have been identified: (1) Opposing coasts on the Strait of Otranto (Barium, Brundisium, Hydruntum, Oricum, Apollonia, Dyrrachium). (2) Coast of Gargano (Sipontum, Vieste, Tremiti Islands up to Ostia Aternum). (3) Coast of Marche (from Ostia Aternum to Ancona). (4) Coast and lagoons of Emilia-Romagna (from Ancona via Ravenna to the mouth of the River Po). (5) Lagoons on the coast of Veneto (from the mouth of the River Po via Altinum to Aquileia). (6) Coast of Friuli Venezia Giulia and the Amber Road (Aquileia, Emona, Nauportus). (7) West Coast of the Istrian Peninsula and the Gulf of Trieste (Pola, Fažana, Brijuni, Dragonera, Loron, Tergeste). (8) North Croatian islands (Krk, Cres, Rab, Pag). (9) Northern East coast of the Adriatic (from Ad Turres to Aenona and Iader). (10) Central East coast of the Adriatic (from Pakoštane to Salona). (11) Central Croatian islands (Vis, Korčula, Hvar, Brač). (12) Southern East coast of the Adriatic (from Dubrovnik to Lissus). (13) Lagoons on the coasts of Albania (from Lissus to Oricum). (14) Offshore Islands of the Adriatic (Sušac, Palagruža, Pianosa, Tremiti Islands).

A group of ports in the larger settlements played a predominant role in trans-Adriatic traffic, including Ancona, Ravenna, Aquileia, Salona, Brundisium, Dyrrachium and Narona (*e.g.* Zaccharia 2001; Adlung 2022). Shipping traffic across the Adriatic had to follow the two currents which separate the sea into northern and southern areas. The border zones of these currents lie between the Gargano peninsula and the region around Cape Ploča. Today, only the currents along the southern coast—the islands of Mljet to Apulia, via Issa, Palagruža and Tremiti to Daunia, starting from the archipelago off Iader to Picenum and from the Istrian Peninsula to the Po Valley—favour a direct crossing of the Adriatic Sea (Radić Rossi 2006: 198). Near the Velebit massif, dangerous downdrafts are common (Wasmayer 1976). In general, surface waters flow in a northwesterly direction along the eastern coastline, turn around in the upper Adriatic, run in a southeasterly direction along the western side, and leave the Adriatic via the Strait of Otranto (Poulain and Cushman-Roisin 2001). In the north of the Adriatic, tides are noticeable, in contrast to wider areas of the Mediterranean. River inflow also strongly influenced the Adriatic Sea in ancient times (Plin. Nat. 3, 20, 22; Poulain and Raicich 2001: 61–64).

Studies of the eastern Adriatic coast revealed that even within a few kilometres, widely varying settlement patterns existed, formed and influenced by topography, microclimate and other natural or geographical factors, as well as by political and cultural conditions (*e.g.* Staffa 2002; Carre *et al.* 2011). Long before Roman settlement and claims of land ownership, coastal settlements made intensive use of shipping to interact with each other (Forenbaher 2009). It is reasonable to believe that at this point, settlements on the coast, both on islands and the mainland, included one or more landing places (*e.g.* building remains on Sveti Klement on the Pakleni archipelago or along the western coast of Istria; see Carre *et al.* 2011; Begović Dvoržak *et al.* 2012). Because the foothills of the mountains reach the sea, the construction of road networks along the eastern Adriatic coast was not feasible in all places. Thus, between ancient Ad Turres and Zengg or between Omiš and Makarska, ships were probably the predominant form of transportation, based on the location and number of ancient shipwrecks in the region (Jurišić 2000; Kirigin *et al.* 2006). The largest ports developed in mainland coastal towns which were directly connected to the provincial road network (Deluka *et al.* 2003).

One step beyond the Roman Adriatic: considering the islands of the Central Adriatic

To clarify further questions about the traffic routes in the Adriatic, about trade and communication, it was necessary to look beyond the Roman horizon of the project. It quickly became clear that we could take into consideration only a small part of the research material and questions of the emerging and actively worked research fields (*e.g.* Jurković 2019: 111–137; Ugarković and Barnett 2020: 89–122). We want to emphasise that this project did not set out to contribute to the large body of research on the Adriatic islands or critically evaluate the extensive research published in recent times, but rather, its goal was to direct attention to clues to pre-Roman traffic routes. The starting point here was also the question of whether small-scale social or economic communities and/or networks can be grasped through finds from the islands, and the connections

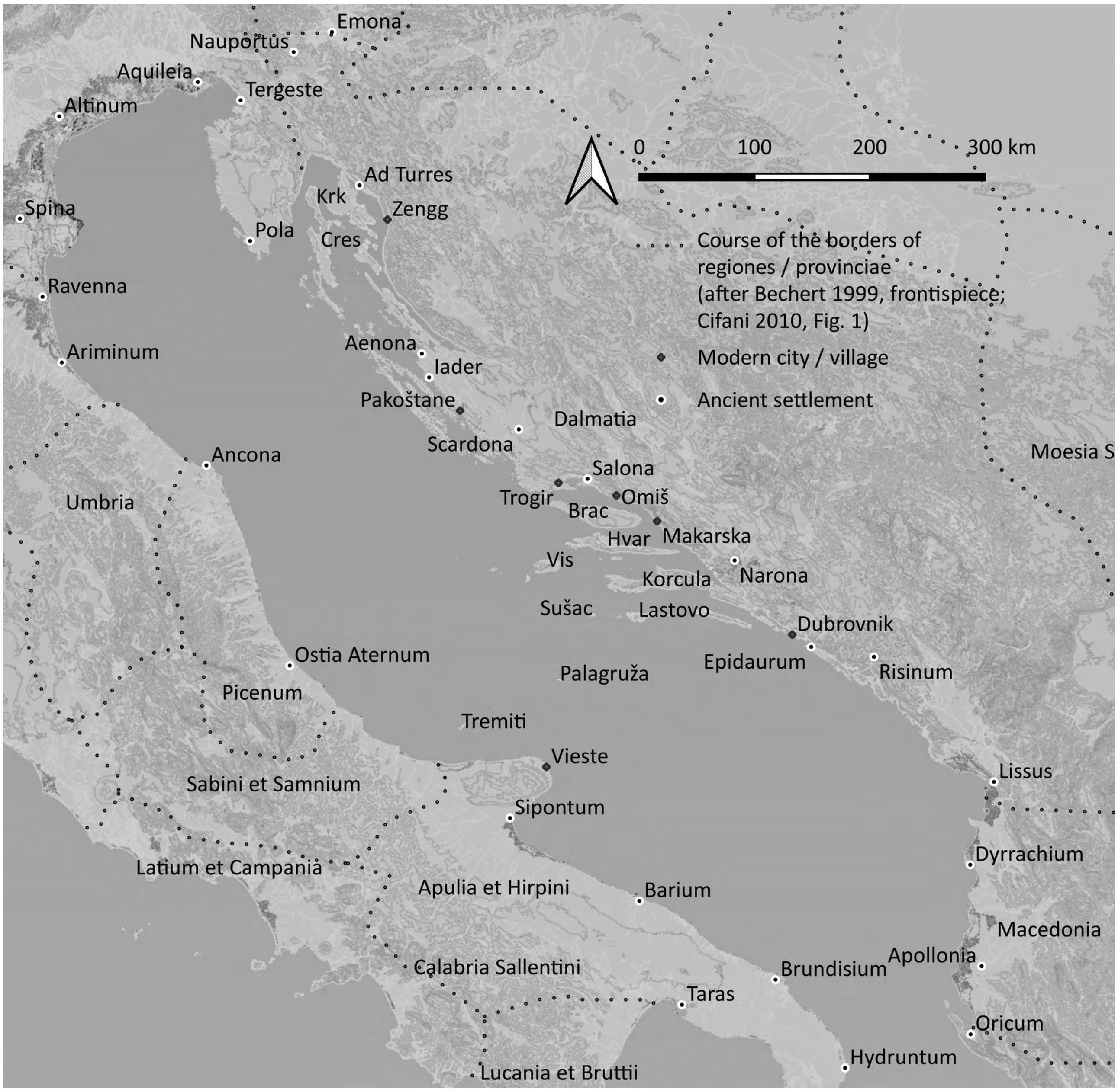

Figure 2.1. The Adriatic Sea with sites as mentioned in the text. Image by Sebastian Adlung and Nils Thiele, QGIS.

these might have with settlement movements and trade in pre-Roman and Roman times. Accordingly, discussion of the islands of the central Adriatic concentrates on just a few examples from the archipelago between the cities of Split and Dubrovnik.

Access to islands depended on seafaring, and the degree of an island's seclusion or dependence, in turn, rested on the relationship between seafaring and craft. At the same time, islands were inhabited by maritime-oriented societies, and owners and builders of boats were certainly the active or determining actors in island life. In addition, ancient societies may have understood island inhabitation as an expression of social identity (Boomert and Bright 2007: 13; Kouremenos 2018). Recent debate on the settlement history of the east Adriatic has intensely focussed on the role of island communities and their identities as maritime societies in relation to the process of ancient migration in the Adriatic (Jurković 2019). Recent studies focus on material remains on central Adriatic islands such as Hvar and Vis (Forenbaher 2018a, 2018b; Ivčević *et al.* 2019; Ivčević 2021). Other works examine finds from islands in the vicinity and their use in antiquity, including sites on Brač with a focus on the evidence for agricultural use or beekeeping (Jelinčić Vučković *et al.* 2022: 133–136).

The Island Vis with the settlement of Issa is the farthest inhabited island off the central eastern Adriatic mainland (Miše and Quinn 2022: 231, 235). According to literary evidence, Greek migration to Vis and Pharos took place in the fourth century BC from Syracuse (Diod. 15, 14, 2; Kirigin 2006). Before the *polis* Issa and its city port were established, a trading base must already have existed at this location. At least five Iron Age hill fort settlements

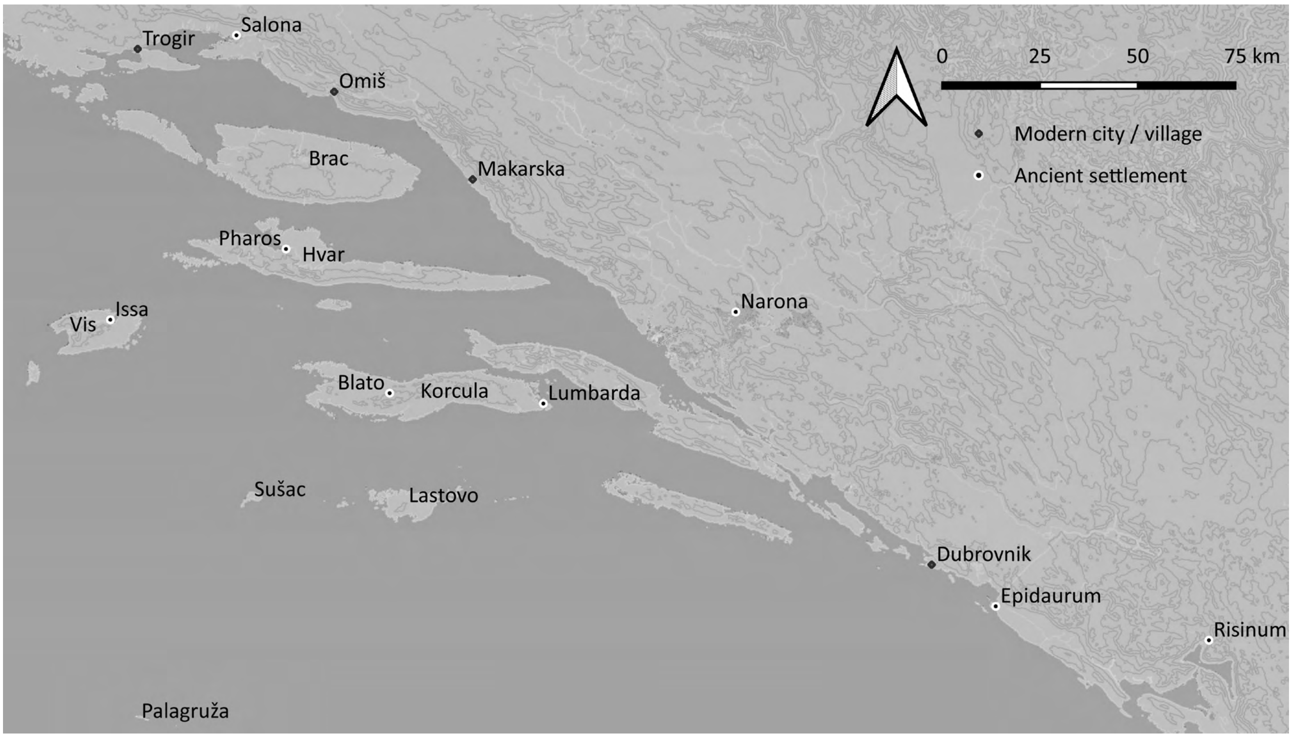

Figure 2.2. The Central Adriatic Sea with sites as mentioned in the text. Image by Sebastian Adlung and Nils Thiele, QGIS.

with Greek and South-Italian painted pottery have been identified on the island. According to Kirigin, one of these sites, Talez, was possibly abandoned by the end of the fifth century BC, when settlement activity shifted to the north coast and Issa was established (Kirigin 2009: 25). In the bay near modern Vis, the remains of ancient Issa comprise necropolis areas, in addition to the enclosing walls. Within the older graves, many objects from Italy, Sicily and Greece have been found, while younger graves contain local fine-ware pottery in addition to imports (Kirigin 2009: 26). Archaeometric analyses of pottery finds from graves yielded the following information (Šegvić *et al.* 2016: 25–27, 45–48): Many ceramic vessels were made from local resources and are therefore local products. Other objects, however, especially red-figured pottery and Gnathia pottery due to their so-called superior production, are considered imports. Based on identified local objects and the presumed organisation of the workshop, Šegvić *et al.* assumed Issa was already a noteworthy settlement in the second half of the fourth century BC (Šegvić *et al.* 2016).

Inscriptions from Issa's burial contexts show a heterogeneous picture of Greek and Illyrian names, but also names from southern Italy, Thebes and the Peleponnes (Kirigin 2009: 26). In front of the walls enclosing Issa, two pottery workshops were reconstructed through misfires, the remains of kilns, kiln suspensors and moulds for relief ware. One was possibly responsible for *amphorae*, including Lamboglia 2, while another focussed on fine Hellenistic table ware; both kilns were used from the second half of the fourth century BC to the first century AD (Miše 2018: 55). Ceramic evidence since the third century BC testifies to pottery workshops; these distributed their products mainly in the Central Dalmatian coastal area (Katić 2005: 75; Ugarković and Paraman 2019: 303; Čelhar *et al.* 2023). These include the type called grey ware from the end of the second century to the first century BC; most of the finds of this type come from graves on the site (Ugarković and Šegvić 2017: 162). Individual objects from Issa have also been found on neighbouring islands (*e.g.* at Kaštel on Lastovo; see Della Casa *et al.* 2009: 122).

Three phases have been differentiated for the local production of Hellenistic pottery at Issa, beginning in the middle of the third century BC or possibly the end of the fourth century BC (Miše 2013; Segvic *et al.* 2016: 48). Miše identified mainly local production of Gnathia pottery at Issa (Miše 2013: 99–130, 2018: 55). Possibly due to the distribution of so-called Canosian Gnathia pottery, potters from the Canosa area in particular were responsible for establishing workshops on Vis in the mid-third century BC (Miše 2012: 240). Finds from Vis show the cultivation of wine, production of ceramics and transfer of cargo. Around 160 sites have been identified on the island and off its coasts with sherds of *pithoi*, *dolia* or *amphorae*; however, it is unclear whether the items were produced for export from the island or local personal consumption (Kirigin 2012: 287–289). Greco-Italic, Lamboglia 2 and Corinthian *amphorae* have also been found near the islet Krava in front of the bay of Issa (Radić Rossi 2003: 158–189; Kirigin *et al.* 2006).

In 230/229 BC, Issa was proclaimed *civitas libera et foederata* by Rome (Plb. 2, 11, 2; App. Il. 2, 7–8). Since the first century BC, it had belonged to the administrative territory of Salona (Wilkes 1969; Džino and Domić Kunić 2018: 80–81; Pavić 2018: 206–215). Since the first Illyrian War, entrepreneurs and merchants can be assumed to have been at Issa (*e.g*. Gaius Fuius; see Milivojević 2010–2011: 194). On site, the remains of a *thermae* building and sculptural finds can be attributed to the Roman phase (Čargo 2021; Jovanović 2021). Some graves within the necropolises (Martvilo, Vlaška Njiva) were also used in Roman times (Miše and Touloumtzidou 2016). A few metres in front of the modern quay, there are ancient stone layers under water. Similarities in building materials suggest these blocks belong to the period from the fourth to the third centuries BC and are legacies of ancient harbour architecture (Faivre *et al.* 2012: 212–219). In the first century BC, the harbour area in front of the peninsula expanded; nine perforated *dolia* date from this period (Jurišić 2000: 77; Pešić 2008: 189). From the late Roman period, findings of African red slip fine ware also indicate a later use of the harbour in the fourth and fifth centuries BC, although settlement and burial finds from this late period are unknown. Likewise, at over 100 so-called farm sites inland, only 26 late Roman pottery finds have been noted (Kirigin 1998: 433–434).

To reconstruct the transfer of goods, information in nautical manuals needs to be included (Wasmayer 1976: 201–207). For example, the Scirocco does not affect the bay of Vis, and it therefore still has a particular importance as a harbour site. Finds of Corinthian vases of the sixth century BC led to the hypothesis that settlers and seafarers from Corfu founded the settlement of Korkyra Melaina on the island of Korčula in the early sixth century BC (Krklec *et al*. 2011; Radić and Borzić 2017b). According to Greek and Roman sources, the first settlers came from Knidos in Asia Minor (Strab. 7, 5, 5; Plin. Nat. 3, 30). Several Bronze and Iron Age hill forts are known on the island; the best known include Corinthian pottery shards at Blato, and contacts with Greek settlers are assumed from the sixth century BC onwards (Kirigin 2009: 21; Radić and Borzić 2017b: 307–309). Corinthian and Apulian geometric pottery finds from the seventh and sixth centuries BC are known from the sites of Kopila and Vela Silja (Radić and Borzić 2017b: 318). An inscription from the second half of the fourth century BC (the so-called Psephisma of Lumbarda) indicates that later Issaeans from Vis founded a settlement on the site of today´s Lumbarda (Bass 1997: 152–158). The inscription, which has survived in several fragments, has so far been divergently dated, from the fourth century BC up to mid-third century BC, on basis of letter form, style and overall impression (Marohnić *et al.* 2021: 139–140). The inscription fragments were evidently built into a cistern built in the third century BC. The reason the fragments were built into the cistern is unclear (Potrebica *et al.* 2019: 119).

Preserved are 200 names of Issaean settlers, but also of Illyrians, who may have been negotiators and landowners (SEG 40–511; SEG 43–348). Where an associated settlement was located has been a major point of discussion in the study of the island ever since (Radić and Borzić 2017b: 304). Grave finds at the settlement at Kopila near Blato show that from the fourth century onwards, Illyrians and Greeks lived side by side, while retaining their material culture, as judged from local and imported material in the excavated graves (Radić and Borzić 2017a: 116–117). A series of rural *villae* formed the core of later Roman land use and migration (Bass 1997: 158–162; Begović Dvoržak and Dvoržak Schrunk 2004). Finds from the sites designated as *villae rusticae* showed the owners of these estates decorated their own buildings with imported stone materials, and possibly inhabitants of Korčula were also involved in distributing and trading stone materials from the island itself. Several quarries may have been in use in Greek and Roman times (Parica and Borzić 2018: 985–987). Ceramic workshops on Korčula have not been found to date, but they have been assumed (Katić 2005: 79–80). Off the coast of Korčula, *amphorae* from the fourth to the first centuries BC have been documented in at least ten underwater sites (Radić and Borzić 2017b: 308).

Ancient harbour areas on the island have not yet been localised through architectural remains. Considering natural conditions and distribution of ancient shipwrecks off Korčula, the bays of Vela Luka, Lumbarda and Korčula appear to be suitable locations for ancient harbour areas. The island of Hvar is about 68 km long and no wider than 15 km; the coastline is steep and in the northern central part lies the flat, fertile plain of Stari Grad (Gaffney and Stančič 1992: 113). The island, just like Vis, must have been an important stopover for travel up and down the Adriatic and across to Italy (Miše and Quinn 2022: 231). Shipwrecks and findings provide evidence for highly frequented sea routes to the bay of today´s Hvar, as well as treacherous conditions for sailing (Jurišić 2000: 63–65, 2006: 177, 181–182). In general, about 230 underwater sites are known to exist off Hvar, the majority of which are on the west coast and mainly between Hvar and the offshore islets; the most common underwater finds are *amphorae* of the Lamboglia 2 type (Petrić 2014: 9–11, 15). Ancient harbour areas on the island have not yet been localised through architectural remains, but a total of 12 localities off the coasts of Hvar have been identified as potential anchorages based on finds from the seabed (Petrić 2014: 17–18). According to Diodorus, the Parians founded a settlement at Pharos in 385/384 BC with the consent of Dionysius; the site is northwest of the present Stari Grad (Diodorus Siculus XV 15, 13, 4; *cf.* Gaffney and Stančič 1992: 123). Graves, fortifications and stray finds in caves on the island have been dated to the Bronze and Iron Ages; according to Kirigin, the majority of the 600 known archaeological sites on the island belong to the Bronze and Iron Ages (Kirigin 2009: 22; Kirigin and Barbarić 2019).

Ceramic objects from the eighth century BC testify to contacts with southern Italy. Iron Age sites are located on hills, referred to as hillfort sites (Gaffney and Stančič 1992: 115–117). Greek archaic painted pottery has been found at the site of the later Greek colony (Kirigin 2009:

22); no Greek fine pottery sherds predate the founding of the city, which has been dated to the years 385/384 BC (Kirigin 2017: 55). The pre-Greek settlement phases of sites are sometimes difficult to place in spatial context. Excavations have provided evidence of early Greek settlement phases from the early fourth century BC (Slapšak and Kirigin 2001: 569; Kirigin and Barbarić 2019: 224–229). Excavations at the site 'Remete Garden' provided evidence of building activities in the period from the third to the second centuries BC with possible remains of an oven (Popović and Devlahović 2018: 391–392). In addition to these, remains of dislocated kilns, *amphorae* waste, moulds for terracotta figurines and ceramic coasters were found near the southern enclosing wall; all were from a Hellenistic context. According to Miše, there are indications of the production of *amphorae*, but not of fine tableware (Miše 2018: 56).

Amphorae have been found from this context. Within the fourth to third century BC, Corinthian B clearly dominates the Greek-Italian, Lamboglia 2 and Corinthian A types. This type dominates, including other findings, both as imports and as locally manufactured objects (Kirigin 2018: 399–402). Corinthian *amphora* sherds from the Classical and Hellenistic periods testify to imports from Corinth and/or Corfu (Kirigin 2018: 405; Konestra and Lipovac Vrkljan 2018: 130). Rescue excavations near Kuća Škoko provided evidence of ceramic material, mostly from the fourth to third centuries BC: Gnathia pottery, Corinthian B *amphorae*, red-figure pottery and small finds from the second to the first centuries BC (Visković and Ugarković 2021: 218). Corinthian B *amphorae* were found in Corinth from the end of the sixth to the third centuries BC; these were produced and distributed over the colonies in the Adriatic region. Local products from Pharos include the Pharos-2 *amphora* from the second to the first century BC. At Pharos, fragments of kilns and over-fired ceramics were the basis for identifying pottery workshops; these finds point to manufacture in the fourth century BC. Certain ceramic objects from Numama and Spina may also have come from the workshops of Pharos (Katić 2005: 75–80). Many objects can be clearly identified as imports from Corfu and Calabria, while some objects are possibly local (Miše *et al.* 2019: 484–485, 2022: 229–230). The Faros 2 *amphorae*, evidently from the middle of the second to the first centuries BC, were found on Hvar, Vis and eastern Bosnia and Herzegovina; according to Katić, these were supplanted by Lamboglia-2 *amphorae* (Kirigin 2009: 24; Katić 2019: 127, 131). Roman coins from Pharos or Stari Grad date from the third to the first centuries BC, with higher amounts coming from the later periods (Bonačić Mandinić 1990: 114–115).

During the Illyrian Wars, the destruction of Pharos by Aemilius Paulus is mentioned (Plb. 3, 18–19); however, no traces of such destruction have been found archaeologically (Kirigin 2009: 25). According to Kirigin, none of the sherds found from *pithoi* which have been examined so far could be verifiably classified as belonging to the Roman period. In his opinion, this is primarily because mainly Greek finds come to light in the city area, while Roman finds are known from the area of the Greek *chora* (Kirigin 2017: 59). Of these Roman sites, 27 were identified as remains of Roman farm buildings (Popović 2017: 582, 586). Until the middle of the first century BC according to Kirigin, traces of settlement are detectable from when the island was incorporated into the Roman province of Dalmatia (Kirigin 2009: 24). The survey of Hvar provided evidence the island was populated densely in late Roman times, and this fact stood in clear contrast with the few findings on Vis (Kirigin 1998: 434–435). Excavations in the city area (*e.g.* in the Burak and Groda areas) provided evidence of several late Roman residential buildings, which together indicate a settlement of this time (Visković and Baraka Perica 2019: 227).

As the westernmost place, the two-kilometre-long island of Palagruža is 40 kilometres away from Sušac, Lastovo and Vis. Palagruža, with its mostly steep coastal sections, has a narrow pebble beach on only its southern shore (Kaiser and Forenbaher 1999). Scholarly research has not identified the ancient remains of harbour constructions so far (Miše *et al.* 2018: 11–12). Presumably, however, only a part of the southern side served for short-term anchoring, while the narrow beach section may also have allowed smaller boats to go ashore. The earliest finds from the island date from the Neolithic (Miše *et al.* 2018: 21–22). Bronze Age stone artefacts found on the island are thought to be from the Gargano, while pottery finds from the mid-third millennium BC are known from both opposite coasts and from the Peloponnese. Forenbaher does not assume a permanent settlement on the island, but rather, frequent visits from fishermen and seafarers (Forenbaher 2018a: 249–256).

From Salamandrija, black-figured ceramic vessels from the end of the sixth and the beginning of the fifth centuries BC are known (Semeraro and Kirigin 2017: 211–214). Greek graffiti on pottery sherds, as well as votive offerings, indicate a sanctuary of Diomedes at this site (Kirigin *et al.* 2009; Miše *et al.* 2018: 13, 24). A few of the more than 100 inscriptions can be interpreted as indicating that Greek seafarers were headed for Palagruža on their routes to Numana, Adria or Spina in the Adriatic Sea (Kirigin 2009: 31). Attic and Gnathic drinking vessels are similar to those known from the Apulian coast and the east Adriatic islands from the fourth to third centuries BC (Miše 2017; Miše *et al.* 2018: 24). Finds of figuratively decorated pottery on Palagruža show correspondences with finds from Spina and Adria; according to Kirigin, objects by presumably the same artists were found in all three places (Kirigin 2009: 21).

Ceramic findings show a wider chronological range from the first century AD to the third century AD. Finds from Deposit 4050 include black-gloss pottery, grey-gloss and relief pottery, while thin-walled and lead-glazed pottery were found from the early Roman period at Eastern Sigillata, North-Italian Sigillata and Italian (Arretine) Sigillata. The majority of these finds date from the Hellenistic period

(Miše and Šešelj 2008: 1–2). In addition to ceramic finds, scattered architectural elements are also known from Roman times, possibly from a temple building. Very few finds exist after the first century AD (Miše *et al.* 2018: 24). Palagruža is known from late Roman times (Kirigin 1998: 429–431): Late Roman and African *amphorae* come from the cistern on the north hill (which has been dated to the third to the sixth centuries AD), possibly associated with a villa on the east hill. A Roman fort may have been built in the fourth or fifth century AD, but possibly as early as the third century AD (Miše *et al.* 2018: 25–26).

On Palagruža and nearby islets, archaeologists discovered several shipwrecks (Kirigin *et al.* 2010). On the reef of Pupak, 600 m to the east, a shipwreck cargo contained Dressel *amphorae* of type 2–4 and Hispanic vessels from the first century AD. The analysis of tombs at Palagruža suggested these were not conceptual burials; therefore, there may not have been a permanent settlement on Palagruža either (Forenbaher *et al*. 2013–2014: 96–98, 108). If we look at coins found on the island, there are coins from the fourth and third centuries BC from Neapolis, Luceria and Pharos, as well as Republican coins from the second and first centuries BC from Rhegium, Brundisium, Apollonia and Dyrrachium; striking are the frequent coins from other places, which also show references to Diomedes (Bonačić Mandinić 2013: 371–377).

These few clues to settlement history and the archaeological finds briefly mentioned indicate that Roman locals and Greeks shaped the cultural and political development of the islands of the eastern Adriatic (Ugarković and Barnett 2020; Borzić 2022). Investigations of the *amphora* finds from Vis (Issa) and Hvar (Pharos) led Katić to assume the differences or the presence/absence of certain *amphora* types should be understood either as indicating competitive situations between productions or the desire for a differentiation of products (Katić 2005: 79). The same can be said of the distribution of shards from *pithoi* on Vis and Hvar, where opposite tendencies can also be observed (Kirigin 2017: 59). In another context, Kirigin discusses the possibility of production on Vis crowding out production on Hvar (Kirigin 2018: 405). Shards of *pithoi* and *dolia* found at over 200 sites on the islands of Brač, Solta, Hvar and Vis indicate that wine or olive oil was stored. The problem here is that the majority of the finds represent body fragments from surveys or pieces in museums; that is, very few objects have provenance verified by excavations (Kirigin 2016: 187–188). In the context of Vis and Hvar, Miše and Quinn proposed that due to the distribution of finds from *amphorae*, Pharos on Hvar may have acted more as a redistribution site for objects from the southern Adriatic region, with neighbouring Issa on Vis actually producing and distributing the objects (Miše and Quinn 2022: 225; also see Miše *et al.* 2019: 237).

Settlement remains and necropolis finds, especially Illyrian grave finds (*e.g*. on Korčula), attest to the existence of indigenous communities and the establishment of marketplaces on the islands before Greek and Roman migration (Gaffney *et al.* 2002). Ancient sources mention Greek mobility dating back to the sixth century BC, while in the fourth century BC, Greeks founded the settlements of Pharos on Hvar and Issa on Vis. Archaeologic evidence clearly shows mobility from the south to the north Adriatic and from the east to the west (for complex cultural identity, see Šegvić *et al.* 2016: 25).

Kirigin draws attention to the relationship between local conditions in the Greek and Roman periods: at Pharos in the modern urban area, mainly Greek settlement features are known, while Roman settlement features are found in the area of the Greek *chora*; here 80 of 129 archaeological sites belong to the Roman era (Kirigin 2017: 59). Another shift can be observed in relation to *amphorae*. In Hellenistic times in Dalmatia, agricultural products were transported in *amphorae* of the Corinthian type A and B sourced from different workshops, and this is evident in the heterogeneous loads from shipwrecks. In the south of the Adriatic, the relationship changed in the late Republican period. Loads on ships—for example, Lamboglia 2—were now significantly more homogeneous. This could possibly be attributed to fewer producers and workshops (Miše and Quinn 2022: 225).

Nautical conditions in the Adriatic Sea have always been very complex, as mentioned above. Seafarers and merchants who sailed or crossed the Adriatic surely depended on the large number and safety of ports on the islands and along the coast (*e.g*. Zaccharia 2001; Radić Rossi 2006). Settlers and traders were certainly involved in ongoing negotiations about passageways and territories (Arnaud 2016: 143–146; for research on the Roman military in the Croatian islands, see Bužanić 2019). Especially controlling access to the Adriatic Sea and the resulting strategic advantages and trade opportunities led to disputes reported by the above-mentioned written sources.

For their maintenance, local communities on islands which managed settlements were partly dependent on trade products from the mainland. Their island status, with accessibility only by sea, often meant they were involved to a lesser extent or in a different way in the conflicts taking place on the mainland (*e.g.* local communities on Vis and on Hvar regarding conflicts with the Illyrians and Romans as mentioned in the ancient written sources).

Auriemma and Degrassi showed that according to findings of different *amphora* types in wrecks and settlements, human activity increasingly concentrated on smaller, local areas beginning with the fourth century BC (Auriemma and Degrassi 2015). As far as the fragmentary preserved testimonies allow a generalising statement, the supply situation with agricultural products or the pottery production seems to have been without noteworthy declines until the second and first centuries BC in the region of the Central Croatian Islands with Greek settlements. Settlement traces and burial finds on Vis and Hvar and trade products from these islands, especially Vis, indicate continuous use of island ports during the Roman Imperial period.

Small Worlds and micro-regions

The brief diachronic look at the island finds from 'Greek' to 'Roman' times shows how small-scale and complex the regional networks of relationships actually were. To compile a picture of trade, migration processes or local social networks within the region, there are even more factors to consider (for recent studies of maritime networks, see Knappett 2013; Leidwanger *et al.* 2014; for the terms mobility/connectivity, see Leidwanger and Knappett 2018: 4). In a recent study, Tartaron describes the local scales of Bronze Age maritime networks as presented by the coastscape and the Small World (Tartaron 2018: 89–90). Following the discussions resulting from the Spatial Turn (Bruner 1984: 5; Lawrence and Low 1990: 453–505; Lefebvre 1991: 26, 143; Bachmann-Medick 2006: 284–328) and the Topographical Turn (Wagner 2010: 102; Rau 2013: 104–105), in our study, we understood space as a socio-cultural category, and not exclusively as a topographical-material category. Space as a symbolic construct enables or limits actions as determined by topographical-geomorphological conditions, but which at the same time exceed them. For example, landing sites are water-bound contact zones (Ilves 2011: 8–9, 2013). Communications which take place in spaces defined in this way require contact situations between acting persons. These communications can be established by other means through traffic route relations on land and water, whereby ports and landing sites as traffic spaces occupy an essential interface. Braudel sees traffic routes and movements as the unifying bracket of the Mediterranean world (Braudel 1997), unlike Abulafia, whose study focusses on the sea and coastal cities (Abulafia 2013).

Horden and Purcell understood ancient urban and settlement history as a history of micro-regions. Consequently, they use the term micro-region to describe a complex entity, one which does not refer solely to a topographical and geographical unit (Horden and Purcell 2000). A micro-region means the existing natural environment and the space defined by its inhabitants as being part of it incorporated into economic and social activities. It is not the city as a fixed entity which is significant, but rather, the interaction between its different forms of governance/economic management, as well as its integration into larger networks of redistribution.

We suggest the concept of micro-region could be useful for this investigation, as it can subsume both the natural space and the space for political, social or economic action. This does not have to coincide with political borders, administrative boundaries and topographical landmarks (Zimmermann 2014: 404) as outlined at the beginning of this chapter. Spatial division models describe, but do not define, the usually fluid boundaries between places and spaces (Hüssen and Gschwind 2012: 161–178; Reinhold *et al.* 2013: 16–17). The concept of micro-ecologies, which describes the interaction between different forms of management and their integration into larger networks of redistribution, should also serve as a working concept for future studies (Horden and Purcell 2000: 80; Zimmermann 2014: 404).

Along the Adriatic coasts, inhabitants of the regions used different strategies to expand, protect and maintain their communities. Therefore, successful local settlement and survival inherently linked the ways in which people take up the particular issues of a settlement area and establish appropriate structures of varying types. With regard to the islands under discussion, various regions formed communication spaces in the sense of Small Worlds (for the concept of Small Worlds, see Broodbank 2000: 175–210; Malkin 2011; Tartaron 2013; Broodbank 2018; Tartaron 2018: 61–92). They relate regionally, as well as supra-regionally, through economic and political entanglements. Actors, goods, political frameworks and different transport routes provide the connecting links between settlements on the eastern and western Adriatic. Along the east Adriatic coast and on the islands, settlement sites developed in different ways in terms of size and infrastructure.

Concluding remarks

The older scholarly literature, in referring to outdated models of colonisation and the seizure of land (Zippel 1974: 4), assumed the ports for trans-Adriatic traffic towards the eastern Adriatic coast gained importance for Italic trade with the subjugation of the Illyrian tribes (Džino 2013: 145–146). Based on recent concepts, there is need for updated views of Romanisation processes (for a detailed discussion, see Wodtke 2018: 59–120; Haeussler and Webster 2020). Roman so-called colonisation in the last years of Caesar's reign had already brought about demographic- and settlement-related change, so Illyricum had become a frontier zone (Šašel Kos 2011: 107–110; Džino 2013: 156–157). Expanded economic and political access led to an intensification of agriculture for products such as wine, oil and grain, as well as the mining of stone, salt and ores (Alföldy 1965: 196; Begović Dvoržak and Dvoržak Schrunk 2004: 65). According to Džino, in the mid-first century BC, *conventi* of Italic traders existed in Lissus, Narona and Salona, and possibly in Epidaurum and Iader (Džino 2005: 89). Shipwrecks, especially on the eastern and northern coasts (*e.g.* at Epidaurum; see Parker 1992: 137; Cambi 2001: 139) attest to the important function of large and medium-sized ports in the distribution of goods for the entire Mediterranean region, and they can be traced in the period from the fourth century BC to the third century AD. Here, too, it is important to point out the limited informative value of this study, since, among others, the role of the indigenous inhabitants and their involvement in historic development did not fall within the scope of the research.

An increased development of raw material sources (*e.g.* stones and metals) apparently took place with the conquest of territories by the Romans (Škegro 2006: 149). Near Patavium, which received the status of a *municipium* of the Tribus Fabia in 49 BC (CIL V 267), there were important stone quarries in the Eugan Hills. Narona was considered the last trading post of the grain transport on the Neretva, which led upstream from the Adriatic (Džino 2013: 157) At the same time, settlers arrived at settlements like Narona in several stages (Bekavac and Miletić 2016: 237–238). Strabon emphasises the mercantile as well as the military character of Aquileia (Strab. 5, 1, 8). Nauportus and Emona functioned as trading centres and military bases at the same time.

Case studies on *villae rusticae*, *villae maritimae* and *piscinae* suggest some of their owners were involved in maritime trade and monetary transactions, as well as military administration. The highest quality of land with natural harbours went to important military officers or members of the Roman aristocracy. From this time on, further development and securing of these territories belonged to the remit of their owners (Fontana 2001: 659; Wilson 2011: 50–51). The provinces of Istria and Dalmatia showed a different approach to the practice of granting land ownership (Carre *et al.* 2011). While in Istria, owners belonged to the elite of the Roman colony and the group of senators, for the *villae* in Dalmatia, presumably envoys from Rome were sent to take over the administration (Džino 2013: 157). However, the extent to which each architectural finding on the coast or islands can be associated with a *villa* or a *piscina* needs to be questioned critically (Begović Dvoržak and Dvoržak Schrunk 2004). Presumably, numerous *villae* were destroyed by building projects in Late Antiquity. *Villae* were generally often situated on or near by main roads in the provinces, near urban centres or larger settlements. They functioned to produce agricultural products and deliver goods to neighbouring centres via the developed roads (Tassaux 2007; Bowden 2018).

There is no question that one of the main forces behind the successful incorporation of territories into the Roman Empire was urbanisation (for critical discussion, see Džino and Domić Kunić 2018: 77–78). We should not ignore the role of *municipia* and *coloniae* in stabilising Roman rule (*e.g.* in Dalmatia) in this respect (Bekavac and Miletić 2016: 243). Nevertheless, complex cultural and political interaction processes accompanied the migration processes, beginning with trade, exchange and military expansion, followed by joint settlements or even hostile land seizure, which did not lead to the takeover of power or to the founding of cities, either in general or in all places at the same time. Roman migration in the last years of Caesar's reign had already caused developments in demography and settlement. In the mid-first century BC, Italic traders appear at Salona, Narona or Lissus, and probably at Iader and Epidaurum (Džino 2005: 89; Milivojević 2010–2011).

The islands of the east Adriatic with smaller-sized, functional ports as discussed here formed important entities by means of transport, geomorphology and natural environment. Because of their significant role as traffic nodes and safe harbours for trading routes, coastal communities emerged and probably carried out specific tasks in intercultural communication and trade. From our current state of knowledge, it is difficult to describe the social, political, or cultural identities of these island communities from the fragmentary archaeological, literary and epigraphic evidence as cited above. The chapter tried to shed light on their entanglements to some regional and interregional places or players. Working with concept such as Small Worlds and micro-region in the Adriatic Sea in Roman times, a few remarks indicate the islands could have played a more central role, probably as stabilising factors, and they could also have acted more resiliently in conflict situations in their small regional contexts. Recent research in Island Archaeology also addresses this question of isolation and connectivity (Dawson 2019: 5).

The interpretation of the findings from the islands Vis, Korčula, Hvar and Palagruža off the eastern Adriatic coast fit the common narrative of Romanisation (*e.g.* for the province of Dalmatia), but they clearly show the understanding of migration processes and settlement development needs a broader chronological perspective (*e.g.* findings from Palagruža: Forenbaher 2008: 239). In this chapter, the focus was on settlement and migration movements in Greek and Roman times. However, this limited timeframe should not hide the fact that on many islands, findings from the Neolithic period onwards indicate prior settlement. Coastal connections in the Early and Middle Bronze Age are based on pottery and stone objects, with the central Dalmatian coasts and islands playing a key role (Forenbaher 2018a: 255–256; Arena *et al.* 2020: 254–255). Within the Adriatic, at least since the eighth and sixth centuries BC, there is evidence of cultural contacts with Greek traders and migrants between opposite coasts, including matches and imports of pottery vessels (Kirigin 2009: 20; Miše 2018: 54). Another research focus is on the Greek 'pre-colonial' settlement phases on the islands (Gaffney *et al*. 2002). The connections between the coasts intensified from the fourth century BC, when Greek colonists migrated to the mainland from the islands of the Adriatic Sea (Džino 2013: 154; Jeličić-Radonić 2015: 23–24). These processes intensify and come to a head in the first century BC, a period characterised by dynamic developments in harbour construction and trade relations (Milivojević 2010–2011: 189–191; Džino 2013: 147).

Ports and landing sites have played a central role since Greek times at the latest, and they retained these in Roman times. Even today, many bays on the east coast, including the example on the island of Vis, are important harbours for ships and boats of the Adriatic water-transport system. The case studies of our research project thus offer insights into ancient connections between maritime links and human activities on the coasts of the Adriatic. At the same time, our research shows that certain stretches of coastline were of great importance in antiquity, but they seem to have lost this significance in modern times. Here, changes in sea level and land movements emerge as explanations which must always be kept in mind when evaluating ancient coastlines.

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3

Maritime cultural landscape of fishing communities in Cyprus

Maria M. Michael

Abstract: This chapter examines the interdependent social, economic, cultural, technological and environmental aspects of fishing within the archaeological context of Cyprus. Through this examination, it is possible to understand the human utilisation of maritime space and the relationship between fishers and their maritime cultural landscape on the island of Cyprus from the Neolithic to the Early Christian periods (tenth millennium BC–mid-seventh century AD).

Heretofore, fishing in Cyprus has been neglected from an archaeological perspective. Consequently, the research presented here studies the archaeological evidence of fishing gear with the fishbone assemblages and the iconographic and written sources to determine the establishment and development of fishing in Cyprus diachronically. Environmental and ethnographic data are used to examine how the island's topography and physical Mediterranean environment determine the presence or absence of fishing within its maritime landscape. Through this study, an attempt to recover the mental maps of fishers is conducted by trying to reveal fishers' choices of specific fishing grounds, gear and/or fish species. Consequently, this study attempts to provide a comprehensive understanding of the human daily activity of fishing in Cyprus diachronically. Subsequently, it contributes to understanding the life of fishing communities in Cyprus through maritime archaeology.

Introduction

Being a fisher is not only about having the equipment to catch fish to fulfil the needs of daily subsistence or commercial purposes; rather, it is chiefly a way of living (Mylona 2008: 74). Fishing is not a simple two-way interaction between the fisher and the sea, but rather, an activity whose establishment and development is influenced by technological, social, economic, cultural, biological and environmental factors (Bekker-Nielsen 2010: 187; Cottica and Divari 2010: 363; Marzano 2013: 51–88; Michael 2022: 68–98). As a result, a holistic understanding of the occurrence and nature of fishing in the past can be acquired by considering all these factors/variables together and attempting to perceive fishing as a 'lifestyle' of ancient Cypriot communities.

The research presented here is based on the results developed during the author's PhD research project (Michael 2022), under the supervision of Dr Julian Whitewright, Dr Anna Collar and Dr Jaco Weinstock. According to a substantial literature review, fishing and its subsequent role in the ancient maritime cultural landscape of Cyprus are rarely acknowledged by other scholars (Ohnefalsch-Richter 1913; Frost 1985; Desse and Desse-Berset 1994a: 78–79; Michaelides 1998; Egoumenidou and Michaelides 2000: 12; Ionas 2001: 217; Reese 2007; Keleshis 2013; Lindqvist 2016; Knapp 2018: 151; Michael 2022: 15–66). Consequently, this research is the first attempt to explore and determine the occurrence and nature of fishing in the maritime cultural landscape of Cyprus through time, from the Neolithic to Early Christian periods (tenth millennium BC–mid-seventh century AD).

Through the systematic examination and mapping of the archaeological evidence of fishing gear (harpoons, fish-hooks, traps, stone, clay and lead weights for net or line, fish-ponds) and fishbone assemblages recovered in a variety of archaeological sites in Cyprus, the occurrence, the nature and the regional and temporal distribution of fishing in Cyprus are defined. In addition, the iconographic and written sources, the modern and historical environmental data from modern, archival and ethnographic sources, are a supporting class of evidence which leads to the reconstruction of ancient fishing methods and the understanding of the reasons behind the choice of a specific method, fishing ground or/and fish species.

The chapter emphasises the environmental and cultural aspects of fishing, as it aims to understand how the parallel study of archaeo-ichthyological evidence with the physical Mediterranean environment, the topography of Cyprus and several economic aspects of Cypriot society determined the presence or absence of fishing in the maritime landscape over time. Through the study of three chronological case studies (Neolithic period (9200/9000 BC–4000/3900 BC), Late Bronze Age (1650 BC–1125/1050 BC) and Historic periods (Geometric–Early Byzantine periods: 1050 BC–647 AD) which yield more prominent archaeo-ichtyological evidence, this chapter attempts to comprehend how fishers perceive, value, use and move through their landscape and seascape. Thus, a potential explanatory framework for understanding fishers' perceptions and spatial preferences to establish and develop fishing can be proposed. Consequently, this chapter delves into how the concept of the maritime cultural landscape—the human utilisation of space through the daily activity of fishing (Westerdahl 1992: 5)—might be understood and investigated in the archaeological context of Cyprus.

Accessing maritime cultural landscape of fishing communities: theoretical approaches

Fishers are people who interacted with the maritime environment (coast, estuary, sea, ocean) and navigated the seas and coasts to find the best fishing grounds every day. Thus, they developed and nurtured the local maritime knowledge, which can perceptually construct fishers' mental maps of their known maritime environment (McKenna *et al.* 2008: 5; Obied 2016: 157; Michael and Obied 2022: 151–155). Through this knowledge, fishers can decide where and when to fish, whether to create and use a particular gear, whether to choose and use a specific fishing ground and whether to fish a specific fish species. These decisions are also affected by many technological, natural, social, economic, cultural, biological and environmental variables because fishers live and interact within a natural, social, religious, economic, administrative and cultural environment (Figure 3.1).

Meteorological knowledge (currents, winds, temperature), navigational skills, the ability to manufacture and maintain tools and equipment, as well as fishing skills and resource availability, which are some broadly defined variables of the specialised knowledge (mental maps) which fishers have, influence the decisions of a fisher relating to the establishment and development of fishing or the creation and alteration of fishing gear (Figure 1; Morrill 1967; Acheson 1981: 290–291; Wilson 1990: 28; Palsson 1993: 124–129; Sabetian 2002: 22–23: 30; Sosis 2002: 588–591; McNiven 2003: 330–332; Cooney 2004; Westerdahl 2007: 207–208; Morales-Muñiz 2010: 28–29; Duncan 2011: 273; Van Dolah *et al.* 2020: 1757–1758). In addition, fishers acquire a knowledge of ecology (the seabed ground) and more specifically, how fish species behave daily, seasonally and annually in their life cycles, as this assists in understanding the marine environment, where fish species live and fishers interact with them, in order to catch them (O'Sullivan 2003; Duncan 2011; Theodoropoulou 2011; Aswani 2020: 481; Michael 2022: 78). Considering these variables of specialised knowledge (mental maps) which can be chosen, as well as inherited or implicit, is essential because they determine generally where, when and how they established fishing in the past (Bird and Bird 2000: 472–473; Parker 2001: 33–34; Mylona 2008: 67; Michael 2022: 74).

Thus, it is essential in interpreting the archaeology of fishing to start by supposing how fishers interacted with and perceived the physical and cultural space specifically, where they live and fish. In Cyprus, the physical space, where fishing is mainly carried out, is the coast and continental shelf. The continental shelf is defined as the seafloor at water depths shallower than 200 m (Demetropoulos 1985: 70; Department of Fisheries and Marine Research 2012: 2). This environment is generally narrow in the north and wider in the south and at maximum extends about 16 km from the shore. Also, it slopes seawards to very deep water practically from the

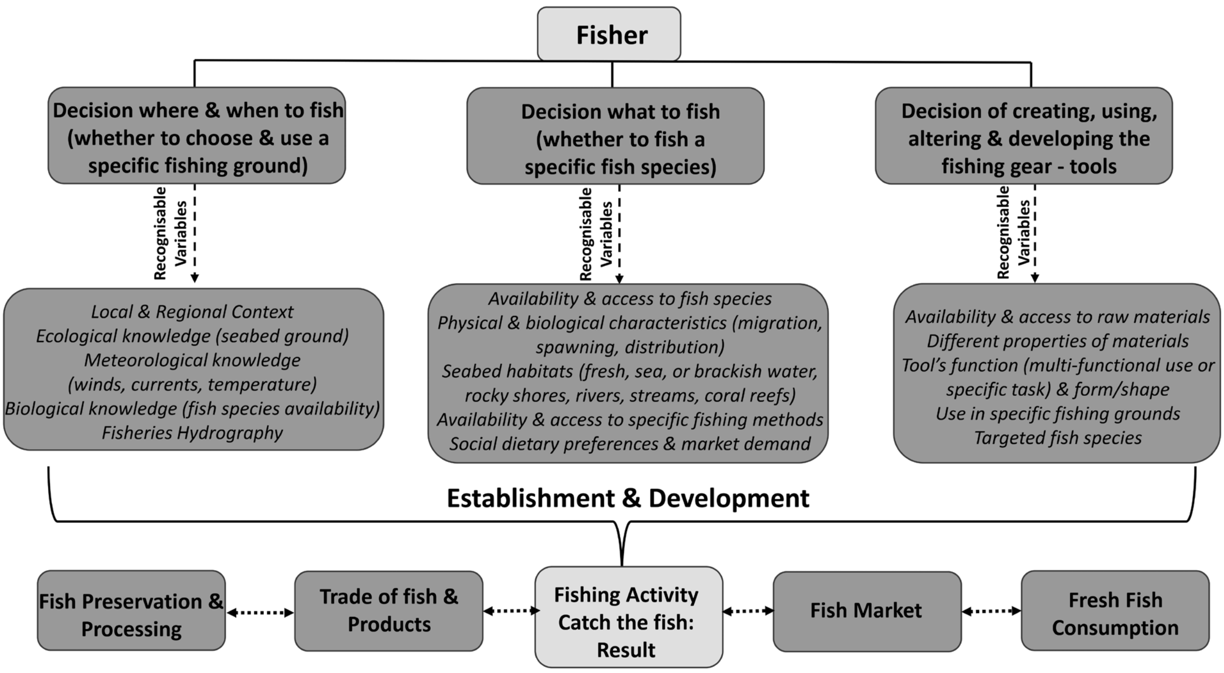

Figure 3.1. Theoretical diagram presenting the tangible and intangible variables affecting the decisions of creating and developing the fishing. Image by the author.

shore (Demetropoulos 1985: 70); as a result, it provides opportunities to exploit pelagic resources at a short distance from the coast. However, the cultural aspect of this space is not tangible in the way its physical aspect is. Consequently, different analytical tools are needed to explore how the human interaction and use of this physical space turns it into a place of culture (Van Dyke and Alcock 2003: 5; Wylie 2007; Obied 2016: 25).

In 1992, Christer Westerdahl (1992: 5) introduced the concept of the maritime cultural landscape in an attempt to observe and interpret the maritime aspect of a landscape, including the sea, the foreshore and the coastline. The term has become a useful analytical tool in the case study of fishing because it comprises the physical and cognitive aspects of terrestrial space (landscape) and a marine space (seascape) for investigating and comprehending the culture of maritime people within a spatial context (Westerdahl 2007: 212–215, 2011; Ford 2011: 4–5; Michael 2022: 78–90, 327–333, 356–360, 399–403).

However, it is difficult for the physical and cognitive aspects of a maritime cultural landscape to be brought into view through the isolated study of the archaeological data alone; as a result, researchers use ethnographic datasets, including folklore, oral histories, contemporary local knowledge and the traditions of a fishing community (Kirch and Dye 1979; Parker 2001: 34; Duncan 2011: 267–268, 275–281; Aswani 2020: 476, 479; Michael 2022: 83–84, 217–254).

Ethnographic sources of human-marine interactions consist of research on human ecology, cultural and societal values, political relations and socio-economic institutions (Aswani 2020: 476; Thurstan 2022: 357). For instance, the use of traditional ecological knowledge, which encompasses the knowledge, practices and beliefs of local communities whose lives depend on the natural environment, can reflect social behaviour and aspects of marine resource use and how the landscapes and seascapes were organised and utilised in the past (Calamia 1999: 3–5; Huntington 2000: 1270; Teixeira *et al.* 2013: 241–242). This knowledge develops across generations and passes down mainly as an oral tradition (Teixeira *et al.* 2013: 241–242). Also, the use of historical knowledge of ecology from historical written materials, imagery and public, private and government archives increases the understanding of the dynamic nature of landscapes and provides a framework for a detailed understanding of the type, scale and consequences of fishing over the past until the present day (Swetnam *et al.* 1999: 1190; Szabó 2015: 1001–1005; Aswani 2020: 475–476; Crumley 2021: 1–2; Thurstan 2022: 351, 353).

Consequently, this methodological approach enables land and sea to be perceived in the way fishers did in the past in order to explore potential interpretations about fishers' thoughts, beliefs and decisions (Palsson 1993; Johnson 1999: 86; Parker 2001: 39; Barber 2004: 444; Cooney 2004: 324; Westerdahl 2007: 214; Westerdahl 2011: 751; Knapp 2018: 31). In other words, it helps in reconstructing the mental map of the space, which fishers have formed to know how to choose the right fishing ground and the most effective fishing method since the earliest human exploitation of the sea (Parker 2001: 33–34).

Although this methodological approach benefits the examination of past fishing, it must be conducted cautiously. Ethnographic sources, historical ecology and archaeological data should be compared only if they come from the same region and share similar technological knowledge or/and social organisation (Wheeler and Jones 1989: 175; Nédélec and Prado 1990; Swetnam *et al.* 1999: 1201; Bekker-Nielsen 2010: 201; Ono 2010: 279; Marzano 2013: 3, 302; Trakadas 2018: 88–89). In the case of Cyprus, ethnographic, archaeological and historical ecological evidence are both from the same geographical and climatic zone. Consequently, an ethnoarchaeological approach, which mainly focusses on the parallel examination of the main indicators of fishing (fish remains and evidence of fishing gear) with ethnographic evidence, seems appropriate for examining past fishing in Cyprus in order to understand and reconstruct the maritime cultural landscape of Cypriot fishing communities.

Methodological approach

As revealed from the discussion, the concepts of the maritime cultural landscape (terrestrial space and marine space–seascape) and historical knowledge of ecology can be analytical frameworks which use an ethnoarchaeological approach to understand fishers' decisions of where and when to develop fishing activity and what to fish. The material, which was examined for the purposes of the current research, has been mainly derived from an intensive desk-based study.

First, an intensive desk-based study of the published final reports of Cypriot archaeological sites and museum inventories was conducted in order to collate the archaeo-ichthyological evidence, which mainly includes artefacts related to fishing methods and fishbone assemblages (Michael 2022: 19–23). The archaeological context of the archaeo-ichthyological evidence was also studied for further information about the social, economic, administrative and cultural processes occurring and potentially impacting the establishment and development of fishing in Cyprus diachronically. Simultaneously, fieldwork focussed on the examination of the excavated archaeological finds was also conducted in order to achieve better and more suitable documentation. All this information was archived in a database (Michael 2022: 127–131, 257–300). Through this systematic recording and visual mapping of archaeological sites where archaeo-ichthyological evidence has been recovered, temporal and spatial patterns were also revealed (Jacobsen 2005: 103; Michael 2022: 406–411). This approach highlights the presence and absence of fishing in different chronological periods or areas.

The desk-based study also encompassed iconographic and written sources dated in the studied time (Michael 2022: 50–62). Regarding iconographic representations of fishing, their number is extremely limited in Cyprus, and they are not found in all chronological periods (they are mainly found in the Geometric to Roman periods, 1050 BC–330 AD; see Karageorghis and des Gagniers 1974: 50, 229; Karageorghis 2006: 69, 99, 127). As a result, iconographic representations of fishing methods and gear from other areas in the Mediterranean region were considered in reconstructing the fishing methods, especially if they have not preserved in the archaeological records (Ayodeji 2004: 231, 438: Fig. 151; Michael 2022: 121).

Also, the written sources used in the study consisted of the geographical and natural science treatise by Oppian (*Halieutica*) and the agricultural manual of Columella (*De Re Rustica*); these mainly provide information about the Classical and Roman periods (Michael 2022: 123). The information derived from these sources was compared with the ethnographic and historical data in order to reconstruct the ancient fishing methods and understand the reasons for choosing specific methods in specific fishing grounds.

Furthermore, the physical context of Cyprus was examined mainly on historical, modern and ethnographic data in order to understand how fishers adapted to environmental conditions and how this adaptation affected their choice of fishing grounds, gear and/or fish species. The ethnographic data were chiefly derived from 110 interviews with fishers from the community which established fishing in Cyprus during the nineteenth and twentieth centuries. These interviews are deposited in the Archive of Oral Tradition and Folk Study (Cyprus Research Centre). The main sources for the modern marine biological and geomorphological data and the bathymetric data are the publications and archives of the Cypriot Department of Fisheries and Marine Research, which include data since the 1950s. Finally, the geomorphological changes and the impacts of past sea levels on the coast were considered because they might contribute to the alteration or extinction of marine habitats, past fishing grounds and littoral topography.

Main indicators of fishing in the past: Fish remains and evidence of fishing gear

As already mentioned, the current research focusses on the study of the main indicators of fishing, which are distinguished by fish remains and archaeological evidence of fishing gear consumed or used respectively and finally recovered in inland, coastal and underwater archaeological sites in Cyprus (Figure 3.2). Through intensive desk-based study and fieldwork, 74 archaeological sites dating from the Neolithic period to the Early Christian period (tenth millennium BC–mid-seventh century AD) yielded evidence of fishing gear and fish remains (Figure 3.2; Michael 2022: 104–105). The temporal and spatial contexts of some of them could not be determined, and as a result, important contextual information which would help their further interpretation was absent. Consequently, their temporal or/and spatial contexts were characterised as unknown.

The systematic mapping of these archaeological sites demonstrates the extent of this evidence and contributes to the further investigation of the correlations between these data and their maritime environment (landscape and seascape). According to the former definitions and interpretations of the mapping space (landscape and seascape) of Cyprus (Vogiatzakis *et al.* 2017: 7), Cypriots engage more with maritime activities within the area 10 km from the coastline towards the inland part of Cyprus (Figure 3.2). The seascape of Cyprus from the coastline to the sea extends only 15 km (Figure 3.2), which is the area of the continental shelf of the island.

Although the spatial distribution of the main indicators of fishing in Cyprus highlights the fact that the engagement of Cypriots with fishing is mainly along the coastline or/and within the area 10 km from the coastline towards the inland part of the island. However, there are also sites with evidence of fishing beyond the Cypriot defined maritime environment (Figure 3.2). In addition, the identification of evidence of fishing in the same area leads to the hypothesis that Cypriots presumably decided for environmental, cultural or/and economic reasons to engage in fishing in some areas diachronically. Before exploring and identifying the reasons for the presence or absence of fishing in some areas throughout time, it is important to briefly describe the available main indicators of fishing in Cyprus to provide an overview of its nature and inherent issues.

Fish remains

Fish remains are the primary indicator of fishing, fish consumption and preservation and trade within an archaeological context (Casteel 1972: 406–416; Wheeler and Jones 1989: 3, 7, 162–176; Reese 1991; Rose 1994: 448–476; Morales-Muñiz 2010: 31–32). Identified and unidentified fish remains have been recovered from 54 sites distributed throughout Cyprus. There are 12 sites which yielded fishbone assemblages dated to the Neolithic period, four sites to the Chalcolithic period, 21 sites to the Bronze Age, two to the Cypro-Archaic period and six sites to the Hellenistic/Roman periods. There are also some sites which have produced fishbone assemblages from several periods.

Although fishing seems more intense during some periods because of the number of sites, the number of sites is not representative regarding the number of fish remains recovered. The numbers of fish bones from many sites are not provided, or they are mainly very small or/and unquantified; as a result, many fishbone assemblages vary greatly from just one or two bones to over a thousand. This is a result of the non-systematic use of dry and wet sieving in many excavations and the absence of using reference collection to identify fish species. These issues

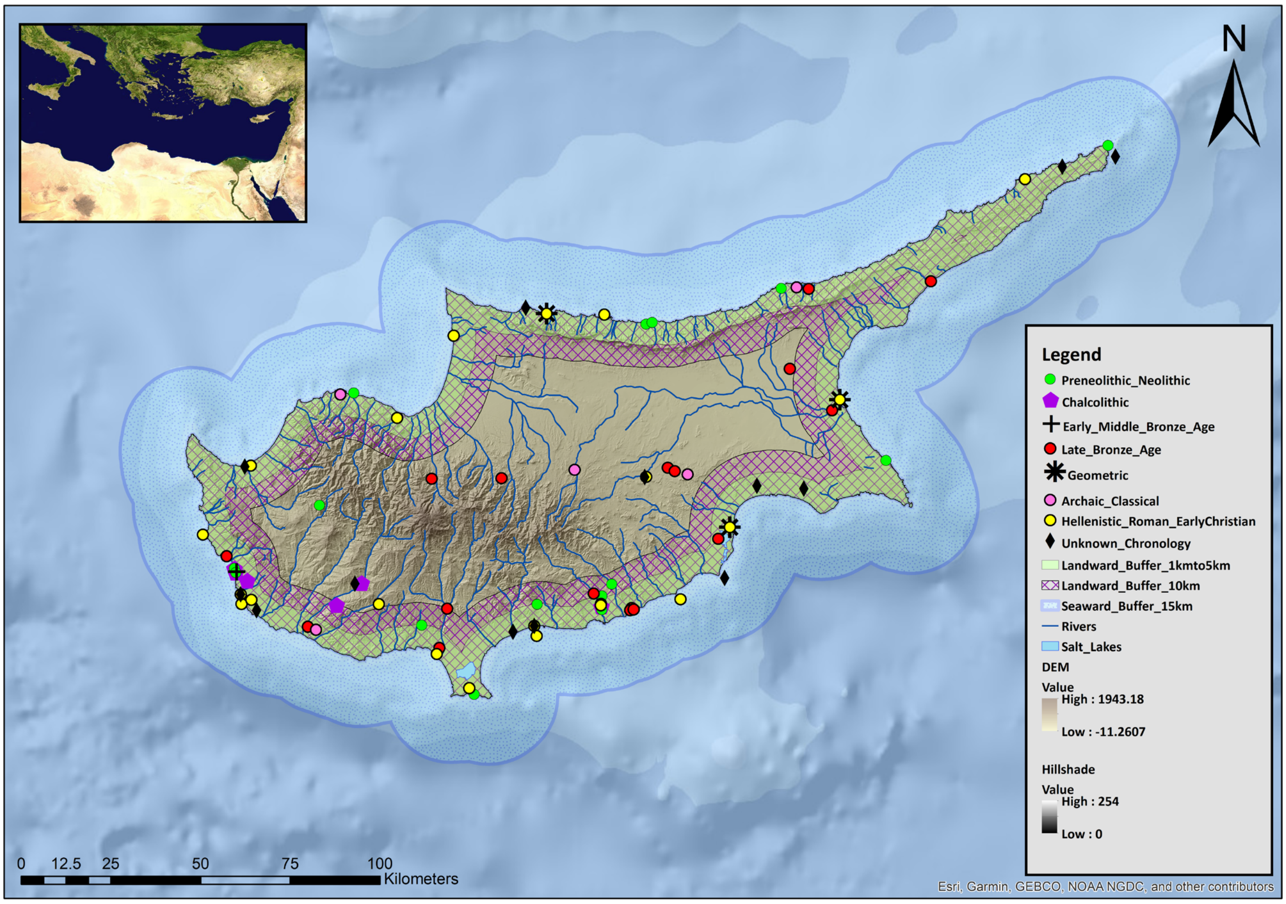

Figure 3.2. The temporal and regional distribution of archaeological sites where archaeo-ichthyological evidence has been recovered. This distribution is presented in relation to the landward and seaward buffers (land and coastal zones of Cyprus), which have been defined based on the generally accepted interpretations of Vogiatzakis *et al.* (2017: Fig. 1). Produced by the author on ArcGIS. Source for layers of Digital Elevation Model, Hillshade Coastline, Rivers and Salt Lakes: Department of Lands and Surveys, Cyprus (DLS Portal); source of the base map: Esri Garmin, NCAA NGDC and other contributors; layer of archaeological sites produced by the author.

cause difficulties in defining the intensity of fishing during the different chronological periods or between different sites. To overcome these issues, each identified species has been considered here as a unique occurrence within the chronological context in which it was recovered, while unidentified fish remains have been simply noted as present (Locker 2007: 144; Trakadas 2018: 53–54; Michael 2022: 107–112).

This approach identified 61 taxa of fish in the archaeological sites of Cyprus through time (Table 1). In addition, it shows that more identified fish remains have been recovered from Neolithic and Bronze Age sites, while sites from later periods demonstrate a lack of identified fish remains (Table 1). The presence of specific fish species within the archaeological record and the study of their different physical characteristics and behaviour can provide information about the availability of fish sources, the process of fish preservation, dietary preferences and market demand (Michael 2022: 76). Although it is difficult to define the aforementioned information, the acquisition of this knowledge can help with the reconstruction of fishing gear/methods.

Evidence of fishing gear

Fishing gear is the other main indicator of fishing in the past. Its study can be characterised as challenging, as it can be often described as multi-use or as miscellaneous objects (Bolger 1988: 91; Vermeule and Wolsky 1990: 73, 94, 130, 146; Swiny *et al.* 2003: 227, 230; Steel 2004: 58; Stewart and Rupp 2004: 163, 167–170; Peltenburg and Christou 2006: 16–17; Bürge and Fischer 2018: 473–485; Mantzourani 2019: 317–318). Consequently, fishing gear can be difficult to recognise and identify.

Despite these limitations, evidence of fishing gear has been recorded at 48 archaeological sites in Cyprus. Nine Neolithic sites, two Chalcolithic sites, 12 Bronze Age sites, two Cypro-Geometric sites, two Cypro-Archaic sites, two Cypro-Classical sites, 18 Hellenistic/Roman/Early Christian sites and one site with an unknown chronological context produced evidence of fishing gear. This evidence mainly consists of fish-hooks and stone and lead weights; their quantity differs from period to period (Figure 3.3; Michael 2022: 257–300). Also, three sites with fish-ponds, which are rock-cut basins built entirely on the coast and

Table 3.1. Occurrence of identified taxa (species and families) in Cypriot archaeological context through time. Compiled by the author.

Neolithic period (9200/9000–4000/3900 BC)	Chalcolithic Period (3900–2500 BC)	Bronze Age (2500–1050 BC)	Geometric period (1050–750 BC)	Archaic period (750–480 BC)	Classical period (480–310 BC)	Hellenistic/Roman/ Early Byzantine periods (310 BC–647AD)
Argyrosomus regius (meagre) ***Balistes carolinensis / Balistes capriscus*** (triggerfish) **Carangidae family** ***Carcharhinus sp.*** (requiem sharks) ***Chrondrichthyes*** (sharks) **Clupeidae family** ***Dentex sp.*** (dentex) **Dasyatidae family** ***Dicentrarchus labrax*** (European seabass) ***Diplodus sp.*** (seabream) ***Epinephelus sp.*** *(grouper)* ***Euthynnus alletteratus*** *(little tunny)* ***Merluccius merluccius*** (European hake) **Mugilidae family** (mullets) ***Muraena helena*** (Mediterranean moray) ***Oblada sp***. (saddled seabream) ***Pagrus pagrus*** (Red porgy) ***Pagellus sp***. (Pandora) ***Platichthys flesus*** (European flounder) ***Sarda sarda*** (Atlantic bonito) ***Sarpa salpa*** (salema) ***Sciaena umbra*** (brown meagre)	***Chelon ramada*** *(Lisa ramada)* (Thinlip grey mullet) **Clupeidae family** ***Dicentrarchus labrax*** (European seabass) ***Epinephelus sp***. *(grouper)* ***Micromesistius poutassou*** (Blue Whiting) ***Muraena helena*** (moray) ***Sardina pilchardus*** (European pilchard) ***Scarus sp***. (parrotfish) ***Scomber scombrus*** (Atlantic mackerel) **Scombridae family** **Serranidae family** **Sparidae family** (sparids) ***Trachurus trachurus*** (horse mackerel) **Triglidae family** (sea robin) ***Zeus faber*** (John Dory)	***Argyrosomus regius*** (meagre) ***Chelon ramada*** *(Lisa ramada)* (Thinlip grey mullet) ***Chrondrichthyes*** (sharks and rays) **Cichilidae family** ***Cyprinus carpiio*** (Common carp) ***Dicentrarchus labrax*** (European seabass) **Elasmobranchii** (shark/ray) ***Epinephelus aeneus*** (white grouper) ***Lates niloticus*** (Nilotic perch) **Mugilidae family** (mullets) ***Mugil cephalus*** (Flathead grey mullet) ***Mullus sp.*** (mullet) ***Pagrus pagrus*** (Red porgy) ***Pagellus sp.*** (Pandora) ***Polyprion Americanus*** (Wreckfish) **Serranidae family** **Sparidae family** (sparids) ***Sparisoma cretense*** (parrotfish) ***Sparus aurata*** (gilthead seabream) ***Sparus sp***.	***Chrondrichthyes*** (sharks and rays) ***Clarias sp.*** (catfish) ***Diplodus annularis*** (Annular seabream) ***Epinephelus sp.*** *(grouper)* ***Labrus sp***. (wrasses) ***Lates niloticus*** (Nilotic perch) ***Lophius Piscatorius*** (Angler) **Mugilidae family** (mullets) ***Pagrus pagrus*** (Red porgy) ***Scorpaena scrofa*** (Red Scorpionfish) **Sparidae family** (sparids) ***Sparus aurata*** (gilthead seabream) ***Thunnus thynnus*** (Bluefin tuna)	**Carangidae family** ***Chrondrichthyes*** (sharks and rays) ***Dentex sp.*** (dentex) **Elasmobranchii** (shark/ray) ***Epinephelus sp.*** *(grouper)* ***Lates niloticus*** (Nilotic perch) **Sparidae family** (sparids) ***Trachurus trachurus*** (horse mackerel)	***Argyrosomus regius*** (meagre) **Carangidae family** ***Clarias sp.*** (catfish) ***Dentex sp.*** (dentex) ***Dicentrarchus labrax*** (European seabass) ***Epinephelus sp.*** *(grouper)* ***Epinephelus gigas / Epinephelus marginatus*** *(grouper)* ***Lates niloticus*** (Nile perch) **Mugilidae family** (mullets) **Sparidae family** (sparids) ***Sparus aurata*** (gilthead seabream)	***Arius thalassinus / Netuma thalassina*** (giant sea catfish)

Neolithic period (9200/9000–4000/ 3900 BC)	Chalcolithic Period (3900–2500 BC)	Bronze Age (2500–1050 BC)	Geometric period (1050–750 BC)	Archaic period (750–480 BC)	Classical period (480–310 BC)	Hellenistic/Roman/ Early Byzantine periods (310 BC–647AD)
Scomber scombrus (Atlantic mackerel) **Scombridae family** ***Scorpaena scrofa*** (Red Scorpionfish) **Scyliorhinidae family** (shark) ***Scyliorhinus stellaris*** (Nursehound) ***Seriola dumerili*** (amberjack) **Serranidae family** (grouper) **Sparidae family** (sparids) ***Sparus aurata*** (gilthead seabream) ***Sphyraena sphyraena*** (barracudas) ***Thunnus alalunga*** (Albacore) ***Thunnus thynnus*** (Bluefin tuna) ***Trachurus trachurus*** (horse mackerel)		***Sphyraena sp.*** ***Sphyraena sphyraena*** (barracudas) ***Spondylisoma cantharus*** (Black seabream) ***Thunnus thynnus*** (Bluefin tuna) ***Umbrina cirrosa*** (Shi drum)				

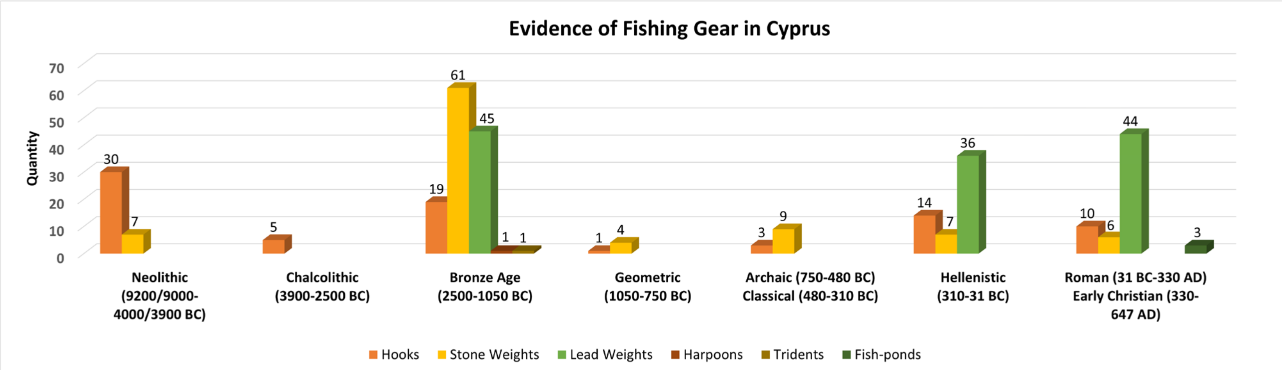

Figure 3.3. Graph presenting the quantity of the identified types of fishing gear and fish-ponds recovered in Cypriot archaeological sites through time. Image by the author.

filled with salt water in which live fish were kept, date to later periods (Roman and Early Christian). As already mentioned, the limited quantity of fishing gear in some periods may be the result of methodological approaches (Michael 2022: 15–66, 163–192).

Regarding fish-hooks, they have different sizes, shapes and materials over time (Figure 3.4). The earliest ones are smaller, made of bone and have a half-circular shape, while the latest ones are bigger, made of copper or bronze and have a 'J' shape. At the top of their shanks, there is usually an eye or groove where the line would be tied, while some of them have a sharp barb. Bone and bronze gorges have also been recovered. The recovery of hooks and gorges indicates the use of fishing lines, while the different sizes and/or shapes of hooks determine if they were used on multiple or single hooked lines and/or used to catch large or small fish (Bernal-Casasola 2010: 89; R. Thomas 2010; Michael 2022: 368–369). In addition, the use of fishing lines is also defined by the recovery of weights with a solid body formed from a lead mass and a groove, a hole or a ring for a line attachment (Figure 3.4; Galili *et al.* 2002: 183–184).

Fishing nets, in comparison, are not generally preserved in the archaeological record because of their perishable materials. Only their clay, stone and lead weights and metal needles are preserved (Michael 2022: 257–300, 375–377). Net weights, which were fastened/fixed on the ground rope of a net to help it to sink, were generally shaped like tubes or folded in one plane, or they are small pebbles with a straight perforation for the rope (Figure 3.4). The most common type of this category is the folded rectangular lead weight, which was bent over the ground line of the net (Figure 3.4; Galili *et al.* 2002: 183–184). Larger stone weights with straight perforations for rope were used on the net edges to anchor it (Figure 3.4).

Furthermore, the comparison of ethnographic data with written and iconographic evidence from Cyprus and the wider region of the eastern Mediterranean reveals that some other fishing methods, including fish poisoning and basket-traps, were used during the Classical and Roman periods, but they did not leave any archaeological trace to establish their use (Michael 2022: 235–240). In addition, through the examination of oral histories about these fishing methods, it is possible to comprehend how fishers carefully observed, adapted and utilised their knowledge of the environment and animal behaviour to their advantage.

Regarding the method of fish poisoning, it is difficult to observe in the archaeological record because the archaeo-botanical analyses did not clarify whether ichthyotoxic plants were available in the past (Michael 2022: 413). On the other hand, the comparison of written sources with ethnographic data from Cyprus highlights that this method was employed during the Roman period in the same way it was employed during the early-modern period in Cyprus (*Hal.* 4.647–693; Michael 2022: 235–236, 413–414); as a result, this method appears to have been used, but the perishable nature of the evidence meant it could not be identified archaeologically.

Finally, the simultaneous study of Classical iconographic representations with the corresponding description in the Roman written sources of traditional Cypriot baited basket-trap demonstrates the ancient use of this fishing method survived in traditional knowledge through time, despite no evidence existing within the archaeological records (*Hal.* 3.414–431, 4.40–74; Ayodeji 2004: 231, 438: Fig. 151; Michael 2022: 237–240, 414). Through the examination of oral histories about this method, it is also possible to distinguish the existence of specialist knowledge about how to exploit individual fish species and their favoured habitat conditions. For instance, modern Cypriot fishers sail to a specific location early in the morning and feed the fish prior to dropping basket-traps in the sea (Keleshis 2013: 63–64; Michael 2022: 239). When a lot of fish gather in the area, they drop the trap, whose design is based on the behaviour of fish to avoid their attempts to escape when they get inside (Figure 3.5). The trap is collected full of fish a few hours later. The same practice is described by the Roman writer Oppian (*Hal.* 3.414–431, 4.40–74); as a result, it seems that Cypriots follow the same practice when they fish by using basket-traps as the Roman fishers, but the perishable

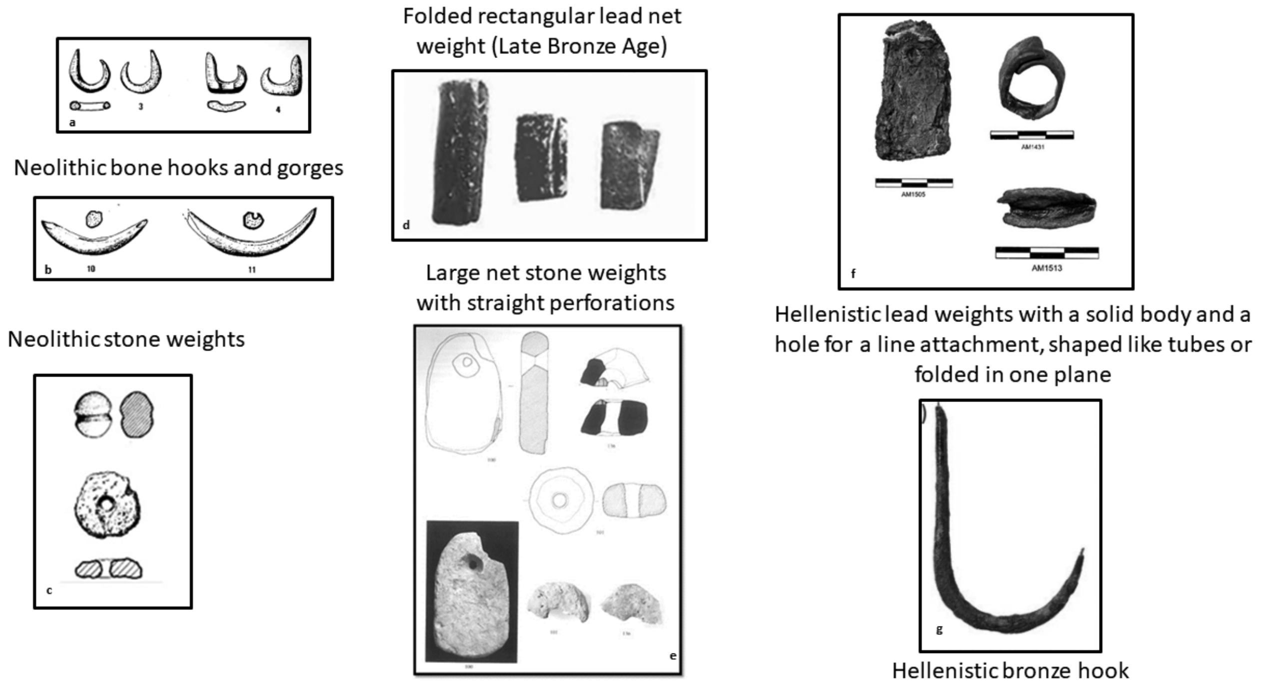

Figure 3.4. Evidence of fishing gear recovered in a variety of archaeological sites dating from the Neolithic to the Early Christian periods (tenth millennium BC–mid-seventh century AD). (a-b) Neolithic bone hooks and gorges from the archaeological site of Cape Apostolos Andreas, Kastros; source: Le Brun 1981: 203, Fig. 56.3–4, 10–11. (c) Neolithic stone weights from the archaeological site of Cape Apostolos Andreas, Kastros; source: Le Brun 1981: 181, Fig. 56.8–9. (d) Folded rectangular lead net weight from the Late Bronze Age site of Athienou; source: Dothan and Ben-Tor 1983: 126, Fig. 57.18–20, 128–129, pl. 47:4. (e) Limestone net weights from the archaeological site of Kition-Bamboula; source: Frost 1985: 173, Fig. 79. (f-g) Hellenistic bronze hook and lead weights from the archaeological site of Amathus; source: Michael 2018: 109, Fig. 4.

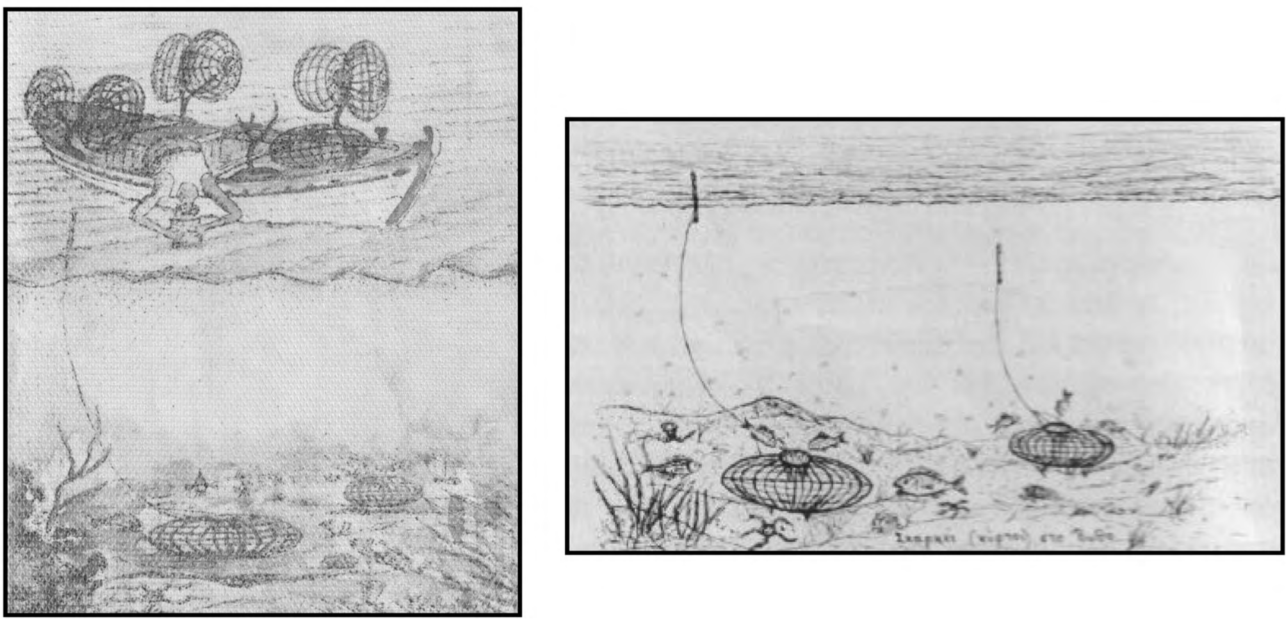

Figure 3.5. Paintings by fisher Andreas Keleshis presenting fish basket-traps with or without a boat. Source: Keleshis 2013: 22.

nature of this method is the main reason it is invisible in the Cypriot archaeological record.

Exploring the maritime cultural landscape of fishing communities in Cyprus: analysis and discussion

As the methodological approaches and the available main indicators of fishing in Cyprus have been presented briefly, some case studies dated in different chronological periods have been chosen to highlight how Cypriot fishers adapted to environmental conditions and how these conditions affect fishers' decisions of establishing and developing fishing in the past. Through this study, it is possible to clarify how the different topographical characteristics of each archaeological site, where main indicators of fishing have been recovered, could affect how Cypriots comprehended their maritime environment. In turn, this information will assist in hypothesising and understanding how fishers navigated, identified or choose specific fishing grounds and/or fish species to catch.

Case study of the Neolithic period (9200/9000 BC–4000/3900 BC)

The first case study is the Neolithic site of Cape Apostolos Andreas, Kastros (Aceramic Neolithic: 9200/9000–5200/5000 BC). This site is located on the most northeasterly point of the Carpasia Peninsula and combines environmental characteristics from both the south and north coasts of Cyprus (Figure 3.6; Le Brun 1981; Reese 1978: 87–88). On the south side of the peninsula, the morphology of the seabed is mainly soft with sand and gravel or muddy (Department of Fisheries and Marine Research 2012: 39). The north side of the peninsula is rocky and dominated by hard limestone with patches of mixed sediments of coarse sand gravel (Department of Fisheries and Marine Research 2012: 39). Also, on the north side of the peninsula, meadows of Mediterranean tapeweed/seagrass (*Posidonia oceanica*) have been recorded in recent studies about their current distribution in the eastern Mediterranean (Telesca *et al*. 2015: 7: Fig. 4). Consequently, it seems the north side of the peninsula can be characterised as a fertile fishing ground, as meadows of Mediterranean tapeweed/seagrass (*Posidonia oceanica)* are a fundamental source of nutrition in marine environments (Campagne *et al.* 2015: 394; Jackson *et al.* 2015: 900; Kleitou *et al.* 2020: 2). This is supported by oral histories, as many Cypriot fishers mentioned the seabed of the north side of Cyprus is far richer in different fish species in comparison to the southern part, due to its rocky nature and the occurrence of seagrass meadows (Michael 2022: 379–388).

It is nonetheless difficult to confirm whether these meadows of Mediterranean tapeweed/seagrass (*Posidonia oceanica*) existed in this area during the Neolithic period, despite the fact they can live for hundreds to thousands of years (Kleitou *et al.* 2020: 12). The occurrence of fish species such as groupers (*Epinephelus* sp.), porgies (*Diplodus* sp., *Dentex* sp., *Pagellus* sp.), Salema (*Sarpa salpa*), red porgy (*Pagrus pagrus*), gilthead seabream (*Sparus aurata*) and saddled seabream (*Oblada* sp.) within the fishbone assemblage of Cape Apostolos Andreas, Kastros may indicate that Mediterranean tapeweed/seagrass (*Posidonia oceanica*) meadows existed in this area during the Neolithic period, as these species live or migrate in these meadows to find food (Jackson *et al.* 2015: 903; Michael 2022: 330). Consequently, the simultaneous examination of the environmental conditions with archaeo-ichthyological evidence recovered at the site of Cape Apostolos Andreas, Kastros can propose that the distinctive topography of this area could contribute to the growth of a strong relationship between fishers and their environment, which in turn may have affected fishers' decisions of where and how to develop fishing in this area (Michael 2022: 327–333).

Furthermore, more than 6,000 remains of bony fish have been found at this site, 3,888 of which have been anatomically identified (Garnier 1981: 93–94; Desse and Desse-Berset 1994a, 1994b). Although the fish remains are fragmentary and poorly preserved, this fishbone assemblage seems to be a representative assemblage of mixed exploitation of coastal and pelagic resources at

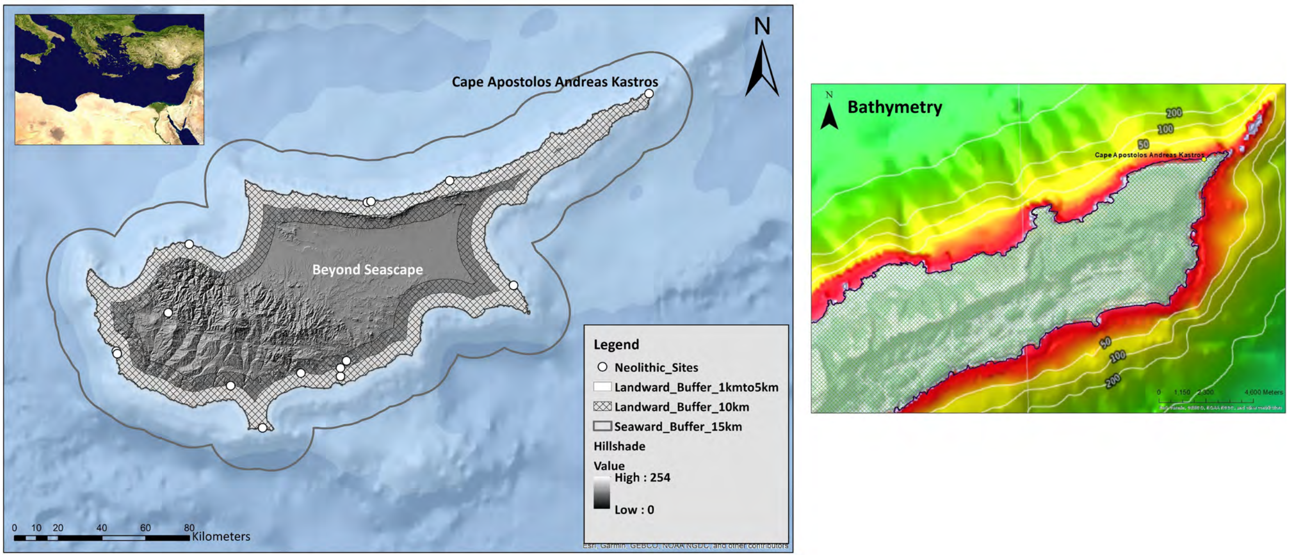

Figure 3.6. Map defining the landward and seaward buffers of Cyprus (land and coastal zones of Cyprus) in relation to the Neolithic sites. The landward and seaward buffers have been defined based on the generally acceptable former interpretations of Vogiatzakis *et al.* (2017: Fig. 1). The site of Cape Apostolos Andreas, Kastros is marked as discussed in the text. A detailed map defining the bathymetry of the site of Cape Apostolos Andreas, Kastros. Bathymetry: red, 50 m depth; yellow, 100 m; green, 200–500 m. Produced by the author on ArcGIS. Source for layers of Hillshade Coastline: Department of Lands and Surveys, Cyprus (DLS Portal); source of the basemap: Esri Garmin, NCAA NGDC and other contributors; source of the bathymetry: EMODnet; layer of archaeological sites produced by the author.

the subsistence level (Michael 2022: 259, 324–326). It mainly consisted of fish species living at depths of 1–100 m, confirming the continental shelf was the area where fishing was carried out mainly (Figure 3.6; Michael 2022: 327–328). On the other hand, remains of pelagic fish have also been recovered from this context. Most of them migrate close to the coast either seasonally or daily according to currents, temperature differences, spawning season or their marine habitats and age; as a result, their occurrence supports the exploitation of pelagic resources, but at the same time, it is possible they were caught during their migration near the coast (Michael 2022: 325). Consequently, it can be hypothesised the continental shelf could have been the main area of fishing, but the inhabitants of this site may have put more effort into sailing and exploiting the pelagic resources beyond the continental shelf. It has also been noted that sailing in this area was challenging during the Neolithic period, and this may demonstrate the good sailing skills of its inhabitants in exploiting pelagic resources (Bar-Yosef Mayer *et al.* 2015: 426–429).

Case study of the Late Bronze Age (1650 BC–1050 BC)

Moving to the Late Bronze Age period (1650–1050 BC), the site of Hala Sultan Tekke, which is on the southern coast of Cyprus, also highlights how the characteristics of its landscape and seascape affect fishers' decisions of where, when, what and how to fish (Figure 3.7; Michael 2022: 356–360). The present coastline in this area is characterised as lowland, and it is now some distance from the ancient shoreline due to sedimentary infilling (Gifford 1978; Thomas 1981). Based on the relatively recent intensive study of coastal alterations in association with archaeological evidence recovered at the site of Hala Sultan Tekke, a confined lagoon existed and was used as a harbour during the second millennium BC from the site of Hala Sultan Tekke (Gifford 1978: 166–169; Devillers *et al.* 2015: 75–78). This lagoon was finally eroded and silted to form the Larnaca Salt Lakes which exist today (Figure 3.7).

Lagoons offer fertile fishing grounds exploited by human settlements throughout the Mediterranean basin, as seagrass meadows are one of their main characteristics (Rose 1994: 53, 101–102; Broodbank 2013: 158–159; Marzano 2013: 199–205; Crosetti *et al.* 2015: 22, 24, 28; Kleitou *et al.* 2020: 12). Based on studies (Telesca *et al.* 2015: 7: Fig. 4), Mediterranean tapeweed/seagrass (*Posidonia oceanica*) exists along the present coastline of Hala Sultan Tekke. The occurrence of Mediterranean tapeweed/seagrass (*Posidonia oceanica*) may have dated to the Late Bronze Age because the study of the alteration of the coastline showed a Posidonia bed existed when the lagoon was in use as a harbour (Devillers *et al.* 2015: 78). In addition, the recovery of fish species living in lagoon environments such as gilthead seabream (*Sparus aurata*), European seabass (*Dicentrachus labrax*), flathead grey mullet (*Mugil cephalus*) and thinlip grey mullet (Chelon *ramada*) within the fishbone assemblage of the site of Hala Sultan Tekke also supports the exploitation of the coastal lagoon for fishing (Crosetti *et al.* 2015: 30–31; Michael 2022: 357).

In addition, comparisons between modern meteorological information and studies of modelling ancient winds and currents in the region of the eastern Mediterranean show the prevailing current and wind patterns have not changed remarkably since ancient times (Murray 1995; Leidwanger 2020: 31). Consequently, the predominant currents and winds in this area seem to benefit the exploitation of the lagoon (Meteorological Service 1986: 9; Safadi 2016: 353–355, 2018: 229, 259; Michael 2022: 358). The light southerly sea breezes—the predominant features in the area, especially during the winter and summer times—may create southerly currents, which in turn 'force' fish to enter the lagoon to find food; as a result, they would have been easy to catch within the area of the lagoon or along the coast. Consequently, the parallel study of currents along the present south coast with the archaeological evidence indicates the lagoon may have been exploited by the inhabitants of Hala Sultan Tekke. In addition, fishing seems to have been an activity which relied on accumulated knowledge and mental maps of the landscape and seascape of an area for the choice of a fertile fishing ground.

Evidence of fishing gear and fish remains dated to the Late Bronze Age (1650–1050 BC) have been also recovered from inland sites located within an area beyond the theoretical knowledge of the seascape (Figures 3.2, 3.7; Michael 2022: 347–349). More prominent evidence has come from the archaeological site of Apliki-Karamallos, which was a small copper-mining settlement (Figure 3.7; Du Plat Taylor 1952). As lead-folded rectangular fishing sinkers with fish remains have been recovered, the use of fishing nets is attested there (Michael 2022: 270, 348). However, the limited evidence and its location suggest the inhabitants of this site did not directly engage in fishing, but their fish supplies were probably acquired as the result of a local complex exchanging network. This complex exchanging network existed between the several Cypriot Late Bronze Age sites distinguished from primary coastal centres, inland centres, agricultural villages and mining sites (Catling 1963: 144–145; Karageorghis 1982: 61–63; Keswani 1993: 76–80; Georgiou 2018: 82–88). Based on this exchange network, subsistence and utilitarian goods, copper and its products and other essential or prestigious objects were distributed between the sites.

In the case of Apliki-Karamallos, it seems its inhabitants exploited copper and provided it to the inhabitants of a primary coastal centre, most probably the site of Toumba tou Skourou (Figure 3.7), and at the same time, they obtained subsistence and utilitarian goods from this primary coastal centre. Fish may have been included in these goods. Consequently, the examination of fish remains and fishing gear within their topographical and contextual depositions of inland archaeological sites

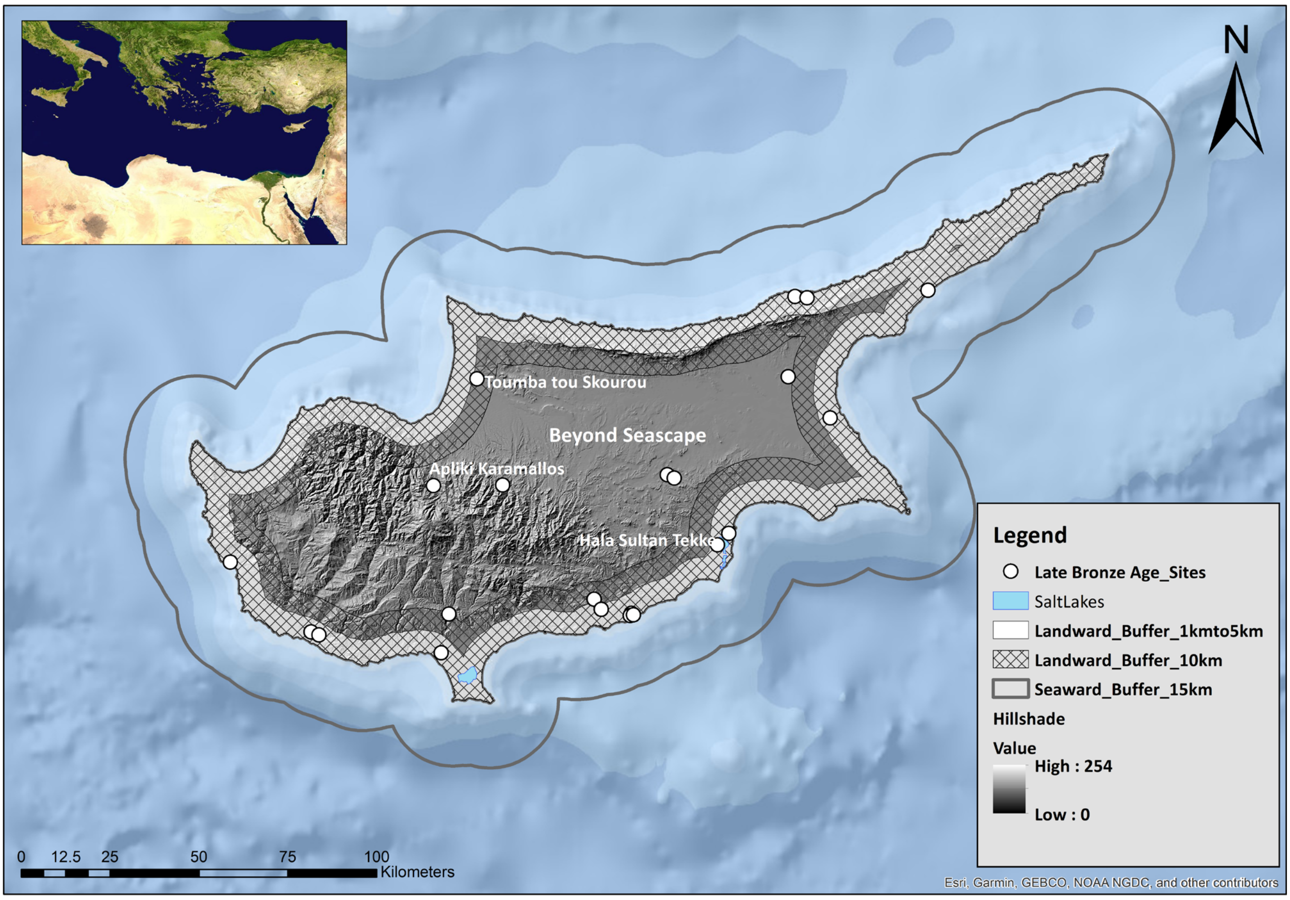

Figure 3.7. Map defining the landward and seaward buffers of Cyprus (land and coastal zones of Cyprus) in relation to the Late Bronze Age sites. The sites of Hala Sultan Tekke, Apliki-Karamallos and Toumba tou Skourou are marked as discussed in the text. The landward and seaward buffers have been defined based on the generally acceptable former interpretations of Vogiatzakis *et al.* (2017: Fig. 1). Produced by the author on ArcGIS. Source for layers of Hillshade Coastline: Department of Lands and Surveys, Cyprus (DLS Portal); source of the basemap: Esri Garmin, NCAA NGDC and other contributors; layer of archaeological sites produced by the author.

suggests their existence in these contexts may be ascribed to local administrative and/or economic factors.

Case study of historic periods (Geometric to Early Byzantine periods: 1050 BC–647 AD)

Moving to later periods, Amathus is also an excellent example of an archaeological site with evidence dated from the Archaic (750–480 BC) to Early Christian periods (330–647 AD) which can highlight the importance of the knowledge of the maritime environment in the growth of fishing. Amathus is located on the south Cypriot coast and it represents evidence related to fishing from both terrestrial and underwater contexts (residential area and harbour) (Figure 3.8; Empereur 2017; Michael 2018a, 2018b).

Although oral traditions understood through fishers' interviews highlight the fact the south Cypriot coast has no fertile fishing grounds, the simultaneous study of Amathus' archaeo-ichthyological evidence with the environmental characteristics of its coast and seabed shows fishers acquired specialised knowledge of their marine environment which enabled them to navigate and identify key fishing grounds (Michael 2022: 218 399–403). This contrast seems to be a result of coastal alterations which happened along the south coast over time because of very severe erosion in conjunction with eustatic sea-level changes and tectonic activity (Thomas 1981; Andreou *et al.* 2017: 201). These changes led to the submergence of Amathus Harbour and the erosion of the coast (Empereur 2017: 111–120). Consequently, these alterations should be considered during the examination of ancient fishing, as places which are now perceived as not being fertile fishing grounds may have been fertile in the past.

The fertility of the fishing ground at Amathus may be a result of specific environmental characteristics found in this area of the south coast. For instance, the upwelling phenomenon, which is strong in this area during the summer months and enriches surface water with nutrients, is possibly the reason for the presence of seagrasses (Figure 3.9; Department of Fisheries and Marine Research 2012: 10–11, fig. 1.8; Demetriou *et al.* 2022: 12). The marine environment of Amathus consists mainly of Mediterranean tapeweed/seagrass (*Posidonia oceanica* and *Cymodocea nodosa*) and green alga (*Caulerpa prolifera*); these seagrasses transfer nutrients to food webs,

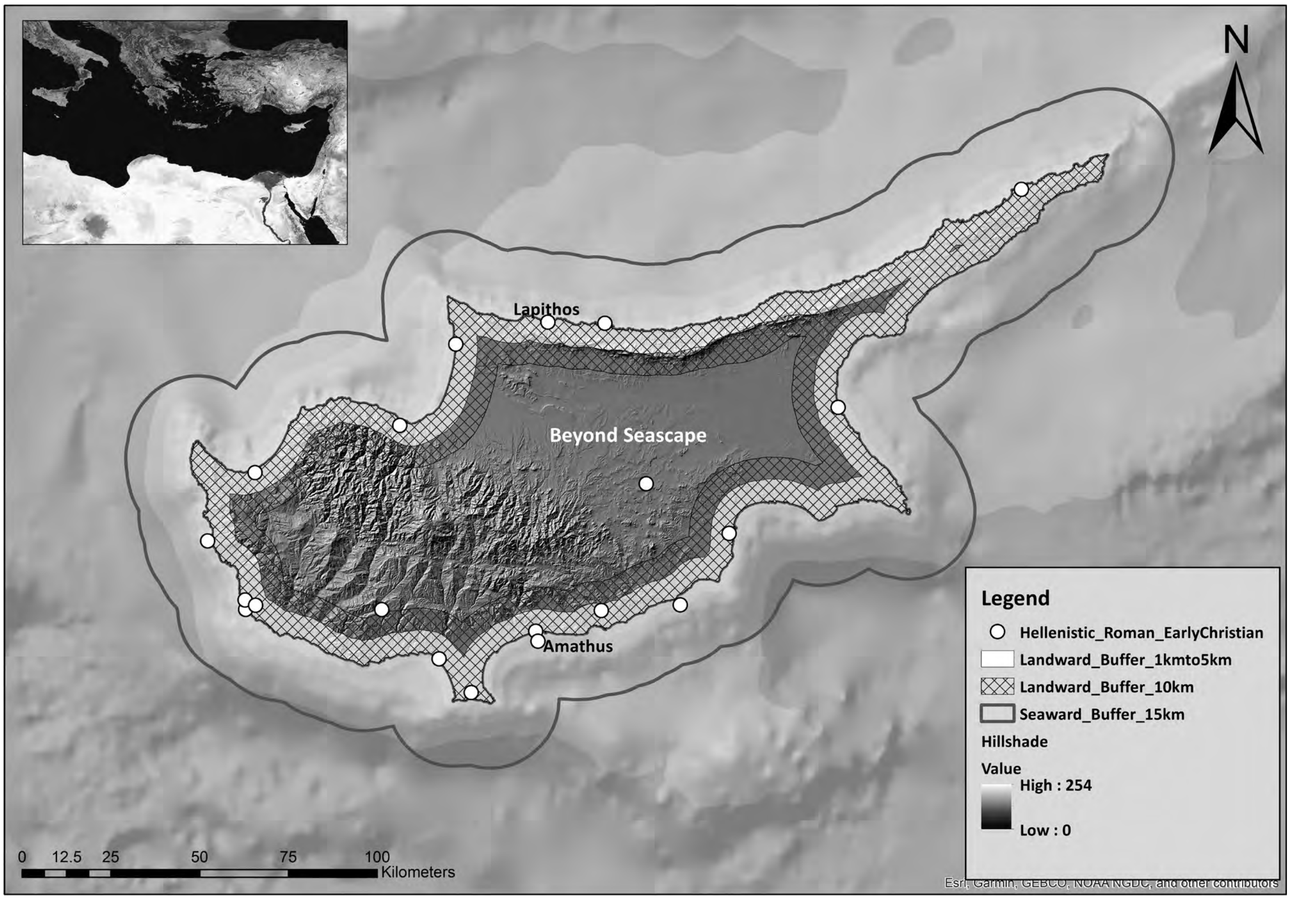

Figure 3.8. Map defining the landward and seaward buffers of Cyprus (land and coastal zones of Cyprus) in relation to the Hellenistic, Roman and Early Christian sites. The sites of Amathus and Lapithos are marked as discussed in the text. The landward and seaward buffers have been defined based on the generally acceptable former interpretations of Vogiatzakis *et al.* (2017: Fig. 1). Produced by the author on ArcGIS. Source for layers of Hillshade Coastline: Department of Lands and Surveys, Cyprus (DLS Portal); source of the basemap: Esri Garmin, NCAA NGDC and other contributors; layer of archaeological sites produced by the author.

provide essential habitat for many species and contribute to fishing (Department of Fisheries and Marine Research 2012: 53–55; Campagne *et al.* 2015: 394, 396; Jackson *et al.* 2015: 900; Kleitou *et al*. 2020: 1–2). These seagrasses may be ancient, as the remains of fish species living mainly in a substrate with seagrass meadows from depths of about 1 to 50 m have been recovered within Amathus' fishbone assemblage (Department of Fisheries and Marine Research: 2012: 53–55; Kleitou *et al.* 2020: 2, 12; Michael 2022: 401–402). Consequently, the presence of seagrass meadows within this area provides a fertile fishing ground which was exploited by the inhabitants of Amathus.

During summer, when the upwelling phenomenon occurs, the local wind patterns, which become predominant features, also favour the growth of fishing in this area. The northerly land breezes developed at night help fishers to sail or row in calm weather offshore, and the light southerly sea breezes developed during the whole day help them return safely to the coast (Meteorological Service 1986: 9; Michael 2022: 158, 401). In addition, the northerly land breezes and light southerly sea breezes are predominant features during the winter time (Meteorological Service 1986: 9); as a result, they create the ideal circumstances for the growth of fishing within this season. Although it is difficult to confirm the seasonality of fishing in this area based on the available evidence, fishers were probably aware of the environmental conditions in this area, and they likely took advantage of them in order to achieve the successful exploitation of their marine supplies.

In addition, the construction of rock-cut fish-ponds along the northern coast of Cyprus is likely a result of the knowledge of the landscape and seascape of Cyprus (Auriemma and Solinas 2009: 136–137; Marzano 2013: 205–233; Morhange and Marriner 2015: 148–150; Evelpidou and Karkani 2018: 3; Michael 2022: 379–388). Their structural arrangement mainly consists of a pond and one or two rock-cut channels used as an entrance from the sea to the pond, while they involved human effort and required unremitting care (*De Re Rus.* 8.1.3). Based on the written sources, the structure of a fish-pond depends on the seabed morphology, sea level, tides, prevailing winds and currents (*De Re Rus.* 8.16.6–8, 8.17). This descriptive information has been confirmed by combining the archaeological remains of the fish-ponds at Lapithos, an archaeological site located on the northern coast of

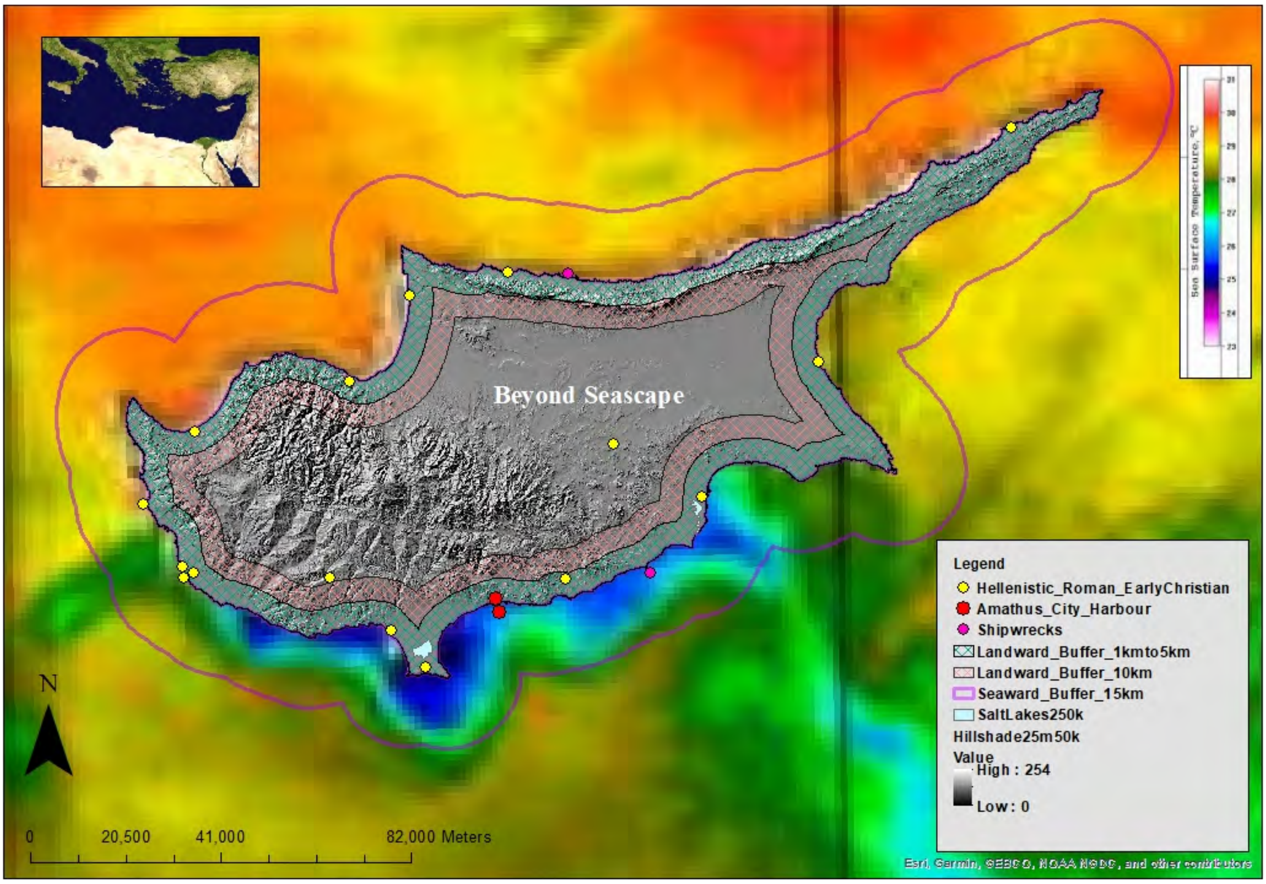

Figure 3.9. Map defining the upwelling phenomenon in relation to the landward and seaward buffers of Cyprus (land and coastal zones of Cyprus) and the Hellenistic, Roman and Early Christian sites. The site of Amathus is marked with a red point as discussed in the text. Produced by the author on ArcGIS. Source for layers of Hillshade Coastline: Department of Lands and Surveys, Cyprus; a single passage NOAA-AVHRR image on 15 August 2011 from the CYCOFOS ground satellite receiving station at the Oceanography Centre of the University of Cyprus is used as basemap. This image shows the upwelling phenomenon and its offshore extension south of Cyprus (Department of Fisheries and Marine Research 2012: 11); layers of archaeological sites produced by the author.

Figure 3.10. A view of the fish-pond at the archaeological site of Lapithos, on the north coast of Cyprus. Photo by the author.

Cyprus (Figures 3.8 and 3.10), with environmental and ethnographic data (Nicolaou and Flinder 1976: 134: Fig. 1; Michael 2022: 381–386, 399).

As already discussed, the seabed of the northern part of Cyprus is more fertile in comparison to the southern part based on oral histories and traditions, while the stability of the north coast to the present sea level benefited the construction and development of fish-ponds in this area (Nicolaou and Flinder 1976; Panayides 2018: 227, 235–237). As a result, the construction of fish-ponds along the north coast of the island was a choice based on the potentially lucrative ground. In addition, the orientation of fish-ponds was intentionally chosen in order to take advantage of the incoming tide of the sea and the predominantly northwesterly to northeasterly winds (Michael 2022: 147, 379, 384). These winds create a current tending towards land, which contributed to the continuous renewal of water within the pond. Consequently, the occurrence of fish-ponds along the north coast of Cyprus is not by chance, while the daily interaction of fishers with their maritime environment led to acquiring a maritime knowledge, which in turn affected the growth of fishing.

To sum up this brief discussion, it seems that Cypriots who decided to become fishers and engaged in fishing also decided to adopt a specific lifestyle. Knowledge of ecology (seabed ground), meteorology (winds, currents, tides, *etc.*) and biology (availability of fish species) was an essential 'tool' for establishing and developing fishing. The only way to acquire this knowledge was to interact daily and systematically with the physical and cognitive aspects of the terrestrial (landscape) and marine space (seascape) in which they lived and worked. Consequently, the understanding of fishing in Cyprus diachronically contributes to understanding an important aspect of the human life of Cypriot maritime communities.

Fishing as a way of living in the field of maritime archaeology

To end this discussion, it is essential to address the question of how the understanding of the human daily activity of fishing in Cyprus diachronically contributes to advancing the field of maritime archaeology as a way of understanding human life. To answer this question precisely, the author returns to the definition of maritime archaeology, which—in general terms—is the study of human interaction with the sea through the archaeological study of material evidence of maritime culture (Delgado 1997: 259; McKinnon 2014). Through the research presented here, the study of material related to fishing demonstrates that fishing communities relied on the accumulated knowledge of their local maritime landscape and seascape to navigate and identify fishing grounds and develop the activity of fishing.

Thus, fishing is not just the engagement of a person with the sea to catch fish; rather, it is a lifestyle because fishers interact with different aspects (*e.g.* environmental, biological, cultural, *etc.*) of their landscape and seascape in order to decide where, when, what and how to catch fish. For instance, the knowledge of the vegetation of a fishing ground, as already discussed, is an important element for the effectiveness of fishing because the presence of Mediterranean tapeweed/seagrass (*Posidonia oceanica*) within a fishing ground may be one of the main factors in the establishment and development of fishing in an area because these seagrasses are a primary source of nutrition in marine environments (Michael 2022: 428).

In addition, the knowledge of the seabed's nature is essential for deciding whether an area is a profitable fishing ground or/and the right point to use a specific fishing gear or/and fish the targeted fish species which fishers want to catch (Acheson 1981: 276–277, 290–291, 307; Aswani 2020: 475–479, 481; Michael 2022: 428). According to the oral Cypriot tradition, fishers used heavy rocks covered on their bottom with animal fat (Michael 2022: 219–220). They threw them on the seabed and after a few minutes pulled them up. If sand stuck on the animal fat, it meant the seabed was sandy and not rocky, so it was a good area for setting up nets. These heavy rocks that Cypriot fishers used to identify the morphology of the seabed seem to be similar to ancient stone or lead sounding weights, which have been mainly found in Israeli waters and can be seen as auxiliary to fishing activity (Oleson 2000, 2008: 120–121; Galili and Rosen 2008: 72; Galili 2010: 133; Galili *et al.* 2013: 154–157; Safadi 2018: 240–241). Only three have been recorded from ancient Cyprus (Oleson 2000: 299, 2008: 146, 154, 157). Although their usage is similar to the stone that Cypriot fishers used, sounding weights are not mentioned as fishing gear, but they are interpreted as navigational tools used to identify the morphology of the seabed during a sailing trip (Oleson 2000: 295–296, 2008: 125–129; Galili and Rosen 2008: 75). Consequently, combining the traditional use of heavy rocks to distinguish the seabed's nature with archaeological evidence of sounding weights from the wider region of the eastern Mediterranean suggests fishers interacted with its marine environment in order to acquire knowledge about the morphology of the seabed.

Finally, fishers, like all seafarers, pay constant attention to some points of orientation to locate their fishing grounds, especially when there are currents or it is windy (Frost 2000; Morton 2001: 203; Obied 2016: 9–11, 36–38, 64, 145–158; Safadi 2018: 239–241; Michael 2022: 218–219). Based on oral traditions, Cypriot fishers watch a fixed landmark or a pair of landmarks—for example, a church, a distinctive elevation or familiar mountaintop and/or promontory—and observe how the landmarks look from their boat to enable them to know their present position (Michael 2022: 429). In the same way, the ancient promontory shrines/temples of Phoenicians, Greeks and Romans would have been visible to seafarers and fishers moving along the coast, acting as key navigational markers in the mental maps of their environment (Semple 1927: 379). In addition, Strabo describes how seafarers used the mountains Amanus, Rhosus and Pieria to sail south along the rocky seascape of the Northern Levant (Obied 2016: 148). Consequently, it seems fishers attempt to perceive, interact and use their landscape and seascape in order to acquire knowledge (a mental map) of their landscape and seascape, which is important for establishing and developing fishing.

Thus, the effectiveness of fishing depended on the constant interaction of fishers with their landscape and seascape, while this constant fisher-sea interaction led to the acquisition of knowledge of their landscape and seascape, an intangible aspect revealed through the simultaneous study of archaeo-ichthyological and contemporary/ traditional evidence (Michael 2022: 428). Through this systematic and simultaneous examination, it is possible to comprehend the nature and synthesis of fishing and how and why it was established as a social and cultural action in various archaeological contexts over time. Consequently, the contribution of the study of fishing through time is essential to advancing the field of maritime archaeology as a way of understanding human life.

Conclusion

This chapter explores and interprets the human utilisation of space through the daily activity of fishing in the archaeological context of Cyprus through time. Through the concurrent study of archaeo-ichthyological evidence with the environmental and cultural characteristics of their archaeological context, the reconstruction and comprehension of fishers' knowledge of their known local environment (mental map) is accomplished. By using the ethnoarchaeological approach, it is possible to reveal this intangible knowledge, which in turn can determine the occurrence or absence of fishing in the Cypriot maritime landscape and enable hypotheses about the relationship between fishers and their maritime environment in the past.

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4

Ropotamo: an Early Bronze Age pile-dwelling on the Western Black Sea coast

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Abstract: Ropotamo is a multi-period archaeological site located on the southern Bulgarian Black Sea coast, in a small bay where the Ropotamo River flows into the sea. Due to the unique natural habitat, the site has preserved the stratigraphy left by millennia of human activity in the bay. In 2017, underwater excavations were launched as part of the international Black Sea Maritime Archaeology Project (Black Sea MAP). Over the following seasons to 2020, four trenches were excavated. Documentation was primarily done with a multi-camera rig for high-resolution digital photogrammetry, and interdisciplinary analyses were carried out. At depths between 1.5 and 2.0 m below seabed, artefacts from the Early Bronze Age were discovered: pottery, flint, stone, bone tools and wooden piles of structures. Detailed analysis of the stratigraphy shows that when the sea level was *c.* 6 m lower than the present one, a pile-dwelling settlement was established. The structures were raised on posts near or on a calm freshwater environment such as a river or a lagoon. Radiocarbon dates the site to the very end of the fourth millennium BC. The settlement's inhabitants relied more on hunting than husbandry and were forced to make repairs as the sea level rose, until they eventually abandoned the site.

Introduction

In 1921, when digging for a navigable channel connecting two coastal lakes in the area of Varna, the remains of a prehistoric settlement were found below sea level at a depth of between 3.0 and 4.5 m. In the following decades, the number of known similar settlements increased, and to date, we have data on over 20 underwater prehistoric sites along the Bulgarian Black Sea coast (Ivanov 1993; Draganov 1995, 1998). Most of them date to the Late Chalcolithic and Early Bronze Age (fifth–fourth millennia BC) and are concentrated in two zones: north in the waters of Varna and Beloslav Lakes and in coastal marine bays south of Burgas. Although more than a century has passed since the discovery of the first settlement underwater, only a few of these settlements have been researched archaeologically. Therefore, the study of the archaeological site in the bay in front of the mouth of the Ropotamo River (Figure 4.1) deserves particular attention (Dimitrov *et al.* 2020; Ballmer *et al.* in press).

The Ropotamo River is typical for the southern Bulgarian Black Sea coast: small and almost drying up during summer in the upper reaches but, at the same time, wide and navigable year-round in the last 8.5 km for vessels which draw up to 2.5 m. Typical for Ropotamo and other rivers of the Bulgarian coast (for example: Kamchia, Karaagach and Veleka) is that the estuary is blocked by a sand bank, which closes and opens depending on the winds and the amount of rainfall. These characteristics cause the development of a lasting brackish or freshwater marshy area at the mouths of the rivers, the level of which can rise by more than a metre with a strong east wind and heavy rain in the area.

The bay into which the Ropotamo River flows is about one kilometre wide. From the north, it is closed by a semi-submerged rocky reef with a length of about 200 metres, and from the east by a small sandy and pebbly beach. Due to its specific location, orientation and shape, the bay in front of the mouth of the Ropotamo River is one of the best protected natural harbours on the Bulgarian coast (Figures 4.1.3 and 4.1.4). These exceptional conditions for docking, including wintering, combined with access to the rich and diverse natural resources of the hinterland, have been attracting people to this place since very ancient times.

Underwater archaeological research in the bay at the mouth of the Ropotamo River

Surveys 1973–1989

Underwater studies in the bay began in 1973 and continued with several interruptions until 2020. Until 1989, the leader of the excavation was Prof Ivan Karayotov from the Archaeological Museum in Burgas. In 1989, the last archaeological season directed by Prof Karayotov, an archaeological trench was excavated in a small area; under a layer of mixed archaeological materials (mainly ceramics from Antiquity and the Middle Ages) and a dense mussel layer, prehistoric materials were found: wooden piles fixed in the bottom, burned clay plaster fragments, sharded and whole pottery vessels, grinding stones, bones, flint, stone,

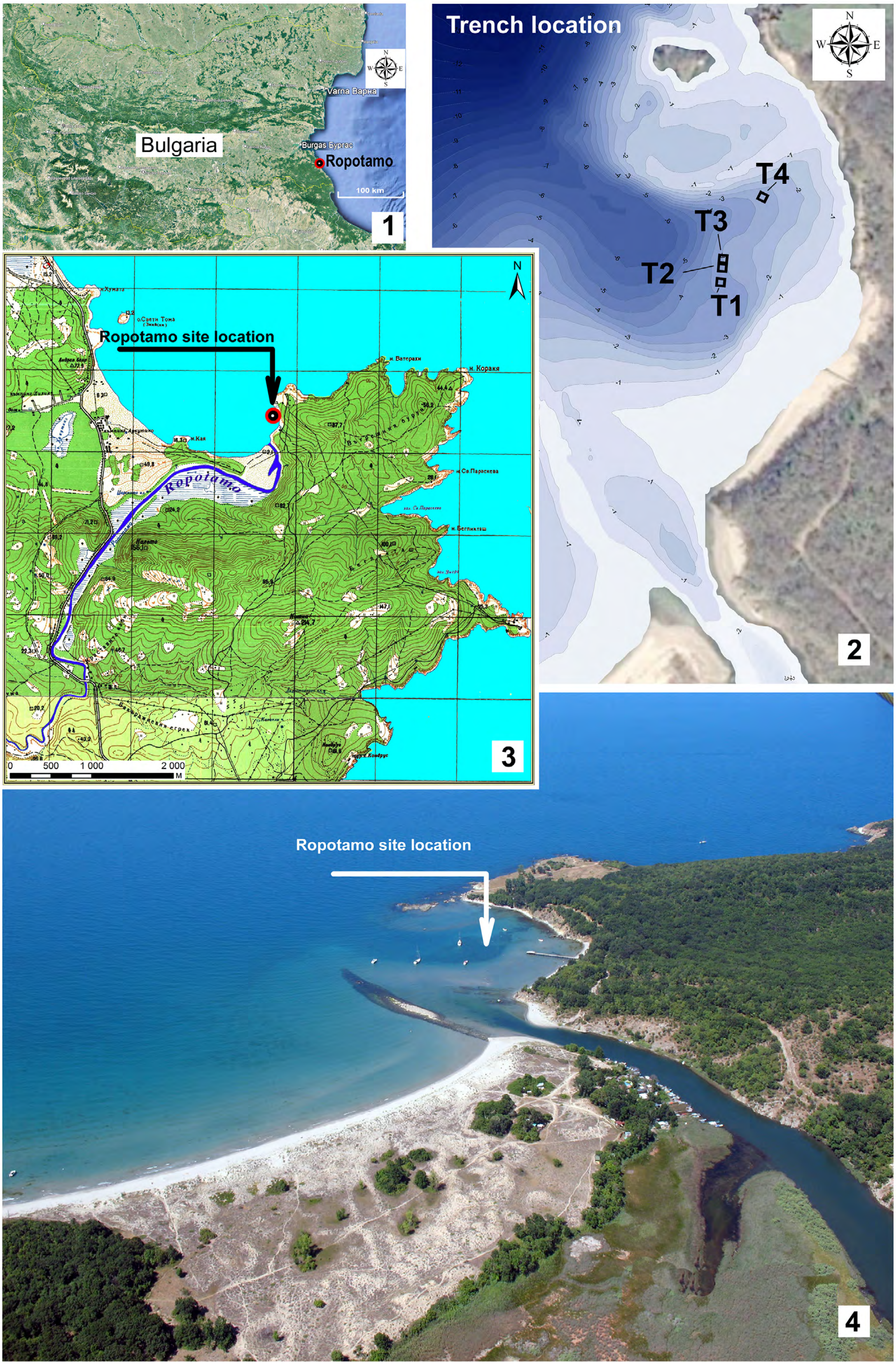


Figure 4.1. Location of the Ropotamo archaeological site. 1, Location of the site on the Western Black Sea coast. 2, Location of the archaeological trenches in 2017–2020 on a bathymetric map. 3, Topographic map of the area of the lower course of the Ropotamo river; a 1:25000 map was used as a base. 4, Arial view from SE of the Ropotamo river mouth and the bay in front of it. Maps compilation by K. Dimitrov.

bone and antler tools. These finds were recorded at a depth of *c*. 2.0 m into the bottom, which means a depth of *c*. 5.5 m below the sea surface. The finds are dated by typology to the first stages of the Early Bronze Age (EBA). Karaytov's studies were interrupted after 1989, but in several publications in the following years, based on numerous finds, he summarised his observations about the studied site, which he defines as a 'sunken harbour' and 'sunken prehistoric settlement' (Karayotov 1990, 1992, 2002).

Surveys 2017–2020

Methodology of excavation and documentation

In the period between 1989 and 2017, archaeological excavations were not conducted, but Ropotamo remained an important site on the map of submerged prehistoric settlements along the Bulgarian Black Sea coast. It remained of great interest because, unlike all other known settlements of this type, this site has not been affected by development or destroyed by large-scale dredging or other anthropogenic activities. This is why in 2017, the prehistoric settlement was selected for underwater archaeological excavations within the framework of the international Black Sea Maritime Archaeology Project. The goal of the excavations was to explore, using modern methodology, the submerged prehistoric settlement in order to shed light on changes in sea level, the changes in the environment and the human response to this evolution. In this way, environmental and archaeological data from Ropotamo would be complementary to the sea-level change data acquired by the Black Sea MAP deep water surveys on the Bulgarian Shelf acquired 2015–2017 (Sturt *et al*. 2018). During the four years of work, two sectors lying 25 m apart were studied; these were labelled T1–T2 (later T2–T3) and T4. In total, an area of about 100 m^2 was studied. The excavation was carried out in layers of about 10 cm or by stratigraphic units. Sediment removal was effected with water suction dredges operated by divers. Each revealed level was documented by underwater digital photogrammetry and photographic and video records. At the conclusion of each of the two sectors (T2–T3 and T4), samples of the profiles were collected to carry out sedimentary, palynological and archaeobotanical analyses. The stratigraphic layers were dated by typological determination of the artefactual and structural material and by radiocarbon dating of wooden and other organic remains (Вагалински *et al*. 2018; Димитров *et al*. 2019, 2020, 2021).

The photogrammetry survey at the site was carried out according to the specifics of the Black Sea and the archaeological site, whose conditions would require some ingenuity. First of all, visibility is usually much lower than in other seas worldwide, even more so for a site located close to a river mouth. For this reason, a rig of several action cameras was used. Every camera was mounted to shoot at a different angle to ensure sufficient overlap of 60–80%, which is essential for a successful photogrammetry model. For the first two seasons at Ropotamo, a specially designed rig to mount five GoPro 7 Black was employed, which gave very good results even in visibility less than 50 cm (Pacheco-Ruiz *et al*. 2018). The drawback was this technique accumulates a very large number of frames, which require a lot of computational power and time to process. Because of this, since 2019, a custom-built frame for just three action cameras was used, which drastically reduced the number of images per survey. This allowed for the completion of daily recordings of the archaeological site and the construction of ready model for the next day.

Surveying a trench in the seabed for photogrammetry is a challenge in itself. It requires sufficient overlap of the images connecting the ground control points or markers; these are fixed on the seabed with the archaeological situation, which can be up to 3 m below seabed. For this, a new survey pattern was applied, one which combines the spiral pattern used by Pacheco-Ruiz *et al*. (2018: 124, Fig. 7 b) and the transversal and longitudinal path presented by Yamafune *et al*. (2016: 12, Fig. 12). To increase local accuracy, 4×1 metre-scale bars or smaller were always placed in the survey area, which minimised the error to 1.5 mm per 1.0 metre. The models were georeferenced by four coded markers, the coordinates of which were taken with a differential global navigational satellite system (GNSS) with a real-time kinematic correction.

Taking precise global coordinates on an underwater site has always been a challenge, especially in deep water, because the signal from the satellites cannot penetrate through the water's surface. Fortunately, the Ropotamo site is at a relatively shallow depth and can be measured by just using a 5 m-long pole to keep the transceiver of the signal above water, a method which has been widely used in recent years (Pacheco-Ruiz *et al*. 2018: 125; Reich *et al*. 2021). Coupled with the millimetric intra-site accuracy noted above, this fixes the position of the trench and every object in the model down to 2 cm of global accuracy.

Since in the Ropotamo project the spatial positioning of the sectors was carried out with a GNSS receiver, the depths below sea level discussed in the actual text are relative to the Baltic geodetic system, which is the standard used in Bulgaria. The real depths, measured on the site with a depth gauge or tape measure, differ from the geodetic ones by up to 20–25 cm. The difference is variable and depends on the tides, which, although small, still exist in the Black Sea.

Before images were loaded into a photogrammetry software, they were first processed with the open-source software RawTherapee. This software provides a fast and easy way to make corrections without affecting the quality of the original image: the white balance has been corrected on all the photos to remove the loss of colours due to the water environment and reduce the resolution to half, as for our purposes, 4k is too much. For the photogrammetry processing, the software Agisoft Metashape was used with a standard workflow (Agisoft LLC 2023), with additional processing steps to clear any interference added by the water environment.

From the photogrammetry model, we export a high-resolution orthomosaic and a digital elevation model. These were used to create a detailed site plan in a vector graphics editor software such as Adobe Illustrator. There the archaeological finds are outlined in standard colours based on their material of manufacture. Stratigraphic changes in the sediments can be visualised with the exact coordinates and depths of any samples taken for further analysis. Furthermore, from the photogrammetry model, we can create animations to better visualise the archaeological situation for the general public.

Stratigraphy of the archaeological site of Ropotamo

In 2017, a complex marine geophysical survey was conducted, and underwater excavations were started within two standard archaeological squares of 5×5 m (T1 and T2). In 2018, the excavation area was increased by a new square of 5×5 m, marked as T3, positioned on the north side of T2. During the excavation in 2018, the excavations in T2 and T3 were connected and shaped as a stratigraphic trench T2–T3. The survey in 2019 and 2020 focusses on square T4, which lies 25 m to the northeast of T3 (Figure 4.1.2).

The stratigraphic observation in T2–T3 and T4 are similar, although not identical, and they present some differences in the thicknesses of individual layers (Figure 4.2). In both sectors, five stratigraphic layers have been established[1]:

- **Layer 1:** At the top,[2] a layer of marine sediments has been studied, which was formed when the bay was used as a harbour. It contains a large number of archaeological materials, mainly ceramics, which were deposited in a recognisable chronological sequence from the Late Archaic to the Late Ottoman period. The chronological and that quantitative analysis of the finds in this layer shows that port in the bay in front of the mouth of the Ropotamo River began to be used with the arrival of the first Greek colonists along the western the Black Sea coast at the end of the seventh century BC, and it experienced prosperity during the Roman and Late Roman time. The discovered amphorae and table vessels are imported and originate from different parts of the Mediterranean. The complexity of the archaeological materials of this layer very well illustrates the periods of economic prosperity and crises on the western coast of the Black Sea.
- **Layer 2:** Under the port materials is a layer of marine sediments in which no archaeological finds are found. The layer is characterised by a large amount of large mussels and oyster shells. This layer represents a cultural hiatus and was accumulated in a period when there were good conditions for mollusc development in the bay: quiet and warm water, rich in nutrients. Chronologically, this layer was accumulated between the third and first millennia BC. Its formation is also associated with a rise in sea level over this long period.
- **Layer 3:** Under the 'hiatus' layer in an environment of marine sediments are found the remains of a settlement from the Early Bronze Age (EBA): fixed wooden piles of building structures oriented vertically or at an angle, pieces of burned clay plaster, pottery, antler, bone, stone and flint tools. The EBA layer also contains faunal remains, most likely related to nutrition.

Archaeological finds and materials from the EBA are found unevenly distributed in this layer from *c*. –4.55 m to *c*. –5.50 m below modern sea level in sector T4 and between *c*. –5.00 m and *c*. –5.65 m in sector T2–T3 (Figure 4.3). Apart from the wooden piles which are still fixed in place, the other finds are not found in situ in the proper sense of this term. The observations (mainly in the trench T4) of the stratigraphic distribution of the individual categories of findings, however, allow for some conclusions concerning the construction of buildings and the stages of their operation and destruction. The buildings are erected as pillar structures with horizontal wooden platforms with a clay coating (Figure 4.4). The vertical wooden piles are carefully sharpened and driven into the terrain by digging and hammering into two layers (4 and 5) on top of which the EBA settlement is built. During the habitation of the settlement, a change in the dynamics of the coastline occurs, and the accumulation of marine sediments between the piles begins. The process is relatively slow; probably at the beginning, it seemed episodic and allowed the inhabitants to carry out repairs and other reinforcement activities to the wooden pile structure. The rise of the sea level and the entry of marine sediments into the boundaries of the settlement continued until the point the site had to be abandoned. Later, the site was completely destroyed and covered by marine sand. It is difficult to estimate the speed of flooding and the absorption of settlement's remains by the sea, but the good preservation of the wooden piles and the archaeological finds suggest the process is relatively fast, and the rise in the sea level of *c*. –5.50 m to *c*. –4.55 m occurs before the wood had time to rot and probably lasts no more than 100–200 years.

- **Layer 4:** Particularly interesting and important for understanding the changes in the environment during the Bronze Age is the layer lying at *c*. –5.6 m to *c*. –5.7 m below modern sea level, on which the settlement is built. In T4, it is a grey silty layer formed in a freshwater environment (Figures 4.4.2 and 4.4.4), and in T2–T3, it is a naturally lithified surface of a coastal sand dune. It is on these levels, which once marked the ancient coastline, people first chose to settle by digging and driving into them the wooden piles for the construction

[1] The terms 'layer' and 'stratigraphic layer' are used here to bring together a stratigraphic unit with similar taphonomy and chronology of findings. This generalization approach is justified by the fact that individual stages of accumulation and formation in the stratigraphic layer often have vague boundaries, since the site Ropatamo was formed by mobile marine sediments.
[2] The description of the stratigraphic layers follows the order of excavation from the surface of the seabed.

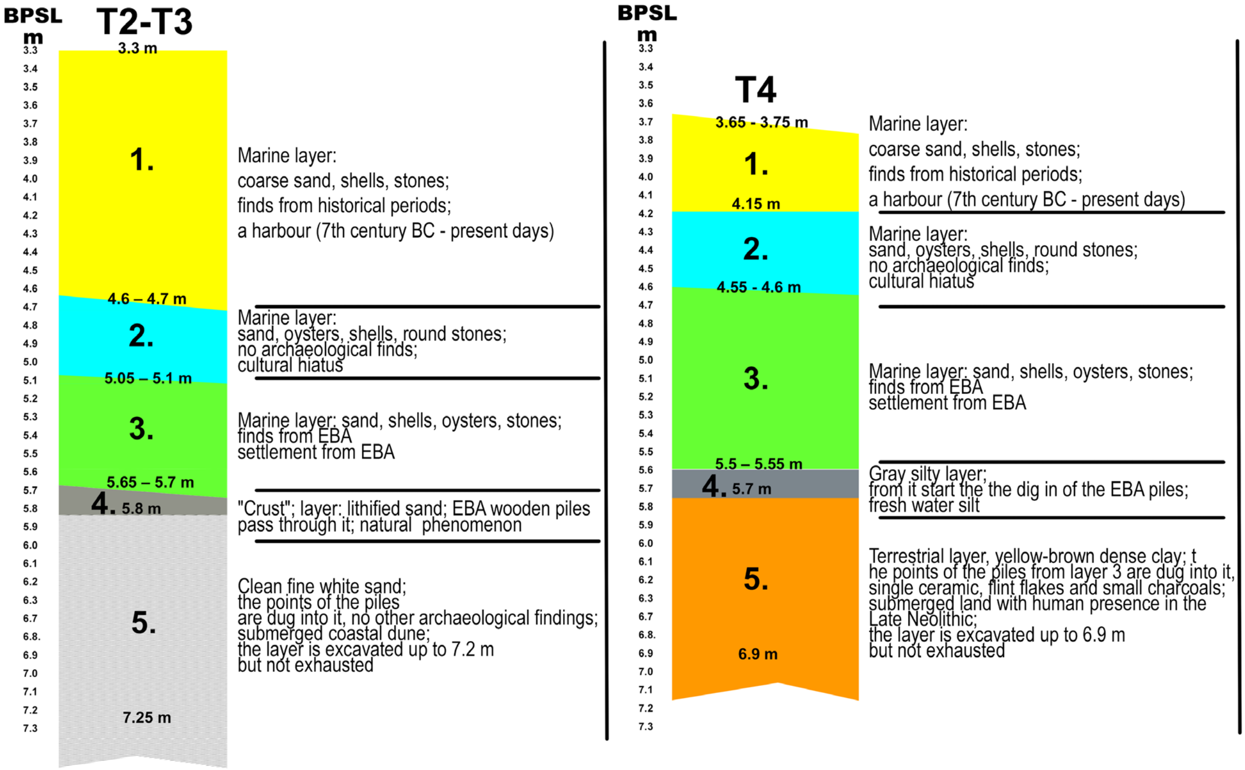


Figure 4.2. Comparative scheme of the stratigraphy in sectors T2–T3 and T4. Compilation and drawing by K. Dimitrov.

of their buildings. Settlement close to the sea level is possible only because the EBA settlement is located not on an open seashore, but on the right bank of the ancient river Ropotamo, not far from its mouth. The place of EBA habitation was probably very similar to the modern landscape which the Ropotamo River has formed along its left bank in the last two hundred metres of its course (Figure 4.1.4).

- **Layer 5:** Below the level of construction in T4 is documented a layer of dense dark yellow, yellow-brown clay, which has a preserved characteristic of a terrestrial soil. In 2020, during a final control trench in this sector, reaching a depth of –6.7 m below modern sea level, several fragments of handmade pottery were found. Their surface is well preserved, and the graphic reconstruction of the forms showed parallels with vessels from the Late Neolithic, the most direct being those from the site Aşağı Pınar 3. Since during the underwater studies of Ropotamo, no archaeological structures have been found which have such an early date, the presence of these single materials from the end of the sixth millennium BC should be explained by the existence in the near vicinity of a still to be located earlier prehistoric settlement, which predates by about 2000 years the occupation of the EBA.

Below the level of BA materials from sector T2–T3 to a depth of –7.9 m from modern sea level is documented a layer of homogeneous white, fine and uniform sand, with no archaeological finds. There are no shells of marine molluscs in this layer, and it is most likely a flooded ancient coastal dune.

Findings

The great majority of prehistoric finds from Ropotamo belong to the EBA layer. The exceptions are the few fragments of ceramics, for which an earlier date has been proposed.

The EBA pottery from Ropotamo is handmade and relatively roughly: there is often a lack of symmetry in the forms, and the clay is coarse with inorganic, crushed shells or fine organic temper. The pottery has a severely eroded surface, which is probably due to poor initial firing, the secondary accidental fire at the destruction of the site and its deposition in a layer of mobile marine sediments. The percentage of whole vessels is relatively small, which distinguishes the collection from Ropotamo from the finds from other submerged settlements on the Bulgarian Black Sea coast. About 50 whole profiles were recorded (Figure 4.5). Most well-preserved vessels are small or medium in size, and large vessels are highly fragmented. Twelve categories of vessels are distinguished: dishes, bowls, jugs, askos, cups, amphorae, pots, containers, lids, ladles and strainers (Figure 4.5). The most common categories of vessels on the site are pots, bowls and jugs. Important for the chronology of the site is the record of askos in the ceramic repertoire (Figures 4.5.19 and 4.5.25), which suggests an earlier date of the complex to the EBA 1 stage.

A small number of the vessels are decorated in a manner typical for the period: stamped, incised, corded, cuts, embossed strips, relief buds and finger pits (Figures 4.5.1–4.5.4, 4.5.8 and 4.5.15). Corded and incised decoration are rare, mainly on the finer vessels (Figures 4.5.1 and 4.5.2),

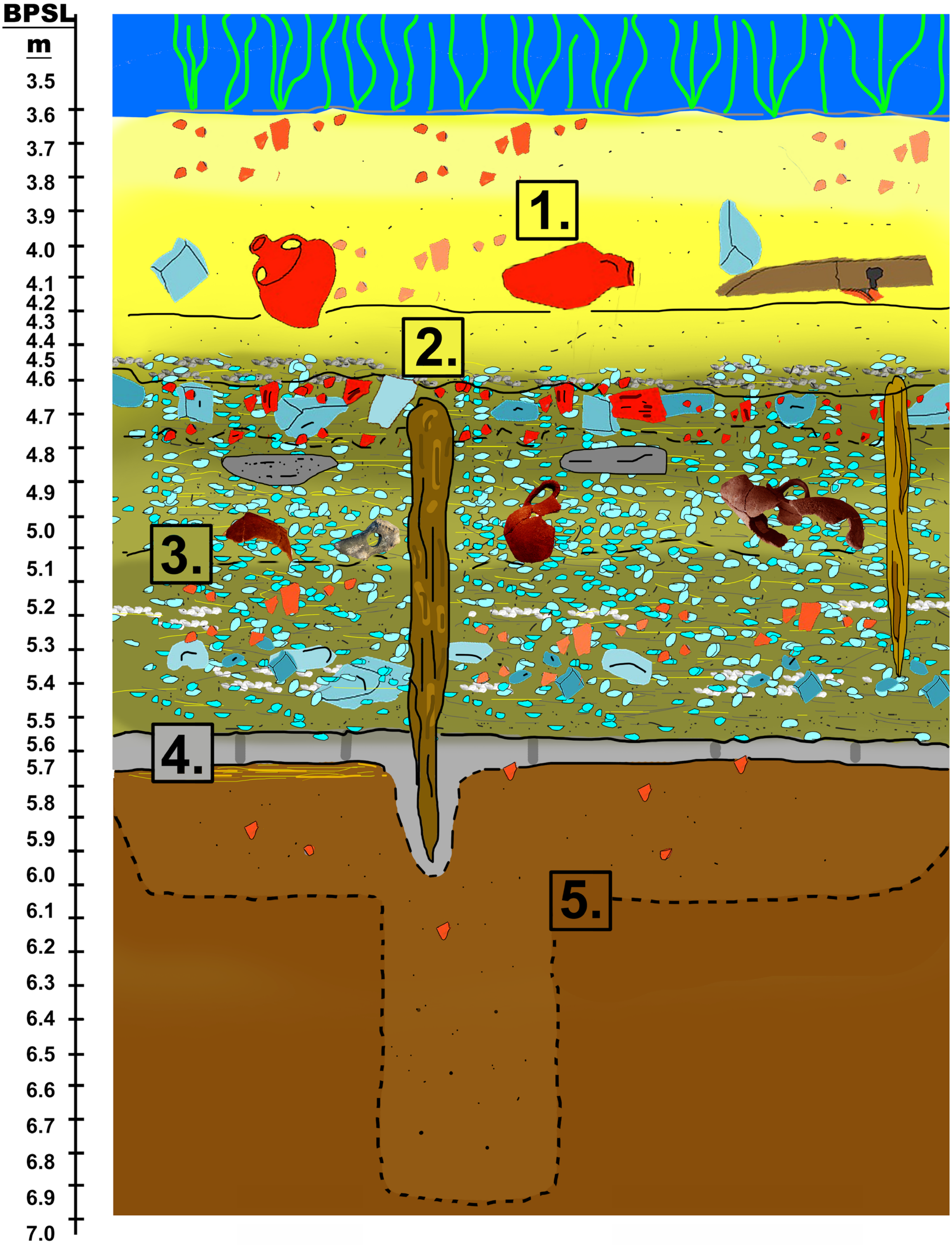


Figure 4.3. Stratigraphic scheme of the archaeological layers in sector T4. Drawing by K. Dimitrov.

but they are important as a chronological indicator for the beginning of EBA 2.

The ceramic complex of the EBA settlement at the mouth of the Ropotamo River finds parallels with the other submerged EBA settlements along the Bulgarian Black Sea coast—those at the Varna Lakes, Burgas, Sozopol, Urdoviza and Atia, the closest being those with the settlement in the harbour of Sozopol. Unfortunately, none of the ceramic complexes of these underwater site is fully published, but based on the known finds, some general conclusions can be drawn.

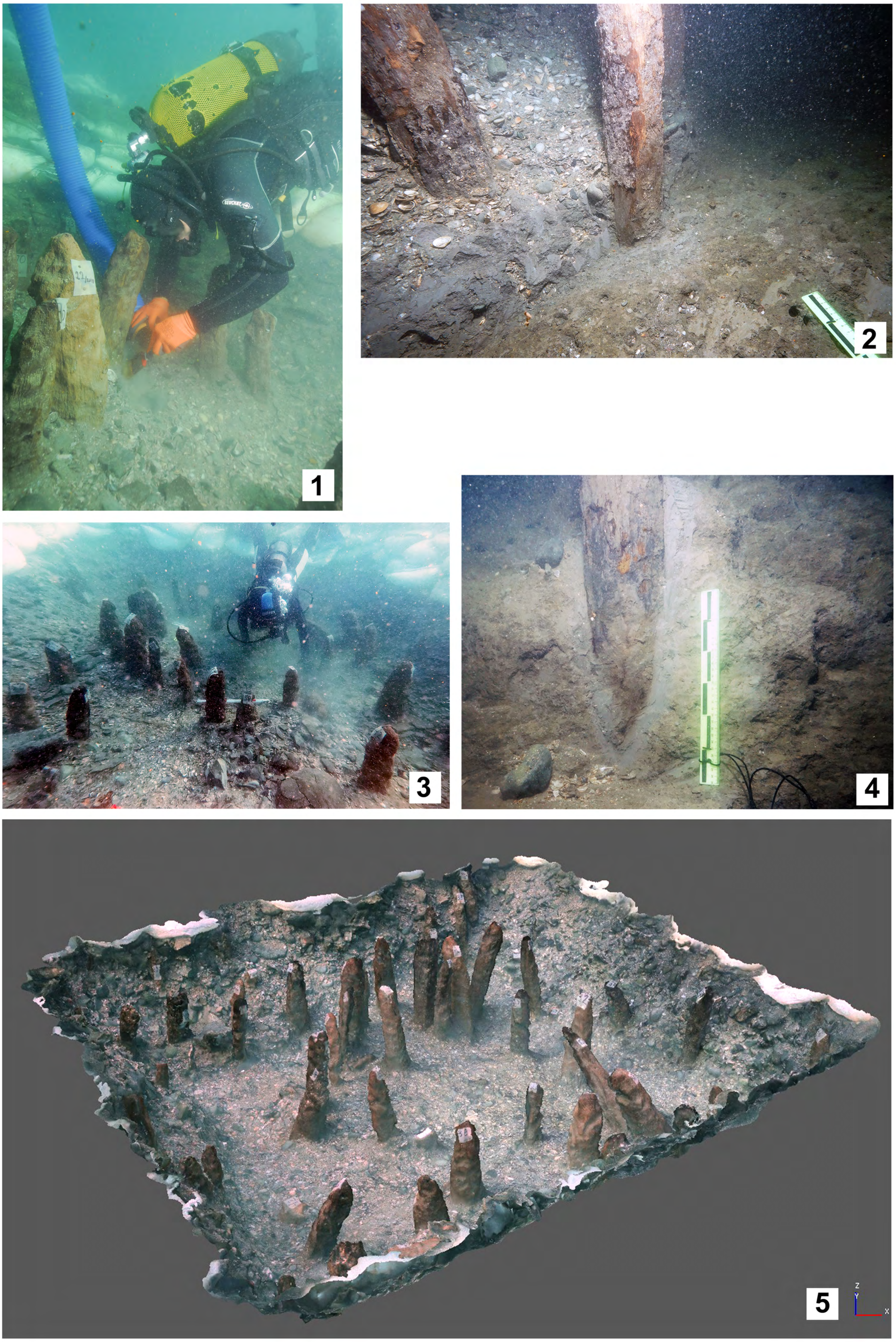


Figure 4.4. Underwater archaeological research in sector T4. 1, Excavation with a waterjet on wooden posts in sector T4. 2–4, Documented stratigraphic situation showing how piles from sector 4 were dug into layers 4 and 5. 5, Wooden piles in sector T4; axonometric view from S. Photos by K. Dimitrov; 3D modelling and axonometric view by P. Georgiev.

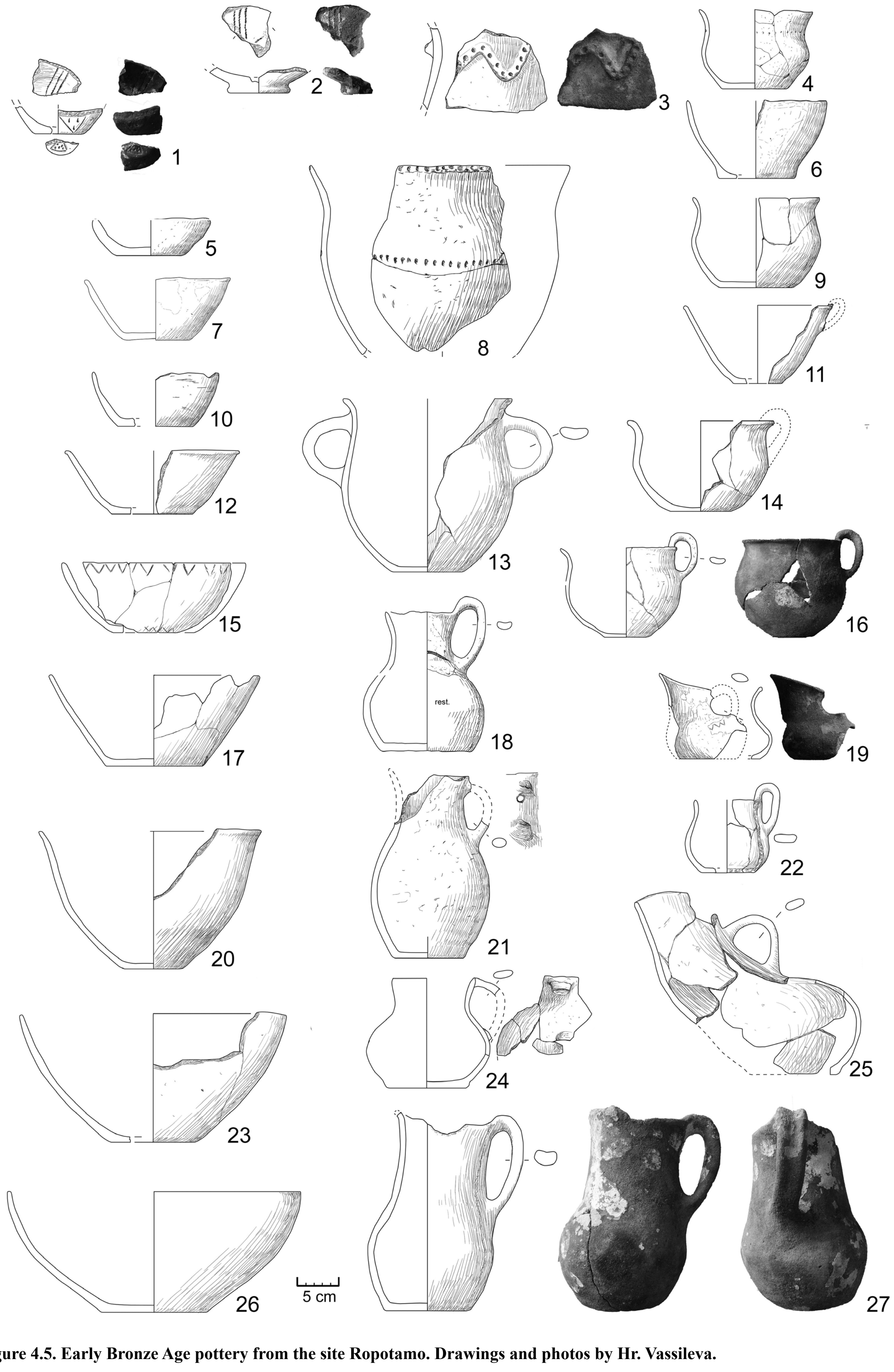


Figure 4.5. Early Bronze Age pottery from the site Ropotamo. Drawings and photos by Hr. Vassileva.

Among the finds from the Varna Lake settlements Ezerovo I, Ezerovo II, Stashimirovo I and Stashimirovo II, almost all types of vessels found in Ropotamo have parallels. Similarities are found in the shape of plates and bows (Маргос and Тончева 1962: Fig. 11; Маргос 1973: Fig. 5/1–5; Иванов 1973: Table V/1–9; Tončeva 1981: Fig. 18/3–8, 19, 20); jugs, cups and askoi (Маргос and Тончева 1962: Fig. 5; Маргос 1973: Fig. 5/11–15, Table VIII/1–3; Иванов 1973: Table IV/3–5; Tončeva 1981: Fig. 7–11); pots and amphorae (Маргос and Тончева 1962: Fig. 6/1–4, 7; Маргос 1973: Table IX/1–4; Иванов 1973: Table V/15–17, 19; Tončeva 1981: Fig 16, 21, 22). The incised and corded decorations from Ropotamo are similar to those found in Ezerovo I (Маргос and Тончева 1962: Fig. 8, 9), Ezerovo II (Tončeva 1981: Fig. 12–14), Stashimirovo I (Маргос 1973: Tables VIII/8–12, IX/8–14) and Strashimirovo II (Иванов 1973: Table V/18, 20). The decoration found in Ezerovo II is dominated by corded and incised ones. Comparing with Ropotamo, a difference in the amount of these types of decoration is clearly discernible. The small amount of corded decoration from Ropotamo indicates this site should be dated earlier than Ezerovo II. On the other hand, there are clear similarities with Ezerovo I in the ceramic shapes, the decoration and probably in the chronology as well.

When the shape and decoration of the ceramics from Ropotamo are compared with the finds from the southern Black Sea coast, parallels can be noted in the forms of jugs, cups and askoi from Burgas (Dimitrov *et al*. 2020: Fig. 7), as can similarities with plates, jugs, cups, pots and amphora found in Atia (Dimitrov *et al*. 2020: Fig. 9).

The ceramic complex from the Kiten–Urdoviza is the best represented in the literature, and this allows the most well-argued typological and chronological comparisons with Ropotamo. Parallels can be found in all types of pottery: plates and bows (Leshtakov 1991: T I, T II; Draganov 1995: Fig. 4/2, 4, 6, 6/1; Angelova and Draganov 2003: Fig. 5/1, 2, 13; Vasileva 2018: Fig. 4/7–12); jugs, cups and askoi (Leshtakov 1991: T VI, T VII/1–6; Angelova and Draganov 2003: Fig. 6/2, 3, 5–13; Vasileva 2018: Fig. 5; Dimitrov *et al*. 2020: Fig. 41/1–8, 10, 11); pots and amphorae(Leshtakov 1991: T III, T IV, T V; Draganov 1995: Fig. 3, 5/15–17, 6/2, 5; Angelova and Draganov 2003: Fig. 5/5–11, 14–17; Vasileva 2018: Fig. 6/6–8; Dimitrov *et al*. 2020: Fig. 42/8). The cord and incised decoration is one of the main characteristic of the ceramic complex from Urdoviza (Leshtakov 1991: T IX; Angelova and Draganov 2003: Fig. 4) as a contrast to the Ropotamo repertoire. This fact points to the likely earlier dating of the Ropotamo settlement.

Parallels with the ceramic finds from Ropotamo are found with those from the submerged settlement in the harbour in Sozopol: plates and bows (Draganov 1998: Fig. 5/2, 3, 9, 10, 14; Vasileva 2018: Fig. 3/2; Dimitrov *et al*. 2020: Fig. 26/4–9); jugs, cups and askoi (Draganov 1998: Fig. 4/12, 5/5–7, 11, 12; Klasnakov and Stefanova 2009: Fig. 1, 2; Vasileva 2018: Fig. 3/3, 4; Dimitrov *et al*. 2020: Fig. 26/2, 27/2–13), pots and amphorae (Draganov 1998: Fig. 5/8; Vasileva 2018: Fig. 3/7, 8; Dimitrov *et al*. 2020: Fig. 26/1, 10–12). Both the types of the vessels and the incised and corded decoration patterns are closest between these two settlement compared to the other submerged sites (Draganov 1998: Fig. 5/1–3, 10, 11).

The relative chronology of the EBA layer of Ropotamo can be related to the transition between EBA 1 and the beginning of EBA 2 in Thrace and synchronised with the some of the land reference sites too: with Ezero in Thrace, at the transition between Ezero A stage and the beginning of Ezero B (XIII-VIII/V construction horizons) (Георгиев *et al*. 1979: 498), with Cernavodă III (Morintz and Roman 1968: 81–98) and Cernavodă II in the Danube Nord East area (Morintz and Roman 1968: 106–115), with Troy I (Blegen *et al*. 1950: 31–199) and Troy II in the Marmara region (Blegen *et al.* 1950: 201–378) and with the Yunatsite XVII-IX horizons in Western Thrace (Николова 1990: 9–16; Катинчаров and Мацанова 1993: 156–157).

The main conclusion from the detailed presentation of the typological pottery parallels with other coastal and inland sites is the Ropotamo pile dwelling represent a specific initial phase of Early Bronze development which nevertheless remains within the traditions of the eastern Balkan Early Bronze cultures of Cernavodă and Ezero type.

The 11 pieces of ceramic fragments in the control trench from sector T4 found in the fifth stratigraphic layer differ from the ceramics described above and have a well-preserved finely worked surface (Figures 4.6.1–4.6.5). From this scarce material can be partially reconstructed three vessel shapes (two cups and one bowl), which find the most direct parallel with finds from Layer 3 of Aşağı Pınar (Parzinger and Schwarzberg 2005: 63, 69, 149, 229). In the periodisation of the Neolithic in Thrace, this means Karanovo III/IV or the beginning of Karanovo IV (after Nikolov 2003), and along the Danube the Vinca B complex. If this preliminary relative and determined only by typology date is confirmed in the future, it means the Ropotamo site has materials from the end of the sixth or the very beginning of the fifth millennium BC, referring to the Late Neolithic (the end of the Karanovo IV period).

The wooden artefacts from the site can be attributed as elements of structures. In total, 83 elements are recorded: 19 in T2–T3 and 64 in T4. Of the total, 75 are posts or piles, five could be categorised as laths and the horizontal beams or joists are just three. On one of the latter elements, a carved joint was recorded. The wood is in different states of preservation, which is most probably linked to its species. The main tree types are oak (*Quercus sp*.) and ash (*Fraxinus sp*.), with a small number of other genera. All the posts have their tips sharpened, and on those in better condition, the traces of tools and partial burning, probably for fire hardening and endurance, could be seen. Their diameter ranges 7–23 cm and their preserved length from 48 cm to 1.40 m. Of all the discovered piles, only

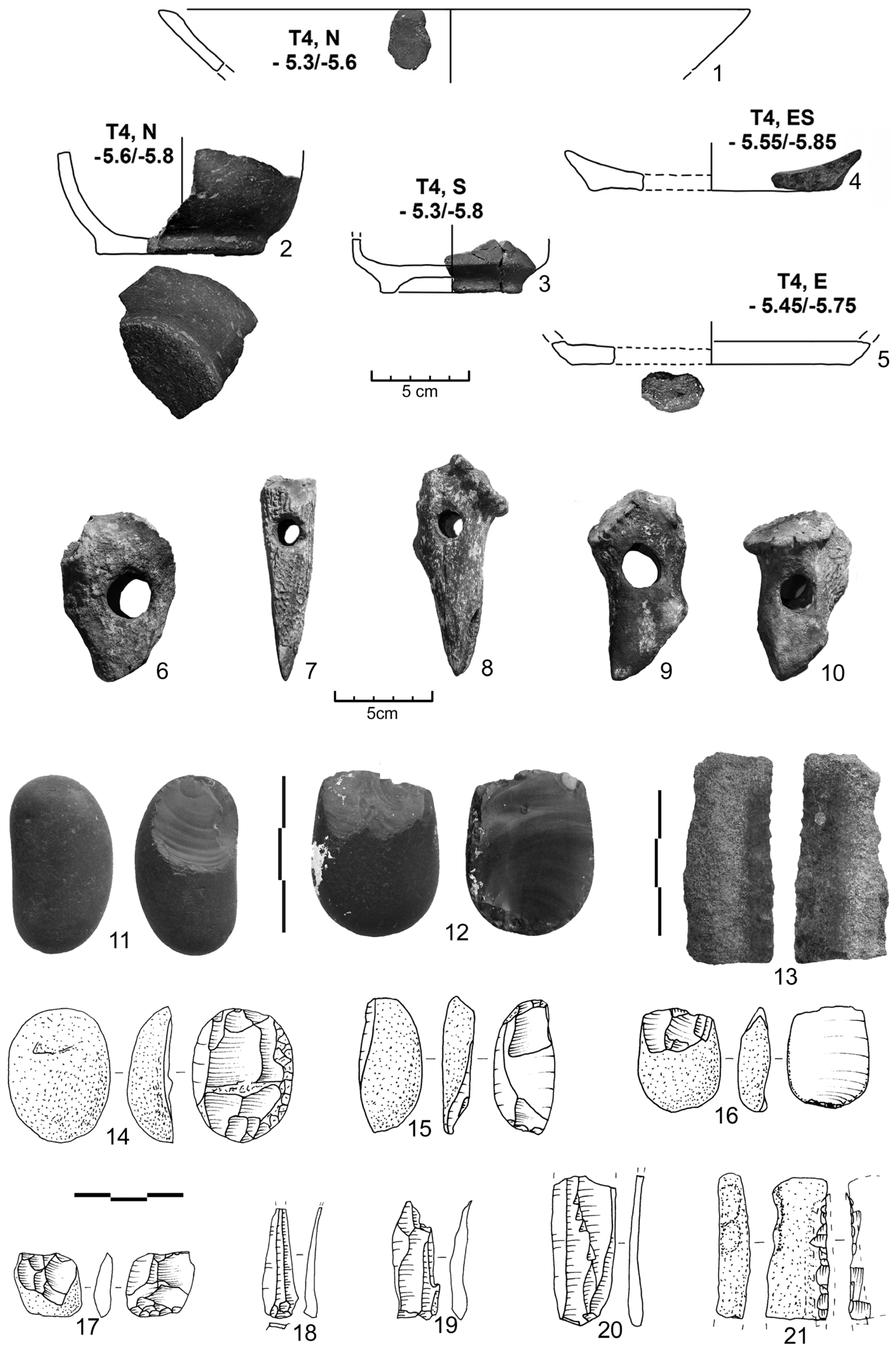


Figure 4.6. Finds from the Roptamo prehistoric site. 1–5, Neolithic pottery from sector T4. 6–10, Antler tools Photographs and drawings by K. Dimitrov. 11–21, Chipped stone artefacts: 11: nodule with unifacial removal; 12, 14–16, 17 and 19: splintered pieces; 18 and 20: blades; 13 and 21: retouched blade used as sickle insert. Photographs and drawings by M. Gurova.

11 had their bark, which could be evidence of intentional stripping. Only two laths have a rectangular cross-section, and several posts could have had one or two of their sides worked. Ten of the wooden piles were intentionally split longitudinally in half, and three were of quarters; the rest were used as a whole trunk.

Most of the piles are found in a vertical position and are from a straight section of the tree. A small number are either curved or slanted. The first is due to the natural curvature of the tree, and the others are the result of the construction with elements at an angle or by a deterioration after abandonment of the settlement.

The collection of prehistoric tools from the Ropotamo site is small and modest, but it contains almost all categories typical of EBA objects: grinding stones, hammers, blades, a socketed antler axe collar, flat stone axes, fragmented, socketed stone hammers, bone awls, *etc*. (Figures 4.6.6–4.6.10). Among the finds, a fragment of a clay metallurgical crucible should be noted. Its presence in the settlement can be associated with the well-known copper deposits of Medni Rid, lying about 12 km northeast from the site.

The knapped stone assemblage from Ropotamo (seasons 2019–2020) is very interesting and comprises 171 artefacts. A proportion represents nodules (most of them black, compact and opaque) with an ovoid-ellipsoidal shape and lengths between 3.0 and 4.8 cm. The nodules were subjected to splintering techniques/bipolar reduction by direct percussion using a hammerstone, with the nodules placed on a stone anvil (Clark 1953; Shott 1999). This technique results in various splintered pieces and rare typical blanks (flakes and blades).

The assemblage contains 34 pseudo-artefacts, four atypical flake cores, 27 nodules with uni- and bifacial removals (Figure 4.6.11), 48 flakes (16 entirely cortical, 24 with partial cortex and eight without cortex) and 18 fragments (10 of flakes and eight undetermined). There are 31 uni- and bipolar splintered pieces, of which 15 were on dimidiated nodules (Figures 4.6.12, 4.6.14–4.6.16); eight on blanks (Figures 4.6.17 and 4.6.19) and eight on fragmented nodules. Separately, there is a small series of blades (four examples), three of which were removed from blade cores (Figures 4.6.18 and 6.20). Apart from splintered pieces, there are five other typological tools, four of which are on blades—three endscrapers and one retouched blade (Figures 4.6.13 and 4.6.21); there is also one backed tool on a kombewa flake.

Use-wear analysis of the blades, the five tools mentioned above and a small series of splintered pieces, allowed the identification of five artefacts used as sickle inserts (Figures 4.6.13 and 4.6.21). There are two tools (an endscraper and a backed tool) with microchipping and undiagnostic polish spots, indicating the cutting of hard material which cannot be identified more precisely.

The presence of standard blades and tools on blades cannot be linked to the application of the splintering technique as part of the on-site *chaîne opératoire*. The blades indicate the importation of blanks of a standard type which can plausibly be linked to the particular domestic needs of the EBA community which inhabited the site.

During the archaeological excavation of the EBA layer in the sectors, T2–T3 and T 4, a collection of a total of 120 animal bones was accumulated. Of these, 87 fragments are defined as species: red deer (NISP 35), cattle (NISP 17), bones of small ruminants (sheep, goat) (NISP 4), domestic and wild boar (NISP 16), roe deer (NISP 1), fox (NISP 1), fallow deer (NISP 7) and fragments of tortoise shells (NISP 2). The ratio of domestic to wild is in favour of wild animals, which accounted for 69% of the total material. Of note, most of the bones and horns belong to red deer, with the remains almost double those of cattle, which is not typical for this period. Deer antlers (noble (red) and fallow deer) were mainly used as raw materials for tools (Figures 4.6.6–4.6.10). For this purpose, antlers already shed in the forest were collected, but those separated from the animal when it was killed were also used.

The cattle's remains are mostly from the upper and lower jaws, but there are also fragments of the pelvis and lower extremities. Only one bone belongs to the auroch (*Bos primigenius*): a distal part of a large tibia. Of the small ruminants, the remains are also very few—mostly jaws and two teeth of individuals in adulthood. Most of the remains of pigs are from wild boar (*Sus scrofa*), while only one jaw and phalanx have been found from a domesticated one. Other single finds are the fragments of bones from horse and fox.

Most of the material in the collection belongs to adult animals over two years, but there are also single fragments of young animals—red deer, wild and domestic pigs, and cattle. All the bones were burned at high temperatures (above 500 C°), most likely along with the layer in which they were found.

The identified species of wild and domestic animals are typical for the period and the area. Red deer and fallow deer have been the most hunted animals since the Late Chalcolithic period (Spassov and Iliev 1994). Fallow deer remains drastically decreased during the Early Bronze Age, but are still found in small numbers at sites in the coastal strip such as Urdoviza (Ribarov 1988; Spassov *et al*. 2018) and Sozopol (Ribarov 1991). The archaeozoological collection from Ropotamo is characterised by a large percentage of wild animals (69% of the total material), which is similar to that of the sunken settlement in the harbour of Sozopol (Ribarov 1988; Spassov *et al*. 2018). The presence of a large number of horse bones from this period in the site of Urdoviza is described by Ribarov and Spasov (Ribarov 1988; Spassov *et al*. 2018), but during the excavations of Ropotamo, only one fragment of a scapula was found, although it is difficult to identify to which species it belongs. According to Spasov, in Urdoviza, 'horses belong to *Equus germanicus*, a broad-hoofed horse and are a domesticated species' (Spassov *et al*. 2018: 14). The bone found at the Ropotamo site may belong to same species, but this cannot be precisely determined.

The faunal material shows that in the Ropotamo region, the climatic conditions in the EBA were similar to those of today, as these wild animals are characteristic of today's habitat. The presence of fallow deer shows a relatively warm and mild climate in the region and mixed forest comprising a mosaic of dense deciduous stands interspersed with open clearings and meadows. The large percentage of bones of wild animals, as well as the age and species composition of the osteological collection of the EBA layer, suggest an economy of the inhabitants in which hunting had a very important place.

Radiocarbon dating

Samples for radiocarbon dating were taken throughout the four seasons of excavation. In total, there are 15 14C dates. One is from a carbonised wheat ear (*Triticum*) found in T2, and all the rest are from vertical wooden piles (Figure 4.7). The latter were selected based on stratigraphy and the number of tree rings, with a preference for piles with more annual rings and the possibility for wiggle-match modelling. Samples were measured at the Scottish Universities Environmental Research Centre AMS Laboratory and calibrated to calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration programme OxCal 4.4 (Bronk Ramsey *et al*. 2001; Dunbar *et al*. 2016).

From sectors T2–T3, there is one sample from pile P 0, four from P 03 and another four from P 07. Accordingly, from sector T4 are two samples from pile P 21 and three from pile P 67. As seen from the result, the dates can be put into three groups: the oldest from pile P 67 which is around 3300–3200 cal BC; the second group from piles P 0, P 03 and P 07 are set around 3100–3000 cal BC, and third and youngest from the wheat ear set around 2900–2800 cal BC. The dates from pile P 21 are uncertain with 45.4% for 3291–3203 cal BC (95.4% probability) and 44.0% for 3066–3013 cal BC (95.4% probability), which means it can fall either to the first or second group of dates.

As for the youngest date from the site (SUERC-108102, wheat ear *Triticum*), we must view it with caution, as the dates from it are too broad (2906–2702 cal BC with 95.4% probability) for a definitive conclusion. Nevertheless, they are coherent with the known general chronology of the site and fit within the EBA.

Based on these results, we can conclude that the excavated section of EBA settlement in Ropotamo could have two building phases: one set around 3300–3200 cal BC and the second around 3100–3000 cal BC. However, the calibration curve for the period 3300–3100 BC is not categorical and allows for the interpretation of the dates in one phase. However, while the 14C dates may represent either two distinct periods of construction or a more or less continuous period, the presence of two phases with a small time gap between them is also suggested by the analysis of the pottery, which shows vessel forms considered diagnostic for the first phase of the EBA (the askoi), as well as a decoration technique (corded ware) associated with the second phase of the EBA.

The discussion here revolves around the dates from pile P 21. If we consider it to be part of the first phase, then we have a situation where sector T4 is from the first phase and sectors T2–T3 are from the second phase. If pile P 21 is part of the second phase, then we have a more complicated situation where in sector T4 are building elements from the first and second phases overlapping each other. It must be pointed out the tip of pile P 21 does not penetrate Layer 4, and pile P 67 is dug in Layer 4 and penetrates deep into Layer 5. After the study of the dendrochronological samples is completed, perhaps this dilemma will be resolved.

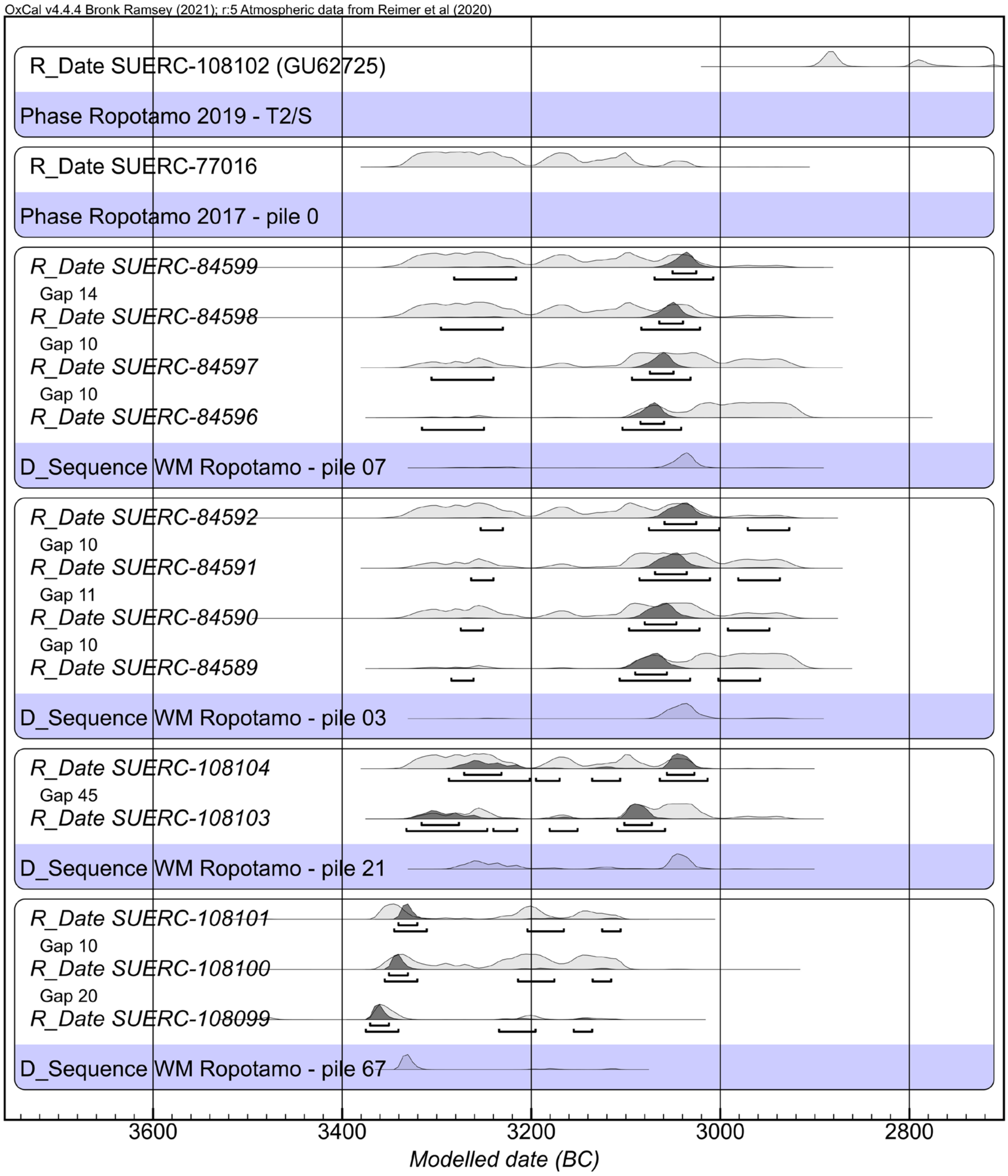
Main results

Underwater archaeological excavations in the bay near the mouth of the Ropotamo River began 50 years ago, making them the longest-term such project in Bulgaria. During these decades, several teams of researchers were sequentially involved, and methodologies of research, excavation and documentation were developed and improved. The final stage of the study took place between 2017 and 2020. It began with a heightened interest and focus on the remains of a settlement from the Early Bronze Age, registered back in 1989, but after four seasons of work, it is clear there is also a contribution to the overall study of the complex underwater archaeological site of Ropotamo. The 2017–2020 study can be considered as a completed stage from which a historical account of people's lives for over 7,000 years can be deduced.

At the beginning of this period, there are modest finds which date back to the end of the Neolithic (the end of the sixth millennium BC). In addition to the fact these materials are the earliest ever found underwater in the Black Sea, they were discovered in a terrestrial layer which today lies below modern sea level.

The well-documented archaeological situations at Ropotamo for the first time provide detailed information about the construction, existence and death of EBA buildings which we find underwater today.

It was discovered that in T4 the wooden piles of the structures were fixed by digging through a grey, sticky alluvial clay layer in order to fix and secure them in the much more stable clay layer beneath it (stratigraphic description Layer 4 and Stratum 5, respectively). The piles are fixed only with grey clay, and there are no marine materials (sand and mussels) in it. This means that during the construction, Layer 4 was free of marine sediment, and this prehistoric surface was directly accessible to humans. These observations and the topographic peculiarities of the area make it possible to describe quite accurately



Site №	Sample ID	BP	±	Archaeological context		Genus	Tree rings	Gap
Rop2017 P0	SUERC-77016	4474	21	T2/2017	Vertical post	Ash *(Fraxinus sp.)*	0-5	
Rop2018 P03	SUERC-84589	4390	34	T3/2018	Oblique post	*Ash (Fraxinus sp.)*	0-1	
Rop2018 P03	SUERC-84590	4437	34	T3/2018	Oblique post	*Ash (Fraxinus sp.)*	10-11	8
Rop2018 P03	SUERC-84591	4422	34	T3/2018	Oblique post	*Ash (Fraxinus sp.)*	21-22	9
Rop2018 P03	SUERC-84592	4452	34	T3/2018	Oblique post	*Ash (Fraxinus sp.)*	31-32	8
Rop2018 P07	SUERC-84596	4386	34	T2/2018	Oblique post	Oriental plane *(Platanus orientalis L.)*	0-1	
Rop2018 P07	SUERC-84597	4423	34	T2/2018	Oblique post	Oriental plane *(Platanus orientalis L.)*	10-11	8
Rop2018 P07	SUERC-84598	4459	34	T2/2018	Oblique post	Oriental plane *(Platanus orientalis L.)*	20-21	8
Rop2018 P07	SUERC-84599	4460	34	T2/2018	Oblique post	Oriental plane *(Platanus orientalis L.)*	34-35	12
Rop2020 P67	SUERC-108099 (GU62722)	4572	23	T4/2019	Oblique post	Oak *(Quercus sp.)*	7-12	
Rop2020 P67	SUERC-108100 (GU62723)	4523	25	T4/2019	Oblique post	Oak *(Quercus sp.)*	28-32	15
Rop2020 P67	SUERC-108101 (GU62724)	4544	23	T4/2019	Oblique post	Oak *(Quercus sp.)*	39-41	6
Rop2020 P21	SUERC-108103 (GU62726)	4436	23	T4/2019	Vertical post	Oak *(Quercus sp.)*	5-6	
Rop2020 P21	SUERC-108104 (GU62727)	4463	23	T4/2019	Vertical post	Oak *(Quercus sp.)*	49-52	42
Rop2019_T2/S	SUERC-108102 (GU62725)	4231	23	T2	Grains	*Triticum*	N/A	N/A

Figure 4.7. 14C dates from the EBA layer of the site and their wiggle matching model. Date compilation by P. Y. Georgiev; calibration with OxCal 4.4 by R. Krauß.

the environment where the settlement from the EBA was constructed: not far from the right bank of the Ropotamo River, in an area outside the direct impact of the sea, probably on periodically flooded terrestrial terrain or in a shallow firth (a long, narrow indentation of the seacoast) of variable level, on which the river had deposited freshwater alluvium.

During the excavation of T 4, it was found that in the time of the existence of the settlement, the space between the piles began to be filled with marine sediments (large mussels, sand and stones), which gradually covered the grey alluvial layer. It was not a steady process and took place in many stages during the continued habitation of the settlement. Evidence of this are whole and fragmented pottery and other archaeological finds situated at different depths in the stratigraphic Layer 3. We believe the appearance of marine sediments in a place they did not exist when the buildings were constructed, was due to a change in the balance between the river level and the sea level which occurred during the habitation of the settlement. The advent of marine sediments to the settlement was probably at first only after the strongest storms. This forced the inhabitants of the settlement to carry out several repairs which have been documented: the installation of additional supporting piles, some of which are fixed only in the marine layer and supporting wooden piles with medium-sized stones. Attempts to preserve the buildings in the face of the advancing sea were clearly not successful because at some point, the inhabitants left. The abandonment of the settlement was probably organised, as in the archaeological finds from the EBA, there is not a single prestigious or cult or other object which we can define as valuable and important for the people of the Bronze Age.

The detailed study of the remains of the settlement from the EBA provides new data to a long-debated question in archaeology: whether the prehistoric settlements underwater along the Black Sea coast were pile dwellings or built on land and later flooded. The stratigraphy of Ropotamo and the distribution of finds and archaeological materials in Layer 3 give several arguments for the pile dwelling construction of the settlement. At the top of this layer are concentrated all the fragments of burned wall and/or floor plaster which have been found. Almost on the same level were found two large grinding stones, as well as several horizontal wooden elements. These categories of finds are associated with the level of habitation, which in this case will be on a platform about one metre above the terrain on which the settlement was built (Layer 4). The second argument for the presence of an elevated construction is the discovery of several relatively large and well-preserved vessels, as well as other finds which lie in the middle part of Layer 3. Our explanation is they mark the intermediate stages of partial filling of the space under the construction before the abandonment of the settlement. The third argument for the pile construction is the location of the settlement itself. It is near the river and on a sedimentary layer in a riparian zone. Knowing well the large amplitudes of the level of the Ropotamo River after heavy rain, often more than one metre, we can easily understand why ancient people would have opted for pile buildings, elevated above the terrain to protect them from periodic flooding.

Archaeological studies in the bay of the Ropotamo River have also contributed to the clarification of the dynamics of changes in the level of the Black Sea over the past 7,000 years. The Neolithic materials from Ropotamo testify that the sea level at the end of the sixth millennium BC is lower than the modern one by significantly more than 5.6 m. Where the coastline was located at this time is not yet possible to say. It can be assumed the Neolithic settlement from which these finds are sourced, as happened in later periods, was located to take advantage of the rich ecological niche which has the resources of the transitional landscape river-sea-land, *i.e.* the late Neolithic coastline was probably no more than a few hundred metres from the present one.

The above interpretation of site stratigraphy and the taphonomy of Layer 3 allows some chronological conclusions, concerning sea level changes in EBA and later. When the settlement was built at the beginning of the Early Bronze Age, about 3100 BC, the sea level was about 5.6 m lower than the modern one. During the habitation, probably for a short period of time, it rose by about 0.5 m, and during the final flooding of the settlement, which probably occurred 3000–2900 BC, the level rose to about 4.5 m lower than today. Sea level rise continued after the final inundation of the settlement, when a shallow, calm and warm bay formed over the remains. This bay becomes an excellent habitat for the oyster colony of Layer 2: oxygenated water with a high light level and with remnant timber structures providing an ideal anchorage for oyster spat. It is only when the timber has finally eroded to seabed level that the deposition of oyster shell ceases. With the extinction of the oyster colony, the seabed of the bay is progressively covered by coarse marine sand, which in the first millennium BC became the bottom of the ancient harbour.

A sea level change of around 1 metre per one to two centuries over the EBA should be regarded as significant and unusual. Whether this phenomenon is local or not will be confirmed by research on other sites along the Bulgarian coast. In this regard, the simple generalisation of the sea level curve from data of the settlement at Ropotamo and their extrapolation to a larger area may be misleading. The unusual amplitude may be a result of the specific location of the site too, which is sensitive to the river-sea interaction and local tectonic causes.

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Interpreting maritime objects and representations

5

Reconstructing prehistoric watercraft in Northeastern Europe by means of Stone Age rock art: one more attempt

Ekaterina Kashina, Ville Mantere and Evgeniy Kolpakov

Abstract: In this article, we discuss Stone Age rock art as a source for reconstructing early means of water transport used in the forest zone of northeastern Europe. Concentrations of Stone Age petroglyphs are known in northwestern Russia, Sweden and Norway, all of which contain boat images. However, identifying specific boat types used in reality on the basis of a morphological analysis of rock art figures remains problematic. Sporadic images provide clues for interpretation, and these suggest the use of frame boats. Stone and Bronze Age archaeological finds from the forest zone of northeastern Europe also point to the use of frame boats. These include a series of wooden paddles and a unique ceramic model of an alleged birch-bark canoe. The widespread tradition of representing boat figures in rock art with elk-headed stem posts also has parallels in the archaeological record of northeastern Europe. Presumably, sculpted elk-head boat stem posts were used for festive activities. Although finds of logboats are very scarce and remains of frame boats are completely absent, we conclude that highly diversified means of water transport were used in northeastern Europe from the Mesolithic period onwards.

Introduction

Prehistoric hunter-gatherer-fishers had relations with watercraft which depended on local environment, lifestyle and economic factors. During more than one hundred years of focussed archaeological investigations, scholars paid quite scarce attention to the means of water transport, in comparison with stone and bone working, early ceramics and settlement structure. The main reason for this was the rareness of archaeological finds such as paddles and boat fragments. Recent research has postulated the existence of highly developed networks between the regions of the forest zone of the Circum-Baltic zone, encompassing the exchange of goods, ceramics, prestige items, marriages, visiting relatives, performing festive events, *etc*. (Herva *et al.* 2014). Together with an increase in studying diets and ceramic vessel functions (Courel *et al.* 2020), new perspectives have thus arisen for reconsidering prehistoric water transport, both maritime and inland. The frequent movements of people in frames of social networking, together with extensive fishing, allow recognising boats as fast and highly efficient means of transport. They were inevitable during the warm/open water season not only in coastal areas, but all over the vast inland territories within the taiga zone. There are two main groups of sources for reconstructing early watercraft in northeastern Europe: archaeological finds of boats and rock art images. An auxiliary source is the ethnographical data on Northern populations.

The numerous boat images found at large rock art concentrations dated to the Stone Age have confirmed the wide presence of watercraft. The Scandinavian rock art images of boats were studied extensively during the last decades (for an overview, see: Helskog 1985: 199; Wickler 2019: 184–185; Gjerde 2021: 138–139). Views still diverge as to which boat type emerged first, as the data on climate conditions and vegetation of woodlands in the territory of Scandinavia could be interpreted quite differently (see Glørstad 2013 and comments). Scholars also disagree regarding the specific means of watercraft used in the Mesolithic and Neolithic periods based on rock art images in Scandinavia, Finland and Northern Russia (Helskog 1985; Kolpakov and Shumkin 2012b; Mantere 2023). The main questions are the following: how precisely can we interpret these rock art images as particular boat types (skin boat, logboat, bark canoe), and which additional sources (archaeological and/or ethnographical) could help us? As Russian sources are not always easily available to a wide audience, we attempt to revise all available sets of data in order to clarify the problems mentioned earlier.

Aims of the chapter

In this chapter, we aim to discuss Stone Age rock art as a source for reconstructing early northeastern European hunter-gatherers' water transport practices, focussing mainly on the territory of modern Northern Russia. We compare rock art images with available archaeological finds dated to the Stone and Bronze Ages, and we discuss the value of certain ethnographic sources concerning native watercraft. We start by addressing the archaeological finds.

Archaeological evidence of the most ancient watercraft

Today, not many archaeological sources are available to reconstruct the most ancient watercraft of the forest belt in the northern latitudes of Europe. In western Europe, the large corpus of artefacts is represented by logboats and sometimes paddles/oars, belonging both to hunter-gatherer-fishers (Mesolithic) and farmers (Neolithic) at a time range of approximately 7500–3000 BC (Andersen 1986; Arnold 1995). However, there are still no data on the presence of other possible boat types, like skin boats, canoes and rafts. In central Europe, no Stone Age logboats have been found, apart from a single find in Slovenia, dated to around 6000 cal BC (Rogers 2010; Gaspari and Erič 2012). The existence of bark boats is questionable in this region, though the unique find of a bark mat at Dąbki 9, Poland, could probably be interpreted as remains of such a boat type (Kotula *et al.* 2018).

In eastern Europe, the oldest logboat was found in Lithuania and dated by radiocarbon at around 2800–2600 cal BC; it likely belonged to the Corded Ware culture (Piličiauskas *et al.* 2020). This Šventoji 58 logboat was made of oak and found at a paleo-river bottom. It represents a rather elaborate and fine woodworking technique; it has a narrow hull with thin sides. It was probably supplied with an outrigger in a form of a thick oak plank, as one was found near the drowned and damaged vessel.

The oldest logboat in Russia comes from the *chernozem* (black soil) belt, Voronezh region, besides the Don River. It is made of oak and represents a slightly unfinished large vessel evidently intended to be used for transportation, perhaps even as a ferry. It was dated by radiocarbon at around 1800–1700 cal BC (the Bronze Age), and it belonged to forest-steppe mobile pastoralists. Based on its large size, it could have been used to transport cattle and cargo in addition to people. It was obviously carved with bronze tools (Gak *et al.* 2021).

As for the presence of skin or bark boats in eastern Europe, a unique find of a fragmented ceramic canoe model dated approximately to 2200–2000 BC comes from Central Russia, Ryazan region, Shagara burial ground (Bronze Age). It strongly suggests that such a boat type might have been used in the region (Kashina and Shutikhin in prep.) (Figure 5.1). Its silhouette reminds the viewer of the native North American Eastern Cree birch bark canoe (Adney and Chapelle 1964: Figure 95).

The existence of frame/bark boats still cannot be proved by archaeological finds. According to Aleksandr Shutikhin, an independent researcher of traditional watercraft and a professional craftsman in Kotlas, Arkhangelsk region, Russia, some elongated pieces of worked wood, now kept in museum collections, might have been canoe framing details such as stringers, ribs and beams. It should be noted, however, that unlike the Inuit boats *kayak* and *umiak*, the birch-bark canoes probably did not have such well-identifiable and recognisable details. Conversely, they could have contained many details taken literally 'right from the forest', worked with minimal treatment (Kashina and Shutikhin in prep.). Thus, we may simply fail to recognise such wooden details.

The connection between archaeologically known light and small paddles and frame or bark boats and canoes is still being investigated. One-metre fragments of paddles with narrow blades discovered in Norway are dated by radiocarbon to around 2700–1700 cal BC, and they are presumed to have been used with light boats (Wickler 2019: 190–192). Light paddles (around or less than 150 cm in length and around 300–450 grams in weight), together with double paddles, were detected at Bronze

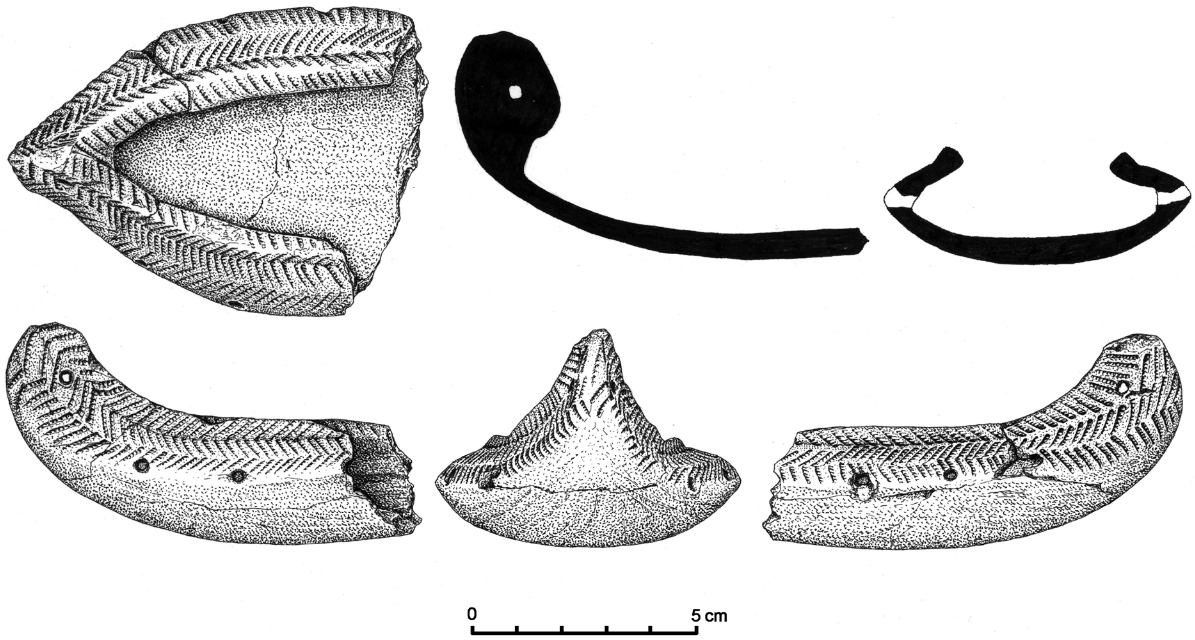

Figure 5.1. Fragment of a ceramic canoe model from the Shagara burial ground, Ryazan region, Central Russia, dated to around 2200 BC. Image courtesy of Ekaterina Kashina, State Historical Museum.

Age hunter-gatherer-fishers' peat-bog settlements in the Middle Trans-Urals as a wide series of perfectly preserved finds (Kashina and Chairkina 2017). It is quite likely that some of these light paddles fitted logboats as well. Conversely, there is no doubt that double paddles, the remains of which were found in Northern Russia and in Middle Trans-Urals, were fitted exclusively for skin or bark boats. In the territory of northern and central Russia, as well as in the territory of modern Latvia and Lithuania, finds of wooden paddles are known at peat-bog sites, dated to the Late Mesolithic (7500–6000 cal BC) and Neolithic-Early Bronze Age (fourth–mid-third millennium BC). These have dimensions close to the finds from the Middle Trans-Urals. They sometimes feature narrow and/or pointed blades, which correspond well with the reconstructed landscapes: inland lakes (sometimes shallow and overgrown with weeds) and sea lagoons (Vankina 1970; Zhilin 2004; Rimantienė 2005). The paddle-blade attributes, very similar to the eastern Baltic finds, can be observed in the rock art of Lakes Onega and Lake Kanozero in the Republic of Karelia and Murmansk region, Russia (Figure 5.2, 1–3).

Before presenting an overview of boat figures in Stone Age rock art, the point must be made, that—at least in the Bronze Age of northeastern Europe—the presence of different watercraft types is substantiated by archaeological finds of vessels, namely, logboats and birch bark canoes. Moreover, there is a high probability of boat production using bark other than birch (*e.g.* spruce or fir bark) and frame (the skin of sea mammals or elk).

Depictions of boats in the rock art of northeastern Europe

In Sweden, elk-head boat figures are more or less evident at the rock carving sites of Nämforsen (Hallström 1960) and Norrfors (Ramqvist *et al.* 1985) and at the Tumlehed rock painting site (Schultz Paulsson *et al.* 2019). The rock painting sites in the southeastern part of Finland together comprise around 100 figures interpreted as boats (Luukkonen 2021). Only a dozen of these can be regarded as depictions of elk-head boats. In Norway, there are several Stone Age rock carving sites with boat depictions. Elk-head boats are found at the sites of Slettnes and Alta in northernmost Norway, but other types of boat figures are known at many other sites along the Norwegian coast (Gjerde 2017). Recently, two large (*umiak*-style) boat figures were discovered at Valle in the Ofoten region, and these probably represent the oldest boat figures in the world (Gjerde 2021). Another recent

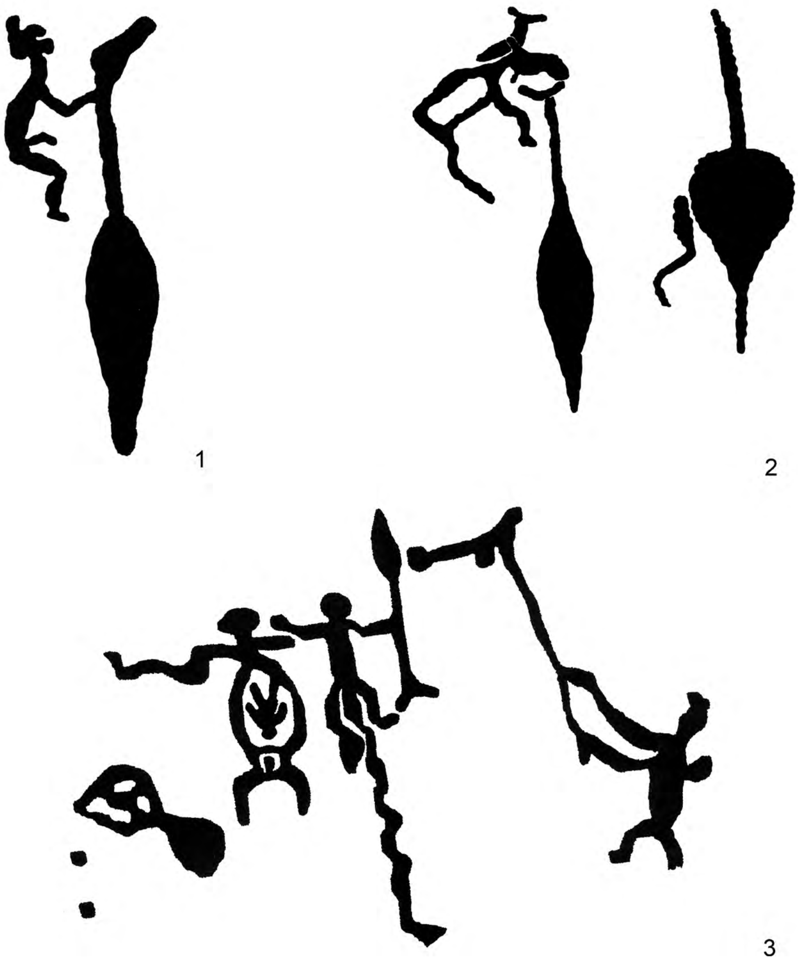

Figure 5.2. Images of paddles at Lake Onega and Lake Kanozero. 1, 2 – Lake Onega, 3 – Lake Kanozero. Image adapted from Zhulnikov 2006; Kolpakov and Shumkin 2012a. Not drawn to scale.

find worth mentioning is the first rock painting found in the Republic of Karelia, Tulguba, which depicts a single boat figure (Zhulnikov 2022).

Three main groups of Stone Age petroglyphs are known in northern Russia, all of which contain elk-headed boat images. The first concentration is situated on the eastern shore of Lake Onega, Republic of Karelia (Figure 5.3); the beginning phase of these petroglyphs is believed to be the oldest (fifth to third millennium BC). The second concentration is located at the estuary of the Vyg River, close to the town of Belomorsk and the White Sea shore, Republic of Karelia; it has been widely dated to the late fifth to third millennium BC (Ravdonikas 1936, 1938; Savvateyev 1970). The third concentration is situated in the southern part of the Kola Peninsula, Murmansk region, on the shores and the small islands of Lake Kanozero; it has been dated to around fourth to second millennium BC. Formally, some of the Kanozero images probably belong to the Bronze Age, but the economy of this region's population was fully based on hunter-gatherer-fisher activities, including sea mammal hunting (mainly, beluga whale) (Kolpakov and Shumkin 2012a). Shore displacement and neighbouring archaeological finds together serve as the main chronological indicators of these petroglyphs (Zhulnikov 2006; Poikalainen and Ernits 1998, 2019).

The number of boat images in each concentration is different: at Lake Onega, there are around 60 images; at the Vyg River, more than 500, and at Lake Kanozero, around 200. We will take a closer look at their appearance in each concentration. The Lake Onega boats always have the hull shown by a line; they depict a varying number of passengers (from zero to more than 10), and the boats often have an elk-head stem post. This concentration contains almost no hunting scenes (Figure 5.4). The Vyg River boats have usually a rectangular hull, a false prow or a protruding keel; they have zero to more than 20 passengers and elk-head stem posts. A lot of hunting scenes are shown (mostly beluga whale hunting, but also the hunting of birds and elks) (Figure 5.5). The Lake Kanozero boats have many parallels with the Vyg River images. Their hull is usually rectangular, with a false prow or protruding keel and a sternpost; their number of passengers ranges from zero to more than 20, they have elk-head stem posts, and many belong to sea hunting scenes (mostly associated with beluga whales) (Figure 5.6).

Based on the general boat characteristics, we unfortunately are unable to decipher the boat construction types—that is, whether they depict carcass boats, bark canoes or logboats. Only while interpreting some rare compositions, where two persons hold the boat from each side, we can presume that lightweight boats are depicted

Figure 5.3. Distribution of rock art agglomerations with elk-head boat images. Map by Ville Mantere.

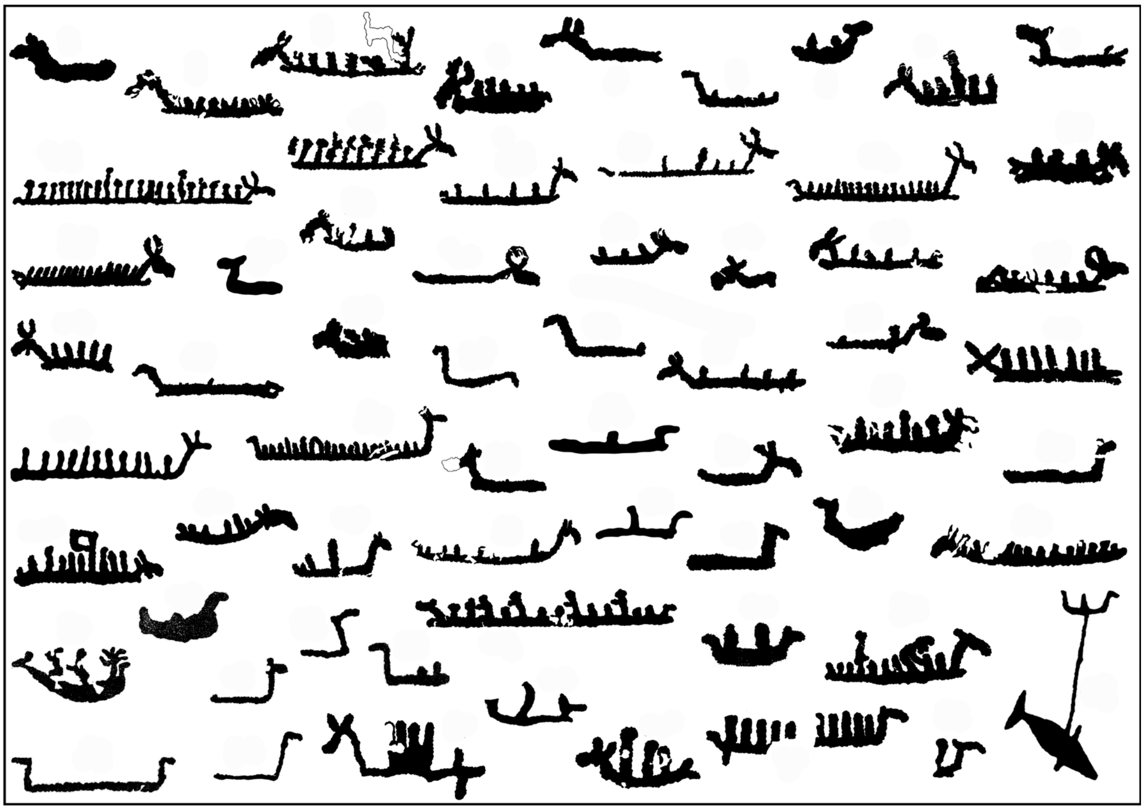

Figure 5.4. Elk-headed boat figures depicted at Lake Onega. From Mantere 2023. Not drawn to scale.

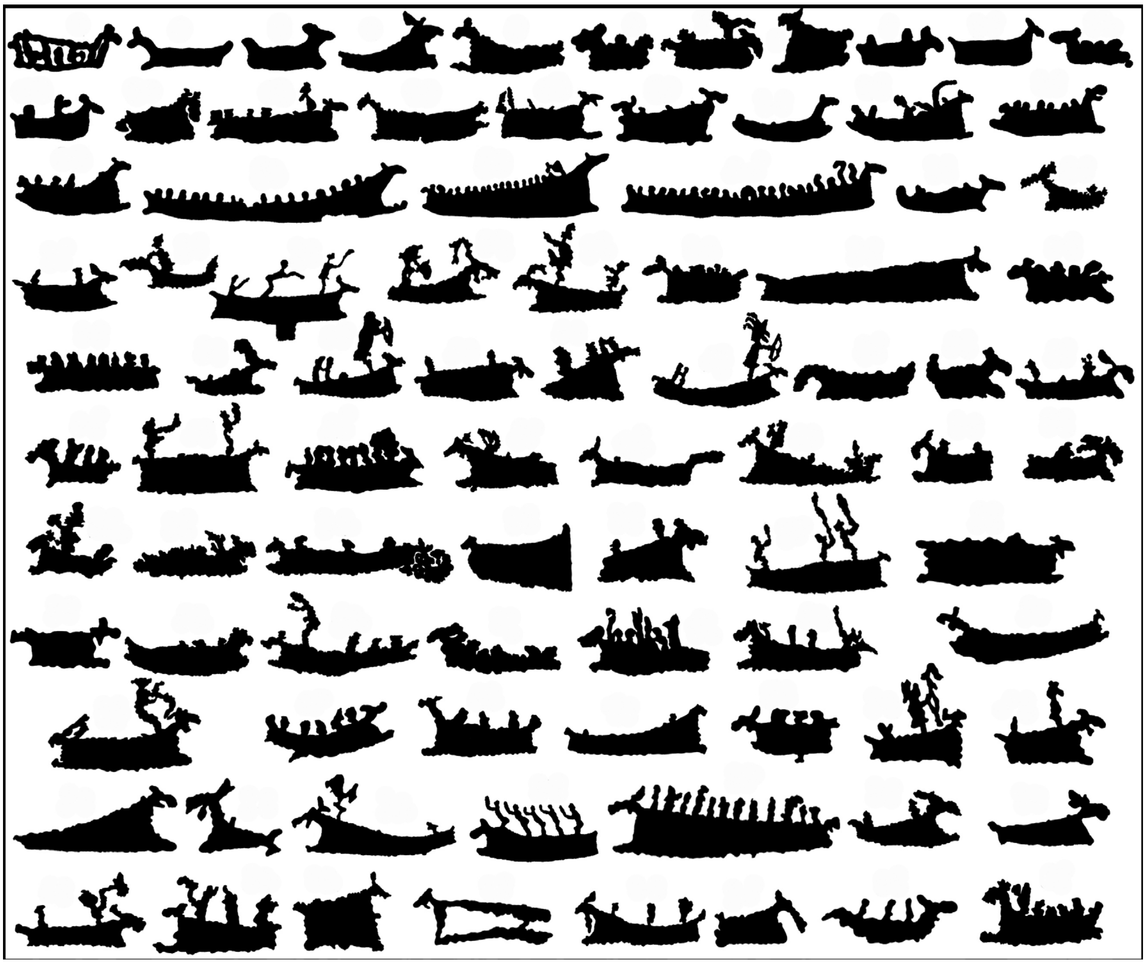

Figure 5.5. Elk-headed boat figures depicted at Vyg River. From Mantere 2023. Not drawn to scale.

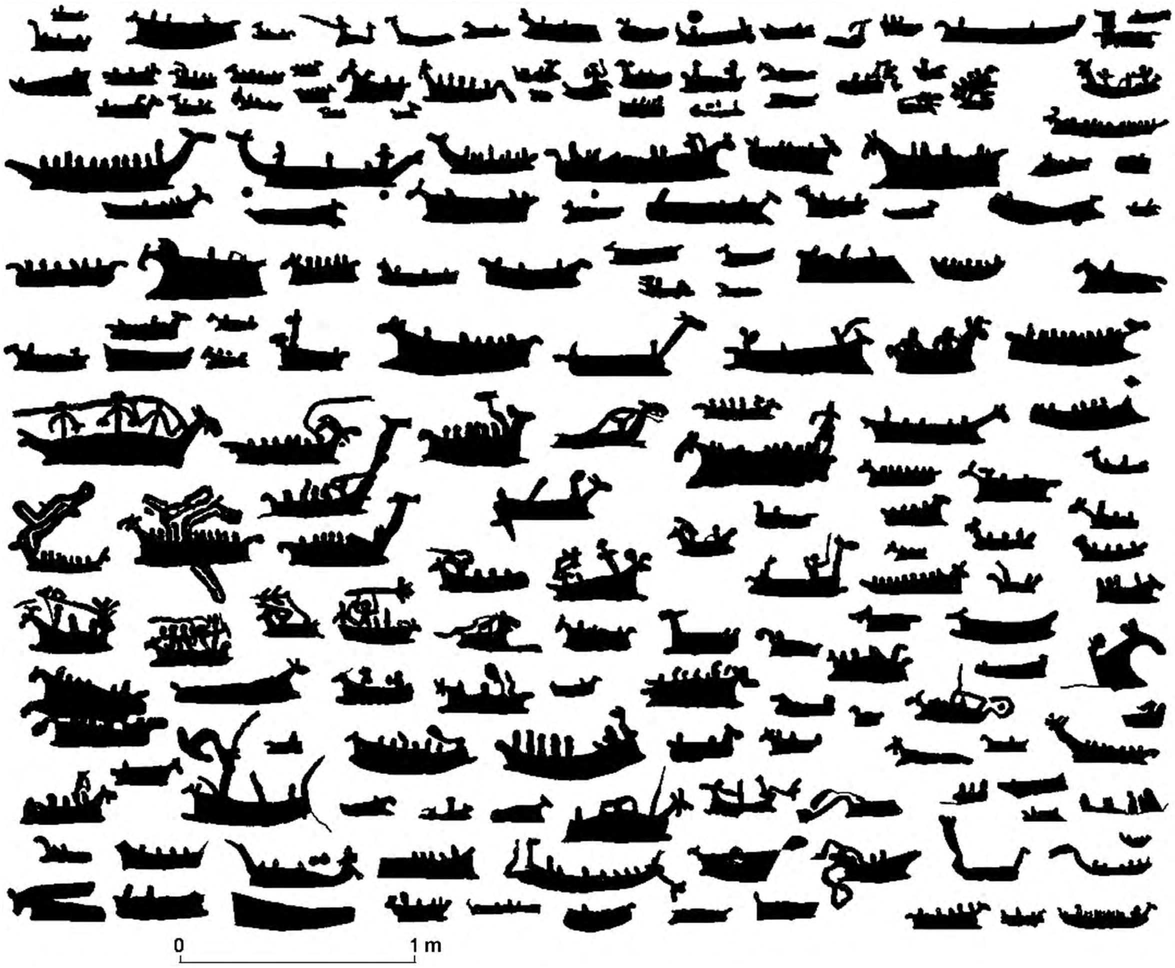

Figure 5.6. Images of boats at Lake Kanozero. Selected boat images from Kolpakov and Shumkin 2012b.

(Figure 5.7, 1–2). There exists one such composition in the Vyg River concentration, and two more in Alta, Norway (Zhulnikov 2006: 143; Helskog 2014: 89–93). In these cases, the boats seem not to be logboats. Several boat images are also made in 'x-ray style', with the boat ribs visible, which could correspond to skin-boat or bark boats. These rare boat images are known in concentrations of the Vyg River and Alta (Zhulnikov 2006: 143; Helskog 2014: 136–141) (Figure 5.7, 3–4).

Scholars argue that the large rock art concentrations resulted from meetings between different groups of people in the course of seasonal rites or festivals, managing the exchange of goods and marital connections (*e.g.* Meinander 1979; Gjerde 2010; Mantere 2023). The aims of rock art images, their subjects and scenes, are generally believed to have been deeply connected with myths and rituals, though petroglyphs usually include images of real-life objects and activities along with imaginative ones (Helskog 1985, 2012; Zhulnikov 2006: 5–11; Kolpakov 2020). It goes without saying, however, that for the prehistoric hunter-gatherer-fishers themselves, a modern-style distinction between 'mythical' and 'common' reality was unlikely to exist (see *e.g.* discussion in Mantere 2023).

Estimating boat size and carrying capacity

The interpretation of the number of passengers in boat figures in rock art often faces problems. There are visible human figures with arms and legs, or upright 'rods', and sometimes 'elk head staffs' or 'cargo' are depicted inside the boat figures. Moreover, in some cases, the boats are empty, and sometimes they are 'overwhelmed' with crew (Hallström 1960; Helskog 2014). According to A. Zhulnikov (2006), depictions might show the ancestors' spirits being transported by boat to the afterlife, or their arrival by boat at a celebration to accompany the living community members. This is a plausible explanation, especially for boat figures carrying exceptionally high numbers of passengers (*e.g.* up to 25 'rods' in one boat at the Vyg River, while there are not more than 12 at Lake Kanozero) (Zhulnikov 2006: 108). According to the ethnographical data on the Chukchi/Inuit, four to eight or five to 10 people could take part in the sea mammal hunt in the average *umiak* frame boat, and for travelling, up to 20 people might take a single boat (Anichtchenko 2016; Gjerde 2021). The social aspects of the crew images in Scandinavian rock art have been addressed several times: the difference in person's size and attributes has been recognised as a potential source of data to investigate

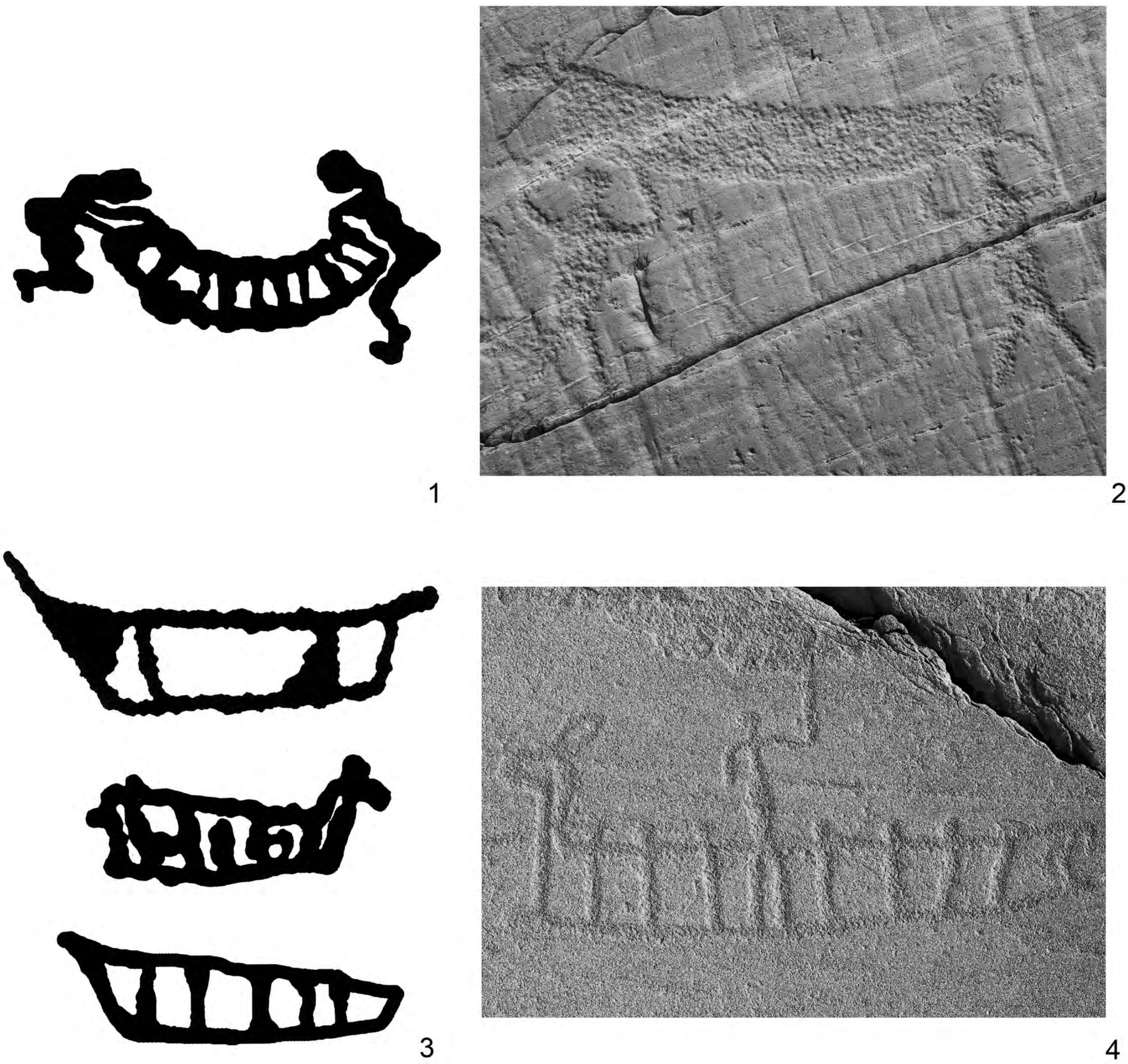

Figure 5.7. Images of probable frame boats: 1, 3 – River Vyg, Republic of Karelia; 2, 4 – Alta, Norway. 1, 3 from Zhulnikov 2006; 2, 4 – photo by Ville Mantere. Not drawn to scale.

leadership, family and gender issues (Helskog 1985; Ling 2012). However, the main part of rock art images are highly schematic, and therefore, they do not suggest such differences in status.

According to osteological data from the Kola Peninsula settlements, probably more or less contemporary to the Kanozero images, the hunted sea mammals included harp seal, white whale and porpoise (Kolpakov 2020). In the Lake Kanozero rock art, sea mammal images depicting porpoise and white whale can be observed. These species are moderate in size, in comparison to the large whale species hunted by the Inuit. Thus, it is likely that fewer boat passengers would have been involved in sea hunting during the north Russian Stone Age.

In the Oleneostrovskiy burial ground at the Kola Peninsula, dated to the end of the second millennium BC, several finds of plank sledge, treated with tar, have been investigated (Figure 5.8) (Murashkin *et al.* 2016; Kolpakov *et al.* 2019). They are very similar to Sami sledges, well known ethnographically and named *keryozhka* (a Russian term with a Sami origin). Though they have the silhouette of a boat, they obviously did not belong to a 'normal' type of watercraft, since their length was 2 metres or less. Their use was most probably restricted to the transport of dead bodies from the mainland to the island cemetery, where they were then used as coffins. On the basis of these finds, it can be argued that the technology of plank-boat building was already formed by this time period (*i.e.* the second millennium BC) and that many of the ancient boats (for example, those depicted at Kanozero) could in fact have been plank boats (Kolpakov and Shumkin 2012b). Plank boats appear in the British Isles at the boundary between the fourth and third millennia BC (Kastholm 2015), but their presence in mainland Europe during that period is questionable.

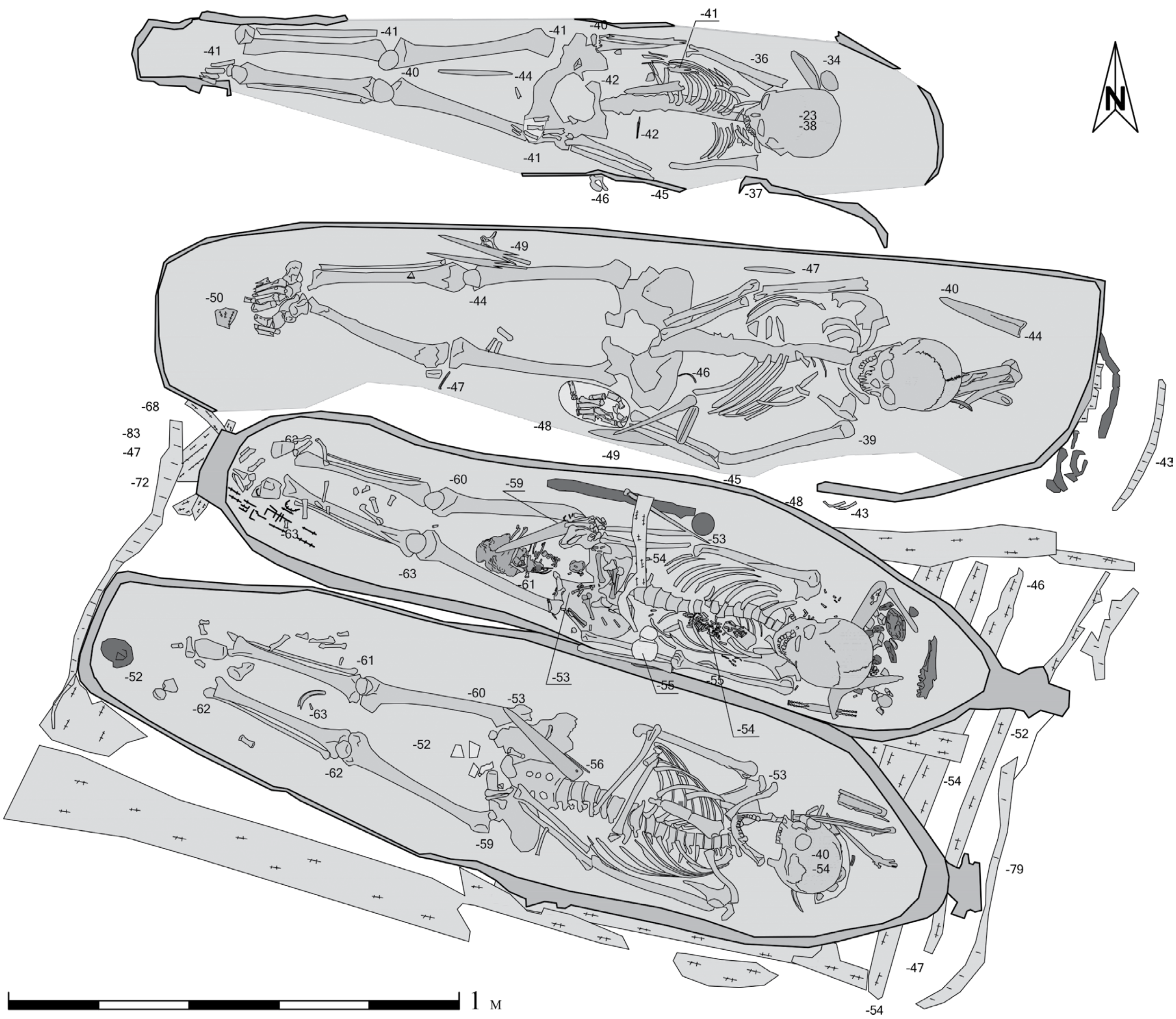

Figure 5.8. Burials in wooden sledges, Oleneostrovskiy burial ground, Kola Peninsula, dated to the second millennium BC. Image from Murashkin *et al*. 2016.

A recurring detail of the Kanozero boats is the keel protruding forwards and backwards beyond the hull (see Figure 5.6). This has been interpreted by E. Kolpakov and V. Shumkin as the actual wooden keel, to which planks were fastened by binding (2012b). This evokes Early Iron Age plank-built vessels, well investigated by archaeologists, such as the famous Hjortspring ship, Denmark, or the boat frame from Grunnfarnes, Norway, dated to around the mid-first millennium BC (Ling 2012; Wickler 2019).

There is an alternative interpretation of this detail based on the existence of special type of birch bark canoes known from northern areas. Such canoes were used in the Amur River by *Gol'dy* or, in modern ethnographical terminology, *Nivkhi* tribes (Khabarovsk region, Russian Far East), and by the Lake Kootenay West Canadian natives: namely the canoe with the so-called sturgeon nose (Figure 5.9) (Luukkanen *et al.* 2020: 191; Arnold 2021: 56). From our point of view, their silhouette corresponds well with majority of boat images depicted at the Vyg River and at Lake Kanozero (see Figures 5.5 and 5.6).

The boat stem post decoration

As mentioned, a considerable number of boat images in northern rock art contains mysterious elk-head stem posts. The elk head usually has long protruded ears but no antlers. Questions abound as to the meaning of the elk head in boat construction. Was it an elk skull, or a killed animal's head, or something else, and should it be interpreted as a male or female elk head? It has been almost 70 years since the famous Lehtojärvi wooden elk-head sculpture was discovered in a peat-bog in northern Finland. This unique find measures around 40 cm, and it has been interpreted as the stem-post decoration of a prehistoric boat (Erä-Esko 1958) (Figure 5.10). The sculpture has been radiocarbon dated to the Late Mesolithic, around 5700 cal BC (Hel-130), but as the date was obtained a long time ago (Jungner 1979), we believe it would be worthwhile to redate the item using the AMS method.

The Lehtojärvi artefact has a slot on its top. This was made for the express purpose of inserting wooden ears, not antlers, because next to the slot, a stub representing

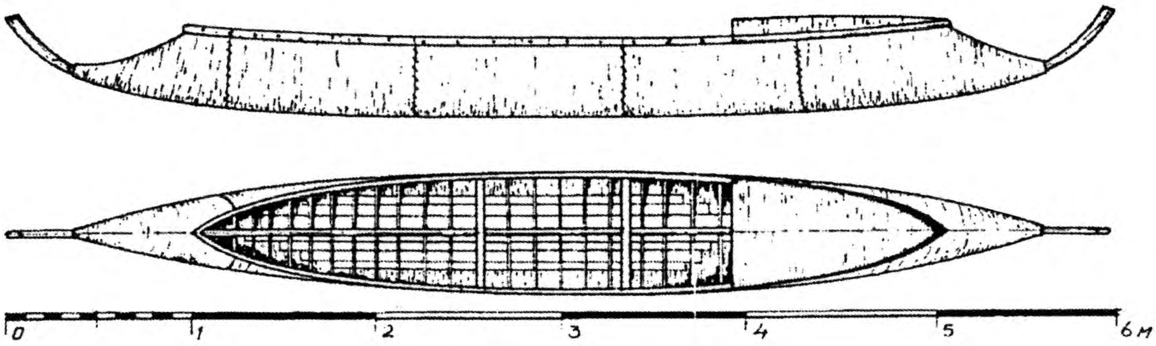

Figure 5.9. Birch-bark canoe of Nivkhi natives, Russian Far East, with a ‘sturgeon nose’. Image from Chepelev 2004.

Figure 5.10. Wooden elk-head sculpture from Lehtojärvi, Finland, possibly a boat prow. Photo by Ville Mantere. Not to scale.

shed antlers is visible on the left side of the elk head. Thus, the depiction is obviously of a male elk in winter. We have paid attention to the fastening structure (the bottom slot and a transverse rounded hole) and propose that it could have been suited for assembling and disassembling the sculpture. Perhaps it was a special boat decor, used only during festive occasions. Other interpretations are certainly possible, including the periodic renovation of such elk heads (see the broken lower part of the fastening device from the right side at the Lehtojärvi artefact, Figure 5.10) or their attachment as a separate act at the very end of a boat building process.

The ship images on Scandinavian Bronze Age petroglyphs with long decorated prows, for example, contain persons with musical instruments (*lures*), horned figures and acrobats, which have been interpreted by Ling (2012: 18) in light of ethnographical data on Pacific peoples, where large canoes demonstrate power and prestige. We realise these Bronze Age materials are quite distant by chronology and cultural background from the discussed rock art, and that the meaning of hunter-gatherer-fishers' watercraft was different. Likewise, the North American Algonquin put a vertical 'headboard' wooden detail in the form of a human figure to any canoe prow to strengthen it physically and symbolically (Arnold 2021: 80–81), and the Siberian Nganasan attached a forked wooden or antler detail to the prow (Zhulnikov 2006: 109).

According to A. Shutikhin, a wooden sculpture of the size of Lehtojärvi could have fitted not only a logboat stem, but also the prow of a small-sized skin or bark boat. There is, however, a possibility that real elk heads could have been attached to boat stems (see Hallström 1960). Judging from the Kanozero boat images, we could further propose that the elk's tail (or its replication) could have been fastened to the protruding sternpost (see Figure 5.6).

Another find that, with a hint of imagination, looks like an elk-head boat stem post is the antler sculpture found at the Mayak 2 multi-period settlement at the Kola Peninsula, Murmansk region, Russia; it measures only 12 cm in length (Gurina 1997). By its silhouette, it corresponds to boat depictions with elk heads, especially because of its large ears, and it is also more-or-less contemporaneous with these, as the sculpture has been roughly dated to the period 2500–1500 cal BC (Figure 5.11). Looking at it, we can imagine how the intact wooden elk-head stem might have looked.

But why was the elk so commonly associated with the boat? Most probably, there were a number of reasons, but one

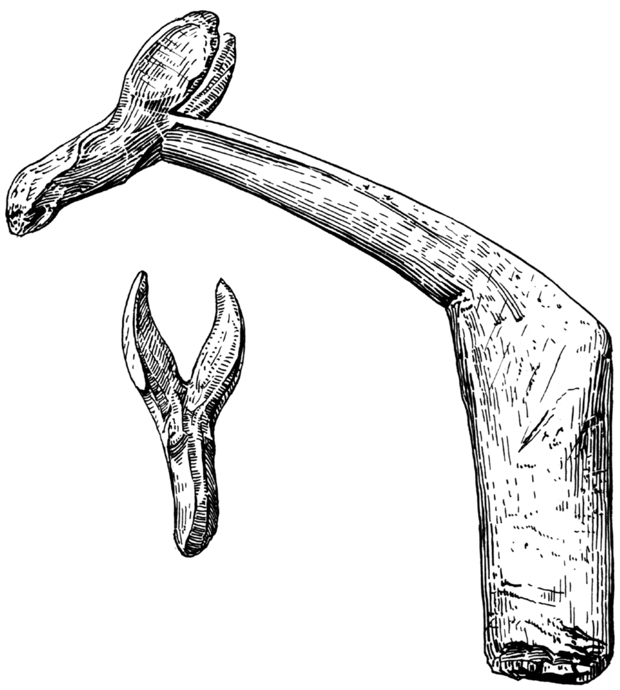

Figure 5.11. Antler sculpture of an elk head from the settlement of Mayak 2, Kola Peninsula. Image from Gurina 1997. Not drawn to scale.

was undoubtedly that the elk was the single most important game animal in the boreal forest zone. Therefore, northern hunter-gatherers had a special relationship to this animal, and it is possible the elk was seen as a guardian or patron of hunters. Another key factor was probably that elks prefer aquatic environments, especially in the summertime, and they are also very good swimmers. Thus, we can assume that boats and elk were conceptually somewhat similar in the minds of Stone Age hunter-gatherers (*e.g.* Westerdahl 2005). Just as the elk could easily move between land and water, so, too, could humans travel between land and water by boat. Boats were also used for hunting elks, so a further explanation is perhaps that the elk at the boat stem indicated the purpose of the boat. In addition, elk skins were perhaps used for making boats, at least in some areas (*e.g.* Stölting 1997).

Discussion

The deepest prehistory of watercraft remains the most understudied topic in the field of maritime and underwater archaeology. The hunter-gatherer-fisher watercrafts in the northeastern European Mesolithic, Neolithic and Bronze Ages differed a lot. This is partly a speculative conclusion, although it is supported by some rare unequivocal archaeological finds, which unfortunately cover neither all regions of this vast zone nor the multitude of chronological periods. Thus, we usually need to extrapolate the data obtained to a neighbouring region and/or time period. In the territories of modern Russia, Baltic States, Finland, Sweden and Norway, no vessels dated to the Stone Age have been found. Bronze and Early Iron Age archaeological finds therefore provide us the closest frame of reference. We believe that some younger data could be extrapolated to the Stone Age, since we discuss the boreal/forest zone/taiga, where the hunter-gatherer-fisher way of life continued up to historical times. We have mentioned light/narrow paddles, double paddles and a Bronze Age canoe model as indirect archaeological evidence of early watercraft. Another important source of Stone Age watercraft is rock art, but, as we have demonstrated in this chapter, in most cases, the boat images cannot be unambiguously deciphered as particular boat types. Luckily, some rare images (*e.g.* at the Vyg River and Alta) clearly demonstrate the ribs, but the whole exterior still, as a rule, does not allow us to distinguish frame (skin) boats from bark boats. According to A. Shutikhin, based on his experience of a sea journey between the town of Kem and the Solovetsky Islands in the White Sea in 2007, as well as inland routes, a birch-bark canoe is well suited for both salty and fresh water. However, ethnographic data on Arctic peoples mention that frame boats covered with skin, namely, the *kayak* and *umiak* of the Chukchi and Inuit, were exclusively used for the sea hunt. The absence of bark boats in these contexts is obviously connected to the lack of raw material, namely, appropriate wood and bark.

The existence of Stone and Bronze Age plank boats before the mid-second millennium BC (the Kola

Peninsula burials' radiocarbon dating) remains unclear. The presence of 'keels' on most boat images depicted at the Vyg River and Lake Kanozero is sufficient for some authors (see, for example, Kolpakov and Shumkin 2012b), but archaeological finds of plank boats with keels are still not known for the fourth and third millennia BC. For this reason, these images can be equally interpreted as bark canoes with a 'sturgeon nose' bow and stern, with parallels in the ethnographical data of the Russian Far East and western Canada. It is beyond doubt that boats in sea mammal hunt compositions in northern rock art are in any case not depictions of logboats (Kolpakov and Shumkin 2012b: 320). The emergence of skin boats in northern Europe has been debated (*e.g.* Glørstad 2013; Gjerde 2021), but a wooden kayak detail in western Greenland radiocarbon dated to around 2200 cal BC (Grønnow 1994; Anichtchenko 2016: 46) provides a reason to believe that skin boats already existed during the Stone Age. Similarly, a ceramic canoe model dated to around the same time helped us to re-evaluate the role and antiquity of bark boats in the forest zone.

The general form of northeast European Stone Age rock art boats frequently features the elk-head stem. A credible, though unique archaeological parallel to it, found in Northern Finland where no rock art is thus far known, raises new questions about how common such a construction was among these petroglyph-making communities. Was it an everyday boat feature, or a festive detachable décor? It remains impossible to answer this question with certainty. We mentioned earlier the general purpose of rock art as mythical and ritual. Simultaneously, these rock art images and compositions include a row of well-recognisable real-life items such as weaponry, snowshoes, ski poles, *etc*., and the elk-head boats are shown in the 'realistic' scenes of hunting, fishing and travelling. As previously mentioned, the form and the size of an elk-head stem seemingly would not interfere with the boat's economic facilities. Conversely, in comparison with the row of indigenous watercraft examples, as well as archaeological finds, such sophisticated decor as a protruding animal head has no analogues among boats for everyday use. The 'supernatural' version, when the crew is interpreted as a group of dead ancestors, also makes us suppose the use of common boats for rituals and festivities, with the elk-heads added temporarily to the prows.

Thus, the impact of our study in the prehistoric maritime archaeology of Northeastern Europe is the following: we postulate the presence of different boat types during the period of rock art production (at least during the wide chronological frame between fifth and second millennium BC, but perhaps as early as in the tenth millennium BC). The novelty in deduction is that we have made more visible the presence of frame (skin) and bark boats during this epoch. The characteristics of these vessels could have been very different: large or small, carrying from one or two to a dozen passengers, and having different functions such as transportation, fishing and hunting. The last point could also be connected with different boat types: beaver, otter, waterfowl and elk were perhaps hunted with the use of individual boats, while sea mammals, mainly porpoise and white whale, were hunted from large boats with multiple crew members involved. We proposed, though quite speculatively, an additional function for boats—a ceremonial/festive one, judging from the use of a sculpted stem post in the form of an elk's head, which was probably a temporary and detachable detail. This could suggest that prehistoric hunter-fishers perceived the boat as a living creature, one with which a particular set of spiritual beliefs was connected. The extensive distribution of elk-head boats in space and time probably indicates the wide and universal presence of such beliefs within the Northern hemisphere.

Prehistoric watercraft comprised a number of established boat types, adapted to different hunter-gatherer-fisher needs. This reflects the long and diverse history of watercraft building techniques in the forest zone. Great future potential lies in the archaeological study of peat bogs and waterlogged settlements (coastal, as well as inland locations), where wood and other organic material has survived under favourable conditions. In these contexts, additional elk-head stem posts and sewn bark mat debris could be unearthed. Hopefully, some distinct wooden frame details, especially ribs, and plank boat remains will also be discovered in future. The discovery of a Stone Age logboat in northern latitudes would be a true sensation.

Conclusions

After an analysis of multiple boat images in the rock art of northeastern Europe, we came to the conclusion that, in most cases, it is impossible to ascertain which construction types were implemented. Nevertheless, some observations of ethnographical materials and archaeological finds belonging to the hunter-gatherer hemisphere allowed us to propose the following conclusions. Logboats probably emerged during the Mesolithic period, but were not used for sea mammal hunting; frame (skin) boats or bark boats were used for this purpose. Seemingly, both were represented in rock art, and were most probably already in use across the forest zone in the Mesolithic period. The knowledge of plank-boat building existed in northernmost Russia in the second millennium BC, but the presence of this building technology in earlier times remains unsettled. Boats decorated with elk-head sculptures were seemingly widespread in northern latitudes, and we suggest that they probably reflected temporary transformations of 'everyday' boats into ´festive' means of transportation.

Acknowledgements

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6

From Portus to Fucino (Italy): naval archaeology and symbolism on Torlonia reliefs

Marina Maria Serena Nuovo and Stefania Tuccinardi

Abstract: In the years 1852–1878, during the draining of the Fucino Lake, fragments of a large monumental relief bearing a waterfront landscape with views of a city, a countryside and two floating boats was recovered. Around the same time, during the archaeological excavations at the harbours of Claudius and Trajan in Portus (Rome, Italy), a small relief depicting a boat approaching a harbour was brought to light. The scene combines symbols with many realistic details to represent the boat and harbour. Subject of studies for nearly two centuries, the relief has been approached almost exclusively from an art historical perspective. The original context for both reliefs remains subject of speculation. The analysis of the two depictions—possibly contemporaneous (from the end of the second to the beginning of the third century AD) but different in dimensions, artistic treating of the scenes and probably also patronage—affords an opportunity to clarify the symbolic meaning of the depicted elements and propose new interpretations.

This chapter explores the symbols represented in the two scenes from a naval-archaeological approach. The naval details, together with the symbolic elements and a brief review of the original excavation documentation, assist the authors in presenting a new interpretation of the two reliefs, one which may link them to their original historical, social, and political meaning and significance, while at the same time, reinterpreting their iconography in the most correct and plausible way possible.

Introduction (MMSN, ST)

During the second half of the 1800s, Alessandro Torlonia, an influential banker from Rome, was involved in land reclamations in central Italy, particularly at the mouth of the Tiber River and in the area occupied by Fucino Lake, in the Abruzzi (Figure 6.1). The Torlonias hailed from a village near Lyon and did not have any aristocratic origin, but in exchange, they had a strong flair for business. Alessandro Torlonia continued the social rise of his family through the flourishing economic activities he undertook, and thanks to the draining of Fucino Lake in 1875, he received the title of Prince of Fucino from the King of Italy, Victor Emmanuel II (Felisini 2019).

The exploitation of the land ownership afforded Alessandro Torlonia the opportunity to carry out archaeological excavations, thanks to which outstanding artefacts were discovered and became part of his private collection of ancient art.[1]

These artefacts include the two reliefs which are the subject of this chapter. These reliefs, one from Fucino Lake and the other from Portus, are exemplary in the field of Roman artistic production in terms of waterfront representations and symbolism connected to ports, ships and maritime activities. Before this analysis, the two reliefs had never been studied together, and this chapter presents them in parallel for the first time. They share a few characteristics: the circumstances of their discovery, that is Alessandro Torlonia's undertakings; the presence of boats; the symbolic and/or realistic representation of a waterfront landscape; and, possibly, their dating. Moreover, they are in some way comparable also because they both comprise a sort of real 'portrait', representing images of where they were found and where they belonged. The areas where they were found, even if not close to one another, are both locations of the remarkable hydraulic undertakings started by the emperor Claudius. These are, namely, the outlet of Fucino Lake and the impressive harbour at the mouth of the Tiber River, and they were later sites of interventions by the emperor Trajan and the economic interests of Alessandro Torlonia. The reliefs differ in their dimensions, artistic treating of the scenes and, probably, also patronage.

Through a naval-archaeological approach, this chapter analyses the symbols depicted in the two reliefs with the ambitious goal of clarifying the symbolic and topographic meaning of the depicted elements in order to link them to their original historical, social and political context and significance. The chapter is organised in three parts. The first describes the topographic context and the iconographic characteristics of the relief from Fucino Lake,

[1] Only the finds from Fucino Lake were acquired by the Italian Government in the 1990s, and they are now exhibited at Castello Piccolomini, in Celano (Ministero della Cultura, Direzione Regionale Musei Abruzzo). The finds from Rome and its hinterland are still part of the Torlonia's collection, which is considered the largest private collection of ancient art in the world. Parts of these masterpieces were displayed to the public during a temporary exhibition in Rome (2020) and Milan (2022) (Settis and Gasparri 2020).

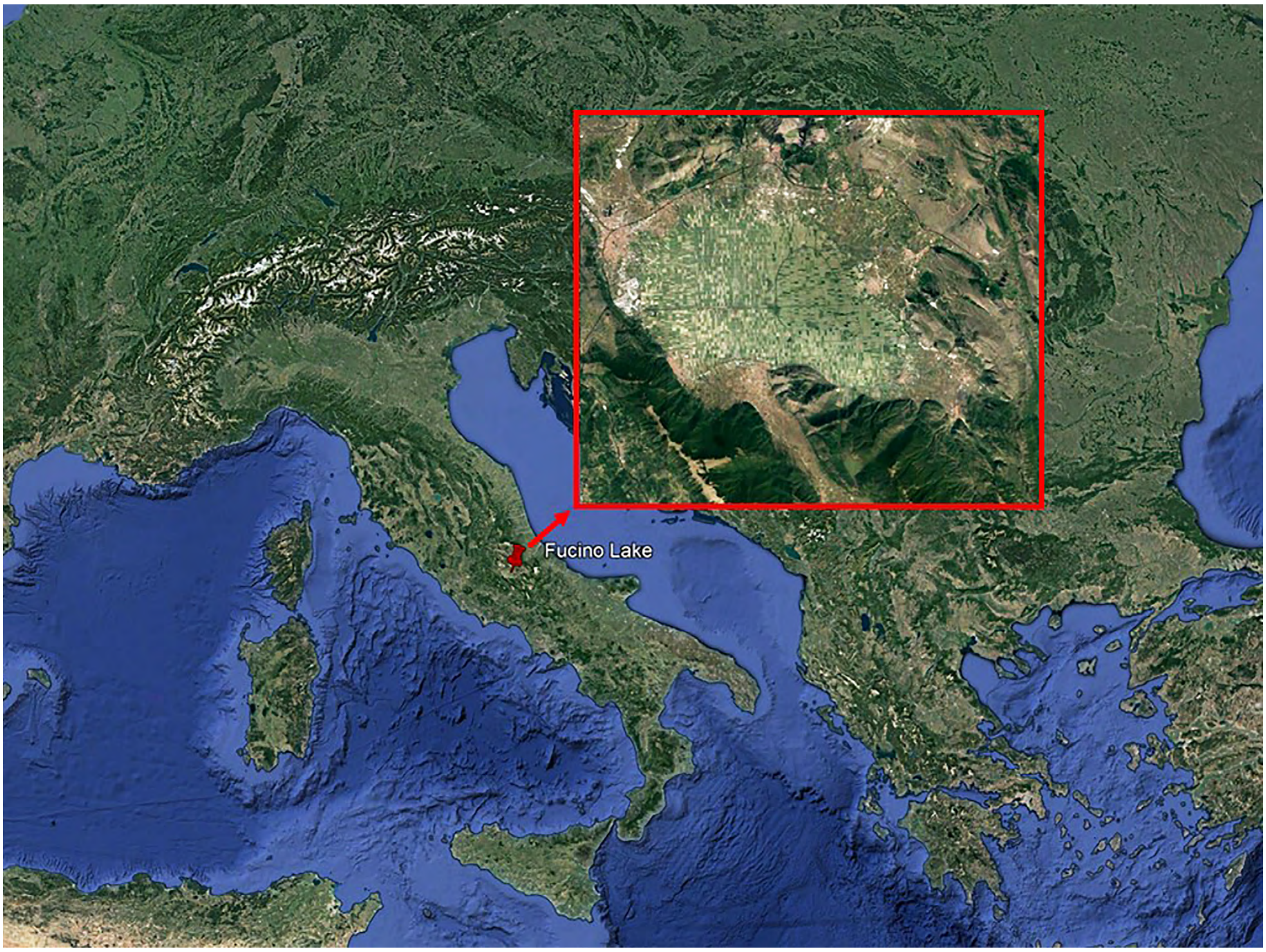

Figure 6.1. Abruzzi, central Italy: Fucino Lake. Image from Google Earth.

the second concerns the Portus relief and the third includes a discussion and conclusions about the two artefacts.

The authors worked as a team; however, in this analysis, M. M. S. Nuovo focussed mainly on the relief from Fucino Lake and naval archaeological topics, while S. Tuccinardi worked principally on the relief from Portus and the symbolism in ancient Roman art. The combined research was an occasion for a general review and updating of the scientific literature published to date, but it can still be considered as a preliminary stage because many questions have not been answered yet, and they will be the object of further detailed investigations.

Fucino Relief: a brief history of the finding context (MMSN)

Before it was drained in 1878, Fucino Lake was the third largest lake in Italy; it was located in Abruzzi, a central Italian region. The absence of an efficient outlet was the reason for changes in the lake level and frequent disastrous overflowing. This problem was already known during Roman times and had been considered by Julius Caesar (see, for example, Letta 1994: 203).[2] However, work did not begin until the emperor Claudius promoted the construction of an artificial outlet of the lake, an ingenious and impressive hydraulic work (Suet., Divus Claudius, 20, 1). The outlet consisted of a canal bringing the water to the Incile, a complex of basins closed by shutters, from which point water flowed into a 5 km tunnel through Salviano mountain, finally to reach the Liri River (for the technical aspects, see Giuliani 2008: 33–48). Its completion required 11 years of the continuous and constant work of 30,000 workmen (Suet., Divus Claudius, 20, 2), and it had substantial costs (Plin., HN, 36, 124). A complete draining was not in the project (Letta 1994: 203), in order to retain a local economy based on agriculture, fishing and related activities (Migliorati 2015: 137). Suetonius, Tacitus and Cassius Dio (Suet., Divus Claudius, 21, 4; Tac., Hist., 12, 56; Cass. Dio, 60, 33, 3–4) note that during the inauguration ceremony for the outlet opening in 52 CE, Claudius organised a *naumachia*, a naval battle performance involving 24 triremes divided in two fleets.[3] Despite the great effort spent on this remarkable project, the ancient writer Pliny (Plin., HN, 36, 124) states that the emperor Nero did not continue the project because of hatred towards his predecessor Claudius.

[2] On the coincidence between the projects and works of Julius Caesar and Claudius, see Migliorati 2007: 108–109.

[3] There were 50 triremes for each fleet, according to Cassius Dio, 60, 33, 3; Claudius equipped triremes, quadriremes, and nineteen thousand combatants according to Tacitus (Tac., Hist., 12).

Figure 6.2. The relief now consists of five elements, all exhibited at Castello Piccolomini—Collezione Torlonia e Museo d'Arte Sacra della Marsica, in Celano (Abruzzi). Courtesy of Ministero della Cultura, Direzione Regionale Musei Abruzzo; unauthorised use, reproduction or alteration is prohibited.

There is not much information about the functioning of the outlet after the reign of Nero. Probably, from Nero to emperor Hadrian, the outlet was kept functioning (Letta 1994: 208) thanks to the presence of a station of *classiarii* (a garrison of marines, CIL IX, 3993) from the imperial fleet of Ravenna. However, an inscription, which had unknown provenance and was destroyed by a tremendous earthquake in 1915, commemorated the intervention of the emperor Trajan in 117 AD, who gave back to the owners the lands flooded by Fucino Lake (CIL IX, 3915; Sommella and Tascio 1991: 459–460; Letta 1994: 208, note 64). Finally, according to the laconic sentence of the *Historia Augusta*, the emperor Hadrian 'Fucinus lacus emisit' ('made the Fucino lake flow'). Perhaps Hadrian completed the repairs of the outlet and made it fully operational again or, more likely, he had work done to lower the canal, improving the water flow and realizing a greater extent of land for cultivation (Letta 1994: 208, with previous references).

Probably due to earthquakes dated to the fourth century AD, the outlet stopped working. During the following centuries, it was alternatively cleared and kept functioning or abandoned. After a considerable water rise between 1804 and 1817 (Clemente 1976: 242), efficient restorations were carried out between the 1820s–1830s under the direction of the engineer Carlo Afan de Rivera (Segenni 2003: 56). During these works, many artefacts were discovered. On 29 August 1833, the archaeologist Giuseppe Melchiorri wrote a report to the secretary of Istituto Archeologico in Roma (Archaeological Institute in Rome) communicating the discovery, among other finds, of a limestone relief depicting two boats found near the Incile (Afan de Rivera 1836: 50), reused in a wall separating the first basin from the second one (Clemente 1976: 241). It is unclear whether the relief was removed at the time of the discovery or was left on site and removed from its location during the time of Alessandro Torlonia.

In 1853, the Court of Auditors and the Società Anonima Regia Napoletana (Napolitan Limited Royal Company) signed an agreement to restore the Roman outlet. In 1855, Alessandro Torlonia bought all the shares and decided to revamp the original project as a complete sap of the lake.

The works were completed in 1878, and the historian Auguste Geoffroy reported that, in addition to the fragment already known in 1833, three more fragments with reliefs were discovered (Geoffroy 1878: 3) to have been reused in the lower part of a pit (Segenni 2003: 60). A fifth fragment was illustrated for the first time by E. Agostinoni in 1908 (Agostinoni 1908: 13; 16). The same kind of limestone—sourced from local quarries in the area of Fucino Lake (Agostini 2003: 87)—and certain stylistic similarities helped to identify the new fragments as part of the same monument as the previous find. Consequently, the relief currently consists of five elements: two large, nearly complete blocks, two joining fragments and an additional small piece, all exhibited in Celano (the Abruzzi), at Castello Piccolomini—Collezione Torlonia e Museo d'Arte Sacra della Marsica (Figure 6.2).[4]

Fucino's relief (MMSN)

The first block (inv. no. 67501, height 58.4 cm; width 104.5 cm; thickness 20.6 cm) represents a stretch of water cut through by two vessels sailing left (Figure 6.3). Based

[4] Schäfer (2022: 280) erroneously states the relief is stored at Palazzo Torlonia in Rome.

Figure 6.3. The first block discovered bearing the relief of a stretch of water cut through by two vessels going from right to left. Inv. no. 67501; courtesy of Ministero della Cultura, Direzione Regionale Musei Abruzzo; unauthorised use, reproduction or alteration is prohibited.

on their characteristics, Beltrame (2003: 83) suggests they can be interpreted as military vessels, of a type generally called long ships or *naves longae* because of their elongated shape. The one to the right is an oar-driven vessel with no sail (Figure 6.4); it has an unusual concave prow, ending with a rhomboidal decoration.[5] Six human heads, schematically represented, come out from the side of the vessel; they can be interpreted as rowers who look at the *gubernator* (helmsman), who in turn looks back at them while clearly holding a side helm out of the aft cabin. The aft cabin is flanked by two *styloi* and flags. The *styloi* were pointed poles, which were set on units of the Imperial navy alongside the ornamental stern—or aplustre/apluster—and carried the standards and the image of the boat's guardian deity, called *tutela* (for an example, see Casson 1995: 346–347). The aplustre curves inwards and ends with a *cheniscus*, a boat decoration in the shape of a goose/swan head used 'for finishing off the sternpost' (Casson 1995: 347). There are 13 oars; these do not cross the side of the boat but are represented all at the same level, below what looks like a jutting out bulwark (Beltrame 2003: 83), or a simple balustraded deck, or a side screen to protect the rowers. The latter is very similar to the ones sculptured on the warships on the Trajan's column (see Pitassi 2011: 138). The oars are more than double in number, relative to the heads of the rowers. It is possible the artist may not have given the exact number of oars actually used on the boat, but just depicted the idea of a multitude; it is also possible this higher number of oars indicates the presence of two banks of rowers, possibly even superimposed. The raised squares on the oars might be interpreted as tholes. No deck was represented over the rowers.

The relief with the vessel at left (Figure 6.5) is badly damaged in its lower part; however, it is still possible to distinguish the stem ending in an inward volute on top and a pointed cutwater at the bottom. An oblique foremast, the *artemon*, is distinguishable. The aplustre ends upwards and, as in the previous boat, it is flanked by *styloi* with flags. Below it, the aft cabin stands, out of which there is the *gubernator*, looking at left. At least eight rowers are preserved, looking at the helmsman; not only their heads, but also their chests and right arms are visible. It is not possible to determine the whole number of oars and rowers because of the poor preservation in this part. Even if incomplete, as in the previous ship, it can be interpreted as a monoreme, or at most as a bireme.[6] Again, no deck was represented over the rowers. It is also possible the rowers would not in fact have been visible, and the sculptor used an expedient artistic convention to show them onboard (see Pitassi 2011: 136).

[5] For a parallel, see Maiuri (1958: 24, fig. 3–4).

[6] Since the end of the first century BC to the beginning of the first century AD, the larger multirow warships were disposed of in favor of smaller types: the quadriremes and the triremes became the larger types, and a variety of smaller ships developed (Pitassi 2011: 115–117).

Figure 6.4. A zoom-in of the right boat. Inv. no. 67501; courtesy of Ministero della Cultura, Direzione Regionale Musei Abruzzo; unauthorised use, reproduction or alteration is prohibited.

Figure 6.5. A zoom-in of the left boat. Inv. no. 67501; courtesy of Ministero della Cultura, Direzione Regionale Musei Abruzzo; unauthorised use, reproduction or alteration is prohibited.

Even if well outlined, the function of these boats remains doubtful because of the absence of clear offensive elements. They are surely military vessels because of their shape and because of the *stiloi*, but at least the one at right has been interpreted as a light non-combatant auxiliar galley (Beltrame 2003: 83). They are less likely merchant galleys, even if these last could also have a prow 'ending in a cutwater that jutted forward into a ram-like point' (Casson 1995: 158).

The central part and a portion of the top left of the block is occupied by water, stylistically rendered through

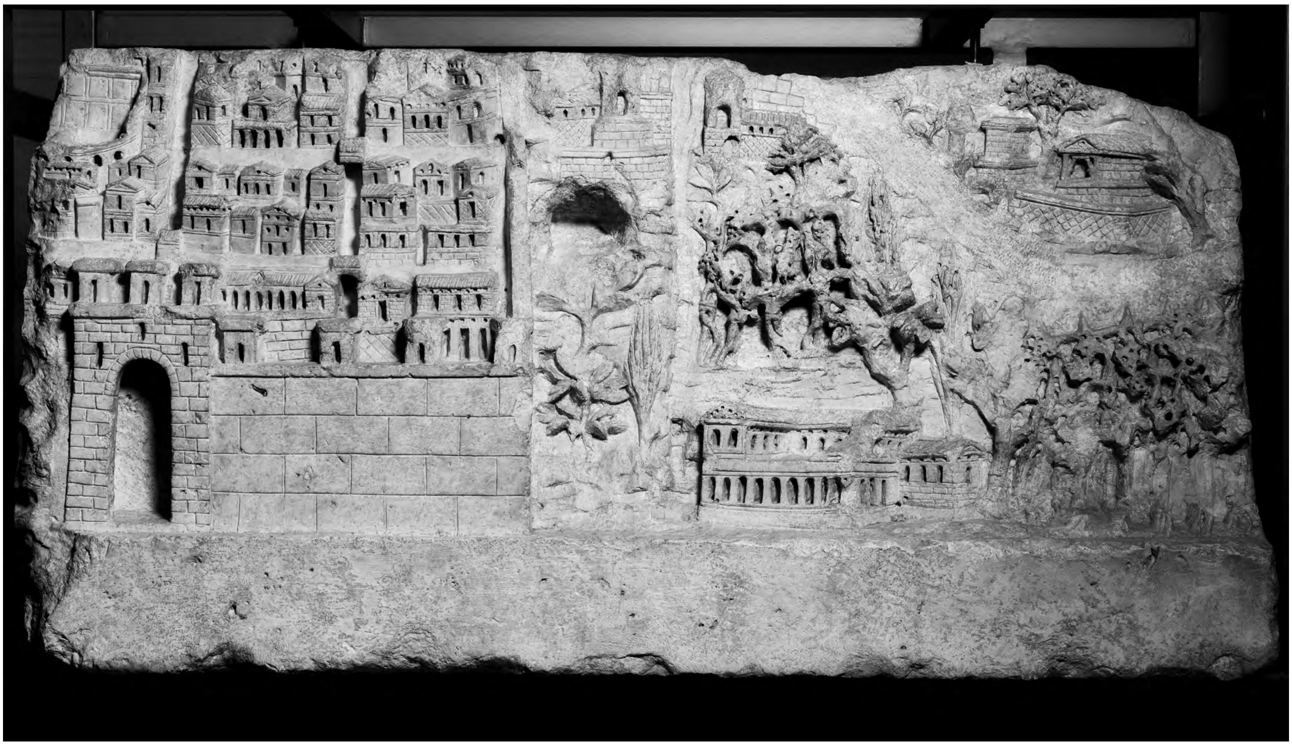

Figure 6.6. The block representing an urban landscape. Inv. no. 67504; courtesy of Ministero della Cultura, Direzione Regionale Musei Abruzzo; unauthorised use, reproduction or alteration is prohibited.

a series of parallel waves. A couple of aquatic plants (*thypha latifolia*?) come out of the water. On the bank, there are stylised trees. The presence of many small cavities indicate that this part had been worked by a drill to render the thick foliage of the trees. Chisel marks seem to have erased some of the waves in the centre of the relief because, probably by mistake, the waves were initially carved too close to the trees. The upper part of the relief is occupied by a detailed scene which is helpful for understanding the whole context. At the right corner, there are workmen working at a double drum winch, connected to a tripod with a pulley. The detail of the turning of the ropes, well visible in the uppermost part, and the perfect straightness give the idea of the functioning of this lifting machine: one rope goes down, while the other goes up, in a continuous movement (Giuliani 2003a: 81–82). The ropes depicted on the relief descend vertically, giving the idea of a lifting work and not of a work by traction, necessary, for example, to haul a boat, even if the functioning of a hauling winch is the same as a lifting winch (Giuliani, personal communication).

The second block[7] (inv. no. 67504, height 61 cm; width 123 cm; thickness 28.8 cm) represents the urban landscape of a walled city, organised in regular blocks of houses and streets with a theatre (Figure 6.6). Outside the city walls, at right, there is a stream and a bridge, and below the bridge, there is a street flanked by buildings, perhaps funerary monuments.

The third (inv. no. 67502, height 30.7 cm; width 35.3 cm; thickness 33.2 cm, Figure 6.7) and fourth (inv. no. 67503, height 23.5 cm; width 32cm; thickness 30 cm, Figure 6.4) fragments join. To the left, there is a colonnaded building, very likely a temple, below which, on a terrace, there are four figures which can be interpreted as statues of deities. Next to them, at right, a staircase descends to a lower level, where other elements (Geoffroy 1878: tav. XV.C) were chiselled out between 1878–1883 (Brisse and de Rotou 1883: tav. XXI). The scene may represent the terraced sanctuary of goddess Angitia at Luco dei Marsi, partially built into Salviano Mountain rock, about 3 km south of the Claudian outlet.

The right face of the right fragment bears traces of reworking (Figure 6.8). On this face, there are the remains of soldiers' rows, almost completely erased by levelling with a claw chisel. Fortunately, a few details allow us to distinguish the chest of a soldier wearing a *lorica segmentata*, a segmented armour used by the Roman army since the first decades of the first century AD (Bishop 2002: 23). D. Faccenna dates the scene from the Flavian times onwards because this type of cuirass is known on monuments only from this date (Faccenna 2003: 74). Probably the relief continued further left because the figures are too close to the edge of the block, and the body of the leftmost soldier appears incomplete; consequently, the block was then broken at left and reused on another side. Currently, it is not possible to determine how many times the block was reused, perhaps at least two. However, a detailed study of this block exceeds the scope of this chapter and will be the subject of further investigations.

[7] R. Belli Pasqua (2016: 58) erroneously reports the material is marble and not limestone.

Figure 6.7. The two joining fragments with the representation of the sanctuary of the goddess Angitia. Inv. nos. 67502 and 67503; courtesy of Ministero della Cultura, Direzione Regionale Musei Abruzzo; unauthorised use, reproduction or alteration is prohibited.

Finally, the fourth fragment (inv. no.67500, height 22 cm; width 19.8 cm; thickness 13 cm) bears the remains of four buildings, of which three have a gable roof (Figure 6.9).

Discussion on interpretation and dating (MMSN)

The relief is fragmentary, and many elements have been lost, so it is not possible to reconstruct the mutual position of the preserved blocks with absolute certainty. C.F. Giuliani (2003b: 79–81) has proposed a very plausible reconstruction, based on the preserved original faces of the blocks and on the topographic references represented. The monument might have been about 2 m high and 3.5 m width, with an average thickness of the blocks of about 0.25 m (Figure 6.2).

The men at work with the winches provide enough clues to identify them as workmen working at the Claudian outlet and, consequently, the body of water can be interpreted with a certain confidence as Fucino Lake, viewed from south (up) to north. The block with the urban landscape has a large band at the bottom, the base from where the whole scene takes place, and it is the bottom of the relief. If we assume that the two joining fragments represent the sanctuary of Angitia, then this would stand on the top right part of the scene, and it would be the right end of the relief. The sanctuary was at the southwestern boundary of Fucino Lake.

The urban landscape might be a representation of the ancient city of Marruvium, now San Benedetto dei Marsi, but other hypotheses are also possible.[8]

The whole scene can be interpreted as an astonishingly detailed description of Fucino Lake and its environs, photographed as an instant picture during the works carried out at the outlet during Roman times.

The two boats might be a representation of the *naumachia* organised by Claudius for the inauguration of the outlet of Fucino Lake, as described by Suetonius, Tacitus and Cassio Dio. The hypothesis is extremely fascinating, even if clues are not enough to fully support it, at least at the present state of the research. Compared to the vessels

[8] Because of the bird's-eye view, the perspective is very compressed, and the real distance between objects has been altered. Consequently, the city represented might have been not directly built on the lake's banks. If so, the view might be from south-southwest, and the city represented might be Alba Fucens, which is indeed surrounded by massive walls and has a theatre in the southern part of the city, as in the representation. The topographic relation with the Incile and the sanctuary of Angitia also matches. This hypothesis will be object of a further study.

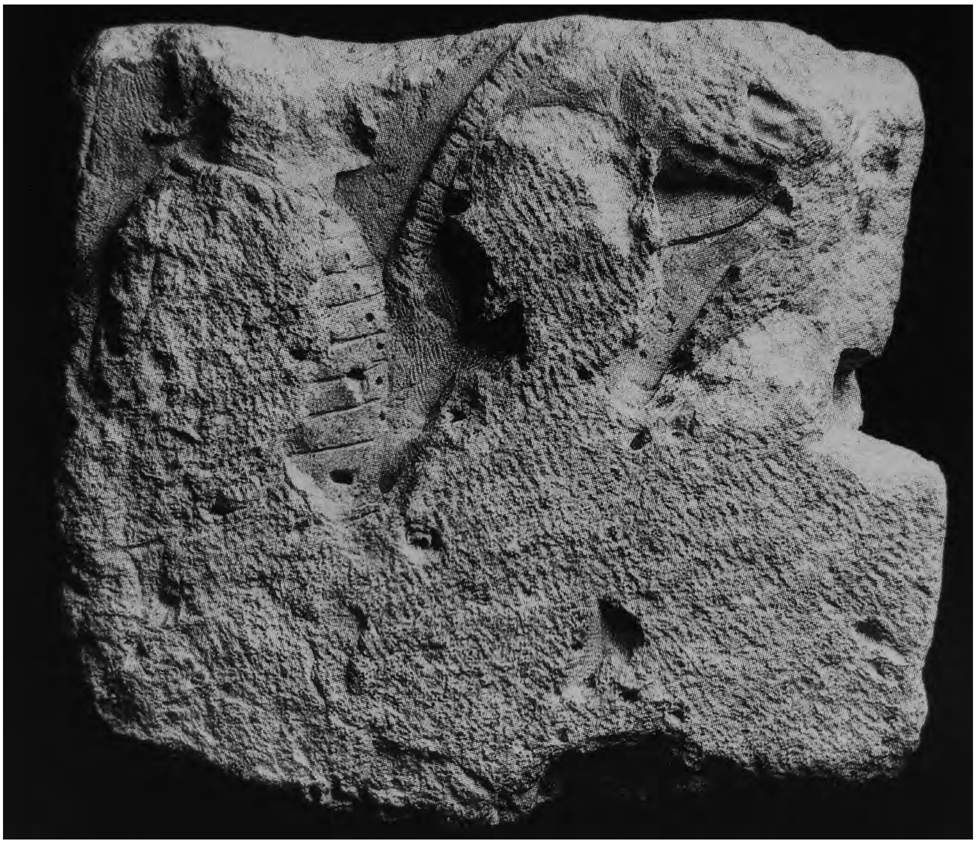

Figure 6.8. The right face of inv. no. 67502, bearing traces of reworking with remains of soldiers' ranges, almost completely cancelled by a levelling with a claw chisel. It is possible to distinguish the bust of a soldier wearing a *lorica segmentata*, a segmented armour used by the Roman army since the first decades of the first century AD; courtesy of Ministero della Cultura, Direzione Regionale Musei Abruzzo; unauthorised use, reproduction or alteration is prohibited.

Figure 6.9. The fragment with the representation of buildings. The largest building seems organised on three stories and bears a series of holes with unclear function. Inv. no. 67500; courtesy of Ministero della Cultura, Direzione Regionale Musei Abruzzo; unauthorised use, reproduction or alteration is prohibited.

represented in the *naumachiae* in Pompeii, the ones in the Fucino relief do not have proper or undeniable offensive elements, even if, as stated above, they are military boats. This is supported by C. Beltrame's suggestion (2003: 83) that the ship on the left very closely resembles the vessel represented on coins from the time of Hadrian with the type of *Felicitati Augusti* (see, for example, Amandry *et al.* 2019: 86, no. 963A). Even on the coin, it is possible to distinguish a schematic representation of a military vessel: a few rowers with a multitude of oars, the volute stem, the oblique foremast, the pointed cutwater and not a proper ram, the aplustre flanked by *styloi* and the cabin with the *gubernator*. Moreover, it is important to note that the fast military vessel *liburna* was not necessarily provided with a ram, and it was used as a battleship in the second line for fast raids (Avilia 2002: 132). The ship to the right, which is in actuality in the second line, might have been a *liburna* used in the *naumachia* on the Fucino Lake. The *liburna* could have been rowed as a bireme (see, for example, Pitassi 2011: 141). The *naumachia* organised by Claudius must have been such an extraordinary event, its memory possibly survived for decades. In this regard, it is interesting to note that in the temple of Apollo at Alba Fucens (now the church of St Peter in Albe), there is a graffito dated to the first–second century AD (Nuovo and Tedeschi forthcoming) or the end of the Republican times–beginning of the early Imperial times according to Guarducci (1953: 120) representing a vessel with a ram and the inscription 'navis tetreris longa' (Guarducci 1953: 119–130, Fig. 5; Mertens 1969: 21; 22, Fig. 11). Certainly, it is not possible to the determine if the author of the graffito actually saw a *navis longa* in the Fucino Lake, as for example, during the memorable Claudian *naumachia*, or if he was a sailor coming back home or asking for protection from the god.

The hypothesis that the two ships might be auxiliary military vessels used by the *classiarii* for patrols[9] appears unlikely, as this corps was probably involved in technical aspects of the constant control of the Claudian outlet, more than in proper military operations.

However, even if the representation of Fucino Lake is beyond doubt, it is not sure if the urban landscape is real, imaginary or, most likely, a fusion between reality and imagination. In fact, it is possible the artist was inspired by the real landscape around Fucino Lake, and the care for the details in the urban landscape, as well as in the representation of men at work, attest to this. Nevertheless, at the same time, the artist could have combined the real landscape with iconographic models, widespread during the imperial times, representing landscape as impressions rather than as a topographic map. The composition of a scene with a body of water, vessels and a walled city is very common in wall paintings in Pompeii, for example (Avilia and Iacobelli 1989). It is generally used in mythological representations or in images with *naumachiae*.

Portus Relief: a brief history of the finding context (ST)

In 42 AD, Emperor Claudius began the construction of a new extensive harbour in a lagoonal area at the mouth of Tiber River, about 2 km north of Ostia. Its construction was a long process which included the excavation of a large extent of the ancient coastline, the construction of enclosing walls and the erection of two artificial piers jutting into the sea (for ancient sources describing the enterprise, see Keay and Millet 2005: 11–14, 315–327; Bergen 2022: 198–203; Bukowiecki and Mimmo 2023). According to Suetonius (Divus Claudius: 20,3), the lighthouse was in deep waters facing the entrance of the harbour. The harbour was inaugurated under the rule of Nero, as demonstrated by the coins minted for the event (Felici 2022: 10–17). Emperor Trajan enhanced the structure by building the outstanding inland hexagonal basin behind the Claudian Complex (Plin., Panegircus, 23.2) and by excavating a channel called Fossa Traiana (CIL XIV, 88), which was critical to the regulation of the Tiber River (Figure 6.10).

The external basin, called *Portus Claudii*, was probably in use even after the sack of Portus by Alaric the Goth (410 AD), while in the fifth century AD, the basin made by Trajan and the central area of the port were surrounded by a defensive wall (Keay 2021: 54); the Fossa Traiana was navigable until the twelfth century (Paroli 2005: 43). The site of Portus was easily identifiable, even after centuries, thanks to the presence of the hexagonal basin. From the Renaissance onwards, the harbour was the object of cartographic and archaeological interest (Bignamini 2003; Felici 2022). In 1856, Alessandro Torlonia purchased land in Portus in which he started the drainage project which in 1878 implemented a real archaeological rediscovery of the place.

The excavation reports, the proceedings of the Pontifical Commission and a series of letters published in the Bullettino dell'Instituto di Corrispondenza Archeologica and Bullettino di Archeologia Cristiana allow us to reconstruct a sequence of important archaeological campaigns, carried out between 1857 and 1870 (for the documents mentioned above, see Tuccinardi 2022: 86–100).

These excavations were carried out in the area occupied by the imposing structure called the Imperial Palace and by the so-called Grandi Magazzini di Settimio Severo (Lanciani 1868: 171), near the Xenodochium of Pammachius, now identified as the Basilica Portuense (Maiorano and Paroli 2013), as well as in the area adjacent to Villa Torlonia. The first archaeological plan of the site is due to Rodolfo Lanciani who, during occasional short visits, was able to document the archaeological excavations undertaken by Alessandro Torlonia; Lanciani's study was fundamental

[9] It is known the *classiarius* Onesimus erected a small temple between the Incile and the underground tunnel, dedicated to the cult of the Caesar family, of the Lares and of the Fucino (CIL IX, 3887; Sommella and Tascio 1991: 459–460).

Figure 6.10. Lazio, central Italy. Image from Portus Project (https://www.portusproject.org).

in defining the topography of the Torlonia excavations at Porto (Lanciani 1868).[10]

From 2006 to the present day, the Portus Project, directed by Simon Keay in 2006–2021, has started a new season of systematic investigations in Portus, including extensive geophysical surveys, excavations and geoarchaeological studies. These have produced, as a result, an up-to-date knowledge of the topography and the monumental complexes of the most important port of the Empire (Keay and Millet 2005; Keay 2012, 2021; Keay and Woytek 2022, with previous references; on the geomorphological studies see Bellotti *et al.* 2009: 51–58; Salomon *et al.* 2017: 53–60) (Figure 6.11).

The Portus relief (ST)

Among the numerous marble highlights found during the Torlonia's excavations and included in the Torlonia's collection, the Portus relief (Figure 6.12) is surely one of the best known (Rome, Laboratori Torlonia, Pentelic marble, height 75 cm; width 122 cm).[11]

In recent years, thanks to a renewed interest in the Torlonia Collection, the relief has been the topic of several scientific contributions aimed, above all, at interpreting the complex symbology of the representation (Cecamore 2019; Felici 2019a, 2019b; Tuccinardi 2020; Felici 2022; Ugolini 2022: 68–78, *passim*). Beyond a general analysis of the represented symbols, the symbolism connected to the boats' representation, the communicative expedients and the topographical references will be considered in this chapter.

Since the time of its discovery, the port view was interpreted as a representation of the monumental structures in *Portus Claudii* and *Portus Traiani* and, in a time when shipwrecks were not yet investigated, the relief immediately became a source of precious information about shipbuilding and ancient naval engineering, fundamental to reconstructions of the large merchant ships during the Imperial age (see Guglielmotti 1874).

On the left side of the relief, within a frame with a Lesbian kyma, a *navis oneraria* (cargo ship) is approaching the waterfront of the port of Claudius, indicated by the lighthouse. The ship has only sail propulsion: an artemon

[10] Before the surveys of the last decade, fundamental studies about Portus were Lugli and Filibeck 1938 (with cartography by I. Gismondi) and Testaguzza 1970.

[11] In the latest edition of the Torlonia Museum catalogue (Visconti 1884, 1885), 52 sculptures are published as originating from Portus. In many cases, however, the stated origins are not reliable (see Tuccinardi 2022: 86–100).

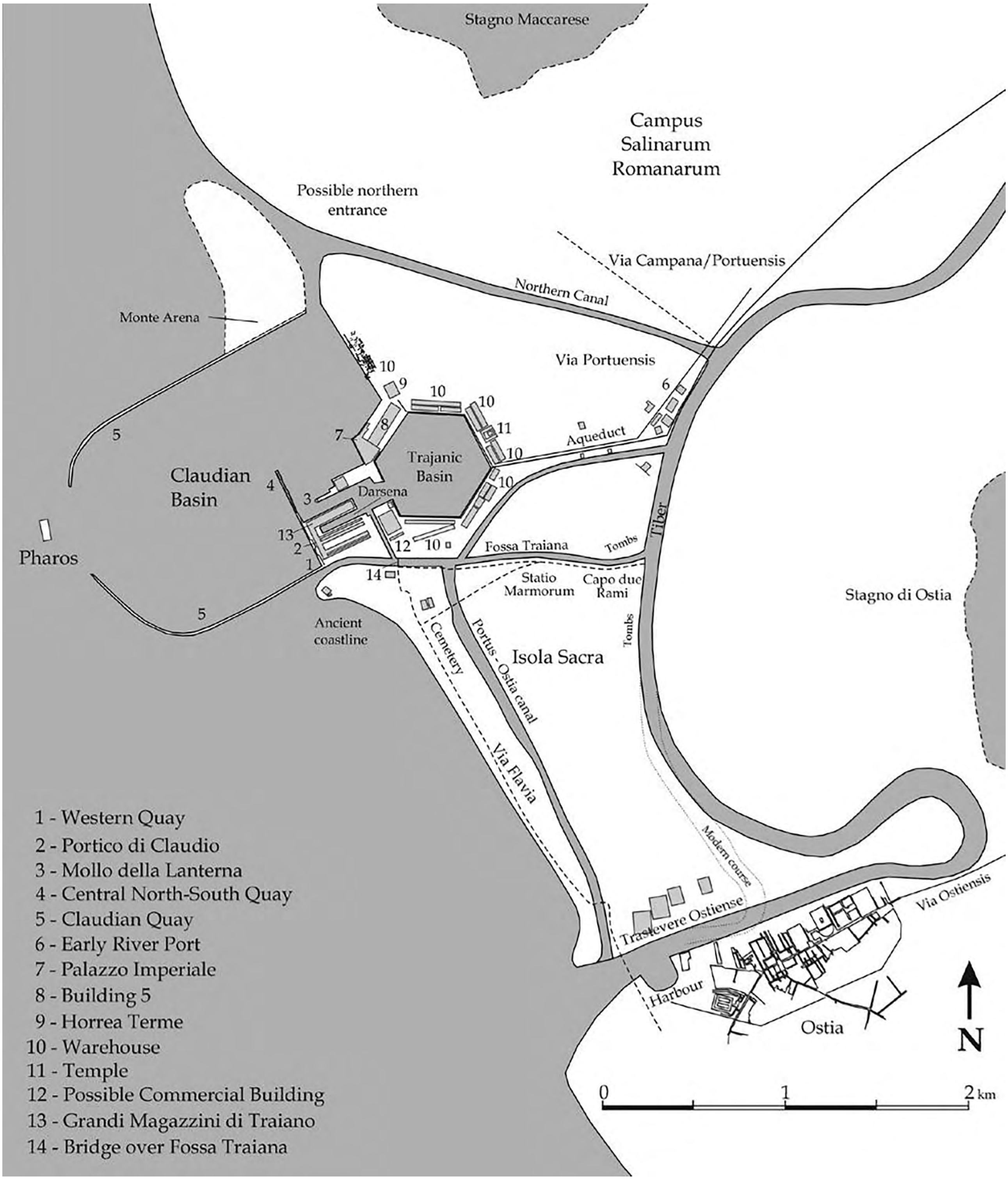

Figure 6.11. Map of Portus, the Isola Sacra and Ostia, showing the location of buildings discovered by the recent research. Image from Portus Project (https://www.portusproject.org).

and a main mast equipped with a square sail and a triangular topsail. A small boat flanks the cargo ship, on which a muscular sailor is steering the right helm with a rope passing through two holes in the helm, in order to direct the vessel safely to the entrance of the port. This type of sailor can be compared to modern harbour pilots on pilot boats commanding, for example, large ferries, or to modern sailors on tugboats.[12] In fact, because of its large dimensions, the vessel had reduced manoeuvrability and needed external support. In the meantime, the mainsail was slackened to make the vessel slow down, while a sailor

[12] On small boats probably operating as tugboats in the Trajan's harbour, see Casson 1965: 33–34.

Figure 6.12. Torlonia Relief n. 430. Image courtesy of Fondazione Torlonia, unauthorised use, reproduction or alteration is prohibited; photograph by L. De Masi.

with a double-block halyard had probably already furled the sail of the artemon, which is folded next to the prow.[13] The rest of the crew, composed of four additional sailors onboard, is intensely engaged in various tasks, including the shaping/repair of a piece of wood by a carpenter. On top of the gallery cabin at the stern,[14] a man, probably the owner of the ship, officiates an *apobaterion* ritual, a sacrifice to the gods for the success of the journey (Feuser 2015: 38–39). The owner is accompanied by a woman, perhaps his wife or an attendant, and by another male figure. An additional merchant ship is already docked at a pierced docking stone of the pier. Four muscular sailors are finishing furling the mainsail and topsail, while the gangway is already on the pier, where there are ongoing unloading activities, summarised by a man carrying an amphora. Possibly, this might be the same ship represented as docked inside the Trajan's basin.

The stern of the ship at left is decorated with a Victory holding a wreath, very likely the *tutela navigii*, a patron deity to help safety throughout a voyage from which the ship often took its name (see Brody 2008: 2–5; Fenet 2016: 318–323). The stern has a small aplustre which ends with a *cheniscus*; another decorative element with unclear function is also present.[15] A refined allegorical representation embellishes the hull, maybe Aurora among the Winds, or a Venus *velificans* between two Erotes (Felici 2022: 33). The mainsail, on which the rings for the sheets are well visible, shows the specular group of a she-wolf with twins on each side of the mast. The top of the mast is surmounted by a winged Victory bearing a wreath. A decoration representing Bacchus with a panther (Di Franco and Mermati 2022: 528–536) is on the prow; it is identical to the representation visible at the top right of the block and similar to the decoration of the prow of the docked ship.

In the background, a view of the most representative monuments of Portus can be identified: the lighthouse of *Portus Claudii* with the bronze statue of an emperor raised on top (Ojeda 2017) and a triumphal arch, recognisable by its attic—seen from the side—and surmounted by a quadriga drawn by elephants, whose attribution and real

[13] It is also possible this sailor is positioning the gangway (Avilia 2002: 150–151). However, M. M. S. Nuovo (personal communication) emphasises that the gangway is usually represented as a flat plank put on one of the sides of the ship (see, for example, Casson 1965: plate II, Figs. 2 and 3, respectively, a painting and a mosaic, both from Ostia) and not as a curved element in the prow as in the Portus relief. In the docked vessel, the gangway is clearly visible on the right side of the ship; it is crossed by a man carrying an amphora, and behind it is the artemon with the 'curved element' connected to it.

[14] On the religious value of the stern, see Fenet 2016: 264.

[15] This element is interpreted as a lighthouse by E. Felici (2022: 21–26). However, it seems to belong to the ship, rather than being a part of the landscape. An interpretation as a small stern cabin or as a similar structure appears more plausible (Avilia, personal communication and discussion with M. M. S. Nuovo); see also the ship represented in a mosaic from via Nazionale in Rome (Pensa 1999; Salvetti 2002).

location are still debated (De Maria 1988: 247; Fähndrich 2005: 230–232; 236; Tuck 2008: 331–332).

In this symbolic and topographic representation, several well-defined images of deities are present: at the centre, Neptune with a pistrice (marine monster) and the trident (Simon 1994, p. 487, no. 34; Di Franco and Mancini forthcoming: 122–123), Bacchus with a panther to the top right and three Nymphs at the fountain to the bottom right.

On both sides of the lighthouse, on moulded bases, perhaps supported by monumental columns, stand two statues of the deity protecting the place. To the left, there is the Genius Loci of Portus, a youthful togate figure crowned by a lighthouse, with a cornucopia in the left hand and a wreath in the right one (Romeo 1997: 606, n. 35); to the right, there is a bare-chested figure wearing a robe wrapped around the hips, bearing the cornucopia and the wreath, probably identifiable as the Genius Populi Romani (Canciani 1994).

Discussion on interpretation and dating (ST)

Shortly after the discovery of the relief, the archaeologist Alberto Guglielmotti gave sparce information on the exact place of the finding; he says only that it was found in the ruins of the porches around the market of the Roman port, built on the right bank of the Tiber River (Guglielmotti 1874). Archaeological discoveries in the area of the northeast jetty of the hexagonal port confirm the presence of a sacred place dedicated to the cult of the god Liber Pater (Van Haeperen 2019: 294–295). For example, in 1864, an inscription was brought to light, dedicated to Liber Pater Commodianus (CIL XIV, 30; EDR n. 149981, R. Marchesini). Furthermore, according to antiquarian sources, a statue of Liber Pater had been found in the area in the fifteenth century, but it was thrown into the sea at the order of Cardinal Bessarione (Volpi 1734: 156).[16] The presence of this temple with rectangular shape was confirmed during the archaeological surveys carried out by Simon Keay (Keay and Millet 2005: 109).

From the analysis of the Portus relief, it is clear the whole view is built on the constant juxtaposition of allegorical images and realistic elements, of allusive figures and explicit representations of the monuments that characterised and made immediately recognisable *Portus Claudii* and *Portus Traiani*. The precise correspondence of the main monuments represented on the Torlonia relief and the ones depicted on the sarcophagus slab at the Vatican Museums (De Maria 1988: 247; Fähndrich 2005: 125–127, pl. 81–82) supports the idea much care was given to the realistic details. For example, the representation of Neptune could have been either symbolic, as he was the god of the sea, or a precise topographic reference to a real worship place. In fact, the same iconography of the god occurs also in a well-known mosaic found in Ostia with the representation of the lighthouse of Portus (Simon 1994, p. 487, no. 34). Moreover, the effigy of Bacchus should be associated with a cult of Liber Pater, of which, as stated above, a worship place has indeed been identified. Finally, the bathing Nymphs at the bottom right (Figure 6.13), below the Dionysian group, are probably an allusion to a nymphaeum located in Portus, possibly near the temple of Liber. However, even if precise topographic references can be identified, the realism is always combined with the symbolic and allegorical meaning of the relief.

In the case of the man performing the ritual, the face is sufficiently characterised to be considered a real portrait and, perhaps, the owner is the client who ordered the relief. Because of the portraits' modes of execution and the type of hairstyles, a dating in the Severan period can be suggested, a chronology which would also fit well with the marking of the pupil of the large apotropaic eye in the form of a pelta shield (Figure 6.13). Furthermore, although the use of the drill is attested in this period to give greater depth of field and emphasise the contrast between shadows and light (see Belli Pasqua 2022: 43), it is interesting to note the drill is not used everywhere, but only for certain details, like in the relief from Fucino Lake.

A different interpretation of the whole scene was proposed by some scholars (Chevallier 2001: 25; Cecamore 2019: 169), based on the chronology and the presence of symbolic elements like the she-wolf which also have political meanings. The whole scene could represent the imperial ship of Septimius Severus returning to Portus from his trip to Africa in 204 AD. Therefore, according to this interpretation, the relief of Portus would be part of a larger public monument dedicated to Septimius Severus.

However, the parallels found in the portrait (Figure 6.14) might not necessarily be a real representation of the ruler (Balthy 2013), but simply either a *zeitgesicht* (period-face: Zanker 1982) or a *Bildnisangleichnung* (image assimilation: Massner 1982), which implies the imitation of the emperor's portrait by wealthy men or their identification with the image of the emperor.

Moreover, the presence of the she-wolf on the mainsail is not necessarily connected to the imperial ship, and it does not automatically mean it is a realistic element (on the Lupercal in the public and private spheres, see Dardenay 2012: 106–124). The representation of the she-wolf, exclusively symbolic, might be placed in the same semantic context as the large eye, unrelated to the rest of the composition. Both the eye and the she-wolf (Duliere 1979: n. 123) can be interpreted as apotropaic elements. A large eye was commonly used as an apotropaic element on ships because it represents the wider and deeper view which guides the ship through a secure journey and

[16] G.R. Volpi cites the inscription on the statue dedicated by the *Lenuncularii* to Liber Pater, reported by the famous sixteenth-century antiquarian Pirro Ligoro. The *Lenuncularii* was a guild of boatmen that oversaw the driving of the ships across the Tiber River (on *Lenuncularii*, see Casson 1965: 31–36). However, the news about Bessarione seems unfounded, and the inscription, which is not registered in the *Corpus Inscriptionum Latinarum*, may have been invented by Ligorio (see also Lanciani 1868: 181).

Figure 6.13. Torlonia Relief: the apotropaic eye and the three Nymphs at the fountain. Image courtesy of Fondazione Torlonia, unauthorised use, reproduction or alteration is prohibited; photograph by L. De Masi.

avoids accidents (Meda 2010; Felici 2019a: 7). The she-wolf might also have been a generic symbol of *romanitas* (Zanker 2002: 86, with previous references).

From the times of its discovery, the relief was interpreted as a dedication to Liber Pater offered by a wealthy shipowner to thank the gods for a safe and successful journey.

The frequency of Dionysian images, which deliberately repeat the same statuary type, seems to corroborate the traditional identification of the relief as a votive offering to Liber Pater-Bacchus (and perhaps also to Neptune?) made by a merchant or shipowner; this hypothesis might be confirmed by the interpretation of the letters inscribed on the mainsail. According to some scholars (for example, Feuser 2015: 39) they could be unravelled as V(otum) L(ibero) or as a shortened formula for V(otum) L(ibens animo solvit) (see Meiggs 1973: 165; Dardenay 2012: 122). Recently, Enrico Felici (2022: 43) proposed a different interpretation. These initials represent the name of the ship painted on the sails, which was sometimes the same as the *tutela*, as stated above. Consequently, VL may be the abbreviation for Victoria Libera.

The connection between the symbols of victory, repeated multiple times (Victories and wreaths), and the positive outcome of the navigation is evident (Felici 2022: 43); even Vergilius points out how ships which would successfully return to port were celebrated as victorious (Verg. G. 1, 303–305). The inscription on the sail might call to mind the ritual of embroidering on the sails the best wishes for a good navigation (Tuccinardi 2020: 178), mentioned in Apuleius (Metam., XI, 16), for example.

Reflecting on the symbolic meaning of the ship and rejecting the votive purpose, Felici (2019a, 2022: 23) advances the hypothesis the relief might have been part of a funerary monument. In fact, in antiquity, ships and lighthouses were often connected to funerary contexts as a metaphor of the journey from life to afterlife.[17]

However, even if the interpretation of the relief as part of a funerary monument might be plausible, it contrasts

[17] See the mainstream reference in Cumont 1949: 283–286, an overview of the prosaic and spiritual value of boats in funerary representations in Guidetti 2007: 86–87 and the political meaning of the lighthouse as a triumphal monument in Ugolini 2022: 76–77.

Figure 6.14. Torlonia Relief: the cargo ship. Image courtesy of Fondazione Torlonia, unauthorised use, reproduction or alteration is prohibited; photograph by S. Tuccinardi.

with the high probability the slab comes from the so-called second side of the hexagon, where Alessandro Torlonia's archaeological excavations certainly took place and several pieces of evidence suggest the presence of a temple dedicated to Liber Pater (Van Haeperen 2019: 294–295). The three Nymphs depicted near the left edge of the slab, in close connection with the image of Bacchus-Liber Pater, may suggest the presence of a scenographic fountain (nymphaeum); this type of architectonic complex may be connected—given the topography of the locations—to the layout of the aqueduct that lies on the second side of the hexagon where the Liber Pater temple is located, offering a new link between the relief and this specific area (Fig. 6.11).

Moreover, representations of the deities in funerary reliefs with work scenes, celebrating the achievement of the deceased from a professional point of view, are rare or completely lacking. Take, for instance, the reliefs from the tomb of Eurysaces at Porta Maggiore (Ciancio Rossetto 1973; Jones 2018) or the monument of Naevoleia Tyche in Pompeii (Kockel 1983, 100–109 no. Sud 22) and the numerous slabs of similar subject from the necropolis of Ostia (on this subject, see Zimmer 1982): in the concreteness of these images, the divine is an offstage spectator.

Final considerations and conclusions (MMSN, ST)

On the basis of the analysis presented here, both iconographic and topographic, it is possible to state the relief from Fucino Lake is a celebration of the extraordinary feat of engineering represented by the construction of the artificial outlet of the lake. The works to regulate the waters of the lake remained vivid in collective memory for generations because of the great effort in terms of its planning, the implementation of the project and the involvement of thousands of workmen for more than 10 years. The enterprise carried out by Emperor Claudius is clearly evoked in the relief by the presence of the workmen with the winch, which gives information not only on the depicted historical event, but also on the exact topographic location represented, namely, the channel and the tunnel of the artificial outlet. The purpose of a precise topographic representation appears fairly clear, even though the entire scene is only partially preserved: in fact, it is possible to identify a sanctuary; a Romanised city with orthogonal streets and a theatre, surrounded by walls; a road flanked by a necropolis and cultivated fields which survive only thanks to the intervention of the emperor. In this way the landscape itself becomes a symbol of the triumph of order out of chaos, of the capacity for Roman engineering to dominate a messy and uncontrolled nature and an allegory of the good government of a great ruler. If the interpretation of the two boats as an evocation of a *naumachia* is correct, the two vessels contribute to the reconstruction of a precise landscape in a specific moment and with an explicit political message: the memorable and impressive inauguration of the outlet organised by emperor Claudius with the involvement of at least 24 triremes. The view of a multitude of warships at 700 m at sea level—in a mountainous area on the Apennines—must have been such an event, possibly remembered also with a graffito in the temple of Apollo in Alba Fucens. The presence of vessels from the imperial fleet in the context of the Fucino Lake is otherwise unexplainable, and their reading as auxiliary boats appears to be a hypothesis not sufficiently supported by historical and/or archaeological evidence. The *classiarii* were involved in the maintenance of the outlet as engineers of the military genius, more than as sailors patrolling the lake.

The unknown artist of the relief had a celebrative intent in his mind: every single element represented contributes to the celebration of Rome and of the greatness of the emperors. The use of a type of limestone available in the area of the outlet (Agostini 2003: 87) indicates a municipal production which exploits both local materials and workshops with their own style and technical abilities. However, even if the artistic language is local, it is possible to argue the client was public or somehow connected with the public, like a wealthy imperial official (a freedman?) or a *procurator*. The relief can be considered as the expression of official art, conveying a message of political propaganda. Its original location remains unknown, but as two large and heavy fragments were reused in the walls of the pit where they were found, it is possible the original location was not far from their replacement location. Perhaps it was a large celebrative monument located near the Incile, maybe in proximity of the tunnel under the Salviano Mountain. Because of the large dimensions and because of its iconography, it is less likely it was a private funerary monument. The stylistic characteristics suggest a date in the second century AD. Consequently, the monument was not built for the inauguration of the outlet, but nearly a century thereafter. The ancient sources mention the involvement of the emperors Trajan and Hadrian for the refunctioning of the outlet, and their interventions in the Fucino Lake area might have been a good occasion to celebrate the works carried out by their predecessor, Claudius. However, the use of chisels and the drill for specific purposes might indicate the late second century AD or early in the beginning of the third century AD,[18] under the rules of the Severii, even if works carried out by this imperial family in the Fucino Lake area are not known.

The relief from the Fucino Lake and the one from Portus can be associated together, not only for the circumstances of their discovery, the presence of detailed ships rich in meticulous particulars and the perfect fusion of realistic and symbolic elements, but also because both the reliefs celebrate great feats of engineering and the magnificent infrastructures built by the Roman emperors (Claudius and Trajan). In the relief from Portus, the symbolic elements seem to refer to actually existing topographic locations and, at the same time, the detailed elements on the large merchant boat are obvious allegories.

[18] According to T. Schäfer (2022: 280), the relief is dated to the time of the emperor Claudius.

Portus was the largest and the most important harbour of the Empire; its monumental layout, known from iconographic sources, was striking in many respects: the lighthouse, the statues on columns, the arch surmounted by a quadriga.[19] As rightly noted, in the Portus relief, the celebration of the empire and beneficent emperors merges with that of the security of the empire's food supply, closely linked to the great harbour of Portus (Felici 2022: 28–33).

The merchant boat itself is a symbol of wealth and prosperity, guaranteed by the Roman empire through the complex food supply system. For the Portus relief, it is possible to suppose a private client, a wealthy merchant offering a vow to the god Liber Pater through a monument with a specific and well-constructed semantic structure and a clear message: only thanks to the strength and the solidity of the empire was it possible to achieve individual goals and carry out fortunate private undertakings. A wise and prudent management of the empire is the basis for the happiness and prosperity of the entire community, just as the success of a sea journey depends on the skill, wisdom, prudence and judgment of the commander.

The owner of the monument, probably an imperial freedman, might have decided to be represented during his flourishing activities on the sea, according to a rather widespread custom. Consequently, there is a coexistence of symbolic and real elements, and the sea journey has the double value of biographical memory and metaphor. On the grounds of the specific topographic references of the finding context and the dense presence of divine elements rarely attested in the funerary repertoire—ruling out the mythological scenes and the cases where the defunct is compared to the divine—the hypothesis of a funerary purpose appears less probable than a votive offering. The propitiatory and apotropaic meaning of numerous symbols, the ritual represented and the large protective eye seem to indicate a ritual function of the relief, that shows the representation of devotional practices related to daily life in Portus and, more generally, to the seafaring world.

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[19] For the imperial monuments at Portus, see Tuck 2008: 325–335; Ugolini 2022: 57–84.

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7

Maritime material culture and its connection to Eastern Orthodox Christian saints: a preliminary study

Rafail Papadopoulos

Abstract: Christianity has long been associated with water: it acts as a natural barrier in Moses' story, it is a means of spiritual cleansing used by John the Baptist and it is connected to parables and miracles attributed to Jesus and various saints. Water and water-related activities such as fishing and seafaring have been purposefully adopted into faith, spiritual practices and remembrance. Moreover, marine vessels, which have been an important means of transport for Mediterranean civilisations since prehistory, were included in Christian practices in a variety of ways, not just as symbols of saints but also as part of rituals.

This chapter presents a preliminary study of the connection between Christian saints and maritime material culture. The focus is examples from early Christianity, especially Greek Orthodox Christianity, as developed in the eastern Mediterranean during the Mediaeval period and thereafter. The first part of the study assesses written sources associated with saints of the sea such as Nicholas of Myra and Phocas the Gardener. The second section discusses how art and material culture—mainly icons and frescoes, religious works of art—relate to narratives of the saints' lives, associated miracles, local beliefs and spiritual practices. Icons are devotional paintings of Christ or other holy figures typically executed on wood and used ceremonially in the Byzantine and other Eastern Churches, while frescoes are religious murals painted on walls.

Thus, the main purpose of this chapter is to present matters of faith and materiality in maritime context, as expressed through textual evidence and material artefacts from Eastern and Greek Orthodox Christianity. It is hoped this preliminary study will reveal new insights into and connections between maritime material culture, the sea itself and the artefacts, symbols, monumental art, votives and rituals which have been used by Christian maritime communities for over two millennia.

Introduction

Water has been associated with faith and the divine since prehistoric times (Rappenglück 2014). In Europe as early as the Neolithic, it was conceived as the personification and extension of deities (Tvedt and Oestigaard 2006; Oestigaard 2011). This conceptualization inspired cults, beliefs, rituals and practices in many communities. Some of the earliest material evidence for processes linking divinity with water comes from the Mediterranean region and dates to the first millennium BC. Poseidon, the ancient Greek god of the sea, was its embodiment, personification and sole ruler. Temples to Poseidon were built near ports and maritime routes to influence maritime activities and movements and gain the god's patronage and protection (Mylonopoulos 2013). Deities such as Poseidon and mythological events taking place in water were the frequent subjects of sculptures, paintings and other types of artefacts from the period, while rituals and festivals celebrated water-related events such as the 'Navigium Isidis' ['The Voyage of Isis'] of Roman-era Alexandria, the annual reopening of the sailing season (Hanrahan 1962) which memorialised the links between divinities, aquatic environments and the communities using them.

This deep entanglement between water, religion, material culture and rituals continued into the first millennium AD. In its first five centuries, Christianity, which was then just emerging from and still firmly connected to the Judaic tradition, was closely associated with water and maritime material culture (Goodenough 1943: 408–410; Siegal and Yovel 2023). Water—including sea water—was viewed as means of purification, as well as a symbol for spreading the message of the new religion (see Réau 1955–1959 and Jensen 2000 for a discussion of baptism and iconography in early Christian art). Some of the apostles were fishermen (Matthew 4:18–22), or they spread their message through maritime journeys across the Mediterranean, or they were baptised with water (Acts 2:38). Christian maritime communities built churches and chapels to host and honour icons and relics of saints and gain the saints' patronage and protection (Morgan 2010: 23–24; for a general introduction to early saints and their connections to pre-Christian traditions, see Réau 1955–

1959 and Mathews 1993). Connections between churches dedicated to patron saints of seafaring and cities with harbours and seafaring activities are readily apparent in the archaeological and textual records of the Mediaeval and post-Mediaeval periods.

The connection between water and Christian societies has long been a subject of study and analysis (e.g., Flatman 2011: 313–315). Perhaps the most prominent of these efforts is the nine-volume series *A history of water* (edited by Tvedt and Oestigaard), which includes contributions from more than 230 scholars and took a decade to publish (2006–2016). Another major study of maritime material culture, maritime archaeology, theology and Christian saints is Gambin's 2014 book *Ships, saints and sealore: Cultural heritage and ethnography of the Mediterranean and the Red Sea*, which provides important interdisciplinary research results.

Despite these extensive studies, a new research question emerged during an assessment of the contemporary literature, one which concerned maritime material culture in the context of Christianity during the Mediaeval and post-Mediaeval periods. In archaeology, the analytical approach to the production of material culture includes artistic expression. Nonetheless, few analyses have focussed on the interconnections between maritime communities, their material culture and the maritime landscape. In other words, artefacts are typically analysed as individual pieces of material culture, but few scholarly studies have connected them to other aspects of the local communities which produced them (Hatch 2011: 217–218, 231). This chapter aims to fill the gap by providing a holistic overview of the entanglements between maritime environments, social aspects of Christian communities and the representation of those aspects in the associated material culture, particularly forms of religious art.

Research aims and methodology

By combining theological, textual, archaeological and art historical research data, derived mainly from the Eastern Orthodox tradition, this preliminary study provides insight into the maritime interconnections between religion, the environment and local communities. Saints such as Nicholas of Myra and Phocas the Gardener, their honouring and veneration by local communities, the symbols used to depict them and the related artefacts produced in southeastern Europe during the Mediaeval and post-Mediaeval periods are discussed, with a particular focus on Greece and the eastern Mediterranean. The data and details discussed here were collected through a desktop study and analysis of published scholarship, along with Christian texts (*e.g.* the Bible, missals and liturgical books).

Analysis of the collected data, as presented here, seeks to bridge the gap identified in the literature by providing critical interpretations of Christian beliefs, material culture and rituals within the context of the maritime cultural landscape of the eastern Mediterranean region (Westerdahl 1992). Specifically, within the research framework formulated by Hatch (2011), this study focuses on the ways religious artefacts, symbols and rituals are created and used by fishermen and maritime communities. These elements connect maritime material culture to specific maritime communities, showing how artefacts become core parts of cultural identities. Through specific case studies, this chapter also examines how these elements become part of broader networks of beliefs, rituals and traditions.

For the purposes of this analysis, specific case studies of saints and relevant artefacts were selected. Admittedly, the case studies presented here are a subset of the available data intended to represent the larger range. They are also part of a broader field of study with significant potential to reveal the interrelations between the identities of maritime communities and their Eastern Orthodox beliefs, practices and artefacts.

The Christian faith and water

The roots of Christianity are deeply embedded in the spiritual and philosophical life of the ancient Mediterranean and Near Eastern cultures, which had various connections to water through cultural beliefs and practices and pre-Christian religions. Christianity often adopted these earlier associations of water with divinity (Flatman 2011: 313–315, fig.17.2). Water is often mentioned in the Bible. In the Old Testament, God is referred to as 'the spring of living water' (Jeremiah 2:13, 17:13). In the New Testament, Jesus is mentioned as 'the water of life' (John 4:10–26, 6:22–59). In the Gospels of the New Testament, John the Baptist baptised people in water in the name of God. In Orthodox Christian liturgies, water is used in baptisms, and holy water is used to cleanse and bless believers. Blessings over waters underline the power of water to cleanse, a belief belonging to ancient traditions in the Mediterranean region (Armstrong and Armstrong 2006: 367–375; N. Papadopoulos 2012: 390–391, 432–433, 456, 510; Papastavrou 2012). There are many blessings for cleansing seafarers, their activities and the tools and products of their craft. In Eastern Orthodox maritime communities, there are also blessings for the construction of sea vessels, the fishermen who sail them and their fishing nets (N. Papadopoulos 2012: 390–391).

In the vitas (biographies) of saints, water—and especially the sea—often take the role of an adversary. In the stories of Moses and Elijah, it is a natural barrier, and in accounts of Saint Brendan and Saint Nicholas of Myra, it is a liquid desert full of arduous trials. Water is ultimately conquered by the prayers of the prophets and saints through divine intervention (Töyräänvuori 2022), a topic discussed in greater detail in later sections. Water is also a means of travelling and an environment for work, shared experience which connected saints to local maritime communities. For example, Saints Peter and Andrew were particularly venerated by maritime communities because they were fishermen both before and while they conducted their apostolic work (Pontifical Council 2023).

Patron saints and sacred material culture

In early Christianity, saints were regular people who were baptised and enlightened by the teachings of Jesus which had spread through his apostles and followers. Many saints from the first several centuries of the new millennium were fishermen and seafaring merchants (Luke 5: 1–11). They spread the new religion by leveraging the advantages of their maritime mobility (Acts 27: 1–2). Many died due to, within or through instruments used on or in water. Some also possessed honorary titles because they either worked at sea or conducted or experienced miracles related to the sea. Saints such as Nicholas of Myra and Mary, the mother of Jesus, are often adopted as patrons and protectors of maritime communities. These religious beliefs and associated stories have also been expressed in Christian material culture, through forms such as the icons used to decorate the walls of churches. The tradition of icons emerged in the early days of Christianity, and it continued throughout the Byzantine and Post-Byzantine eras (Kenna 1985: 364–368).

Cultural forms like icons often possess additional meaning, especially when they are incorporated into rituals and spiritual practices. Such uses make this type of artefact an important part of religious, cultural and social identity, thus aligning Orthodox Christianity with the anthropological concept of 'lived religion'. Religions are understood as 'ways of fabricating networks of relations among human beings, on the one hand, and relations with gods, angels, saints, the afterlife, spirits or ancestors, nationhood, destiny, or providence, on the other'; in 'lived religion', images and artefacts 'work as ways of engaging the human body in the configuration of the sacred' (Morgan 2010: 16; also see Kenna 1985: 367–368). An icon becomes more than a depiction of a saint, as it becomes associated with cultural beliefs, social interactions, ritual behaviours and places for practicing those behaviours.

Saints' icons and symbols in Holy Scripture, art and material culture

Material culture[1] and artistic products[2] related to the lives of saints almost invariably depict the various events and divine interventions which brought them into the Christian faith. Icons typically depict events described in scripture and other Christian texts. Often regulated by theologians and Church leaders, these artworks are known to impact the communities using them quite deeply. For example, an icon of Saint Nicholas showed him miraculously saving a ship's crew from certain destruction; sailors and fishermen felt directly connected to the subject of the icon and prayed to receive his protection when at sea (Morgan 2010: 20–21).

Some of the most important symbols of Christianity are also connected to the sea. The anchor, a symbol of hope (Hebrews 6:19), is often placed on tombstones. Similarly, the fish (ΙΧΘΥΣ in Greek, an abbreviation of Ιησούς Χριστός Θεού Υιός Σωτήρ, which translates as 'Jesus Christ, son of God and saviour') was used by Christians in the era of Roman persecution to mark them as having been 'fished out' of the sea of humanity and saved by the apostles (Luke 5:11; Mark 1:17; Lamberton 1911; Delvoy 1988: 23). In early Christian art, fish represent the souls of the deceased that the Divine Fisherman catches in his net. This assimilation become commonplace in relation to the vocation of the apostles, as the first four were recruited from among fishermen from the lake Genesaret and were later transformed as fishermen of souls (Reau 2000: 102). The fish also takes the form of the dolphin, thought to be the saviour of castaways who swims by the vessel/ship of the church, sometime even carrying the church on its back as a symbol of Christ holding his church (Reau 2000: 102).

Fish and their connection to water are also found in the *Physiologus*, a collection of moralized beast tales with several references to fish and their connection to Christian faith (Sbordone 1936). The compendium is thought to have been written around the third or fourth century AD, although it was initially believed to have been written as early as the second century AD. The *Physiologus* also contains a reference to the *aspidochelone*, a sea monster which tricks sailors into thinking they have found land before sinking their ships; this beast is considered a representation of Satan (Konstantakos 2020: 281).

In the Old Testament, Noah's ark and his God-given mission to save humanity from the flood are symbolically paralleled in the New Testament, where the Church is the ark and assumes its mission to save the human species. Finally, the ship on stormy waters symbolises the Church as it sails towards heaven while facing worldly dangers; Jesus is the captain of the metaphorical vessel, and his lieutenants are the Church leaders and the saints (Lekkos 2015: 8–22). John Chrysostom, an early Church leader who also served as the archbishop of Constantinople and was later canonised as a saint, described the Church as a ship in stormy seas saved from destruction through divine intervention:

> … δέχεται τραύματα, καὶ οὐ καταπίπτει ὑπὸ τῶν ἑλκῶν· κλυδωνίζεται, ἀλλ' οὐ καταποντίζεται· χειμάζεται, ἀλλὰ ναυάγιον οὐχ ὑπομένει·…
>
> … she is wounded yet sinks not under her wounds; tossed by waves yet not submerged; vexed by storms yet suffers no shipwreck … (Papadimitrakopoulou 2009: 153).

[1] These artefacts can be directly connected to the life of a saint, including his or her physical remains, personal belongings, housing, means of travel, tools of work, *etc*. They can also be objects related to miracles and/or teachings of a saint while he or she was alive. Other objects include instruments related to the death of the saint, the location of his or her death or martyrdom, and relics and materials connected to miracles after his or her death.

[2] The most common artistic products are representations of saints and their symbols in portable icons, wall paintings (frescos) or mosaics.

Even today, a building built as a church is compared to a ship: the main architectural component is referred to as the *nave*, a term related to the Latin *navis*, meaning 'ship' (Rabiega and Kobylinski 2018: 207). These examples show water and ships as deeply connected to the Christian faith and its symbolic tradition.

Churches and relics of saints were often destinations of choice for pilgrimages made by local and distant believers alike. These faith-inspired journeys created networks and means of communication that spanned and connected communities, societies and regions (Morgan 2010: 27–28). Pilgrimages were important contributors to and influences on the socio-economic growth of cities, especially those containing sites with religious significance such as Rome and Jerusalem (Bell and Dale 2011: 601–603). In many locations, icons, frescos and other types of artefacts were dedicated to specific saints due to the miracles associated with them. These depictions often contained inscriptions which briefly narrated the story depicted. Such artefacts are found throughout the Mediterranean region (Drewer 1996: 7–9; Gambin 2014: 10–11).

Patron saints of the sea: icons and the maritime element

The following sections review five maritime saints whose patronage is directly associated with scripture and/or can be verified with archaeological data. Particular focus is given to two saints: Nicholas of Myra and Phocas the Gardener.

The Virgin Mary

While Mary's life is not described in any detail in the New Testament or the Apocrypha, a large cult formed around her after the First Council of Constantinople in the fourth century AD. This circumstance motivated the theologians of the era to examine her biblical importance and refer to her as the Virgin Mary in the Nicene Creed. In Greece, starting in early Christianity and continuing in the Eastern Orthodox faith, the Virgin Mary (Παναγία or Panagia in Greek, meaning 'all holy' or 'most holy') was given over 2,500 epithets and 70,000 honorary adjectives which varied by location and time period (Maas 1914; MKPK 2007). Some of her titles, given to her by local communities as a form of endearment and veneration, are directly associated with water. Contemporary examples include Παναγία Γοργόνα (Panagia the Gorgon/Mermaid) and 'Παναγιά Θαλασσινή' (Panagia of the Sea).

An early title, Ζωοδόχος Πηγή ('the spring of life'), relates to Mary's role as the mother of Jesus. This title is attested by the sacred spring and the Church of St Mary of the Spring in Istanbul, Türkiye, which dates to the fifth or sixth century AD (Saint-1475 2023). The veneration of Mary as a patron of maritime communities is reflected in *votive icons* (these are paintings given to a church in honour of prayers answered), which usually depict her accordingly to the content of one of her titles or by referencing a miracle attributed to her intercession. An example is shown in Figure 7.1 (BXM-02267 2023); it is a wooden votive icon dedicated to Mary held in the collection of the Byzantine and Christian Museum of Athens. Mary is depicted on the top half of the icon holding Jesus in the stance of the Οδηγήτρια ('guide'). The bottom half depicts a shipwreck, with men swimming towards the shore and safety. The inscription names Κούρτζουλα (Kurczula) as the site of the wreck, and Ioannis Ardavanis, a sailor from the island of Kefalonia in the Ionian Sea, as the person dedicating the icon to Mary in gratitude for his surviving the shipwreck due to her intercession.

Saint Nicholas

Saint Nicholas (Άγιος Νικόλαος, in Greek) of Myra is one of the most venerated saints in the Christian world (Delehaye *et al*. 1940: 568; Zias 1969: 275–277). He was born in the third century AD in the Patara of Lycia on the Mediterranean coast of Türkiye. He lived during a particularly troubled period for the new religion: the Roman Emperors Diocletian and Maximian had launched the Great Persecution in 303 AD, severely punishing Nicholas and thousands of other Christians for their faith. Nicholas was imprisoned during the persecutions, and he was known as an educated man and a paragon of justice, philanthropy and kindness (Μpakopoulos 2002: 215–216).

While no contemporary documents mention Nicholas, he is referenced in texts dated to about two centuries after his death. One was written by Theodorus Lector between 515 and 520 AD. In the text, Nicholas is described as one of the individuals attending the Council of Nicaea of 325 AD. By the time the *Life of Saint Nicholas of Sion* was written sometime during the second half of the sixth century, there was a martyrium (a church built over the tomb of a martyr) for Saint Nicholas of Myra (Sweetman 2017: 31–32). Given this, it seems likely his cult had already been established by the time the texts were written (Blacker *et al.* 2013: 250).

A later vita of Saint Nicholas is the *Vita Compilata*, an anonymous manuscript from the ninth or tenth century AD. This account is interesting because it combines two vitas: one concerns Nicholas of Myra, the other Nicholas of Sion (Strati 2015: 586). Other early compositions of Nicholas' vita are based on a tenth-century series of books, the *menologion* (a collection of saints' lives) of Saint Symeon the Translator. Symeon's work was translated and included in later vitas such as the scripts of Saint Nicodemus the Hagiorite (Μpakopoulos 2002: 207, 210).

Saint Nicholas would ultimately absorb many of the characteristics and traditions associated with Neptune, the pre-Christian god of the sea (Réau 1955–1959: 361–365). Although it had emerged from the aniconic Judaic tradition, early Christianity embraced the use of icons and imagery as a way of transmitting its most important

Figure 7.1. Portable icon (BXM-02267) depicting Mary holding Jesus (top) and a shipwreck (bottom); it measures 45.0 × 33.0 cm and has been dated to the second half of the seventeenth century. The icon reflects the refined post-Byzantine techniques of the Ionian islands, combining realistic elements from Italian Renaissance art with the late Byzantine techniques used in workshops in Crete and western Greece. The icon is composed of vibrant colours—mainly gold, black, dark green and blue—and is of excellent craftsmanship. Copyright Hellenic Ministry of Culture and Sports—Hellenic Organization of Cultural Resources Development, Byzantine and Christian Museum, and used with permission.

dogmas to recent converts. Paraphrasing earlier Christian scholars in the sixth century, Pope Gregory the Great defended the use of religious images as fulfilling 'a useful and important function: the pictures are made for the instruction of the illiterate' (Barasch 2013: 64). Many artists engaged to make the images were trained in the classical Greco-Roman tradition, and thus they applied well-known, pre-existing models to biblical stories. In this way, the Christian God acquired the attributes of Apollo or Sol Invictus as the new religion spread in Europe. After the Roman Empire made Christianity its official religion, God acquired the image of Jupiter, the main deity. As biblical stories and associated artistic images became codified, artists retained some discretion in how they represented stories associated with saints. As Réau notes, many of the early saints took over the cults of heroes (warriors, protectors, or healers) and minor gods, assimilating not only their physical characteristics and powers but also their attributes. Thus, Saint Nicholas took over Neptune's role.

Saint Nicholas' position as a patron of the sea and sailors is connected to miraculous events from his life and after his death, especially ones described after the tenth-century vita compilations. According to these narratives, when Nicholas decided to sail to Jerusalem, he had a vision of the devil cutting the ropes of his ship; this foretold an upcoming storm, which the saint calmed with a prayer. During the storm, a sailor accidentally fell from the sails to his death. The saint prayed over the body, and the sailor was brought back to life. When the crew of the ship decided to head for their homeland instead of Patara, their original destination, the rudder of the ship broke. The saint prayed once more so they could safely reach Patara (Mpakopoulos 2002: 213–214). In another miracle, the saint appeared on the helm (steering wheel) of a ship and safely guided its crew to his city of Myra (Mpakopoulos 2002: 224–225). Miracles attributed to Saint Nicholas after his death include his delivering the crew of a ship from malicious demons. He also saved a man drowning in a storm; he miraculously brought the man back to his house, wet from the stormy waters but otherwise unscathed (Mpakopoulos 2002: 226–228).

Based on his life, miracles and popularity among maritime communities throughout the Mediterranean, Saint Nicholas has been considered the patron saint of the sea and its workers since the Mediaeval era. His veneration flourished well before the Great Schism broke the communion between the Roman Catholic and Eastern Orthodox Churches in 1054, and it continued afterwards in Eastern Orthodox Christianity. Churches were built in his honour near the sea, and small wooden icons depicting him are used to this day on boats and ships to honour him and gain his protection (Blacker *et al*. 2013: 249–251).

In Greece, Saint Nicholas is considered the guardian of the Hellenic navy, and as such, he is honoured with celebrations on his feast day (December 6th) and by the use of his name and image on sailing vessels. After the construction of every vessel is completed, blessings are read, and they invoke his name specifically (N. Papadopoulos 2012: 390–391; *Άγιοι Προστάτες των επαγγελμάτων* 2016: 48–49).

In Eastern Orthodox iconography (the use of visual images and conventions to convey cultural ideas), Saint Nicholas is typically depicted as a bishop, and he is usually near ships. These visual choices refer to episodes from his life and associated miracles, and they signify his status as the protector of sailors. Interestingly, in his physical depiction, his physiognomy usually combines the features of two saints: Nicholas of Myra and Nicholas of Sion. This phenomenon becomes evident starting in the tenth century, and it originates in the aforementioned unification of the vitas for the two saints (Strati 2015: 586–589).

Beginning in the tenth century AD, the life episodes in the depictions of Saint Nicholas start to follow the details of his vita as found in the narrations of Saint Symeon the Translator. These episodes show themes not present in portable or monumental depictions before Symeon's time (Skavara 2005: 81). The scenes in this depiction are complex, greatly varied, and derive from Nicholas' life and miracles, a fact which endures even during the post-Byzantine era throughout the entirety of the Balkan region (Skavara 2005: 80–81). Despite the use of different artistic styles and the wide geographic range of manufacture and use, these depictions exhibit a thematic and chronological continuity which goes hand in hand with the post-ninth century scriptural references to the saint (Zias 1969b: 276–277).

In southern Albania (*e.g*. Gjirokastër) and northwestern Greece, icons and frescoes combine simple linear designs with expressive eyes and lighted faces, characteristics also found in the fourteenth-century visual depictions of Saint Nicholas at the Church of St Nicholas of the Roof near Kakopetria, Cyprus (Skavara 2005: 91–93). Particularly in northwestern workshops, these characteristics reflect the combination of older and newer techniques and style, while also incorporating methods from the schools of artists in northwestern Greece and Crete. These phenomena show the endurance of artistic themes and techniques in Orthodox Christian hagiography, despite political and societal change, implying the formation and endurance of networks for communication and interaction between communities (Skavara 2005: 92–93).

Starting in the fifteenth century, the Greek northwestern region of Kastoria was home to Christian art workshops which became renowned throughout the region. An example of these workshops comes from the fourteenth-century icon of the life of Saint Nicholas at the Church of Saint Nicholas in Dragota, Kastoria in Greece. The icon includes the miracle of Saint Nicholas on a ship travelling towards Jerusalem, in which he calmed a storm (Strati 2015).

The miracles connected to Saint Nicholas continued to be depicted in post-Byzantine art, often 'vita icons', based on details from the combined vita. A 'vita icon' is the image of the life of a saint which typically consists of a large central portrait surrounded by episodes from the saint's biography. For example, in the early seventeenth-century church of Saint Nikolaos at Sarakinishte of Lunxheri in southern Albania, we find scenes of Saint Nicholas' life, including some of his miracles near the sea and on ships (Skavara 2005: 85, 86, 89, 92). In this church, the Artemis miracle, in which Saint Nicholas demolished through prayer a temple of Artemis, the chaste Greek goddess of the hunt, also appears in the early eighteenth-century church of Saint Nicholas in Petra on the island of Lesvos in Greece. This is directly related to the fourteenth-century Holy Church of Saint Nicholas Orphanos in Thessaloniki, Greece. Interestingly, this once again highlights the enduring artistic traditions regarding depictions of Saint Nicholas, as well as the networks of communication between distant Christian communities within which these traditions were transferred (Sakellariadi 2018: 266).

In the collection of the Athens Byzantine and Christian Museum, there is a portable wooden icon of Saint Nicholas (Figure 7.2; see BXM-13185 2023). Chronologically, it is placed at the end of the seventeenth or the beginning of the eighteenth century. This vita icon was chosen for this study because its depiction follows the saint's life as described in vitas written after the ninth century. The correspondence between visual depictions and textual descriptions confirms the continuity of the tradition across a span of many centuries.

The icon contains three rows of images. Each consists of three small scenes, for a total of nine images. Starting from the top left, the beginning of the saint's pastoral work is depicted with his ordination. Next to it is an example of his charity: he gives a pouch filled with coins to the father of three poor sisters who lie in bed. The third image shows the saint's religious zeal, which inspires him to destroy false idols.

The second, central, row contains the main image of Saint Nicholas in its middle position; he is depicted seated on his bishop's throne, and he blesses the viewer. In this row are two miracles performed by the saint on the sea. To the left, he saves a sailor from drowning; to the right, he saves the crew of a ship from a storm caused by malevolent spirits. It is not a coincidence these miracles have been placed in the central row, as they refer directly to the saint's association with the sea and his patronage of sailors.

The third (bottom) row is dedicated to the saint's righteousness and his disdain of injustice. In the centre image, the saint intervenes in the wrongful accusation and attempted execution of three innocent men, generals of Emperor Constantine the Great. When the generals returned to the Emperor after successfully quelling a revolt, they were wrongfully accused of treason by an imperial adviser. Remembering the saint's righteousness, the three generals prayed to him for help. The saint answered their prayers by appearing in the dreams of the emperor and his adviser, threatening them with divine retribution if they wrongfully executed the generals. To the left, the saint warns to the emperor as he sleeps. To the right is the result: the emperor, after heeding the saint's warning and admiring his righteousness, frees his generals and also orders the creation of a golden crosier and decorated gospel as gifts for Saint Nicholas. The freed generals depart for Myra to become monks in order to venerate their benefactor.

Saint Phocas the Gardener

Saint Phocas (Άγιος Φωκάς, in Greek) the Gardener lived in the fourth century AD in Sinop, a city located in what is today northern Türkiye. His name possibly derives from the ancient Greek word φώκη, the aquatic mammal 'seal'.

His identification is debated, since there was also a Saint Phocas who was the bishop in Sinop in the first or second century AD, and the written references to their lives overlap. The earliest account of the saint's life is a homily (sermon) written by Saint Asterios of Amasea in the fourth-to-fifth centuries AD. In the homily, the saint's life is described in detail. He is presented as a humble and charitable man known for helping lost sailors. During Trajan's persecutions of Christians in the first-to-second centuries AD, the saint was marked for execution, so imperial soldiers sought him in Sinop. On finding Phocas, they asked him for directions and explained their mission, at which point he offered to host them in his house for the night and promised to assist them. The next morning, Phocas dug his own grave in his garden, and he surrendered himself to the shocked and now-reluctant soldiers. The saint, however, insisted they carry out their duty and requested they bury his body in his garden. The soldiers respected these wishes (Foskolou 2018: 319–320).

According to Saint Asterios, sailors venerated Saint Phocas and created songs based on the homily about his life. He was honoured by sailors in a region which spanned from the Black, Adriatic and Aegean Seas to the ocean to the west and the bays of the eastern lands (Foskolou 2018: 319–320). However, the cult around the saint declined around the ninth century, while the cult of Saint Nicholas of Myra gained in popularity. This circumstance perhaps occurred because Saint Nicholas' feast day (December 6th) was connected to the turbulent weather of the winter season, something that made his protection quite valuable and directly connected to the needs of sailors (Olgun 2022: 75–76).

The designation of Phocas the Gardener as a patron saint of sailors is attested by a documented tradition in the eastern Mediterranean which emerged after the saint's miraculous interventions in saving seafarers. Sailors, considering the saint to be a member of their crew, would split a share for him, bought every day by a different sailor. Once the ship reached port, they would donate the sum of money

Figure 7.2. Portable icon (BXM-13185) depicting Saint Nicholas and scenes of his life. It measures 74.2 × 50.0 cm and has been dated to the end of the seventeenth or the beginning of the eighteenth century. The icon shows the very fine post-Byzantine technique of the Cretan school of artists, incorporating older linear techniques and vibrant colours such as gold, white and red, with the long figure technique of the Italian Renaissance. It was produced by the Cretan artist Μόσκος Ιωάννης (Moskos Ioannis). Copyright Hellenic Ministry of Culture and Sports—Hellenic Organization of Cultural Resources Development, Byzantine and Christian Museum, and used with permission.

collected for the saint's share to charity and ask for his patronage and protection (Saint-2483 2023).

The saint's patronage is attested by various forms of material culture associated with pilgrims in the eastern Mediterranean. For example, he is mentioned in graffiti dated to between the fifth and seventh centuries on the natural southern port of the island of Syros, in Cyclades, Greece. These inscriptions are devoted to Saint Phocas, and they include invocations to the saint's assistance, including a prayer to save a ship named *Maria*. The saint's patronage is also attested by a sixth-to-seventh century AD clay medallion which depicts Saint Phocas wearing a sailor's clothes, while standing on the deck of a boat in a praying stance. The clothes and the boat symbolise and highlight his patronage (Foskolou 2018: 319).

Within the context of pilgrimages made during the Mediaeval era, a type of artefact known as *ampullae* was widely circulated. These were flasks, often containing holy water or oil from different pilgrimage sites. A collection of these artefacts is currently held in the Art Museum of Princeton University. One such flask, dated to the sixth century AD, is dedicated to Saint Phocas, as it contains imagery of boats in hagiography connected to the saint; it is made of terracotta and originates from Asia Minor (Abramowitz 2022: 3, 6).

Saints Spyridon and Theodora in Corfu

Saint Spyridon (Άγιος Σπυρίδων, in Greek) was a bishop from Cyprus in the third or fourth centuries AD. Accounts of his life describe him as an ethical person of deep faith who performed miracles. After his death, his body was transferred to Constantinople to save it from a raid on the island of Cyprus. After the fall of Constantinople in 1453, his relics were moved to the island of Corfu in Greece, where they are still kept to this day. He is named as a protector of the island in liturgical texts dating to 1674. Miracles attributed to his intervention occurred on multiple occasions of disaster, especially in the Ionian Sea during the eighteenth century, and this established him as a patron saint of the island of Corfu (Mpitha 1995: 163–167; Saint-3247 2023).

His designation as the protector of the maritime community of the island of Corfu is attested in locally produced artefacts. Examples include two portable icons devoted to Saint Spyridon in the collection of the Christian and Byzantine Museum of Athens. The first icon (Figure 7.3; see BXM-02073 2023) is from the late seventeenth century. Its centre depicts a galley in stormy water; however, to the right at the top of the scene, Saint Spyridon is seen blessing the ship. According to the icon's inscription, it is a votive of a man named Avgoustinos (Αυγουστίνος, in

Figure 7.3. Portable icon (BXM-02073) depicting a miracle by Saint Spyridon. It measures 21.5 × 32.0 cm in size and is dominated by the colours red and light and dark blue. The icon's production in the Ionian islands (Greece) is attested by the use of western Greek techniques. Copyright Hellenic Ministry of Culture and Sports—Hellenic Organization of Cultural Resources Development, Byzantine and Christian Museum, and used with permission.

Greek) from the island of Corfu, Greece, who was saved from a shipwreck and devoted the icon to Saint Spyridon for his miraculous intervention. This votive icon connects the saint to the sea and his patronage to the Ionian islands, especially Corfu.

The second icon (Figure 7.4; see BXM-10817 2023) further solidifies the saint's connection to the sea. The icon in its current, restored, form shows Saint Nicholas enthroned and dates to the seventeenth century. However, in the eighteenth century, a newer layer depicting Saint Spyridon was painted over this image; it has since been removed.

Why an image of Saint Spyridon was painted to cover one of Saint Nicholas has not been explained. However, we might speculate, based on the aforementioned information, that the islander community of Corfu considered Saint Spyridon their patron because he was believed to have performed miracles for Corfu and the Ionian Islands region. Based on this observation, this icon suggests the Christians of Corfu reprioritised the two saints in their patronage of maritime Christian communities in the Ionian Islands region.

Along with Saint Spyridon and Saint Nicholas, Saint Theodora is another patron of the maritime community of Corfu. She was Regent and Empress of the Eastern Roman Empire, and an important figure in the history of Christianity.

During the eighth and ninth centuries, politicians and religious leaders fought one another over the religious significance of iconography and the potential classification of icons as idols, whose use and veneration was specifically prohibited in the Christian faith. These arguments came close to civil war in the Eastern Roman Empire. Countless portable icons were shipped to remote locations for safekeeping; others were destroyed, and some were painted over. Many frescos did not survive. However, Theodora managed to restore the honouring of icons after summoning a council on 11 March 843. To this day, during Lent, the Sunday of Orthodoxy honours the re-establishment of icons in the liturgical life of the Church. For this reason, Saint Theodora is honoured in the Eastern Orthodox Church. Her relics are currently kept in Corfu (Saint-3639 2023).

In the icon shown in Figure 7.5 (BXM-01566 2023), Saint Theodora is depicted on a throne, in imperial attire, holding an icon of Mary and Jesus. This imagery references her role in re-establishing the honouring of icons. The icon has an interesting detail: under the saint's feet, there is a small crest depicting a ship, the emblem of Corfu (Mpitha 1995: 164). This symbolises her patronage of the island.

Conclusions

As mentioned at the beginning of this chapter, in Christian spirituality, faith is associated with material realities. From water itself, blessings and rituals, to depictions of saints and their lives, the materiality entangled with the Eastern Orthodox Christianity is ever present and impactful. The material culture used for spiritual practices and veneration holds agency and deeply affects believers and their respective communities. These artefacts provide a narrative of their own, acting as agents of historical, religious and cultural continuity regardless of their origin or time of creation (Shanks 1998; Rountree *et al*. 2012: 8–12).

The longstanding traditions of venerating saints through their icons, rituals and activities as illustrated with the cases of Saints Nicholas and Phocas are indicative of the vastness and the persistence of the social, cultural and trading networks between different maritime communities across the eastern Mediterranean and beyond (Sweetman 2017: 6–8). The cult of Saint Nicholas was so popular, it eventually reached northeastern Europe. He became established there as the patron of the Hanseatic League, and cathedrals and churches in Lübeck, Stralsund and Wismar (Germany) were dedicated to him starting in the twelfth century (Mehler *et al*. 2016; Friedel 2017; Rösch 2021).

The topographical spread and continuity of religious material culture such as the vitas and blessings asking for the intercession of different maritime saints, the complex yet enduring iconography of Saint Nicholas, the votives to Virgin Mary, Saint Nicholas and Saint Spyridon and, finally, the traditions surrounding Saint Phocas show not only the agency of religious material culture, but also the connectivity and chronological continuity of the associated beliefs and traditions between different maritime communities. The connectivity between harbours and ports in combination with network theories, as used in Sweetman's research in the eastern Mediterranean, could be used in future studies to assess the extent of the cults of the saints of the sea in southern and northern European societies (Noble and Smith 2008: 581–605; Leidwanger and Knappett 2018: 1–21).

Tracing the cults of maritime saints in scriptural, textual, archaeological and artistic data shows promise for future interdisciplinary research. This introductory study is a small but hopefully positive contribution in our understanding of how past maritime communities perceived the divine, how it affected their material culture and how it can define and shape their maritime cultural identity to a significant extent. Future research should include a robust methodology for the study of iconography (*e.g*. Walker Vadillo and Walker Vadillo 2022) and apply it to a robust sample of iconographic material from Greek and Eastern Orthodox practices. This could also be expanded to Catholic practices, either through comparative analysis or independent study, for example, highlighting the use of votive offerings in the churches of fisherfolk communities (see the study by Armendariz 2009 for an example).

Figure 7.4. Portable icon depicting an enthroned Saint Nicholas (BXM-10817). It had been painted over with a depiction of Saint Spyridon; the newer image has since been removed. The icon measures 123.0 × 78.0 cm in size. It is predominantly gold, white and red in colour, and western Greek workshop techniques are well incorporated with the Italian style. Its place of origin is Messina, Sicily. Copyright Hellenic Ministry of Culture and Sports—Hellenic Organization of Cultural Resources Development, Byzantine and Christian Museum, and used with permission.

Figure 7.5. Portable icon (BXM-01566) depicting Saint Theodora. The detail under her feet shows a crest with a ship. The icon measures 40.5 × 29.0 cm, and its colours are mainly shades of red and gold, the colours of royalty. Its construction displays the notable skill and technique of the Cretan artist Εμμανουήλ Τζάνε (Emmanuel Jane). It is dated to 1671. Copyright Hellenic Ministry of Culture and Sports—Hellenic Organization of Cultural Resources Development, Byzantine and Christian Museum, and used with permission.

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8

Ancient sculptures lost at sea: stories of loss and discovery

Katerina Velentza

Abstract: This chapter explores stories of loss and discovery of ancient sculptures in the Mediterranean Sea from the period of Classical Antiquity until today. Through the study of archaeological evidence, literary sources, historical records, contemporary art and popular culture, this research demonstrates the continuity in the reception of sculptures from the waters of the Mediterranean Sea over the centuries. From the period of Classical Antiquity to Mediaeval times and from the shipwrecks of the 'Grand Tour' period to the most recent archaeological discoveries, incidents of underwater deposition, discovery or recovery of sculptures have instigated strong feelings of catastrophe, mystery and wonder in both pre-modern and modern narratives. These emotional and conceptual associations have shaped long-term attitudes towards sculptures from under water in the stories and traditions of multiple eras. Through the study of sculptures from under water, this chapter addresses issues of public perception and portrayal of underwater archaeology. The overarching aims of this research are to comprehend more fully human interconnections with the underwater environment and to advocate for greater care in conducting and presenting underwater archaeological research to the public today and in the future.

Introduction

Humanity has always had a special bond and dependence on the sea (Horden and Purcell 2000; Omstedt 2020). Since prehistoric times, the sea has been a space of communication and connection, as well as a divider. It has been a source of both livelihood and disaster. It has had a deep emotional and societal meaning for people, while its mysterious waters have inspired, over the centuries, wondrous adventures and innovations, as well as stories and feelings of catastrophe and chaos (Strang 2004: 50–51; Phelan 2007; Lampinen and Mataix Ferrándiz 2022: 1–8).

Similarly, most cultures have conceived the underwater world as a place of wonder, adventure and risk. This perception of the underwater environment as something extraordinary created thrilling tales of domination during Classical Antiquity. An example is the fascinating story of Alexander the Great going under water in the Mediterranean in a glass bathyscaph to prove his supremacy (see [Pseudo-]Callisthenes, *Historia Alexandri Magni* 2.38); this tale parallels underwater exploration and treasure-seeking narratives of the modern era, especially from the middle of the twentieth century (Bass 1966: 22; Muckelroy 1978: vii; Earle 1986: 68–72; Green 1990: 2–3; Burrows 2010).[1] Despite the efforts of many scholars to define clearly the academic and theoretical background of the discipline of maritime and underwater archaeology in ways which disassociate it from the earlier adventure-seeking and treasure-hunting connections, the thrill which the underwater world incites continues to foster misrepresentations of underwater archaeological discoveries as treasure salvage even today (Du Plat Taylor 1965; Bass 1966; Muckelroy 1978; Adams and Rönnby 2013; Maarleveld *et al*. 2013; Gately and Benjamin 2018).

As George Bass, the pioneer of maritime archaeology, once stated, 'everything made by man was carried at one time or another in a ship or was simply lost at sea somehow, fell accidentally or were placed purposefully in the water' (Bass 1966: 17). Ancient Greek and Roman sculptures have been such objects, lost at sea and recovered from its depths throughout the centuries. From the sixteenth century until today, hundreds of ancient sculptures of various dates, types, sizes and materials have been retrieved from the Mediterranean seabed by early underwater explorers and archaeologists or simply by fishermen, sponge divers and recreational scuba divers (Velentza 2022). Given the special artistic value of these artefacts, sculptures from under water have been seen by scholars and the general public alike as exceptional objects evoking mystery, adventure and lost treasure. The fascinating idea of discovering and recovering ancient sculptural works of art from the water has also stimulated local enthusiasm and pride (*e.g*. Rackl 1978; Stenuit 2002; Petriaggi 2005; Queyrel 2012; Bellingham 2014; Koutsouflakis and Simosi 2015). More recently, the romanticism accompanying underwater

[1] The wider exploration of the underwater world started with the invention of the diving equipment known by its acronym, SCUBA (Self-Contained Underwater Breathing Apparatus), and more specifically, with the type known as 'aqualung' invented by Emile Gagnan and Jacques-Yves Cousteau in 1942. This safer and lighter apparatus made it possible for divers to spend more time under water and avoid the life-threatening dangers of helmet diving.

sculptural finds has inspired contemporary artists, who display their sculptures under water or use the idea of discovering ancient sculptures under water as part of their artistic narratives (*e.g*. Hirst 2017a).

Recent analysis of 110 Mediterranean underwater deposits with ancient sculptures of various types and materials showed these artefacts were lost or deposited under water for various reasons across a wide period of time, ranging from the time of Classical Antiquity to the nineteenth century AD (Velentza 2022: 61–63). The same study showed that most of the ancient Greek and Roman sculptures from the waters of the Mediterranean were found accidentally, by chance rather than in archaeologically organised operations (Velentza 2022: 12–35). These circumstances of discovery, along with the lack of archaeological means for scientifically investigating underwater archaeological contexts until the second half of the twentieth century, have been the main reasons for the different perceptions of sculptures found under water, as compared to artefacts found on land. However, there is evidence that long-term attitudes towards objects found under water, especially sculptures, likely shaped and defined the perception of underwater sculptural finds in modern thought.

This chapter explores narratives of loss and discovery of ancient sculptures in the Mediterranean Sea from the period of Classical Antiquity until today. The analysis starts with a discussion of ancient literary sources and pre-modern historical records which refer to underwater depositions or discoveries of sculptural pieces in the Mediterranean region. Stories from preserved ancient and Mediaeval texts, combined with preserved iconographic and material evidence, unveil how people of the Mediterranean past perceived and dealt with the underwater loss and discovery of sculptures. Next, the focus turns to modern accounts of underwater sculptural depositions and discoveries from the eighteenth to the twenty-first century. This analysis includes the 'Grand Tour' shipwreck of Lord Arundel's sculptures, Lord Elgin's sunken sculptural collection, early underwater exploration missions in the ancient Antikythera shipwreck and the site of Artemision and chance sculptural finds such as the Riace bronzes and the 'Dancing Satyr' of Mazara del Vallo. As this chapter will demonstrate, the interpretations and stories of catastrophe and wonder attending the discovery of ancient sculptures under water draw immediate connections to pre-modern narratives. The chapter concludes by exploring how the rendering of the sea as both a wondrous and catastrophic sphere has impacted the work of various contemporary artists. Examples such as Damien Hirst's 2017 exhibition and film 'Treasures from the Wreck of the Unbelievable' and Luca Guadagnino's 2017 film 'Call Me by Your Name' present astonishing links to ancient and post-Classical narratives. These works thus illustrate the various influences that the extraordinary underwater archaeological record has had, not just on modern archaeological scholarship but also contemporary art, popular media and culture.

This analysis highlights the continuity in the reception of sculptures from under water throughout time, from the ancient Mediterranean to the modern world. Hence, it shows that the current association of ancient sculptures from the sea with strong feelings of mystery, romance, wonder and pride are not solely based on the modern circumstances of sculptural discoveries. On the contrary, this association has been influenced by pre-modern narratives and earlier considerations of sculptures from under water which have been cultivated by different societies for centuries.

In its conclusion, this chapter addresses more widely the issues of public perception and portrayal of underwater archaeology in the modern era. Through narratives related to sculptures from under water, the study traces more extensive patterns of cultural and conceptual understandings of loss and discovery in the sea. These patterns can help maritime archaeologists understand the deeper human interconnections with the underwater environment across different periods of time, insight which will enable them to portray and safeguard underwater archaeological finds more effectively according to the scientific principles of the discipline.

The loss and discovery of sculptures in classical and pre-modern narratives

Classical Antiquity

Starting with the period of Classical Antiquity, the loss of sculptural artefacts under water due to natural disasters, shipwrecks and human actions are reported in ancient textual sources and iconographical representations.

Strabo, in his work *Geography*, describes how a bronze statue of Poseidon was lost at sea in the strait near the Greek city of Helice in the Peloponnese in 373 BC due to an earthquake and subsequent tsunami. During the incident, the entire city was submerged. Strabo recorded the following:

> For the sea was raised by an earthquake and it submerged Helice, and also the temple of the Heliconian Poseidon …. Helice was submerged by the sea two years before the battle at Leuctra. And Eratosthenes says that he himself saw the place, and that the sailors say there was a bronze Poseidon in the strait, standing erect, holding a hippocampus [seahorse] in his hand, which was perilous for those who fished with nets (Strabo, *Geography* 8.7.2).[2]

One of the most interesting aspects of the story is its description of sailors talking about the statue of Poseidon as a danger for those who fished with nets because of the way it was deposited in the sea. The account is particularly

[2] This passage from Strabo and the other ancient textual sources cited in this section were translated by the author.

valuable because it reveals how the loss of a sculpture under water survived in seamen's tales. Because statues were considered images and personifications of actual gods in ancient thought, the underwater existence of Poseidon's statue was associated with catastrophe (the earthquake and tsunami), as well as generic danger and fear of how the god might react to the boats sailing over him.

Lucian, in his second-century AD work *Zeuxis*, describes how a 'picture' (*εἰκών* in Greek, usually meaning a sculpture) was wrecked on a ship transporting it as plunder from Athens to Italy after the sack of that city by Sulla in 86 BC:

> There is a copy of the picture now at Athens, taken exactly from the original. The latter is said to have been put on a ship sailing for Italy with the rest of Sulla's art treasures, and to have been lost with them by the sinking of the ship, off Malea, I think it was. (Lucian, *Zeuxis* 3)

The catastrophic shipwreck took place off Cape Maleas in the southern Peloponnese, Greece, a site notorious for its bad weather. Significantly, it is located close to the area where the first-century BC Antikythera shipwreck was discovered in the 1900s. Due to this geographical proximity, Lucian's story has been an important basis for scholarly interpretations of the transport of sculptures found in the Antikythera ship (Velentza 2022: 13–15).

In his *Description of Greece*, written in the second century AD, Pausanias described how the people of Thasos threw the statue of the athlete and Olympian winner Theagenes into the sea after his death because of a 'dispute' between the sculpture and some of Theagenes' enemies:

> When he [Theagenes] departed this life, one of those who were his enemies while he was alive came every night to the statue of Theagenes and whipped the bronze as though he were hurting Theagenes himself. The statue put an end to the outrage by falling on him, but the sons of the dead man prosecuted the statue for murder. So, the Thasians dropped the statue to the bottom of the sea (Pausanias, *Description of Greece* 6.11.6–8).

As the story continues, the Oracle of Delphi instructed the Thasians to retrieve the statue from the sea to save the island from famine. It was apparently difficult for the Thasians to conceive of a method of retrieving the statue from under water. When they could not think of a plan and had given up, some fishermen unexpectedly caught the statue in their nets and brought it back to land. Hence, the story by Pausanias presents both the catastrophic but also redemptive nature of depositing a sculpture under water, while at the same time highlighting the challenges and supernatural aspects of a sculpture's recovery from the seabed.

A similar scenario of a discovery or recovery of a statue from under water is represented by a first-century BC stone sculptural relief found near the temple of Hercules in Ostia, Italy (Museo Ostiense, Inv. No. 157; Boin 2010: 258–264, Fig. 7; Santangelo 2013: 78–79, Fig. 3.1; Kloppenborg 2018: 581, Fig. 4). The relief, which must have been a sculptural dedication, contains a depiction of a group of fishermen who drag a male sculpture from the sea. The sea is represented by sculpted fish and boats. The retrieved statue is depicted in a posture similar to that of other Classical sculptures, including the bronze statue of a god retrieved from the sea off Artemission in Greece (Bass 1966: 72; Rackl 1978: 57; Parker 1992: 60; Hemingway 2004: 35–40; Arata 2005: 146–147; Tzalas 2007: 350–353), the 'Poseidon of Livadostra' (Mattusch 1988: 4–5, 79–80; Kaltsas 2002: 86; Arata 2005: 172; Tzalas 2007: 343–344) and other statuettes of Hercules and Zeus.[3] It is not clear why this depiction was sculpted in the relief or who the sculpture actually represents. Based on its style and features, Hercules or various deities have been suggested (Becatti 1938–1939: 40; Boin 2010: 260–261). It is also not clear from the representation or the inscription why the sculpture was under water. Was this incident a myth or a true event? Was the statue found by accident, was it lost or deposited and then retrieved? And was the sculpture dedicated in Ostia? And if so, was that before or after its recovery from the seabed? Despite all these unanswered questions, the plain existence of this representation on this Ostia relief highlights the importance and wondrous aspects of a sculpture's discovery and/or recovery from under water, as well as the supernormal effort required by the fishermen to bring the statue on land.[4] Additionally, this representation of a retrieval of a statue from the sea by fishermen with their nets confirms the existence of distinct provisions and techniques for the salvage of sculptural material from the Mediterranean seabed in case of an underwater loss.

Mediaeval times

Stories of loss and discovery of ancient sculptures under water are also preserved from the Mediaeval times. For example, Chapter 43 of the eighth- to ninth-century AD text *Parastaseis syntomoi chronikai* (*Παραστάσεις σύντομαι χρονικαί*, meaning 'brief historical notes') mentions the theft and subsequent loss at sea of a late antique porphyry statue with three heads depicting the Emperor Constantine and his sons Constans and Constantius (Nicetas Choniates, *Historia* xxiv.181, 648.1751–655.1772; Mango 1963: 55–

[3] For examples, see the bronze statuettes of Hercules in the collection of the Metropolitan Museum of Art in New York, accession numbers 96.9.273 and 28.77; the 'Zeus of Ugento' in the Museo Archeologico Nazionale di Taranto; and 'Zeus, Thunderbearer', Ident. Nr. Ol. 12701, in the Staatliche Museen zu Berlin.

[4] Becatti (1938–1939) suggested the discovery of a statue from under water would have been a *monstrum*, namely, a sign which indicated that the harmony between gods and men was out of balance; such a circumstance would have required the intervention of a priest to interpret the sign and propose a remediative course of action.

75; Queller and Madden 1997: 138; Cameron and Herrin 1984: 31–34, 48–50, 167–277; Bassett 1991: 87–88). More specifically, the narrative says:

> And the porphyry statue (*zodion*) there of three stones with three heads, which some said was of Constantine the Great in the middle, Constantius on the left and Constans on the right, with two feet, but six hands—a strange spectacle (*theama*) for those who saw it, each one looking in a different direction—and one head. But once there was a fire in this place, and while everyone was busy (so to speak) that extraordinary thing was stolen, in the reign of Theodosius II (408–50) …. Those who dared to do this were not able to remove it to their own country but were overtaken by the emperor's boat and did away with themselves; they cast both the spectacle (*theama*) and themselves into the sea and drowned (*Parastaseis* B 174.43).[5]

Despite the best efforts of sailors 'with rope-baskets' and divers commissioned by the emperor Theodosius, the statue was never retrieved. Its permanent loss at sea was said to have made the emperor extremely angry.

Another story of a Mediaeval underwater deposition and recovery of a late antique statue comes from the Italian town of Barletta on the coast of the Adriatic Sea (Johnson 1925: 20–25; Koch 1926: 20–27, plates 20–21; Kiilerich 2016: Figs. 1 and 3). According to local tradition, a larger-than-life-sized bronze statue of a man known as the 'Colossus of Barletta' was found in a Mediaeval shipwreck, probably a Crusader ship bringing material to Italy after the 1204 sack of Constantinople (Mango 1963: 55, 68; Magoulias 1984; Queller and Madden 1997: 160, 195; Harris 2003: 14, 169, 186; Phillips 2005; Kiilerich 2018: 55–56, 68–70). The statue was supposedly found in the Adriatic Sea in 1309 and brought to the harbour of Barletta shortly afterwards (Kiilerich 2018: 55). Due to the early date of the discovery, the exact origins and circumstances of the underwater deposition were never investigated and thus cannot now be reconstructed with any certainty. However, the mystery and romanticism surrounding the discovery of the Colossus of Barletta have deeply influenced the local culture and traditions (Kiilerich 2018: 69, Figs. 11 and 12). This can be seen through the position given to the now-restored statue, which has stood outside the Basilica del Santo Sepolcro at the centre of the town since the fifteenth century.[6] Moreover, the impact of this underwater sculptural discovery is highlighted by a surviving local folktale about the mysterious giant of Barletta, a beloved character who watches over and protects the city and its inhabitants. An illustrated version of this fascinating local story was published by DePaola (1984).

[5] Translation by Cameron and Herrin 1984: 117–119.

[6] According to Kiilerich (2018: 55, Fig. 2), the statue was initially placed in front of the Sedile del Popolo in 1491, but when the Sedile was demolished in 1923, the statue was moved to its present location in front of the Basilica del Santo Sepolcro.

The loss and discovery of sculptures in the modern era

The stories associated with the submersion and underwater discovery of ancient sculptures do not stop at the Mediaeval era. Since the start of European Antiquarianism and the period of the 'Grand Tour', there are surviving reports of archaeological discoveries of ancient sculptures which were found on land but ended up under water during their transport to northwestern Europe. Additionally, from the sixteenth century onwards, hundreds of ancient sculptures have been discovered, primarily on the Mediterranean seabed in the context of ancient shipwrecks or other sites (Velentza 2022: 12–35). These discoveries have deeply impressed the public imagination in the nearby regions, making the statues objects of local pride. At the same time, as it will be explained, the highly emotional and impactful nature of underwater sculptural discoveries has influenced twenty-first-century artists, who have displayed their works of art under water or included the loss and discovery of sculptures from under water in their artistic storytelling.

'Grand Tour' losses and recoveries

The development of European Antiquarianism and the 'Grand Tour' initiated a large-scale shipping of ancient sculptures to northwestern Europe between the seventeenth and nineteenth centuries (Black 1985: 226–229; Trunk 2003: 257; Coltman 2009: 117–158). The 'Grand Tour' was a touristic movement in which wealthy European elites visited the Mediterranean region to see the monuments of the ancient Greek and Roman civilisations. One of its main elements was the acquisition of ancient art from the places visited (Sweet 2012: 2–3; Spivey 2013: 314). Architectural remains and sculptures were the most popular pieces transported for the collections of touring European elites (Spivey 1996: 225; Sweet 2013: 59–61). The collection and long-distance movement of ancient works of art and sculpture was performed mainly by ships; these sometimes wrecked, taking with them the ancient artefacts which they carried (Coltman 2009: 119).

One of the earliest recorded submersions of this type was the seventeenth-century shipwreck of the Arundel collection. This underwater loss involved ancient stone sculptures from terrestrial sites in Asia Minor lost under water during their transport to London for the collection of Lord Arundel (Velentza 2022: 10–11). William Petty, who was in charge of the collection and oversaw its transportation, shipwrecked somewhere in the Aegean Sea along with the collected sculptures; upon his rescue, he was arrested as a spy (Angelicoussis 2004: 143–159; Vickers 2006: 8). After his release from prison, Petty conducted salvage operations to recover the sunken marbles, which arrived in London in 1627 (Vickers 2007: 29–32). The sculptures of the Arundel collection are currently in the Ashmolean Museum, Oxford, UK, and the degradation of their surfaces due to their submersion is still visible.

Lord Elgin's ship, the *Mentor*, carried 17 crates of antiquities from Greece, including sculptures from the Acropolis of Athens. In the nineteenth century, the *Mentor* suffered a fate similar to that of Lord Arundel's ship. The *Mentor* wrecked off the Greek island of Kythera in 1802, along with her cargo (Throckmorton 1970: 163–168; Lianos 1983: 25; Kourkoumelis and Tourtas 2014: 6–7; Velentza 2022: 11). Although no passengers or crew died in the wreck, the loss of the antiquities she carried was a catastrophic loss and huge financial blow for Lord Elgin, who organised a two-year salvage operation to recover as much of the ship's cargo as possible and transport the sculptures to their final destination in Britain (Throckmorton 1970: 166–168; Lianos 1983: 26). Some marble sculptural pieces from the Parthenon, currently held in the Acropolis Museum in Athens with signs of marine degradation could have been subjects of this underwater deposition during the nineteenth century (Figure 8.1).

These stories of the underwater deposition and later recovery of ancient sculptures are not well known. However, surviving records indicate that the collectors and salvagers involved in these incidents saw the sea as a repository of treasure so valuable it could not be allowed to remain lost. In conjunction with the surviving pre-modern narratives examined previously, these encounters significantly influenced how ancient sculptures from under water were handled and interpreted by scholars and the general public in the context of the archaeological discoveries which surged after the twentieth century.

Underwater archaeological discoveries

Sculptures have been found in the Mediterranean Sea since Classical Antiquity and Mediaeval times. However, the first discovery of an ancient sculpture from under water with antiquarian interest did not occur until the sixteenth century. The incident involved the retrieval of the Livorno sculpture from the sea off Tuscany; the piece was quickly absorbed into the antiquities collection of the Medici family in Florence (Mattusch 1978: 101–104; Arata 2005: 7, 170). It marked the start of several underwater archaeological finds involving ancient sculptures.

From the sixteenth to the nineteenth centuries, discoveries were scarce and accidental. All the recorded examples were isolated finds retrieved with no information regarding their archaeological context (Velentza 2022: 12–13). In the first half of the twentieth century, a period still well before the invention and broad use of SCUBA, discoveries of sculptures in the waters of the Mediterranean Sea became more frequent but still mostly accidental (Velentza 2022: 13–20). During this time, single sculptures and larger assemblages of sculptural material were found, some coming from shipwreck contexts. The sculptural discoveries of this era astonished contemporary scholars and collectors. In most cases, the sculptural objects were considered valuable treasure of national importance, requiring salvage rather than careful archaeological extraction and investigation. The salvage operations of the time were typically organised by the governments of countries claiming territorial rights to the waters where the sculptures were discovered. Retrieval was extremely

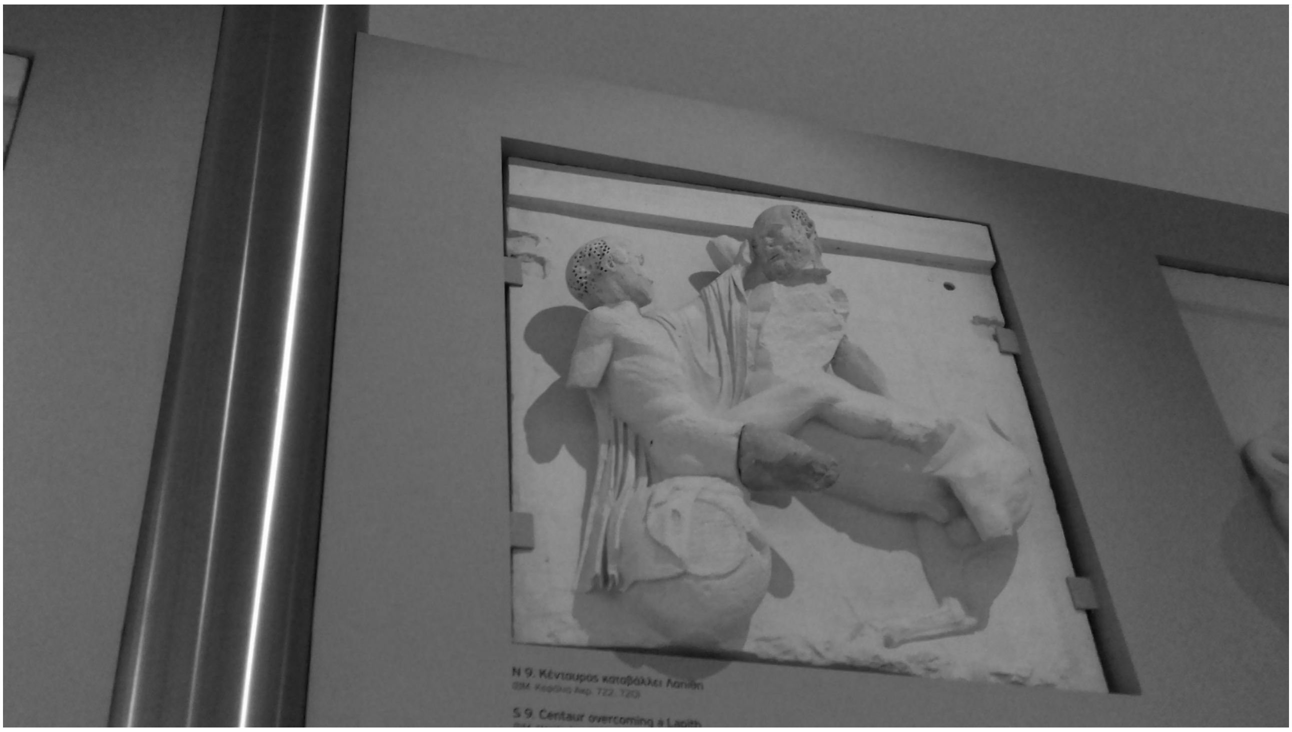

Figure 8.1. Fragments of a marble metope from the Parthenon with signs of marine degradation, from the collection of the Acropolis Museum in Athens. Photograph by the author.

dangerous, and several people perished in the efforts to bring ancient sculptures to the surface.

One such story comes from the Antikythera shipwreck, the first ancient wreck found in the Mediterranean Sea and the first big concentration of ancient sculptures (Muckelroy 1978: 12). In 1900, the wreck was found accidentally by Greek sponge divers who were fleeing a storm during their return from operations in Northern Africa (Bass 1966: 74–75; Throckmorton 1970: 113–168; Rackl 1978: 15–36; Tzalas 2007: 344–346). After the sculptural discoveries were reported to local authorities, the Greek government conducted salvage operations between 1900 and 1901. Over the course of many months, archaeologists worked from the surface on ships of the Greek navy, while sponge divers went under water to retrieve as many sculptures as they could (Tsiropoulou *et al*. 2012: 18–28). This massive undertaking was arduous and disastrous. Bad weather, the significant depth of the site and the lack of safe diving equipment combined to make conditions hazardous. Some heavy sculptures were lost in greater depths, one sponge diver died and two others were permanently paralysed (Bass 1966: 29; 'Return to Antikythera' 2021).[7]

Similar incidents occurred during salvage operations of the underwater site at Cape Artemision in the Aegean Sea. From this site, two bronze sculptures—the 'God (Zeus or Poseidon) of Artemision' (Hemingway 2004: Fig. 22, Fig. 26) and the 'Horse and Jockey' (Hemingway 2004: Fig. 23–24, Fig. 30–33)—were retrieved in fragments in 1926–1929 and in 1936 (Bass 1966: 169; Rackl 1978: 57; Parker 1992: 60; Hemingway 2004: 35–40; Arata 2005: 146–147; Tzalas 2007: 350–353; Koutsouflakis 2017). Similar to the circumstances of the Antikythera wreck, fragments of the Artemision sculptures appeared accidentally, as chance finds in fishermen's nets (Hemingway 2004: 35–43). The local archaeological authorities immediately interpreted the sculptural fragments as precious works of art created by great masters of ancient Greek sculpture. This reaction, along with the potential for illicit salvage, inspired Greek authorities to organise rescue operations. However, during this process and amid bad weather, several of the helmeted divers died from embolism as the result of rising to the surface too rapidly (Bass 1966: 72). Following these deaths, the salvage work at Artemision was halted, and the exact location of the underwater site became forgotten over time.

Overall, early archaeological and scholarly conceptions of ancient sculptures found under water were based largely on the experience of these salvage operations, instigating feelings of thrill and wonder, awe and fear. These elements fit with pre-modern conceptions of the underwater environment as a dangerous realm which cannot be accessed without risk (Frost 1968), and they evoke even earlier stories of sculptural loss and discovery. These factors decidedly shaped how early modern discoverers, archaeologists and scholars understood and interpreted ancient Greek and Roman sculptures from under water. The artefacts were seen as valuable treasure whose salvage from the underwater world involved arduous labour and personal danger.

The methods, techniques, equipment and knowledge of underwater archaeology have vastly improved since the early twentieth century. Nonetheless, even today, ancient sculptures from under water are mostly found by accident and without archaeological context.[8] For example, the Riace statues, two large-scale bronze sculptures of male warriors, were found in 1972 off the coast of Riace Marina, near Porto Farticchio in southern Italy, by a recreational diver who reported his discovery to the local archaeological superintendency (Lattanzi 1986: 13–14; Gianfrotta 1986: 25; Arata 2005: 186–188). The Lošinj sculpture, also known as the 'Croatian Apoxyomenos' or 'Apoxyomenos of Vela Orjule', was found in 1996 in the Lošinj archipelago in Croatia, close to Vela Orjule, by a tourist (Stenuit 2002: 41–44; Arata 2005: 172–173). The Mazara del Vallo 'Dancing Satyr' (Figure 8.2) was discovered in fragments during 1997 and 1998 in the nets of local fishermen operating a motor trawler at the sea off Sicily, between the island Pantelleria and the African coast (Arata 2005: 154; Petriaggi 2005: 74–76). In 1999, another bronze sculptural fragment, a life-size bronze elephant foot, was brought to the surface, with no contextual information, by the same fishermen from Mazara del Vallo (Arata 2005: 154; Lapatin 2018: 159–168). The fishermen who discovered these sculptures—the crew of the *Captain Ciccio* fishing boat and especially their captain—have been praised as local heroes by the Museo del Satiro in Mazara del Vallo (Velentza 2022: 639–644). The museum exhibit presents the efforts to bring these works of art onto land with awe, despite the use of outdated investigative methods and the obvious lack of proper contextual analysis and systematic archaeological investigation. In similar fashion, at least seven fragments of ancient bronze sculptures were found between 1994 and 2009 around the island of Kalymnos, Greece, by local fishermen who reported and surrendered their striking discoveries to the Greek archaeological services (Koutsouflakis 2007: 48–49; Koutsouflakis and Simosi 2015: 74–75; Koutsouflakis 2017).

There are dozens of similar accounts of non-archaeological retrievals of ancient sculptural artefacts from under water, even as late as the 2010s (Velentza 2022: 20–35). All

[7] Since then, the site of the Antikythera shipwreck has been revisited, first by Jacques-Yves Cousteau with short surveys and excavations in 1953 and 1976, and since 2014, by the team of the 'Return to Antikythera' project organised by the Hellenic Ephorate of Underwater Antiquities (see Parker 1992: 55–56; Arata 2005: 144–146; Kaltsas *et al*. 2012: 14–15, 36).

[8] Of 110 underwater deposits examined in a recent study by Velentza (2022: 63, Fig. 26), approximately 64 (more than 58% of the recorded data) lack a known underwater archaeological context or a potential date for their underwater deposition. This circumstance is related to the discovery of the sculptures as isolated finds and their recovery from sites which are undated and not surveyed.

Figure 8.2. The bronze statue of the 'Dancing Satyr' of Mazara del Vallo, displayed in the Museo del Satiro Danzante in Sicily. Photograph by the author.

have been accompanied by elements of mystery, surprise, excitement and pride. Frequently, these incidents appear in local news and other popular media accompanied by interviews and descriptions of how the discoverers realised they had found an ancient sculpture under water, thus intensifying the thrill of these extraordinary recoveries. These circumstances of discovery, combined with the catastrophic loss and wondrous, supernatural discovery associated with sculptures from under water since Classical Antiquity, keep alive the concept of salvaging ancient treasure.

This outdated antiquarian approach has obstructed the analysis of these sculptural artefacts within well-defined archaeological contexts, frequently leading to misinterpretations (Velentza 2022: 41–45). One such example is the case of the Riace sculptures mentioned earlier. These two sculptures were found by a recreational scuba diver in 1972. The Diving Unit of the Carabinieri salvaged the reported sculptural fragments without putting a specialized framework for underwater archaeological research into place (Gianfrotta 1986: 25; Lattanzi 1986: 15; Arata 2005: 186–188), despite the many academic underwater archaeological projects which were taking place in Italy at the time (*e.g*. Owen 1971; Eiseman and Ridgway 1987). Only a year after the salvage of the Riace statues, an archaeological investigation was organised for the discovery site. During this survey, more bronze fragments fitting the already retrieved sculptures were found, though according to the archaeological reports, no ship wreckage was detected. However, more recent examination of the recovered archaeological material, survey reports and seabed photographs have given scholars a different perspective. As Lattanzi (1986: 16) and Gianfrotta (1986: 28–29) have observed, during the salvage and surveys of the site, a large quantity of amphorae fragments was found, especially under the armpit of Statue A, as was a fairly thick piece of amphora wedged between the arm and the torso of one of the statues. Additionally, small pieces of wood and several lead rings were found during salvage operations. These contextual artefacts and data, though included in the archaeological publications of the underwater operations, have not yet been used in a methodological study of the underwater site, nor have they been taken into account in interpreting the statues and their maritime transport. Simply, the opportunity to understand the exact archaeological context of these artefacts has been lost through the thrill and excitement of underwater salvage. As a result, most scholars can examine the Riace bronzes only from an art historical perspective (Busignani 1981; Boardman 1985: 53; Mattusch 1997; Neer 2010: 148–155).

The same idea is promoted by the display of these statues in the gallery of the Museo Nazionale della Magna Grecia in Reggio Calabria. The Riace sculptures are exhibited next to sculptures from the Porticello shipwreck as works of art, with no information about the site or the conditions of their underwater discovery (Figure 8.3). Because of this presentation and the lack of information, most scholarly interpretations of these sculptural artefacts regarding their original land context, primary function, transportation and underwater deposition have been based on purely hypothetical theories which draw conclusions from art-historical analyses and mentions in ancient sources. This practice has promoted significant misunderstandings of the provenance and use of the Riace sculptures. The most prevalent theory sees the sculptures as booty stolen in the Roman era from a Greek sanctuary, probably Delphi, with the intention of transporting them to Italy (Mattusch 1996: ix-x, 47, 64–65 and 193–194; Mattusch 2002: 111–114; Jenkins and Turner 2009: 29–30; Neer 2010: 148–155; Bellingham 2014: 209–219). In reality, there is no documented archaeological evidence to support any of the dates, places or activities mentioned in these hypotheses.

From the examples cited above, it is clear that the various concepts and emotions associated with discovering sculptures under water, from Classical Antiquity until today, have prevailed over the need for careful archaeological investigation and interpretation. This has masked any contextual data, which are frequently considered unimportant. This, in turn, has perpetuated the misrepresentation of underwater archaeological finds as treasure goods, worthy only of salvage rather than archaeological investigation. As Gately and Benjamin (2018) analyse in depth, this portrayal of underwater archaeological research as a treasure hunting endeavour is a problem with which maritime archaeologists still struggle. Moreover, the lack of methodological research and contextual analysis of the sculptures from under water is a reason why these artefacts are frequently subjects of illicit trafficking. Examples include the sculptural head from the Porticello shipwreck, which appears in the gallery adjacent to the Riace sculptures in Figure 8.3; the Fano sculpture, also known as 'Statue of a Victorious Youth' or 'Getty Bronze' (Figure 8.4), currently held in the collection of the J. Paul Getty Museum; and most recently,

Figure 8.3. The Riace bronze statues (left) and one of the Porticello shipwreck bronze sculptures (right), displayed in the Museo Nazionale della Magna Grecia in Reggio Calabria. Photograph by the author.

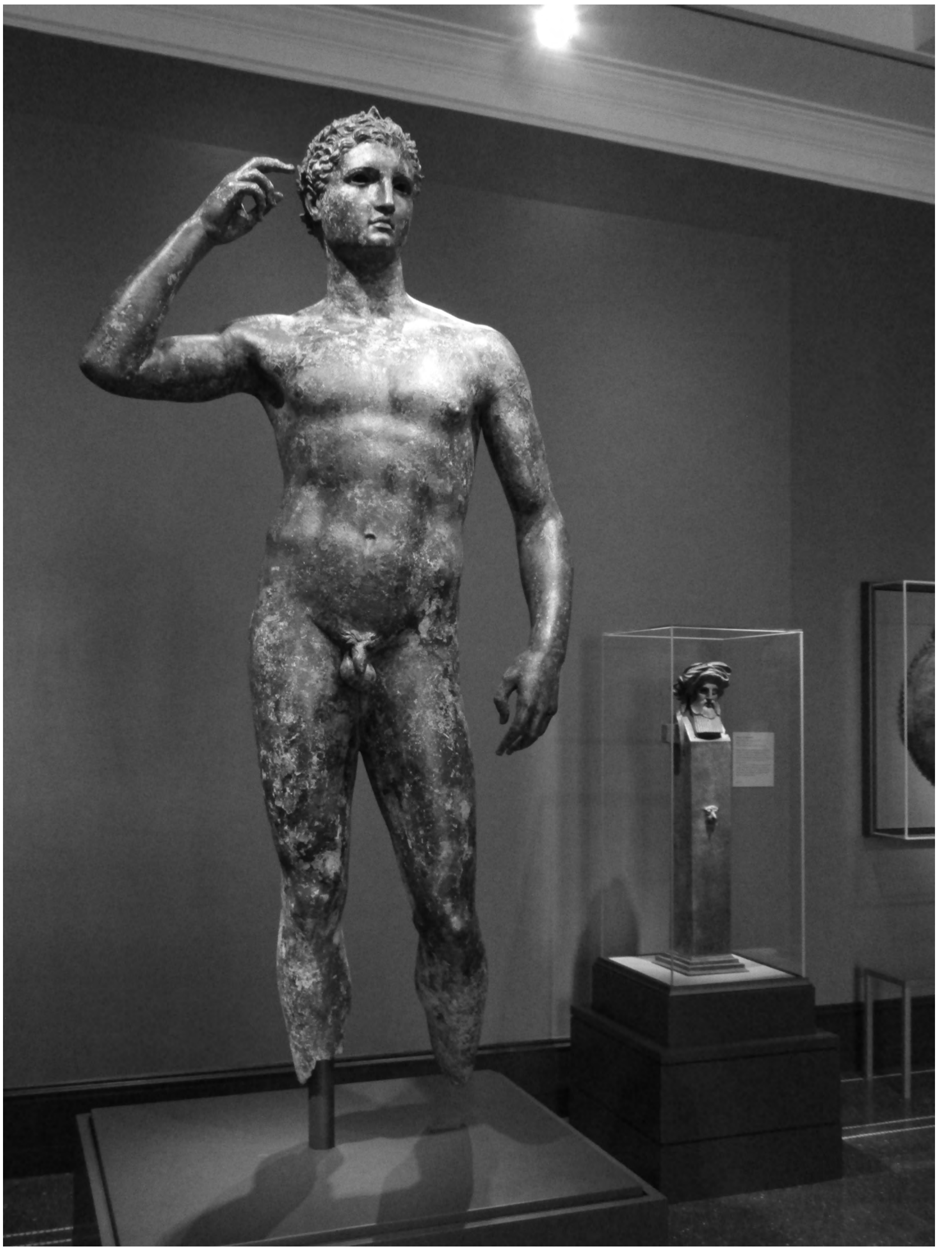

Figure 8.4. The smaller-than-life-size bronze male sculpture found off Fano, Italy, displayed in the Getty Villa in Los Angeles. Photograph by the author.

a large-scale bronze statue found off the coast of Gaza, which was sold through eBay after its out-of-context discovery (Velentza 2022: 44–45).

Modern reception and inspiration

The romanticism and mystery surrounding ancient sculptures from under water have had an interesting impact on the work of contemporary artists. In recent years, several artists have exhibited their sculptural creations under water, thus developing underwater sculpture museums visited by diving tourists. For example, the Museo Subacuático de Arte in Cancún, Mexico, is an underwater museum which exhibits a wide range of underwater sculptures to visitors who can dive, snorkel or see the underwater galleries from glass-bottomed boats. The museum promotes its concept and visiting experience as a unique adventure and opportunity to view the ocean in a way unlike anything visitors have ever seen before (MUSA 2023). One of the artists exhibiting his sculptures there, Jason deCaires Taylor, describes being under water as a 'deeply personal, liberating and otherworldly experience' (deCaires Taylor *et al*. 2014: 6–9). He explains that by choosing to display his sculptural works under water, he both expresses his adventurous personality and encourages insights into human relationships and experiences with watery environments.

To date, the most fascinating contemporary art adaptation of underwater sculptural discoveries is Damien Hirst's exhibition and mockumentary film, 'Treasures from the Wreck of the Unbelievable', which presented the tale of a fictional Roman shipwreck full of sculptures from an imaginary ancient collector. The exhibition was first presented in 2017 at the Palazzo Grassi and the Punta della Dogana in the Venice Biennale, and then in a 2017 film produced by Netflix. For the exhibition and film, Hirst submerged several of his own sculptures in the Indian Ocean and then filmed their retrieval as if they were newly found archaeological discoveries. Impersonating a scientific patron, Hirst then restored, catalogued, interpreted and curated the retrieved sculptures to be presented to the public in Venice (Greene and Leidwanger 2017: 2–11; Hirst 2017a, 2017b). Moreover, as Greene and Leidwanger (2017: 4–6) note, some of Hirst's sculptures resemble well-known ancient sculptures retrieved from under water, including a colossal statue, called 'Demon with a Bowl', which mimicked the form and posture of the Riace statues. This imaginary narrative and counterfeit story of loss and adventurous discovery was the basis of an unprecedented, highly exciting and engaging artistic project which juxtaposed truth and fiction, mystery and wonder and the ancient and the modern.

The artistic curiosity inspired by ancient sculptures from under water was also featured in the 2017 film 'Call Me by Your Name', directed by Luca Guadagnino and based on André Aciman's 2007 novel of the same name. This film, rich with classical references, presents pictures of ancient Greek and Roman bronze sculptures in its opening titles, including several pieces found under water (Stevens 2018). The most notable sculptures are the Marathon sculpture (Bass 1966: 74 and 169; Parker 1992: 259; Mattusch 1997: 15–16; Arata 2005: 178) and the 'Dancing Satyr' of Mazara del Vallo (shown in Figure 8.2). Importantly, the film features an underwater sculptural discovery in detail. The two main characters, Elio and Oliver, join Elio's father, Professor Perlman, to retrieve an ancient bronze sculpture from Lake Garda. In this scene, after the statue is removed from the water by divers, the characters examine its fragments. The professor suggests the statue was a Hellenistic copy of one of Praxiteles' originals from the fourth century BC, noting that it must also have been a gift from a Count Lechi to his lover, the contralto Adelaide Malanotte (Melnikova 2020: 387). The bronze statue presented in the film resembles the sculptural type and posture of the Fano sculpture (Figure 8.4), which was found under water somewhere in the Adriatic Sea and has been part of the J. Paul Getty collection since 1977 (Mattusch 1997: 1–3). Overall, the sculptures from under water featured in the film are Guadagnino's inventions; they do not appear in Aciman's original novel, which frequently mentions figures from ancient literature, history and myth. However, as Stevens (2018) notes, the novel seldom refers to ancient art history or archaeology. Hence, the film director likely used ancient bronze sculptures—especially those from under water—to represent visually the novel's references to ancient literary texts (Melnikova 2020). Anachronistically, the 'Dancing Satyr', which appears in the opening titles, was discovered in 1997–1998, several years after the novel's fictional setting. Undoubtedly, the specific choice of the scene of the underwater sculptural retrieval and the thrilling emotions of excitement, wonder, mystery and romance that overtake the two main characters were chosen deliberately by the director to assist in the peak of their romantic idyl of Elio and Oliver and contribute to the film's visualisation of desire, nostalgia and adventure.

Conclusion

This study highlights an interesting continuity in the reception of sculptural loss and discovery in the Mediterranean Sea. From the period of Classical Antiquity to Mediaeval times and from the shipwreck losses of the 'Grand Tour' to the most recent archaeological discoveries, incidents of underwater deposition, discovery or recovery of sculptures have been associated with intense emotions and cultural concepts of mystery and adventure in both pre-modern and modern narratives. These concepts have created long-held reactions to sculptures from under water in the stories and traditions of multiple eras, deeply influencing modern scholarship and art as well. This realization reveals that there are certain attitudes towards sculptures from the sea which have been shaped over centuries. In modern times, these attitudes—combined with the abrupt and sometimes difficult circumstances of discovery and salvage of underwater sculptures—have influenced the level of analysis and understanding feasible for these archaeological artefacts. As the present analysis has demonstrated, diachronic concepts associated with sculptures from under water have decidedly interfered with the way sculptural discoveries have been perceived, not just by scholars, archaeologists and art historians but also by the general public, the media and contemporary artists.

This realisation highlights the dynamic role of the sea as a space of lived experiences where polar opposites—catastrophe and utopia, chaos and wonder—co-exist. More widely, the narratives and incidents of sculptures lost and found under water also provide insight into long-term conceptual processes which have influenced academic and public perceptions of maritime archaeology and underwater archaeological finds in the modern era. With this deeper understanding of why things have been viewed and presented in certain ways, practitioners of maritime archaeology can work towards advancing the public understanding of the sea and underwater environment. Greater care in portraying maritime and underwater archaeological discoveries is necessary, as suggested by Gately and Benjamin (2018), along with building the capacity for better approaches, processes and methodologies. Targeted education on the subjects of maritime archaeology and maritime heritage in schools and academic settings, but also for divers and heritage authorities would also help to improve the understanding of maritime archaeological finds in the public sphere (Staniforth 2008).

For the case of sculptures from under water, efforts for capacity building and expanding education will enhance public awareness of the underwater archaeological contexts where sculptures are found (*e.g.* shipwrecks, deposits of jettisoned objects and ritual depositions; some of these are currently invisible in the archaeological record due to the lack of data). Additionally, better and more strict methodologies should be followed in researching and recovering sculptures from underwater deposits, following the guidelines and frameworks developed by prominent scholars and organisations of the discipline (*e.g.* Muckelroy 1978; Adams and Rönnby 2013; Maarleveld *et al*. 2013). These initiatives will help the field move away from the outdated antiquarian practice of treasure salvage, while also safeguarding archaeological objects from potential antiquities trafficking.

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The archaeology of ships and boats

9

Boats from bogs in Arctic Norway: depositional contexts and explanatory frameworks in the Late Iron Age and Mediaeval period

Stephen Wickler

Abstract: A comprehensive assessment of boat-related bog finds from the collection of the Arctic University Museum of Norway (Norges Arktiske Universitetsmuseum, NAU) materialises the entanglement of boat technology and cultural meaning in northern Norway during the Iron Age. Nineteen boat parts and related equipment made of Scots pine (*Pinus sylvestris*) from 17 bog locations have been documented. As the Early Iron Age and pre-Iron Age bog finds have been discussed in an earlier publication (Wickler 2019), this chapter focusses on bog boat finds from the Late Iron Age. The documentation of bog boats has emphasised absolute dating using radiocarbon and dendrochronology, in addition to detailed descriptions and graphic documentation of the objects. Some finds are related to ritual activities which include votive bog offerings and a boat grave. Most of the Late Iron Age boats have sewn planking, a construction technique which predates the use of iron rivets first documented in the Roman Iron Age and which is also associated with indigenous Sámi boats. Hybrid vessels combining sewing with treenails and rivets are also represented. Bog boat remains are discussed in the context of relevant explanatory frameworks in order to evaluate their significance for the development of boat technology and as expressions of northern Norwegian maritime culture.

Introduction

This chapter describes a project undertaken by the author which analysed and dated wooden boat parts and boat-related equipment from bog contexts from the archaeological collections of the Arctic University Museum of Norway (NAU). All of the materials referenced are Mediaeval or earlier in age and originate from Arctic northern Norway. The project has emphasised obtaining reliable radiocarbon age estimates for as many finds as possible, in addition to collecting or creating detailed descriptions of the individual objects and their comparisons with relevant materials sourced from elsewhere in Scandinavia. As finds pre-dating the Late Iron Age were previously published (Wickler 2019), the present study focussed on bog boat material from Nordland and Troms dating to the Late Iron Age, along with several objects from the Mediaeval period (Figure 9.1; Table 9.1). No bog finds from the Late Iron Age have been found in the northernmost region of Finnmark. Most of the analysed objects were discovered while cutting peat for fuel and then given to the museum between the 1880s and 1950s. Two boat finds from the Viking Age, the Øksnes boat grave and Bårset votive offering, were documented by archaeological excavations in the 1930s (Gjessing 1941).

Boat finds are presented by context and type, including those from ritual contexts, boat planks with information on fastening techniques and miscellaneous boat parts and equipment. Also described are two spades initially identified as paddles. Overarching themes of relevance to bog boat finds are also reviewed and evaluated, including ritual deposition of boats in bogs and importance of sewn boats in Late Iron Age northern Norway. Also argued is the need to create models of boat development from a northern Norwegian perspective as an alternative to models with a predominantly southern Scandinavian bias.

Bog boats from ritual contexts

Three bog boat finds from northern Norway are interpreted as being associated with ritual activity. These include a boat grave intentionally placed in a bog at Øksnes in Vesterålen and votive boat offerings at Bårset in northern Troms and Rydningen on the island of Senja. In this section, these contexts are discussed and compared as bases for modelling the importance of bogs as a liminal entity mediating between landscapes and waterscapes of ritual significance.

The Øksnes boat grave

During road construction at the Øksnes vicarage on Skogøya Island in Vesterålen in 1934, the remains of a wooden boat with an estimated original length of 8.0–10.0 m and width of 1.5 m were discovered in a bog *c.* 4.5–5.0 m above sea level (a.s.l.) and *c.* 60.0–70.0 m from the shoreline. Subsequent excavation revealed the boat was buried in the latter part of the Viking Age in a low grave mound with a ring of stones placed around the outer margin (Figure 9.2A). The results of the boat grave excavation were published by Gjessing (1941), who described the burial as the grave of a Norse male,

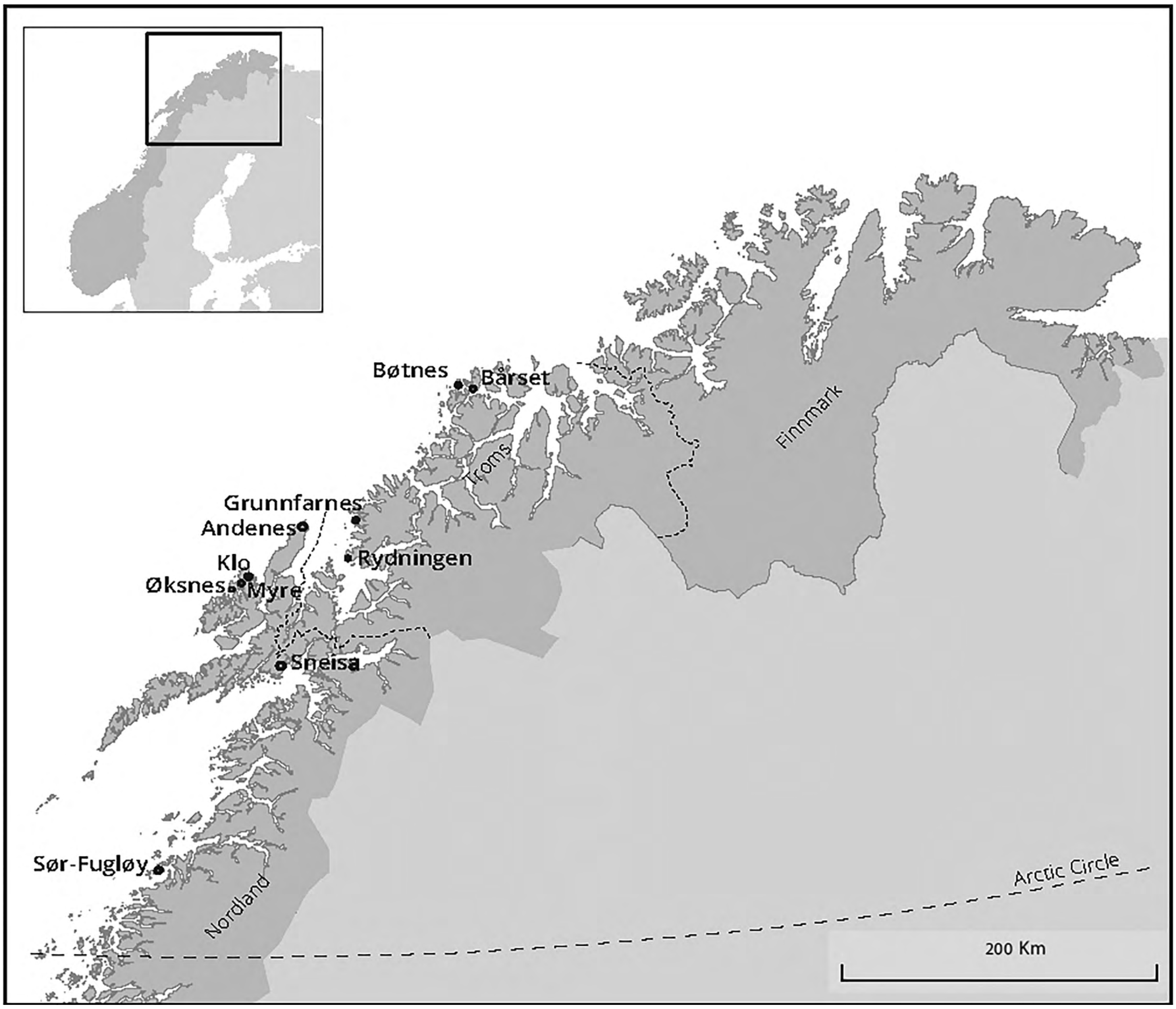

Figure 9.1. Map showing the bog boat find locations mentioned in the text. Illustration: Arctic University Museum of Norway and used with permission.

based on the presence of an axe. Although the bow and stern sections of the boat had been removed by earlier turf cutting, the keel, lower planking and a displaced frame were preserved. Pieces of birch bark found under the boat planks suggested the entire vessel may have been covered with this material (Gjessing 1941: 41). Although skeletal remains were absent, a pillow with feather fill and a woven wool textile pillowcase were found with adhering animal hair originating from a cowhide which had wrapped the body (Figure 9.2B). A radiocarbon date of 888–994 cal AD from the pillowcase agrees well with the typological assignment of the axe found in the grave to the tenth century.

Microscopic analysis of feathers from the pillow fill identified three avian orders: *Anseriformes* (eider); *Suliformes* (cormorant) and *Charadriiformes* (unspecified gull). Downy feathers from gulls (*Laridae*) composed most of the material (Dove and Wickler 2016). Archaeoentomological analysis of the pillow fill revealed remains from a variety of insect species (Panagiotakopulu *et al.* 2018). These included the blowfly, which indicates exposure of the body and the probable timing of the burial. The quantity of fleas among the feathers suggests the pillow under the corpse had been in use for some time before being placed in the grave. The presence of a beetle species which feeds on flowers suggests that flowers were placed on the corpse as part of the burial ritual. The absence of a body and any associated post-burial decay fauna implies it was intentionally removed and disposed of elsewhere.

A 3.1 m section of the boat keel was preserved with a 5.0 cm long scarf for the fore stem on one side. There were no treenail holes for fastening the garboard strake, but a set of eight large treenail holes were placed along the centre of the keel about 10.0–48.0 cm apart, presumably for fastening frames. A single displaced frame fragment with an 8.5 × 4.5 cm profile was found with deep notches for planks and fragments of treenails for fastening the garboard strake. The remains of three strakes on the port side and two on the starboard side were also preserved. Long strands of twisted-wool caulking from additional

Table 9.1. Bog boat radiocarbon and dendrochronological dates.

Catalogue no. (Ts.)	Description	Year	Location	Municipality	Material	Lab no.	Conventional age (BP)	Calibrated ^{14}C age (2 δ)**
3499	broken boat parts—votive offering	1931	Bårset	Karlsøy	pine	T-3802 dendro.—10 planks	1080 ± 80	772–1158 AD dendro. >845 AD
3981b	boat grave	1934	Øksnes vicarage	Øksnes	pine	TRa-2953*(wool textile)	1100 ± 25	889–995 AD
5141	boat keel with sewn bottom plank—votive offering	1954	Rydningen	Senja	pine	TRa-2428* (charcoal) Beta-363164*ˣ (wool)	1760 ± 30 1480 ± 30	234–381 AD 550–644 AD
4145b	thwart	1939	Bøtnes	Karlsøy	pine	Beta-363163*	1510 ± 30	534–640 AD
4145a	rowing oar blade	1939	Bøtnes	Karlsøy	pine	TRa-2425*	1180 ± 25	772–895 AD
3845	boat plank	1936	Sør-Fugløya	Gildeskål	oak	Beta-363162*	1380 ± 30	601–680 AD
6366	multiple boat planks	1962	Grunnfarnes	Torsken	pine	Wk-30117 Beta-363166* dendro.	1627 ± 37 1520 ± 30	365–546 AD 530–608 AD dendro. >800 AD
4682	flooring board	1951	Andenes	Andøy	birch	TRa-2426*	960 ± 25	1027–1158 AD
5412	bailer	1955	Andenes	Andøy	pine	Wk-30113*	752 ± 30	1225–1289 AD
5414a	bailer	1950s	Myre (settlement mound)	Øksnes	pine	—	—	—
Non-boat finds								
709	spade	1886	Sneisa	Lødingen	willow/ aspen	TRa-2424*	805 ± 25	1213–1276 AD
1697	spade	1906	Andenes	Andøy	willow/ aspen	Wk-30112*	572 ± 28	1308–1363 AD

Note: wood samples unless otherwise indicated.
* AMS / ˣ solvent extraction
** See Bronk Ramsey 2009; Reimer *et al.* 2020. Calibrated with OxCal.

planks show the boat would have had at least five strakes on each side. The planks were thin and about 20 cm wide. Although Gjessing (1941: 46, 72) claims the planks were fastened to one another with reindeer sinews, subsequent analysis has shown that plant fibres were used, potentially from tree roots. Fibre threads were placed through pairs of drilled vertical holes spaced 1.0 cm apart and knotted on the interior (Figure 9.3A). Spacing between hole pairs was about 18.0 cm. The garboard strake was sewn to both the keel and stem, and strakes were fastened to frames with treenails.

Gjessing (1941: 72–73) argued that the boat was built by the indigenous Sámi, partially because he associated sewing which used reindeer sinew with traditional Sámi boat building; this has since been shown to be inaccurate. Gjessing (1941: 74) concluded that the boat could have been a Sámi vessel made to order for a Norse community. Although the basis for this assertion about the ethnic origin of the boat has been questioned (Wickler 2010: 353), elements of the Øksnes grave do suggest a mixture of Norse and Sámi traits, illustrating the hybridised nature of ethnic identity and cultural interaction in the Vesterålen region during the Late Iron Age. Although birchbark is commonly used for wrapping corpses in Sámi burials, the practice was widespread and thus not restricted to the Sámi. Grave mounds and boat burials are commonly associated with Norse burial practices. Sewing has also been used as a basis for identifying the Øksnes boat as Sámi (Westerdahl 1987: 28–31). The potential blend of Norse and Sámi elements in the Øksnes burial challenges commonly held assumptions about material expressions of ethnicity and reveals the complexity of ethnic identity in the region. Entomological evidence that the body was exhumed from the grave may also be linked to ritual practices with ethnic associations, such as the avoidance of haunting by the spirit of the deceased (Jakobsson 2017).

The Bårset boat

In 1931, the remains of a boat were exposed by peat cutting in a bog at Bårset on the large island of Nord-Kvaløy, one of many offshore islands along the outer coast of northern Troms. The find was reported to the Tromsø Museum, and zoologist Soot-Ryan conducted an excavation which was later published by Gjessing (1941). The boat was a rowed

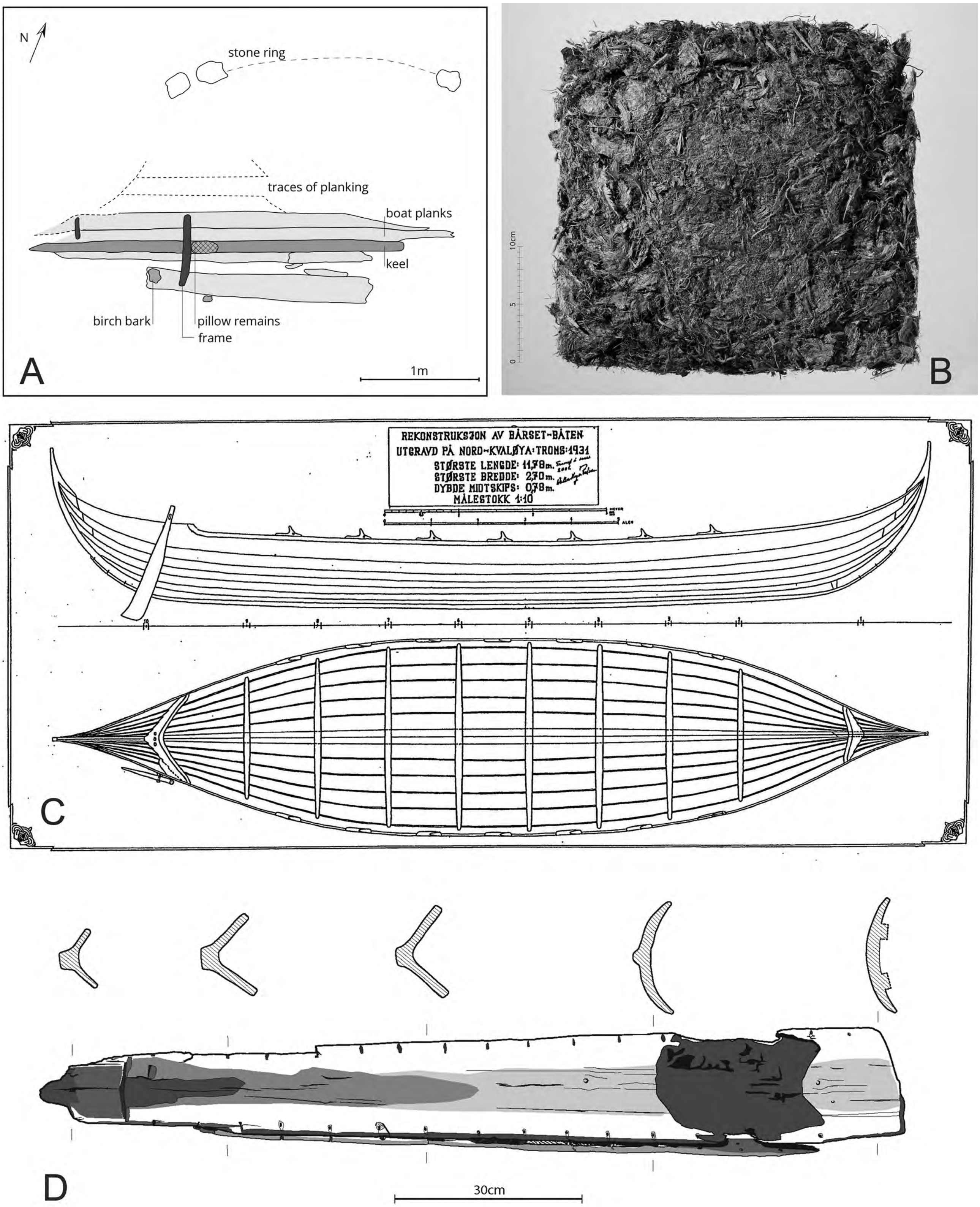

Figure 9.2. Bog boats from ritual contexts: A) plan drawing of the Øksnes boat grave redrawn from Gjessing 1941, Fig. 31; B) feather pillow fill from Øksnes boat grave; C) drawing of 1931 Bårset boat reconstruction; D) top view of Rydningen boat keel with cross-section profiles. Illustrations: Arctic University Museum of Norway and used with permission.

vessel with no evidence of a sail. It was estimated to have been 13.1 m long with a maximum width of 2.6 m and a midships height of 5.7 m. An initial radiocarbon date of 722–1158 cal AD was followed by a dendrochronological analysis of 10 planks, producing an age estimate for boat construction in the ninth century, sometime after 845 AD (Kirchhefer 2000). Although only *c.* 20–25% of the boat was preserved, a reconstruction was drawn at a scale of 1:20 (Figure 9.2C); in 1937, this drawing was used as the basis for constructing a 1:5 scale model. In 1993, a

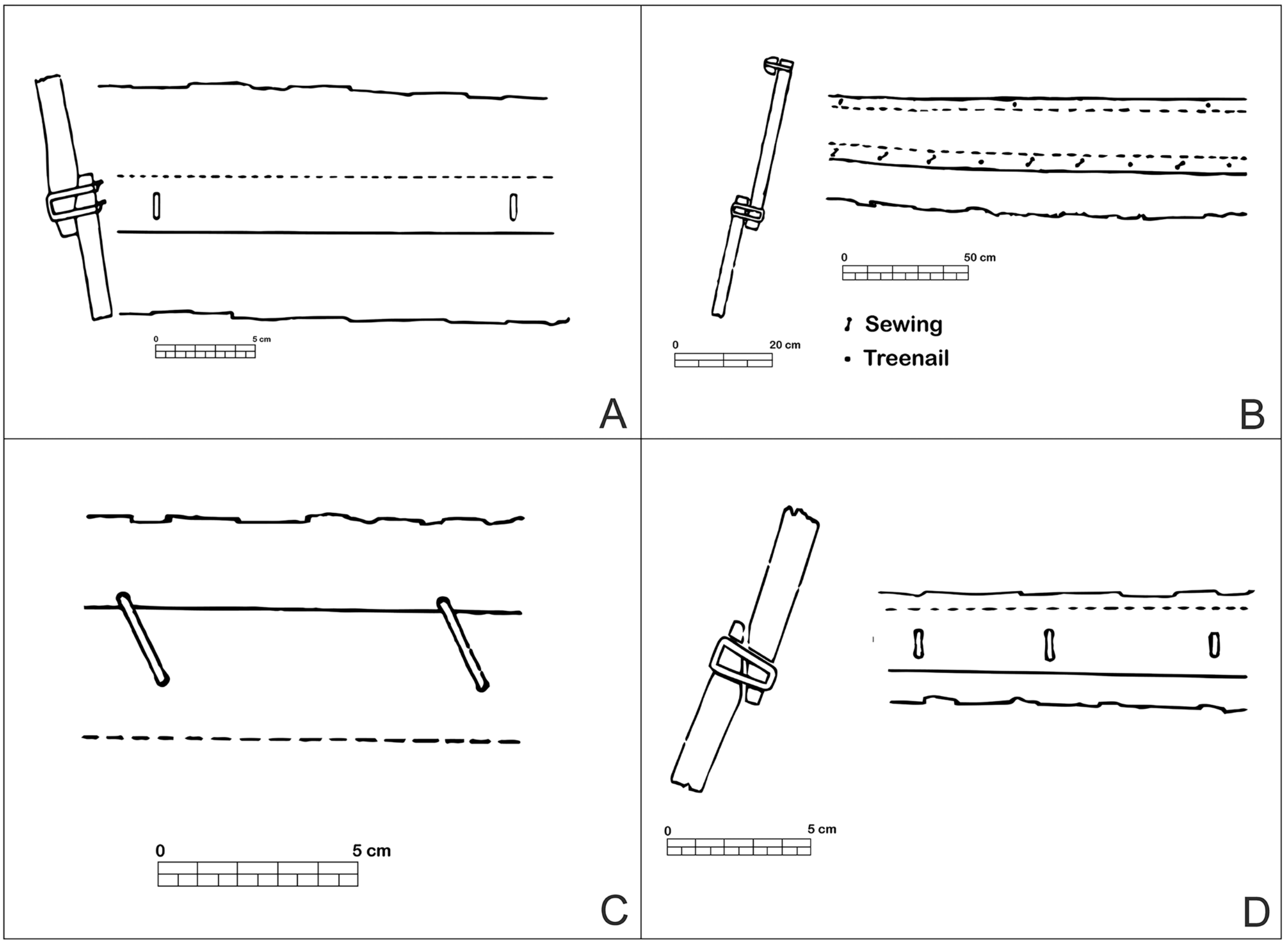

Figure 9.3. Boat stitching seams: A) Øksnes boat plank stitching seam; B) stitching and treenails fastening the upper two strakes on the Bårset boat; C) continuous stitching fastening keel to bottom plank on the Rydningen boat; D) plank stitching seam on the Halsnøy boat. Redrawn from Prins 1986: Figs. 9, 11, 12 and 14 with permission from H. H. T. Prins.

group of experts reanalysed the boat remains to assess the validity of the 1937 reconstruction; this led to a number of its construction details being questioned. A more recent reassessment of the vessel (Pedersen 2002) yielded an alternative reconstruction which added a seventh strake, a feature which harmonises the design to a greater degree with Viking vessels from the same period such as the Oseberg ship and the largest of the small boats from Gokstad.

The following description of the Bårset boat construction focusses on fastening techniques which are relevant for its comparison with other bog boat finds. The frames are *c.* 90.0 cm apart and lashed to raised cleats on the strakes through single holes. The planks are thin (1.5–2.5 cm) with widths ranging from 22.0 to 29.0 cm. Apart from the top two strakes, the boat planks are fastened to one another and to the keel with rivets and caulked with long strands of twisted wool, not hemp rope as claimed by Gjessing (1941: 36). The two upper strakes are fastened together with a combination of stitches and treenails, although rivets are present near the fore and aft stems. The stitches are sewn with plant fibres, potentially from tree roots, between paired holes set at an angle and spaced 1.0–2.0 cm apart (Figure 9.3B). The interval between the stitches/treenails varies 18.0–22.0 cm, although distances of 11.0 cm and 13.0 cm also occur. The gunwale is attached to the interior of the sheerstrake with treenails.

The Bårset boat was intentionally placed in a bog, most likely as a votive offering, and thus is unlikely to have been an abandoned vessel or a wreck which washed ashore. Clearly visible axe marks show the boat to have been partially chopped up and broken apart, with individual pieces subsequently spread over a relatively large area. Loose objects were apparently removed prior to the ritual deposition, including boat parts such as thwarts and floorboards, although one complete oar was recovered. Gjessing (1941: 64–65) remarked on the presence of light-coloured, mostly white, water-rounded stones spread among the boat remains, which he suggested had been thrown at the broken vessel as part of a ritual in which white stones had a magical meaning.

A bog boat votive offering from Rydningen, Senja

A boat keel with fragments of a sewn bottom plank was found in 1954 about one kilometre from the coast at *c.* 150.0 m a.s.l. near the farmstead at Rydningen along the southwest coast of Senja, Norway's second-largest island.

The boat remains had been placed in a large bog hole *c.* 30.0 m wide surrounded by bedrock at a depth of 80.0 cm and 40.0 cm above the base of the bog. The bog hole may have had standing water in it when the boat was deposited. The aft end of the keel section was chopped off, and a 24.0 × 16.5 cm area of the interior surface was carbonized, suggesting a fire was intentionally lit in the area (Figure 9.2D). It can be argued that these actions were associated with a ritual event in which the keel segment was cut to size in advance and ritually deposited in a small bog pool as a votive offering while a fire burned in the keel. Two radiocarbon samples from the vessel were dated. An initial sample taken from the carbonized wood produced a date of 234–381 cal AD. A sample of twisted-wool caulking material produced a significantly younger age range of 550–644 cal AD. The second date is undoubtedly more reliable, given the significant problem of 'old wood' when dating heartwood from long-lived species such as pine, as Wickler (2019: 190) discussed in connection with bog boat finds.

The keel segment is 1.4 m long and was carved out of a pine log extending from a pointed end where the fore stem was attached to a point where remnants of two cleats for lashing frames are visible at the opposite end (see Figure 9.2D). The width of the keel board narrows from 18.6 cm at the aft end where the cleats are located to 18.5–16.1 cm in the midsection and 10.7 cm where there is a scarf for attaching the fore stem. The stem was likely lashed in some manner to the keel scarf, which is 8.0 cm long with a notch 0.5 cm high, although there are no lashing holes. The lashing cleat fragments are 14.0 × 2.5 cm with 4.0 cm between them, but one has been almost completely removed, and the upper portion where the lashing hole would have been is missing from both cleats. The cleats may have been intentionally removed when the aft section of the keel was chopped off. The keel board has a raised keel 2.7 cm wide and 2.0 cm high at the stem scarf; this gradually reduces and transforms into a rounded bottom 30.0 cm from the aft end. The interior height of the keel board is 3.3–3.5 cm.

There are remains of the first strake on one side, which is sewn to the keel board with angled pairs of 0.3 cm holes placed 1.1 cm apart in the plank and single 0.5 cm holes in the keel (Figure 9.3C). The distance between stitching holes varies from 6.0 to 8.5 cm. Wedge-shaped pegs for holding the thread in place are preserved along the interior margins of the stitching holes. The stitching is continuous, using plant fibres twisted together to form a thread which is still in place and well preserved, along with strands of twisted wool used as caulking. The caulking material does not appear to have been impregnated with a sealant such as pine tar.

Boat remains with similarities to the Rydningen keel which are either contemporaneous or date to the Merovingian Period (550–800 AD) are generally scarce. The closest parallel in terms of construction techniques may be the fragmentary remains of the Halsnøy bog boat from western Norway found in 1896 (Shetelig 1903). A single radiocarbon date of 340–557 cal AD provides a rough age estimate for the boat (Myhre 1980), but as was noted for the Rydningen keel date, this estimate may be too early given the significant problem of inbuilt age for pine. The Halsnøy vessel is a small rowboat around 5.2 m long with a broad bottom board and frames lashed to the planks with 'thin fibres of wood' (Shetelig 1903: 20), likely from roots, through cleats with single holes which are 22.0–24.0 cm long and 2.5 cm high. The planks were sewn together through vertically aligned, paired holes which are 0.2 cm diameter and spaced 4.0–5.0 cm apart; the stitches are discontinuous, and wedge-shaped pegs were used to hold them in place (Figure 9.3D). Planks were scarfed and sewn to the stem with stitching holes perpendicular to the stem and a thick tar impregnated thread fastening planks on both sides through the stem. Strips of a woven wool textile impregnated with tar were used for caulking between the planks and planks and stem. The tar used as a sealant is most likely from pinewood. A recent full-scale reconstruction of the boat represents one possible interpretation of how the boat may have been constructed (Sørnes 2012).

Ritual deposition of boats in bogs: contexts and explanatory models

The ritually associated bog boats from northern Norway can be grouped into two distinct categories: boat graves such as the one from Øksnes and votive boat offerings such as those found at Bårset and Rydningen. Although the intentional interment of individuals in bogs is uncommon, other bog burials have been documented in northern Norway, including the eleventh-century Skoldehamn grave discovered in 1936 on the southern tip of Andøya, not far from Øksnes (Gjessing 1938). Analyses of the well-preserved clothing and other grave items reveal a blend of Norse and Sámi features, features which have been interpreted as an expression of ethnic interaction and coexistence at the time when Christianity was gaining influence in the region (Svestad 2021). Although several boat graves located in bogs are known from western Norway (Gjessing 1941: 40), the Øksnes bog boat grave is unique in northern Norway. Multiple aspects of the grave reflect ethnic hybridisation, and evidence for exhumation of the body represents a highly unusual secondary ritual event. The widely held belief that bogs represent liminal entities which could transcend and mediate the boundary between water and land provides a meaningful context for understanding both Sámi and Norse beliefs and burial practices in the Iron Age.

Although the ritual contexts for the votive offerings of boats in bogs at Bårset and Rydningen may reflect beliefs similar to those associated with bog burials, the intentions and objectives of the ritual acts involved are dissimilar. Votive offerings involve the deposition of objects in specific locations for ritual purposes. As noted earlier, at Bårset, a boat was intentionally broken apart, chopped into pieces with an axe and spread across the bog. Water-rounded stones appear to have been placed among the boat fragments as part of a ritual act. All loose items and equipment, apart from a single rowing oar, were apparently removed from the boat prior to performance of the ritual. In contrast, the votive offering at Rydningen involved a different process, one which prepared a boat keel and attached plank fragment by chopping off the aft end prior to the ritual deposition. The boat keel was carried about a kilometre inland to an elevated bog hole *c.* 150.0 m above the shoreline, where there may have been standing water at the time. A fire appears to have been lit in the keel before it was lowered into the bog hole.

Other votive offerings of boats include the Early Iron Age Danish bog offerings at Hjortspring and Nydam, where boats, weapons and other war booty were sacrificed in a small pond about 3.5 km inland at Hjortspring and a freshwater lake at Nydam (Rieck 1995: 127–128; Crumlin-Pedersen and Trakadas 2003; Holst and Nielsen 2020). In western Norway, the Kvalsund bog offering of a ship and a boat, excavated in the 1920s (Shetelig and Johannesen 1929) and recently dendrochronologically dated to *c.* 780–800 AD (Nordeide *et al*. 2020), highlights the importance of water as a central ritual element with a pit dug into the bog and filled with water to form an artificial pool in which the vessels were deposited. The boats were broken into pieces by hand and placed in the pit along with sharpened wooden objects thrust into the bottom of the pit. Although some scholars still view Kvalsund as a war-related victory offering in the same category as Hjortspring and Nydam (Christensen 2022: 75), the ritual context is distinct. Nordeide (2015: 178–180; Nordeide *et al*. 2020: 7) interprets the find as an offering of a vessel to prevent shipwrecks along an exposed coastline, ritual activity which also has elements of a fertility cult.

Although unlike the Danish offerings and Kvalsund in terms of context, the finds at Bårset and Rydningen highlight the importance of water as a medium of ritual communication. In the case of Bårset, water might link the bog to the sea as part of an extended seascape, whereas the bog pool at Rydningen could have provided a spiritual conduit between the mountains of the interior and the ocean below. Both sites may also be strategically located within a shared Sámi-Norse ritual landscape.

Boat planks with evidence of fastening techniques

Individual boat planks from the Late Iron Age have been found at two bog locations in northern Norway. Although restricted to a single boat part type, these finds provide valuable information on aspects of boat construction such as vessel size and origin, in addition to critical details regarding how planks were fastened to one another and to frames and scarfs.

Gildeskål oak plank

An oak boat plank, originally *c.* 2.2 m in length but now broken into three fragments ranging 58.0–98.0 cm in length, was found at the bottom of a bog at Indre Klauven, Sør-Fugløya, Gildeskål in 1936. The plank has a row of small treenail holes, *c.* 0.7 cm in diameter and 18.9–21.0 cm apart, located on a 1.5 cm wide smoothed surface for the lap between strakes. The plank is 0.7–1.0 cm thick and up to 11.0 cm wide, but it was originally wider, as one edge has been broken off. The plank thickness indicates that it was from a boat about 5.0 metres in length. A single radiocarbon date of 601–680 cal AD provides a rough age estimate, and the number of growth rings is insufficient for dendrochronological assessment. The use of oak indicates that the plank originated from a vessel which was built further south. Although the depositional context is unclear, the lack of waterworn surfaces argues against it being washed ashore.

Grunnfarnes boat planks

At Grunnfarnes on the island of Senja, a group of fragmentary boat planks were exposed by peat cutting in 1962. While the planks are not adjoining, they appear to be from the same vessel, and they were intentionally placed together, potentially for later reuse, at a depth of 27.0–28.0 cm in a 70.0 cm thick peat bog overlying beach sand and stones. A boat frame radiocarbon dated to the Bronze Age–Iron Age transition (598–402 cal BC) was found *c.* 10.0 m to the northwest (Wickler 2019: 192–193). Two plank fragments yielded overlapping radiocarbon dates with a collective age range of 332–574 cal AD spanning the Migration Period. Dendrochronological analysis of a third plank fragment recorded growth rings up until 709 AD, but given the lack of sapwood and the outermost rings of heartwood, it is reasonable to assess the plank as originating from a boat built no earlier than *c.* 800 AD (Kirchhefer 2013). The dendrochronological age estimate suggests that the two earlier radiocarbon dates reflect the ‘old wood’ problem for planks which were used several centuries later. This interpretation is supported by similarities in form and construction details between the planks.

The three main plank fragments are 1.9, 3.3 and 3.6 m in length (Figure 9.4A). Plank segments with intact edges range 20.0–23.0 cm in width and 1.0–1.5 cm in thickness. Plank thickness indicates they are from a small boat about 5.0–6.0 metres long. Vertical paired stitching holes 0.5–0.6 cm in diameter and spaced 0.7–1.0 cm apart extend along both plank edges with average distances ranging 15.0–17.5 cm between pairs. Although remains of ‘rope’ were reported in the stitching holes when the planks were found, no definite evidence of this was observed during later examination. However, plant fibres were likely used for stitching. Small wedge-shaped plugs used to hold the thread in place remain in some stitching holes. A concave lap moulding 2.5–3.0 cm wide where caulking was placed is present along the edge of three plank fragments. Rectangular cleats up to 13.0 × 7.5 cm in diameter and 1.5 cm high with single treenail holes *c.* 1.5 cm in diameter for fastening frames are preserved on several planks (Figure 9.4B). The

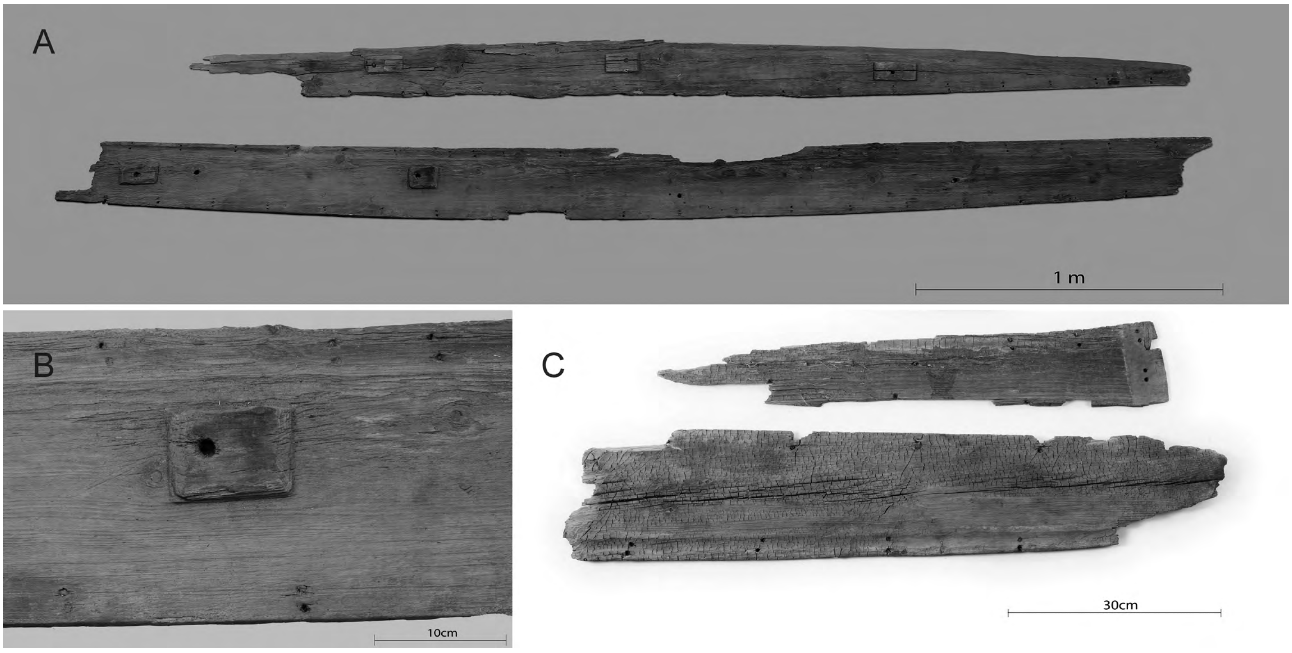

Figure 9.4. Grunnfarnes boat planks: A) the two largest plank fragments; B) closeup view of a cleat with treenail hole and paired stitching holes on the largest plank; C) smaller plank fragments, including a scarf with two pairs of stitching holes. Photos by Adnan Icagic, Arctic University Museum of Norway and used with permission.

distance between cleats is *c.* 82.0 cm, and two additional treenail holes without cleats spaced 77.0–85.0 cm apart were used for fastening frames closer to the stem, which did not require cleats. Scarfs are present on three plank fragments. The most complete is 5.2 cm long with two pairs of stitching holes 0.5–0.6 cm in diameter and 0.7 cm apart (Figure 9.4C).

Sewn boats in the Late Iron Age: northern cultural conservatism or nautical adaptability?

Four of the northern Norwegian bog boat finds from the Late Iron Age have evidence of sewing and other fastening techniques which provide insights into technological innovation and transformation (Table 9.2). The use of rivets as an alternative to sewing for fastening boat planks in Scandinavia is first documented at the Danish Nydam ship votive offering dated to *c.* 190 AD. Although the use of rivets may have expanded during the Early Iron Age in southern Scandinavia, sewing was still common, and it has been suggested that rivets were used in the ships of elite chieftains long before they became common in everyday boats (Christensen 2022: 59). As discussed above, the fragmentary Halsnøy boat, one of a handful of Early Iron Age boat remains in Norway, has sewn planks and lashed frames. While there is some evidence of riveted boats from boat burials in northern Norway by the early Merovingian Period, a significant percentage of these are hybrid vessels which combined the use of rivets with sewing. Hybridized boats of this type continue to be present in burials throughout the Viking Age, along with fully riveted vessels (Lund 2019). Bårset is currently the only bog boat within this category, although sewing is combined with the use of treenails and restricted to fastening the top two strakes.

The other three bog boat finds from northern Norway have sewn planks. The earliest is the Rydningen boat from Senja, which has been dated to the early Merovingian Period. This find is unique and represents the earliest known securely dated evidence for the use of continuous stitching in Scandinavia and Northern Fennoscandia. This type of stitching is also a distinguishing characteristic of traditional Sámi boats such as the bask used in eastern Finnmark (Westerdahl 2010: 331–333; Alava and Rantamäki 2016). The planks from Halsnøy, Grunnfarnes, Øksnes and Bårset are sewn with discrete discontinuous stitches through paired holes, which are vertical with the exception of the Bårset boat, where the paired holes are set at an angle. Small wedge-shaped pegs are driven into the stitching holes to hold the plant fibre thread in place, except for the Øksnes boat, where the stitches are knotted on the interior and lack pegs. The thread used for stitching appears to be exclusively from plant fibres which may be from tree roots, as is common in traditional Sámi boats, although this has yet to be confirmed by archaeobotanical identification. Caulking between planks consists of twisted/twined strands of wool in three of the boats and a tar-impregnated, woven-wool textile in the Halsnøy boat.

There are raised cleats with single holes for lashing frames on the planks of the Halsnøy and Bårset boats, and fragments of similar cleats are found on the Rydningen keel board. In contrast, the planks from Grunnfarnes and Øksnes were fastened to frames with treenails. The Grunnfarnes planks were fastened with treenails through holes both with and without raised cleats. Use of treenails is also a feature on strakes above the waterline on the Kvalsund ship, as well as the small boats from Kvalsund and Gokstad dating to approximately the same period as the northern Norwegian boats, although rivets are

Table 9.2. Construction details of selected bog boat finds in Norway with evidence of sewing.

Boat find	Frame fastening	Plank fastening	Sewing material	Caulking material	Scarf fastening
Halsnøy, western Norway	Single hole lashing	Discontinuous stitch, paired vertical holes	Bast string for rowlock, plant (root?) fibre	Wool textile: (pine) tar impregnated	Stitched to stem with (pine) tar impregnated fibre
Rydningen, Senja	Probable lashing	Continuous stitch, paired angled holes on plank / single hole on keel	Plant fibre (root?)	Twisted wool	Unknown
Grunnfarnes planks, Senja	Treenails	Discontinuous stitch, paired vertical holes	Unknown	Unknown	Sewn: double set of paired holes
Øksnes, Vesterålen	Treenails	Discontinuous stitch, paired vertical holes	Plant fibre (root?): knotted on interior	Twisted wool	Sewn: keel and stem
Bårset, northern Troms	Single hole lashing	Discontinuous stitch, paired angled holes / treenails / rivets	Plant fibre (root?)	Twisted wool	Rivets

used for fastening planks. Integrated cleats are used for reinforcement to insure sufficient plank thickness for treenails, particularly on the lower strakes (Shetelig and Johannessen 1929: 59; Planke *et al*. 2021: 289).

The replacement of frame lashing with treenails during the Late Iron Age is generally viewed as a technological advancement, while retention of support cleats for treenails is regarded as a vestige of an earlier developmental stage in which cleats were lashed to frames. This assessment fits with the notion that light rowed vessels such as those from Kvalsund and Bårset were old-fashioned relics, compared to real Viking ships with sails (Christensen 2022: 118–121). The significant number of sewn boats and the combination of sewing and treenails in northern Norway during the Late Iron Age do not fit the southern Scandinavian model, where sewing first disappears and lashing subsequently appears (Prins 1986: 35). The continuation of sewing in the north has been explained both as a consequence of iron being too costly and scarce for rivet production and as an expression of the conservative nature of northern society (Gjessing 1941: 54, 72; Christensen 2022: 60).

In some analyses, the association of sewing with the Sámi has been used to reinforce the idea that sewing is a primitive trait maintained in northern Norway long after it was abandoned in the south (see criticism in Wickler 2010: 353–354). Iron Age sewn boats with a running seam or continuous stitching found in areas with a predominantly Sámi population also tend to be interpreted as Sámi in origin (Larsson 2007: Ch. 5.4, 2015). Gjessing viewed sewing as a trait rooted in the ancient coastal Sámi culture (Norwegian *sjøfinnekulturen*), and this influenced his interpretation of both the Bårset and Øksnes boats. Westerdahl (1987: 28–31, 2010: 336) has suggested that both the Øksnes and Bårset boats were built by the Sámi. On the other hand, Pedersen (2002: 82–91) found no evidence of Sámi influence in the construction of either the Bårset or Øksnes boats, citing the use of separate rather than continuous stitching, which he claims to be a distinctive Norse trait. These views reflect a false dichotomy between Sámi and Norse boatbuilding traditions based on specific traits which misrepresent the true nature of ethnic interaction and coexistence in northern Norway.

The collective evidence suggests that Iron Age boats in Arctic Norway which are sewn and hybrid boats which combine sewing and rivets are both expressions of a shared Sámi-Norse boat building tradition which extends back to the Early Iron Age. The continued use of sewing in the Late Iron Age was neither conservative nor primitive, but rather, a reflection of active choices made by boatbuilders within multi-ethnic contexts for constructing watercraft which were seaworthy and best adapted to the seafaring conditions in the north.

Miscellaneous boat items

Some boat parts and boat-related objects are relatively small and not fastened down in the boat. These include thwarts placed on frames and floorboards on the bottom of the hull which can be removed easily. Bailers are also essential boat gear. These items are not commonly associated with archaeological boat finds, and their presence in bogs provides a rare opportunity to explore continuity and change in essential items still commonly used in traditional Norwegian clinker-built boats (Figure 9.5A).

Bøtnes thwart

In 1939, a rowing oar blade and a thwart were found about 1 m deep in a bog near the shoreline at Bøtnes on the island of Grøtøya along the outer coast of northern Troms. The finds have been mentioned in several earlier publications (*e.g.* Gjessing 1941: 61–62; Bratrein 1989: 148). The oar blade has been radiocarbon dated to 772–895 cal AD, and although Gjessing (1941: 62) identified it as a steering oar, it is an example of standardisation in rowing oar blade form during the Viking Age (Wickler 2019: 199). The thwart is made of radially cut pine and has been radiocarbon dated to the Merovingian Period (534–640 cal AD). It is 89.0 cm long, 15.0 cm wide and 2.0–2.5 cm thick, with a sub-rectangular cross-section and 8.0 cm end notches with 2.0–5.0 cm bevels on the underside to fit a frame (Figure 9.5B).

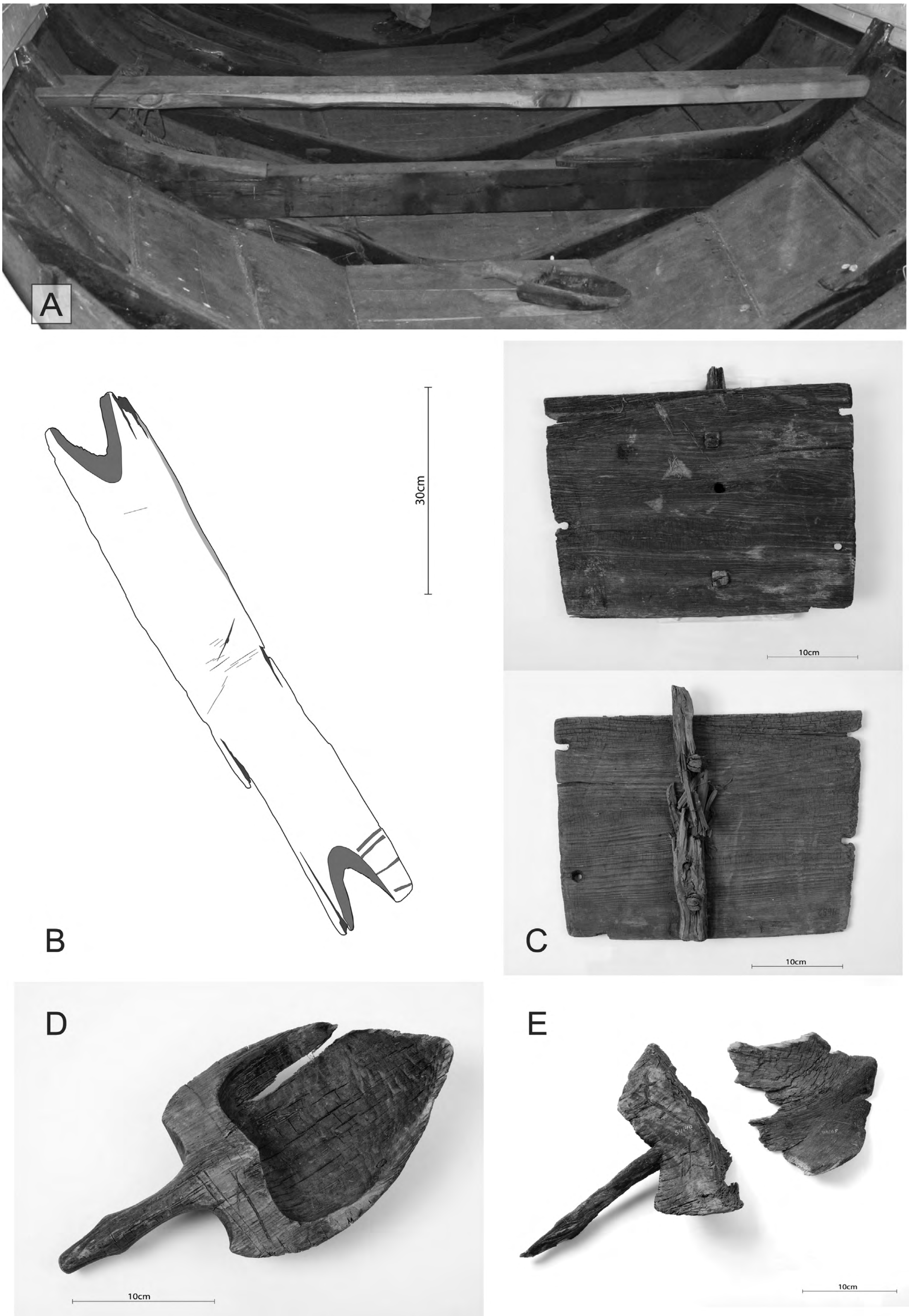

Figure 9.5. Miscellaneous boat items: A) traditional Norwegian clinker-built rowboat with a thwart, floorboards and bailer; B) underside of thwart from Bøtnes with beveled end notches and cut marks in the midsection; C) flooring board from Andenes viewed from top and bottom; D) boat bailer from Andenes; E) boat bailer from Myre settlement mound in Vesterålen. Photo A from Wikimedia Commons distributed under a Creative Commons license; Photos B–E by Adnan Icagic, Arctic University Museum of Norway and used with permission.

The thwart dimensions indicate that it was used in a small boat such as a *færing* with two sets of oars and frames about 1.3 m wide. Knife cut marks on the underside are suggestive of fishing bait preparation. Thwarts are rarely found with boat remains, as they are loose and easily removed. One exception is the two thwarts found in the tumulus over the grave chamber of the Gokstad ship burial from the early tenth century (Nicolaysen 1882: Pl. VII). These are associated with two of the three smaller boats found with the ship. The larger of the thwarts is from the mid-size 8.0 m long boat recently described by Planke *et al*. (2021: 290, Fig. 22). The smaller thwart is from the smallest boat, a 6.6 m long *færing* (Christensen 1959). This thwart is 106.0 × 15.0 × 3.0 cm with a 22.0 cm bevelled notch that closely resembles the Bøtnes thwart.

Andenes flooring board

A pine boat flooring board (Norwegian *plikt*) fragment was found 1.0 m deep at the bottom of a bog near Andenes on the island of Andøya in 1951. A radiocarbon date of 1025–1155 cal AD was obtained from a birch beam attached to the board. Based on the original description of the find, the object was larger and had more intact pieces when it was found than at present. The length was originally 47.0 cm but is now 24.0 cm (Figure 9.5C). It is interpreted as the floorboard from the compartment closest to the fore or aft stem (Norwegian *skottplikt*), and it tapers from 33.5 to 30.7 cm in width towards the stem. The board is 1.4 cm thick, and a fragmentary birch beam 27.5 cm long, 3.3 cm wide and 2.5 cm high is fastened to the centre of the floorboard with treenails. The inner end of the beam is broken off, and the outer end is cut flush with edge of the board. It was originally fastened with three treenails, and two remain in place. Both treenails are 1.5 cm in diameter and 3.0 cm high with wooden expansion wedges driven into them on the underside of the board. They have square 1.5 cm diameter heads flush with the upper surface of the board. There are two treenail holes with a diameter of 1.3 cm along both outer edges where two additional beams were previously located. The upper surface of the board has been smoothed by use wear.

The size of the flooring board indicates that it was used in a small boat. In traditional clinker-built vessels such as the Nordland boat, the flooring boards are placed with the beams resting on a lap joint between planks and against the plank above, although some are placed with the beams resting on the middle of a plank such as a broad garboard strake. Floorboards in Nordland boats were often made of recycled boat planks, and there was always a hole so they could be lifted, often a small one at the end (Eldjarn and Godal 1990: 157). The location of beams on the Andenes floorboard is unusual as there is a centre beam which must have been placed over the keel; this contrasts with traditional boats, where there are two beams closer to the edges which rested on planks.

As with thwarts, very few boat finds have floorboards present, as these were often loose and easily removed or displaced. The numerous floorboards from the Oseberg and Gokstad ships were fastened to the cross beams. There is a single loose flooring board associated with one of the smaller Gokstad boats (Planke *et al*. 2021: 290, Fig. 22). It has two equally spaced beams in the midsection and part of a hole taken out in the middle to lift the board as well as graffiti of stem profiles cut into the upper surface.

Boat bailers

In 1955, a pinewood boat bailer was found about 1.2 m deep in a bog near Andenes on the island of Andøya. It has been radiocarbon dated to 1210–1290 cal AD in the high Mediaeval period. The bailer has a total length of 31.5 cm, width of 15.5 cm and height of 6.5 cm. The handle is 11.0 cm long, 2.0 cm wide and 2.5 cm thick in the centre (Figure 9.5D). It was made from a split log and has a heart shaped rim with rounded bottom and a pointed end which is slightly upcurved in profile. The heart-shaped form has two chambers which reduces the energy required to bail out water. The handle has a semi-circular profile angled slightly downward to optimise grip and avoid slipping during use. A slight bulge near the end of the handle creates the impression of the head and bill of a large goose-like bird in flight. The bailer displays a high level of craftmanship which is both aesthetically pleasing and highly functional. There is also evidence of considerable use wear around the sides of the bailer tip from contact with lap joints between planks on both sides of keel at the same time. Traditional boatbuilder Gunnar Eldjarn (2002) provides a detailed description of the bailer, and he notes that similar early finds are known from Bergen and the Danish Viking Age trading centre of Hedeby.

A second bailer most likely dating to the Mediaeval period was found in a settlement mound cultural deposit at Myre in Øksnes, Vesterålen around 1955. Although this is not a bog find, preservation conditions in settlement mound deposits resemble bogs due to the significant quantities of peat used in house construction. The bailer consists of fragments from the front and back end with a long, thin handle. The back end is 24.0 cm long, 20.5 cm wide and 6.7 cm high with an 18.0 cm long handle. The front-end fragment is 15.5 cm long and 17.5 cm wide (Figure 9.5E). Two owner's mark symbols are carved into the top of the back-end fragment. The first consists of three prongs with lengths of 2.5–3.0 cm radiating from a central point. The prongs are crossed by short perpendicular lines *c.* 1.0 cm from the ends, forming three joined crosses. The second mark is a cross form with two angled lines extending from the lower end to form a three-pronged fork. The use of owners' marks reached its greatest extent in Europe in the late sixteenth century and declined in the seventeenth century, as the use of initials became more common (Cappelen 2005).

Spades originally identified as paddles

Several objects found in bogs appeared to be associated with boats but proved to be unrelated following more detailed examinations. These include spades originally identified as paddles. Although not boat-related, their description is useful as it points out traits which enable spades, as objects sometimes associated with boat finds, to be distinguished from paddles. Spades are utilitarian objects associated with peat cutting and other tasks typically associated with bog contexts. Wooden spades roughly resemble paddles in their shapes and sizes, so the two are easily confused.

Two spades were found at the bottom of bogs. They were most likely made of willow (*Salix caprea*), although botanical identification cannot rule out aspen (*Populus tremula*). Although originally identified as paddles, the tree species used, general appearance and blade shape make this assignment unlikely. The spades are both radiocarbon dated to the high Mediaeval period, while the most recent pre-modern paddle known from northern Norway is dated to the second millennium BC (Wickler 2019: 190–191). Historically, willow wood (Norwegian *selja*) was used for skis, rake handles and other utilitarian objects, but are not for paddles. The spades are similar to each other in appearance, and both were made from tree trunks with the heartwood centrally placed. The larger of the two spades was found in 1906 at the base of a bog about 2.0 m below the surface in the vicinity of Andenes on Andøya Island, and it has been radiocarbon dated to 1300–1370 cal AD. It is complete, with a total length of 114.0 cm and a 43.0 × 12.0 cm blade (Figure 9.6A). The second spade was found in 1886 below a bog deposit at a depth of 81.0 cm at Sneisa, Lødingen. It is 67.0 cm long with a 23.5 × 10.0 cm blade and an incomplete handle 39.0 cm long (Figure 9.6B).

It is unclear how the spades were deposited, but deposition must have occurred at the start of bog formation in locations some distance from the shoreline. The spades may have been used for turf cutting or moving soil in the general area. Although spades have been found in bogs at other locations, these are the only examples known from northern Norway. Well-preserved oak spades were recovered from the Viking Age ship burials at Oseberg, Gokstad and Tune. These include several from the original burial contexts and a substantial number from grave plundering of the Oseberg and Gokstad mounds during the tenth century (Bill and Daly 2012). At least one of the spades from the Oseberg break-in closely resembles the spade from Andenes, with a total length of 100.0 cm and a blade that is 40.0 × 16.0 cm (Bill and Daly 2012: Fig. 2).

Conclusion

The abundance of well-preserved bog boat finds in northern Norway dating to the Late Iron Age provides a rare opportunity to document a wide variety of boat-related material which is not otherwise present in the archaeological record. It is also striking to consider how many additional bog finds of considerable age were undoubted lost over the years, as they were neither retrieved by the finders nor added to museum collections; this may be due in part to their excellent preservation in bog conditions, which gives objects a misleadingly modern appearance. The study presented here opens a window not only on the extent of the variation in boat construction during the Iron Age in Norway, but also the technological continuity over time. Most importantly, this study expands the material evidence of what boats were like and how they were used in the north.

Arctic Norway has long been viewed as a peripheral and passive recipient of boat knowledge from the south, rather than recognised as a centre of maritime innovation and adaptability in its own right, a status clearly supported by the bog boat evidence. Northern boat-building has also been subject to inaccurate and prejudicial misconceptions, such as the claim that the continued prevalence of sewing was due to a lack of economic resources for boat rivets coupled with societal conservatism. Contrary to these assumptions, the continued practice of sewing and the hybridisation which combined sewing with treenails and rivets were expressions of maritime proficiency and skill, in which vessels were adapted to features along an exposed coastline with demanding seafaring conditions. Boat-building technologies also reflect a shared Sámi-Norse tradition developed over many centuries. Acknowledging this shared identity is more productive than continuing to label specific traits as ethnic identifiers.

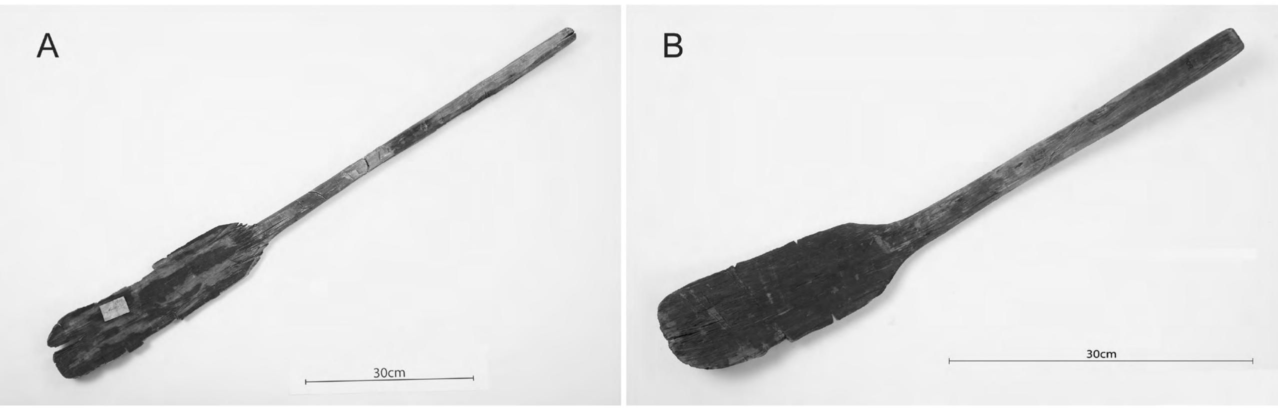

Figure 9.6. Spades found in bogs: A) Andenes, Andøya; B) Sneisa, Lødingen. Photos by Adnan Icagic, Arctic University Museum of Norway and used with permission.

The well-preserved bog boat finds discussed here provide a wealth of new insights into the importance of boats for maritime communities in the north, revealing how elements of nautical technology were interwoven to meet the challenges of the sea.

The key role of boats in both mundane and spiritual aspects of life in Arctic Norway is demonstrated by their ritual deposition in bogs. Insights into the meaning of boat burials and votive offerings of boats are the major contributions of the evidence presented here. A mixture of Sámi and Norse ethnic identities played an important role in ritual expressions such as the Bårset and Rydningen votive offerings. Although boat offerings from the early Iron Age in Denmark and Kvalsund in western Norway represent distinctly different ritual contexts, water is the shared element of central importance in all these contexts.

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10

Gribshunden in perspective: a castle on the sea

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Abstract: The royal Danish-Norwegian flagship *Gribshunden,* launched in 1485, was among the earliest northern European warships purpose-built to carry artillery. However, King Hans employed his vessel as far more than a weapons platform. The ship was his 'floating castle', fulfilling all the various purposes of a land redoubt. At its loss in 1495 enroute to a political summit in Kalmar, where Hans expected to be crowned king of Sweden, it was his mobile seat of government, an instrument combining hard and soft power functions. Recent excavations of *Gribshunden* reveal its martial aspects: artillery, small arms (including several crossbows and hand guns) and personal armour. Soft power is reflected more subtly in other artefacts: silver coins; secular artwork depicting flowers, animals and mythical beasts; and prestige provisions, including copious amounts of exotic imported spices and a large sturgeon. Continuing excavations of the wreck are revealing the structure of the ship itself, while providing insights into the social division of space aboard this royal castle at sea. Combined with archival documents, analyses of all these artefacts deliver deep insight into the people aboard the ship and the late Mediaeval period through which they travelled.

Introduction

In the waning decades of the late Mediaeval period,[1] European adoption of a fundamentally disruptive technology contributed to a re-ordering of the world. Often referred to as a 'floating castle', this innovation fused Mediterranean and northern European design and construction styles to create the artillery-carrying ship (Unger 1981; Gardner 1994; Adams 2003; Eriksson 2020; Adams and Rönnby 2022). Vessels of this type conveyed European explorers on direct voyages to the most distant points of the globe, catalysing a race to seize territory and build colonial empires. Within Europe, ships carrying gunpowder weapons formed the core of emerging nation-states' naval fleets from the end of the fifteenth century. These ships were technological agents in the tumultuous changes sweeping through societies at the dawn of the modern era. Archaeological study of their remains—and more particularly, their contents—offers a portal into the late Mediaeval universe, granting us the possibility of understanding the historical trajectories which led to the world as we now experience it. While the military functions of these warships have attracted ample attention (Cipolla 1965; Padfield 1973; Caruana 1994; Hildred 2011), we contend that their range of uses extended far beyond this narrow utility. However, despite their stout construction, the archaeological record offers scant physical evidence of these machines (Castro 2008; Mearns *et al*. 2016).

The finest archaeological example of a late Mediaeval floating castle is the wreck of *Gribshunden*, flagship of the Danish-Norwegian King Hans (1481/83–1513). This shipwreck presents to archaeologists the opportunity to extend the interpretation of this style of vessel far beyond its use as a warship. Hans employed his new ship as an instrument of royal power in all of its complexity. Scholars of international affairs describe power as 'the ability to get others to do what they otherwise would not' (Nye 1990: 177, citing Dahl 1961). Hard power is coercive because it threatens violence. Soft power is more subtle, and entails economic, cultural and social conditioning. When competently harnessed over time, soft power can be more effective and long-lasting in obtaining political ends. Historical documents and archaeological artefacts relating to *Gribshunden* offer clues about King Hans' hard and soft power tactics in pursuit of his political goals.

The loss of *Gribshunden*

The circumstances of *Gribshunden*'s final voyage and the direct reasons for its loss are worthy of some discussion. The ship sank at anchor following an explosion in the summer of 1495, while the king sailed to a political summit in Kalmar where he expected to gain the Swedish crown. The meeting was a major event along the decades-long trajectory of conflict in the Nordic region. Sailing alongside the flagship was a squadron containing the Norwegian Council and many of the Danish nobility and senior clergy. At the Kalmar summit, Hans would make

[1] The date for the conclusion of the 'Mediaeval period' varies according to region and the scholar discussing the topic. While the Renaissance might have started in the mid-to-late 1400s in the Mediterranean and southern Europe, in the Nordic region, the Mediaeval period is widely considered to have continued until the Protestant Reformation which began in 1517.

every attempt to cajole the Swedish Council into electing him king of Sweden, thereby fulfilling his great ambition to re-unify Denmark, Norway and Sweden into a single political entity: a greater Danish nation-state (Gustafsson 2006). Hans was ready to employ every tactic to bring this to fruition.

For reasons not recorded, *Gribshunden* and some other vessels moored in the protected waters of the archipelago near Ronneby, in the Blekinge region. This was Danish territory at the time. Perhaps Hans intended to visit the town and its church, either by travelling over land or more likely, traversing the shallow waters and narrow passages in a smaller boat. A few written sources of the time briefly recount the events which follow, but each source is problematic in some way, and archaeological evidence does not support many of the contentions made in the accounts. One is a letter written many years after the event by Tyge Krabbe, a Danish nobleman who would have been a teenager in 1495. He claimed to have been present for the events at Stora Ekön, but eyewitness testimony is often flawed. In his short description, he claims the wrong year for the event. He also avers that the fire on the ship claimed many lives; so far, neither human remains nor evidence of fire has emerged from the wreck. Another account comes from *Sturekroniken*, a chronicle in verse of Swedish regent and rival to Hans, Sten Sture the Elder. An inclination towards propaganda is clear; this account describes loss of at least two other ships in the same event. A third, self-contradictory, account was written in a Danish history more than 60 years after the loss of the vessel. Two other versions of events come from Hanse towns, Lubeck and Danzig, but like the others, they are short on details (Huitfeldt 1599; Weinreich 1855; Christensen 1912; Zeeberg 2003; Nordquist 2015; Rönnby *et al*. 2015). Nevertheless, from these passages and the archaeological evidence, we can speculate on the sequence of events which led to the destruction of the ship.

A plausible scenario is that King Hans took the opportunity of the transit from Copenhagen to Kalmar to make stops along the way, in order to show his flag and prized ship in towns throughout his lands. The Stora Ekön anchorage where the ship sank is easily reached from the open Baltic, and the island and nearby mainland provide a lee from all winds and rough seas. Hans and a retinue may have put out in small boats to visit Ronneby, some 10 km distant through the archipelago and up river. The travel to and from town and activities while there would have taken more than a day, leaving time for the crew of *Gribshunden* to perform tasks more easily accomplished while at anchor than in a seaway. Among these tasks might have been maintenance of the gunpowder stores, and repositioning of casks in the hold of the ship. For some reason, an explosion occurred. One source suggests it could have been due to a lightning strike; others say fire broke out and eventually detonated the gunpowder stores. There is no evidence of fire on any of the ship's timbers or artefacts, though future excavation may reveal charring on elements not yet exposed (Foley 2022). The archaeological evidence and disorder of the port quarter suggests an explosion below the waterline, which might have been enough to blast open the hull outright, or might only have sprung planks to permit uncontrolled flooding (Figure 10.1). During the 2022 field campaign, the archaeological team may have discerned the first indirect evidence of this explosion. From the locus of the tiller, two partially deformed lead/iron composite artillery shot both showed flattening and scoring on one side. Perhaps these shot were stored near the source of the explosion, and were flung against the interior of the ship during the event (Jahrehorn 2023).

With continued excavation, it may be possible to identify the exact locus of the explosion which sank the ship. The archaeological evidence may paint a clearer picture of the ship's loss. More importantly, continued study will reveal more facets of King' Hans utilisation of *Gribshunden* before its destruction. Our goal is to propel maritime archaeology beyond the biography of this ship by embracing new interpretative methods, thereby encouraging broader perceptions of shipwrecks.

Castles and ships in archaeo/historiographical trends

Maritime archaeology in Scandinavia has a long history. The excellent preservation of shipwrecks in the Baltic Sea has generated studies of their hulls and construction techniques; the best-known example is the *Vasa*, a seventeenth-century Swedish warship. However, maritime archaeology could be criticised for its practitioners' narrow focus on technical aspects of shipbuilding. Compared to land archaeology, underwater archaeology in Scandinavia has relied on a narrative historical approach seldom grounded in a specific theoretical frame (Cederlund 1995; Eriksson 2020). Only recently have maritime archaeological studies expanded beyond descriptive particulars of ship construction. For example, one scholar has shown how an archaeology of buildings on land can be used as a theoretical and methodological framework when studying social structure and hierarchical spaces onboard ships (Eriksson 2014). This is the rich vein to mine with *Gribshunden* and other sites.

The physical arrangement of *Gribshunden* invites comparison with monumental architecture on land, where a historiographical trajectory similar to that of warships is evident. Though Mediaeval castles have been an important subject for historical, art-historical and archaeological research since the nineteenth century, during most of this period, castles were mainly seen as military structures: defensible strongholds able to resist sieges. Beginning in the 1980s, a more nuanced view of the castle landscape emerged which recognised its importance in society. Scholars increasingly rejected the previous narrow reading of castles as isolated monuments. Instead, castles were argued to have been one of several elements in a complex web of social and economic relationships aimed at organising the use of the natural environment and its resources. In the last 25 years, a still broader perspective on castles has emerged, with far greater notice taken of

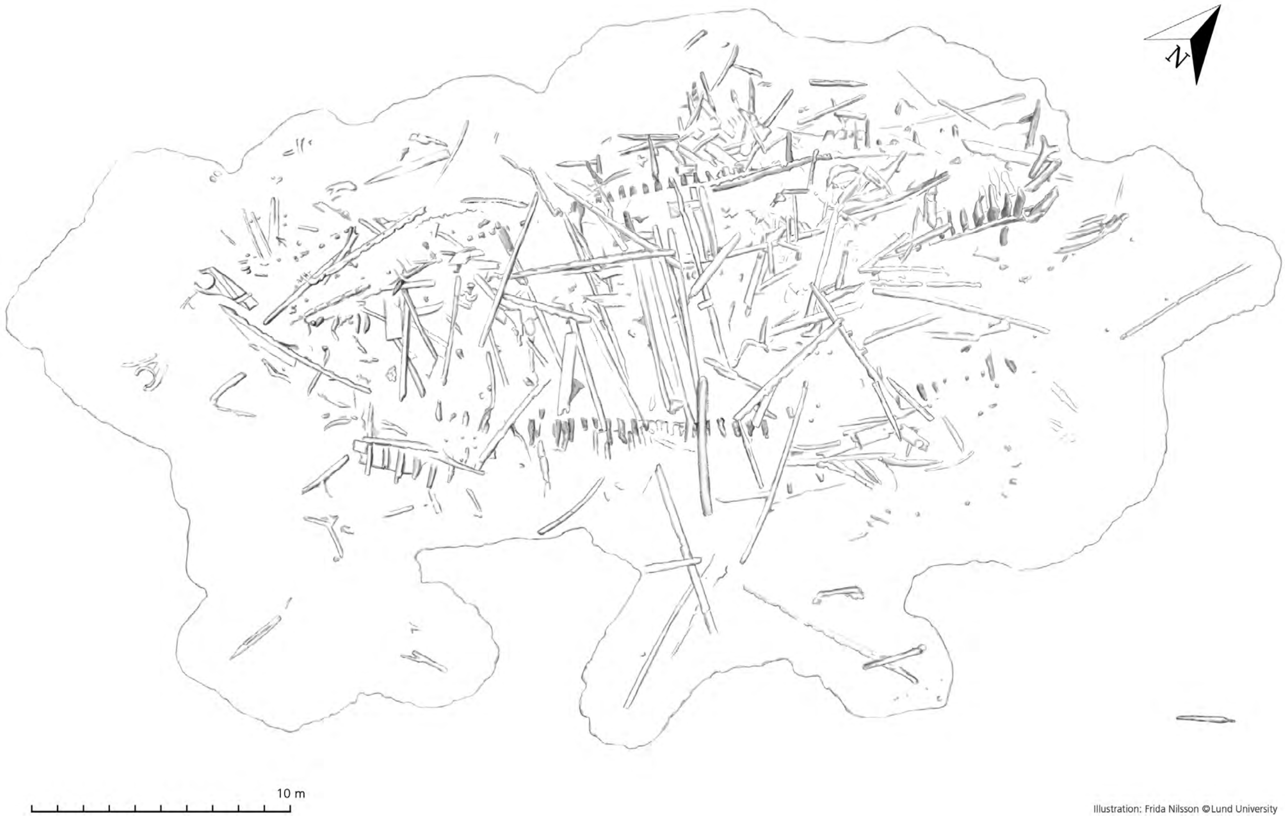

Figure 10.1. Site plan of *Gribshunden* shipwreck, derived from photogrammetric model. Illustration by Frida Nilsson, MediaTryck/Lund University.

castles' soft power functions (Austin 1998; Hansson 2006; Creighton 2009). Castles are increasingly understood as multifunctional loci, just as much administrative and social centres as symbols of military power.

These citadels were secular cathedrals, intended to exalt the lord (of the castle) and convey strength, authority and permanence. Castle builders imagined and created the total environs of the fortress. The layout of castles emphasised not only defensive battlements, but also external sightlines and vistas. Constructed waterways were vital elements of castles: when castles were not positioned directly on shorefronts, their architects incorporated surrounding moats and artificial lakes to improve their defences. In many cases, the waterways enhanced the visual impact of the castles, making them appear as if they were floating (Johnson 2002). Defensive elements such as berms, revetments, plains and water-filled moats also served other ends. Open fields doubled as gardens, tournament grounds and gathering places for events. Watercourses supported wild game, encouraging the nobleman's pastime of hunting. Artificial lakes contributed to illusions, creating the visual effect of the huge stone structures floating on the water's surface. Ultimately, castles were physical expressions of military, political, economic and social authority critical to maintaining elites' status (Hansson 2006, 2015).

Gribshunden can be considered in the same light. It, too, was monumental architecture, though of wood rather than stone. We have begun to reconstruct the physical form of the ship. Digital modelling of the rudder, tiller, tiller arch, stempost, knees and hawse pieces have provided substantial information about the dimensions and appearance of the vessel (Figure 10.2). Each of these elements was sequentially lifted from the seafloor in 2022, placed on underwater supports and 3D-modelled with photogrammetry. A selection of elements was recovered to the surface for further 3D modelling with structured light scanners and photogrammetry in air. The tiller and a gun bed were retained for conservation and further study, and ultimately exhibited alongside the figurehead and other artefacts previously recovered (Figure 10.3). All the other ship elements were replaced in their original positions within the wreck site, with the exception of the tiller arch, which was buried *in situ* to improve its preservation (Björk and Foley 2023). Combining these elements with *in situ* measurements of other structures, we derived key dimensions. The keel length is approximately 25.5 m. The length overall would have been greater: the sternpost raked approximately 15 degrees, and the stem curved upwards from the keel and would have been topped with a forecastle which extended forward from it. The rudder length measures 6.5 m, and the tiller attached near its top. The steeridge (or steering compartment) containing this tiller was possibly positioned on the third deck level. The tiller as preserved is 2.1 m long. The inboard end is broken, but a large rebate provides the socket for an extension. If *Gribshunden*'s steering gear was similar to

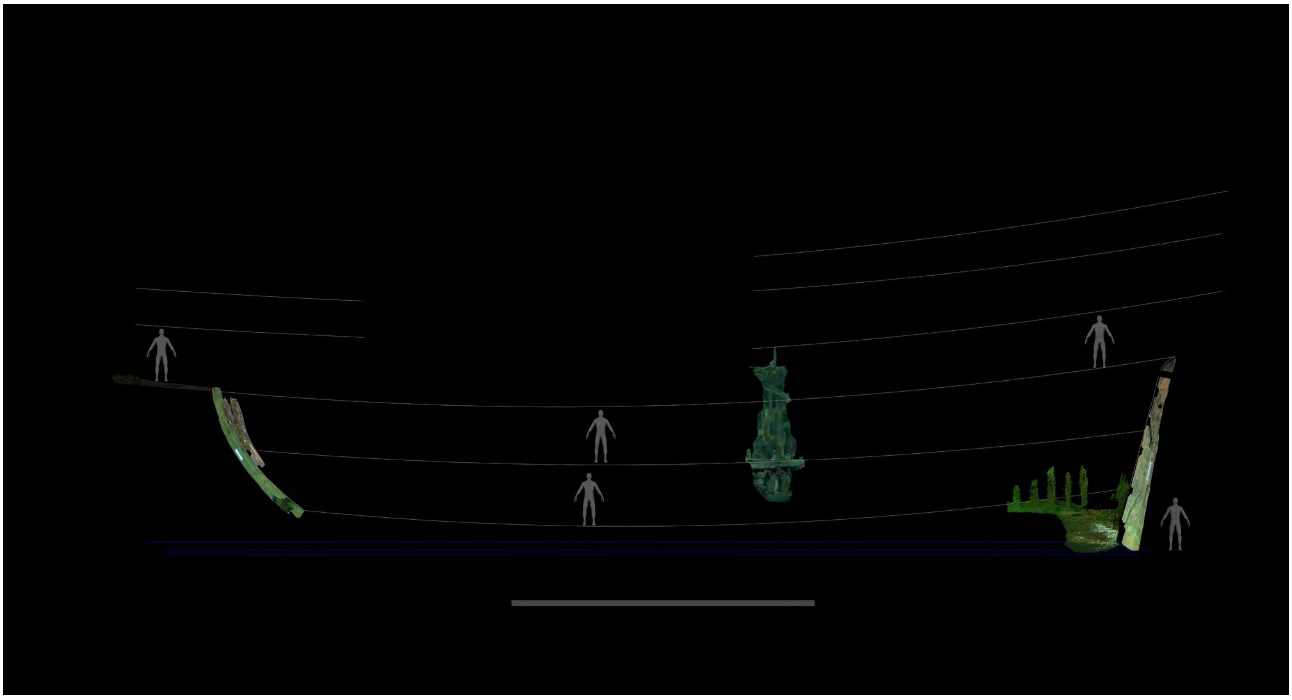

Figure 10.2. Conjectural elevation view of *Gribshunden*, derived from photogrammetric models of key features. Image by Mikkel Haugstrup Thomsen, *Gribshunden* Project, Lund University/Blekinge Museum/Vikingeskibsmuseet.

Figure 10.3. The tiller of *Gribshunden*, prepared for photogrammetric modelling underwater prior to recovery. Image by Brett Seymour, *Gribshunden* Project Lund University/Blekinge Museum/Vikingeskibsmuseet.

that of later warships like *Vasa*, this extension might have connected to a rowle and whipstaff. The whipstaff would have terminated on another deck above the steeridge (Pipping 2000; Harland 2011). The curved forward edge at the head of the rudder would have matched an overhang for that deck. Perhaps yet another deck rose above that level, potentially bring the distance from keel to the upper extreme of the sterncastle to 12 metres or more. For comparison, the sterncastle of the *Mary Rose* (1545) had three decks above steeridge (Marsden 2009). We expect our continued excavation of *Gribshunden* will deliver more information on these points.

The physical structure and hard power aspects of *Gribshunden* are necessary interpretative points; however, they are not the focus of the thoughts presented here. A full examination concerning the military gear found on the wreck and the ship as an integrated weapons system will be published in a dedicated manuscript now in preparation by the authors and their colleagues. In brief, the first archaeological investigations of the ship and the excavations conducted 2019–2022 show *Gribshunden* was a carvel-built hull topped with light lapstrake superstructures (Einarsson and Wallbom 2001, 2002; Einarsson and Gainsford 2007; Rönnby *et al*. 2015; Björk and Foley 2023). In later generations, such a hull would have been pierced with gunports, but none have yet been found on this ship. Instead, several wrought-iron swivel guns would have been positioned in the high castles fore and aft, and along the gunwale of the low waist. While very large contemporary English warships carried as many as 140 or even 225 guns, historical documents suggest *Gribshunden* was equipped with perhaps 68 guns (Oppenheim 1896; Barfod 1990). Remains of 14 guns have been located during archaeological surveys, with 11 of their oak gun beds recovered since 2002 (Figure 10.4). The forecastle topped and projected from a curving stem, while another castle sat over the raked stern. These castles provided elevation from which artillery fired composite lead/iron projectiles about the size of golf balls, 31–47 mm in diameter. The castles also provided some cover for soldiers armed with handguns and crossbows like those recovered in our excavations (Einarsson and Wallbom 2002; Foley 2021, 2022; Björk and Foley 2023). The ship would have presented a formidable appearance, and that was perhaps deterrent enough. The best weapon is the one which never has to be used; there is no record of *Gribshunden* ever engaging in combat actions. While problems persisted with piratical raids at sea, Denmark was not openly at war until some years after this ship sank.

Gribshunden as a floating castle

Hans was ashore when calamity struck *Gribshunden*, but despite this massive setback, he continued on to the weeks-long meeting in Kalmar. Hans' loss is our gain: the detonation consigned to the bottom a royal inventory of objects which together symbolised the authority, wealth and cultural power of a late Mediaeval monarch. From the artefacts recovered in the excavation, we begin to glimpse the mechanisms through which late Mediaeval elites constructed their place in the social hierarchy, and solidified their dominance. Many of the *Gribshunden* artefacts can be described as *barometerobjekte* (Hundsbichler *et al*. 1982), objects characteristic for a specific social strata in society, like the nobility. These objects encompassed not only different types of luxurious and exotic items used for drinking, dining and clothing, but also weaponry and objects which were part of the interior design of castles and manors. Display of *barometerobjekte* was one way the late Mediaeval aristocracy distinguished itself from the rest of the population, but there were other methods. Knowledge of the Latin language was an indicator of social status. Leisure activities such as hunting and high-stakes gambling further distinguished the elite from the masses. Access to rarified spaces, where entry was forbidden to all except the nobility and their servants, was yet another means of maintaining hierarchy (Duby 1977; Crouch 1992; Hansson 2006). *Gribshunden* offers glimpses of all of these practices, especially when compared to land castles, and study of this ship opens a path to a richer maritime archaeological practice in the Nordic region.

Excavation within and reconstruction of the sterncastle would enable a more detailed view of Hans' use of *Gribshunden*. A topic of active speculation is this: where would Hans and his closest companions have berthed and congregated, and can we find archaeological evidence for it? A compartment on the deck above or forward of the steeridge is one possibility. In later periods, this was the location of the cabins occupied by the captain and commodore; traditions must start somewhere. At first glance, the entire stern section of the wreck is a jumbled mess (Figure 10.1). This disruption might have been caused by the explosion which sank the vessel. It might also be due, in part, to the dismantling of this part of the ship during the salvage operations which commenced soon after the loss, when, according to one historical source, many of Hans' possessions were reclaimed (Zeeberg n.d.). We trust that meticulous archaeological investigation will untangle the disorder.

Soft power at sea: social division of space

If Hans utilised his ship similarly to a land castle, then he might have reserved certain spaces for himself or selected companions. Privacy and status of the castle inhabitants were enforced by concentric areas of selective access, from semi-public outside the walls to intimate interior spaces reserved for only the castle owners and their private servants. Put succinctly, spatial distance signified social distance, and proximity was power (Hansson 2006). Detailed understanding of the interior spaces of Mediaeval castles escapes us because the objects contained within them have vanished through the centuries. *Gribshunden* offers the prospect of repopulating those exclusive environs, through the artefacts still contained within the wreck site. On a vessel which carried perhaps 150 people on its final voyage and was only 35 m in length overall, this level of privacy might simply have been impractical and impossible (Weinreich 1855). Whatever the daily social separation might have been at sea, Hans on certain occasions sought interaction with selected individuals.

Evidence for this comes not (yet) from the archaeological remains, but from historical sources. Records of royal expenses relating to Hans' spring 1487 voyage on *Gribshunden* to Gotland are illuminating.

Figure 10.4. Ten of the gun beds recovered from *Gribshunden* during operations in 2002 and 2021. Image by Ruth Rynas Brown, *Gribshunden* Project Lund University/Blekinge Museum/Vikingeskibsmuseet.

The mission's purpose was political: uncertain of the loyalty of the nobleman in Visborg castle, Hans forcibly ejected Ivar Axelsen Thott and replaced him with his own man, Jens Holgerson Ulfstand, a member of one the most powerful families in Denmark in the late fifteenth century (Wallin 1979). King Hans sent a fleet to Gotland, and followed soon after on his flagship. Contrary storm winds caused delay, and the ship waited for better weather outside of Copenhagen. During this lull, the king and his companions killed time with amusements typical of their class. On *Gribshunden*, this diversion was gambling with cards. Accounting records show Hans lost substantial amounts to his comrades, with six payouts, each between two and 16 marks. From the perspective of anyone but the richest aristocrats, these pots were large. For comparison, the three senior officers of *Gribshunden* received a salary of four marks each month; the salary of the admiral of Hans' fleet, Tonnius, was 20 marks each month (Wegener 1864; Ingvardson *et al*. 2022). Hans was not gambling with his ship's officers: the only men who could afford to buy into his table and also had the necessary social stature to do so were nobles.

The card games aboard *Gribshunden* reveal the stratification of Nordic society, and also a means by which members of the wealthiest class differentiated themselves. They show that the king was the first among the nobility, but not at all isolated from them. The fact that noblemen would gamble with the king speaks to their relationships and their wealth. One would not want to win too much from the ruler; at the same time, one could not lose too much, either. To play at that table, one had to be willing to spend. The stakes in these games would have been extravagant to a ship's officer and everyone below that status, but they would not have seemed exorbitant to the people in Hans' social stratum. Appearing in the accounts for Hans' voyages on *Gribshunden* are several wealthy and/or noble Danish families: Ulfstand, Gyldenstjerne, Urne, Walkendorff, Hardenberg and Laxmand (Wegener 1864). As an example of the resources commanded by these clans, Poul Laxmand ruthlessly acquired 900 farms during his lifetime, putting him foremost among landowners in Hans' kingdom. Laxmand's aggressive and possibly underhanded tactics caused outrage, and in 1502, two noblemen stabbed him and threw his body off a bridge in Copenhagen. King Hans did not order the arrest of the assassins. Instead, he insinuated that Laxmand had committed treason by dealing secretly with the (now enemy) Swedes, and seized all of his properties (Dalgård 2000). Ultimately, when gambling with the king, the house always wins.

If Hans or his companions on *Gribshunden's* 1495 voyage carried large amounts of money with them for gambling or other purposes, it has not yet appeared on the wreck. Limited excavation of *Gribshunden* so far has delivered about 200 silver *hvid* coins, most of which were apparently contained in a single pouch or purse (Figure 10.5). This is a rare example of a hoard of 'active money', differing from the usual situations of caches buried as savings or votive offerings (Märcher 2012; Ingvardson 2018). It is also a unique example of coinage certainly sanctioned by the issuing king. This combination of factors is uncommon, and provides new interpretive possibilities.

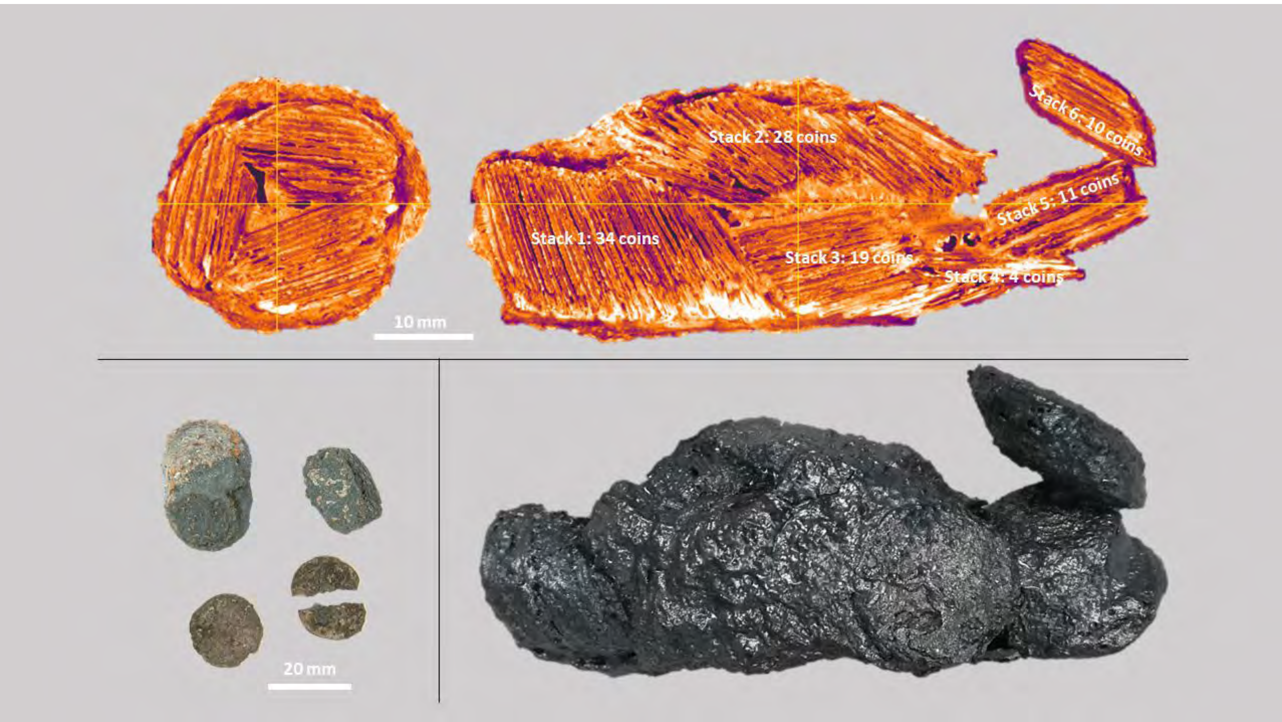

Figure 10.5a. Top: Computed Tomography (CT) image of silver coin concretions from *Gribshunden*. Image: Gitte Ingvardson, Dirk Muter and Brendan Foley. Bottom: small and large concretions. Images by (left) Max Jahrehorn, Oxider and (right) Anders Henk, Danish National Museum.

Figure 10.5b. Left: CT image of coin motif from concretion. Image: Gitte Ingvardson, Dirk Muter and Brendan Foley. Right: A similar Danish *hvid* coin from the Blekinge Museum collection, minted in Malmo during King Hans' reign. Image by Brendan Foley, Lund University/Blekinge Museum.

Gribshunden and soft power: economics

The recovered coins are concreted and badly degraded, too fragile for mechanical separation. To identify them, we have relied instead on Microscale Computer Tomography (μCT). Our interpretation of this purse is that it belonged to one of the officers of the ship, or perhaps a mid-to-upper level mercenary (Ingvardson *et al*. 2022). The first revelation is that the coins in this purse are all from the Danish realm, including Norway and Gotland. Second, the coins were drawn not only from new issues of *hvids*, but from previous regimes. Some of the coins were newly minted during Hans' reign. Others are older, dating from the reigns of Hans' father, Christian I, and possibly his predecessor, Christoffer III. The conclusion which can be drawn is that the Danish kings did not always recall coinage when they ascended to the throne. Even if they devalued their coins by altering the ratio of copper and silver in new issues, they also permitted older coins to stay in circulation. Also notable is that the motifs on *hvid* coins are remarkably similar throughout time, featuring the first letter of the king's name on the obverse: for Christoffer or Christian, a crowned 'k' (in the font of the time, its appearance resembles a modern 'R'), and for Hans, a crowned 'h'. At a glance, it is difficult to discern which king issued the coin, suggesting a desire for continuity in the royal lineage. Another feature of the coins is a blending of high and low culture. Around the outside of both obverse and reverse of Hans' coins, Latin script (abbreviated) spells out the monarch and the city of the mint. For Hans' *hvid* coins minted in Malmo, the obverse inscription read: IOhES:D:G:R:DACIE. Translated and expanded, this read: Johannes [Latin for Hans] (by) Grace (of) God King (of) Denmark. The use of Latin links Hans to the Catholic Church and the Christian god. The reverse read: MOn | MAL | MOI | EnS |. As translated and expanded, this reads: Coin (of the City of) Malmø. The central character of the obverse is the 'h' for Hans, the Danish version of his name, complementing the high status and Latin lettering around the perimeter of the coin (Ingvardson *et al*. 2022). The combination of the Latin and Danish languages is also seen in correspondence between the king and his noble subjects: salutations were penned exclusively in Latin, while the bodies of letters were written in Danish (Christensen 1912).

Gribshunden played a role in the creation of the coins minted in Norway during Hans' reign, and provides a view into the fusion of soft and hard power in late Mediaeval Scandinavia. In spring 1486, soon after taking possession of the ship, King Hans sailed to Bergen, the site of one of the mints Hans had chartered in his coronation *håndfæstning*. Presumably on this and subsequent visits, he or his delegate would have inspected the coin production facilities. The 2019 *Gribshunden* excavation revealed the earliest known coins from the Norwegian mints, establishing their production earlier than 1495 (Wegener 1864; Ingvardson *et al*. 2022). The increase in Hans' coin production is another example of his soft power capabilities. Not only did he establish mints in Norway, he simultaneously created new mints in the Danish cites of Copenhagen and Aalborg. Further, he ordered a dramatic increase in *hvid* production in Malmø. After 1495, he took the additional steps of creating two new silver coins of higher denominations, and eventually, a gold coin. This was a capacity his Swedish rival could not match. Soft power translated into hard power: the new supply of coins financed mercenary armies to fight the Swedes (Kreem 2001; Ingvardson *et al*. 2022).

The 1486 voyage was Hans' first recorded visit to the Norwegian part of his realm after his 1483 coronation in Trondheim/Nidaros. It was a major summer-long excursion, and it provides an apt case study for how Hans employed his new ship as a floating castle. *Gribshunden* was the central site for royal administration functions. Historical sources record that when the king travelled, his baggage train included 'chancellery chests' containing documents necessary for his administration of the country. 'Writing rooms' were always established when the king temporarily settled into a castle or nobleman's manor house to permit the king and his administrators to conduct the business of the state. There must have been similar areas set aside in the ship when Hans was at sea. Surviving letters show that Hans maintained official correspondence while aboard his flagship (Jorgenson 1884; Etting *et al*. 2019). It may be too much to hope that continued excavation will deliver a chest of correspondence, but maritime archaeological conservators suggest that preservation of some written material may be possible on *Gribshunden*.[2]

Gribshunden and the world of the nobility: foodways and art

Gribshunden was the physical political instrument for Hans to show the flag throughout his kingdom. The ship provided the mobility necessary for the king to appear off any coastal city, secure in his own redoubt. Upon arrival in Bergen in 1486 (and again in 1491), the impressive ship provided a base for negotiating economic and trade policies with Hanse merchants. The ship was also a locus for strengthening social bonds among the aristocratic classes and clergy. It accommodated and fed several bishops and noblemen, exactly as would be expected from a castle. At the same time, the ship reinforced stratification within the social ranks. Access to this space was limited to those invited by the king, and not all who accompanied the king to Norway would have been onboard his ship. A who's-who of the powerful in Denmark sailed in a fleet alongside the new ship: 644 nobles and clergy. Some of these men were directed to travel on the king's own ship, while others had to provide their own means of transport, along with the provisions for their retinues (Wegener 1864). This was the accepted routine for royal voyages, including the 1495 sojourn to Kalmar.

The *Gribshunden* excavation provides direct evidence of how food and foodways were utilised in the Mediaeval construction of social status. In 2019, the wreck relinquished a cask containing the skutes and some bones from a sturgeon. The fish was probably caught locally; ancient DNA analysis reveals that it was *Acipenser oxyrinchus*, the species native to the Baltic Sea. Butchering marks on the remains indicate the two-metre-long fish was chopped into several sections. In Mediaeval Denmark, sturgeon was a species reserved solely for the king, and poaching was a capital offense. Presentation and consumption of this fish on *Gribshunden* or in Kalmar would have been a visible example of the king's privilege and authority (Macheridis *et al*. 2020).

Another archaeological example of prestigious foodstuffs on *Gribshunden* comes from the spices and confections recovered in 2021: saffron, ginger, clove, pepper, almonds and other exotic and expensive delicacies. Hans' accounting records from 1487 show that he spent large amounts of money on these food categories, including 36 marks for saffron (Wegener 1864; Larsson and Foley 2023). Spices like these were available around the Baltic in some quantities from at least the middle of the fourteenth century, but they were not widely consumed (Sillasoo *et al*. 2007). The spices on *Gribshunden* show the opulence of the highest elite. Feasting was an essential, compulsory part of major political events, such as coronations. In the process of making treaties, it was mandatory. For example, in 1493, Hans sent an envoy to Moscow to broker a treaty with Ivan III. Russian chronicles note the tsar 'honoured' this envoy by inviting him to dine in his presence (Pape 2022). In England, surviving documents describe the extravagant menus served to celebrate the 1527 treaty between Henry VIII and the king of France (Lehmann 2018). The amount of spices recovered from *Gribshunden* would not be enough for the lavish days-long feasting described in the English documents, but larger quantities may have been conveyed on other ships in the fleet. The spices from the 1495 wreck were not enclosed in any apparent containers, but the observable discrete concentrations of saffron may have been wrapped in light textiles or even paper. Gift-giving is a long-standing method of building social capital (Woolgar 2011). These individual allotments of spices might have been intended as gifts to members of any of the Nordic Councils.

Feasting, gambling and gaming, gift-giving and displays of martial prowess surely would have been activities conducted during the Kalmar summit. Hunting, too, might have been pursued by the participants. *Gribshunden* presents some evidence to support this. The 2021 excavation trench produced a number of crossbows and accessories for them, including several arrows of different designs (Foley 2022). Some of these are interpreted as bolts for hunting. While any crossbow could be used for game, some of the most elaborately decorated Mediaeval crossbows in museum collections were the property of princes and used exclusively for hunting. The tillers of these crossbows were richly inlaid and decorated, and their composite prods were often covered with birch bark embossed with patterns and repeating designs. Finds from *Gribshunden* include two birch bark panels measuring 330 × 110 mm, and pressure-printed with identical motifs.[3] The entire motif has not yet been discerned, but floral elements swirl around a unicorn, and several wild animals and birds adorn the perimeters of the panels (Figure 10.6). These panels were recovered from a locus at the edge of the

[2] Personal correspondence, conservator Max Jahrehorn, Oxider, Kalmar, Sweden, 11 May 2023.

[3] At the time of writing this manuscript, the panels have only just been delivered from conservation. A detailed study of them is now in progress.

Figure 10.6. The unicorn embossed/printed on two identical birch bark panels with floral and mythical animal motifs recovered from *Gribshunden* in 2021. Image by Åke Nilsson, Blekinge Museum.

2021 trench. If excavation were to resume at that area, we speculate that other elements of a hunting crossbow may be present. The elaborate decoration of this weapon is an indication of the visual world in which the Nordic nobility lived. While the stone walls of extant castles in the region are largely muted, stripped of their adornments, the finds emerging from *Gribshunden* provide hints for recreating those environments with *barometerobjekte*.

Conclusion: The future of *Gribshunden* studies

Where does the study of *Gribshunden* as a floating castle go next? The ship can be compared profitably to land castles of the late fifteenth century, particularly the well-preserved stately fortress Glimmingehus. This castle was built in 1499 in Skåne, a region of southern Sweden which at the time was Danish territory. Glimmingehus is considered the best-preserved Mediaeval castle in Sweden (Nilsson 1999; Ödman 2004; Hansson 2009, 2016). It is ripe for comparison to *Gribshunden* because the nobleman who commissioned the structure was Jens Holgersen Ulfstand, King Hans' righthand man. Direct connections existed between Glimmingehus and *Gribshunden*, as Ulfstand likely sailed on the ship and certainly would have been aboard during his installation in Visborg castle on Gotland in 1487. Within his Scanian castle, a ship resembling G*ribshunden* is etched into the wall of the chamber reserved for the lord of the manor.

Overall, the spatial layout of the castle is similar to that of the ship. The lowest levels of the castle held the kitchen and storage spaces. This is analogous to the hold of the ship, in which the multitude of provisions casks have been identified. *Gribshunden*'s galley has not yet been exposed, but the copious amounts of firewood encountered in the 2019 and 2021 interventions suggest that it is located slightly forward of the areas excavated to date. This would correspond to the location of the galley in the *Mary Rose* (Marsden 2009). Slit windows in Glimmingehus' foundation wall have rebates on either side, interpreted as sockets for timbers on which artillery was mounted, similar to gunports on a ship. The next higher level of the fortified manor contains a sort of receiving room on one end the castle hall. On the opposite side of a central staircase are the lord's living quarters, featuring the ship etching. The next highest level contains the great hall, suitable for banquets and other large gatherings. Adjacent to this and directly above the lord's quarters are the chambers of the lady of the house. The fourth, uppermost level of Glimmingehus is termed the 'archers' loft'. The similarity to the forecastle and sterncastle of *Gribshunden* is obvious: on this level, sharpshooters armed with crossbows could snipe at marauders. Above this gallery are the timbers of the roof, which is topped with carved figures at either end, reminiscent of a figurehead on a ship (Figure 10.7).

The similarities between castle and ship extend to the flexible use of private or restricted spaces. In post-Mediaeval seafaring, the captain's quarters were transformed when the ship engaged in battle. That space went from semi-private sanctuary to a common combat arena. The same could happen at Glimmingehus. If a threat emerged, the lord's chamber was transformed into a 'battle scene'. One of the castle's many defensive traps was sprung from this room: hidden firing slits in the walls and overhead chutes for pouring various liquids would turn the central staircase into a killing ground. The division and importance of private spaces varied over time and with circumstance, both onboard the ship and within the castle.

Prominently in the case of King Hans and *Gribshunden*, this new style of warship served the same varied purposes as castles on land, but with the added benefit of high mobility. *Gribshunden* was an administrative, economic, cultural and social centre, all while projecting military power throughout the Nordic region. The ship was Hans' essential instrument to knit together his far-flung realm. He relied on it not only for the hard power of its artillery and men-at-arms, but for subtler soft power manifestations of his authority. As we further develop this comparison between land castles and warships, we will gain new insights into the functions and functioning of the floating castle.

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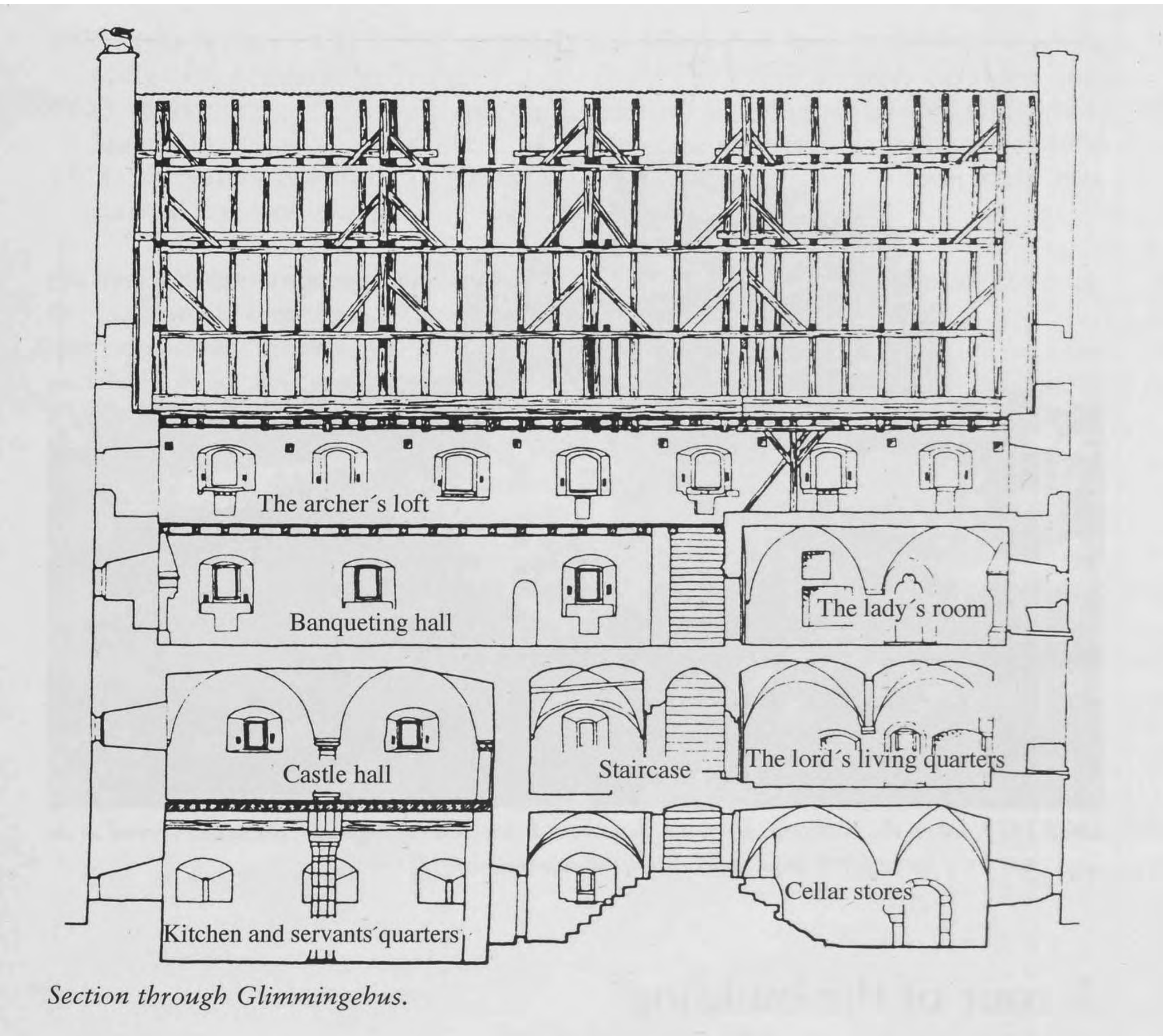

Figure 10.7. Elevation view of Glimmingehus fortified manor, with a floor plan similar in many ways to *Gribshunden*. Image by Agneta Hildebrand, as relabeled and reprinted from Ödman 2004: 16.

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11

New ideas about an old ship: some thoughts on the construction features of the late sixteenth-century *Scheurrak SO1* shipwreck

Hendrik Lettany

Abstract: The *Scheurrak SO1* shipwreck has become known in nautical archaeology as the flagship site of the 'Double Dutch' discourse. Discovered off the coast of Texel (The Netherlands) in 1984, the site delivered much new information about Dutch shipbuilding techniques in the early modern period. One of the peculiarities of the shipwreck was the presence of a double layer of hull planking. Thijs Maarleveld (1994) assessed the building sequence of this construction feature and concluded that, for a brief moment in time at the turn of the seventeenth century, Dutch shipbuilders built larger seagoing ships with a double layer of planking. This was considered necessary since Dutch carvel ships were built in the 'Dutch flush' tradition, to which a strong, self-carrying hull was essential. Although Maarleveld's paper became influential in the discourse on early modern Dutch shipbuilding, further details on the construction of the *Scheurrak SO1* shipwreck were never published. Preliminary results of the (re)assessment of *Scheurrak SO1*'s construction features reveal an image which deviates from earlier observations. Embedded within the historiography of Dutch flush shipbuilding, this chapter presents some construction details from *Scheurrak SO1*'s keel and stem which challenge former hypotheses about the ship's building sequence.

Introduction

Dutch Flush

At the 1982 *International Symposium on Boat and Ship Archaeology* in Stockholm, Richard W. Unger (1985) presented a paper on Dutch shipbuilding technology in the early modern period. Based upon historical research, Unger argued the Dutch building sequence to create flush-planked hulls deviated from other contemporary shipbuilding traditions in Europe. The common understanding up to that point was that in order to create a carvel-built vessel, the frames of the ship needed to be pre-erected. Yet, by studying the now well-known treatise of Nicolaes Witsen (1671) and digging into the written records of French spies who observed the shipbuilding techniques in the Dutch *Noorderkwartier*, he demonstrated that in the seventeenth century, the Dutch built their carvel vessels by first assembling the hull planking. Starting off with assembling the keel, stem and stern, then the first 10 to 12 planking strakes were installed before any timbers were added. The strakes were initially held together by means of temporary cleats, which were removed again once the floor timbers had been fastened. Although the building sequence was quite different from French, English or Iberian carvel vessels, the flush-planked look of the hull would have been quite similar.

Unger was not the first to draw upon the aforementioned sources. Hasslöf (1958, 1963) had used the same material to dispute the dichotomy between shell-first versus frame-first shipbuilding and their association with respectively clinker and carvel-built hulls as proposed by Hornell (1946: 193–194). Hasslöf too had demonstrated that carvel-built vessels were constructed in a sequence that did not begin by pre-erecting the frames, but rather, with assembling the hull as an empty shell. Other authors soon reached the same conclusion (*e.g.* Timmermann 1979). Yet, it was Unger's presentation which sparked the interest of the nautical archaeological community. It led to the further elaboration and verification of his arguments through existing archaeological, historical and iconographical data (*e.g.* Rieth 1984; Hoving 1988, 1991; Vos 1991a), but it also induced new archaeological surveys (*e.g.* Maarleveld 1987; Reinders 1987; Green 1991; Oosting 1991).

The different studies identified a number of construction features which have now become diagnostic for identifying the deviating Dutch building method in the archaeological record. Maarleveld (1992) was the first to create a full overview of these features, and coined the term 'Dutch flush' to refer to this deviating building tradition. With some additions of later research (Maarleveld *et al*. 1994; Maarleveld 2013), the current diagnostic features for identifying a Dutch Flush construction are:

- The presence of *spijkerpennen*, which are small wooden plugs used to fill the nail holes left by removing the temporary cleats.
- The use of a non-interconnected framing system, since frames were not pre-erected.
- Varying dimensions (both length and scantlings) of individual timbers.

- The use of treenails to fasten ceiling planks, timbers and hull planking.
- The presence of 18 to 23 frames within 4 m of the ship's length, or what Maarleveld (2013) referred to as 'the Dutch Flush Index'.

By now, many examples of Dutch Flush ships have been identified in the archaeological record. Although in the late seventeenth century, this building tradition was mainly associated with the *Noorderkwartier* and the northern part of The Netherlands, it is likely that in earlier periods, the Dutch flush tradition was also practiced along the *Maaskant* in the south (Hoving 1988: 216). The earliest known examples of the Dutch flush tradition date to the early sixteenth century. It is notable that one of these early examples was found in Norway, made of local materials (Vangstad and Fawsitt 2020; Sarah Fawsitt, Norsk Maritimt Museum, personal communication). Most known Dutch flush finds, however, have a clear Dutch association.

The Scheurrak SO1 shipwreck and the Double Dutch discourse

In 1980, Thijs Maarleveld was the first underwater archaeologist to be appointed by the predecessor of the Cultural Heritage Agency of The Netherlands (Rijksdienst Cultureel Erfgoed (RCE)). Although his initial responsibility was to catalogue the underwater cultural heritage of The Netherlands, his mandate soon gave way to the organization of actual underwater excavations. This led to the development of the Department of Underwater Archaeology in 1985 (Maarleveld 1981: 1, 1984: 12, 1998: 14, 52). The *Scheurrak SO1* shipwreck was discovered off the coast of Texel in the Wadden Sea in 1984. Amidst the exciting times in which the methodology and practice of Dutch underwater archaeology was being developed, and triggered by specific new research questions inspired by Unger's paper, this find provided a critical opportunity. Its excavation would become a pioneering project for Dutch underwater archaeology in the Wadden Sea. Running parallel to the excavation of the Aanloop Molengat shipwreck in the North Sea, both shipwrecks were the first underwater sites to be excavated by the Dutch government over a period of multiple years.

The *Scheurrak SO1* shipwreck carried a main cargo of grain and has been associated with the Baltic grain trade. Based upon former dendrochronological analysis, the ship appears to have been built in the first half of the 1580s. A trumpet made in Genoa had the date 1589 engraved in it, while a lintstock had a Dutch poem inscribed in it with the date 1590. The latter date was also the outer range of the youngest-dated barrel stave, which had a felling date between 1590 and 1605. This indicated that the ship sank in, or more likely after, 1590. On Christmas Eve, 1593, a severe storm hit the Roads area. Around 40 ships sank that night. Many of them were grain traders, and it has become a popular hypothesis that the *Scheurrak SO1* shipwreck was one of them (Hanraets 1997; Maarleveld 1990; Manders 2001; Vos 2013).

What made the *Scheurrak SO1* shipwreck of special interest for investigation at that time was the fact that the ship's construction was largely well preserved. The bottom survived from stem to stern and up to the turn of the bilge. In addition, the ship's entire starboard side was preserved from stem to stern and from the turn of the bilge up to the bulwark. The starboard had broken off from the bottom and was lying next to the ship's bottom. Both parts only remained attached to one another by the bilge stringer near the bow. The ship was excavated between 1987 and 1997, and analysis of the hull remains met all criteria for interpreting it as a ship built in the Dutch flush tradition. But analysis also demonstrated that the ship had been built with a double layer of hull planking: not a sacrificial layer of pine sheeting, but a double layer of 7 cm-thick oak strakes, creating a sturdy 14 cm-thick hull (Maarleveld 1994: 156). This peculiar feature did not correspond to the characteristic features of Dutch flush known up to that time, indicating a need for further study. How far the double layer of hull planking extends is not known. Based upon excavation data, it is clear that the double layer runs at least as far as the bilge. How far it continues on the starboard side is unclear, yet a loose part of the ship's port side at the height of the main deck demonstrates that in this area, the ship had only a single layer of planking.

Not much earlier, the remains of the Dutch East Indiamen *Mauritius* (1601) and *Batavia* (1628) demonstrated that these ships too had been outfitted with a double layer of hull planking (l'Hour *et al*. 1989: 213, 221–222; Green 1991: 70). The *Batavia* sank on its maiden voyage, indicating that the double layer of hull planking was part of its initial construction. Maarleveld analysed part of the *Scheurrak SO1* construction in order to assess the building sequence of the double-layered bottom, and he would conclude that here too the double layer was part of the initial construction. It was his belief that when economic development at the end of the sixteenth century demanded larger ships, shipbuilders added a second layer of hull planking in their Dutch flush building process. He called this a 'double Dutch solution', in which shipbuilders simply strengthened what was, in their view, the most important part of the ship: the self-carrying hull. Due to the double Dutch solution, shipbuilders were able to increase the scale of their vessels and make them larger and stronger (Maarleveld 1994: 159, 162).

Wendy van Duivenvoorde (2008, 2015) has demonstrated that Maarleveld's interpretation is not entirely valid when it comes to the construction of double-planked hulls by the Dutch East India Company. Based upon bits and pieces collected in historical sources, she notes that building ships with a double layer of planking was a common practice for Dutch ships sailing to the East Indies in the early seventeenth century. Ships were built with a double skin, and when purchased with a single skin, a second layer of planking was added. According to Van Duivenvoorde's research, the main reason for double planking was the need for sturdy ships. Especially in the early years of the Dutch East India Company, the infrastructure abroad was limited, and each repair could cause a delay of multiple months. There were certain advantages to the use of a double layer of (thinner) planking over one (thicker) layer of planking. Not only would it be more difficult to shape the hull with strakes of such thickness, it would also be much easier to make repairs when two thinner layers were applied. Van Duivenvoorde's argument for the use of double-planked hulls provides a much more functional reason than the one brought forwards by Maarleveld. Yet, since the *Scheurrak SO1* shipwreck was clearly not a Dutch East Indiaman, we cannot simply project her interpretation onto it. Nor are Maarleveld's and van Duivenvoorde's discourses mutually exclusive. Yet, it is mainly his assessment of the *Scheurrak SO1* shipwreck that validates Maarleveld's interpretation.

Most scholars who have studied the phenomenon of the double-planked hulls agree it was a short-lived tradition which should be situated around the late sixteenth and early seventeenth centuries (Vos 1991b: 54; Maarleveld 1994: 162; van Duivenvoorde 2015: 204). In recent years, however, evidence has appeared of double (oak) planked hulls from later years. In Germany, the *Hörnum Odde* shipwreck (late seventeenth century) and the *Süderoogsand 1* shipwreck (first half of the eighteenth century) demonstrate double-hulled planks in a fashion similar to Dutch flush (Zwick 2021, 2023: 99–102). The *Stavoren 18* shipwreck in The Netherlands exhibited a double layer of oak planking, covered with a third sacrificial layer made of pine. It was built in the late seventeenth or early eighteenth century and sank in the mid-eighteenth century (Muis and Opdebeeck 2022: 35, 64–65). It has been suggested that after 1650, the only ships with double skins were those meant for whaling (Vos 1991b: 54; van Duivenvoorde 2015: 204); yet it is uncertain whether all of the aforementioned younger shipwrecks should indeed be interpreted as remains of whaling vessels. Notarial archives from Amsterdam also demonstrate that adding an oak doubling layer was not uncommon in the eighteenth century (Muis and Opdebeeck 2022: 71). Although it is at this point unclear whether these later examples should be interpreted in the same way as the double-oak layers used in the late sixteenth century, these new examples do raise questions about the former interpretation, especially since the double Dutch discourse builds upon the idea that the double-oak layers of hull planking reflect only a short period of experiment and innovation in the Dutch flush shipbuilding tradition.

Given these changes in the state of the art, it seems appropriate to reassess *Scheurrak SO1*'s construction. In 2020, an interdisciplinary research project started at Leiden University, in which the *Scheurrak SO1* shipwreck will be assessed from both a maritime archaeological and maritime historical perspective. The archaeological component will focus mainly on the ship's construction, with the excavation data from the 1980s and 1990s field seasons as its main source. In the following section of this chapter, specific attention will be given to the reassessment of the keel and stem assembly from the *Scheurrak SO1* shipwreck.

Keel and stem construction in the lower hull

Former research

At the end of the 1988 field season, the forward end of the lower hull was sawn off and lifted for an in-depth analysis on land (Figure 11.1). The structure was transported to the city of Alphen aan den Rijn, where it was registered and described. In order to understand the relation between the different structural elements, the assemblage was dismantled in a systematic way. First the riders and ceiling planks were removed, then the keelson and next the frames. Finally, the two layers of hull planking were removed. A first analysis of the construction was mainly executed by intern Ronald Koopman, naval engineering student at the Hogeschool Rotterdam and Omstreken. His study resulted in a brief unpublished report (Koopman and Goudswaard 1991), as well as in several loose notes and drawings. These documents provide a useful source of information now, since most of the dismantled timbers were reburied afterwards on lot OZ40 in Zeewolde (Flevoland province), which is elaborated by the RCE as a ship (timber) graveyard. It is notable that not all timbers were reburied, probably only those which were fully examined and drawn by Koopman at that time.

The data provided by Koopman were further elaborated by Thijs Maarleveld and provided the basis for his 1994 article on the building sequence of *Scheurrak SO1*'s lower hull. In this article, Maarleveld delimits a 1 × 2 m section of *Scheurrak SO1*'s portside, which includes ceiling planks, floor and futtock timbers, the inner and outer layer of the double hull planking, as well as the treenails. By treating every element as a stratigraphical unit, a Harris matrix could be created of the stages of construction. The presence of both blind and transecting treenails was especially informative in this regard. Maarleveld's (1994: 156–162) research suggested the keel was first assembled from several units; then, the stem and sternposts were installed, including deadwoods; and next, a double rabbet was applied. The garboard strake of the inner shell was nailed into the upper rabbet and other strakes were added by means of temporary cleats (marked again by the presence of the so-called '*spijkerpennen*'). Next, floors were added by means of dottled plugs. After removal of the clamps, the ceiling was put in place, fastened by treenails which penetrated timbers as well as inner planking. Finally, the outer shell was nailed into the lower rabbet and onto the inner shell. It was fastened to the pieces above (*i.e.* outer and inner planking, floors and ceiling), again, with treenails. It is notable that for many of these latter treenails, care was taken to drill through earlier treenails which fastened the inner planking to the floors and/or the

Figure 11.1. Lifting of the forward end of *Scheurrak SO1's* lower hull. Copyright Rijksdienst Cultureel Erfgoed.

ceiling planks. Maarleveld states that only in a next phase were riders installed.

The remaining timbers, which include the keel and stem assemblage, as well as a number of hull planks, were examined by another intern, Richard Kroes, in 1994–1995. His study also resulted in an unpublished report (Kroes 1995) and drawings, yet further notes were preserved to a much lesser extent than for Koopman's study. Kroes' research focussed specifically on the building sequence of the stem and keel construction, for which he applied a stratigraphical units-approach similar to the one used by Maarleveld. The most interesting outcome of his research was evidence of the keel being repaired in its forward end. Koopman and Maarleveld had already noted that the recovered part of the keel was assembled out of two pieces by means of a nibbed diagonal scarf, yet Kroes was the first one to associate this with repair. According to Kroes, this repair most likely occurred during construction, and not when the ship was already in use.

Reassessment of keel and stem construction

A reassessment of the construction details of the recovered keel and stem assemblage in the forward end of the lower hull, based upon the drawings, reports and notes of Koopman, Maarleveld and Kroes, was executed to gain a better understanding of the repair in relation to the building sequence of the *Scheurrak SO1* shipwreck as proposed by Maarleveld. The available pencil drawings were digitised in Illustrator, which allowed for combining them in their respective relations to one another. Drawings of the two riders which were part of the forward end of the lower hull were also digitised and for the first time confronted with Maarleveld's hypothesis.

The assemblage of keel and stem exists of four main parts (Figure 11.2a). The identification of the different elements has varied in the past. The keel itself is assembled of two pieces joined by a nibbed diagonal scarf. A third element is assembled to the front of the keel by means of a boxing scarf. This element has been referred to as the 'outer stem' (Koopman and Goudswaard 1991: 1), as well as a third part of the keel (Kroes 1995: 3). A fourth element is attached to elements two and three and has been referred to as the 'inner stem' (Koopman and Goudswaard 1991: 1) or stem (Kroes 1995: 3). According to Koopman, the assemblage had a total length of *c*. 570 cm, yet according to measurements of the scaled drawings, the length must have been *c*. 550 cm. It is possible this difference of 20 cm was caused by parallax when the assemblage was manually measured, due to the height difference of both extremities.

The aft part of the keel (Figure 11.2b, element 1), has a total length of 345 cm. Towards the forward end, the

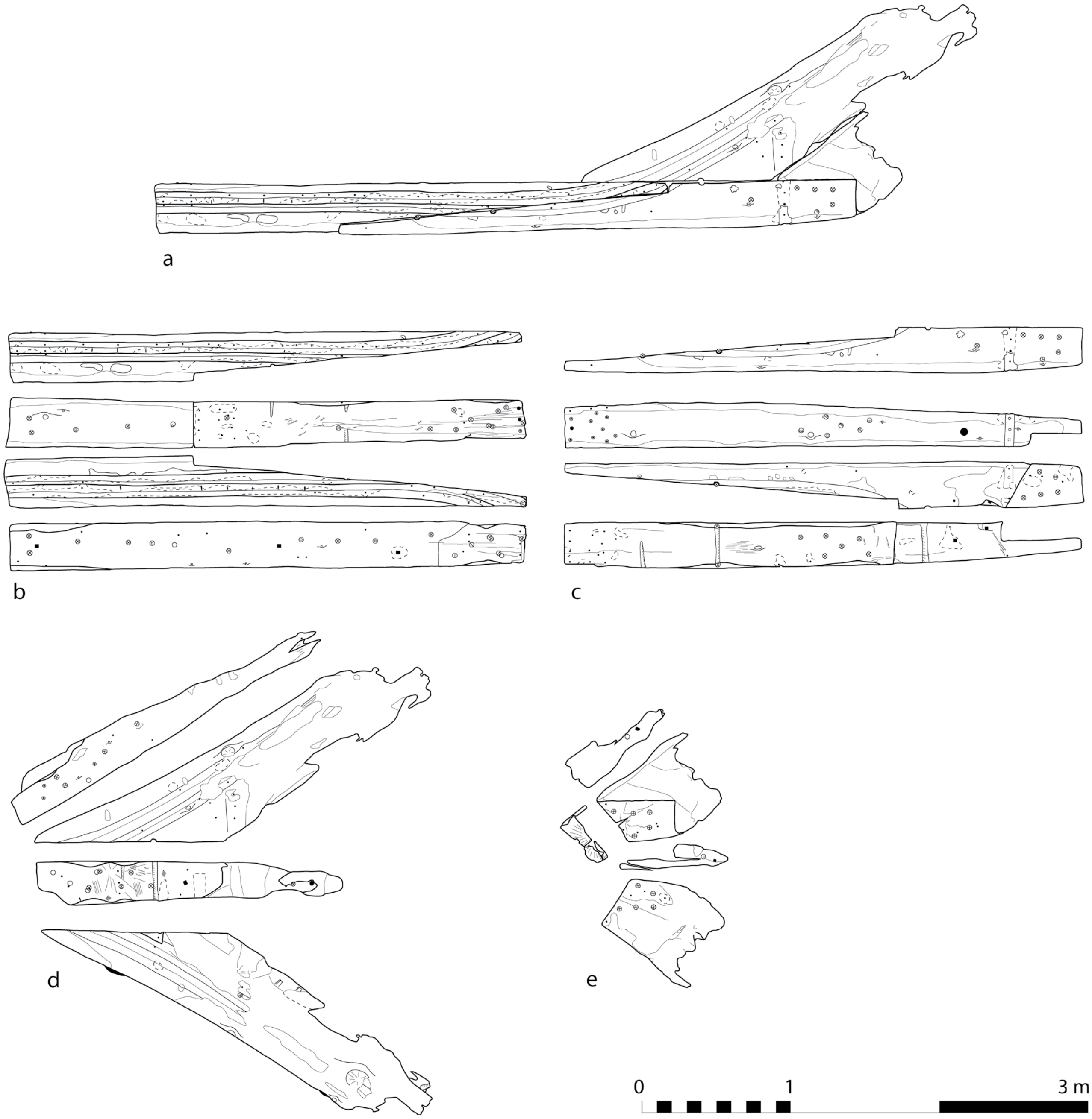

Figure 11.2. Starboard side of the keel and stem assembly of the forward end of the lower hull (a) and individual elements of the same assembly: (b) element 1, (c) element 2, (d) element 4 and (e) element 3. Image by H. Lettany, after Kroes 1995.

upper part of the nibbed diagonal scarf is present, which has a total length of 220 cm. The nib itself has a height of *c*. 5.5 cm. The keel's cross-section in the aft is more or less square-shaped, measuring 33 cm sided and 32 cm moulded. The fastening of this part of the keel does correspond to Maarleveld's description. Treenails were used to connect it to the superposed floor timbers and keelson. On both port and starboard side, two rabbets are present, corresponding to the inner and outer garboard strakes of the double hull planking. Exact depths of the rabbets are not mentioned in any of the reports. Yet, based upon drawings of the aft cross-section, they all appear to measure *c*. 5 cm, except for the lower port rabbet, which measures *c*. 6 cm. Nails, at *c*. 17 cm intervals (± 2 cm, sometimes with an extra nail in the middle), were used to fix the inner garboard strake to the upper rabbet. Nails were also used to fix (preliminarily) the second layer of hull planking to the inner layer, yet to a much lesser extent, and there are no indications the outer garboard was fixed to the lower rabbet in the same way.

While the upper rabbet continues directly from the aft part of the keel into the stem, the lower rabbet crosses the forward end of the keel first (Figure 11.2c, element 2). This part of the keel has a total length of 348 cm. It is 24 cm sided and 32 cm moulded. The aft 220 cm of this element comprises the lower part of the nibbed diagonal scarf which corresponds to element 1. In the front, a vertical boxing scarf is present. Because of the oblique shoulder of this scarf, its cheek has a length of 32 cm at the top and 52 cm at the bottom. Towards the aft, nails were used to fasten this element to the upper part of the scarf, perhaps preliminarily, in order to trunnel the treenail holes. Also in the front, a nail was used to fix the forward part of the keel to the stem. When it comes to the treenails, something notable can be observed. The treenails used to fasten the aft part of the keel (element 1) to the superposing elements do not continue in the forward part of the keel (element 2); instead, they only run as far as the scarf, where they have been excessively dottled with no less than three dottles per treenail. Another six treenails, as well as an iron bolt, transect the forward end of the keel from the bottom, and most of them end blind in the stem (element 4). Two stopwaters transect the keel horizontally from side to side along the seam of the nibbed diagonal scarf. A third stopwater runs from side to side in the seam between the forward end of the keel (element 2) and the stem (element 4).

It is notable that element 4 (Figure 11.2d), which we will refer to as the stem, contains a number of transecting treenails which do not continue in the underlying forward part of the keel (element 2). One blind treenail is present in the stem's bottom face, which does not continue in the underlying element either, consequentially not serving any purpose in the current construction. The stem's bottom face measures 128 cm by 28 cm. The stem is preserved over a length of *c*. 270 cm. It rakes relatively strong over a preserved distance of *c.* 145 cm, while it only reaches a height of 113 cm. Due to significant deterioration, no further construction details can be observed in its upper part. In the lower part, traces of the double rabbet can clearly be observed on both port and starboard side. In its forward face, two blind iron bolts are present, by which element 3 is fastened to it.

Element 3 (Figure 11.2e), which in the past has been referred to as an 'outer stem', is *c.* 24 cm sided and 55 cm moulded. It is connected by means of a vertical boxing scarf to the forward end of the keel (element 2). Five treenails, one of which is dottled, transect the boxing scarf horizontally. Another four nails were also used to fasten the 'outer stem' to the forward end of the keel. A treenail and iron bolt were driven diagonally into the forward face of the 'outer stem' to fasten it to the stem (element 4). Other than the boxing scarf, most of this element is strongly eroded.

An iron strap was nailed onto the construction in its forward part. The strap crosses the stem, the 'outer stem' and forward end of the keel on starboard side. It continues underneath the keel and goes up as far as at least the 'outer stem' on port side. At starboard, the strap has a maximum width of 15 cm, which tapers to 6 cm at the keel's bottom face. Former descriptions of the construction mention the presence of two small wooden laths or battens along port side. One ran underneath the iron strap and would have covered the seam between keel and stem. The other piece would have covered the stopwater in the same area. Neither of these parts appears to have been drawn or photographed, and their shape and extent therefore remain unknown. A triangular notch in the stem's port side close to the stopwater may be associated with this.

Caulking material was present in between scarfs and along all seams and rabbets.[1] A thick layer of organic material was present in between both faces of the nibbed diagonal scarf in the keel. Samples of the caulking material were in the past taken on different locations in the fore-end of the lower hull. Analysis of a number of sub-samples demonstrated that peat moss (*Sphagnum*) was mainly used as a caulking material, although some samples were described as 'amorphous' and one sample as 'other plants' (Cappers *et al*. 2000: 589). Although the exact species of the sub-samples were not determined, samples from the aft end of the lower hull proved to be *Sphagnum cuspidatum*.[2] This species, which grows in wet, acidic, oligotrophic environments, is common in The Netherlands. In the frame of the current research, further botanical and palynological analysis of some of the remaining samples will be executed.[3]

All four parts were assessed for dendrochronological analysis (Jansma and Hanraets 1995). Although both parts of the keel presented well-suited tree-ring sequences, only the aft part (element 1) resulted in a felling date. This felling date, 1585 ±8 (with a non-specified German origin) did not contradict the general assumption this ship was built in the first half of the 1580s (Maarleveld 1994: 155; Manders 2001: 320; Vos 2013: 11), yet it also presented the possibility that the shipwreck could actually be younger. The forward part of the keel (element 2) presented sufficient tree rings for an adequate analysis but did not deliver a match with the available refence sequences. Several dendrochronologists were asked to take another look at the data using current reference sequences, since much has evolved in the field of dendrochronology over the past 25 years. Unfortunately, the sample still did not match any available reference sequence.[4] The stem (element 4) presented 51 tree rings, including waney edge, but did not deliver a match either. What has been interpreted as the 'outer stem' (element 3) was not feasible for analysis because of insufficient tree rings.

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[1] According to Kroes (1995: 3), caulking was found in between all scarfs except for the boxing scarf between the forward end of the keel and the 'outer stem'. Yet, when the author collected the available caulking samples, a sample was found originating from this specific area. Cappers *et al*. (2000: 589, sample 58f) also describe this location for one of the studied caulking samples.

[2] Based upon unpublished correspondence between W.J. Kuijper and T.J. Maarleveld, 11 July 1988.

[3] In December 2017, the freezer in which the remaining caulking samples were stored was found to be defective. The samples were not refrozen afterwards, but were stored at 'room temperature' without further intervention. This was still the case at the start of the current research project. The possible impact of this situation on the samples is as yet unclear.

[4] I would like to thank Petra Doeve, Esther Jansma, Kristof Haneca, Aoife Daly and Sjoerd van Daalen for reassessing this specific sample.

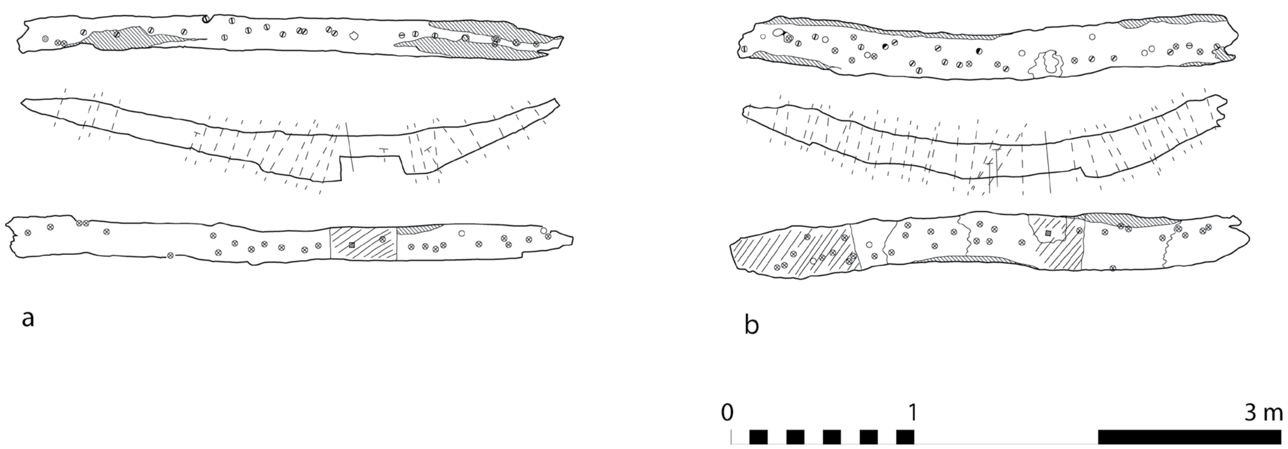

Figure 11.3. Rider 1 (a) and rider 2 (b) from the forward end of the lower hull. Image by S. Mulder, after Kroes 1995.

Reassessment of riders

Two riders (Figure 11.3) were present in the forward end of the lower hull when it was recovered from the seabed. An imprint in the ceiling planks indicated that aft of these two, a third rider might have been present (Koopman and Goudswaard 1991: 1). During excavation, the presence of a third rider was indeed proposed, but the interpretation of one rider was also refuted later when it turned out to be a loose timber from higher up in the ship's construction which had ended up on top of the ceiling planks (Dive report Thijs Maarleveld 19 July 1988; dive report Peter Stassen 30 September 1988). It is unclear as to what extent these statements relate to one another and whether the loose timber is indeed the same as the presumed third rider and/or the cause of the imprint in the ceiling planks.

Structural elements in the forward end of the keel were numbered from aft to front, making the rider closest to the bow rider 2 and the one aft of it rider 1. Rider 1 (Figure 11.3a) is 18 cm sided and 25 cm moulded at its largest extent near the centre and is *c.* 240 cm long. It has a *c.* 34 cm wide and *c.* 13 cm deep notch at the centre of its bottom face, which allows the rider to fit over the keelson. Rider 2 (Figure 11.3b) is situated about 50 cm forward of rider 1. It is 25 cm sided, 20 cm moulded and has an overall length of 265 cm. Rider 2 was notched in the centre of its bottom face too, yet with only a clear indent of *c.* 6 cm on starboard side, again, to make the rider fit over the keelson.

Both riders were fastened to the underlying elements by means of treenails and an iron bolt. In both cases, the iron bolt transects the rider from its upper face downwards, fastening into the underlying elements. Rider 1 is connected to the underlying keelson, floor timber and the aft part of the keel where it ends blind. It is notable this is the location of the nibbed diagonal scarf in the keel, and the iron bolt thus does not fasten both parts of the keel to one another. For rider 2, the iron bolt transects the underlying keelson and floor timber. Although it does not end blind in this floor timber, it does not seem to continue in the stem. Kroes (1995: 4) does mention the presence of a nail in this area of the stem, for which the origin or function is unaccounted. It is not unlikely this presumed nail is actually a trace of the bolt's end, but there are no images to confirm this. Other than the iron bolts, a large number of treenails were used to fasten the riders to the rest of the construction. Due to small inaccuracies[5] in the drawings, it is unclear exactly how many treenails were used and to which underlying elements they connect; however, it is clear that for riders 1 and 2, the number of treenails exceed respectively 20 and 30. Most of these treenails are wedged on the rider's upper face. However, both timbers do also present blind treenails—three for rider 1 and two for rider 2—that enter from the bottom face.

Rider 2 was sampled for dendrochronological analysis in the past; yet despite its feasible tree-ring series, it did not match any of the available refence sets at that time (Jansma and Spoor 1991: 3). Reassessment of the same series in the frame of the current research project did demonstrate an origin for rider 2 in Southern Norway, with a felling date between 1590 and 1600 (Doeve 2021: 15). This may mean that the construction date, which in the past was believed to fall in the first half of the 1580s, should be adjusted to the early 1590s, or that rider 2 was only added to the construction at a later stage.

Discussion

The above reassessment of keel and stem reveals several features which can clearly be associated with an alteration of the initial construction. The relation between the nibbed diagonal scarf in the keel and some of the treenails is especially telling in this regard. Four treenails which run through the upper part of the scarf stop abruptly at the level of the scarf itself and do not continue in the lower

[5] As can be seen in Figure 11.3, the pencil drawings of the recovered ship timber is not always as detailed as desired. When looking at the top, side and bottom view of the recorded riders, it is difficult to conclusively link the locations of treenails on all three views of the same timber.

part. Three of these treenails have been dottled on the inside of the scarf. Three more treenails run through the stem, but again, they do not continue in the forward part of the keel. One of these treenails therefore does not have any purpose, since it ends blind in the stem's bottom face. These seven treenails initially must have continued in the keel but were shortened when the forward end of the keel was put in place. We can presume the aft end of the keel initially was longer, and for some reason, this part was later removed.

A similar conclusion was drawn by Kroes (1995: 3). He points out adze marks in the scarf as an extra argument. In the forward part of the keel (element 2, the part that was added only after the initial construction), the adze marks are very neat and clean. In the aft part of the keel (element one, or the initial part of the keel that was altered), the adze marks are much rougher and plentiful. Kroes interprets this as possibly indicating that element 1 had to be worked in a more difficult position—for example, upside down—when the keel and stem were already in place. Although this could be true, we also cannot exclude the possibility the difference in finish simply is the result of different shipbuilders working on the same construction. Nevertheless, what is not in doubt is that the keel was indeed altered.

Yet there is even more to the alteration of the keel. When the outer keel rabbet is observed, it is found to cross the forward end of the keel—*i.e.* the altered part—and thus must have been added only after the initial construction was changed. Again, this was noted by Kroes (1995: 6). He interpreted this as indicating the keel had been altered during construction, and and that only after this modification the two layers of hull planking were added. Kroes's reasoning was likely influenced by Maarleveld's paper on the Double Dutch solution in early modern shipbuilding. Maarleveld had argued that both layers were part of the ship's initial construction and were put in place at the very beginning of the building sequence; 'it was only in the next phase that riders were added', while it remains unclear when elements such as futtocks, knees and beams would have been added (Maarleveld 1994: 159). This would indeed correspond to Witsen's discussion of the Dutch flush sequence, where the riders were only added when the ship's bottom was already finished and the futtocks and top timbers were in the process of being installed (Hoving 1994: 116–119). Yet the question is whether this can simply be extended to the *Scheurrak SO1* construction.

The answer appears to lie in a detail of the riders. These elements were never before incorporated in an analysis of *Scheurrak SO1*'s building sequence, yet their assessment influences the former hypotheses. As discussed above, both riders had a number of blind treenails in their bottom face. The riders, however, were fastened from the inside of the ship outwards; it would have been inefficient to enter treenails from the outside of the hull just to fasten these elements. This means the blind treenails were not meant to fasten the riders, but were part of fastening another element in the ship's bottom—yet only after the riders were already in place. The diagnostic features of the Dutch flush building sequence are clearly present in the *Scheurrak SO1* shipwreck, so we do know that the (inner) hull planking must have been assembled first. The floor timbers and ceiling planks all lie underneath the riders and thus must have been put into place before the riders. This means the only element which could have been added after the instalment of the riders is the outer layer of hull planking. Maarleveld's analysis of the building sequence demonstrated the outer layer of hull planking was fastened with treenails which ran through all of the above lying elements, all the way up to the ceiling planks. However, if the rider at that point was already in place, perhaps some of these treenails did indeed continue into this element, hence, the blind treenails. An alternative explanation for the presence of the blind treenails could be reuse, with the riders having served a different purpose before being used in this construction. Yet, this seems less likely, given that rider 2 is currently the structural element with the youngest felling date within the *Scheurrak SO1* shipwreck.

The new observations shed a different light on the former interpretations of the *Scheurrak SO1* building sequence; however, the question remains how we should interpret them. A first thought would be that the keel and stem were indeed repaired. Different than Kroes' interpretation, this repair would have occurred when both layers of hull planking were already in place, and to some extent, new strakes of outer planking were added during this repair. There is, however, one notable feature in the altered keel which seems too specific to be a coincidence: the location of the scarf in relation to the keel rabbets. It is placed in such a way that the inner layer of hull planking is not affected at all, while the outer layer of hull planking does run over the new part of the keel. It is a construction that, in a way, resembles the altered keel of the *B&W1* shipwreck (phase 1 *c.* 1583; phase 2 *c.* 1607), a Dutch built *verlanger* (Lemée 2006: 237–240). The Dutch word *verlanger* refers to the lengthening of ships, a practice that was common in the early modern Netherlands. A ship would be cut in half and pulled apart, after which both parts were reworked into a longer variation of the old ship by adding an extension in the middle. In the case of the *B&W1* shipwreck, the only archaeological example of such a ship to date, the ship was given a new layer of hull planking over its old one. This resulted in a ship with two layers of hull planking in the fore and aft, and only a single layer of hull planking in the middle. Interesting in the context of this analysis is how the keel and stem (Figure 11.4) were adjusted in the process of lengthening the ship. To give the lengthened ship longitudinal strength, among other strategies, a new keel was added underneath the old keel. The lower part of the original keel was cut away to just underneath the inner garboard strake. The new keel, which was added underneath, extended *c.* 130 cm further underneath the stem than the original keel did, and it was given a second rabbet, just underneath the rabbet of the original keel.

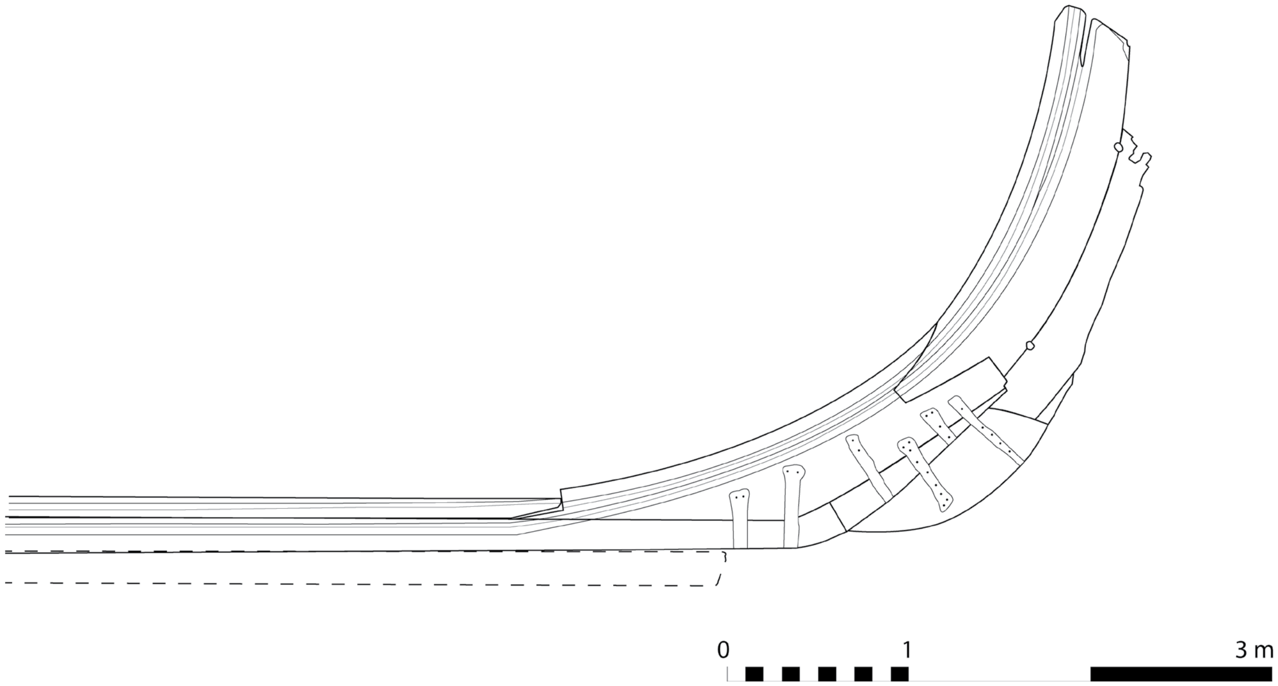

Figure 11.4. Starboard side of the keel and stem assembly of the *B&W1* shipwreck. Image by H. Lettany, after Lemée 2006: 237.

The original keel was fastened to the stem by means of a diagonal scarf, of which only the final 26 cm remained, while the lower-lying remainder had been cut away and replaced by the new keel. In front of the stem, a cutwater or gripe had been added, existing of multiple pieces. Both the new keel and the parts of the gripe were fastened to the stem by means of iron straps.

Although very different in execution, the underlying idea of the alteration of the *B&W1* keel and stem in the forward end of the hull in a way resembles what can be observed in the *Scheurrak SO1* construction, especially if we compare it with Witsen's description of the keel and stem construction. Witsen (1671) meticulously describes the construction of a 134–foot pinas, built according to the Dutch flush method (Hoving 2012). Although it is important to remember the *Scheurrak SO1* and *B&W1* shipwrecks date from late sixteenth and early seventeenth century and Witsen's publication to the latter half of the seventeenth century, the information that Witsen provides about the stem and keel construction can be observed in earlier seventeenth century shipwrecks as well. An example is the *Vasa* (1628), which was built according to Dutch design (Rose 2014: 239–243). Witsen (1671: 149) describes how keel and stem are connected by means of a boxing scarf and are afterwards rabbeted. His description does not mention any other timbers which are part of this construction. Later in his book, he does explain the meaning of *looze voor-steven* and *sny-water*, which correspond to gripe and cutwater. His description is very similar to what can be observed in the *Vasa*, and here a gripe was added to the lower half of the stem's forward face, which ends together with the stem in the boxed keel.

Lemée (2006: 240) demonstrates that part of the gripe of the *B&W1* shipwreck was only added when the ship was lengthened. It is therefore not unlikely that the initial keel-stem construction may have been similar to what Witsen describes, yet with a nibbed diagonal scarf instead of a boxing scarf (Figure 11.5a). When the ship was lengthened, the lower half of the keel was removed. In order not to affect the original layer of hull planking, care was taken to remove the keel only to the point where the present rabbet began (Figure 11.5b-c). A new and longer keel was then placed underneath the old keel and stem, and the gripe assembly was added as well (Figure 11.5d). A second rabbet was added for the outer planking of the now-lengthened hull. This second, outer rabbet did cross the elements of the new keel (Figure 11.5e). The second building phase was finalised by adding iron straps around the construction (Figure 11.5f).

The construction details of the *Scheurrak SO1* shipwreck clearly demonstrate that the keel and stem construction was adjusted here as well. The cut off and dottled treenails in the upper part of the diagonal nibbed scarf, as well as a blind treenail in the bottom face of the stem, show that a part of the original keel must have continued more towards the bow but was removed. The blind treenails in the riders demonstrate that the ship's bottom had already been constructed when this alteration was executed. It is possible the second layer of hull planking was already in place, but was replaced or fastened again as part of the repair in the stem and keel. However, the fact that the rabbet of the inner layer of hull planking was not affected by the modification, while the outer rabbet crosses the modified parts, resembles what we can see in the *B&W1* shipwreck, and it raises the question of

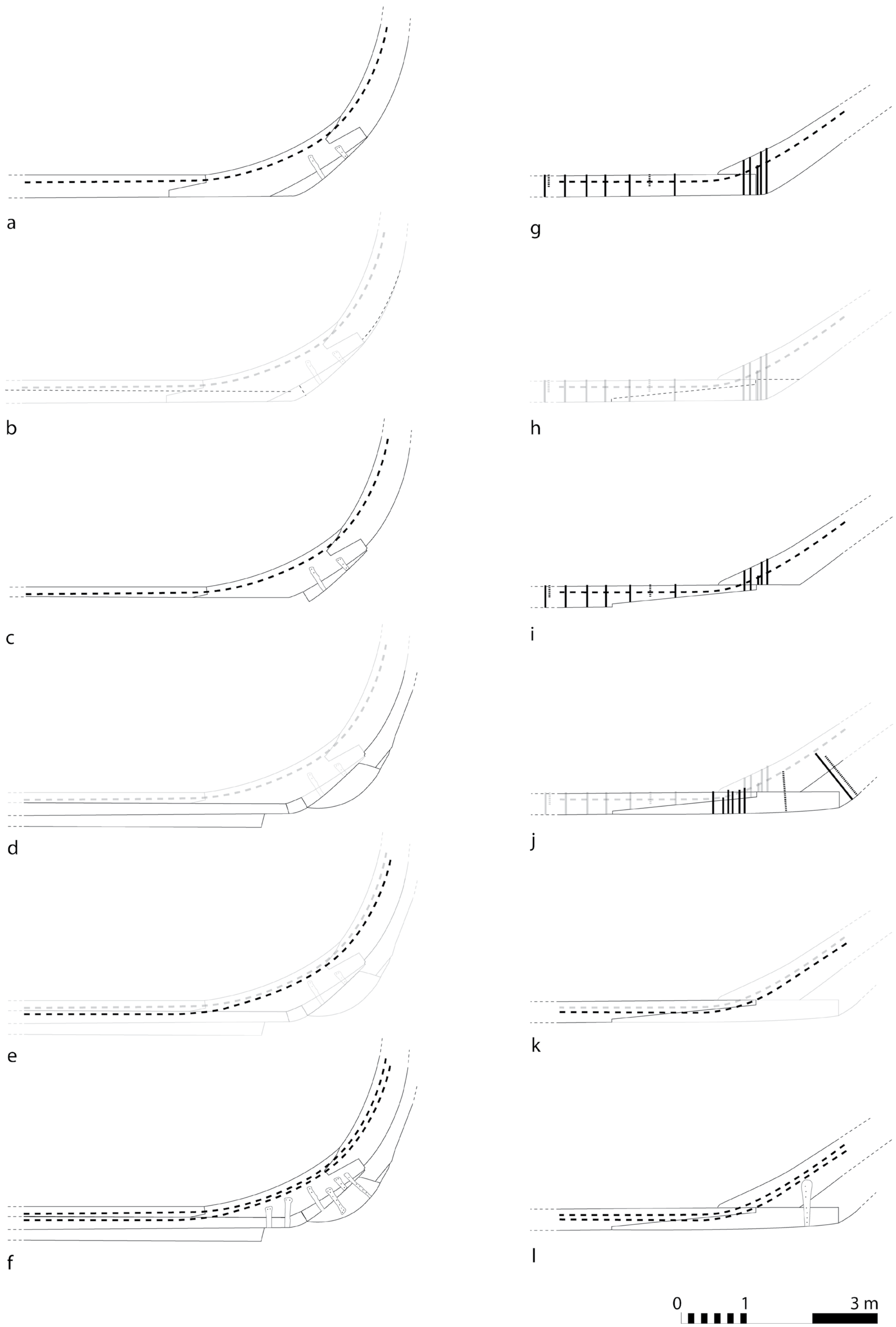

Figure 11.5. Hypothetical initial stem and keel construction of (a) the B&W1 shipwreck and (g) the *Scheurrak SO1* shipwreck, and the consequential steps of the second building phases ((b) through (f) and (h) through (l)). For *Scheurrak SO1*, treenails (black) and iron bolts (dashed) are indicated as well. Image by H. Lettany.

whether the second layer of hull planking there could have been a later addition. For the sake of reasoning, let us presume the stem and keel were initially built with a boxing scarf as described by Witsen (Figure 11.5g). For an unknown reason, the forwardmost part of this construction was then adzed away. In this process, the initial scarf and part of the treenails were removed. Yet, similar to the *B&W1* shipwreck, care was taken not to affect the rabbet of the original layer of hull planking in the process (Figure 11.5h-i). A new element was then added as part of the keel, one that protruded more to the front than the original keel had and which was fastened with new treenails and an iron bolt (Figure 11.5j). It is plausible that element 3 was also added at this point in the modification process. In the past tentatively interpreted as an 'outer stem', this element more likely served as a gripe and should be interpreted as such. A second rabbet was then added just underneath the original rabbet. Contrary to the original rabbet, the second rabbet therefore crosses the modified part, the new keel (Figure 11.5k). At the very end of the process, an iron strap was added to fasten the old and new parts together (Figure 11.5l).

Although the execution of the alteration of keel and stem in both the *B&W1* and *Scheurrak SO1* shipwrecks is different, the conceptual idea seems to correspond. This does not mean the second layer of hull planking from the *Scheurrak SO1* shipwreck served the same function as that of the *B&W1* shipwreck. In the past, similarities between both shipwrecks have been highlighted, especially in regards to the fastening of the outer layer of hull planking. In both cases, the treenails used to fasten the outer layer of planking are organized in such a way they transect—or are close to—the treenails used to fasten the inner layer of hull planking to the timbers and ceiling planks. Yet at this point, it is indeed difficult to prove or disprove whether the *Scheurrak SO1* shipwreck was lengthened. Maarleveld, when asked about this by Lemée, saw no reason to believe that *Scheurrak SO1* would have been a lengthened ship (Wegener Sleeswyk 2003: 44; Lemée 2006: 227). Similarities between both shipwrecks, however, suggest the second layer of hull planking in the *Scheurrak SO1* shipwreck was a later addition.

The reason why, in this specific context, a second layer of hull planking would be added at a later stage is as yet unclear. It is known that the Dutch East India Company added additional hull planking to ships which were sailing to Asia. Whaling ships were given an extra layer too, as were warships, for protection against the impact of ice and round shot, respectively (van Duivenvoorde 2015: 204). Yet none of these circumstances seem to apply to the *Scheurrak SO1* shipwreck, which carried a cargo of grain probably originating from the Baltic and likely meant for the Mediterranean. Although lengthened ships are known to have been involved in this specific trade in the late sixteenth century, there is presently no evidence to determine whether *Scheurrak SO1* was indeed a lengthened vessel. Despite the fact a clear interpretation is currently not possible, the observation that *Scheurrak SO1*'s construction reflects two separate building phases is important. It allows us to challenge former hypotheses which have become entrenched in the field of maritime archaeology over time. As a consequence, new questions related to the interpretation of these observations can and should be raised, in order to develop further our understanding of the maritime past. It is the aim of the *Scheurrak SO1* project to raise these questions and to embed and elaborate the technological observations discussed in this chapter within their wider historical context. Additionally, the new insights in the construction of the *Scheurrak SO1* shipwreck demonstrate the potential of using legacy data within the field of maritime archaeology; new information can be gained by (re)assessing old datasets based upon specific research questions. This is not always an easy task, since archaeological practices related to recording and data management may have changed significantly since the initial excavation campaigns. As a consequence, the study of such data becomes a historical study of sorts in its own right. Yet, it is this kind of archaeological detective work which enables us to extract new information from known archaeological sites, and to develop new ideas about old ships.

Conclusion

The use of two layers of thick oak hull planking has been archaeologically observed in a number of shipwrecks. Maarleveld, who studied part of the *Scheurrak SO1* construction, associated this phenomenon with a deviating shipbuilding tradition that created flush hulls in the early modern Netherlands, known in nautical archaeology as Dutch flush. It was his belief that, when the need for larger ships occurred at the end of the sixteenth century—a time of growing globalization and increasing maritime trade—shipbuilders used the second layer of hull planking as a 'double Dutch' solution to build larger seagoing vessels in the Dutch flush tradition. This implies the ships were initially built with a double layer of hull planking and the outer layer was not a later addition. Maarleveld's proof was the analysis of a part of the *Scheurrak SO1* hull, which indicated a building sequence in which the double-layered bottom was built before any other elements were added.

Reassessment of the keel, stem and riders from the forward end of *Scheurrak SO1*'s lower hull now challenges Maarleveld's interpretation. Blind treenails in the riders show these elements were already in place when outer planking was added, replaced or refastened. Construction features in the stem and keel construction demonstrate this part of the construction was altered. It is possible the outer layer of hull planking was part of the initial building sequence, as suggested by Maarleveld, and the outer planks were only replaced or refastened during repair of the area. Similarities with the alteration of the same area in the *B&W1* shipwreck, however, suggest the outer layer of hull planking was added only when the keel and stem construction was altered, and thus it reflects a second building phase. The fact that the inner rabbet is not affected by the modification of the keel, while the outer rabbet transects the modified part, can especially motivate this interpretation.

Many questions, however, remain. The parts of the stem and keel construction which are part of the modifications did not yield any dendrochronological results. Therefore, the time span between the initial building and the modification remains unclear. However, if rider 2 was part of the initial building and the modification of stem and keel happened afterwards, the 1590–1600 felling date would push the hypothesis of the *Scheurrak SO1* wrecking in 1593 to its limits. This would mean the ship was either adjusted shortly before it sank, or it sank at a later date. Samples from the outer layer of hull planking are currently not available, and therefore, it cannot be conclusively associated with a first or second building phase. The blind treenails in the riders, however, do indicate that the modification of the forward end of the lower hull was not limited to keel and stem, but also affected the outer layer of hull planking in this area.

If indeed the outer layer of hull planking reflects a second building phase and was not a 'double Dutch solution', it remains as yet unclear what the purpose of this second layer of planking was. Despite similarities between the *B&W1* and *Scheurrak SO1* shipwrecks, there is no decisive evidence to prove or disprove whether *Scheurrak SO1* was a lengthened ship. It is unclear why a merchantman associated with the Baltic grain trade would be given a second layer of hull planking after its initial construction. This question is subject to current study within the framework of the *Scheurrak SO1* research project.

In order to find additional answers, the excavation data from the *Scheurrak SO1* shipwreck will be further assessed and archival research will be executed. In addition, a revisit to the *Scheurrak SO1* site is currently being organized. This campaign, organized by Leiden University with the support of the RCE, will aim to collect specific samples for dendrochronological analysis and make focussed observations based upon the current hiatuses in the *Scheurrak SO1* excavation data in order to answer the questions posed above. By uncovering a very limited part of the site, 26 years after its initial excavation, the aim is to shed new light on the interpretation of the *Scheurrak SO1* construction specifically and gain new insights in early modern Dutch shipbuilding in general.

Acknowledgements

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12

Evidence for repairs and hull maintenance from the Yenikapı Byzantine shipwrecks

Michael R. Jones

Abstract: The shipwreck assemblage from the Marmaray Project excavations at Yenikapı (Istanbul, Turkey)—Constantinople's Theodosian Harbour—provide an unparalleled source of information on Byzantine ship construction technology and maritime trade. Many of these vessels are a source of surviving evidence for hull maintenance and repairs: most show some signs of repair, while many were substantially overhauled or rebuilt. Hull repairs potentially provide evidence for economic concerns related to the operation of ships, including the duration and nature of ships' careers, salvage activity and the prevalence of recycling ship timbers and other components. Many of the Yenikapı vessels appear to have had long sailing careers, with some hulls showing extensive use of recycled ship timbers, while others were repaired with newly cut timber. Significantly, repair timbers can also obscure evidence for the original construction methods of vessels. This chapter examines indirect evidence for marine salvage from the Theodosian Harbour and presents an updated survey of hull repair methods and timber recycling identified in the Yenikapı shipwreck assemblage, with an emphasis on shipwrecks studied by the Institute of Nautical Archaeology. Such shipwrecks recovered from terrestrial sites play an essential role in the interpretation of Mediaeval shipwrecks documented underwater across the Mediterranean.

Introduction

Between 2004 and 2013, the Istanbul Archaeological Museums conducted rescue excavations associated with the Marmaray Project, an expansion of Istanbul's rail and subway lines in the city and its suburbs. The largest excavation area, covering approximately 58,000 square metres, was begun in Istanbul's Yenikapı district, along the southern Sea of Marmara shore in the location of the Theodosian Harbour, one of Byzantine Constantinople's most active harbours between the fifth and tenth centuries AD (Figure 12.1) (Gökçay 2007: 166; Asal 2010; Kızıltan 2010: 1–2). The excavation area spanned the original 800–metre harbour basin, the outlines of which are still visible in the modern city's street plan and the course of surviving mediaeval walls (Mango 1993: 121; Dark and Özgümüş 2013: 30–31; Semiz and Ahunbey 2014). The site's Byzantine-era deposits contained thousands of artefacts, remains of wharfs and other harbour installations, and at least 37 shipwrecks dated from between the fifth and tenth century AD, besides many loose ship timbers and items of ships' equipment. These remains provide an unparalleled source of information on Byzantine ship construction technology and maritime trade (Çölmekçi 2007; Koyağasıoğlu 2022; Külzer 2022).

The Yenikapı shipwrecks include both a variety of round ships, or sailing vessels typically used as cargo carriers, and the oldest substantially preserved galleys (or 'long ships') excavated in the Mediterranean (Pulak *et al.* 2015: 39, 42, 45, 62). Several hull reconstructions and a number of interim reports have been completed on the eight shipwrecks (YK 1, 2, 4, 5, 11, 14, 23, and 24) studied by the Institute of Nautical Archaeology team (*e.g.* Ingram 2013, 2018; M.R. Jones 2013, 2017; Pulak *et al.* 2015; Pulak 2018) and the 27 shipwrecks studied by a team from Istanbul University (*e.g.* Kocabaş 2008, 2015; Turkmenoğlu 2017; Özsait-Kocabaş 2018, 2022). Although further research will reveal more details, the hull documentation of the Yenikapı ships completed so far provides a fairly detailed picture of their various features.

The Yenikapı shipwreck assemblage includes extensive evidence for hull maintenance and repairs, including both the addition of new repair timbers and the use of repurposed timbers salvaged from other vessels. Several were substantially overhauled or rebuilt, a process that often obscures original construction features but, on the other hand, can provide evidence for the service life and sailing careers of individual vessels. While references to the age of vessels and maintenance materials and methods are found in textual sources and are occasionally shown in artistic depictions, there is relatively little detailed information from the period on how repairs were actually made (*e.g.* Rival 1991: 309; Meiggs 1998: 467–471; Pryor and Jeffreys 2006: 151, Fig. 11).

Hull repairs are often noted in archaeological reports on individual shipwrecks, and their importance for understanding a vessel's construction and career is often

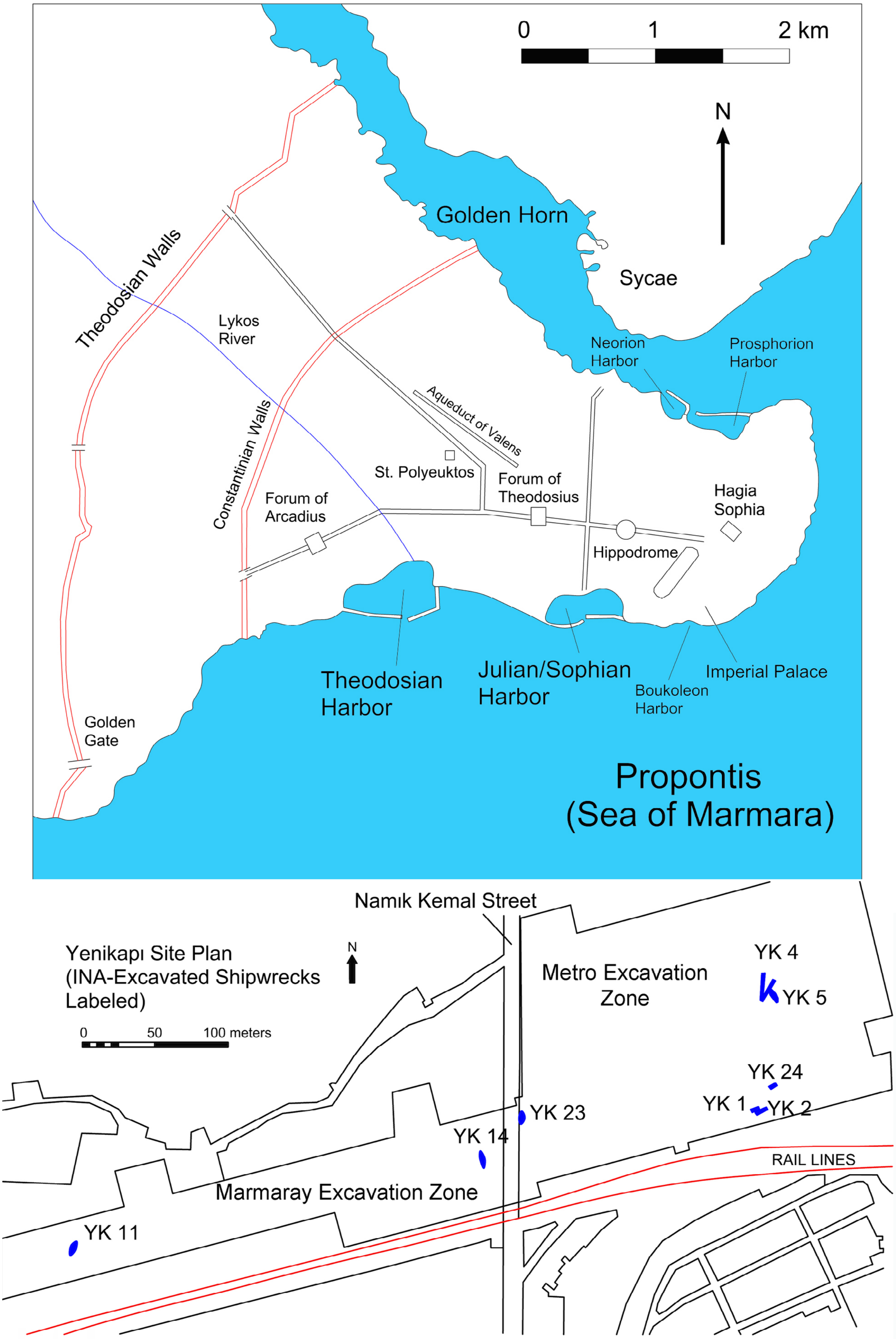

Figure 12.1. Map of Constantinople (after Müller-Wiener 1977: 58, Abb. 38; Treadgold 1997: 674; and Mango 2002: 64), the Theodosian Harbour and the Yenikapı Excavations. Adapted from Kocabaş 2008: 184–185 and Gökçay 2010: 135, Fig. 1.

recognised (Steffy 1999: 395). However, such repairs on Byzantine-period ships have not yet been studied systematically, particularly for a group of shipwrecks that can potentially be identified as products of a distinct shipbuilding industry or regional tradition.[1] The identification of hull repairs and maintenance activities can be difficult with fragmentary hull remains, and repair materials such as pitch or caulking deposits are easily damaged or lost (*e.g.* Steffy 2004: 165; Israeli and Kahanov 2014: 375, Fig. 18). Often, repairs can only be identified when the shipwreck is dismantled, especially in hulls in which planking edge fasteners were employed. The Yenikapı shipwrecks' rapid burial in waterlogged sediments, followed by full excavation and dismantling, has allowed the detailed documentation of wear and damage which occurred during the service life of a number of ships, as well as how shipwrights and crews conducted repairs, major overhauls, and salvage of derelict vessels. Such evidence is better preserved at Yenikapı than at most Mediterranean shipwreck sites discovered underwater.

The systematic study of hull repairs may provide answers on how long ships were sailed before they were no longer considered worthwhile to repair. Textual evidence offers some clues: for example, the *Rhodian Sea Law* and some later Mediaeval law codes distinguish between the cost of a 'new' *vs*. an 'old' ship, and Byzantine and Islamic maritime law includes extensive rules on the monitoring of the safety of vessels.[2] Archaeologists often note the presence of repairs, and they sometimes speculate on the age of the hull in a general way ('new' or 'old', for example), but, with many shipwrecks, it is difficult to reach more specific conclusions without detailed documentation, usually requiring the full dismantling of the hull, and the use of dendrochronology and other dating methods.

The study of hull repairs also contributes to research on the 'shell-to-skeleton transition' of shipbuilding technology in first-millennium AD Mediterranean vessels, a period which saw a shift from constructing shell-first or shell-based hulls, which involve the assembly of most of a ship's hull planking before the insertion of frames, to frame-first or frame-based hulls, whose design was determined by frames pre-erected on the ship's keel. This change likely occurred due to a combination of different economic, environmental and cultural factors which varied by region, with the Yenikapı assemblage likely forming its own distinct group (Hocker 2004b: 5–6; Pomey *et al.* 2012: 305–307). At least 30 of the Yenikapı shipwrecks can be considered shell-based or mixed construction vessels,[3] in which the lower hulls were built planking-first with edge fasteners, while pre-erected frames were used to design their upper hulls (Kocabaş 2015a: 11–12; Pulak 2018: 243–247). The lack of edge fasteners reported for six of the Yenikapı shipwrecks under study by Istanbul University (YK 10, 17, 27, 28, 29, and 31) suggests the use of either frame-based or bottom-based construction methods (perhaps using temporary cleats) (Hocker 2004a: 77; Kocabaş 2008: 168–175, 2015a: 12; Pomey *et al.* 2012: 296–297; Pulak 2018: 280–281). Repairs to hull planking can obscure or remove original construction features, particularly planking edge fasteners, which are cut and caulked over in Byzantine hulls, unlike the practice of using 'patch tenons' for ancient mortise-and-tenon hull repairs (Steffy 1999: 397–398; Beltrame and Gaddi 2007: 142, Fig. 11). A first-millennium AD hull lacking edge fasteners on many of its plank seams can therefore resemble a frame-based hull, even if it was built using a shell-based method and 'structural philosophy' (Hocker 2004b: 6). In some cases, the hull construction methods used for a shipwrecks could have easily been misidentified due to the presence of major repairs (Pomey *et al.* 2013; Israeli and Kahanov 2014: 376, Fig. 18; Ingram 2018: 131, 136–138; Pulak 2018: 251–252).

Repairs can also offer insights into the practices of timber recycling and salvage. Shipwreck hull elements sometimes include timbers salvaged from other ships, often small pieces used as ceiling planks (*e.g.* Steffy 1985: 95, Ill. 17). The Yenikapı shipwrecks allow a comparative examination of this practice in a group of vessels that operated in the same region, and may have been built locally. This chapter will examine the hull repairs and timber recycling documented on six of the Yenikapı shipwrecks excavated by the Istanbul Archaeological Museums between 2005 and 2008 and documented by the Institute of Nautical Archaeology team at Yenikapı directed by Cemal Pulak. These will be supplemented by published examples of repair features from other first-millennium AD shipwrecks from Yenikapı and other sites.

Salvage and maintenance activities in the Theodosian Harbour

Ship maintenance and the salvage of sunken or derelict vessels was likely common around the Theodosian Harbour and the neighbouring Julian Harbour further east along Constantinople's southern shore. Both were excavated as expansions of existing natural harbours, supplemented with stone and marine concrete quays and breakwaters; marshy areas along the Marmara coastline were also filled in order to provide more territory for construction (Mango 2001: 17–21; Külzer 2022: 78). The

[1] See Postiaux 2015 for the most comprehensive treatment of hull repair methods based on ancient shipwreck evidence. However, the study focuses primarily on the Roman and pre-Roman evidence and includes only a selection of the most recent Byzantine and early Islamic shipwreck finds (see Postiaux 2015: 1:185–189, for a list of shipwrecks discussed in the text). Other authors discuss relevant pre- and post-Mediaeval evidence for repairs and maintenance that can be usefully compared to Byzantine vessels (*e.g.* Steffy 1999, 2004; Lemée 2006; Beltrame and Gaddi 2007; Belasus and Daly 2022).

[2] Ashburner 1976: 63, 91–92. See Ashburner 1976: ccivii–cclxxxviii, and Khalilieh 2006: 205–223 for references to salvage law in Roman and Mediaeval legal codes, and Khalilieh 2005 for a summary of safety standards for Mediaeval Islamic and Byzantine ships.

[3] See Pulak 2018: 243–247 for a discussion of the different terminology used to discuss 'mixed' or 'intermediate' construction vessels.

southern Marmara shore installations were much easier for vessels sailing from the southwest against the prevailing winds and currents to reach and could accommodate the largest, deep-draft cargo ships of late antiquity, including ships carrying the state-subsidised *annona* grain shipments to the capital; shipwrecks YK 22 and 35, dating to the fifth and sixth centuries AD, likely represent this largest class of vessels (Magdalino 2000: 215; Kocabaş 2015a: 23, 29, 31; Külzer 2022: 79).

As with many Roman port installations, the Theodosian Harbour did not continue to operate as designed in later centuries. Siltation from the Lykos River, which emptied into the northern end of the harbour, contributed to a gradual shrinkage of the basin, although dredging—documented by Byzantine sources for the Julian and Neorion Harbours—was also likely practiced at the Theodosian Harbour based on a recent geological study (Yalçın *et al.* 2019: 371–372). Refuse dumping and deliberate infilling also reduced the harbour's area and depth; shipwreck YK 3's rubble and stone cargo was perhaps intended as fill for some section of the waterfront (Kocabaş 2008: 152–156; Perinçek 2010: 214; Kızıltan and Baran Çelik 2013: 191–196; Polat 2016: 395, Res. 3; Onar 2020). Occasional high-energy events (storms or tsunamis) may have been responsible for thick layers of marine sand that rapidly buried many of the site's shipwrecks, some of which appeared to be relatively new when they sank (Perinçek 2010: 198–215).

Since most of the Yenikapı shipwrecks were shallow-draft vessels, shoreline areas or simple wooden slipways were likely adequate for most maintenance work, and vessels could have moored at wooden piers (*skalai*), remains of which were excavated across the Yenikapı site. Towing and beaching vessels was also likely a common practice. Transverse holes were cut into the keels and endposts of a number of the Yenikapı vessels, either singly or in pairs, including YK 1, 14 (two holes), 23 and 24 (single holes), in a disarticulated keel timber found under YK 5 (Pulak *et al.* 2015: 52), and at least seven of the shipwrecks studied by Istanbul University (YK 8, 9, and 12: two holes; YK 6, 7, 15, and 20: one hole) (Figure 12.2) (Kocabaş 2008: 104, 117, 126, 135, 136, Fig. 72b, 148, 164, 166, Fig. 80; Güler 2019: 32; Özsait-Kocabaş 2022: 80, Fig. 3.2, 3.4–5). The holes are typically 4–6 cm in diameter, and are only rarely attested on shipwrecks outside of Yenikapı as, for example, on the St. Gervais 2 shipwreck (Pulak *et al.* 2015: 52). A particularly worn, 40 cm-long area on the probable bow end of the of the YK 14 shipwreck at the keel/endpost transition could be wear related to beaching (see figure 12.2) (M.R. Jones 2013: 166, Fig. 3.27–28, 2017: 260, Figs. 7–8).

Most of the Yenikapı shipwrecks buried in thick sandy layers towards the site's eastern end contain few or no artefacts, which would be expected if they were found and salvaged after a storm: the ninth-century shipwreck YK 14, for example, was apparently picked clean, without even ballast stones remaining, although others such as YK 5 had a few objects on board (Perinçek 2010: 191–192; Pulak *et al.* 2013: 23, 56). Valuable objects were sometimes lost in the harbour as well (*e.g.* Kızıltan and Baran Çelik 2013: 64–74, 122–138; Baran Çelik 2016). Four shipwrecks were found with largely complete cargoes, including YK 1, a small tenth-century ship whose amphora cargo shifted when the vessel capsised, covering and preserving the ship's starboard side from the turn of the bilge to the caprail (Kızıltan and Baran Çelik 2013: 154–218; Polat 2016; Özsait-Kocabas 2018: 357–358). YK 1's cargo and equipment, particularly two wrought-iron 'Y'-shaped anchors, would have been particularly valuable and well worth salvaging (Ashburner 1976: 77; Pulak *et al.* 2013: 31–33); even if the contents of the amphoras were spoiled,

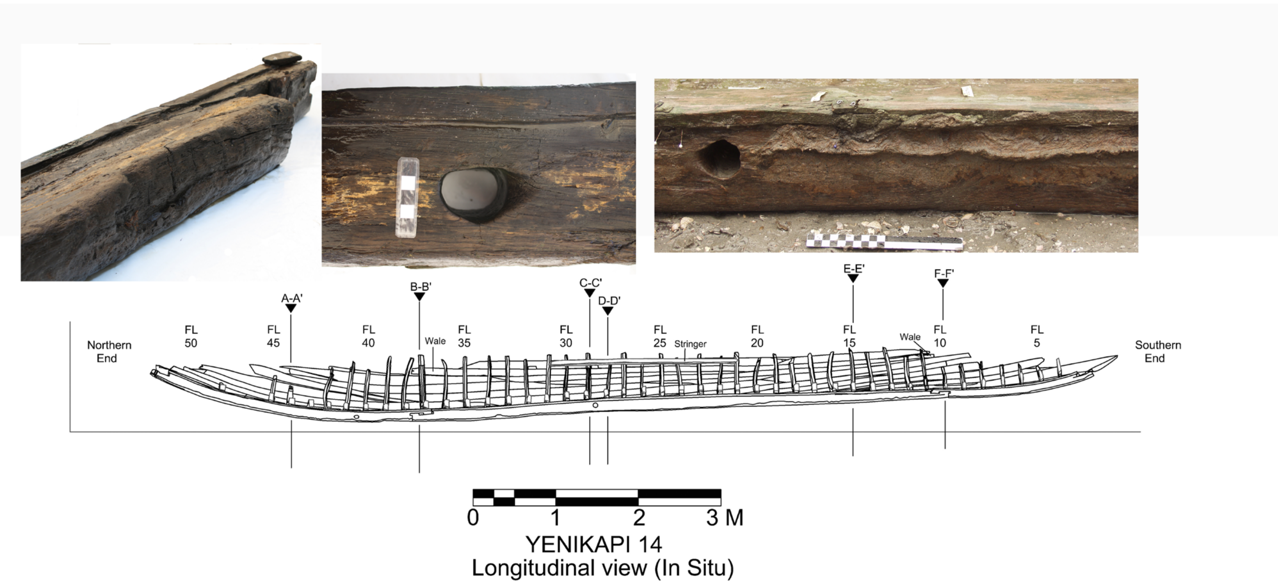

Figure 12.2. Examples of 'towing holes' from shipwrecks YK 14. The inset photograph to the upper left shows wear to the keel of YK 14 at the keel/stem-post transition at the forward end (Keel 3). This may have been caused by beaching or running aground. Figure by M. Jones, INA.

the jars themselves could have been recycled, a practice documented from other Byzantine shipwrecks (van Doorninck 1989).

Timber types used in the Yenikapı shipwrecks

Construction techniques and the cost and quality of timber and other materials naturally influenced the number and types of repairs necessary for a vessel, and often provide some indications of a ship's intended service life (Steffy 1999: 395; Belasus and Daly 2022: 214). Some ships were robustly built, with high quality timber and fastenings to last as long as possible, while others were built with whatever timber was most available or economical, even green timber in some documented cases, and may have been intended to last only a few years. Generally, the roundships or cargo vessels appear to have varied in quality. The earlier ships (fifth to seventh centuries) are built with pine hulls, frequently with oak keels, endposts and frames, recommended by Theophrastus (*Hist. Pl.* V.7.1–3) and common choices for Mediterranean cargo ships in antiquity; cypress species were also used in the earlier ships.

After the seventh century, oak construction tends to dominate, although chestnut (*Castanea* sp.), elm (*Ulmus campestris*), ash (*Fraxinus excelsior*) and sometimes Oriental plane (*Platanus orientalis*) were also employed (Liphschitz and Pulak 2010; Akkemik 2015: 183–185; Pulak *et al.* 2015: 45, Fig. 5; Pulak 2018: 277). The main oak type used in the INA-documented shipwrecks was identified as *Quercus cerris*, or Turkey oak, by Nili Liphschitz of Tel Aviv University.[4] This species is abundant in Anatolia and the eastern Mediterranean, but is more porous and susceptible to shrinkage and rot than the white oaks generally favoured for ship construction. Some literary sources and Mediaeval ship construction contracts recommend or stipulate against its use; Liphschitz and Pulak suggest that this could help explain the copious amounts of pitch on some of the oak hulls from Yenikapı (*Vitr*. 2.9.8; Liphschitz and Pulak 2010: 170; Lipke 2013a: 187–188; Pulak 2018: 277). YK 1, 5, 23 and 24 were built entirely of Turkey oak, with timbers of other species added to YK 1 only in a later overhaul phase (Liphschitz and Pulak 2010: 166–168). The builders of the later Yenikapı roundships may have opted for a lower-quality material which was easier to obtain locally or cheaper to import. Ships built of this timber likely required repairs sooner than those built of more water-resistant wood species.

Higher quality timbers of Black or Calabrian pine (*Pinus nigra*), were used for hull planking of the YK 2 and YK 4 galleys; some hull planks of 11–12 m in length and over 35 cm in width were recovered from these shipwrecks (Liphschitz and Pulak 2010: 168–169). Oriental plane (*Platanus orientalis*) was utilised for most frame and keel timbers on the galleys, although elm, an excellent hardwood timber, was also used. Oriental plane is said by Theophrastus to be a poor shipbuilding timber, but may have been utilised due to its lightness—an advantage for galley construction—or the large number of curved compass timbers available from this species; it seems to have been the timber of choice for the galleys' frames (Liphschitz and Pulak 2010: 168–171).[5] Akkemik's (2015: 48–53, 56–61, 92–95, 136–139) wood identifications from galley wrecks YK 13, 16, 25, and 36 showed similar results, but a wider variety of softwoods were used for stringers and hull planks, including fir and two species of cedar, and small numbers of elm, hornbeam, walnut, oak and chestnut timbers were employed. Rowed warships would have required frequent maintenance and likely had a shorter lifespan than merchant ships, but performance characteristics were perhaps even more important for these vessels.

Hull repairs found on the Yenikapı shipwrecks: a preliminary study

The examples of hull repairs that follow are taken from a group of eight shipwrecks studied by the Institute of Nautical Archaeology team (Table 1), supplemented with published examples of repairs and recycled timbers from other shipwrecks from the Yenikapı site.

Seven of the eight seventh-to-tenth century shipwrecks studied by the Institute of Nautical Archaeology team clearly exhibit evidence for hull repair or maintenance (YK 1, YK 4, YK 5, YK 11, YK 14, YK 23, YK 24) (Figure 12.3). While the galley YK 2 and the cargo vessel YK 5 (with a single repair to its preserved endpost) appear to have been new or nearly new when they sank, the other six vessels had all undergone significant repair and maintenance activities, including the application of pitch and caulking to damaged areas of the hull, the addition of repair timbers or more complex overhaul episodes.

Repair evidence may be the result of single or multiple episodes. Sometimes it is clear that one repair was made before another: a 'repair to a repair' is present on at least one ship (strake PS 6 on YK 14) (Figure 12.4), and some repair timbers appear to be more worn than others. However, often the sequence cannot necessarily be established, or it is based on impressionistic evidence. Planking edge fasteners are useful for identifying hull planking repairs and recycling: when hull planks were

[4] The identification of oaks from archaeological samples to the species level is questioned by a number of scholars, who state that it is impossible to determine the difference between white and red oaks (including the Q. *cerris* species) microscopically. However, it is also acknowledged that Turkey oak was the main red oak species available in Anatolia and most likely used widely (Lipke 2013a: 187–188; Akkemik 2015: 5–6, 196, 198).

[5] Bartolomeo Crescentio Romano (1607: 4) describes Oriental plane as 'an excellent wood that behaves particularly well in water' (Braudel 1995: 1:142). Ancient authors describe Oriental plane as being used for 'bentwood' (wales or compass timber?), which, along with elm, is described as 'tough and strong', although 'That made of plane-wood is worst, since it soon decays' (*Hist. Pl.* V.VII.2–3, trans. Hort 1916: 457, n. 5).

Table 12.1. Identified repairs and recycled timbers from the Yenikapı shipwrecks.

Shipwreck/estimated date of sinking	Shipwreck type	Repair types	Recycled timbers?	Selected published sources
YK 1 (mid-tenth century)	Roundship	Repair plank and graving pieces in lower hull, freeboard extended in overhaul (new futtocks/ strakes added); possibly new iron fasteners added (?)	One recycled graving piece; possibly recycled upper strakes (S 12-14 area)	Pulak 2007, 2018; Pulak *et al*. 2015
YK 2 (ninth to tenth centuries)	Longship/ galley	None identified	None identified	Pulak 2007, 2018; Pulak *et al*. 2015
YK 4 (ninth to tenth centuries)	Longship/ galley	Repair frames added adjacent to original frames; possible repair plank added to hull (SS 8-2)	None identified	Pulak 2007, 2018; Pulak *et al*. 2013, 2015
YK 5 (tenth century)	Roundship	One repair piece treenailed to endpost	None identified	Pulak *et al*. 2015
YK 11	Roundship	Repair planks, graving pieces, repair frames, repair fasteners (55 repair pieces)	Recycled 'sternson,' recycled ceiling planks [?]	Pulak *et al*. 2015; Ingram 2018; Pulak 2018
YK 14	Roundship	13 hull plank repairs identified, besides two probable repairs made during construction; one possible repair frame	All but one hull plank repair were recycled from a coak-built hull similar to YK 14.	M.R. Jones 2013, 2017; Pulak *et al*. 2015
YK 23	Roundship	**[Partially documented]** 20–22 repair and probable repair planks; one or more repair frames (futtocks)	Two possibly recycled hull planks	Pulak *et al*. 2015; Pulak 2018
YK 24	Small roundship	Planking repair pieces; replaced endposts, possible repair nails(?)		Pulak *et al*. 2015; Pulak 2018
Shipwrecks studied by Istanbul University (selected evidence based on published sources)				
YK 12	Small roundship	Three repair planks	None identified	Kocabas 2008, 2015; Ozsait-Kocabas 2018, 2022
YK 20	roundship	Probable repair planks and frames	Recycled or re-cut mast step; probable recycled hull planks with coaks on site plan; irregular graving pieces; replaced keel?	Güler 2019: 32, 50–51, S. 36

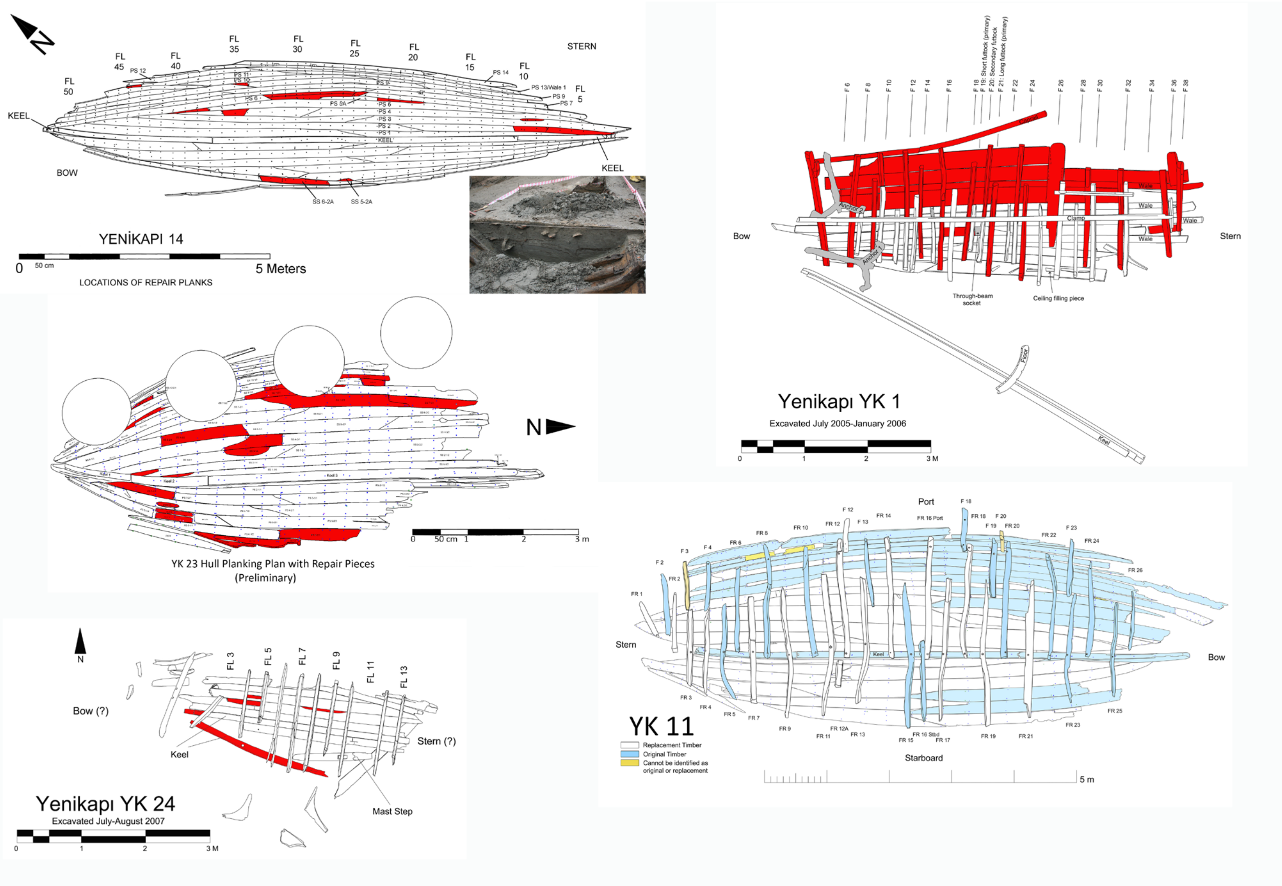

Figure 12.3. Yenikapı roundship wrecks studied by the Institute of Nautical Archaeology, with identified repairs or additions shaded. The inset on the YK 14 plan shows the stratigraphy in the hull, indicating it was buried without cargo. The YK 23 plan is a preliminary plan of hull planking repairs; some repairs indicated in the area of the concrete pillars are considered probable repairs due to the damage inflicted on the hull. Site plans by S. Matthews/INA. Adapted by M. Jones, except for the YK 11 plan; copyright R. Ingram.

recycled from edge-fastened derelict ships, the coaks or tenons were necessarily cut on the planks to be recycled. Misaligned, cut planking edge fasteners on recycled repair pieces, or cut edge fasteners on original plank seams, are usually strong indicators of hull repairs and can be easily identified if the hull is dismantled.

Other signs of recycled or repair timbers are also apparent in the Yenikapı shipwreck assemblage. These include tool marks indicating the use of different tools or fabrication methods for the piece—for example, YK 23's hull includes some hull planking repairs with adze-dubbed surfaces that are inserted in a hull with primarily sawn hull planking. The use of flat or butt scarf ends, rather than the diagonal, 'S' or 'Z' scarf ends in hull planking typical of Roman and Byzantine ships of this period, often indicates a hull repair. Other common characteristics of hull planking repairs include the use of atypical fasteners in a hull, for example, the exclusive use of iron nails to fasten a timber when treenails are the majority of fasteners; differences in the preservation of original and repair planks (often including evidence for wood rot or shipworm damage on the original sections of the plank); irregularly shaped hull planks, especially along plank seams (graving pieces); or gaps in plank seams filled with thick deposits of pitch or caulking due to a poor or loose fit of repair timbers. 'Mismatched' fastener holes found during the dismantling of a shipwreck sometimes indicated locations of repair pieces: for example, a larger number of nail holes may be present in a frame to which a repair plank was later fastened (although caulked holes in hull timbers could have served other purposes as well, such as the use of temporary shores or cleats, or even mistakes made during construction). Similarly, timbers made of unusual wood types in a hull could correspond to repairs: Akkemik (2015: 203–205) notes small numbers of anomalous wood types in specific hulls (YK 6, 7, 8, 9, 12, 18, 19, 20, 21, YK 27, YK 31, YK 35-ceiling) and suggests these are likely repairs, but (rightly) notes this cannot always be proven. The specific context of such features must always be closely examined in order to identify hull repairs. In the descriptions below, only clearly identified repair pieces will be discussed in detail, although specific damaged pieces, fasteners, caulking and resin deposits or other features could also be considered evidence of repair or maintenance episodes.

Figure 12.4. Examples of repairs from the Yenikapı shipwrecks: (a) Floor timber FL 44 from YK 14's hull. Note the caulked drilled holes next to the frame's location, which may be from an original frame, now removed; the timber's unique cross section and hook scarf are different from other frames on the ship. M. Jones, INA. (b) YK 24 Keel 3 timber, with the scarf for an endpost, Keel 4, which likely replaced more complex keyed hook scarfs normally used to join keel timbers. M. Jones, INA. (c) YK 14, PS 5-1A/5-2 scarf, at which an original plank piece was repaired with a worn, recycled timber. M. Jones, INA. (d) YK 11, end of the 'sternson,' recut from a keel timber (note the rabbet cut into the timber). R. Ingram, INA. (e) YK 4, replacement ash floor timbers in the midship area of the hull during excavation. M. Jones, INA. (f) YK 23, hull plank PS 4-1, with replacement piece PS 4-1A inserted in a rotten area (note the score mark and surface charring is missing on the repair piece). J. Čelebič, INA; (g) YK 14, replacement hull planks PS 2-1/1-2 and PS 3-1A, both recycled from a coak-built roundship similar to YK 14. M. Jones, INA. (h) A 'repair to a repair' (hull plank PS 6-2/1-4) from the hull of YK 14. A split in the plank (which was located at the turn of the bilge, and may have consequently been subject to more wear) was caulked. PS 6-2/1-4 was recycled from another ship (note the caulked treenail holes from its original use). The opposite end of the plank also had a repair piece installed into its scarf end (PS 6-2/5). Image by M. Jones, INA.

Hull repairs to Yenikapı cargo vessels

YK 14 dates to the first half of the ninth century and was originally about 14.5 m in length and 3.5–4.0 m in beam. YK 14's hull was built primarily of Turkey oak (*Quercus cerris*), with smaller numbers of timbers fashioned from sessile oak (*Quercus petraea*), sycamore maple (*Acer pseudoplatanus*) European ash (*Fraxinus excelsior*) and Oriental beech (*Fagus orientalis*), with a wider variety of wood types used in the wooden coaks (M.R. Jones 2017: 256–258). These species are fairly typical of the post-seventh-century Yenikapı merchant ships, although there is more variety in YK 14's hull than many of the other vessels.

YK 14's hull planking was edge-fastened with hardwood coaks (planking edge fasteners), while frames were fastened to the planking primarily with oak treenails supplemented with iron nails, more often used towards the ends of the ship or at the hull's sharp turn of the bilge. Iron nails constitute only a small proportion (*c*. 13.8%) of the overall number of fasteners in the surviving hull, which suggests an attempt to economise in the ship's construction. Some nail holes were also suspected repairs based on their location and condition in rot-damaged areas; Steffy suggests that similar repairs were made to the hull of the Serçe Limanı ship, but admits that this interpretation is an impression based on unusual fastener patterns rather than conclusive proof (Steffy 2004: 165; M.R. Jones 2013: 147–157).

YK 14 suffered extensive damage from dry rot or a similar organism; such damage can be caused by different species of bacteria and fungi (Blanchette 2000; M. Jones 2015: 16–17). Most of the damage occurred under frames, since many of the heavy caulking and pitch repairs in the hull relate to plugging damage around treenail holes or rotting plank seams, particularly in the turn of the bilge area and at the waterline along the lower edge of the first wale, where rotten areas were plugged with 2–3 cm thick deposits of resin and caulking (M.R. Jones 2013: 285–287, Table 3.8). Some plank seams appear to have been re-caulked, based on cut marks on planking edge fasteners at the seams and gouges in the keel rabbet stuffed with caulking (M.R. Jones 2017: 263, Fig. 13, 264, Fig. 17).

Twelve repair pieces were identified in YK 14's hull, all of which were recycled from another vessel. This identification is based on the presence of cut treenails or 'blind' treenail holes plugged with caulking and cut coaks or dowels on the neighbouring plank seams. The repair pieces range in length from 29.40 cm to 1.85 m, and 11 of the 12 originate from the hull planking of a vessel similar to YK 14, built with wooden coaks as planking edge fasteners. Several are graving pieces, used in rotten areas on the seams which were too large to repair using pitch and caulking alone, or repair pieces set into the ends of diagonal scarfs. Most of the repair pieces were installed at the turn of the bilge area of the hull, which may have been exposed to more wear or changes in moisture, and all but one were clearly salvaged from one or more vessels built using similar construction methods as YK 14: the recycled pieces are oak or elm planking originally edge-fastened with coaks. Some nails in the turn of the bilge area appear to have been driven into or next to rotten areas, perhaps during maintenance episodes.

Floor timber (FL 44) may also be a repair, based on its trapezoidal cross section (different from the other frames) and a hook scarf on its end for an in-line futtock, a unique feature on the ship. A series of plugged drilled holes were found in the hull planking under this frame, indicating it was either replaced or was perhaps shifted slightly during construction (Figure 12.4a).

YK 14 was repaired almost entirely with recycled hull planks from a vessel built using similar methods (oak planking edge-fastened with coaks), besides extensive recaulking and application of pitch for waterproofing (Figures 12.4c, 12.4g, 12.4h). It was likely used for at least several years. It is unclear whether the repairs were installed in a single episode or multiple episodes, but the latter possibility seems more likely, based on the nature of the repairs. Low-quality or unseasoned timber may have required such maintenance within a shorter time (Liphschitz and Pulak 2010: 179; Belasus and Daly 2022: 213)

YK 23 was a larger cargo vessel, about 15 m in length and 5 m in beam, most likely built in the later eighth century (based on radiocarbon dates); it may have sunk in the early ninth century based on the dating of copper coins found in the hold of the ship (Pulak 2018: 252). YK 23 was built with larger, good-quality oak timbers and a slight 'wine glass' shape to the hull: hull planking is a robust 3 cm thick on average, and the ship was built with heavy frames with cross sections of 13 × 10 cm arranged in a pattern of alternating floors and pairs of half-frames; frames were fastened to the hull planking exclusively with iron nails (Pulak 2018; 269–275). The hull planking was edge-fastened with coaks spaced on average 50 cm apart. The coaks appear to have been used up to the ninth strake, although they may have been installed up to the first wale (Strake 12) before repair planks were added; some identifications of repairs in this area are inconclusive due to damage from construction machinery.[6] Original hull planks were sawn, with regularly-spaced coaks, while the repair pieces are more irregular, and in some cases display adzed rather than sawn surfaces.

Although the hull's study is ongoing, YK 23 was clearly an old ship when it sank: over 20 repair planks and at least two probable repair planks have been identified (Figure 12.4f), in addition to at least one probable repair futtock at the turn of the bilge (F 15); rotten and shipworm-damaged

[6] The other Yenikapı roundships under study by INA were built with planking edge fasteners up to the first wale (Jones 2017: 276–277; Pulak 2018: 249, 258), as well as many of the ships studied by Istanbul University (*e.g.* YK 12) (Özsait-Kocabaş 2022: 257, Fig. 4.157).

Figure 12.5. View of the preserved starboard side of YK 1, including strakes added during the overhaul of the ship, to the right. Copyright INA.

areas of the planking and frames were also repaired with a mix of resin (probably pine pitch) mixed with grass or hair.[7] Only two of the catalogued repair planks are likely reused from another vessel.

YK 24 was a small, flat-bottomed hull, perhaps a small cargo or utility vessel with an original length of about 8.0 m and a beam of 2.5 m; it is tentatively dated to the tenth century AD (Pulak *et al.* 2015: 57). It was built of Turkey oak and has a hull edge-fastened with coaks at regular intervals, similar to other contemporaneous small vessels from the site. Although poorly preserved in comparison to other vessels of its size from the site, three graving pieces and a larger repair plank are apparent in the hull, along with a large number of iron nails used to fasten planks to frames, some of which could have been driven in later overhauls or maintenance of the vessel (Pulak 2018: 262). Most significantly, the endposts appear to have been replaced during an overhaul: while the main keel timber was original and still connected to the garboards with coaks, the curved sections had been removed at the ends (Figure 12.4b). The original scarf ends, almost certainly keyed hook scarfs, had been replaced with weaker three plane scarf ends fastened with treenails and nails (Pulak 2018: 262).

YK 1 was a small merchantman built of oak, with planking edge-fastened with coaks and in-line frames primarily fastened with treenails, similar to many of the other ninth-to-tenth-century wrecks from the site (Figure 12.5). The bottom of the hull was missing aside from a disarticulated rockered keel and one floor timber, but its starboard side was preserved to the caprail by the ship's amphora cargo (Pulak *et al.* 2013: 31–33). YK 1's hull shows clear evidence for a single major overhaul episode, using a heterogenous collection of timbers, besides other hull repairs.

Four small repair planks and graving pieces were installed in the starboard side of the lower hull, with three around the waterline area (strake 6) where a through-beam was likely installed amidships. At a certain point in its career, the sides were extended by three strakes (S12-14) to

[7] About 70% of the hull has been recorded as of July 2023. All of the ship's hull planking has been cleaned and documented, so the identification of hull planking repairs should be considered more accurate than the identification of repair frames, since the framing documentation is not yet complete.

increase the vessel's cargo capacity and freeboard; plugged holes in strakes 13 and 14 may indicate that they were recycled hull planks. Roughly adzed 'secondary frames', fastened exclusively with iron nails, were added to the hull in order to fasten the new strakes, while the 'primary' futtocks were cut down. A pair of grooved timbers for a removable weather strake were installed. The additional strakes were of a variety of wood types, including Oriental plane (*Platanus orientalis*), Turkish pine (*Pinus brutia*) and poplar (*Populus nigra/alba*), and showed variations in workmanship (Liphschitz and Pulak 2010: 167–168; Pulak *et al.* 2015: 61). The many nails in the lower hull, some driven through or near treenails, may have been added when the freeboard was extended (Liphschitz and Pulak 2010: 167).

YK 11, a small merchantman (reconstructed dimensions: 11.2 m length, 3.8 m beam, with an estimated cargo capacity of *c*. 8 tonnes) was likely built in the second quarter of the seventh century based on artefact finds and radiocarbon dates (Figure 12.4d) (Ingram 2018: 104). It likely had the longest sailing career of all of the ships documented by the INA team, perhaps spanning a few decades. The ship was almost certainly abandoned as a derelict, and any useful upper hull timbers above water may have been salvaged; it was found in marshy area of the site, most likely shallow water at the time, where large amounts of refuse was dumped (Ingram 2018: 104).

The hull was constructed of pine planking fastened with unpegged mortise-and-tenon joints, with oak frames and keel, and repairs of pine; the hull was built with a framing pattern of alternating floors and pairs of half-frames typical of many late antique merchant ships. Essentially, YK 11's hull consists of more repairs than original pieces: 28 of 47 hull planks were replaced (not including 11 graving pieces), or 60% of the planking, while 16 of the 36 frames (44%), including nine of 13 surviving floor timbers, are replacements (Ingram 2018: 111, 131–132). FR 21, a repair floor timber, was originally bolted to a keel scarf. Later, it was removed, and the replacement was nailed—a weaker connection. Ingram suggests it was done away from a home port, one of a 'series of major repairs rather than one massive overhaul' (Ingram 2018: 121, 130–131). Most repair pieces were cut from new timber, but a curved sternsom fastened over frames in the keel area (Ingram 2018: 121, 122–123, Figs. 27–28, 131), three hull planks, a stanchion block and ceiling plank were recycled from other vessels.

Repairs to Galley YK 4

The five or six galley shipwrecks from the site are remarkably similar in their construction; large, high quality softwood timbers, most often Calabrian pine (*Pinus nigra*) were used for hull planking and wales, while keel timbers and frames were made from Oriental plane (*Platanus orientalis*), a hardwood type perhaps chosen due to availability of curved timbers. Iron nails and (occasionally) bolts, as well as treenails were used as hull fasteners, and coaks were used in hull planking, although they were smaller and more widely and irregularly spaced than those used in roundship hulls of the same period (Pulak *et al.* 2015: 63). The hulls themselves may have been up to 30 m in length and 4 m in beam, and likely had a maximum of 25 rowers per side; they most likely represent *galeai* or *monoreis*, single-banked warships lighter than the bireme *dromons* more frequently mentioned in Byzantine sources (Pryor and Jeffreys 2006: 190; Pulak *et al.* 2015: 62, 69).

Both YK 2 and YK 4 studied by the INA team are dated to the eighth-to-tenth centuries based on stratigraphy and AMS radiocarbon dates (Pulak 2018: 263–264). While YK 2 was apparently a relatively new ship when it sank (Pulak *et al.* 2015: 62), YK 4 was repaired in a number of areas. Large ash (*Fraxinus excelsior*) floor timbers were placed amidships, most likely as additional reinforcement for the location of the mast step (Figures 12.3, 12.6), as well as at either end of the hull (Pulak *et al.* 2015: 68; Pulak 2018: 266). Some of these frames were fastened with treenails smaller in diameter than those used in the original hull (9–10 mm as opposed to 12–15 mm) and with fewer iron nails than usual for original frames. Several futtocks in the turn of the bilge area and possibly one short hull plank (SS 8-2) also appear to have been repairs.

The presence of several war galleys in the Theodosian Harbour, intermingled with the wrecks of merchant vessels in what was apparently a commercial harbour, is unexpected. Perhaps the ships were berthed or beached in a designated 'naval' section of the harbour, were seeking shelter opportunistically when a storm or other disaster occurred, or were simply abandoned in a convenient spot (Perinçek 2010: 206–208; Pulak 2018: 238). Ancient warships were typically housed in slipways or shipsheds in complexes away from commercial harbours (Blackman and Rankov 2013; Kislinger 2022), but there is no such evidence within the Yenikapı excavation area; no securely dated Mediaeval shipsheds have been identified in Anatolia before the thirteenth century stone shipsheds at Alanya (Redford 2015: 549). During the siege of 673–677 AD, Theophanes records that the Byzantine fleet was mustered in the 'Harbour of Kaisarios' (another name for the Theodosian Harbour) before sailing out against the Arab fleet, but this does not necessarily mean they were normally stationed there; the Neorion Harbour on the Golden Horn was apparently used as the main naval harbour for warships from the sixth century (Mango and Scott 1997: 493; Magdalino 2007: 20, 94–95; Kislinger 2022: 11). YK 4 was likely considered an older galley, and was perhaps being held in reserve for use in case of emergency, a common practice in navies throughout history, or for salvage and recycling of parts to repair newer ships (Koivikko 2017: 150–151).

Conclusion: observations on the repair pieces used in the Yenikapı shipwrecks

Wood rot by bacteria or fungi appears to have been a serious problem for the older oak-built merchant ships,

Figure 12.6. Site plan of YK 4, with identified repair frames shaded. Image by S. Matthews, INA; adapted by M. Jones.

especially YK 14; shipworm damage was also a major problem for some of the ships, particularly for YK 23. Pine resin and caulking materials—usually grass but sometimes hair—was generously applied in all of the roundships, with repair pieces were installed in the most severely affected areas. Repair fasteners, usually iron nails, were probably used to reinforce specific areas of these hulls, especially around rotten or loosened treenails, but conclusively proving the use of individual nails as later repairs is not always possible. The builders of the newer roundships from Yenikapı such as YK 5 and possibly YK 14 seem to have tried to minimise the number of iron fasteners used in the hull's initial construction. Iron bolts were commonly used in Roman and late antique ships, but are uncommon in the Yenikapı merchant vessels after the seventh century, being used mainly to fasten keel and endpost timbers. Iron nails were used sparingly on YK 14, primarily to fasten frames at the keel and turn of the bilge. The large number of nails used as frame fasteners in older hulls may indicate later hull maintenance rather than features of the initial construction (Liphschitz and Pulak 2010: 167; M.R. Jones 2013: 148–157, Table 3.1). Similarly, there is no evidence of lead sheathing, either covering the entire hull or used as repairs to leaky hull sections, although it was commonly used in earlier ships (Steffy 1985: 87; Postiaux 2015: 1:185–186, 2:Pl. 21.2, 27.2, 28.3, 29.1, 31.3, 37.2, 39).

The expected service life of Byzantine ships remains an open question. The *Rhodian Sea Law* (seventh century AD) specifies only that a ship with its tackle should be valued at 50 gold *solidi* per 1,000 *modii* of capacity, while an 'old' ship would be valued at 30 *solidi* per 1,000 *modii* (Ashburner 1976: 63–64). A later Venetian law divide ships into three categories: under five years old, between five and seven years old, and over seven years old (Ashburner 1976: 64). Lane (1992: 263) estimates that Venetian ships were expected to last 10 years on average, citing specific instances in which merchant vessels were scrapped after eight, 14, and 15 years of service. Evidence for repairs to the Serçe Limanı hull led Steffy to suggest the ship had a career of 'a decade or two', although 'it is impossible to raise such a statement above a suspicion' (Steffy 2004: 165).

Dendrochronological analyses of shipwreck hulls can sometimes aid in the identification of hull repairs when new timbers (rather than recycled ones) were used. For example, dendrochronologically dated hull timbers from the eleventh century Skuldelev 1, 2, 3, and 5 shipwrecks indicate periods of up to 20–30 years between the felling dates of original hull timbers and repairs (Crumlin-Pedersen and Oleson 2002: 65–68). The service life of Mediterranean ships was almost certainly shorter, especially for warships, due to the warmer and more saline conditions than those in the Baltic, which result in more exposure to shipworms and other damaging marine organisms (Lipke 2013b). Unfortunately, most of the oak-built Byzantine ships studied so far from Yenikapı were constructed primarily with younger hull timbers: only a small number of sampled timbers from the YK 14 and 24 shipwrecks have the 40–50 growth rings necessary for dendrochronological dating, although timbers from the YK 23 shipwreck are more promising.[8] Lorentzen *et al.*'s study of the sixth-century Dor 2001/1's timbers employed 'wiggle-matching', or a combination of AMS radiocarbon dates of small groups of growth rings in timber cross sections and cross-references with radiocarbon dates on short lived materials, including matting and rope; they conclude that the ship had not sunk on its maiden voyage but was 'likely in service for a relatively short period of time', perhaps up to a decade, before its sinking (Lorentzen *et al.* 2014a: 676–677, 2014b).[9]

War galleys would have required more maintenance than merchant ships, and may have had even shorter careers: Venetian galleys of the fifteenth-to-sixteenth centuries were considered fit for service for eight or nine years, but might have lasted as little as three or four (Lane 1992: 263). Lipke (2013a: 195) estimates that well-maintained ancient triremes probably had a service life of eight to 14 years, and a career of 20 years would have been exceptional; structural properties of wood, the presence of mortise-and-tenon joints or other edge fasteners in planking (which serve as moisture traps) and hogging and sagging limit the lifespan of wooden ship hulls, especially the long and narrow hulls of galleys (Lipke 2013a: 185–186). However, older warships also had some limited uses, as demonstrated in a passage from Liutprand of Cremona on the attempted capture of Constantinople by the Rus in 941 AD:

> 'After [Emperor] Romanus [Lecapenus] had spent some sleepless nights lost in thought while Igor was ravaging all the coastal regions, Romanus was informed that he possessed some dilapidated galleys which the government had left out of commission on account of their age. When he heard this he ordered the *kalaphatai*—that is, the shipwrights—to come to him, and he said to them, 'Hurry without delay, and prepare these remaining galleys for service. Place the devices which shoot out fire [i.e., siphons for Greek fire], not only in the prow but also in the stern and on both sides of the ship'. When the galleys had been outfitted according to his orders, he manned them with his most competent sailors and ordered them to proceed against King Igor.'[10]

While galleys could be maintained to their peak level of performance for only a few years, Liutprand of Cremona's reference indicates that older ships (perhaps including YK 4?) were kept 'mothballed' in storage for reuse as second-line warships, perhaps specifically for defence of the city in an emergency. It is likely that such vessels were also cannibalised for spare timbers and fasteners as well, a common practice with warships and military vehicles in later periods (Koivikko 2017: 150–151).

As shown by the hull repairs on YK 11, YK 14, YK 20, YK 23, and likely YK 1, ship timbers were sometimes cannibalised from derelict hulls. Generally, recycled timbers appear to have been smaller planking pieces—under 1.85 m, and often much smaller—or timbers of large diameters or with useful curved shapes: the latter include the curved keel timber recycled as a 'sternson' for YK 11, a stanchion block from the same shipwreck, and probably the mast step with re-cut notches from shipwreck YK 20 (M.R. Jones 2013: 313, Table 3.9; Kocabaş 2015b: 106–107; Güler 2019: 50–51, S. 36). Perhaps longer pieces without rot damage or other weaknesses were rare: with the possible exception of YK 1, repair pieces cut from new timbers were almost always used to cover large hull areas and for completing the major overhauls apparent in the hulls of shipwrecks YK 1, 11, and 24. It is usually unclear which repairs came first, but different repair episodes can sometimes be distinguished through careful examination. Overall, repair pieces cut from new timbers are far more common than those recycled from older ships in the hulls discussed here, but, in the case of YK 14, recycled pieces were used for nearly all of the hull planking repairs.

The salvage and recycling of ship components likely took many forms. Law codes and textual references to salvage divers indicate that shipwreck salvage from the shore to depths of up to 15 fathoms occurred in the Byzantine period; the salvage of shipwrecks in the in the Theodosian Harbour must have been simpler.[11] While ships' fasteners were probably less valuable as equipment

[8] T. Ważny and B. Lorentzen, personal communication, 18 July 2018. One disarticulated plank found under the YK 14 hull was dated through dendrochronology to the early ninth century (cited in Jones 2013: 54, n. 213). Over 295 of *c.* 4,000 sampled wooden wharf pilings from the Yenikapı site have also been incorporated into existing oak chronologies (Kuniholm *et al.* 2015: 47–48). Current research suggests that they come from a source also utilised for timber repairs to Hagia Sophia and in a Byzantine fort at Capidava in Romania, most likely from the southwestern Black Sea region (Wazny *et al.* 2017: 178–181).

[9] See also Lorentzen *et al.*'s (2014a, 2014b) 'wiggle-matching' study of the nineteenth-century Akko 1 shipwreck, also built of oak: the ship's estimated service life (under 10 years) is similar to that of Dor 2001/1.

[10] Excerpt from Liutprand of Cremona, *Antapodosis*, vol. 136, cols. 833–834, tenth century AD (from Geanakoplos 1984: 113). *Kalaphatai* was the term used for 'caulkers' in the early modern period (see Kahane *et al.* 1988: 513–514). Pryor and Jeffreys (2006: 150) note that the first known usages of the Mediaeval Greek terms for 'caulker' (*kalaphatēs*) and 'caulking (*kalaphatizein*) occur in Egyptian papyri dating to the 560s, and occur in the tenth-century *De ceremoniis* in reference to an inventory for naval expeditions to Crete in 911 and 949; Pryor and Jeffreys also state that the term was misunderstood by Liutprand of Cremona in the tenth-century *Antapodosis* to mean 'shipwright' (*calafata*).

[11] A professional guild of *urinatores* or divers is attested at the port of Ostia in the early Imperial period (Oleson 1976: 22–23). Byzantine-period references to salvage diving include the *Rhodian Sea Law* 3.47 (trans. Ashburner 1976: 119) and an eighth-century reference in the *Parastaseis Syntomoi Chronikai* to attempts to salvage a bronze statue lost in the Bosporus (Cameron and Herrin 1984: 119). The salvor typically received a percentage of the item's value, from one-tenth of the value for objects brought up to one cubit from shore to half of the value for objects retrieved from 15 fathoms.

than iron anchors, masts, rigging tackle or ships' boats,[12] the limited use of iron fasteners in some of the Yenikapı hulls such as YK 14 and YK 5 suggest that they may have been valuable enough to scavenge from derelict hulls. Perhaps the Theodosian Harbour's economic life included junk-dealers or other scavengers similar to the *arayıcılar* of nineteenth-century Istanbul, who scoured Topkapı Palace's garbage dump for valuables (Theodorelis-Rigas 2019: 264).

The anaerobic/low oxygen conditions in the deposits at Yenikapı allowed exceptional preservation of shipwrecks and organic remains, including essential materials such as pitch and caulking associated with hull repairs and routine maintenance activity. These remains are found within the original harbour and waterfront area, which potentially can provide more contextual information on urban life than isolated finds of shipwrecks which sank in transit to their destination. Constantinople's Marmara shore harbours were active work areas and would have been used in part for repairs and ship maintenance as well as opportunistic salvaging of shipwrecks and abandoned derelicts. The Yenikapı excavations can shed light on the working methods and everyday conditions of maritime industries. The efforts of typical captains, fishermen and sailors to keep their vessels, and by extension, their livelihoods, afloat can now be better understood with these finds.

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[12] Ashburner 1976: 76–77, 79–80. Few iron anchors have been found during the Yenikapı excavations, but several hundred three-hole stone anchors, including some examples of *spolia* recycled from architectural elements, are currently under study by Cemal Pulak and Orkan Köyağasıoğlu of the Institute of Nautical Archaeology; see Çölmekçi 2007; Kiziltan 2007, 2010 for published examples.

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Interpreting underwater archaeological sites

13

Topologies of war: an archaeology of the 1741 maritime battlefield in Cartagena de Indias, Colombia

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Abstract: Cartagena de Indias was an important colonial port in the 'New World' and constituted a war-and-defence landscape during seventeenth and eighteenth centuries in the Colombian Caribbean. Accordingly, the 1741 English invasion of Cartagena presents a remarkable opportunity for studying coastal and naval defensive and offensive strategies and tactics, matters involving both natural and cultural elements. The battle began with 186 English ships and thousands of soldiers, sailors and slaves against a Spanish defence comprised of a small number of troops, fortifications of badly worn artillery and a few vessels. Despite their overwhelming advantages, the English lost the battle and retreated with huge material losses and thousands of casualties. Archaeological excavations carried out on shipwrecks and fortification remains in the Bocachica zone between 2007 and 2019 have collected and correlated a rich variety of land and underwater data on this naval battlefield and maritime cultural landscape. By applying multiple interpretative frameworks, we demonstrate that the vessels' tactical moves, the troops and the arrangement of defensive and offensive systems were directly related to winds, sea currents, mangroves, mosquitoes and geomorphology. Throughout this analysis, the Key Terrain/Decisive Terrain; Observation and Fields of Fire; Concealment and Cover; Obstacles; and Avenues of Approach/Withdrawal (KOCOA) methodology is used to analyse the active relationship between the different human and non-human actors which shaped the battle.

Introduction

The 1741 siege of Cartagena de Indias caused great damage to the city and its bay. The damage was not limited to the infrastructure which composed the defence, as the fleet of ships which defended the port was also reduced (Zapatero 1967; Segovia 1987; Dorta 1988). The ruins of the fortifications and the remains of ships lost during the battle are currently preserved in terrestrial, intertidal and submerged contexts. Consequently, archaeological excavations have produced data suggesting the presence of archaeological sites from the confrontation throughout the bay and its environments (Del Cairo 2009; Del Cairo *et al*. 2002; Fundación Terrafirme 2016, 2017; Aldana 2019).

For many of these investigations, research interest has focussed on Bocachica Channel, which lies south of Tierrabomba Island. The remains in the channel have enormous archaeological potential for answering questions about the battle and its development. In these projects, contexts linked to the fortifications of San Luis, San José, Santiago and San Felipe de Bocachica have been excavated (Del Cairo 2011b), as has a shipwreck tentatively identified as the ship-of-the-line *San Felipe* (Fundación Terrafirme 2017; Aldana 2019; Del Cairo and Aldana 2023). To date, most archaeological operations have focussed on the first phase of the 1741 confrontation between the English and Spanish. However, based on analyses of the archaeological data collected, another geographical point to consider for future research is the area of Manzanillo Channel, particularly the entrance to Bocagrande which lies north of Tierrabomba Island (Del Cairo *et al*. 2002, 2021; Fundación Terrafirme 2016).

Each of these archaeological investigations has yielded new and diverse data on the material culture in the bay of Cartagena de Indias, where military constructions, civil infrastructures, shipwrecks and isolated sites stand out above all. Despite the progress made in the last 20 years, there is an emergent need to characterise the archaeological context on a larger scale, one which integrates the different components attested. In response, theoretical and interpretative frameworks have been built and applied, allowing for a comprehensive understanding of the historical trajectory of this 'Fortified Landscape of War and Maritime Defence'. As a result, among other issues of the colonial trajectory of the city from the sixteenth to the early nineteenth century, we have been able to gain insight into the strategies and tactical offensive and defensive movements used during the 1741 battle, as well as the associated material remains (Del Cairo 2011b).

Other consequences included increases in the spatiotemporal scale of analysis and interpretation, as well as filling in gaps in the sociohistorical trajectory of the

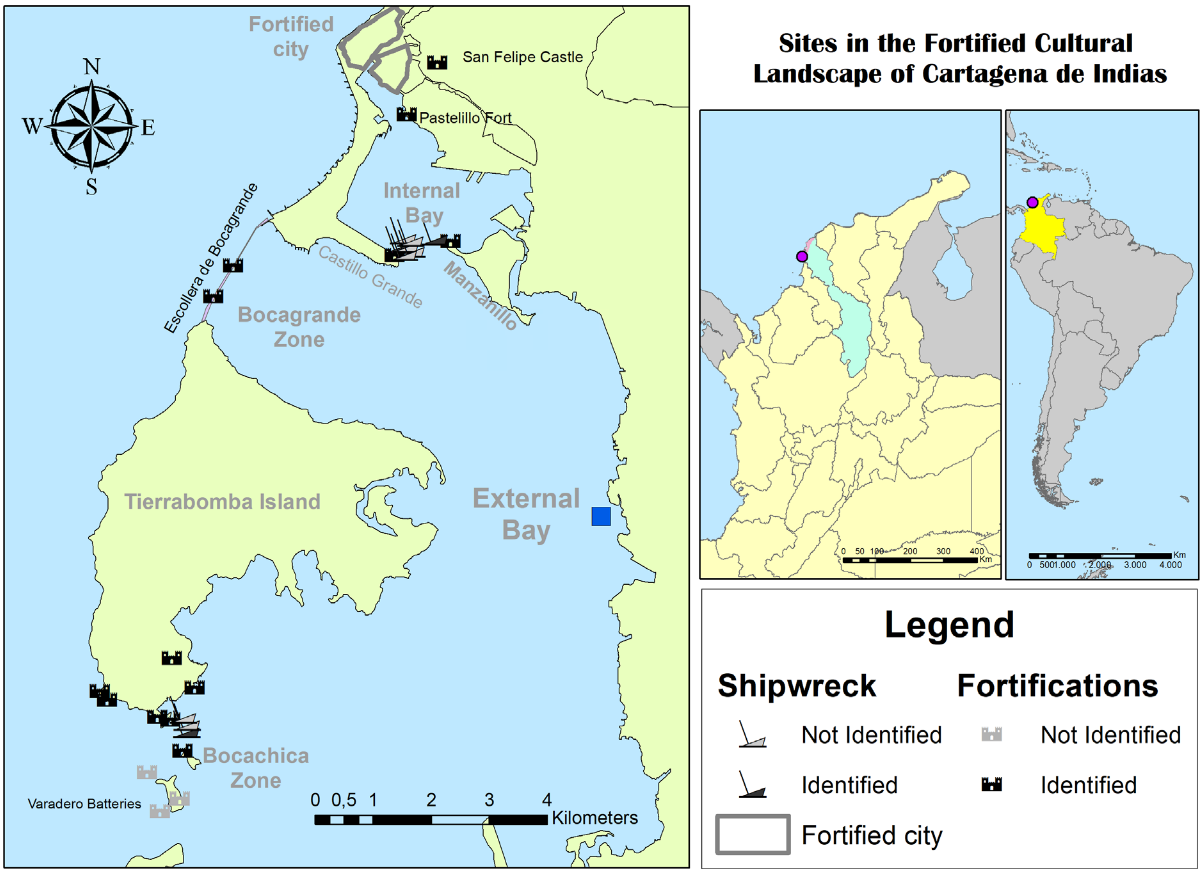

Figure 13.1. Archaeological contexts associated with shipwrecks and fortifications studied in the Bay of Cartagena de Indias. Image from Del Cairo *et al.* 2021 and Google Earth.

region, emphasising events of the 1741 battle. However, it is important to clarify that this particular event was the result of many changes and adaptations of the landscape across a period spanning more than two centuries. Therefore, this territory cannot be understood solely from this warfare confrontation between the English and Spanish. On the contrary, is necessary to understand the configuration of this landscape through the continuous history of tactical decisions and the mistakes of previous battles which took place in Cartagena de Indias (Del Cairo 2012). As a result of all these historical processes, multiple contexts of the Underwater Cultural Heritage have been identified and documented throughout the bay. These contexts can provide valuable information linking several sources of data (Del Cairo *et al.* 2004; Romero and Pérez 2005; Del Cairo *et al.* 2022a).

The archaeology of war and battlefields acquires a leading role, as it enables us to understand aspects such as the planning, development and outcome of a war confrontation (Landa and Hernández 2014, 2020). Therefore, it is pertinent to complement the analysis of this particular battle through diachronic frameworks which contribute to an understanding of this landscape over the centuries. Thus, starting initially from the interpretative proposals of Maritime Cultural Landscape (Westerdahl 1992, 2011), this concept has been applied and adapted to the particular conditions of the bay of Cartagena de Indias. Based on its complex military and war history, today we have sought to understand this territory through approaches such as the 'Cultural Landscapes of War and Political Regeneration' (Kim 2013) or as a 'battlescape' (McKinnon and Carrell 2015).

This 'Fortified Landscape of War and Maritime Defence' can be an object of study for this type of local archaeological research (Del Cairo *et al.* 2022a). In this regard, this chapter reviews the discussion and research advances around an archaeology of the 1741 maritime battlefield of Cartagena de Indias. This chapter follows from a paper presented at the seventh International Congress of Underwater Archaeology (IKUWA 7) held at the University of Helsinki, Finland in the session 'War on Board: The Archaeology of Warships and Maritime Battlefields'.

Based on the theoretical and interpretative frameworks already mentioned and discussed in greater detail below, we wanted to understand the evidence which defines this Maritime Cultural Landscape and its associated naval battlefield. Thus, different analytical and methodological proposals are linked to this particular scenario, wherein social and natural factors play equally important roles in the planning, development and conclusion of the conflicts. As a result, there is evidence of an active relationship between human and non-human actors which shaped this battle from its broad outlines to its minute details (Del Cairo 2011a).

In the context of the Colombian Caribbean, a research approach from the archaeology of war and battlefields has also been proposed for the insular region, particularly the islands of Providencia and Santa Catalina (Del Cairo *et al.* 2020, 2022b). From the archaeological evidence there as linked to community historical and oral sources, an interdisciplinary approach to the 'Maritime Landscape of Mobility and Connectivity' was sought. In this case, multiple maritime battles took place between the different colonising powers of the Caribbean between the seventeenth and eighteenth centuries, resulting in shipwrecks and fortifications on the coastline and underwater (Del Cairo *et al.* 2022b). On the other hand, in the Latin American context, there are several examples of an archaeology interested in maritime battlefields. These include the investigation of a battle which took place during the 1898 American intervention in Matanzas Bay, Cuba (Hernández *et al.* 2014). Interdisciplinary studies of the War of Intervention between Mexico and the United States around the years 1846 and 1848 have also been conducted (Herrera *et al.* 2020).

Investigations in international contexts include the final battle of the Egadi Islands, which took place around 241 BC during the 'First Punic War' between Rome and Carthage (Tusa and Royal 2015). Similarly, there is the investigative approach to two naval battlefields located on Takashima Island, Japan and the Bạch Đằng River in Vietnam, both dated to the thirteenth century (Kimura *et al.* 2013). In addition, there are studies about two naval confrontations which took place in Turkey from 1770 and 1853 in the vicinity of Çeşme, Mediterranean Sea and Sinop, Black Sea (Özdaş and Kızıldağ 2020). Likewise, there is the 1827 naval battle of Navarino, a war context located in Greece (Papatheodorou *et al.* 2005). On the other hand, there is an analysis of the naval battlefield of the American Civil War (1861–1865), which particularly concerns the 1864 sinking of the *H. L. Hunley*, a submarine, and the *USS Housatonic*, a sloop-of-war (Conlin and Russell 2006). From this same war, there are also archaeological approaches to the naval operations of Charleston Harbour, South Carolina (Spirek 2012).

More recent and from the Pacific theatre of World War II is the archaeological study of the 1944 battle of Saipan in the Northern Mariana Islands of Micronesia (McKinnon and Carrell 2015). Also from Micronesia, there is a study of the 1944 battle in the Palau Islands in the Caroline Islands archipelago (Carrell *et al.* 2020). Again linked to World War II are analyses of the anti-torpedo protection pontoons located at Flotta Island, Scotland, which operated between 1941 and 1942 (Christie *et al.* 2016). Finally, there is an investigation of a series of shipwrecks in North Carolina which occurred in 1942 during the battle of the Atlantic (Bright 2021). From a theoretical and interpretative perspective, it is critical to emphasise that these investigations have focussed on different aspects of their subjects (Borrero, 2018). In general, from the beginnings of the discipline towards the second half of the twentieth century, these approaches can be categorised within the particularist historical-cultural, processual and post-processual perspectives (Borrero 2018).

From theory to practice in the maritime battlefield

To understand the maritime battlefield of the 1741 confrontation, it is necessary to address several theoretical aspects. Each one of these constitutes a practical understanding of the planning, development and outcome of the conflict. One of the fundamental aspects is landscape, which links space and human relationships. Landscape is an integrative unit associated with multiple interpretations and perceptions; it is a polyvalent notion meaningful to those who inhabit a territory (Westerdahl 1992, 2011; Gibbs and Duncan 2015). In this way, landscapes link physical and cognitive dimensions. For this reason, the concept of Maritime Cultural Landscape has emerged as an integrating unit between terrestrial and underwater data. This definition, which has been much discussed over the last three decades, is based on human use of maritime space, through material culture and human practices (Westerdahl 1992, 2011; Gibbs and Duncan 2015). Thus, landscape brings together terrestrial and coastal aspects such as port constructions, docks, anchorages, intentional blocking areas, topography, contour lines and bathymetry, among others (Del Cairo 2012). Considering the tangible and intangible relationships which are built into a territory, it is important to apply a construct such as Actor-Network Theory (ANT) in order to understand the symmetrical contributions of the human and non-human actors involved, as well as their capacity for agency, to materialise a hybridisation of space (Dolwick 2009; Del Cairo 2011a).

For the particular case of Cartagena de Indias, its long military and war history requires us to understand it as a 'Fortified Landscape of War and Maritime Defence'. Specifically, for the case of the 1741 battle, analyses are based on 'Military Geography' and the 'KOCOA' proposal. These concepts allow us to understand how military activities are shaped by landscape. Military Geography aims to comprehensively analyse the characteristics of a landscape to understand how it will influence a military operation through its strategic and tactical features (Harmon *et al.* 2004). Strategy is the art of establishing decisive points within a battle scenario, as well as understanding and exploiting key routes for troop and logistics movements in order to achieve military objectives (Heuser 2010). Tactics consist of the ability to execute plans during a battle and the ways in which troops are readied and deployed, according to available resources and the battlespace (Montgomery 1969).

The 'Battle Landscape' (McKinnon and Carrell 2015) is directly influenced by war, as it is modified and conditioned by the reciprocal actions of the opposing sides. This differs from the 'Landscape of Conflict', which encompasses events and components of a territory before, during and after a war (*i.e*. it includes events not limited exclusively to the battle itself) (Asadpour 2016). In order to understand the Battle Landscape of Cartagena de Indias in terms of its natural and cultural components and the ways in which the battle unfolded, we followed the KOCOA methodology (Scott and McFeaters 2011; Babits *et al.* 2013; National Park Service 2016; Del Cairo *et al.* 2022c). This methodology is named by an acronym which lists the aspects considered the most relevant to understanding a conflict, including its environment, conditioning factors and constitutive components (Babits *et al.* 2013; National Park Service 2016):

- **(K) Key Terrain:** The areas where a battlefield advantage can be acquired (Babits *et al.* 2013).
- **(O) Observation and Fields of Fire:** The features allowing for the visualisation of enemy actions, informing the decisions of the friendly side (Babits *et al.* 2013).
- **(C) Cover and Concealment:** The factors or components which provide cover and concealment for friendly troops in order to protect them against exposure and possible enemy fire (Babits *et al.* 2013).
- **(O) Obstacles:** Terrain features which restrict friendly and enemy mobility, such as natural barriers or obstacles (Babits *et al.* 2013).
- **(A) Avenues of Approach:** The routes by which friendly forces can attack enemy positions or which leave friendly forces open to being attacked (Babits *et al.* 2013).

From this analytical structure, the topology of war can be derived. This topology can be visualised as a strategic and tactical geographical organisation of a particular network, in which human and non-human actor linkages are organised either as a hub hierarchy or as a more decentralised rhizomatic pattern (Shields 2013). To analyse a battle topology, we must consider the relationships and intersections between various nodes, which can be human or non-human. To do so, the topology must be seen as the result of 'indicators or representations [which] may no longer be fixed measures of stable entities out in a neutral environment but … [which] participate together with their referents in a dynamically animated relationship to amplify the intensity of a phenomenon (positive feedback), to build new relationships between entities (by tagging or classifying them together with previously unlike entities) as if the field has been shrunk, bringing them together. A topological sensibility considers the intersection or "transitive" relationships which arise between categories and their mutual constitution as aspects of the same temporal and spatial continuum' (Shields 2013: 160).

The topology encourages 'an approach that stresses not only relations in networks but … [sees] their nodes, rather than being "sealed units", … [as] alive and in process' (Shields 2013: 159). For the case of centres of gravity in the maritime operational art, nodes can be conceived as battle targets or as economies of force. The identification of a centre of gravity begins with the recognition and analysis of critical factors at the individual and physical levels (Uribe 2020). In this way, they are analysed according to their dynamism. Centres of gravity can change over time and space. As a result, nodes can lose relevance or gain greater importance in the course of battle. Wind, sun, troop morale, weapons, forts, navigational skill, knowledge (or lack of knowledge) of key terrain, obstacle management, *etc*., change the topological relationships. Nodes in a topological approach can be identified at decisive points in a battle. These can be, for example, a geographical location, an event or an army's capabilities. These types of elements can allow friendly forces to gain important advantages over enemy forces and influence the outcome of an operation.

This is why topology 'develops the character of these nodes in relation to their engagement, their co-becoming, with a milieu of other nodes. . . . [It also] draws on a milieu that is both and at once spatial and temporal and has a range of dynamisms—a dynamic repertoire' (Shield 2013: 159). To understand the topology of a battle, the war objective must first be identified, as it has implications for the strengths and weaknesses of the opposing forces in their movements, manoeuvres and battle actions, space, time and power. The relationship (direct or indirect intersections) of the nodes can be considered as lines of action in the operational art. They are decisive actions which are connected to the control of a geographical objective or force orientation. These lines are related to offensive, defensive and stability tasks with geographical and positional references in the area of operation (Joint Planning 2017 in Uribe 2020). For a topological analysis of the 1741 naval battle, we must recognise the various human and non-human actors which contribute to developing the process of a battle. We start from an analysis in time and space which identifies where military bases and camps were established and operated. Next, it is necessary to know actions related to decisive points and the best ways to exploit key terrain from the perspectives of defence and attack. In this sense, topology 'accommodates multiple milieux, spatialisations and temporalisations with different qualities so that they coexist and intersect in an object whether material or virtual, a site or a geographic space. Not location, position and fixed shape: instead, *Relation*, *Connection*, *Boundary-drawing and crossing*, *Interaction* and *Dynamics*' (Shield 2013: 159).

In such a way, the entire landscape is overlapped by pre-existing natural and cultural forms as a function of the battle. In the case of maritime battlefields, each component is associated with a moment of confrontation (Del Cairo 2011a; McKinnon *et al.* 2020). The physical spaces of a battle, by their dynamic and changing nature, generally leave a confused and traumatic record. There are gaps related to the duration and intensity of the conflict, its continuity or lapses of non-aggression, the extent (area) of what happened and the behaviour of the material culture. These vary according to the different protagonist spaces during the war event and the aspects which shaped it (McKinnon *et al.* 2020). Everything depends on the strategic and tactical approaches, the human and non-human actors which determine the conflict, the military geography, the factors of the battle, its natural and anthropic components, the topologies of the war and the Maritime Landscape.

The *mise en scène* of the war theatre in 1741

This scenario involves the articulation of several natural and cultural components which allow us to understand the continuity between the sea and land. As a result, the boundary between the terrestrial and the aquatic is limited to a merely physical aspect. For within the framework of the configuration of this landscape and the development of this contest, there is a symbiotic relationship derived from both spaces. The bay of Cartagena de Indias, therefore, constitutes a whole archaeological and historical corpus which accounts for the strategies and tactics implemented to guarantee the Spanish territorial domination of the American continent during the colonial period (Del Cairo 2011b).

This particular war, which took place in the so-called 'Modern World' during the 'Age of Enlightenment', was consolidated in a long-term context which would guarantee the security and sovereignty of Caribbean ports for centuries. As discussed, the defensive components of the 1741 battle are the result of the city's military background and the knowledge acquired from the confrontations which took place throughout the colonial Caribbean. There were continuous changes in the different defensive and offensive strategies and tactics of the Spanish Crown. Consequently, over the years, concepts such as 'defence', 'prevention' or 'fortification' became especially relevant in maritime contexts of economic and commercial interest (Del Cairo 2012).

Thanks to the analytical proposals and theoretical frameworks implemented in the archaeological study of the 'Fortified Landscape of War and Maritime Defence', the notion of this type of battlefields has changed. This change occurred because of the spaces where war confrontations took place do not include only the areas where conflict was focussed, whether in maritime or terrestrial environments. On the contrary, the battlefield also includes areas where the preliminary events which led to the battle took place, as well as those which occurred later, the routes and connecting roads, logistical areas of manoeuvre or retreat and camps and areas of imprisonment, among others (Babits *et al.* 2013; National Park Service 2016).

Thus historically, throughout Cartagena de Indias, a strategy of defence in 'depth' was configured and implemented, one capable of delaying an enemy attack by sea. This defensive strategy was due to the strategic location of the fortifications (and sometimes of the warships), which sought to delay but not avoid the enemy advance at all costs. This strategy derived from a tactical rethinking, a result of battles which took place before 1741, as for example, invasions by the English in 1586 and French in 1697. Thus, from this diachronic perspective, the archaeological records of the 1741 battlefield have been recognised as the result (tangible or intangible) of the wartime background of the bay. As a result, several sources of data associated with defensive and offensive dynamics, as well as the intensity and development of the battle, have been identified on the coast or underwater (Del Cairo and García 2006; Del Cairo 2012; Del Cairo *et al.* 2021).

For many of these archaeological contexts, intrusive and non-intrusive interdisciplinary studies have been conducted. These studies enabled us to understand the use of space and the historic relationships between the population and its environment, materialising a landscape with diverse military archaeological contexts (Del Cairo 2011a, 2012). In the specific case of the 1741 conflict, the English force appeared along the coast of Cartagena City under the command of Edward Vernon. The force consisted of 186 ships, including three-masted ships, fighting frigates, transport ships and burners. These carried 2,000 guns and nearly 9,000 soldiers, 12,600 sailors and 1,000 slaves, as well as a regiment of 4,000 young Americans recruited in the British colonies (Martínez 1961; Zapatero 1967; Segovia 1987; Dorta 1988).

On the other hand, Cartagena had as its defence 3,000 soldiers and 600 Indians, as well as militias and landing troops from six warships and almost a dozen merchant ships. Faced with the immense numerical differences in the offensive and defensive components, defending the city depended on finding various tactical solutions to gain advantage during the battle. The Spanish forces achieved victory by developing plans linking and maximising the military contributions which could be provided by the fortifications (batteries, platforms and forts) and the strategically arranged artillery ships (ships of the line and merchant ships). Once the English attacked, the battle spanned nearly two months, from March to May 1741 (Martínez 1961; Zapatero 1967; Segovia 1987; Dorta 1988).

Military constructions related to the battle have been studied, including the forts of San Luis and San José de Bocachica, San Juan de Manzanillo, Santa Cruz de Castillo Grande and San Sebastián de Pastelillo; the batteries of San Felipe, Santiago, Chamba, Ángel de San Rafael, Varadero and Punta Abanico in Bocachica; the Castillo San Felipe de Barajas; the walls of the urban centre; and the submerged breakwaters of Bocagrande and Isla Draga. Ships wrecked during the battle include the *Conquistador*, *Dragón*, *San Felipe*, *África* and *San Carlos*, all ships of the line, as well as an unidentified merchant ship (Del Cairo and García 2006; Del Cairo *et al.* 2021, 2022a).

Applying the KOCOA methodology to the 1741 maritime battlefield began by articulating the different lines of evidence. With this, we sought to understand each of the

Figure 13.2. (Left) Documentation and excavation work at the San Felipe shipwreck. Image from Fundación Terrafirme 2017. (Right) Recovery and recording of the structural elements of a possible merchant ship. Image from Fundación Terrafirme 2016.

military and war details which materialised the strategies and tactics of the conflict, yielding this particular landscape and its topology of war. In short, this interpretative proposal allowed us to approach the archaeological contexts resulting from the decisions made by both sides. Thus, it encompasses the ‘Principles of War’, including Objective, Offensive, Manoeuvre, Mass, Economy of Force, Unity of Command, Security, Surprise and Simplicity (Scott and McFeaters 2011; Babits *et al.* 2013; National Park Service 2016; Del Cairo *et al.* 2022c).

- **(K) Key Terrain:** For the 1741 battle, the areas which stood out were those presenting a high intensity of confrontation in terms of crossfire during the entire conflict. As a consequence, in order for both sides to fulfil their missions, areas with the greatest confrontational force were associated with spaces of transit to the city. Fortifications considerably strengthened by artillery units were located there, as were vessels whose mission was to attack the enemy. These areas correspond mainly to the navigation channels of Bocachica and Manzanillo. Narrow canals where fortifications were located were dug in parallel and oriented to direct crossfire on any vessels seeking access to the urban centre. These canals witnessed a high intensity of the battle due to artillery fire from both the Spanish forts and ships, as well as from the English ships. As a consequence, several ships from both sides were wrecked in the two canals. In the historical archives, there are references to the intentional sinking of ships of the line and merchant ships as a defensive tactic. In addition to the destroyed forts, wrecked ships and the isolated remains of bullets within the range of cannon fire, key geomorphological units determined the enemy’s advance or retreat. In short, a complex natural and cultural defence of the coastal and underwater topography was configured for battle, which significantly contributed to the outcome of the war.
- **(O) Observation and Fields of Fire:** Fortifications were strategically located, built and relocated according to military objectives. The strategic locations of the forts correspond to geomorphological units of the

Figure 13.3. (Left) Audiovisual recording by drone at the Bocachica Channel fortifications; (Right) documentation of evidence of the 1741 battle such as English artillery, shrapnel, naval graffities on the forts and traces of use on a battery. Images from Del Cairo *et al.* 2020.

coastal border in a way designed to make friendly and enemy forces visible in order to guarantee artillery support to transit zones. This involved both navigation channels and military units located towards the open sea to identify the arrival of enemy forces. Thus, fields of fire are determined by cover and efficiency of fire from the forts and ships which were located in the bay to counteract the English fire. However, shipborne armament defines a ship's field of fire, but this will also fluctuate with factors such as wind, tides, channel obstructions, topographical obstructions and enemy defences.

- **(C) Cover and Concealment:** Several areas of influence from the conflict can be identified, which respond to anthropic and natural components. In the continuous search for protection from enemy fire, observation and surveillance to which friendly forces may be exposed, the tactics of both sides involve the location and relocation of units in land and maritime areas. As a consequence, defenders must know how navigable routes and waters will affect the movement of ships. At the same time, this knowledge is associated with the creation (by means of military structures) or implementation (thanks to natural components) of efficient defences. These defences must protect and obstruct shipping lanes and landing zones which can be used by the enemy. For the latter, the dense areas of mangroves which prevented the English from landing on different coastal edges of the inner bay of the city stand out. At the same time, these mangroves acted as areas for the propagation of mosquitoes which continually affected the English forces, leading to the proliferation of diseases. In this way, the coverage of the static and mobile components of the regional defence of the bay was guaranteed, delaying the enemy's advance and reducing their numbers.
- **(O) Obstacles:** Obstacles are referenced in various historical documents, and several defensive components have been identified in the archaeological record with the purpose of obstructing and hindering the transit of troops and enemy ships. Of course, these obstacles were not only anthropic elements. On the contrary, they also correspond to natural components of the landscape which, in one way or another, were implemented to prevent or divert strategically undesirable movements. With regard to the latter, the water in maritime environments is itself an obstacle to land forces. This forces a reliance on maritime methods of transport, and these, in turn, may be exposed to natural obstacles such as weather (which is always variable) and the bathymetry of the transitable area (*i.e.* shallows). In relation to artificial obstacles, predetermined areas for navigation (*e.g.* dredging activities) could also be included. Submerged breakwaters—underwater stone barriers designed to prevent the enemy from accessing a given space at the cost of likewise impeding friendly transit—also fall into this category. As a result, throughout the bay of Cartagena de Indias, there are historical and contemporary records of fixed and temporarily variable obstacles.
- **Avenues of Approach:** Finally, terrestrial and maritime routes in the bay determined the access, retreat or free transit of local and foreign troops in one way or another. The land routes were relatively free of obstacles,

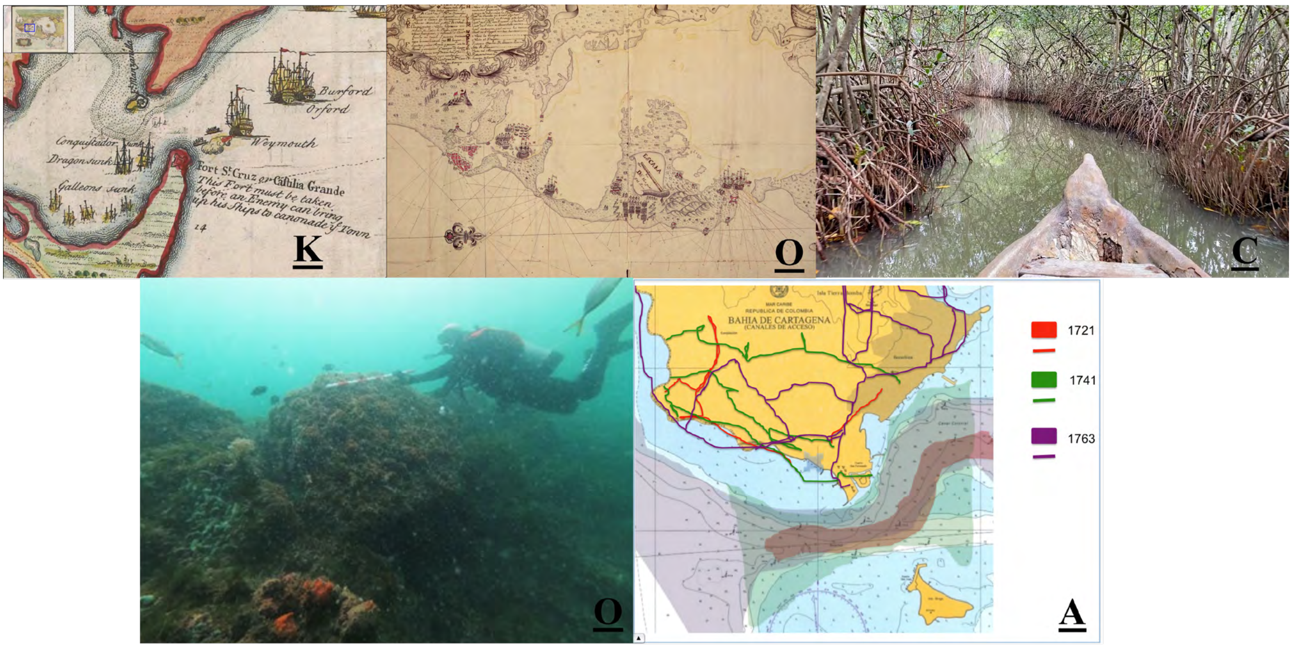

Figure 13.4. (K) Key Terrain: navigation channel and access to the inner bay at Manzanillo (Chassereau 1741); (O) Observation and Fields of Fire: artillery range of the fortifications located on the coastal edge of the city (Blas de Lezo 1739); (C) Cover and Concealment: mangroves used at the time as natural defence during the battle (Del Cairo *et al.* 2022); (O) Obstacles: submerged breakwater of Bocagrande used to prevent the passage of boats (Del Cairo *et al.* 2022a); (A) Avenues of Approach: historical reconstruction of roads for the connection between the town and the forts of Bocachica, as well as historical and contemporary navigation channels (Del Cairo *et al.* 2022a).

although fire from the forts obviously affected mobility. On the other hand, water routes were essential spaces for the advance (or withdrawal) of naval forces which supported landings (or not) at tactically relevant points. In this case, tides and wind can delay offensive or defensive ship movements. In the same area, it is thus possible for a route to be seriously affected by anthropic or natural aspects. As such, all these factors have the potential to prevent units from fulfilling their military objectives. In the case of Cartagena de Indias, the approach routes correspond to those historically used by local populations and the transit areas defined by the military history of the city in past centuries.

Final considerations

The 'Fortified Landscape of War and Defence' which was historically built and reconfigured in Cartagena de Indias played a leading role in the historical trajectory of the Colombian Caribbean. We can understand the historical complexity of this territory, thanks to an interdisciplinary approach, one capable of comprehending the archaeological and environmental contexts and the human and non-human actors which constitute it. The interpretative proposal for understanding the topology of war in the bay of the city acquires particular relevance. The integration of all the methodological and analytical approaches presented here, then, has as its goal the understanding of the landscape related to the 1741 maritime battlefield.

Given the diversity of coastal, intertidal and submerged archaeological sites present throughout the bay, there is a clear need to commemorate the great battlefield constituted by different components over several centuries. Based on all of these factors, the need to generate and apply mechanisms for managing and protecting this particular landscape has arisen. This need is not limited to preserving the material culture of past human activities, but also includes the ways in which this type of historical heritage can contribute to the development of local communities. Consequently, thanks to UNESCO's designation of Cartagena de Indias as a World Heritage Site in 1984, the need to protect tangible (natural and cultural) and intangible (knowledge and traditions) heritages has become a priority in the last decades. Hence, the need to propose research approaches and protection mechanisms aimed at memorialising and commemorating the maritime battlefield finds its critical importance (Del Cairo *et al.* 2022c).

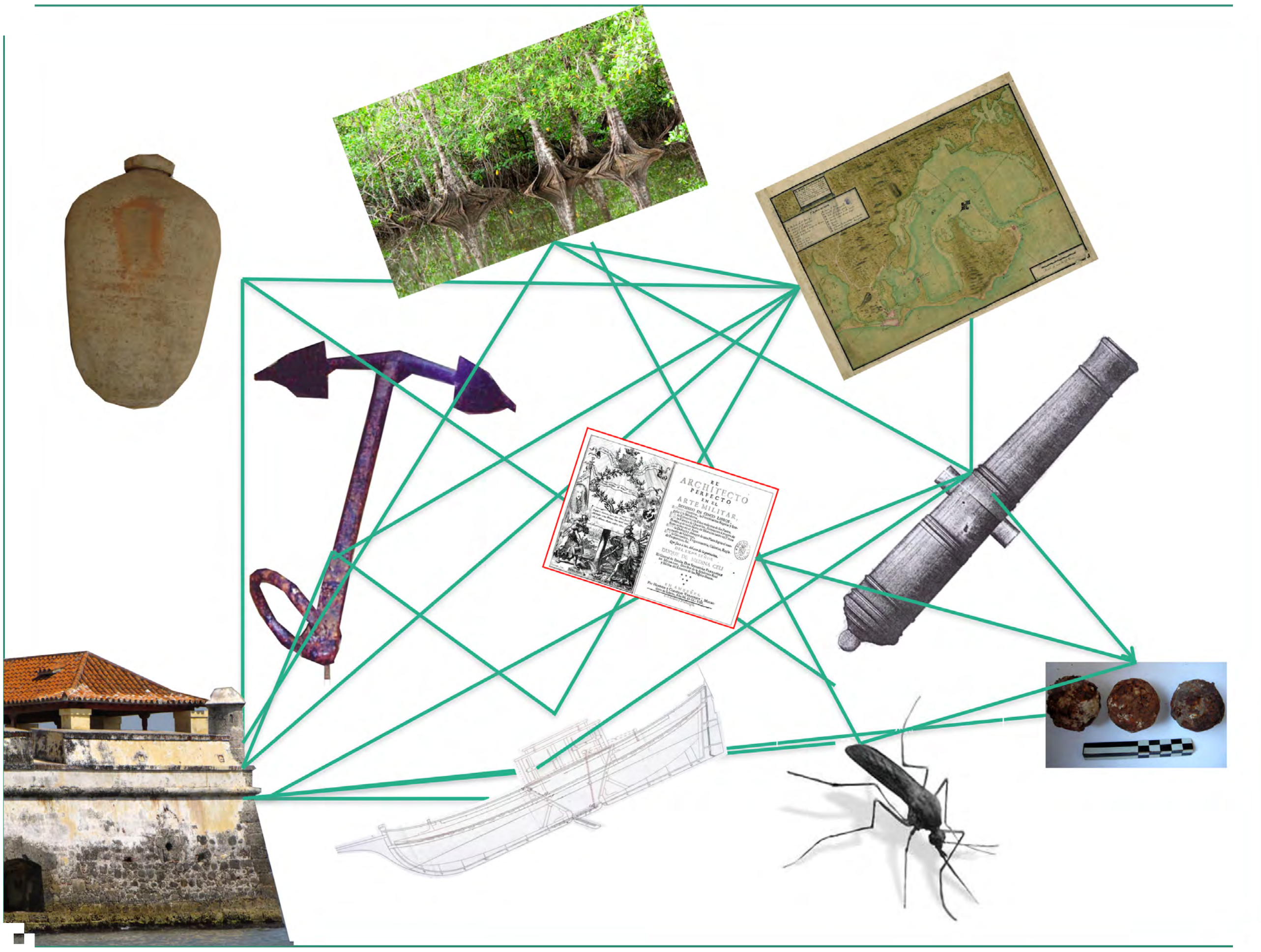

Figure 13.5. Cultural and natural components and their associations, based in Actor-Network Theory (ANT), which act as sources of information for the study of the 'Fortified Landscape of War and Defence' of the Bay of Cartagena de Indias. Image from Del Cairo 2012.

Each of the natural and cultural components of the environment and sources of information acquires great relevance, based as mentioned on the human and non-human actors from the ANT perspective. On the one hand, the cultural field includes fortifications, shipwrecks, civil constructions, artefacts and ecofacts, building traditions, traditional knowledge, historical archives and old maps, among many others. On the other hand, the natural field encompasses geomorphological units, seabed, mangroves, mosquitoes, viruses and diseases and so on. Together, these factors contribute to the proposed integrated view which will permit us to understand this particular landscape throughout time and as a whole.

In this sense, the planning, formulation and development of the Special Management and Protection Plan for the Fortified System of Cartagena de Indias (in Spanish, 'Plan Especial de Manejo y Protección del Sistema Fortificado de Cartagena de Indias—PEMP FORT BAHÍA') has been carried out (Del Cairo *et al.* 2022a). This document is an instrument for managing the different components which are part of the maritime, coastal and underwater heritage of the city. Through this mechanism, the Colombian Ministry of Culture has sought to structure and implement policies for protecting heritage spaces, managing marine territory and integrating coastal and underwater archaeological heritage in coastal marine management plans (Del Cairo *et al.* 2022a).

This type of heritage is obviously vulnerable to multiple natural and anthropic alteration factors, which can lead to its partial or complete loss. This includes not only shipwrecks, but also the fortifications affected by the rise in sea levels, infrastructure which is now underwater, vegetation associated with structures, their topography and the areas of confrontation observed in navigation channels. One of the first steps for the conservation of cultural sites is the inventory of assets linked to the maritime and underwater heritage located in Cartagena de Indias (Del Cairo *et al.* 2021).

On the other hand, the daily co-existence of local populations with archaeological contexts impacts both their significance and preservation. Many of the archaeological projects developed to date have been supported by local communities. Cultural heritage enhancement programmes have been developed, as well as workshops designed to recognise multiple voices and interpretations of local heritages (Fundación Terrafirme 2017; Aldana 2019; Del Cairo *et al.* 2020, 2022a). Based on all this, interdisciplinary archaeological research aims to document and plan, in an effective and comprehensive manner, the successive transformations, uses and adaptations of the marine landscape and its territorial components.

This research has been the focus of many agencies and institutions over the last two decades, including the implementation of research and management agreements among local, regional and national public and private entities. Among them are the Colombian Navy (ARC), Department of Diving and Salvage (DEBUSA), General Maritime Directorate (DIMAR), Centre for Oceanographic and Hydrographic Research (CIOH), Colombian Ocean Commission (CCO), Ministry of Culture, Colombian Institute of Anthropology and History (ICANH), District Institute of Cultural Heritage (IPCC), Cartagena de Indias Workshop School (ETCAR), NGO Terrafirme and NGO Colombia Anfibia.

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14

Lost on their way to Africa: on the provenance of brass rod ingots produced for eighteenth-century AD slave trade found on shipwreck *Paal 27.1* on the island Terschelling, The Netherlands

Heidi E. Vink and Tobias B. Skowronek

Abstract: Where did the (metal) trade wares used in the Transatlantic slave trade come from? Nowadays, we have come to understand quite a bit about the routes and relationships of peoples and wares involved in the slave trade. Much less is known about where materials for items were sourced and products were made, before being shipped to Africa. In this chapter, we present a case study of the shipwreck *Terschelling Paal 27.1* and its associated artefact assemblage. Due to the cargo of—amongst others—specific glass beads and brass ingots with lead seals attached to them, we believe we have identified one of the few ships known in the world to have operated in the eighteenth-century slave trade. The shipwreck and ingots provide a unique opportunity to answer questions on trade product provenance, since ingots mirror the primary composition of metals sourced at certain locations. Through archaeological, historical and metallurgical analyses, we were able to trace the copper to Falun, Sweden and the zinc (calamine) to Stolberg, southwestern Germany. The inscriptions on the seals might point to a particular firm in Stolberg as the production location of the brass. The results testify to the enormous scale at which ingots were used in the African slave trade and link the ingots to a long history of ingot trade since pre-Portuguese contacts with West Africa.

Introduction

Following a northwestern storm in July 2012, a birdwatcher named S. van Dijk from the Dutch Forestry Commission found a shipwreck drifting in the North Sea surf near beach marker 27 on the island of Terschelling, The Netherlands (Figure 14.1). Upon closer inspection, van Dijk could not believe his eyes: there were artefacts lying on top of the shipwreck. This was a surprising find, since other wrecks found within the high-energy environment of the (Frisian) coasts have been mechanically beaten by waves and are typically found stripped of artefacts. As these conditions were rapidly affecting this particular wreck, van Dijk quickly collected some smaller finds as he saw them disappearing in the waves, and he notified the local cultural history museum, Museum ‘t Behouden Huys (MTBH). The museum staff responded and had the wreck fragment pulled up onto the beach. The wreck was photographed, and the remaining artefacts were collected (Figure 14.2), cleaned and stored. None of the artefacts were subjected to conservation treatments.

As prescribed by the Dutch Monuments Law (1988), since 2015 renamed the Dutch Heritage Law, the find was reported to the Cultural Heritage Agency of The Netherlands (Rijksdienst voor het Cultureel Erfgoed; RCE). However, the wreck had already disappeared as a result of tidal action and beach-combing practices. Luckily, the artefact assemblage was still there to study: fragments of glass bottles and beads, stoneware sherds, clay tobacco pipe stems and a large collection of copper alloy rods and other metal objects. While the majority of artefacts were generic in terms of provenance or dating, the MBTH staff recognised the glass beads as having potential for typological analysis. The beads were macroscopically studied by Werkhoven *et al*. (2012), who identified them as a typical commodity amongst cargo on the first leg of the triangular Atlantic slave trade during the seventeenth, eighteenth and early nineteenth centuries. The beads were used for purchasing enslaved people or commodities on the West Coast of Africa.

Scholarly interest in the wreck find was initially limited. While the MTBH set up a small exhibit of the wreck find to introduce the public to the slave trade, the artefact assemblage was not fully studied. Five years later, however, an in-depth study and associated analyses were published on the wreck fragment, its site location and artefact assemblage (Vink 2018).

The artefacts and wreck were well preserved, with indications of mechanical rather than biological and/or chemical degradation. The sudden appearance of the wreck was similar to the situation of most wrecks on the Terschelling coast. The wrecks are buried in gullies in the naturally present or supplemented Holocene sands of the foreshore running parallel to the North Sea, only to recurrently appear for brief periods following northwestern storms. A few of them are known to move short distances (*i.e.* several metres), which calls into question the assumed relatedness of the wreck and artefacts. However, beyond their physical proximity, the

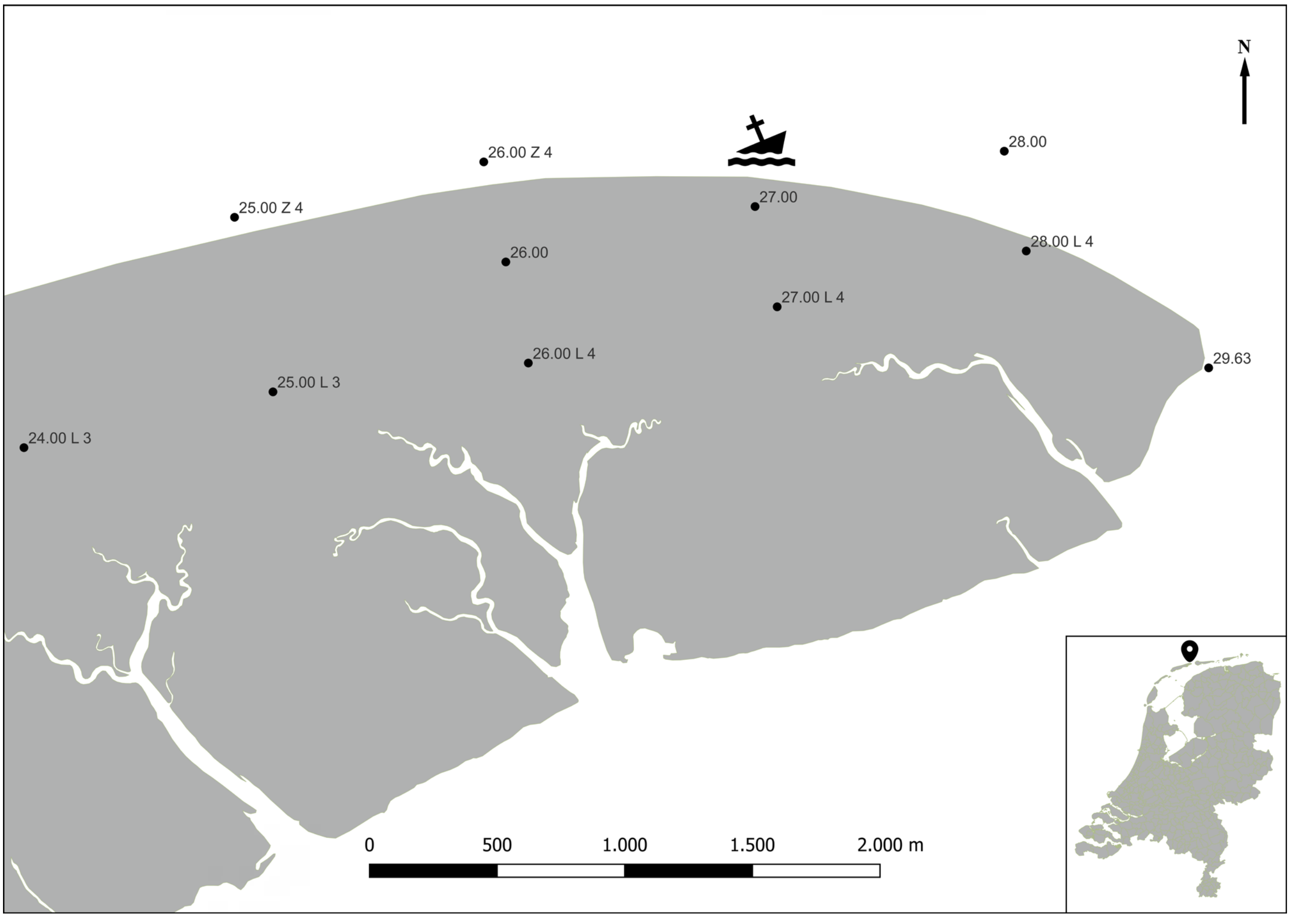

Figure 14.1. Map with find location. Figure by Vink (2023).

Figure 14.2. The shipwreck and its artefact assemblage. Photograph by F. Schot, former curator of the Terschelling Museum 't Behouden Huys, and used with permission.

large quantity, homogeneity and volume of the (metal) artefacts make it likely they were related to the wreck on which they were found.

The present study builds on Vink's 2018 study by subjecting the brass rods/ingots to metallurgical sampling and analysis. Based on the results, we demonstrate the rods have distinct trace-element and isotopic signatures, noting alloys can represent multiple ore sources, extraction and production techniques and might also have been re-smelted prior to being loaded into the ship. We have also identified the rods as the commodity referred to in historical sources as 'coppers' or 'Guinea rods', items used as a barter commodity on the West Coast of Africa (Alpern 1995; Evans 2015). While the other artefacts in this assemblage have been found across the globe and in nautical, maritime and indirect maritime contexts, the ingots highlight our interpretation that this ship and its cargo were related to the Transatlantic slave trade, one of few thus identified to date. While the pre-modern period can be challenging to study because of its increasingly diverse trade relationships, written sources also become increasingly available. Connecting the results of our analysis to historical sources provides us the opportunity to look closely at ore sources, fabrication locations and techniques, and consider the organisation of industries, institutions and relationships behind the trading of metals and enslaved people. We looked beyond the historical period of the slave trade, at the technological history of other (brass) rods/ingots, in order to place the ones studied here in a wider chrono-spatial perspective.

The wreck

The wreck was photographed from several sides on the day it was pulled onto the beach in 2012 (see Figure 14.2). In these photographs, some constructional features such as framing, planking and fastenings are distinguishable. Overall, the wreck seems well preserved. While the hull has obviously been fragmented, it still appears to hold some structural integrity in terms of the connecting elements and the wood still being able to carry substantial weight. Most timbers show their original surfaces, on which saw and adze marks are still visible. Some edges appear mechanically affected, and some elements appear broken off. The metal artefacts likely had a preserving effect on the timbers, but we suspect the wreck fragment was also buried for a long time.

From seven close-up photographs, a total of 32 frames was counted. At least three different types of frames were present, namely floors and first and second futtocks. The frames are fastened with tree nails to a single layer of carvel-laid hull planks (and missing ceiling planks), but do not generally seem to have been fastened to each other. A few frames overlapped through scarves on either sided or moulded view (the one in moulded view was fastened with a treenail). Sided and moulded dimensions were only roughly estimated for a few frames located close to where the artefacts were found, and these ranged 22–27 and 15–18 cm, respectively. Spaces between frames were roughly estimated to around 5–6 cm. The floor timber stretching out the furthest has a notch for the keel. The majority of futtocks and floor timbers form an alternating pattern. And the total length of the wreck part is estimated at 9–11 m. The wreck is interpreted as a carvel-built ship's bottom and one turn of a bilge. The framing pattern and frame features are similar to other archaeological merchant ships built in the low countries from the late sixteenth to the eighteenth century, although we must observe the fairly straight and well-squared frames of the wreck contrast with the often (but not always) irregularly shaped frames known from such ships (Lemée 2006; Maarleveld 2013; Zwick 2021).

In terms of planking, at least five or six flush-laid strakes were counted. Since the wreck part is lying on its hull planks, the dimensions and strakes are difficult to measure and describe. The planks appear variable in width and thickness, with estimates between at least 5 and 7 cm, as scaled to other constructional features. At one end of the wreck part, some scarves are clearly visible in the planks. Additionally, at least one 'inserted' or 'lost' strake is visible, suggesting the wreck part is from an area close to one of the ship's stems.

The artefact assemblage

Vink's 2018 study identified the artefacts as specific types of glass beads, glass bottle fragments, Frechen and Westerwald stoneware sherds, clay tobacco pipe stems, copper alloy cauldrons with iron handles and copper alloy rods bound together with copper alloy wire and lead seals (Figure 14.3). The majority of these objects are dated generically to the European pre-modern period, and they also seem likely to have been made in northwestern Europe.

- **Glass beads.** About 1 kg of glass beads was saved from the waves (Figure 14.3A). Some were broken, and the majority showed slight surface weathering. Based on morphological analysis using the Kidd and Kidd (1970), Karklins (1985) and Dubin (1987) methodologies, the beads have been identified as comprising at least seven distinct groups (Vink 2018: 50–55, 73–75, Appendix G). The majority (over 90%) are white beads of the type historically known as 'galet blanc' (van der Sleen 1967: 84; Opper and Opper 1989: 8). The remaining beads (and six groups) are black, green, green and red, white and red, white to black and a single red bead with a floral decoration. Their shapes are characterised as circular, oblate, tabular, barrel-shaped and truncated. In terms of production, the beads are drawn and double wound, and a few might have even been mould-pressed. While all the types are slightly variable in size, it is interesting to note the greatest variability occurs in the white beads. Some of the bead types represented in this assemblage are known to have been produced in Venice or in Dutch cities such as Amsterdam and Middelburg (Alpern

Figure 14.3. A) All retrieved beads; B) glass bottle bottom fragment; C) Frechen stoneware fragment; D) decorated pipe stem; E) cauldrons with handle remains; F) bundle of rods with wire and seal. Photographs by Vink (2018).

1995: 22–23; Dutch Museum of Ethnology 2017: 58). According to books written by Venetian merchants of the time, it appears these beads were made in varying sizes by type, with each size being traded for a particular but limited range of commodities in West Africa (Karklins 1985). The single bead with floral decoration has undated and unprovenanced parallels in Mali, Congo and Persia (Werkhoven *et al.* 2012), but it might have been made in (or inspired by) the Near East or Egypt (Dubin 1987: 35, 37, 113–120). *Galet blanc* have been identified in shipwrecks and other archaeological contexts across the globe (Dubin 1987: 38–46; Opper and Opper 1989: 16–18; Perttula and Glascock 2017: 524–529).

- **Glass bottle fragments**. The eight glass bottle fragments show a slight iridescence and originate from at least five dark green, square-sided blown and mould-pressed bottles with tapered sides (Figure 14.3B) (Vink

2018: 48–50, 72–73, Appendix F). Such bottles were made in The Netherlands, England, Spain, Russia and Bohemia in the seventeenth or eighteenth century (Brown *et al.* 2017).

- **Stoneware sherds.** Nineteen fragments were found. The bottles were wheel-thrown, fired through oxygenated and reduced conditions and exhibit the general characteristics of Rhenish stoneware (Vink 2018: 36–45; 68–71; appendix D). The majority of sherds are salt-glazed stoneware whose mottled exterior surfaces identify them as either made in Frechen or as Bartmann jugs (Gaimster 1997; Linaa 2017). Two fragments are incised with lines, one of which resembles the number '4'. The other sherd with incised lines is unique among the assemblage in being Westerwald and possibly datable (Figure 14.3C). It is decorated with coloured and incised foliage, characteristics which provide a rather broad *terminus post quem* manufacture date of 1650–1725 AD (Hume 1969; Gaimster and Hook 1995: 69; Gaimster 1997: 40–41, 167, 253, 302, 311, 344; Gawronski 2012). Rhenish potters expanded from Germany's Rhine River valley to other regions of Europe in the eighteenth century (Baaden *et al.* 1990: 34, 40; Steen 1999; Skerry 2008: 32), contributing to finds of Rhenish stoneware across the globe (see, for example, Gaimster 1997: 122–123; Bröker 2008; Gilmore and Reese 2017: 599, 614).
- **Clay tobacco pipe stems.** Fragments of 30 'neatly broken off' pipe stems were collected, ranging in length between 12 and 11,56 mm (Figure 14.3D). Three of them carry the words 'in Gouda', revealing the Dutch city in which they were produced, and they are also decorated with bands of an impressed 'ladder pattern' (Vink 2018: 45–47, 71–72, Appendix E). Unfortunately, these characteristics could not pinpoint their date of manufacture.
- **Copper alloy cauldrons with iron handles.** The largest artefact category in terms of volume was the copper alloy cauldron, identified by their fabric and corrosion product colours. Thirty-one were found in total. They had been stacked into piles which ranged from two to five cauldrons each, sometimes of different sizes, and they were stuck to each other by corrosion products and encapsulated sand (Figure 14.3E) (Vink 2018: 57–63, 75–77). The cauldrons used to have two iron lugs attached by riveting nails, with a hanging element in between. Only a few of these heavily corroded iron elements were found. The cauldrons were hammered out of thin plates, and have outwards folded rims. On the interior bottoms, some silverish circular and smooth lines are visible, but what they are and how they were made remain unclear. The cauldrons range in diameter from 36 to 42 cm, with one exception which is 31 cm. Another object which had washed ashore is a copper alloy open-shaped 'pan' with a diameter of 116 cm; it has tentatively been identified as belonging to the wreck assemblage.

The cauldrons are a well-known artefact category found across the globe. They are—amongst others—found in shipwreck contexts dating to 1600—1800 (Cook *et al.* 2016: 375; Beattie-Edwards 2018: 159, 171, 176). In England, a few publications on the metallurgical analysis of such cauldrons are available, and they list a significant number of European finds and their extraction and manufacture areas, highlighting a flourishing period of mining and trading (non-ferrous) metal (Day and Tylecote 1991; Dungworth and Nicholas 2004; Payton *et al.* 2014). A 'list of trade goods' culled from multiple historical sources spanning several centuries shows a wide variety of copper and brass wares was shipped to Africa in this period (Alpern 1995: 15–16). This evidence is consistent with the results of metallurgical analyses of ingots and finished products recovered during archaeological investigations of pre-modern shipwrecks (Skowronek 2021).

- **Copper alloy rods with wire and lead seals.** Five hundred and forty-five copper alloy rods—an astonishing number—was retrieved from the shipwreck fragment. All were well preserved, with little corrosion. Most were packed in fifteen bundles of 30, though there were also two bundles of 31 rods, and bundles were tied together with two or three copper alloy wires and lead seals (Figure 14.3F) (Vink 2018: 64–67, 77–84, Appendix H). The rods measure in length between 94 and 103 cm, and they are circular to oval in cross-section with a diameter of 7–9 mm, with acentric facets at their ends. Fabrication marks drawn longitudinally are visible to the naked eye. The rods are held together by copper alloy wires twisted around them several times. The wires measure only a few mm in thickness. Lead seals with depictions were found attached to five of these wires. A sixth detached seal was also retrieved from the wreck. The seals are similar in appearance to cloth seals of the period (see, for example, Egan 1994; Elton 2017), and they can be described as single discs with flat attachment rings. They are identical in appearance and measure 3 × 4 cm, including the attachment ring. On one side, they depict a tree with the letters T and P standing on either side of the tree trunk; on the other side, they depict a double-headed eagle (Figure 14.4). Both sides have pearled rims.

Figure 14.4. The lead seal depictions. Photographs by Vink (2018).

Rolls of wire have been found in other (shipwreck) contexts of the seventeenth and eighteenth century. These include the Dutch merchant ship *Vrouw Maria* (1771) and a seventeenth-century wreck near Leasö in the Baltic region (Cederlund 1983: 22–23; N. Eriksson 2022, personal communication), as well as the French barque-longue *La Belle* (1685) wrecked in Matagorda Bay off the Texas coast (Jones 2017: 551–552). In Europe in the seventeenth and eighteenth centuries, wire was used to manufacture pins for sewing clothes. Pin manufacturing has been documented in England, France, Sweden and the Hamburg area of Germany (Caple 1992; Jones 2017: 551–552). In very rare cases, wire has been related or attached to objects such as seals. An example is a seal with the word 'drat'; the term usually refers to cloth thread, but in this case may refer to wire instead (Koppmann 1878; Egan 1994: 122). This specimen has monograms related to a family on it, and it was found on a wire-drawing mill. Another example is a seal with leftover wire which was excavated in Amsterdam (#MH2 13-11-1975), although it is unclear whether the wire represented the commodity or an attachment medium.

The seals found in the wreck assemblage have no exact parallels, though examples of similar designs are known. Seals with stylised depictions of trees and eagles are common; examples include contemporary and modern (heraldic) family-, city-, country- and empire seals, coats of arms, coins and more. The combination of a tree and double-headed eagle is also found on the modern coat of arms of the Dutch city 's-Hertogenbosch. A seal with a tree and double-headed eagle was reportedly found in or near this town, but it has not yet been published; it may date to the late eighteenth century or later (E. Nijhof 2020, personal communication).

Materials and methods

In 2019, the authors were granted permission by the MTBH staff to use invasive techniques to obtain samples from the rods and cauldrons in order to determine the chemical composition of the rods. Eleven copper alloy rods were sampled by one of the authors (Skowronek), taken from three different bundles (Table 14.1). Additionally, five of the cauldrons were sampled. The dimensions of both types of artefacts appear rather normalised indicating pre-industrial manufacture.

Approximately 100 mg of pure metal was obtained for each sample, using a 1.5 mm High-Speed-Steel (HSS) drill bit attached to a portable Dremel. The chemical composition of the samples was measured at the material science laboratory of the Deutsches Bergbau-Museum (German Mining Museum) in Bochum using a Thermo Scientific 'ELEMENT XR' high-resolution, inductively coupled plasma mass spectrometer (HR-ICP-MS). For trace elemental analysis, the BAM-376 copper standard was used, as was a BRASS STANDARD. Lead isotope ratios were obtained using a multi-collector mass spectrometer (MC-ICP-MS) and a Thermo Scientific 'NEPTUNE' at the Goethe-Universität, Frankfurt am Main.

Table 14.1. Weights, lengths and original bundle for the studied rods.

ID. No.	Weight [g]	Length [cm]	Bundle
Tms-1	490	99	B
Tms-2	490	94	B
Tms-3	440	101	B
Tms-4	450	101	B
Tms-5	520	101	C
Tms-6	450	101	C
Tms-7	510	101	C
Tms-8	520	99	A
Tms-9	450	100	A
Tms-10	520	100	A
Tms-11	420	94	A

Analytical results

The results were consistent with the assumption the rods and containers were made of brass. Brass is defined as an alloy of copper and zinc in different ratios to each other. The analytical results on the chemical composition from the ICP-MS analysis are listed in Table 14.2. The trace elements, including lead, did not jointly exceed more than 2 to 3 wt-%. The cauldrons and rods showed a similar compositional trend with trace elemental patterns appearing as highly standardised. Zinc amounts had mean values at around 27 wt-%, with a single exception which reached up to 30.4 wt-%. Lead amounts were slightly higher in the cauldrons, reaching up to mean values of 1.7 wt-% to 2.3 wt-% in rods. The tin values, on the other hand, reached up to 0.18 wt-% in two cauldrons, and were therefore much higher than those of the rods.

The normalised chemical composition of the rods and cauldrons was also reflected in the lead isotopic ratios (Table 14.3). All samples demonstrated remarkably constant values in all three lead isotope ratios: $^{206/204}$Pb, $^{207/204}$Pb and $^{208/204}$Pb. However, two rods (samples TMs-1 and TMs-8, which were taken from different bundles) showed different isotopic ratios and represented outliers from the main cluster, forming their own group as their isotopic ratios were similar.

Raw material sources

Ingots are generally thought to represent a unique source of information as they are not yet transformed into other products. Care should be taken with

Table 14.2. Chemical composition values of rods and containers as measured by ICP-MS. All values in ppm except Cu, Zn and Pb, which are shown as wt.-%.

ID. No.	Ag	Sn	Sb	Te	Bi	P	S	Fe	Co	Ni	As	Se	Cu	Zn	Pb
TMs-1	188	88	154	6,4	12	5.7	149	2,049	64	442	379	6,0	68	26.2	2.17
TMs-2	153	122	316	6,1	12	5.1	80	2,184	120	489	233	<10	72	28.3	1.47
TMs-3	203	61	155	5,0	13	4.8	53	2,064	84	538	307	<10	68	28.4	1.62
TMs-4	177	14	96	15	10	8.0	81	2,781	110	273	301	<10	66	30.3	2.01
TMs-5	188	25	119	15	14	5.9	94	2,091	64	470	296	14	70	27.2	1.58
TMs-6	267	31	119	8,6	13	5.7	306	1,606	119	589	482	14	66	27.7	1.84
TMs-7	152	35	109	6,4	11	4.9	291	2,115	114	470	253	<10	68	26.9	1.51
TMs-8	148	21	133	6,4	13	8.0	<20	1,897	91	418	339	<10	67	26.3	1.62
TMs-9	256	47	80	5,0	13	5.1	23	1,400	160	612	415	<10	66	28.5	1.76
TMs-10	185	22	103	4,4	12	5.6	346	2,059	63	455	304	<10	68	26.7	1.54
TMs-11	186	32	97	4,5	13	4.2	51	1,538	98	479	313	<10	67	27.1	1.49
Tpot 1	293	1,805	139	3,1	20	6.9	239	1,834	69	475	625	<10	62	28.9	2.24
Tpot 2	260	149	113	<3	11	14	457	2,365	228	903	516	<10	66	26.8	2.51
Tpot 3	274	458	115	<3	13	13	602	3,325	86	376	537	<10	61	28.8	2.43
Tpot 4	246	139	112	12	11	11	493	2,570	205	932	547	16	67	26.8	2.19
Tpot 5	270	1,714	120	6,5	18	5.7	180	1,461	68	464	578	<10	63	29.1	2.49

interpreting results of objects made from alloys in general and brass here in particular; their trace elements and lead isotopic ratios derive from the copper and zinc sources (Bougarit and Thomas 2015; Merkel 2018). Furthermore, metallurgical processes such as smelting and diffusion also affect the chemical composition of objects (Pernicka 1999). These processes have become increasingly complex since the Renaissance period (Hauptmann *et al.* 2016: 183).

Until the mid- eighteenth century AD, brass was not produced using metallic zinc but by using calamine ores. Since metallic zinc was sparsely known in pre-industrial Europe, the process of brass manufacture depended largely on the presence of calamine ores. Calamine is a zinc-bearing rock dominantly build of minerals like Smithsonite $Zn[CO_3]$ (zinc carbonate) and Hemimorphite $Zn_4[(OH)_2|Si_2O_7]\cdot H_2O$ (zinc silicate). The process of melting copper with calamine to brass is called

Table 14.3. Lead isotope ratios for rods (Tms-1 to Tms-11) and containers (Tpot 1 to Tpot 5) as measured by MC-ICP-MS including standard deviations (2σ).

ID. No.	$^{206}Pb/^{204}Pb$	2σ	$^{207}Pb/^{204}Pb$	2σ	$^{208}Pb/^{204}Pb$	2σ	$^{207}Pb/^{206}Pb$	2σ	$^{208}Pb/^{206}Pb$	2σ	$^{204}Pb/^{206}Pb$
TMs-1	18.4926	0.0067	15.6280	0.0060	38.4493	0.0157	0.8451	0.0001	2.0792	0.0002	0.0541
TMs-2	18.3878	0.0070	15.6139	0.0067	38.3380	0.0068	0.8492	0.0010	2.0850	0.0018	0.0544
TMs-3	18.3861	0.0133	15.6128	0.0135	38.3367	0.0139	0.8492	0.0011	2.0850	0.0016	0.0544
TMs-4	18.3944	0.0076	15.6159	0.0082	38.3503	0.0088	0.8489	0.0012	2.0849	0.0018	0.0544
TMs-5	18.3866	0.0065	15.6134	0.0061	38.3373	0.0076	0.8492	0.0011	2.0851	0.0018	0.0544
TMs-6	18.3826	0.0063	15.6143	0.0060	38.3366	0.0063	0.8494	0.0010	2.0854	0.0015	0.0544
TMs-7	18.3870	0.0078	15.6130	0.0073	38.3382	0.0197	0.8491	0.0001	2.0848	0.0003	0.0544
TMs-8	18.4941	0.0096	15.6284	0.0079	38.4591	0.0201	0.8450	0.0001	2.0794	0.0002	0.0541
TMs-9	18.3855	0.0088	15.6155	0.0079	38.3413	0.0210	0.8493	0.0001	2.0853	0.0002	0.0544
TMs-10	18.3864	0.0084	15.6133	0.0073	38.3382	0.0183	0.8492	0.0001	2.0849	0.0002	0.0544
TMs-11	18.3877	0.0070	15.6147	0.0060	38.3401	0.0156	0.8492	0.0000	2.0851	0.0002	0.0544
Tpot 1	18.3900	0.0081	15.6136	0.0069	38.3446	0.0183	0.8490	0.0000	2.0850	0.0002	0.0544
Tpot 2	18.3938	0.0086	15.6168	0.0078	38.3560	0.0202	0.8490	0.0000	2.0853	0.0002	0.0544
Tpot 3	18.3875	0.0082	15.6152	0.0071	38.3431	0.0182	0.8492	0.0000	2.0852	0.0002	0.0544
Tpot 4	18.3879	0.0110	15.6165	0.0093	38.3498	0.0236	0.8493	0.0001	2.0857	0.0002	0.0544
Tpot 5	18.3929	0.0139	15.6163	0.0124	38.3490	0.0293	0.8491	0.0001	2.0852	0.0002	0.0544

the *cementation process*. While it was first thought the maximum content of zinc would lie around 28% using this process, several experiments by Werner (1970), Haedecke (1973), Doridot *et al.* (2006), and Craddock (2018) pointed out a higher maximum zinc content could be achieved of up to 30 to 33.3% using historical 'recipes', citing scholars from the eighteenth and nineteenth centuries. With the change of copper production by a coal-fuelled 'Welsh' smelting process in Britain (Evans 2015: 2–3) and the recognition of metallic zinc in the eighteenth century, higher zinc amounts and an even more homogeneous standard composition for brass could be produced.

Where were all the raw materials sourced? With the diversification of metallurgical processes starting in the fifteenth century around the time of discovery voyages and the large social, economic, scientific, political, and religious changes taking place within Europe, there was a coinciding spread of metals around the world, and an increase in their production. Major copper deposits in Europe are located at the Inntal Valley in Austria, Mansfeld in central Germany, and the Slovak Ore Mountains (specifically Banská Bystrica) (Hauptmann *et al.* 2016: 191–194). They are estimated to have produced some 500 tonnes of copper annually in the sixteenth century (Westermann 1986: 196–197). Archaeological half-fabricates made from Slovakian copper have been found in fifteenth- and sixteenth-century ships from Portugal and other nations wrecked off the coasts of Europe and Africa (Mirabal and Arnold n.d.; Maarleveld 1988; Alves 2011; Kluger 2015; Hauptmann *et al.* 2016; Możejko and Ossowski 2017; Skowronek *et al.* 2021; Vink and Skowronek in preparation). The objects are rectangular or circular plates or ingots known as 'Reißscheiben', and half balls also known as 'halbgossenkugeln'. In six of seven cargoes, some of the artefacts also bear the famous Central-European Fugger family 'trident' trademark.

By two centuries later in the seventeenth century, a major shift had taken place, and the majority of the total copper production now occurred at the volcanogenic copper deposits of Falun in Sweden (Figure 14.5). This location continued to produce more than 1000 tonnes annually until the end of the eighteenth century (Lindroth 1955). Additionally, Japanese copper flooded the market from the mid-seventeenth century onwards via the Dutch trade (Glamann 1958, 1977). All these copper deposits (see for smaller ones Hachenberg 1990; Hauptmann *et al.* 2016: 193–194) were considered as possible sources for the brass rods and cauldrons studied here.

Calamine deposits were located in Aachen/Stolberg and Goslar in Germany, Kelmis/La Calamine in Belgium (a

Figure 14.5. Current-day map showing the locations of pre-modern period major copper deposits and calamine sources. Figure by Vink (2023).

few km from Aachen-Stolberg), Upper Silesia in Poland and the Peak district, Mendip Hills and a few locations in Cornwall and Wales in the UK (for smaller deposits, see Hachenberg 1990) (Figure 14.5). Of these, the Rhine-Meuse area with La Calamine and Aachen-Stolberg deposits significantly produced the most brass (see below) and calamine, especially between the seventeenth and nineteenth centuries.

Brass production

In terms of production, much more (up to twice as much) calamine than copper was needed to create brass through the cementation method (Pohl 1977), with the aforementioned final zinc content ending up at around 30%. Many brass production locations were therefore located near the calamine sources (Hachenberg 1990). Interestingly, the brass workers in the Aachen-Stolberg region called themselves 'Kupfermeister', meaning 'masters of copper', since they were not yet acquainted with metallic zinc (Kellenbenz 1970).

The Rhine-Meuse area with the Kelmis/La Calamine/Altenberg and Aachen and Stolberg deposits flourished in terms of brass production, starting in the fifteenth century and possibly earlier (Brown 1673; Willers 1907; Rehren 1999; Gorecki 2000). The deposits at Kelmis had a massive secondary alteration zone where non-sulfidic zinc occurred in the form of calamines (Coppola *et al.* 2008). Approximately 2 million tonnes of calamine with significant low lead amounts were mined there during the nineteenth century, hinting at the size of this giant deposit (DeJonghe 1998). The Kelmis/Altenberg deposit contained lower lead amounts than the one at Aachen-Stolberg (Gussone 1964; Krahn 1988; Redecke 1992; DeJonghe 1998; Chatziliadou 2009). The former nonetheless remained important while Stolberg took over (Peltzer 1908), since both England (Morton 1985) and Sweden (Forsgren 2010) became large producers of brass in the eighteenth century, both sourcing their calamine from Kelmis.

Sweden's brass works at Nyköping, Norrköping and Skultuna together produced such high amounts of brass, the country could export more brass than raw copper in the mid-seventeenth century (Kumlien 1977). In England, British slavers began to exploit calamine deposits in the Peak District in Derbyshire. Later on, Bristol and Birmingham became major production centres for brass used in the slave trade, best expressed by manillas carrying the name 'Birmingham-Manillas' (Denk 2017). The Bristol brass industry of the eighteenth century relied on calamine mined at the Mendip Hills, and might have been built up with the help of *Kupfermeister* from Stolberg (Day 1984).

Smaller amounts of brass were also produced at copper mining centres such as Goslar (Krünitz 1802; Peltzer 1908) and near Baltic ports of Danzig and Lübeck, sourcing their calamine from non-sulfide deposits in Upper Silesia (Boni and Mondillo 2015).

Interpreting results: provenance of the rods and cauldrons

As said above, the interpretation of trace elemental values and lead isotopic ratios is challenging since they are influenced by ore sources and metal production techniques. An interesting metallurgical process may further complicate the picture. During the Renaissance and early new era, lead was intentionally added to Central European copper ores low in silver in order to separate silver from copper using the so-called *saigerprozess* (Suhling 1976; L'Heritier and Tereygéol 2010). In a case study, Hauptmann *et al.* (2016) have demonstrated 60 copper ingots deriving from the *Saigerprocess* have mean lead values above 1 wt-% and their extraordinarily homogenous lead isotopic ratios strongly overprint any lead isotope ratios of the copper ore, thus pointing definitively to the lead source.

In this study of brass rods and cauldrons, we argue against an interpretation of 'Saigercopper' and interpret the isotope signature as representative of the calamine source. This is due to the following two observations. Firstly, the rods and containers have trace elemental (As, Sb, Ni, Bi) values similar to both copper slab ingots of the later Mediaeval and early new era objects known as *Reißscheiben* originating from Sweden (Werson 2015) and Swedish copper ingots dating to the seventeenth century from a shipwreck in the German River Elbe (Althoff 1999; Rehren 1999). While arsenic and antimony strongly correlate with the trend expressed by Swedish copper ingots (Figure 14.6), nickel contents appear elevated (Figure 14.7). However, we must also take into consideration lead-zinc deposits can contain some few hundred ppm of nickel, as is found, for example, at the Diepenlinchen deposit at Stolberg (Chatzialidou 2009). Correlation between nickel and zinc amounts has been observed in plants growing on calamine grounds (Richau and Schat 2009). We therefore argue the elevated nickel amounts are derived from the calamine ore.

Swedish ingots are low in lead (with mean lead values under 0.5 wt-%) (Figure 14.8), as the *saigerprozess* was not commonly used in Sweden (Irsigler 1979). As shown in Figure 14.9, the objects studied here have no similarities with the copper ingots found on the sixteenth-century shipwreck of the *Bom Jesus* in Namibia which Hauptmann *et al.* (2016) provenanced to Banská Bystrica in Slovakia. Copper produced at Mansfeld is of different composition too, being higher in arsenic and nickel and extremely low in bismuth (Skowronek *et al.* 2021). The different trace elements rather seem to point to Falun, Sweden as the source of the copper. Falun copper was traded throughout Europe, and brass fabricators in the Aachen-Stolberg area specifically bought Swedish copper from the seventeenth century onwards when the Mansfeld copper production declined (Malynes 1629; Peltzer 1908).

Secondly, if we assume Swedish copper was used, the high lead content as observed in the lead isotope ratios of the brass rods and containers probably derives from

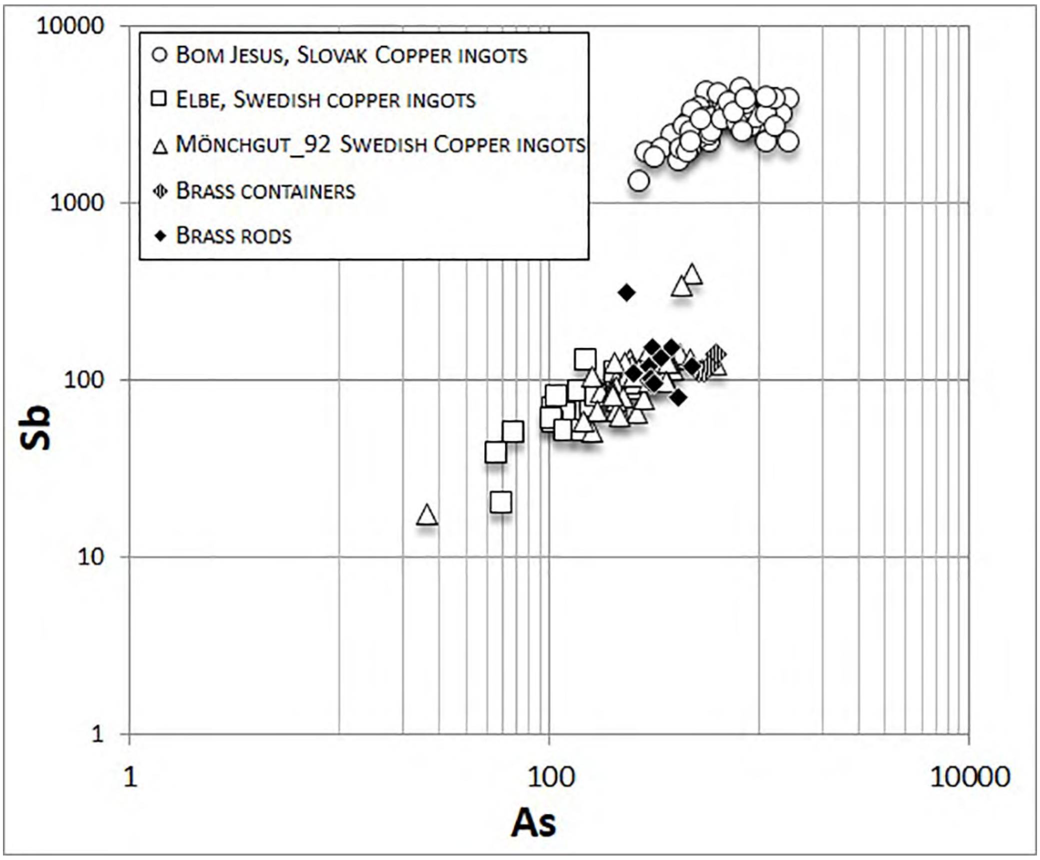

Figure 14.6. Arsenic/antimony plot for Terschelling brass rods and containers in comparison to Slovak copper ingots found on the sixteenth-century shipwreck *Bom Jesus*, Namibia (Hauptmann *et al*. 2016), and Swedish copper ingots found on a shipwreck in the Baltic sea (Mönchgut_92) (Werson 2015) and in the German river Elbe (unpublished). A strong correlation of As and Sb is apparent, as is an overlap with Swedish copper ingots. Figure by Skowronek (2023).

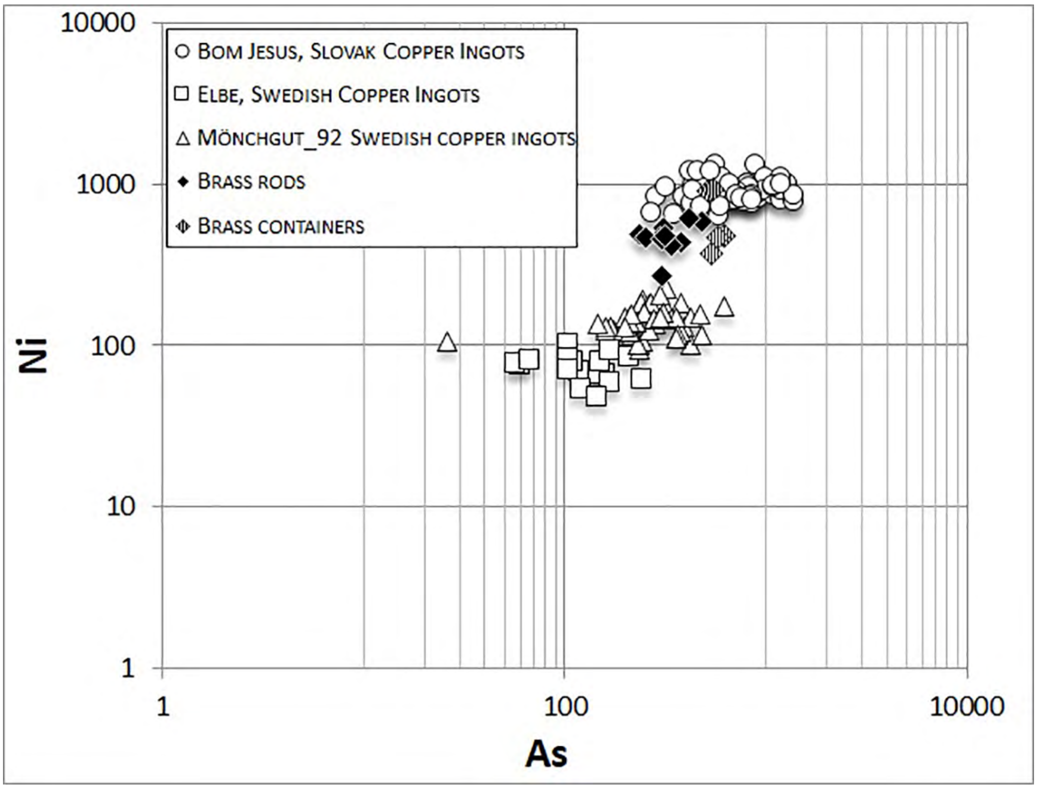

Figure 14.7. Arsenic/nickel plot. Nickel values of rods and containers are some few hundred ppm higher than in Swedish copper ingots, with mean values below the Slovak copper. We interpret this nickel deviation as influenced by the calamine ore used for the brass. Figure by Skowronek (2023).

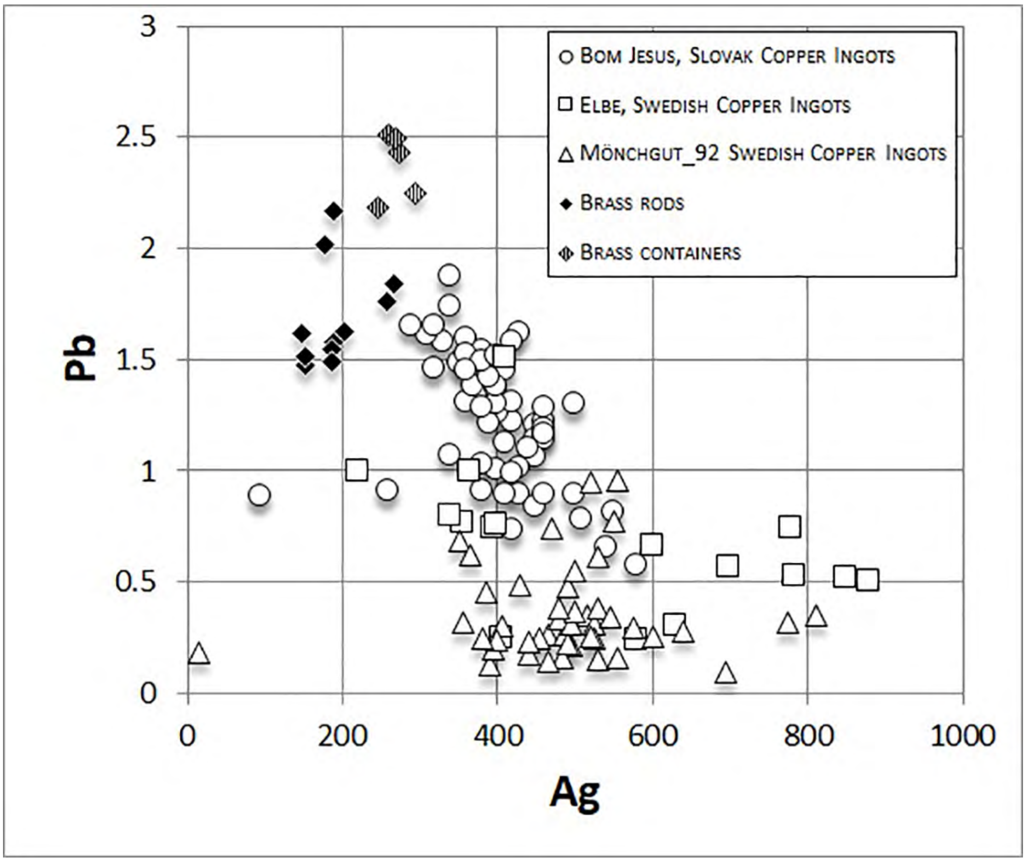

Figure 14.8. Silver/lead plot. Swedish copper ingots are generally low in lead as the *saigerprozess* was not commonly used on low-silver copper ores occurring at Falun. The Terschelling brass rods and containers have high lead amounts, which can be explained by the calamine source. Figure by Skowronek (2023).

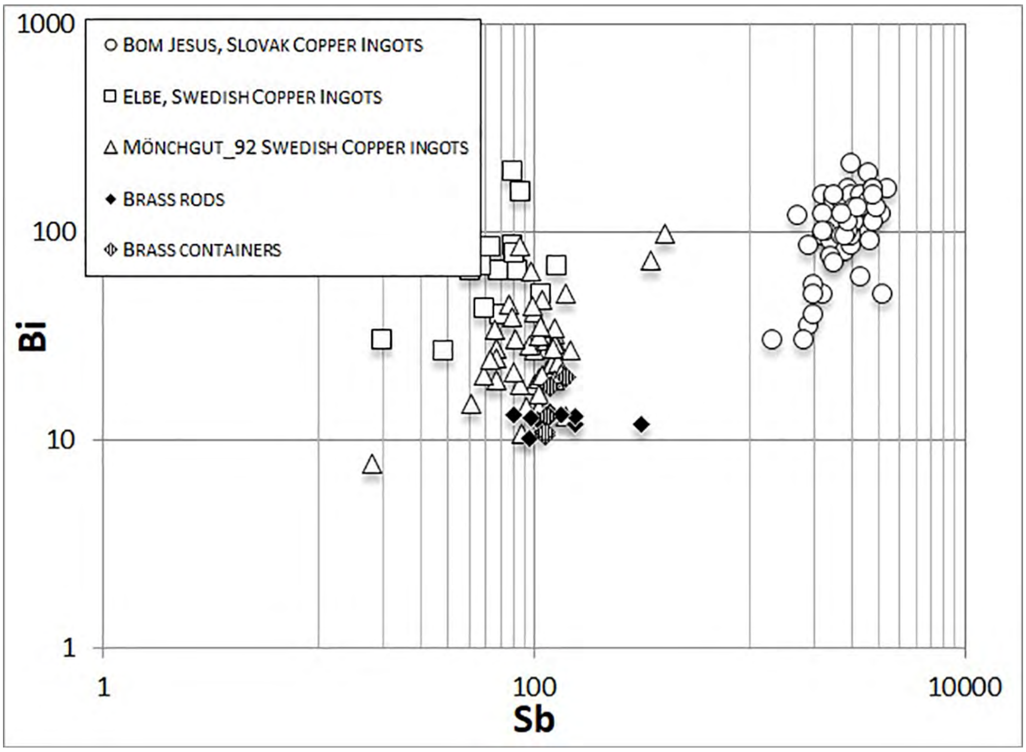

Figure 14.9. Antimony/bismuth plot. Low bismuth values have been detected in the brass studied here, as compared to the Swedish copper slabs. Figure by Skowronek (2023).

the calamine source. When the lead isotope ratios of the objects are compared to those published for European calamine ores, a striking similarity with calamine from the Aachen-Stolberg area is evident (Figures 14.10 and 14.11). The two outliers might indicate re-melting of scrap pieces of household brass, as von Pöllnitz (1998; Morton 2019) noted when visiting Stolberg in 1737.

Discussion: ingots as commodities

As pointed out, Swedish copper and Rhenish calamine were traded as raw materials all over Europe. Based on the materiality of the rods and cauldrons alone, it is difficult to determine the location of the brass works where these ingots and finished objects would have been made. It is even more difficult to say what products the rods would be made into, or where the ingots and cauldrons were on their way to. Having established a link between some artefact categories in the assemblage and the Transatlantic slave trade, and having determined the ore sources of the brass objects, we have the opportunity to consult specific archival sources. Moreover, the lead seals attached to the bundles of rods might reveal additional historical information.

The brass rods studied here are not the only archaeological artefacts published. A few case studies of chemical analyses of older archaeological specimens are known. They date from roughly the Viking age to the early Mediaeval period, and they are sourced to different ore locations (see Monod 1969; Darmoul 1985; Sindbaek 2003; Baylet *et al.* 2014; Merkel 2018). They also have different dimensions and cross-sections than the ones studied here. The publication by Monod (1969) is particularly interesting, as it discusses a supposed camel caravan disaster site from the twelfth century AD at Ma'aden Ijafen in the Saharan desert of Mauritania. Triangular rods of approximately 70 cm long are discussed as a commodity in the metal trade which took place for an extended period of time across the sub-Sahara. Prior to the Portuguese, metals in general had already reached West Africa via Venice, which traded metals with Alexandria and Mallorca, amongst others (Braunstein 1977; Denzel 2004; Elbl 2007). At this early point in time onwards, rods were supposedly already the most sought-after metal half-fabricate in the sub-Saharan trade (Elbl 2007). The brass rods at Ma'aden Ijafen have a lead isotopic ratio characteristic of the Harz mountains (Willet and Sayre 2006; Bayley *et al.* 2014), most likely deriving from Goslar, central Germany. These accounts indicate early long-distance trade of brass made from European deposits, which is in accordance with written sources (Braunstein 1977; Bingener 1998).

Around the mid-fifteenth century, the Portuguese discovered the main commodities traded by trans-Saharan Berbers were copper and brass for gold and slaves (Klein 1999; Evans 2015: 2; Morton; 2019). They established their first fort in sub-Saharan Africa, *São Jorge da Mina*,

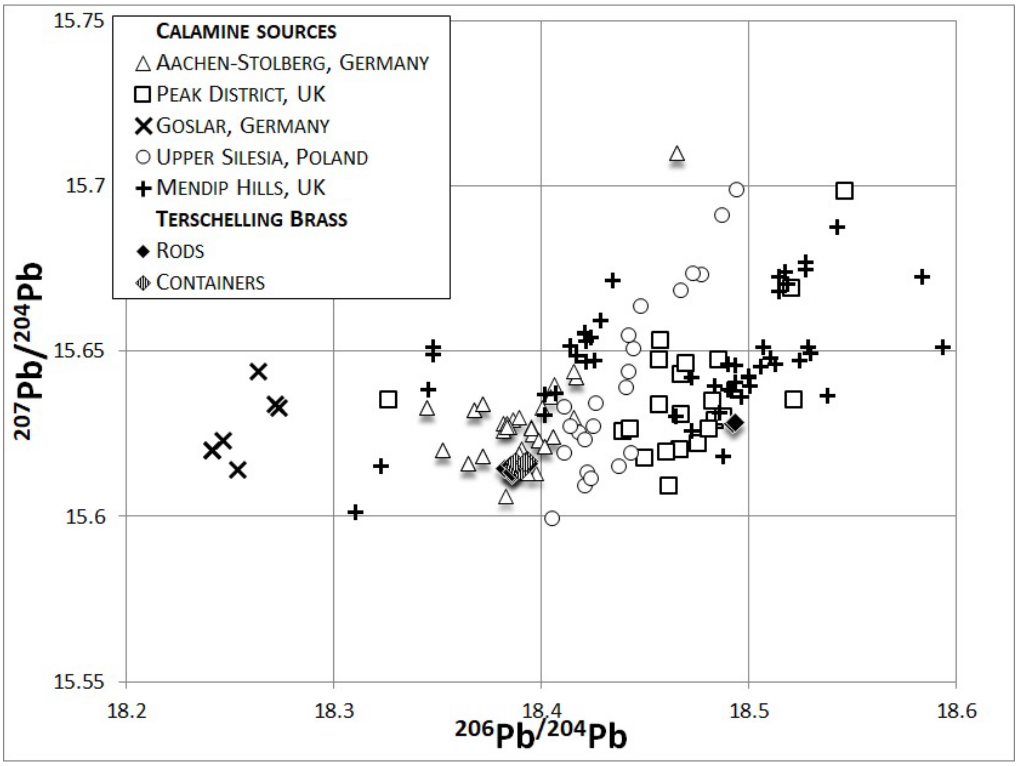

Figure 14.10. Lead isotope ratios for the studied brass rods and containers as compared to European calamine sources used for brass making in the pre-modern era. The homogeneity of the analysed samples suggests a single source, the Aachen-Stolberg region. However, note the two outliers. Data sources: Aachen-Stolberg: Cauet 1983; Bielicki and Tischendorf 1991; Krahn and Baumann 1996; Durali-Müller 2005; Bode 2008. Peak District/Mendips: Rohl 1996. Goslar: Lévèque and Haack 1993. Upper Silesia: Zartman 1979; Clayton *et al.* 2002. Figure by Skowronek (2023).

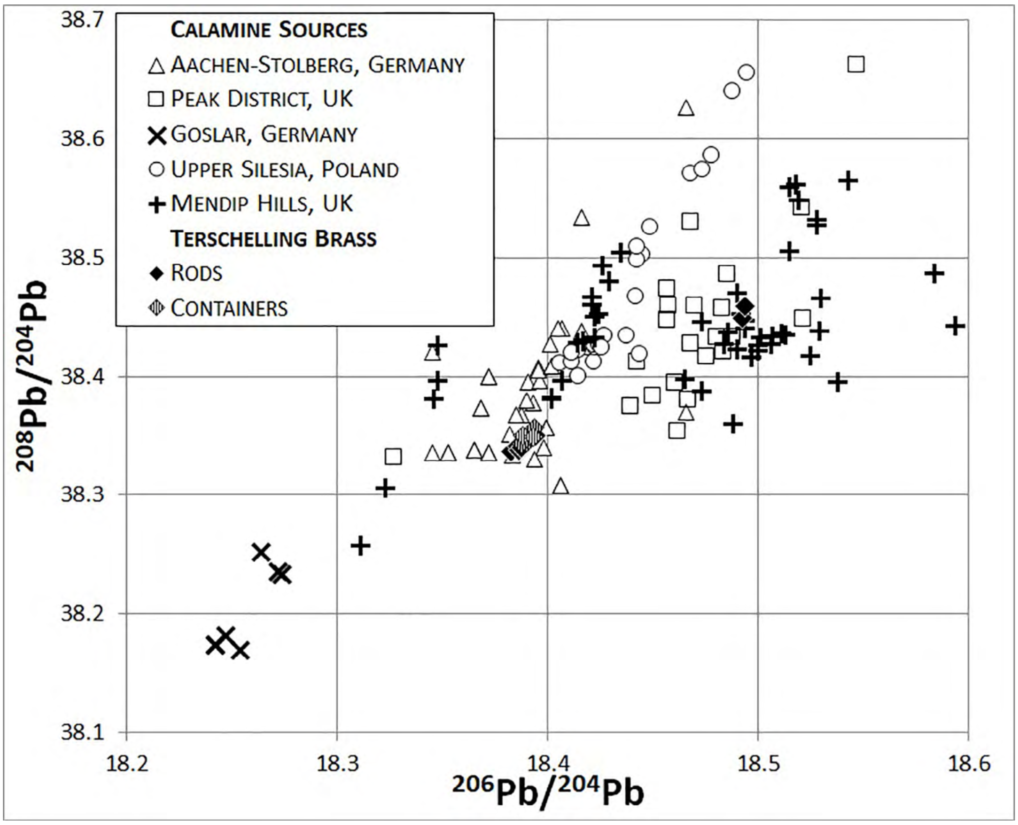

Figure 14.11. Lead isotope ratios. See Figure 9 for comments and data sources. Figure by Skowronek (2023).

in 1482, and soon after the quantities of brass shipped to Africa reached new dimensions (Teixeira da Mota 1969). With the discovery of the New World, the demand for enslaved Africans as a work force rose exorbitantly, and the Transatlantic slave trade was established. Amongst other commodities, brass and copper would remain important trade objects. Rods and their fabrication techniques started to appear on lists of commodities and other historical sources.

As discussed above, a shift took place in the locations where copper was mined during the centuries following the first Portuguese voyages to the east. At first, the majority of copper was sourced from Central Europe, but by the seventeenth century, Falun had become the primary mine for copper. Interestingly, the brass producers in the Aachen-Stolberg region were aware of the qualities of copper from the different regions, and from written sources, we know they actually preferred Mansfeld copper due to its purity (Westermann 1971).

In a few Dutch records of the later seventeenth century, the rods and their dimensions are listed, and it becomes clear the rods themselves were exchanged for enslaved Africans (Ratelband 1953; Alpern 1995). The listed rods were also circular in cross-section, and they are described as being available in several sizes and lengths: in 1668, Dapper mentions a type of rod with a weight of 1.3 lbs (604 g) and length of 34 inches (86 cm) for the first half of the seventeenth century. Ratelband (1953) mentions two types for the later seventeenth century: one about 40 inches (102 cm) length and 1 lbs (453 g) in weight, and the other of the same length but weighing around 1.6 lbs (755 g). The first sort described by Ratelband is therefore somewhat in accordance with the measured dimensions of the rods studied here (see Table 14.1). Furthermore, information on the amount of rods paid for enslaved people is even available. Davies (1957) points out that by 1678, a female slave cost 30 rods and a male slave 36 rods, with some fluctuations in these costs over the years. While an unambiguous date for the Terschelling wreck and its artefact assemblage may never be known, it is shocking to remember the bundles studied here contained around 30 rods each, with implications for the number of people who would be purchased for slavery.

In addition to brass and copper ingots, brass reached Africa also in the form of copper (alloy) 'manillas', a type of bracelet or arm rings in various shapes, sometimes looking like twisted rods (Dapper 1668). Names for the rods for the African trade are 'Guinea rods', 'coppers', or even 'negroes' (Morton 1985; Herbert 1984; Alpern 1995; Berg and Berg 2001; Evans 2015; Denk 2017). Spiral money forms like the so-called 'nt-chang' of Cameroon (Denk 1983) might also very well have been made from rods. This aligns well with the description of rods by the Swedish traveller Angerstein (Berg and Berg 2001), who visited brass works in England and pointed out the importance of the rods' ductility when they were prepared specifically for the trade on the 'Guinea Coast'. This observation fits well with other historical observations that manillas were specifically made in conformance with certain requirements demanded by the African market (Curtin 1975; Herbert 1984; Alpern 1995; DeCorse 2021; Skowronek *et al.* 2023).

It is, as Herbert (1984) put it, hard to visualise the millions of rods and manillas which had reached the African continent by the time the slave trade ended. A recent effort by Skowronek *et al.* (2023) discusses the identification of the metallic sources of the so-called 'Benin bronzes', brass and bronze manillas retrieved from a number of shipwrecks and terrestrial sites dating from the sixteenth to the nineteenth centuries. From a large number of samples, a complex picture emerges of pre-modern experimentation with chemical compositions, preferred chemical compositions for certain types, and uses of finished products; a wide range of metallic sources; and mixing of ores from different sources but also the mixing (re-smelting) of objects.

Discussion: the lead seals

Proceeding with the substantiated assumption the rods were made from calamine sourced from Stolberg, it is fortunate to have historical sources of the *Kupfermeister* families available to consult. In the seventeenth and eighteenth centuries, around 40 families were active in brass works at Stolberg. Assuming the brass was produced there and the monograms were related to family names, we find only two families starting with '*P'* were active, and none with '*T'* (see Figures 14.3F and 14.4), namely, the Prym and Peltzer families (Day 1984: 51). Continuing this line of enquiry, no first names starting with '*T*' are found in the Prym family, while there were several '*Theodor*s' in the Peltzer family, all active as *kupfermeister*. Coincidentally, the Peltzer family weapon includes three trees (Macco 1901). While this evidence is not compelling, it is interesting to look at the individual Theodors. One born in 1644 (who was also a mayor of Stolberg) bought a brass mill called 'Die Weide' ('the willow') in 1723 from the Lynen family. He died in 1738, and Die Weide passed to his son Heinrich (Macco 1901, 1907). Heinrich had the monograms *TP* and *MP*, belonging to his parents, incised into the stones over the entrance to the building. In 1738, another Theodor Peltzer was born, and he was also an owner of Die Weide (Schleicher 1965). The building remained in possession of the Peltzer family until 1805. It was damaged in the Second World War, but the stones with initials were recovered and reused in the new building, which still stands today (Day 1984: 48). It remains debatable whether the tree depicted on the seals studied here show a willow with a thick stem and branches sprouting from the top; nonetheless, the privy seal might be tentatively interpreted as belonging to an eighteenth-century member of the Peltzer family.

Besides the possible German production of brass, we must also take the extensive copper and brass works of England and Sweden into account, and remember, we also have two outliers (Figures 14.9 and 14.10). These outliers point to a younger mineralization than a Rhenish source. Ingots made from English lead ingots cluster near these outliers. Calamine was imported via the Dutch Republic from the Aachen-Stolberg area to England and Sweden, and copper was imported from Sweden to England as well. In England, investors in slaving often had shares in copper and brass works (Evans 2015: 3). Of these, Thomas Patten is a well-known 'TP'. He established a copper and brass company at Bank Quay, Warrington near the Peak district (Morton 1985).

Conclusions

In this paper we have pointed out the explanatory power of a combined archaeological, historical and scientific approach towards the recently established interest in metal trade during the period of the Transatlantic slave trade (sixteenth to nineteenth centuries AD). The amounts of metals shipped from Africa to Europe are often largely underestimated, and would likely have ranged up to several hundreds of millions of tonnes. Their fabrication as exchange currencies also remains poorly studied, especially from a material science point of view.

We have used this case study of brass rods found on a shipwreck on the North Sea coast of the Dutch island of Terschelling to explore the composition and provenance of one of the exchange currencies used in the slave trade. We want to highlight our observation of continuity in trading brass rods with Africa since the early Mediaeval period, as well as their mass production during the era of the Transatlantic slave trade.

The rods studied here have trace element values similar to Swedish copper ingots found on two shipwrecks dating to the post-Mediaeval era and highly homogenous lead isotopic ratios consistent with calamine ores from Aachen-Stolberg, and two from England. Besides the ingots being rare examples of metal ingot commodities used in the slave trade, they are also surprisingly rare examples of ingots or objects consisting (partly) of Swedish copper (Skowronek 2021 and Skowronek *et al.* 2023). Due to the advanced state of globalism by the eighteenth century, it is difficult to investigate who exactly made the rods. This may be solved by finding parallels to the seal marks described here.

For now, we suppose a manufacture origin in Stolberg, Sweden or possibly England. When this location is compared to where the shipwreck was found, the situation is puzzling. The port (or ports) of embarkation for the objects remains unknown. Based on logic alone, a British or southern Dutch port of departure makes less sense than, for example, a Swedish port of departure for a ship ending up on the Terschelling shore. And quite possibly, Africa was not the first destination of the entire voyage, as different commodities were generally loaded at several ports. Further complicating the picture is the slave trade's involvement of many European powers (Portugal, Spain, France, Britain, The Netherlands, Denmark, and Sweden), national trading organisations and foreign investors in European states. While in recent years, major efforts have been made in digitising archives such as the Sound Toll register, a lot of work still remains undone. 'Brass' (or described as copper) rods are not explicitly mentioned in the lists of commodities amongst the approximately two dozen copper and brass notations and ware specifications in several languages. In comparison, copper 'kettles' are already mentioned as early as the sixteenth century, and zinc ores are even mentioned in nineteenth-century voyages.

Moreover, more attention should be focussed on the first leg of the trade between Europe and Africa. Admittedly, the focus has quite logically and humanely always stressed the Transatlantic or 'Middle Passage' and Intra-American slave voyages. The use of archaeometallurgical methods and cross-referencing of those results to archival sources of—amongst others—ship's cargo listings creates a strong potential to learn more about networks of transport and hubs and spokes. Such sources may paint a picture of a larger maritime landscape with overseas and inland waters connecting to hinterlands which we would not at first characterise as 'maritime'. Along the way, we might gain a better understanding of the people who made and used metal objects and the social and economic contexts in which they lived and operated. As is tentatively demonstrated in this case study, it is sometimes even possible to zoom out from an unidentified ship and its wreck site to a large chrono-spatial scale, and to zoom in to a certain network or even a specific individual.

More efforts should also be made to look into the use of metal commodities and brass rods, particularly in Africa, as those are sparsely described in the literature. From an archaeological point of view, we have simply not found enough data to work with and compare, which might suggest other processes such as re-smelting were at play. But we need more than a couple of ingots. In future research, we will also need to focus on the different types of manillas, as they were a common currency in Africa. Together with the work carried out here and in the recent contributions by Rademakers *et al.* (2018, 2019), we might gain a better understanding of both the nature of the European metals traded and their impact on African cultures and peoples.

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15

Forgotten Wrecks of the First World War: examining the significance of merchant ship sites

Julie Satchell

Abstract: The large numbers of merchant vessels lost off the south coast of England during the First World War were investigated during a major study undertaken during the centenary of the war. This study analysed archaeological and historical data to understand how the collection contributes to the understanding of themes related to warfare, ship technology, international trade and personal experiences. Recognising that none of these merchant vessels are protected by heritage legislation, case study examples were used to test the application of the criteria for ascribing significance within the available protection mechanisms.

Detailed review of two average sized cargo vessels, *Eleanor* and *Camberwell*, and two larger passenger-cargo liners, *Medina* and *Alaunia*, considered their individual stories to reveal a range of rare, unique and highly significant attributes. The process revealed how current approaches to significance assessment struggle to capture elements related to late nineteenth- and early twentieth-century shipwrecks, particularly their international significance and their commemorative importance.

Introduction

During the First World War, the global transport and supply network which fed, fuelled and sustained civilian and military populations was key to supporting both Britain and the Central Powers. As a result, the most intense naval warfare took place in the English Channel, in the Western Approaches of the Atlantic and in the North Sea. A high proportion of ships lost in the area were merchant vessels (Friel 2003: 237; for further detail, see MacNeile Dixon 1917; Hurd 1921–1929; HMSO 1976).

This chapter explores the application of current UK approaches to the assessment of significance to First World War cargo wrecks and the effectiveness of this methodology to reflect fully the historical and social context of the ships. It utilises the results of the Forgotten Wrecks of the First World War project, which investigated a collection of over 1,000 wrecks off the south coast of England and demonstrated the diversity of ships and shipping and the magnitude of the conflict. Within the dense and complex dataset, there are many merchant ship losses which have historically been grouped together as 'cargo vessels'. This somewhat reductive term masks the potential for these modern wrecks to add to the understanding of social, economic and political themes at a range of scales, from the perspective of individual vessels to the group value for informing on warfare tactics and outcome, as well as the movement of goods and people transnationally during conflict.

The ascribing of significance is examined through four case studies: the *Eleanor*, which carried a unique wartime cargo and held personal connections for commemoration; the *Camberwell*, which carried a cargo destined for British interests in India; the *Medina*, which carried a colonial Governor's possessions and has been subject to modern salvage interests; and the *Alaunia*, which had an unusual engine type and had been involved with troop transport for Gallipoli and from Canada. They represent the merchant fleet which kept Britain running at a time when it was part of a global empire.

Each case study wreck provides a unique expression at a micro-level, with their physical remains providing perspectives different from the historical record. Research demonstrates how a more holistic approach to their interpretation can illustrate themes within the late nineteenth and early twentieth centuries, allowing them to be placed within their full historical context of the evolving systems of colonialism and capitalism, as well as reflecting developing ship technology. They also demonstrate issues related to heritage management of modern ships in UK waters; many historic wrecks are currently unprotected and vulnerable. The protective legislation which could be applied to these wrecks and the associated criteria for assessing significance are explored, highlighting areas within this system where modern ships are not well served.

First World War wrecks off the south coast of England

Between 2014 and 2018, a major study of First World War wrecks off the south coast of England was undertaken (Forgotten Wrecks of the First World War 2023). It coincided with the centenary of the war and aimed to raise the profile of the maritime archaeological resource. Despite hundreds of centenary projects being delivered, very few concentrated on maritime aspects of the war. The Forgotten Wrecks project did not focus on the major naval battles of the war at sea, but instead considered everyday maritime activity from close to the shore to out in the English Channel.

Project delivery included engaging volunteers, working within a framework managed by Maritime Archaeology Trust staff, and the research and investigation of sites and artefact collections. The resulting information built an understanding of individual wreck sites and the wider south coast resource. The dataset of over 1,000 wrecks included ocean liners, merchant vessels, fishing trawlers, submarines, troop and hospital ships, naval and commercial ships. Each of these sites is not just a 'dot on a map', but each has its own fascinating story of activity and diversity.

The dataset is publicly available through an online viewer through which it is possible to interrogate the wreck collection (Forgotten Wrecks of the First World War Interactive Map 2023). Accessible information includes vessel statistics on construction, ownership, use and build, archaeological site reports, geophysical survey images, videos and 3D models. Options for filtering the data by factors such as ship type, nationality, year of loss and associated archive support a range of potential research questions on a wide variety of themes and data attributes.

The project outputs provided the first opportunity for the collective analysis of First World War wrecks in the study area. Analysis of losses by year (Figure 15.1a) reveals the very large numbers lost in 1917, resulting from the campaign of unrestricted submarine warfare and its devastating impact on shipping losses (Couper 2000: 110; Friel 2003: 238; Greenway 2009: 43). The nationalities of the ships are shown in Figure 15.1b; 67% of the losses are British, which would be expected, considering the location of the study, the size of the British shipping fleet and the density of the traffic in the area. The next most numerous of losses by country are Norwegian, at 10% of the collection; this reflects Norway's large merchant fleet which was active during the war, with almost half of their fleet being lost during the war years. Although officially neutral, their ships were targeted by submarines due to continued trade with Britain. Norwegian ships were allowed to join British convoys, and a number of Scandinavian countries lent ships to Britain in return for coal and food, and these vessels were under the control of the British Shipping Controller (Cant 2013: 85). From 1917, there were increasing numbers of Norwegian ships on the coal route from Wales to Normandy (Koren 2021: 545–560). Although this was less exposed than the North Sea, a significant number of vessels were lost. A similar percentage of ships are of French and German nationality, with the remaining 10% falling within the category of 'Other', including American (11), Australian (1), Belgian (13), Canadian (4), Danish (13), Dutch (14), Greek (5), Irish (6), Italian (14), Spanish (9), Swedish (6), Uruguayan (1), Portuguese (3), Russian (2) and Brazilian (1), with some whose national affiliation is unknown. Although the vessels were owned by a particular nation, those onboard the ships were often from diverse global locations (Parham and Maddocks 2013: 199). Crews often included sailors and mariners from a number of countries; for example, the British merchant marine navy was recorded as having 30% 'foreign' crews (Hughes 2018).

Review of vessel type, shown in Figure 15.1c, reveals a large number of steamships (57%). Twenty-three percent of the collection are sailing vessels, demonstrating there were still a significant number of sail-powered vessels being used for a range of purposes during this period. They varied in size from smaller fishing vessels to large metal-hulled sailing ships. The military vessels represented include warships, submarines, torpedo boats and destroyers, which reflect the naval aspects of the war at sea, while other interesting examples include paddle steamers and sail-steamers.

The vessels were being used for a broad range of functions at their time of loss (Figure 15.1d). Nine percent were fishing vessels, many lost while working to maintain food supplies (Robinson 2019). Four percent were minesweepers, casualties of what was a highly hazardous task during the war (Historic England 2016). Eight percent were in use for general military purposes, with a wide range of additional military functions represented under the category of 'other', which includes ships classed as passenger, pleasure cruiser, troopship, hospital ship, Q ship, tender, minelayer, patrol vessel, auxiliary patrol, blockship, anti-submarine net vessels, seaplane carrier and net layers. Sixty-six percent of the collection are categorised as 'commercial', showing the huge losses within the merchant vessel fleet; this group of cargo vessel losses provides the broad context for the four case study ships being examined in relation to significance.

Merchant ship losses

In 1914, 60% of the food consumed in Britain arrived by sea (Friel 2003: 236). The merchant fleet kept the country running, with everything necessary for the war—from troops and munitions to materials and intelligence—being moved by sea. Britain was not an island nation going to war, but a global empire which was truly maritime (Parham and Maddocks 2013: 199). Although some larger cargo vessels were armed, many, particularly the smaller vessels, relied upon convoys, vigilance and avoidance techniques (Preston 2000: 54). The merchant mariner communities continued to work through the war, risking their lives. However, the number of merchant ships lost indicate the hazardous nature of this occupation.

Examining the distribution and characteristics of the merchant ship losses (Figure 15.2) exhibits relatively similar distribution of steamship losses and sailing ship losses, with a small number of steam-sail vessels. Clusters

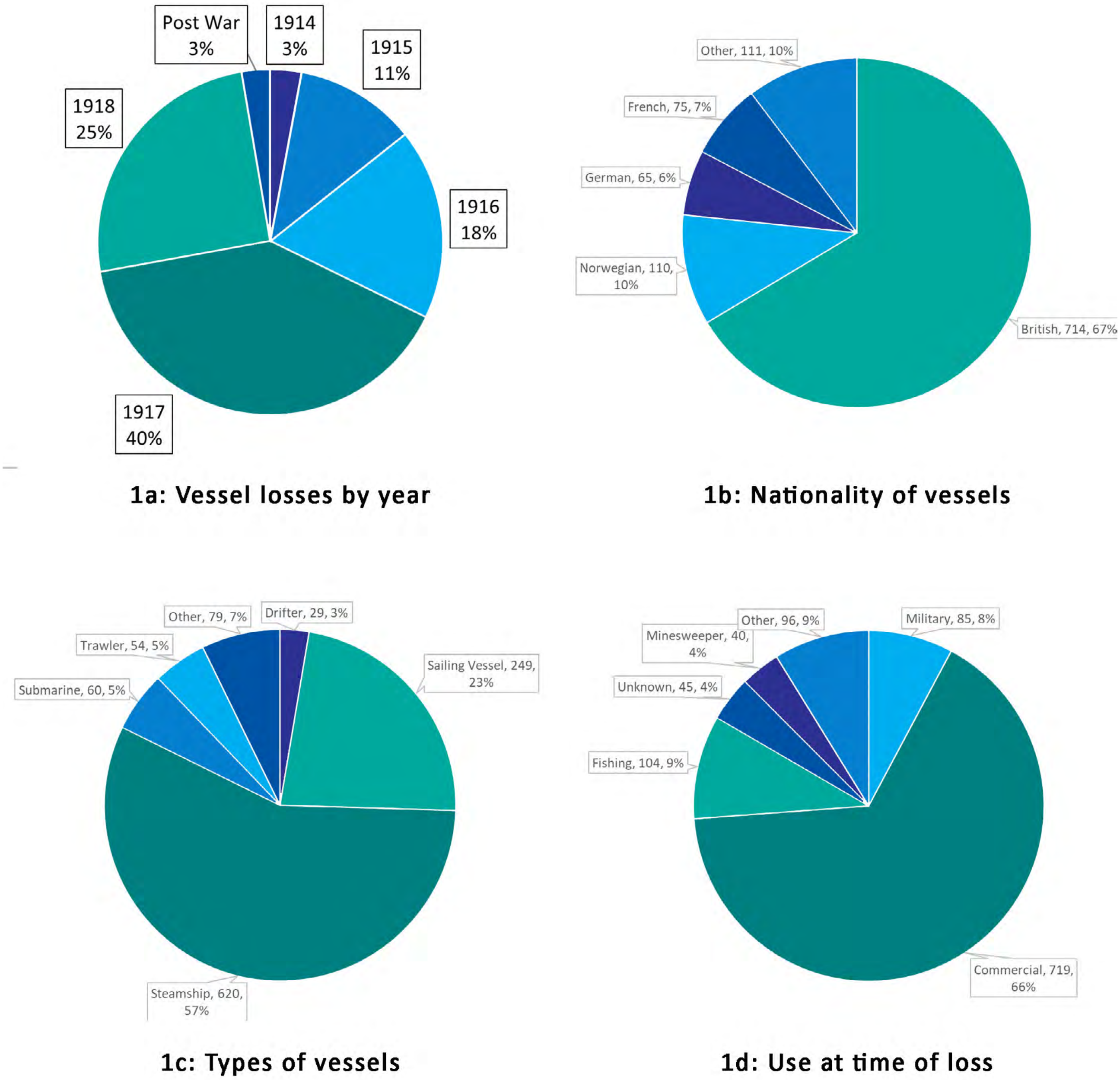

Figure 15.1. Statistics on vessel losses within the Forgotten Wrecks of the First World War project area: (a) vessel losses by year; (b) nationality of vessels; (c) types of vessels; (d) use at time of loss. Maritime Archaeology Trust.

within this data are evident at the main headlands of the southwest coast of England, where there are concentrations of losses around the initial landmass which ships first encounter when heading to the English Channel. Filtering these data for the cause of loss displays concentrations of vessels mined in and around the Dover Straits and a less dense cluster to the east of the Isle of Wight. Many vessels were torpedoed, and these have a wide distribution across the area, with some concentrations off the main peninsulas of the southwest. There is a relatively even distribution of ships which were scuttled within the area ranging from off the county of East Sussex, moving west through the study area. The distribution patterns reveal the impact of a range of warfare tactics; losses in areas which were mined differ from those in areas where submarines were actively hunting shipping.

Examining the collection for steam-powered merchant ship losses reveals that, in terms of nationality, they tend to mirror the collection as a whole, with British ships making up 63% of the total, with an even higher proportion of Norwegian vessels at 18%. The tonnage of the ships as shown in Figure 15.3a demonstrates the highest numbers are between 1,000 and 1,500 tonnes, with numbers of vessels of greater tonnage decreasing as the ship size increases. Most vessels in the collection are under 4,500 tonnes. A review of the decade in which ships were launched, Figure 15.3b, reveals examples of earlier steam

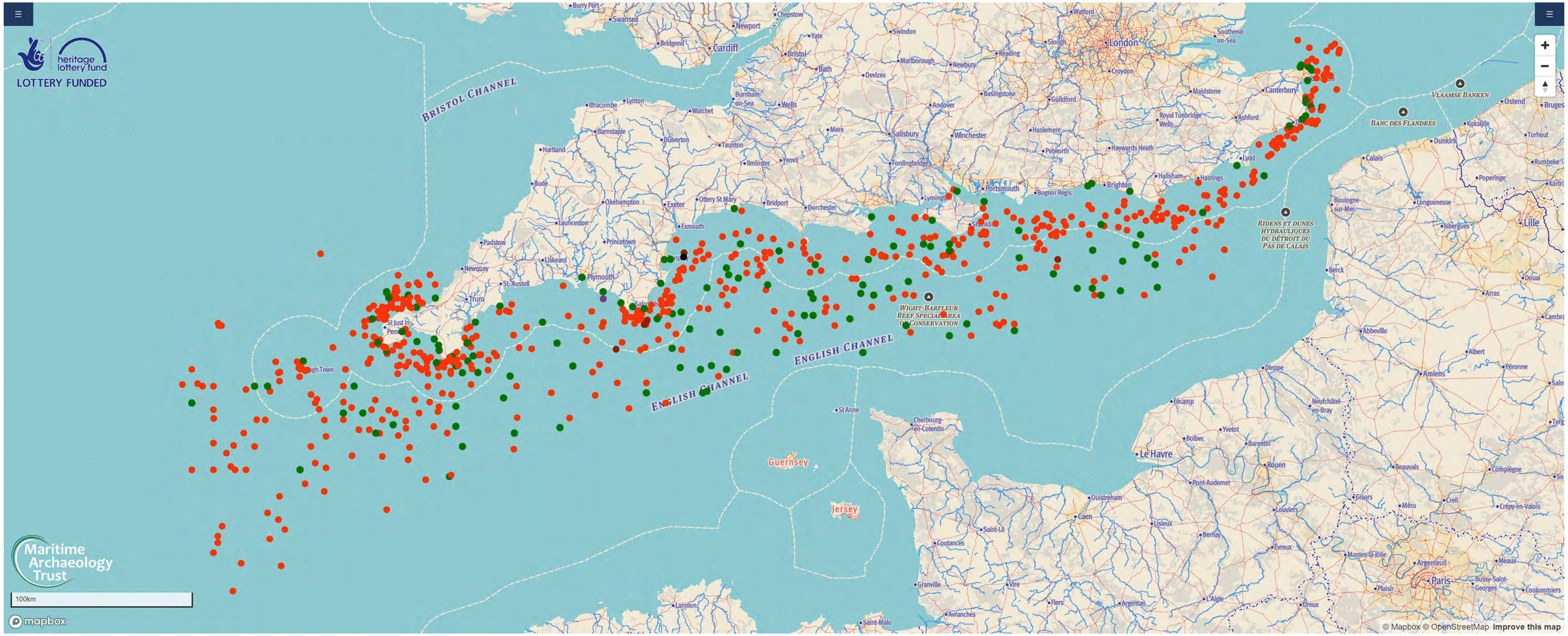

Figure 15.2. Distribution of merchant ship losses within the Forgotten Wrecks of the First World War project area. Steamships are represented by red dots, sailing ships by green dots and sail-steamers by brown dots. Maritime Archaeology Trust.

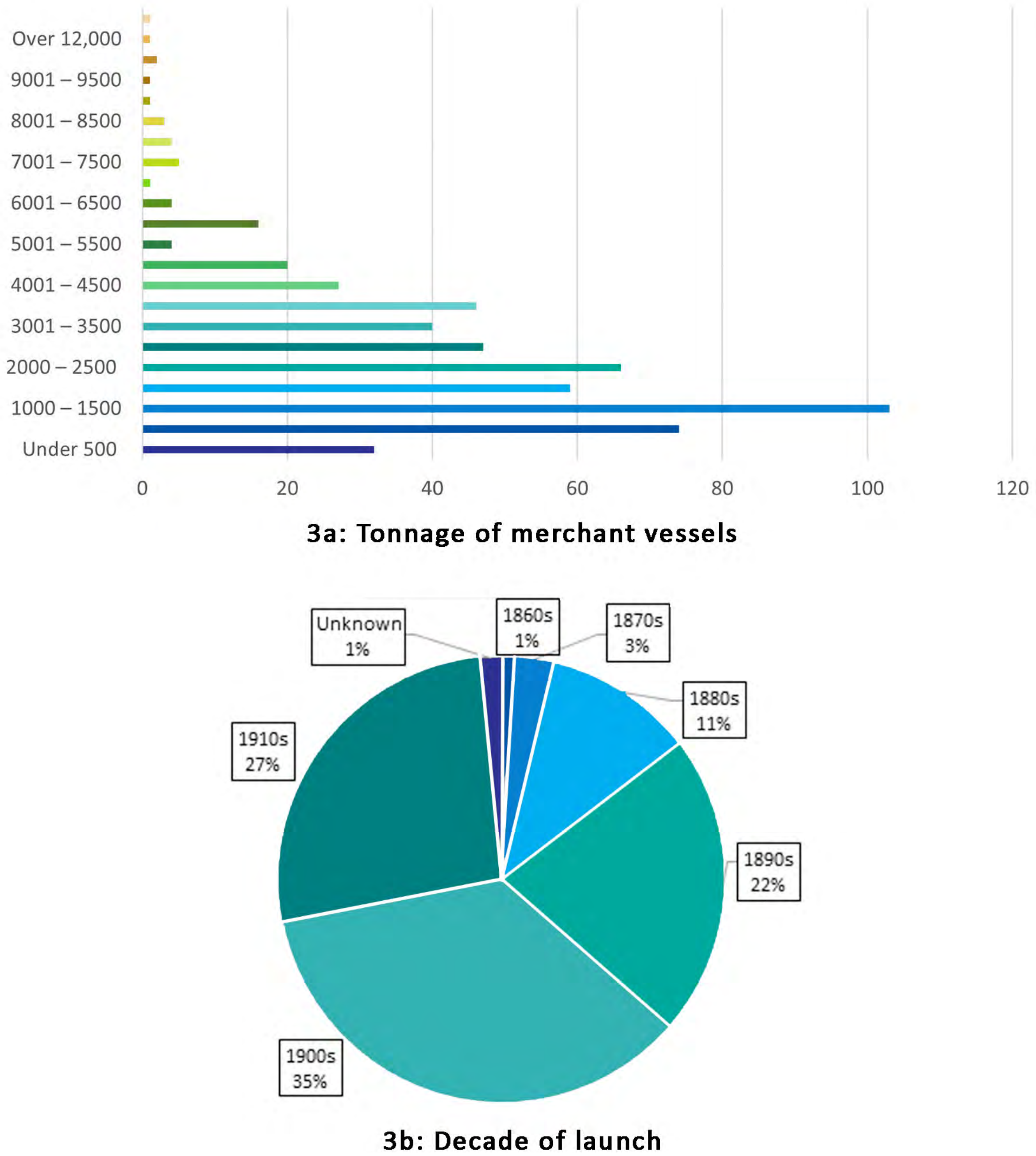

Figure 15.3. Statistics related to merchant ship losses within the Forgotten Wrecks of the First World War project area: (a) tonnage; (b) decade of launch. Maritime Archaeology Trust.

ships constructed in the 1860s and 1870s, with the largest percentage launched between 1900 and 1909.

The cargoes being carried exhibit large variety, and there is further research potential for analysis of these goods, the ports of embarkation and intended destinations. The coal trade is well represented with significant numbers of colliers lost either with their cargo of export or returning to coal ports in ballast. During the First World War, ships were still the most efficient way to transport coal, and the war drove demand, increasing exports from the UK, especially to French ports, to maintain operations. The dataset from the south coast of England supports Cant's (2013: 85) statement that 'Taken as a whole, colliers can be seen to be a substantial discernible group in the landscape of war'.

Within the very large class of vessels described as 'merchant steam ships', there are many further avenues for research, including consideration of the differing types, classes and sizes of ships, place of build and biography of use. While assessment of the collection as a whole provides statistics supporting group considerations and patterning which contribute to understanding of wider historical narratives, such large group categorisations can be reductive, making it difficult to recognise difference and nuance within the dataset. This can mask the significance of individual ships, each of which has its own important story capable of illustrating a range of themes. Examining how significance is ascribed to the assessment of these individual vessels within the UK legislative framework is explored through four examples:

- ***Eleanor***: Launched in 1888, 1,980 tonnes in size and lost in 1918 while heading to Malta (via Falmouth) with a military cargo (MAT 2018a).
- ***Camberwell***: Launched in 1903, 1,478 tonnes in size, armed and heading from London for Calcutta with a general cargo (MAT 2018b).
- ***Medina***: A passenger-cargo vessel (liner), launched in 1911, 12,358 tonnes in size and lost in 1917 while heading from India to London with a mixed cargo and passengers (MAT 2018c).
- ***Alaunia***: A passenger-cargo vessel (liner), launched in 1913, 13,405 tonnes in size and lost in 1916 while heading from New York to London with a general cargo (MAT 2018d).

They were lost in positions which span the English Channel (Figure 15.4). They include two relatively averaged-sized cargo vessels, along with two of the largest vessels within the dataset, which were liners used for both passengers and cargo. Two were outbound vessels from the UK, one with military cargo, the other with a mixed cargo, while two were inbound with mixed cargoes. They demonstrate the range of vessel sizes and cargoes carried, while each has aspects which make their stories and associated physical remains archaeologically and historically significant. Diving survey work has been undertaken on three of the four sites (MAT 2018a, 2018b, 2018d), with high resolution geophysical survey data also available for three of the wrecks (MAT 2018b, 2018c, 2018d). Each of these heritage assets have elements which contribute to historical narratives of nineteenth- and twentieth-century developments, while some have features of particular significance for shipbuilding technology. At present, none of these sites have any formal heritage protection within the UK system, placing them outside of active curatorial management frameworks.

Shipwreck heritage protection mechanisms in England and First World War wrecks

The approach to the management and protection of underwater cultural heritage in the UK, and more specifically, within England, does not take a blanket-coverage approach to protection, but instead utilises specific legislation to apply to individual wrecks (for more on marine protection legislation, see Firth 2010, 2014a; Dromgoole 2013; UK UNESCO 2001 Convention Review Group 2014). The pros and cons of the various mechanisms in terms of protection and management will not be covered here, but instead, there will be a focus

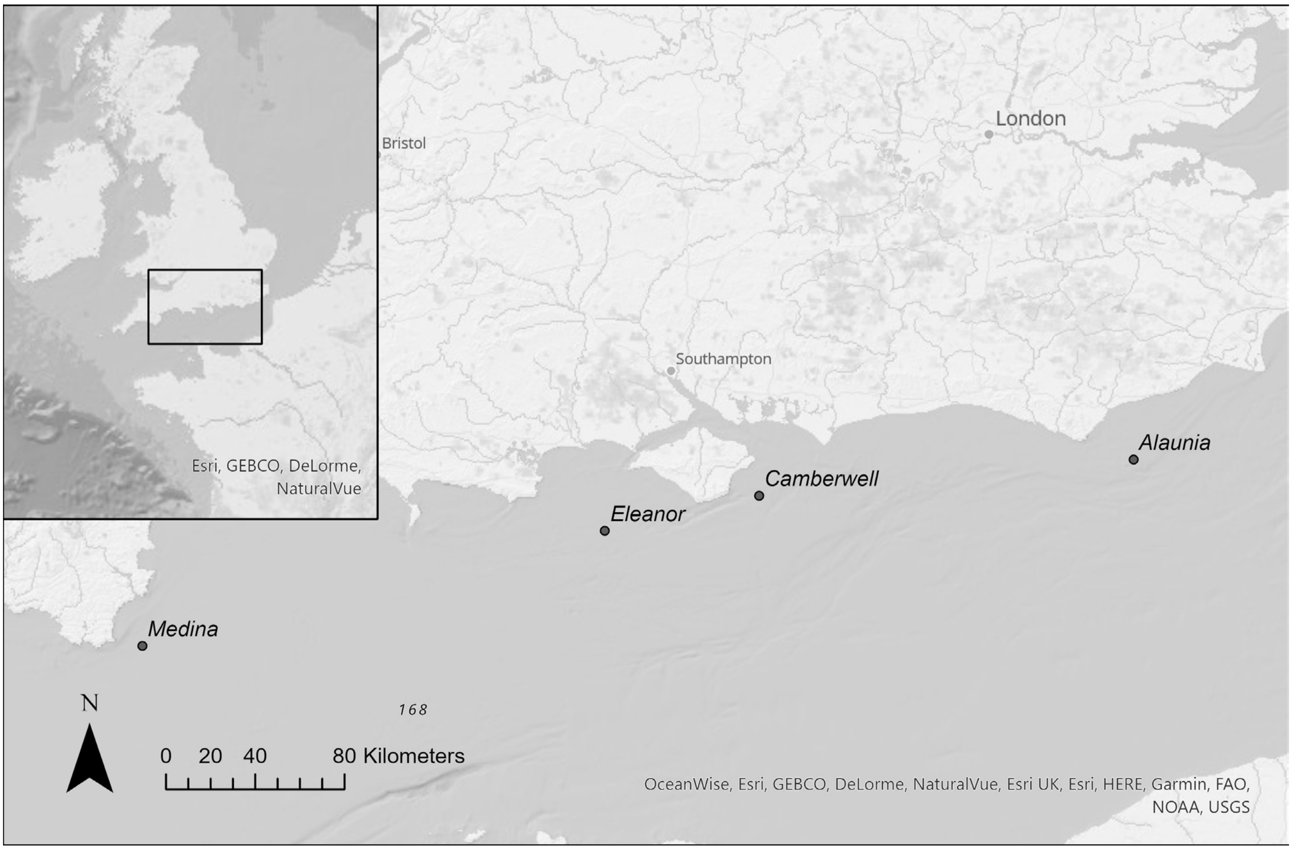

Figure 15.4. Position of the four First World War merchant shipwrecks examined within this chapter, all of which lie off the south coast of England. Maritime Archaeology Trust.

on how the four case study sites can be used to test the significance criteria which are applied to sites within both the Protection of Wrecks Act 1973 (PWA) and the Ancient Monuments and Archaeological Areas Act 1979 (AMAAA). The ability to assess and elucidate the significance of a heritage asset then enables conservation strategies to be enacted to maintain this significance and manage sites for future generations (for more on analysing significance, see Historic England 2019). A further mechanism for protecting UK military wrecks is the Protection of Military Remains Act 1986 (PMRA), which covers sites containing war graves. This legislation can help protect historic vessels from interference and has been applied to several First World War wrecks; however, heritage is not its primary driver, and designation is not accompanied by heritage management strategies.

The selection criteria applied within the PWA and AMAAA, along with examples of their application to wrecks, are outlined by Historic England (2017). In summary, they are:

- **Period:** Vessels from all periods, particularly those which reflect technological advances or provide evidence of trade, industry and transport.
- **Rarity:** Most vessels earlier than 1700 are likely to be of national importance. Those of later dates for which examples survive today will be chosen in exceptional circumstances.
- **Documentation/finds:** Survival of associated historical documentation can be a key factor establishing importance, and the existence of artefacts from a site in museums or collections can enhance significance.
- **Group value:** Importance can be strengthened by association with other similar vessels, or by reflecting wider contexts of use.
- **Survival/condition:** For vessels of a later date, increasingly complete survival, along with strong historical importance is required.
- **Fragility/vulnerability:** The presence of valuable objects within a wreck can make it particularly vulnerable.
- **Diversity:** Can have a diverse combination of high-quality features, or a single important attribute; could relate to ship design, decoration or craft, technological innovation or representativeness.
- **Potential:** A vessel's potential to answer questions on the maritime past; having surviving cargo adds considerably to a vessels significance.

At present, there are no First World War merchant ships protected using either the PWA or AMAAA. This lack of representation has been recognised by Firth and Rowe (2016: v), who highlight, 'The lack of substantive consideration afforded to post-1849 cargo vessel wrecks as a type of heritage asset is difficult to justify given their importance to so many strands of England's history'.

A small number of First World War military vessels are designated under the PWA. These are two German submarines—U-*8* (Historic England (HE) Uid: 901747) and UC-*70* (HE Uid: 909220), and the HMT *Arfon* (HE Uid: 1600390), which was a fishing trawler requisitioned by the Admiralty and in use for mine sweeping when lost. Outside of the Forgotten Wrecks of the First World War project, few wrecks of the period in English waters have received archaeological attention which has resulted in publication. Exceptions are HMS *Falmouth,* which is not protected but has been studied and modelled as it represents the only substantial wreck in inshore waters which fought at the Battle of Jutland (Firth *et al.* 2019), and the SS *Mendi,* which sank with huge loss of life from the South African Native Labour Corp and is protected under the PMRA (Gribble and Sharfman 2014; Gribble and Scott 2017). Both examples add to understanding of narratives of the war at sea.

A number of relevant studies have sought to examine the research context of modern shipwrecks within English Waters (Parham and Maddocks 2013; Historic England 2017). The assessment of the collection of First World War ships within English Territorial Waters by Wessex Archaeology (2011) provides a detailed review of sites, including considerations of 'special interest' which contribute to significance. Particularly relevant for First World War merchant ships is the work by Firth and Rowe (2016) applying an approach to determining national importance or significance within a regional group of merchant ship losses dating post-1840. They explore key narratives of vessels—construction, motive power, trade, life on board and England's history—and the application of these to the build, use and loss of a vessel and how, within each of these, significance can be ascribed at a scale from local to international. Their conclusion—that a detailed ship biography, alongside information from seabed remains, enable greater certainty in the ascribing of national importance—has been further tested through the outputs of the Forgotten Wrecks of the First World War project, which has considered whether the current UK selection criteria fully reflect expressions of significance within this element of the English seabed cultural heritage resource.

The Forgotten Wrecks project examination of the large group of vessels off England took place against an international backdrop of a growing profile for issues related to the assessment, management and protection of First World War shipwrecks coinciding with the centenary of the war (Guerin *et al*. 2014; Tell and Pieters 2022). Investigations across a number of countries reflected the international nature of the archaeological remains related to the conflict. Just some examples include those which audited or collected data on the resource over wider areas, such as Belgium (Deceuninck *et al*. 2014), Ireland (Kelleher 2022), France (Huet 2014) and Northern Ireland (Cotswold Archaeology 2015); took a regional landscape approach (Firth 2022); or related to a particular campaign, such as the Dardanelles (Kolay and Karakas 2014) or battle, such as Jutland (McCartney 2018). Others considered individual ships (Gribble and Sharfman 2014;

L'Hour 2022; Termote 2022), small groups of vessels (Yorke 2014) or a type of vessel within an area (McCartney 2022). Information from these studies, in addition to work undertaken on sites of this period in a number of countries prior to the centenary, provided appreciation of the substantial global resource, against which considerations of significance could be examined.

Examining the significance of merchant ship losses: case studies from English waters

The four case study wreck sites benefited from a range of archive research and fieldwork which enabled consideration of their significance on an individual site level, and within the wider southern English coast dataset, and in relation to any available published comparative material.

SS *Eleanor*

Eleanor was an 82-metre tramp steamer, built in 1888 (Figure 15.5a), powered by a three-cylinder, triple-expansion engine with two single ended boilers. Built for and operated by J Ridley, Son and Tully of South Shields, the ship worked on merchant voyages around the UK, Ireland and Northern Europe (MAT 2018a). *Eleanor* operated throughout the First World War, usually referenced as MFA (Mercantile Fleet Auxiliary), a designation recognising the ship as on hire to the Admiralty. While on a voyage from the Humber (northeast English coast) bound for Malta with a cargo of mines and mine components on 12 February 1918, the ship was around nine miles off the Isle of Wight, when it was hit at 3:30 am near the No. 3 hatch by a torpedo fired by German submarine UB-*57*. The crew of 35 onboard, made up of a mix of Royal Navy, Royal Naval Reserve, Royal Naval Volunteer Reserve and Mercantile Marine Reserve personnel, had little time to react, and the ship sank almost instantly. There was only one survivor, 2nd Officer Barton Hunter, whose account of the incident and rescue provides significant historical detail, along with an archive of letters which were sent to him following the sinking by family members of those who were lost (MAT 2018a: 12–14).

The wreck lies relatively intact in 40 metres of water, with 7 metres of structure proud of the seabed. It had 'broken its back' during the sinking, around the position where the torpedo hit. Elements of the cargo are in situ, with a number of unusual types of mines and mine components recognisable. The ship's manifest includes an extensive list of what was on board, with one of the key cargo items being more than 1,400 mines. To put this number into perspective, by 1918, 6,800 mines were being laid per month (Friedman 2011: 363); *Eleanor*'s cargo would have made up 21% of the average monthly amount required. The financial value of this cargo at the time was £170,000 (worth £63 million in 2023), demonstrating the large financial loss, as well as the strategic loss in terms of the war effort. Within the cargo of mines, there are examples of rare—and in some cases, unique—fittings and devices essential to anti-submarine activities in the First World War; there is significant research potential for these artefacts, particularly as many are still either in, or close to, their original position within the ship, providing information on the stowage and carriage of hazardous cargoes.

The *Eleanor*'s use as a tramp steamer and previous role in the Mercantile Fleet Auxiliary make the site a rare survival in the archaeological record (Wessex Archaeology 2011). While site recording and research have provided detail of the cargo, it is important to consider other aspects of the site as a physical expression of the First World War, such as being armed with deck guns, showing torpedo damage and the geographical place of sinking, all of which are tangible aspects of the site's significance which can be related to historical narratives. More intangible aspects of its significance relate to its commemorative importance. The sole survivor's daughter was contacted and shared an archive of letters sent to her father, which helped disseminate stories associated with the site. The letter archive, and direct personal connection with crew members, poignantly emphasise the connection between archaeological remains on the seabed and commemoration of those who lived and died through the war at sea. Many First World War wreck sites are war graves which are highly important to surviving relatives of those lost. This is an aspect of significance which is often overlooked, and it is arguably not well served by the heritage designation assessment criteria.

SS *Camberwell*

The steam ship *Camberwell* highlights the global nature of trading during the conflict and the diversity of crews involved in keeping the fleet operational. Built in 1903, this 112 metre-long vessel had a crew of 65 who were mostly from the Indian Merchant Service. The ship, built by L.J. Thompson and Sons, Sunderland, had two decks and was powered by a three-cylinder, triple-expansion engine. Its career operating as a general cargo ship transporting goods between the UK and various ports in India is well documented (MAT 2018b). Voyages continued during the war, with a stern gun being fitted. On 18 May 1917 while en route from Middlesbrough to Calcutta via London, the ship hit a mine, laid by submarine UC-*36*, and listed heavily. The mine explosion blew the hatch covers off and left a hole in the side of the ship (TNA: ADM 137 2962). The crew took to the boats; one boat was lost, including seven men from the Indian Merchant Service. Their loss is just one example highlighting the contribution of the many Black and Asian seamen during the First World War (MAT 2018e) and emphasises the significance wrecks in British waters can hold for other countries, particularly when they are the final resting place of sailors from around the globe.

In the 1970s, the site was located, and a collection of artefacts were recovered, which are now on display at the Shipwreck Centre and Maritime Museum on the Isle of Wight. The site lies 5.5 miles off the Isle of Wight at a depth of 31 m. Recent geophysical survey data (Figure 15.6a) and diver records demonstrate there are still substantial remains in situ on the seabed, both structural and the cargo.

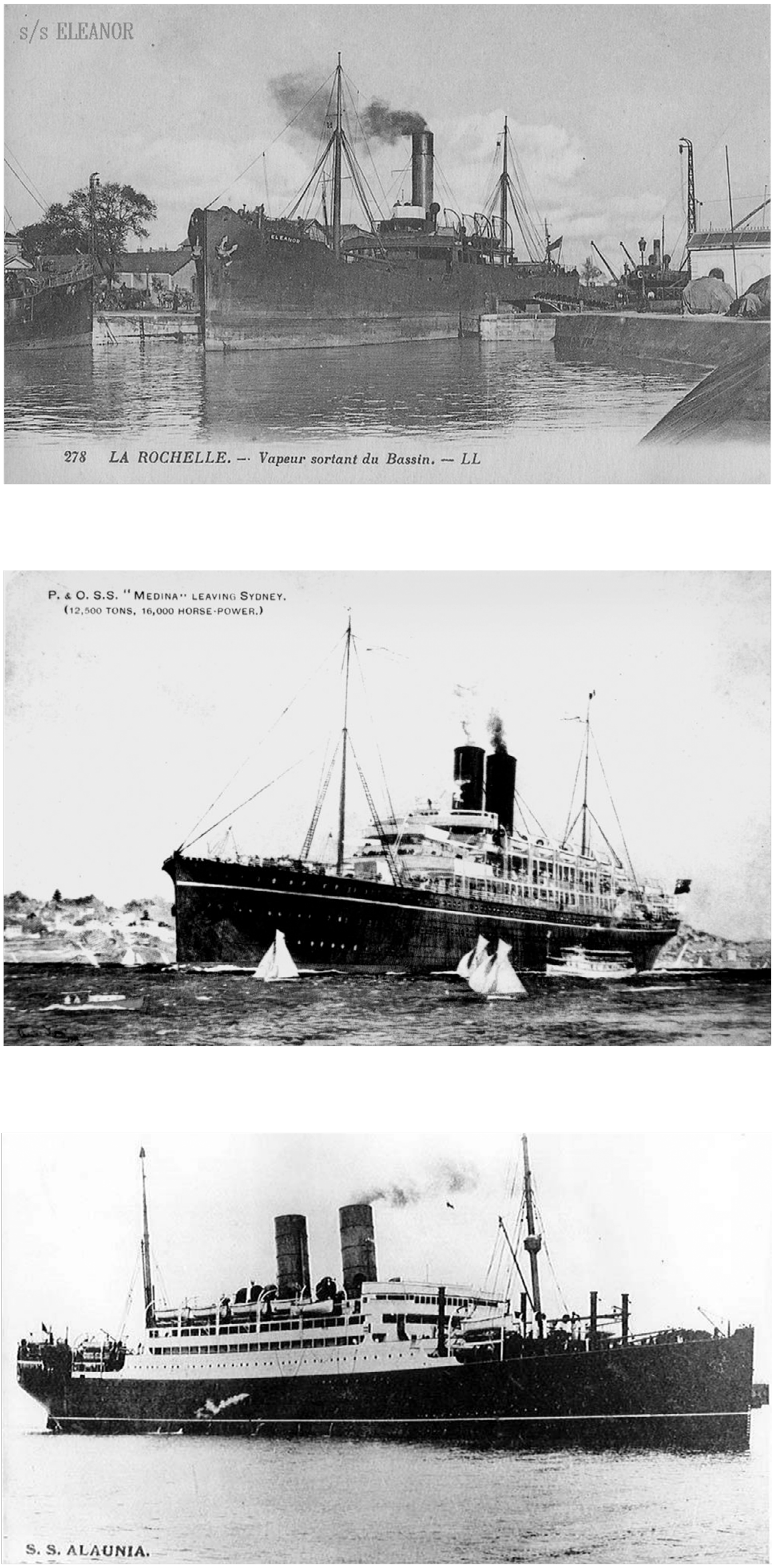

Figure 15.5. Photographs of First World War merchant ships: (a) SS *Eleanor* at La Rochelle, courtesy of Dave Wendes; (b) P&O Liner SS *Medina*, image from the public domain via Wikimedia Commons; (c) SS *Alaunia* at sea, copyright unknown.

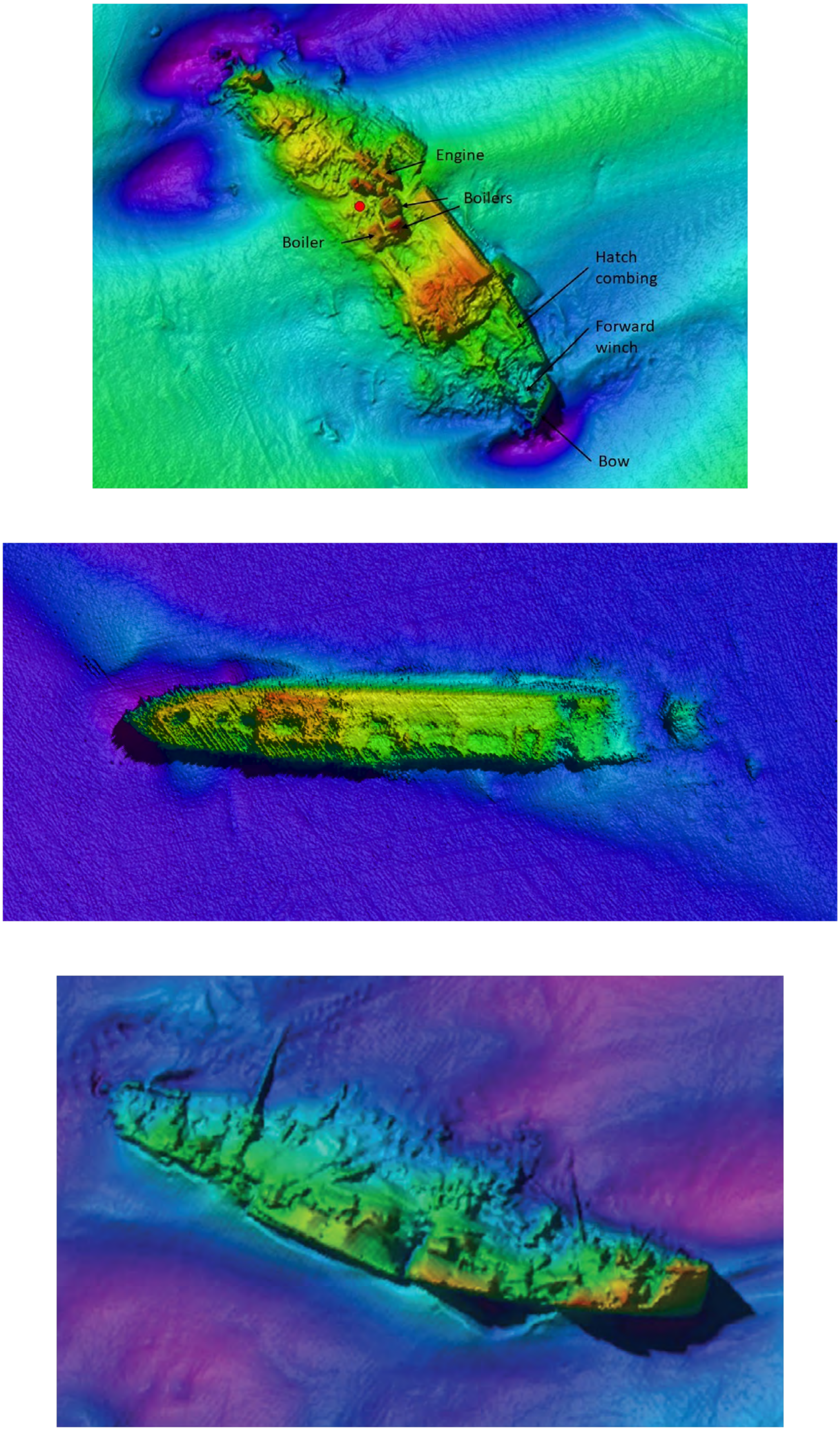

Figure 15.6. Geophysical survey images of First World War merchant ships: (a) SS *Camberwell*; (b) SS *Medina*; (c) SS *Alaunia*. Contains public sector information, licensed under the Open Government Licence V3.0, from the Maritime and Coastguard Agency.

In terms of ship type, *Camberwell* is an example of a relatively 'ordinary' cargo vessel. However, it provides significant potential through the historical documentation, recovered collection and seabed archaeological data for exploring the relationship of Britain with India through the goods being traded during this period at the 'end of Empire'. The cargo, as detailed within the War Risk Insurance records (TNA BT 365), was highly mixed; it included examples of everyday goods, as well as more surprising items (MAT 2018b: 20–34) such as billiard tables, gramophones and footballs which were being exported from Britain to India at the height of the war. Data on the rich and diverse cargo provides a snapshot of the goods, food and items being taken around the globe, and can provide insight on varied social and economic dynamics.

Camberwell illustrates a number of factors of special interest relevant to broader First World War narratives. It was lost during the period of unrestricted submarine warfare and was just one of the many casualties resulting from this new form of warfare. In terms of location, the site is within a cluster of other First World War cargo vessels which show grouping in an area of dense wartime shipping traffic, illustrating how the distribution of archaeological remains of wrecks reflects tactics for marine shipping operations and combat tactics.

SS *Medina*

The *Medina* was designed and built for P&O in 1911 as a passenger and general cargo liner destined for the London-to-Australia mail service via India; it was the last of the 'M' class ships built for P&O (P&O 2017) (Figure 15.5b). Built by Caird and Company of Greenock (Clydeships 2017), *Medina* was a large vessel at 167 metres long. Powered by two quadruple-expansion engines, it had 6,807 cubic metres of cargo capacity and could carry 450 first-class and 216 second-class passengers, in addition to its crew of around 350. Prior to completion, there was a request to use the ship to take King George V and Queen Mary to India for the Delhi Durbar, so it was altered and launched as a Royal Yacht (TNA P&O/65/17a-b, /95/16). The following year, the ship was refitted and repainted to commence its mail, cargo and passenger service (MAT 2018c). Its first commercial voyage for P&O was to Australia, and during its return voyage, it called at a range of ports in the Far East, India and Mediterranean before disembarking at London. Prior to the outbreak of war, *Medina* continued to voyage to Australia and occasionally just to India; these trips continued during the war, with armament added to the ship for protection.

During its final voyage, the ship disembarked most passengers at Plymouth, UK before heading on for London. On 28 April 1917, it was hit in the starboard side by the rear of the engine room by a torpedo from German submarine UB-*31*. The resulting explosion killed six crew, with the rest of those onboard using the lifeboats to escape. Onboard the ship were the possessions of the retiring Governor of Bengal, Lord Carmichael (he himself had taken a safer route home); the rest of the cargo included metals (copper, silver and tin), rubber, paint and produce (meat, eggs, butter, tea and dried fruit). It amounted to £262,319 of insurance claims, equivalent to £17 million today.

The wreck lies in 60 metres of water off the county of Devon, England; it sits almost upright and is largely intact (Figure 15.6b). The site has been salvaged repeatedly, first in 1932 and more persistently in the 1970s and 1980s. Salvage operations in the 1980s targeted the personal possessions of Lord Carmichael, which included art, jewellery, porcelain and personal papers. These artefacts were auctioned at Sotheby's in 1988, with the auction catalogue (Sotheby's 1988) providing lavish images of the antiquities on offer. Some of these were purchased by museums, with many ending up in private collections.

The *Medina* is significant for a number of reasons. In terms of propulsion, it is a rare survival of quadruple-expansion engines; there are only five other examples from the period 1914–1938 in English territorial waters recorded in the national heritage database (Wessex Archaeology 2011: 32), all within liners. Passenger-cargo liners are also rare survivals in the archaeological record and should be 'regarded to be of special interest on the basis of their rarity' (Wessex Archaeology 2011: 32). The seabed remains are relatively intact, with torpedo damage and salvage having had some physical impacts. However, there is much potential for further study of the structure, fixtures and fittings.

The ship is also significant in relation to a number of historical narratives. Its use as a Royal Yacht for the trip to Delhi gives it a unique place in history. Its regular commercial route to Australia via India is a reflection of trade and movement of peoples in the late colonial period. Later in its biography it is significant for use during the First World War, links to Lord Carmichael and his collection, being armed as a reflection of the conflict and being sunk by U-boat action. Each of these narratives has a physical expression within the vessel remains and its associated artefacts. The late changes to the ship design and use for the Royal trip meant alterations not on the original plans; the arming of the ship for war is seen through guns, and the torpedo damage reflects enemy action. Lord Carmichael's collection includes a range of antiques and 'collectables' which have not yet been assessed for their relationship to Indian heritage; more of this material may still be on the seabed.

Less tangible historical narratives related to life on board can be observed within the *Medina*'s 350-member crew; of this number, 200 were Indian, including five of the six who died. In 1914, one in six British merchant mariners—about 51,000 men—were classed as 'lascars' (of Asian or Arabic origin); P&O liners were usually crewed mainly by white officers and Indian seamen. The latter typically received a fifth to a third of the wages of seamen on 'European' employment contracts, fewer rations and smaller quarters (MAT 2018e).

SS *Alaunia*

The *Alaunia*, like the *Medina*, was built as an ocean-going liner for passengers and cargo, this time for the Cunard shipping company and the transatlantic trade. Built in 1913 by Scott's Shipbuilding and Engineering Company in Greenock, it was 158 metres long with four decks, with the capacity to carry 8,000 tonnes of cargo (Figure 15.5c). It was powered by twin screws driven by four quadruple-expansion engines. It had accommodation for 520 second-class and 1,620 third-class passengers (Macdonald 2012).

Launched in June 1913, the ship completed Atlantic crossings from Liverpool to Boston. At the outbreak of the war, *Alaunia* was requisitioned as a troop ship and was responsible for carrying the first contingent of Canadian soldiers for the war; it was also involved in troop transport for the Gallipoli campaign and carried troops to Bombay (Warwick and Roussel 2012). The ship also continued to carry civilian passengers and cargo, and it would be lost on one of these voyages (MAT 2018d). Having sailed from New York bound for London with passengers and a mixed cargo, most passengers were disembarked in Falmouth, UK. The ship then continued travelling along the English Channel, where it hit a mine (laid by UC-*16*) on 19 October 1916. The explosion under the propellers stopped the ship. Of the 165 crew, two lost their lives.

The ship lies off the coast of East Sussex, UK, in 30 metres of water, on its port side with the forward structure more intact than aft. Salvage during the 1960s and 1970s has impacted the vessel remains, although substantial amounts still lie on the seabed, with the positions of the masts and the boilers evident (Figure 15.6c). Diving investigation recorded the intact bow with wooden decking still in place and a bower anchor still hanging on the hull, with the anchor winch and chains in place. The port bow anchor is buried in the seabed. This situation is corroborated by historical accounts which indicate the tug crew who tried to save the vessel were able to raise the starboard anchor but not the port one (MAT 2018d). The site is popular with divers, and a range of artefacts have been recovered and reported over the years through the UK Receiver of Wreck. Most of these are held in private ownership.

The *Alaunia* shares some similar characteristics with the *Medina*: it is one of the five rare survivals of quadruple-expansion engines within passenger-cargo liners in English territorial waters. Significant aspects of the ship's biography include its status as a Cunard liner in this 'golden age of the ocean liner', as well as its role in the war, having been requisitioned to carry troops and equipment, while also continuing to operate as a liner when not engaged in government work. Involvement in transporting troops for the Gallipoli campaign is particularly significant, alongside its importance to both Canada and the United States, in having carried troops from these countries and for the descendants of those carried onboard.

Examining archaeological significance and implications for protection

The Forgotten Wrecks of the First World War project collected new archaeological datasets and interrogated historical sources, enabling a review of the significance of a number of merchant ship vessels. The four case study examples test approaches to significance assessment within the available heritage protection regimes (although none of them currently have any protection) and facilitate review of whether the criteria used fully reflect and recognise the historical and social significance of First World War merchant vessels.

In relation to *Period*, in theory, the relatively modern date of the ships does not impact their significance within the criteria, which recognise any vessel illustrating important aspects of social, political, economic, cultural, military, maritime or technological history. In practice, however, there are very few First World War ships with formal protection in the UK, with most of those with protection being submarines.

Within *Rarity*, due to the relatively modern date of these ships and apparent high numbers of examples, they would only be protected under 'exceptional circumstances'. However, there are aspects of these sites which would be considered rare, including the rarity of the remains of the *Eleanor* as both an example of a tramp steamer and part of the Mercantile Fleet Auxiliary and its unique cargo, as well as the quadruple-expansion engines and status as passenger-cargo liners of the *Medina* and *Alaunia*.

The *Documentation* criterion states the 'significance of a wreck may be enhanced by close historic association with documented important historical events or people'. Clearly, the sites are linked with the key historical event of the First World War and, as a group, they demonstrate elements of this within their physical remains through armament carried, cargo, damage from mines or torpedoes and their location of loss. Each individual site also has its own significant historical associations, either pre-war or within First World War narratives. Of particular note are the *Medina* and its use as a Royal Yacht and its carriage of the goods of the retiring Governor of Bengal; the *Alaunia* and its links with Canadian troops and the Gallipoli campaign; the *Eleanor* with its cargo and the details of its loss and the associated archive of letters from relatives of those lost; and the *Camberwell* with its varied cargo and associated historical records.

Group value can be applied where vessels are linked through events such as the site of a battle or with a particular port or navigational hazard. Approaches to the assessment of the group value of the global collection of wrecks of the First World War as a whole have not yet been tackled in detail. Clearly, the four case study wrecks are part of the group of First World War merchant ship losses off the south coast of England, and the consideration of this group within the Forgotten Wrecks project area (as noted previously) provides an initial review of the wider dataset and their context. However, further work is required to analyse the full potential of this collection.

With more modern wrecks, the application of the *Survival/condition* criterion usually prioritises sites with more complete survival for protection; of the four case study wrecks, *Medina* and *Eleanor* are substantially complete, while *Alaunia* and *Camberwell* exhibit impacts from salvage and/or clearance activities. For metal First World War wrecks, this criterion is intrinsically linked with that of *Fragility/vulnerability.* As these ships have now been underwater for over 100 years, some are in a state of rapid decline due to corrosion, and there is a limited window for their investigation. Additional vulnerability comes from their being targeting due to the financial value of their cargo or parts of their remains; legislation could be used to help protect against this.

The criterion *Diversity* recognises the need to protect a range of vessels which exhibit different design, decoration or innovation, or which are representative of a particular type. As no First World War cargo vessels off England have heritage protection, all 'types' are currently absent from the national collection of managed sites. Within the case studies, both *Medina* and *Alaunia* have the innovative quadruple-expansion engines, and are both representative of passenger-cargo liners. The *Eleanor* is a rare representative of a tramp steamer and also part of the Mercantile Fleet Auxiliary, although both of these characteristics are derived from the vessel's use rather than its design. The *Camberwell* is a representative example of the relatively 'ordinary' merchant steam ship.

The *Potential* of a wreck site to answer questions about the maritime past is recognised within the assessment criteria. Ships with surviving cargo are acknowledged as having added significance due to evidence of trade through material culture. *Potential* is also applied to contributions demonstrating historical associations or aspects of social, economic and mercantile history. All four of the case study examples have high potential within this criterion.

Each case study site arguably possesses characteristics making it eligible for formal heritage protection within the current criteria; as a group, they also illustrate a number of themes and narratives which are not well represented within current assessment approaches. There is a need to recognise the significance which ships may have for other countries, including significance achieved through the movement of goods and people during a ship's career, the international composition of a ship's crew, the status of sites as the final resting place of those lost during the sinking, as well as within the cargoes carried onboard which may survive on the seabed. The importance of a wreck for commemoration and family history is a less-tangible aspect of significance which is harder to quantify alongside the broader narratives. However, there are many individual stories of bravery and sacrifice which should be identified and commemorated. Recognising the contributions and narratives of the sailors and merchant seamen who fought the vital, yet little-known struggle on a daily basis just off the shore is a vital part of understanding the full significance of these individual ships.

Conclusion

There is a need to take a more holistic approach to determining significance of individual vessels and their role within the wider historical narratives of economic, political and social transformations. This is particularly important for ships of the later nineteenth and early twentieth centuries, many of which played a role within these evolving international systems of colonialism and capitalism, as well as reflecting developing ship technology and involvement in global conflict. This reiterates the position of Firth and Rowe (2016), who emphasise that each of these vessels is not just an anonymous metal ship in a seeming mass of dots on the map; rather, each has its own important story to tell. The Forgotten Wrecks of the First World War project has considered patterning within the losses and statistics of this group of vessels to more fully understand narratives related to the war at sea. It has drawn on information from seabed remains and, in some cases, associated recovered collections to examine how the unique physical expression at a micro-level can challenge the detailed historical documentation available for the period.

The power of maritime archaeology within the historical archaeology of shipwrecks is its ability to add new perspectives to understanding human experience onboard ships, as well as how shipboard communities reflect wider social and economic circumstances. Considering individuals within interpretations provides a direct human connection, emphasising ships as active communities, not passive containers for life. These factors can be overlooked when a site is represented with only the basic information often included within heritage databases, which, within this large class of seabed site, can be as minimal as ship type (usually steam cargo ship), date, builder and use on final voyage. This is a product of the large numbers of sites and limited archaeological or historical attention they have received. However, with detailed ship-career biography information alongside the recording of the physical remains, a more comprehensive understanding of a ship's significance is reached. As argued, elements of significance are often not well expressed using only the legislative assessment criteria for these vessels of the modern period. With increasing volumes of digital access to historical archive material and a higher profile for the rapidly degrading First World War merchant ships, there is an opportunity to capture the full research potential of these important sites and use the results as a basis for the application of appropriate protection and management measures.

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16

The recovery of a Fairey Barracuda from the Solent off the former RNAS Daedalus

Alistair Byford-Bates, Ben Saunders and Euan McNeill

Abstract: During survey work in 2018, the extant remains of a Fairey Barracuda—subsequently presumed to be Fairey built LS473, recorded as lost during take-off—were discovered submerged off the former Royal Naval Air Station (RNAS) Lee-on-Solent, HMS *Daedalus*. Widely used, the Barracuda was the first all-aluminium high-winged monoplane of the Royal Navy's Fleet Air Arm, but no surviving complete example of this aircraft exist.

This paper outlines the ongoing research into the aircraft and various archives, identifying several inconsistencies leading to questions about the initial identity of the aircraft, the records around its loss and that of other aircraft of the same type lost in close proximity to the crash site. The examination of the aircraft's remains has provided insights into wartime production contingencies across aircraft manufacturers, and the variations in aircraft design as types were altered or upgraded during the production process, with the recovered aircraft showing features from more than one mark. Though the aircraft were produced under licence to the same set of design drawings, with updates to individual drawings, there is evidence of significant variation between manufacturers' methods. There is also evidence of differing interpretations of the construction drawings, along with several ad hoc alterations to correct errors in the construction process.

Introduction

This paper reports on the recovery of a Mk II Fairey Barracuda (Figure 16.1) from the sea close to the end of the runway at the former Royal Navy Air Station (RNAS) Daedalus in Hampshire, England. The discovery of the extant remains of an aircraft in a shallow marine environment, and its subsequent excavation and recovery under the direction of professional marine archaeologists, is considered a rare opportunity within the UK. Research into recorded losses produced two possible candidate aircraft. These were being flown as training flights with just the pilots onboard, neither of which resulted in a fatality, following their ditching into the sea on take-off.

The aircraft was found due to its location in the planned High Voltage AC (HVAC) cable corridor of the IFA2: Interconnexion France-Angleterre 2 (IFA2) cable route between France and England (Figure 16.2, left). The location of the crash site resulted in a significant restriction on the proposed cable corridor and left insufficient space so close to the landfall to reposition the cables around the site. It was therefore decided, once the research showed neither potential aircraft involved fatalities, to obtain permission to remove the wreckage under licence from the UK Ministry of Defence (MOD) as required under the *Protection of Military Remains Act* (1986). The excavation and recovery followed the methodology created by Wessex Archaeology and approved by Historic England, as the heritage regulator for England and advisor to the UK Government's licencing body for the *Marine and Coastal Access Act* (2009), the Marine Management Organisation (MMO). This was also in line with the Service Personnel and Veterans Agency, Joint Casualty and Compassionate Centre guidance (2011) on obtaining a licence for the recovery of military aircraft material. The recovery was carried out with the incorporation of Wessex Archaeology archaeologists into the contractor's operation, under the conditions set out in the MMO Marine and the MOD licences issued.[1] Full details of the methodology are set out in Wessex Archaeology's Written Scheme of Investigation (2017) and Method Statement (2019a). The project aim was therefore to excavate and remove the aircraft, producing a record sufficient to enable analytical reconstruction and/or reinterpretation of the site, its components and its matrix. All the material recovered was to be transferred to the Fleet Air Arm Museum (FAAM) for disassembly to aid with their ongoing reconstruction project.

The aircraft was found approximately 500 m offshore, near the end of the runway of the former RNAS Lee-on-Solent (HMS *Daedalus*) with the nose of the aircraft pointing approximately southeast. The fuselage and engine were upright and slightly canted to port, with the port wing buried within the seabed sediments from approximately 1 m outboard of the fuselage. The starboard wing was partially detached from the wing stub lying flat on the seabed. The upper part of the engine was 0.5 m proud

[1] MMO Marine licence L/2017/00021/2 issued under the *Marine and Coastal Access Act* (2009), and MOD licence number 1878, issued under the *Protection of Military Remains Act* (1986).

Figure 16.1. Fairey Barracuda Mk. II. Copyright TNA.

of the seabed while the visible remains of the fuselage became lower aft of the observer's cockpit until they were flush with the seabed or slightly buried at their furthest extent. The outline of the cockpit aft of the engine firewall was filled with soft sediment, as were both wing stubs. The empennage was completely missing (Figure 16.2, right). The leading edges of both wings consisted of the surviving rounded frames, with much of the wing skin around the upper part of the leading edges missing. The upper skin of the port wing between the two main spars was largely intact, with small corrosion holes through the skin. This was also the case for all of the remaining fuselage skin below the burial line, giving it poor structural integrity.

Results

The recovered material was initially assessed on-board the contractor's vessel along with basic cleaning, photography, written descriptions and measurements undertaken for the finds record. Radiologically contaminated material, comprising the radon painted indicator gauges from the cockpit, and the organic material artefacts were stored wet and separately from the other finds; all of these were wet stored. Larger fragments were wrapped in a protective layer of decorators' cloth and plastic, and then wetted regularly. Material not retained for FAAM was returned to the seabed for reburial within a deposition site located within the licenced cable route corridor out of the zone of impact. This was based on concerns over the radium paints used and the health and safety concerns these posed. Surviving ordnance, including smoke floats and the drum magazines for the cockpit mounted 'K' gun, were disposed of by the contracted UXO disposal company. No personal effects (except for some boot fragments and a jumper fragment), official books, documents or papers were recovered during the excavation.

The diving operations comprised 38 days of operations and 82 dives. The final day of diving, completing the post-recovery UXO survey, occurred on 26 June 2019. The divers tagged a total of 193 items, including one modern dive weight. A total of 284 objects, or groups of objects, were tagged by the archaeologists at the surface, with 11 items, comprising radiologically contaminated dials, redeposited. Items recovered by the divers were individually tagged, whereas smaller unidentified objects comprising aircraft skin and small structural elements recovered from the sieve on deck were bagged together as a single item, according to their location. Overall, 484 finds numbers were issued. Unusual and unexpected elements included surviving fabric and wooden elements from the control surfaces, leather flying boot fragments, a fragment of a possible jumper, a comfort tube and bag and the screen shield from the radar.

Four manufactures, wartime contingencies and identification

When an aircraft crashes, it is often reduced to an unrecognisable assemblage of broken, crushed and

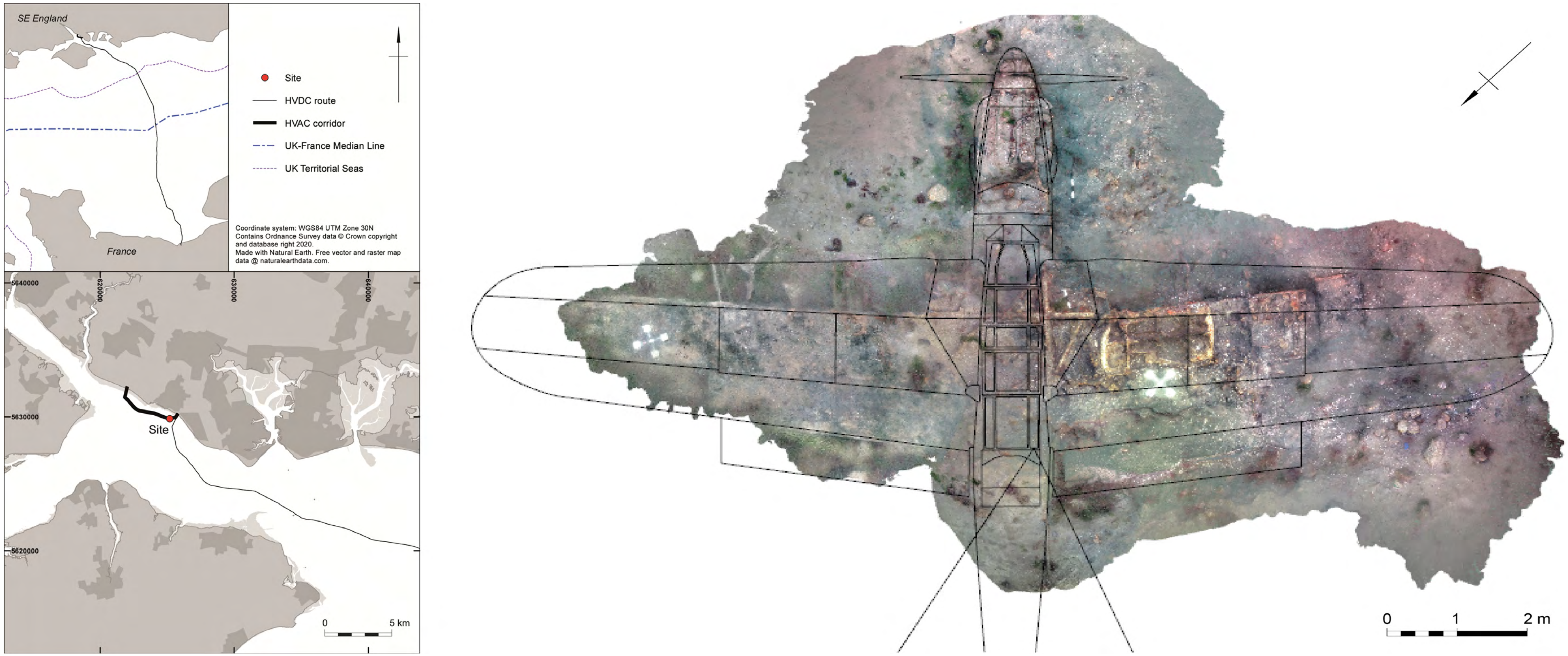

Figure 16.2. (Left) Cable corridor for the HVAC route showing aircraft site. Copyright Wessex Archaeology. (Right) Photogrammetric model of Fairey Barracuda wreck after extents excavation from above with Barracuda outline. Model created by R. Marziani, Wessex Archaeology.

damaged parts, potentially fire damaged, possibly partially recovered at the time of its loss, subject to years of environmental impacts, along with unrecorded human interactions. The latter influence can vary from casual interaction and curiosity, through to the legal or illegal recovery of parts as souvenirs, donor parts for other projects and their clearance as obstructions or hazards in the environment. Whilst some parts may be recognisable at a basic level, their identification to a specific aircraft type—let alone a specific aircraft—may be almost impossible without detailed examination, and suitable reference sources for comparison. These in turn may have been subject to poor archiving, disposal or dispersal over time, leading to further gaps in the surviving resources available to researchers.

In the case of the Solent crash site, the completeness of the aircraft, compared to many sites within the UK (English Heritage 2002), suggested the manufacturer's plate identifying the aircraft, its type, manufacturer and potentially changes to the aircraft led to the hope it might be recovered from the site. Unfortunately, this part of the cockpit, along with the plate, was missing. Furthermore, the effects of 76 years underwater had also removed any evidence of the painted serial numbers which would be expected on the fuselage, internally on bulkheads, on the formers of the main wing sections or tail, though the latter was missing. The tentative identification of the aircraft was therefore based on the surviving material from the crash site cross-referenced with material from both the UK National Archives, local Historic Environment Records and the knowledge and resources of the FAAM staff working on their Barracuda restoration project.

The aircraft has been positively identified as a Mk. II Fairey Barracuda. Two Fairey Barracuda Mk. II's are recorded as lost near to RNAS Lee-on-Solent (HMS *Daedalus*) in 1943 and 1944. At least seven additional Barracudas of various marks have been recorded as lost in the wider surrounding area. It should at this juncture be noted the records for aircraft losses are incomplete due to several factors, and therefore additional aircraft may have been lost in the vicinity (Dave Morris 2019, personal communication). Both of the Mk. II Barracudas were lost within four months of each other due to engine failures on take-off. The first was BV739, a Blackburn built aircraft delivered to 15 Maintenance Unit (MU) on 15 July 1943. On 29 September 1943, it ditched in shallow water whilst being flown by Sub Lieutenant Douglas Williams (Sturtivant and Burrow 1995). The second aircraft was LS473, a Fairey built aircraft, delivered to 15 MU on 24 November 1943 (Sturtivant and Burrow 1995). Initially, the site was thought to be BV739, due to an entry in the logbook of LS473's pilot, Sub Lieutenant MH Sandes RNVR, stating he had a two-mile swim ashore after the crash. Once the recovery of the aircraft started, the evidence of the identification plates on the different parts of the airframe and other makers' stamps and marks on its components indicated an aircraft built by Fairey Aviation at Heaton Chapel, Stockport, though as discussed below, the identification of the aircraft has not been confirmed at the time of writing.

The origins of the Barracuda's design can be traced back to British Air Ministry Specification S.24/37 in 1937, with the requirement to replace the Fairey Swordfish torpedo bomber reconnaissance (TBR) aircraft under Operational Requirement OR.35 (Brown 1975; Harrison 2000; Willis 2016). Fairey Aviation won the tender with the prototype aircraft first flying in December 1940, and the type entering operation service in January 1943 (Brown 1975; Harrison 2000; Willis 2016). The most successful and numerous iteration was the Mark. II with 1,693 aircraft built between Fairey Aviation Ltd., Blackburn Aircraft Ltd., Boulton Paul Aircraft Ltd. and Westland Aircraft Ltd. (Brown 1975; Harrison 2000; Willis 2016). Component parts for the aircraft, such as hydraulic components from Lockheed Precision Products Ltd. (Figure 16.3, top right), were built by a range of companies, with company or Air Ministry (Figure 16.3, top left) part numbers, along with inspection stamps, in this case a Fairey stamp, from the final users (Figure 16.3, centre left). There is at least one example of an unknown manufacturer at this time, with the bomb crutches bearing unrecognised manufacturers' code stamps.

In disassembling and conserving the surviving material from the Solent crash site, it was hoped a definitive identification of the aircraft might be found. Instead, the variety of manufacturers' stamps and marks led to further questions on the how the different manufacturers worked together either cooperatively, or under direction from the Ministry of Aircraft Production, in marshalling the 17,000 plus components in the aircraft (Willis 2016: 18). In the case of the production of the Barracuda, Fairey acted as the 'parent' company with the other manufactures acting as satellite factories. Fairey was therefore responsible for the quality control, and ensuring parts were delivered on time and in the quantities required to maintain production. They also maintained control of the design, production tooling and manufacturing programme for the aircraft. What has not been identified at this time is how much of the tooling was either manufactured to Fairey's specifications or plans, or built and shipped from Fairey, and how much this reduced the amount of sub-assembles or components built or made outside the group.

The different manufacturers also used different forms of subassembly and part identification tags and modification or 'Mod' plates (Figure 16.3, centre left) to identify the different sub-assemblies of the aircraft, and the plans those sections were built off. Plans went through multiple iterations in some cases, with parts receiving corresponding stamps to indicate which plan version they were built to, such as this Boulton Paul stamped, issue one example (Figure 16.3, bottom left). Fairey Aviation used a system of brass hook and eye clips or bands on the airframe tubes (Figure 16.3, centre right); they also stamped the solder sealing these bands. Unfortunately, most have corroded away with their immersion. Boulton

Figure 16.3. (Top left) AM embossed on electrical component. (Top right) Lockheed Precision Parts hydraulic component. (Centre left) Examples of Fairey inspection stamp with drawing and part numbers on front spar frame. (Centre right) Fairey Aviation brass hook and eye band with stamped solder. (Bottom left) Bolton Paul inspection stamp with issue one stamp next to drawing number. (Bottom right) Bolton Paul additional or super nummary numbers. All images copyright Wessex Archaeology.

and Paul used a system of a plain metal band with a folded-over join, and stamped parts with their manufactures code. Boulton and Paul were also known for adding additional or supernumerary part numbers, as well as the standard drawing numbers (Figure 16.3, bottom right). There is also currently one example of a tag which appears to have a month and year stamp on it (Figure 16.4, top left), the visible number being too long to be a drawing number reference. Blackburn initially was thought to have been the only manufacturer of the Barracuda to use ink-stamps in their quality control system (Figure 16.4, top right), though no Blackburn parts have been identified in the Solent Barracuda so far. However, as the parts from the Solent wreck have undergone conservation and cleaning there appears to be a least one example of a Fairey ink stamp, though it is very faint, and also appears to have been smudged, along with another blurred one on an electrical terminal block from the observer's cockpit. It is hoped that by identifying the issue plans identified on the 'Mod' plates, and the date of issue for the related drawing or drawings, the list of potential identifiers for the Solent aircraft can be further refined, based on a production rather than a delivery date for the aircraft. Currently, the gaps in the available plans for the different marks of aircraft means this has not been possible, though this research is ongoing.

The Solent wreck has in part started to answer this question on the basis of its producing, so far, parts with stamps from three of the four manufactures of the aircraft, along with Air Ministry (AM) (Figure 16.3, top left), Aircraft Standard (AS) or Aircraft General Standard (AGS) marks. These latter two were general standardised parts with no relation to a specific aircraft type. The exception here was the Air Ministry Section 26 parts, which were airframe and type-specific, with 26BT being the designated code for the Barracuda (Robertson 1983: 40). However, these were only present on the packaging holding the part, rather the part itself, with the relevant Fairey drawing number being stamped onto the part, along with any inspection stamps (Will Gibbs 2023, personal communication). Currently, no parts bearing this code have been identified.

The parts from the Solent aircraft also show various works inspection stamps comprising, in general, an identifier for the aircraft manufacturer and the works inspectors' number, issued by the UK Ministry of Aviation Aircraft Inspection Directorate (AID), who also inspected aircraft. This includes several from Westland Aircraft Ltd., who only produced 18 aircraft before being moved on to building other aircraft types. There is also evidence of parts being made and inspected by one company, and then re-inspected by another (Figure 16.4, centre left). In some examples the manufacturers have different AS numbers on the identical parts, despite them being the same part; examples of this are present in the fuel drains from the Solent wreck with Boulton Paul and H&B stamps indicating the manufacturers concerned. The latter are another example of an external company producing parts for the four aircraft manufacturers. In addition to this, though only 30 Mark I aircraft were built—five at Westland and 25 by Fairey—there appeared to still be parts from this first iteration of the aircraft being used within the production chain. It is unclear whether the use of the pilot seat base using the Mark I design drawings in a Mark II aircraft was a one-off occurrence in the case of the Solent Barracuda, or systemic within the construction of the aircraft, since pre-constructed subassemblies were used on a 'first in-first out' basis, irrespective of latest changes in the design of parts of the aircraft.

The relationships between the four companies in terms of transfer of parts and subassemblies, the use of part overruns, even when obsolescent due to updated drawings, the deviations between plans and the 'as built' aircraft require significant further research. Another example of the reuse—or perhaps more accurately, the re-purposing—of parts within the aircraft is the use of the throttle linkage from another aircraft design, in this case, the Fairey Fulmar. This part was subsequently redrawn as a Barracuda component, though the example from the Solent wreck still has its Fulmar (DF) rather than the Barracuda (DG) drawing references on it (Figure 16.4, bottom left). As in all systems, there would have also been delays between design changes, retooling and manufacture, whilst ensuring workforces remained employed and were trained and retrained as the aircraft being produced changed. What has not been identified at this time is any part with the aircraft serial number on it, despite this being common practise on many other aircraft from the same period.

What is also apparent from the material recovered from the wreck is the small errors in the applied skills and techniques used in the aircraft's construction. Some reflect working blind whilst assembling parts with examples of double drilling occurring, such as on a leading-edge part; others are examples of widening drilled counter sunk holes through rotating the drill to bore a bigger hole, either due to lack of an appropriately sized drill bit, or possibly due to the rush to maintain throughput on the assembly line. The part in this case still received its Boulton Paul inspection stamp, alongside its drawing reference. As with all the parts so far cleaned, conserved and examined, they all exhibited the various manufacturers' inspection stamps (Figures 16.3 centre left, 3 bottom left, 4 centre right, 4 bottom right, 5 top left and 5 bottom right), with in some cases reinspection stamps from other companies (Figure 16.4, centre left). The team at FAAM have also encountered a number of examples of the same Westland inspection stamp number as they restore DP872, suggesting that either Westland produced a significant number of parts or received them prior to moving onto other aircraft, or less likely, they continued to make and inspect parts after moving onto producing other aircraft.

Though it is not an exact calculation, approximately 60% of the aircraft was recovered, demonstrating the level of loss the aircraft had suffered from corrosion and other damage. The buried portion survived considerably better, although corrosion damage was present, potentially due to changes in burial depth over time. The lower parts of the wreck which had been exposed the least were the least corroded or colonised by barnacles. Significantly, many smaller parts, made from composite plastics and other materials, including Tufnol and Aeroplastic parts (Figure 16.5, top right) and other bonded wood-based products, survived well with no apparent damage or delamination.

Though there is no documentary evidence for any acts of salvage from the aircraft, there is some evidence of activity at the site by divers. This is suggested by the absence of the oil cooling radiators from beneath the front of the engine, evidence of an attempt to remove the top of the crankcases, with sheared off, missing and damaged bolts visible, some of the cockpit gauges and other fixtures missing in parts of the aircraft not impacted by crash damage and a shot weight found during the recovery. However, it is possible the radiators were torn off in the crash, and subsequently moved or recovered by shellfish dredgers. Though oyster and scallop dredging may have removed the significant portion of the upper part of the fuselage, including the canopy and guns, the nature of the

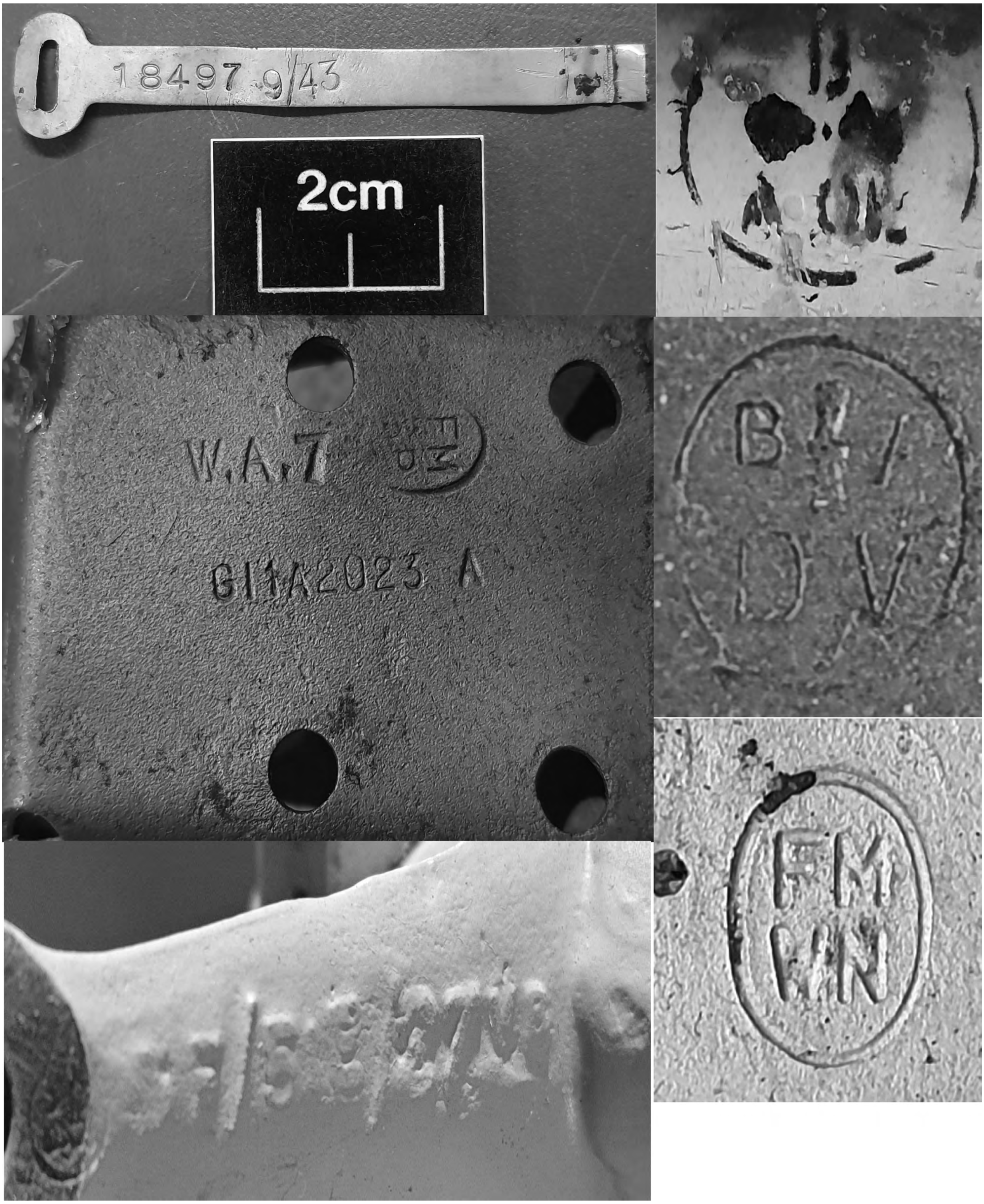

Figure 16.4. (Top left) Tag with possible date. (Top right) Blackburn ink stamp example from another Barracuda wreck. (Centre left) Example of reinspected parts with original Westland stamp, and Fairey reinspection stamp. (Centre right) Blackburn inspection stamp. (Bottom left) Throttle linkage with Fairey Fulmar drawing reference from Solent wreck. (Bottom right) Fairey Aviation inspection stamp. All images copyright Wessex Archaeology.

missing elements suggests items have been deliberately recovered in the past. It may be the gun was recovered at the time of the crash, prior to the aircraft settling onto the seabed, or during a salvage attempt to recover the aircraft shortly after the crash.

Identification of the aircraft

The identification of the aircraft has not yet been definitively confirmed. Based on several indicators, including the surviving internal grey primer paint in

Figure 16.5. (Top left) Boulton and Paul stamped pipe clip. (Top right) Tufnol block for holding hydraulic pipes with ink stamp from the Solent wreck. (Bottom left) Rolls Royce Merlin 32 engine plate. (Bottom right) Westland quality control stamp and part drawing number on cockpit control arm. All images copyright Wessex Archaeology.

places, the torpedo crutch, the identity tags, the mod plates on the tube work, the quality control stamps and most significantly the engine plate, there is a strong suggestion the aircraft is Fairey Barracuda LS473. Work is currently ongoing into the analysis of the primer paints from the different manufacturers, with initial analysis showing there is enough difference between them to definitively identify them.

In assessing the material recovered, the remains of the torpedo crutch with part of its torpedo retaining cable suggest an aircraft which was carrying out torpedo operations. LS473 is recorded as having been carrying a torpedo at the time of its loss, and this is presumed to have been jettisoned prior to the crash. This is because it is considered unlikely the torpedo retaining cable was left on the aircraft when not carrying a torpedo, as the cable was only retained by a bungee cord to prevent damage, and its flailing had been shown to cause significant damage to aircraft before the bungee system was implemented.

Research into the recovered engine plate (Figure 16.5, bottom left) received a response from the Rolls Royce Heritage Centre which also appears to confirm the aircraft as LS473. They report engine 71231 was a Merlin 32 built 8 October 1943 and despatched to Fairey at Stockport on 13 October 1943. It was one of 280 Merlin 32 built under Air Ministry Order C/ENG/426/C.28(a) and delivered between 11 September 1943 and 17 December 1943. The 281259 number is the Air Ministry identification for the engine. LS473 was factory-released on 24 November 1943 and lost on 6 January 1944. As BV739 was built in July 1943 and lost at the end of September 1943 it is highly unlikely to have been fitted with engine number 71231. Also visible on the back of this plate is its Rolls Royce part number. The caveat to this is the possibility the engine fitted to the aircraft was replaced or sent onto a maintenance unit and not accurately recorded. Though this seems unlikely, de la Bédoyère (2001: 42) cites two examples of the convoluted histories of Rolls Royce engines, with engines being built after aircraft were in service or surviving when aircraft were lost, due to the exchanging out of engines for overhauling.

Though the recovery of the Barracuda was planned in order to remove an obstruction for an infrastructure project, it also served as an opportunity to support the ongoing restoration of an aircraft at FAAM. As such, while it no longer exists as an underwater cultural heritage resource, the research into the aircraft and its origins still have a bearing and impact on the wider subject of underwater cultural heritage. In order to attempt to quantify its value, three commonly used methods for wreck sites assessment were used. Though they are generally applied to wrecked ships, the premise of placing a value on a site and the risks it is under are considered to be applicable and valid here. The methods comprised a site characterisation assessment, a site risk assessment and the assessment of the wreck against Historic England's definition of significance and non-statutory site designation criteria for military aircraft crash sites (English Heritage 2002, Historic England 2016).

Historic England's criteria for selection as a site of importance is laid out in their guidance on military aircraft crash sites (English Heritage 2002). To be considered of national importance, a crash site needs to achieve three of the four criteria set out in this advisory document.

The Solent Fairey Barracuda achieves these. Firstly, the aircraft comprised significant surviving elements with few or no examples of type remaining. Though the surviving percentage has not been accurately calculated, it is significantly more than the average 1% for a terrestrial crash site, with 10% survival being considered exceptional (English Heritage 2002). Secondly, the recovered material shows a remarkable degree of preservation, with original features and even pencil marks still visible on some parts. Thirdly, the aircraft was deemed to have the potential for some form of restoration and display, though conservation and display were not considered viable in the long term. Finally, based on the known histories of the candidate aircrafts, there was no evidence that either was involved in any significant events or raids, so neither achieved the requirements for the fourth criteria. Instead, like approximately two-thirds of aircraft losses during the war, they were lost during non-operational incidents (English Heritage 2002).

In order to quantify the archaeological and heritage value of the aircraft, it was assessed against the criteria required for designation under the *Protection of Wrecks Act* 1973 as presented in Historic England's (2017) *Ships and boats: prehistory to present*. Though this is designed for ships principally, within the context of the aircraft being an item of submerged cultural heritage it was again considered an appropriate model for assessing its value and the outcomes of its excavation and recovery. Based on this assessment, the aircraft was considered to be highly valuable overall, with the site risk assessment identifying the aircraft as at high risk, prior to its excavation and recovery.

In general, the inability to recover the Barracuda fully intact (Figure 16.6) demonstrates the vulnerability of submerged aircraft remains, particularly those in locations with strong tides, currents, changes in sediment levels and heightened human activity. The variable survival of parts of the wreck shows that if these artefacts remain buried within stable seabed sediments and are not disturbed, they may survive long term. As reported by Macleod (2016), sheet aluminium does not attract marine growth in the same way iron and steel do. Nevertheless, when exposed to tidal streams, currents, abrasion through sediment movement and highly destructive seabed activity, these wrecks are at high risk and become highly fragile very quickly (North and Macleod 1987; Macleod 2006).

Discussion

The recovery of the Fairey Barracuda from the Solent has contributed in several ways to the field of marine archaeology and our understanding of human life. At its most basic level, it is an example of the technological advances in aircraft design and development in the 1930s and 1940s in the United Kingdom. It shows what

Figure 16.6. (Left) Pilot's cockpit, Observer's cockpit, and wing stubs following recovery with subsea basket. (Right, top) Rolls Royce Merlin 32 engine following separation from airframe and recovery. (Right, bottom) Aircraft during initial lift attempt. All images copyright Wessex Archaeology.

was considered achievable by government procurement offices, and what a specific aircraft manufacturer offered in response to this specification produced at a time of rapid change and development in aircraft design and capabilities. It also shows what were at that point in time the perceived requirements and risks in naval warfare, and how aircraft might contribute to them. It should be noted the original specification for the Barracuda was published in 1937, with British naval orthodoxy of the time looking for multi-role aircraft, rather than role-specific designs. By the time the aircraft was in production, the idea of role-specific aircraft was back in the ascendancy, with the Barracuda expected to carry out an ever-expanding list of roles. Many of these were outside its original specification and design.

In studying the remains of the aircraft in more detail, insight has been gained into not only the technological innovations used in its construction, but also the more human element of its build, the methods used and more significantly, the variations which crept into the process. In considering human factors and the concepts of normalisation of deviancy, teamwork, leadership and risk management, the variations between the planned and designed version of the aircraft and the built version can be put into the contexts of wartime expedience, the rapid expansion of aircraft production with therefore relatively inexperienced workforces utilised in the construction of the aircraft and the under-pressure management and inspection teams. In addition to this, though as yet not fully understood, there is the transfer of components between the different manufacturers of the aircraft, which are suggestive of a system based on what appears to be a 'just in time' style supply chain. This may also relate to not holding large amounts of completed components and subassemblies in any one location in case of attack and their loss. The final element in the context of the Fairey Barracuda is related to the pilot, and how his story brings a connection to past which the aircraft on its own might not. Through the stories of all the individuals who played a part in the construction, services, flights, loss and recovery of the aircraft, a more organic, interactive history of the aircraft can be built. This potentially allows the modern viewer to find common ground with the past, as well as to answer the new questions posed by the archaeological excavation and recovery of the aircraft (de la Bédoyère, 2000: 111). As part of this engagement with the past and exploring the actions of the pilot, FAAM is investigating whether the pitch of the propellor will be able to indicate some of the engine settings at the point of impact, and whether the aircraft was set up to ditch or the pilot was still trying to recover the aircraft at the point of impact (Will Gibbs 2023, personal communication).

The recovery of the Fairey Barracuda from the Solent as part of the development of the IFA2 interconnector project can be considered highly successful in terms of combining archaeologists and commercial divers into a single team to carry out a rescue archaeology project salvaging an aircraft. The project saw archaeological divers integrated within a team of commercial divers, all of whom were experienced surface supply divers. The experience of the commercial dive time in terms of hours of underwater and rapid sediment removal was invaluable to the project progressing as it did, while the presence of archaeological divers with their experience and knowledge of recording processes, aviation archaeology and site formation processes ensured the archaeological significance of the find was retained while additional information on the crash was recovered. The project, within the context of rescue archaeology in a commercial development, was constrained by the need to fit into a fixed timeframe based on the contracted schedule for the cable-laying vessel. Therefore, without the commercial dive team, the recovery may have been slower, less efficient and more costly. Without the archaeological dive team and the advice and guidance of the FAAM staff, potentially large and significant amounts of archaeological data might have been lost, leading to reduced information on the aircraft and its reduced significance as an archaeological resource.

Conclusion

In its recovery, becoming an object of historical significance, rather than just a crashed aeroplane, the Barracuda's value to the wider community changes from that of a lost military aircraft to that of a historic item which can help researchers understand the past, filling in the gaps in our knowledge and linking the documentary record to personal histories of events. The archaeological potential of the aircraft can be viewed in terms of its physical remains and the contribution they can make to the FAAM restoration programme, but also from the personal history of the pilot who survived the crash and his recollection and links to the aircraft. This personal link has generally become more significant in recent years as events pass out of living memory. The journals, logs, photographs and oral histories of events lose context in isolation, and without a sympathetic audience or institution to garner and retain them. This work is already adding to the understanding of the wartime manufacturing process of aircraft, as well as to other research questions the team at FAAM have about FAA aircraft. The full value and potential of the recovered finds will not be realised for several years, both due to the number recovered, but also their conservation and reuse as replacement parts or as a model for the reconstruction where plans and photographs are not available.

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Underwater cultural heritage management and public engagement

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Climate change impact assessment on shipwreck sites in Ireland

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Abstract: In Ireland, the CHERISH project has investigated the impacts of climate change on wreck sites exposed to different environmental conditions. Remote sensing and archaeological recording methodologies created substantive site records, baseline and monitoring datasets. Maritime archaeologists, geologists, divers, surveyors and geophysicists worked together, providing a range of expertise for data collection, analysis and appraisal. The incorporation of previous site records made it possible to assess change and site formation processes for periods longer than the six-year course of the project. The CHERISH project looked at a number of wrecks from three different locations and environments, including unidentified wooden intertidal wreck sites at North Bull Island, Dublin, which are being impacted and damaged by storm activity on an annual basis; the schooner *Sunbeam* located at Rossbeigh Strand, County Kerry, which has suffered severe damage due to storms in recent years; and SS *Manchester Merchant*, which is located a few kilometres offshore from the *Sunbeam* in Dingle Bay and has been reported by local divers as deteriorating due to storm damage. This chapter presents the gathered data, how data can help increase the understanding of these cultural heritage assets and how climate hazards associated with climate change are impacting the coastal and underwater cultural heritage resource.

Introduction

CHERISH (Climate, Heritage and Environments of Reefs, ISlands, and Headlands) investigated how changes to the physical climate of Wales and Ireland are impacting archaeological heritage along the coastal zone and underwater. This cross-nation multidisciplinary European-funded project (Ireland-Wales 2014–2020 Programme) was undertaken by four project partners: the Royal Commission on the Ancient and Historical Monuments of Wales; the Discovery Programme: Centre for Archaeology and Innovation Ireland; Aberystwyth University: Department of Geography and Earth Sciences; and the Geological Survey Ireland. The project ran for a period of six years from 2017 to 2023 and raised awareness of climate change for Irish Sea communities through outreach events such as talks and community excavations.

Anthropogenic climate change is accelerating and intensifying environmental impacts acting on the cultural heritage resource (Cassar 2005; Colette 2007; Jigyasu *et al.* 2013; Fatóric and Seekamp 2017; ICOMOS 2019; Dawson *et al.* 2020). Physical wreck-site change is caused by climate hazards such as coastal erosion and flooding, increased storminess, drought and seabed erosion, phenomena which are increasing in frequency and intensity due to climate change. CHERISH mapped, monitored and assessed potential climate change impacts on shipwreck sites by establishing new metrically accurate baseline and monitoring datasets. A number of the survey methods were able to be repeated during the course of the project, and the results were subsequently compared to the initial baseline or/and other pre-existing surveys to analyse degradation and change at the wreck sites. The research and survey work presented within this chapter produced important information on the overall archaeological context and impacts of climate change on shipwrecks.

The debilitating effects of sea-level rise include more extreme and frequent flooding events, increased impacts of storm surge and accelerated rates of coastal erosion. These are projected to alter the natural and built environments, and therefore, understanding the impacts to heritage is crucial (Curran *et al.* 2016: 23; Horowitz 2016: 40). The relationship between rising sea levels and flood events is clear; this means an uncertain future for heritage assets situated on the coast. Sea level rise is seen as a pressing issue, as coastal heritage and communities were dealt with in the subject matter of 23% of publications on climate impacts and cultural heritage in the five-year period 2015–2020 (Orr *et al.* 2021: 12). In Ireland, sea levels are forecast to increase for all coastal areas, with satellite observations indicating the sea level around Ireland has risen by approximately 2–3 millimetres per year since the early 1990s (Cámaro García and Dwyer 2021). Increasing wave heights have been observed over the last 70 years in the North Atlantic (Cámaro García and Dwyer 2021), and projected changes in sea level will magnify the impacts of changing storm surge. Alteration to storm patterns has the potential to impact wave strength and direction (see Woolf and Wolf 2013), potentially increasing seabed and coastal erosion, which in turn results in the degradation of underwater and coastal archaeological heritage. Erosion is one of the greatest threats to coastal archaeological resources, as wave and tide action cause the loss of invaluable and unrecoverable information (Westley *et al.* 2011: 352). Coastal erosion may destroy heritage sites gradually over decades or cause catastrophic loss during single events (Dawson *et al.* 2020, 2021).

The CHERISH project focussed on wreck sites located in three different locations and environments, including Dublin Bay, which is relatively enclosed and sheltered from the prevailing winds, and Dingle Bay, which is exposed to the full forces of Atlantic weather systems. The main aim was to monitor site condition and change, in order to understand how climatic changes are physically impacting wreck sites located in these exposed coastal and underwater environments. Overall sea-level rise for Dublin Bay is in line with expected trends, but higher rates of rise occurred in recent years (Shoari Nejad *et al.* 2022: 511). Higher sea levels amplify coastal flooding and erosion, which directly impacts the coastal archaeological resource of intertidal wreck sites at North Bull Island. The erosion of the dunes at Rossbeigh, Dingle Bay, where the wreck of the *Sunbeam* is located, has been of particular concern; erosion and flooding events in this area are predicted to intensify in the context of climate change, sea level rise and more intense and frequent storms (Tubridy *et al.* 2022: 7; also see Devoy 2015). SS *Manchester Merchant* is located in 15 m of water in Dingle Bay. Climate change will cause increased storminess for Ireland, which means more frequent storm surges. Seabed sediments are affected by storm surges; during storms, wave–current interaction may result in seabed damage (Zhang *et al.* 2015). From this, it can be ascertained such events may damage archaeological material located in impacted areas, whilst stronger currents will increase scouring around wreck sites during storm periods.

North Bull Island, Dublin Bay

In Dublin Bay, on the intertidal sand flats seaward of North Bull Island storms, shifting sand bars and channels occasionally expose shipwrecks and loose timbers. This island developed after the completion of the North Bull Wall, built to protect the entrance to Dublin Port in 1824 (Gilligan 1988: 89–95). The harbour wall blocked sand movement around the Bay, causing an area of sand dunes to grow to become the island known today as North Bull Island. Over 800 shipwrecking events in Dublin Bay are recorded in the Wreck Inventory of Ireland Database (WIID) held by the Underwater Archaeology Unit (UAU) of the National Monuments Service (NMS) (Brady 2008; WIID 2023). These are compiled from historical records, archaeological investigations by the NMS and development projects such as the Dublin Bay pipeline project in 2001 and 2002. The earliest documented record for a wrecking incident in the Bay dates to 1562, when the Vice-Treasurer of Ireland reported a ship with artillery and munitions wrecked on Dublin Bar. No doubt, many ships were lost in earlier times, and some evidence for this has emerged with keels from clinker-style vessels dating to the eleventh to thirteenth centuries recovered from the 2001 pipeline project (Brady 2008: 268, 322; Dunne 2008: 295–298).

Surveys over the last 30 years have found six wooden wrecks, recorded in the WIID, on North Bull Island strand, though there are approximately 150 historical wrecking events (Brady 2008). The number of vessels recorded as being wrecked on the North Bull, Dublin Bar and North Wall area every decade falls from 35 in the 1790s when the Great South Wall was built to only eight wrecks in the 1830s after the North Bull Wall was built. This not only highlights the effectiveness of the building of the seawalls, but it also suggests many shipwrecks found today could be from the late eighteenth century or earlier. Historical sources also record episodes of plundering wrecks lost on the North Bull; one such occurrence took place in 1745, when Lord Howth jailed tenants for looting recently wrecked ships (wreck no. W01071). This and other historical accounts of the protection of wrecks from plundering by various authorities may explain why the wrecks which are exposed on North Bull were not completely salvaged for their wood at the time of wrecking.

CHERISH undertook seasonal and post-storm site monitoring visits of intertidal shipwrecks, from September 2019 to February 2020 when, unfortunately, the Covid-19 pandemic prevented fieldwork. Fieldwork involved archaeological survey, beach profiles and magnetometer survey to ascertain if significant changes could be detected over time, particularly after storms. Earlier commercial and UAU surveys were incorporated into the site analysis to further the understanding of the archaeological context alongside rates and patterns of change at each wreck site. As well as the usual tidal and seasonal changes, a series of storm events occurred during CHERISH fieldwork in early 2020 which impacted the wrecks, including Storm Brendan (13 January 2020) and Storm Ciara (9 February 2020). Due to the dynamic tidal nature of the environment, weather conditions and the varying levels of wreck exposure, a variety of equipment and techniques were required to record the sites, including GPS (particularly Global Navigation Satellite System (GNSS)), beach profiling and magnetometry (using a Sensys MAGNETO MXPDA 5 sensor channel push-cart magnetometer). Three wrecks were monitored during the CHERISH surveys.

Prior to CHERISH, the UAU surveyed Wreck 1 (W01131 in the WIID) between 2004 and 2006; the vessel was recorded as exposed for 9.30 m by 3.35 m with clinker overlapping planks and 14 oak futtocks (Brady 2008: 236–237). Photographs showed a wreck on the sand flat in a pool larger than the extent of the exposed wooden futtocks. Further images from March 2015 held by the UAU show a wreck in a smaller pool, as there are three futtocks above

Figure 17.1. North Bull Island Wreck 1. Clockwise from top left: 2 September 2019; 8 January 2020; 20 January 2020 (after Storm Brendan, which occurred on 13 January 2020); and 11 March 2020. Photographs taken looking northeast. Copyright Discovery programme/CHERISH project.

water level in the pool on the surrounding sand ripples of the sand flat. The sand level must have been higher, as only two timbers were exposed on the northern side, as opposed to at least nine in the earlier survey. The largest extent during CHERISH surveys was 7.92 m with only one side of exposed futtocks visible. However, the magnetometer survey showed a magnetic disturbance around Wreck 1 of about 12 m long and 5 m wide. Wreck 1 (Figure 17.1) was recorded in September 2019 on the sand flat around 20–30 m seaward from the sloping beach which leads from the sand flats to the sand dunes. Ten timbers were recorded initially, although after the storms in January, this number had reduced to six, and by the last visit in March, there was only one timber visible. The beach profile from the sand cliff at the HWM across the sloping beach and over the wreck in January shows the wreck only 7 m from the sloping beach and the smoothing of the sloping profile of the beach. Wreck 1's length of around 12 m suggests a sloop- or yawl-sized vessel.

Wreck 2 (the Sutton Wreck) is a section of carvel planking covered by sea lettuce (*Ulva lactuca*) near the northern end of the sand flats. The archives at the UAU have photographs of this being recorded in October 2015. CHERISH recorded planking lying on a sand bar 3.49 m long, 0.27 m high and 0.60 m wide. The section consists of two layers of perpendicular planking joined by tree nails 4 cm in diameter. Compared to the 2015 photographs, the CHERISH surveys found the section to be covered more by carragheen (*Chondrus crispus*) and sea lettuce, though similarly surrounded by a shallow pool and sand ripples. This may be a part of the hull section of UAU wreck W01142 (also known as the Sutton Wreck), which is located about 750 m seaward of Wreck 2. A section of hull from the Sutton Wreck floated free and settled on the sand when discovered during archaeologically monitored dredging operations for a pipeline (Dunne 2008: 298). The pipeline route was diverted around the wreck, which was covered over by sandbags and sand and thought to be a trading vessel with a beam of 6.5 m and length of about 23 m.

Substrate changes resulted in Wreck 2 disappearing by January 2020 with a 30 m-wide intertidal drainage channel recorded in its location. GNSS measurements indicated a 3–4 cm drop in sand levels between September and January in the Wreck 2 position, indicating the wreck had not been buried, with the new channel up to 23 cm deeper. It is also possible two loose timbers (Timber 1 and 2) found in the northern area of the beach also came from the Sutton

Wreck. Ship timbers have been intermittently recorded as washing up on the beach (*e.g.* Brady 2002: 475; Dunne 2002: 474), and more recently in March 2021, five ship timbers were reported by the public to have washed onto the southwestern area of beach. Timber 1, recorded by CHERISH, was a plank broken at both ends, found on 8 January 2020 in a shallow drainage channel 350 m west–southwest. It was 3.41 m long, 0.35 m wide and 0.04 m thick, with traces of 21 dowel holes 38 mm in diameter. Timber 2, found 250 m north–northwest of Wreck 2 on 10 March 2020, was 1.5 m long and 0.2 m wide, with dowel holes and one unbroken end exposed.

The primary locus of the Sutton Wreck was inspected during a low spring tide in February 2020, but nothing was visible. A working hypothesis is that the bulk of the wreck remains buried; otherwise, if the wreck structure had been destroyed, larger quantities of timbers would likely have washed ashore since its 2001 discovery. However, Wreck 2 and the timbers found landward probably represent the concentration of wrecks recorded in the WIID around Sutton Creek mouth. Two wooden wrecks were found in the area of Sutton Creek, 150 m apart, during the course of dredging works for the Dublin Bay Pipeline Project (Brady 2008: 239–240). The WIID records 23 wrecked brigs and 10 schooners on the North Bull, some of which would be about the same size of vessel as those recorded around Sutton Creek. A couple of examples include *Lively* (W01025), a brig from London stranded 2 January 1788 on North Bull with cargo of sugar, tea and hops, and *Olive* (W01038), a 97-tonne schooner travelling from Liverpool to Cork wrecked on the North Bull, near Sutton, in a gale on 15 February 1828.

Wreck 3 was a previously unrecorded, *in situ* single timber on the sand flats whose height above the sand varied from 0.36 m to 0.59 m. It lay further seaward on the sand flats than Wreck 1. The single-angled timber is orientated northeast–southwest, reaching 0.41 m high above the sand, with a width of 0.13 m. The magnetometer survey over Wreck 3 indicated a wreck around 35 m long from a similar positive anomaly that same distance to the west–southwest. The angle of the timber in the sand suggested it may be the stern or bow of a vessel. Wreck 3 GNSS beach profiles showed a drop of 9 cm in the sand level over an area of about 3 m between September and January, indicating clear pooling around the single timber. There was a further 20 cm drop in sand height after Storm Ciara in February, which contrasts with the silting over of the more landward Wreck 1. The end of the timber was thinner at the end of the CHERISH surveys, compared to when it was first recorded, suggesting abrasion due to wave action. Similar to the wrecks around Sutton Creek, it could be the remains of a schooner or brig type vessel, due to the 35 m length suggested by the magnetometer data.

Tidal and wave forces continually affected these Bull Island wrecks over the monitoring period, causing changing sand ripples, scour pools, drainage channels and sand bars. The growth of sea lettuce, barnacles (*Semibalanus balanoides*) and carragheen (found only on Wreck 2) on the wooden wrecks contrasted with loose timbers which had no growth, suggesting the latter had been recently exposed above sand level. The colonisation of these wrecks with marine life indicates that wreck site exposure from the time of initial recording by CHERISH probably lasted years, though further biological studies need to be done to further determine the age. The carragheen growth on Wreck 2 suggested it had been exposed for the longest amount of time. The evidence from Bull Island shows seasonal environmental changes, but it also reveals the effects of storms with the silting of Wreck 1 closest to the HWM, attributed to redeposition of sand from an eroded sand cliff. The disappearance of Wreck 2 from wave action powerful enough to remove this section of timbers, and the exposure and deterioration of Wreck 3 from reduction of the height of the sand flats, shows the effects of further seaward and wave abrasion.

Sunbeam, Rossbeigh Beach, County Kerry

The *Sunbeam*, a 99-tonne wooden schooner around 24 m long and 6 m wide, was built in Exmouth in 1860. Bought by Richard Kearon of Arklow, Wicklow in 1874, it had a regular run between Galway, Cork and the Bristol Channel. In January 1904, the schooner departed Kinvara, Galway in ballast for Cork to load timber for transport to the Bristol Channel. Soon after the ship left Galway Bay, the weather deteriorated, with storm conditions intensifying to a force 8–9 gale. The schooner's foresail ripped, and she took shelter in Dingle Bay. The second evening of the storm led to the vessel breaking anchor, and it was driven ashore. The crew walked away unscathed, whilst all salvageable material was shipped to Arklow (Dunne 2014; WIID). With no hope of refloating the largely intact vessel, it was subsequently abandoned on Rossbeigh Beach, County Kerry. It became a popular attraction, remaining as such as the vessel broke down and became partially buried over time. Its lower hull remained intact, and the wreck was a local landmark.

The eastern side of Dingle Bay is bounded by beach-dune barrier systems of the Inch and Rossbeigh Spits orientated approximately north–south (Devoy 2015: 141–142). These dune systems are special areas of conservation in their own right. Given the open and exposed nature of Dingle Bay, the dominant Atlantic southwest–west prevailing winds, swell waves and storm surges result in wave heights reaching 2.8 meters (Devoy 2015: 146). This continuous high-energy wave environment—high winds in tandem with the increased occurrence and intensity of storms—has resulted in the spit suffering significant erosion, with the dune system being breached in a number of areas.

Severe winter storms in 2013/2014 resulted in direct, damaging impact to the *Sunbeam*. The UAU responded to this by commissioning a local archaeological consultancy, Laurence Dunne Archaeology Ltd., to undertake rapid assessment, wreck remains defence works and rescue of over 50 ship timbers, including a large articulated section of the bow (Dunne 2014). As a means to protect the impacted wreck remains on the beach, a temporary defence was put in place using large 1-tonne sandbags to form a protected structure around the articulated hull remains. Large disarticulated timbers recovered were placed within the hull remains, along with iron fixings, to ensure they too were protected. These defensive works were subsequently destroyed by further storms in February 2014, which also destroyed the stern of the vessel. The remaining coherent wreck was also lifted and moved 200 m along the beach, where it lodged up against the dune system, which had also been breached (Dunne 2014). The Google Earth historical images from 2003 to 2012 show the outline of the wreck of the *Sunbeam* orientated northwest to southeast and lying partially buried 16–19 m seaward of the sand dunes on Rossbeigh Beach. In order to preserve the remaining intact wreck structure after the 2014 storm events, it was reburied in this general area. The southern spit, Rossbeigh, was about 4 km long prior to its breaching and the erosion of its distal end by a storm surge in 2008. The satellite data shows a 661 m wide breach had appeared 3.4 km along the length of the spit by 2010.

CHERISH began monitoring the site of the *Sunbeam* from the outset of the project in 2017 in order to record seasonal and storm impacts on the wreck site. On 26 July 2017, a photographic and photogrammetric survey of the *Sunbeam* wreck (Figure 17.2) was carried out, resulting in a Structure for Motion (SfM) 3D model of the site and its immediate surroundings. At this point in time, the majority of the wreck site was buried with only its framing elements exposed. On 19 September 2017, a monitoring inspection of the site recorded the wreck and surrounding sand levels as relatively stable. Only the sides of the vessel remained above the sand, as most of the stern and bow sections had been destroyed in earlier storm events. During the autumn/winter period of 2017 into 2018, several storms hit Ireland, including Ophelia (16 October), Eleanor (2 January) and Fionn (16 January). Following these storms, the site was revisited in April 2018, but no remains of the wreck were located. A further visit on 26 June 2018 involved a snorkel survey; from the results of the survey, the site was presumed either to have been reburied or to have moved again.

A wider search on 10 October 2018, which involved a walkover survey of the entire extent of the spit, found a portion of the lower hull of the *Sunbeam* (Figure 17.3) at the northern tip of Rossbeigh Spit, at the entrance to Castlemaine Harbour. This is 2.4 km northeast of its last recorded position, and it had therefore moved farther north along the spit for at least 2 km and was washed about 700 m into the mouth of the channel. Not surprisingly, the wreck had been badly damaged and was now in poor condition, with only about 10 m of one side remaining and 2 m in height of hull structure surviving above the seabed. The full extent of this remaining part of the hull section could not be fully surveyed due to being submerged within the channel. It lay just beyond the low water mark in an area of sand with patches of pebbles. Marine growth

Figure 17.2. Image of wreck taken during recording works in 2017. Copyright Discovery programme/CHERISH project.

Figure 17.3. CHERISH project staff recording *Sunbeam* in 2019. Copyright Discovery programme/CHERISH project.

(barnacles, mussels and sea lettuce) flourished on the wreck in its new location; this indicated the wreck was exposed near the low water mark for some time. Following another inspection in April 2019, marine growth on the ship timbers was observed to have decreased to mostly barnacles and sea lettuce, possibly indicating continuous levels of sand abrasion was limiting marine growth. The wreck had continued to deteriorate; copper alloy nails and wooden dowels which originally held the hull planks together were very exposed. A beach profile was carried out; this procedure was repeated in May 2022 when the substrate was found to be sandy again, probably indicating longshore drift and accretion of sand. Only five ribs remained above the water line, with six of the previously recorded ribs impacted and lowered to the remaining planking height. Sea lettuce growth had increased to cover the protruding ribs, along with bladder wrack on lower parts more permanently underwater. Beach profiling was undertaken at the northern end of Rossbeigh Spit in 2019 and 2022, revealing several metres of erosion of the island towards landward.

The *Sunbeam* illustrated the destructive and catastrophic nature of singular climatic episodes such as storm events on shipwreck sites. The work undertaken by the UAU, Laurence Dunne Archaeology and the CHERISH project created a timeline, mapped and monitored wreck site change and recorded the impact of storms. This site demonstrated how storm events can occur in tandem with each other, acting as a continual force against an archaeological resource leading to significant deterioration and loss which will eventually result in the complete breakdown and loss of the archaeological site. The reshaping and relocation of this wreck site does not solely result in the loss of the archaeological context and structural integrity of the site, for it also impacts local communities and visitors' sense of place, as the *Sunbeam* was a popular attraction and marker on the beach.

SS Manchester Merchant

SS *Manchester Merchant* was a 5600-gross tonne cargo vessel en route from New Orleans to Manchester. The vessel was 400 km off the southwest coast of Ireland when its cargo of cotton bales spontaneously ignited. The vessel sought refuge in Dingle Bay, Kerry on 15 January 1903, but after attempts to quench the fire failed, most of the crew took to the lifeboats, leaving the master and a handful of crew to scuttle the ship in shallow water with the hope of salvaging the vessel at a later stage. The wreck lies in approximately 12 m of water and is orientated northeast–southwest. The upper works of the steamer are largely destroyed and have fallen onto the surrounding seabed, with the boilers and bow now forming the highest part of the wreck. Local divers have reported structural collapse and change to the wreck site in recent years; this was attributed to storm damage after the worsening condition of the wreck was correlated with storm events.

The CHERISH project aimed to identify physical change occurring at the wreck of the *Manchester Merchant*. Accordingly, a programme of work was initiated to produce individual and combined 3D models using point cloud data captured from methods such as multibeam echosounder (MBES) survey, remotely operated vehicle (ROV) and diver videography and photography, from which 3D SfM models are derived. This programme of work required elements of the survey operation to be repeated over the course of the project to create baseline, monitoring and comparison datasets. MBES data capture was undertaken as part of the CHERISH project in 2019. The acoustic wreck survey used a Kongsberg EM2040D single-swath multibeam echosounder operating at 400 kHz in tracking mode. Multiple survey lines were run at the lowest speed at which adequate control of the vessel and heading could be maintained, ensuring maximum along-track data density (generally 2–3 knots). A 10° overlap between swaths was maintained, and angular coverage of each swath varied between 30° and 70° to maintain coverage within a 10 cm grid over the wreck. The quality of the data was also checked in the field. Sound velocity profiles were taken before and after the wreck survey. The site has been mapped a number of times over the previous 15 years as part of the seabed mapping programme undertaken by Geological Survey Ireland and the Marine Institute (Irish National Seabed Survey (INSS), later Integrated Mapping for the sustainable development of Ireland's marine resource (INFOMAR)).

The image on the top left (Figure 17.4) shows the INFOMAR MBES survey from 2009. This data was compared to the CHERISH 2019 survey results using cloud compare software, and this showed degradation of the shipwreck site over a ten-year period. We can see particular changes in the condition of the wreck site at a number of areas, such as the bow, stern and amidships from this comparison dataset. This change is denoted by the colour green on the main image (Figure 17.4). A repeat survey of the wreck was undertaken in 2021 in conjunction with an ROV survey. It was conducted with a Kongsberg EM2040 D dual head multibeam echosounder using the same survey methodology as the 2019 survey. As MBES data provides structural information only to a certain level of accuracy, it was decided to supplement the MBES data with SfM data which would be captured through ROV and diver photogrammetric surveys. As it was not feasible to record the entirety of the wreck site in this manner due to time constraints, target areas were therefore identified

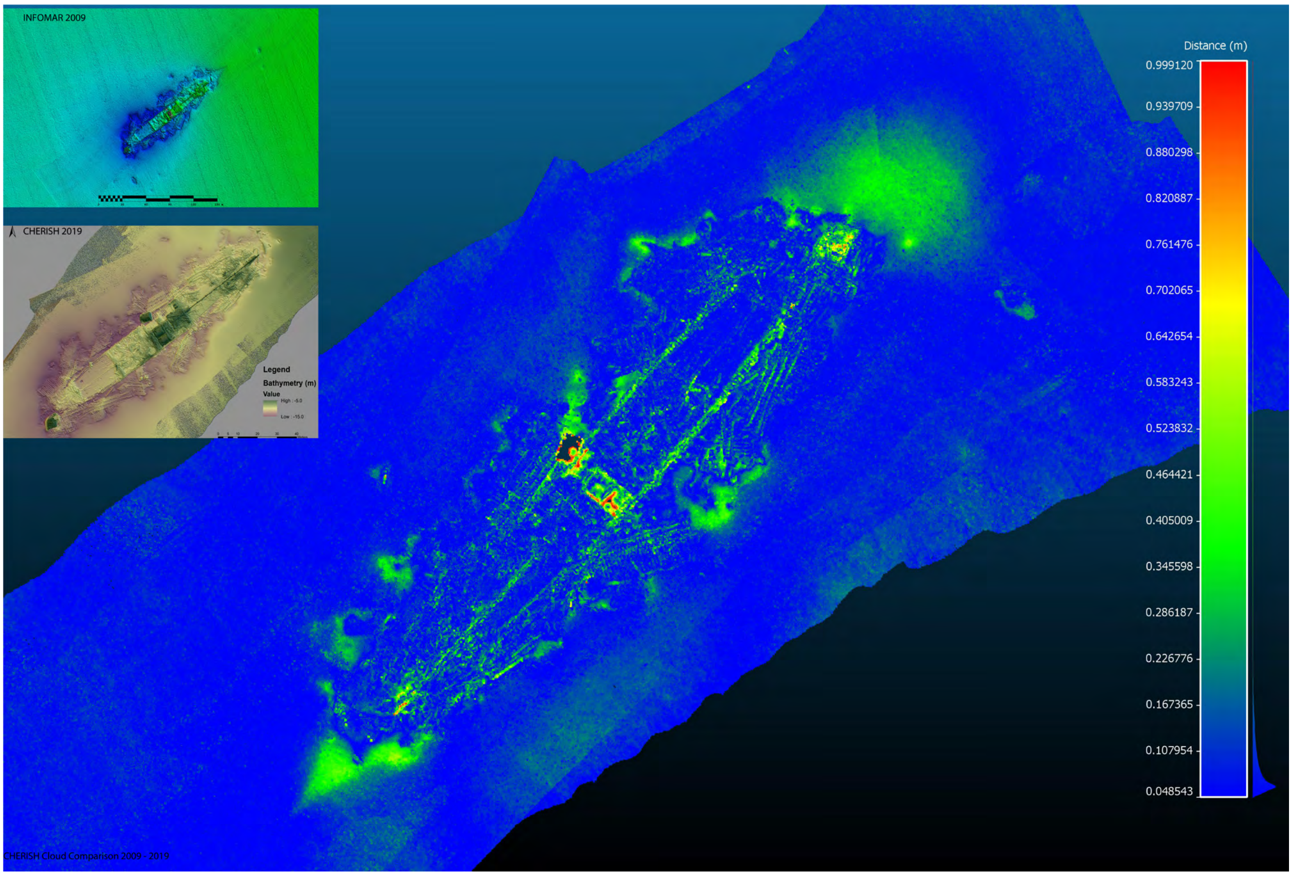

Figure 17.4. (a) INFOMAR 2009 survey (copyright INFOMAR, 2009). (b) CHERISH 2019 survey. (c) CloudCompare results; areas of structural change are denoted by green colouring. Copyright Geological Survey of Ireland/CHERISH project.

from the MBES comparison dataset. These areas were the ones observed to be suffering the most from structural collapse and change. CHERISH initiated the data capture and detailed visual survey of the wreck site with ROV and camera systems to augment the sonar data of the site captured; the MBES and ROV survey were undertaken over a two-day period during June 2021, aboard the RV *Keary*.

The ROV survey of the wreck was conducted by the Centre for Robotics and Intelligent Systems (CRIS), University of Limerick (UL) using the I-ROV system, an inspection-class ROV designed and built at CRIS, UL. It is a smart advanced system, not typically found in the commercial world, driven by a smart navigation and control suite known as OceanRINGS. This system moves away from manual piloting to automated piloting and control. To achieve a higher survey-grade platform, the IROV system facilitates an onboard inertial navigation system (INS), which is utilised by OceanRINGS to provide autonomous navigation and control. The INS is coupled with a doppler velocity log (DVL) for speed estimation, and a submersible GPS gives last known position prior to dive. The INS couples all sensor inputs, including 3-axis accelerometers and 3-axis fibre gyros, to provide a very accurate dead reckoning position over time from last known GPS. These platforms enable more accurate survey trajectories subsea, which can be critical in capturing close-quarter data.

The photogrammetry system utilises a camera system from SubC imaging, which is operated in a continuous shooting mode and triggers two onboard strobe LED lights when a picture is taken. The camera and strobes are positioned in such a way as to minimise backscatter. In terms of execution of the survey itself, the system utilises GPS positioning to manage the navigation of the ROV and ensure photos with overlaps of about 80% between camera frames are achieved. There are many operational issues on shipwreck sites, and it can be challenging to acquire high-quality photogrammetry datasets underwater. The conditions onsite were somewhat challenging, particularly in terms of strong tidal currents and poor visibility. The ROV system completed a number of surveys of target areas (Figure 17.5). The first area surveyed was the boiler section. The survey was designed to ensure good coverage and effective frame/path overlap, and a photogrammetric survey was completed with five passes on one axis and then seven passes on the second axis. The second target area surveyed was the bow section located to the southwest, one of the highest points on the wreck site. The ROV system undertook passes of this section in a less systematic manner. This was due to its height off the seabed and the entanglement hazards presented by this section of wreckage, which were even more prevalent due to the strength of the currents around the wreck site. A photogrammetric survey of this section of the wreckage was completed in roughly 15 minutes, which provided a consistent overlap and full coverage of the upper section of this part of the vessel.

The third survey area focussed on the propeller shaft, which runs half the length of the vessel, starting from the triple expansion engine just behind the boilers to the stern of the vessel. For this survey, three passes were completed along the length of the shaft, with additional data collected from passes made either side of the shaft. An inspection

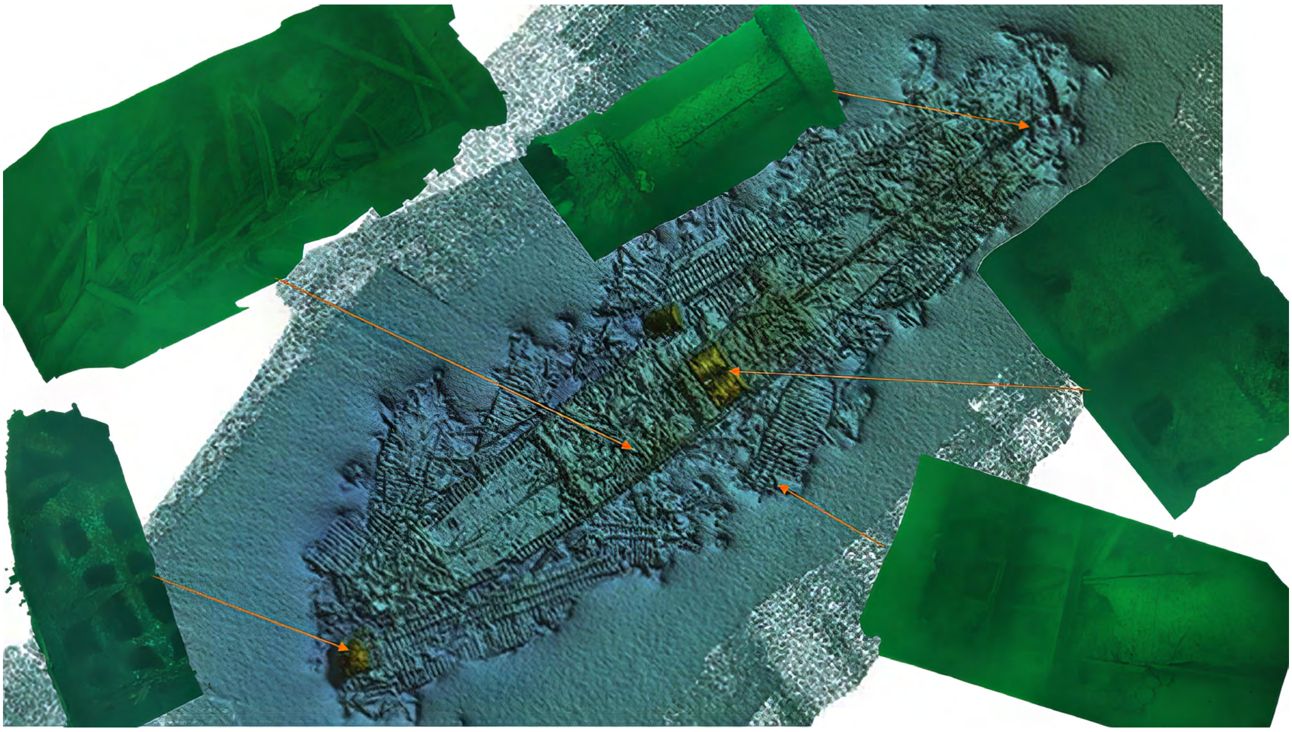

Figure 17.5. SS *Manchester Merchant* with ROV images from the targeted survey areas of the wreck site. Copyright Centre for Robotics and Intelligent Systems, UL/CHERISH project.

survey of the final target area focussed on the stern of the vessel, where the rudder can be seen lying flat on the seabed. The diver surveys were undertaken in August 2022 by Indepth Technical Diving, whose crew collected photographic and video survey of the same areas targeted by the ROV survey. This ensured extensive datasets were gathered for the areas of wreck identified as suffering the most from structural degradation and wreck site change, and the imagery gathered was also used to produce 3D models (Figure 17.6).

The condition of the wreck was assessed through the collected data from the ROV and diver survey. Degradation of the structural integrity of the wreck was identified at all the target areas including the bow, stern and amidships around the boilers along with various other parts of the wreck. The hull plating has fallen away from the main body of the hull structure. This has led to the interior of the wreck being fully exposed and more susceptible to deterioration. The interior of the wreck is a collapsed jumble of various steel structural components, with sections of hull plating mixed with interior piping and other sections of wreckage, highlighting the structural collapse and decay which has occurred on the wreck site over the hundred plus years since its wrecking. SS *Manchester Merchant* is located in an area of strong tidal currents; increased storminess will mean increased current speeds acting on underwater wrecks, and greater potential for seabed damage due to storm related tidal, wave and current action, which inevitably results in damage to underwater cultural heritage located in impact areas. The addition of these forces to an already highly dynamic environment means that sites such as SS *Manchester Merchant* are significantly threatened with rates of deterioration fast-tracked by environmental impacts being intensified by climate change.

This work highlights the importance of mapping and monitoring change, and the importance and significant contribution of visual inspections by the diving community. The project has shown the capability of ROV survey for visual inspection of these important sites. The visibility posed a significant challenge for visual camera survey; however, this was mitigated to a large degree through the use of a smart ROV platform. The divers collected complementary datasets which enabled the production of high-quality 3D models and further material for wreck site condition assessment. The datasets are rich and supplement datasets acquired from ship-based sonar imagery. The SfM models provide dimensional information and data outputs, including point clouds and orthomosaics. These models can be overlain on the 2021 MBES data to provide higher-resolution data which complement the point clouds produced from the MBES survey. This survey established a high-quality baseline which can be utilised to continue to assess and map the deterioration of the wreck site in the future.

Discussion

Climate impacts on coastal and underwater heritage are relatively poorly understood (Gregory *et al.* 2022: 1396). Increases in intense storm events and rising sea level

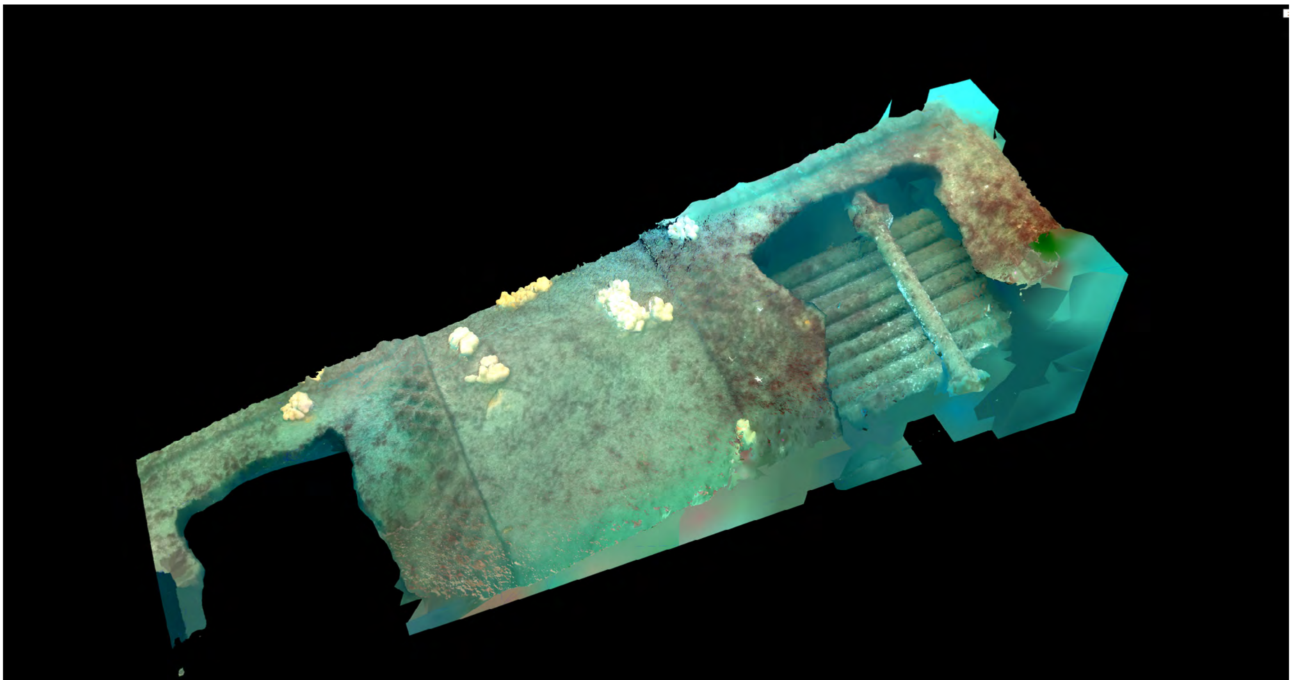

Figure 17.6. Photogrammetric model of the boiler, diver survey Go-Pro images. Copyright Discovery programme/CHERISH project.

accelerate coastal erosion and flooding. As recorded on Bull Island and Rossbeigh, these factors are impacting intertidal archaeology in the form of uncovering, moving, breaking apart, redepositing and reburying sites and artefacts. At Bull Island, shifting sand is regularly revealing evidence in the form of shipwrecks, artefacts and loose timbers. Beach profiling shows the erosion at the HWM of the island during storms and sediment transfer to the sand flats. The environment is less active during calmer periods, resulting in formation of continuously moving sand bars separated by channels which expose and cover over wrecks and timbers. While these conditions are and have been ongoing events over time, climate change is resulting in heightened and increased impact. Beach profiling at Rossbeigh showed extensive erosion of the northern end of the island and sand spit where the *Sunbeam* came to rest following its initial impact during a series of extensive storm events. The dynamic nature of sediments outlines the extensive erosion occurring in the area of the wreck. This intertidal work has highlighted the need to undertake repeat intertidal surveys, not only around low spring tides but seasonally and following storms when sediment is most likely to be in flux. Many shipwrecks are in danger of being damaged and lost before confirming identification through available historical and artefactual evidence, and creating substantive site records.

Remote sensing techniques such as magnetometry have proven successful in identifying potential archaeological anomalies, alongside locating and determining the extent of wreck sites. This enables archaeologists to be prepared for the uncovering of high-potential areas after storms, seasonal changes or the continual movement of sand bars and channels. The results gained at Bull Island from surveys in areas immediately surrounding exposed timbers are promising, and this method needs to be expanded to assess the full length of the beach to test its value further. This is logistically challenging as the tidal window at low water can be limited, and other techniques would be required to cover larger areas quickly. The geophysical data provided an indication of approximate size of the buried remains of the wrecks, but it would be useful to confirm these results with test excavation or probing. The site records and information created for Bull Island and Rossbeigh are useful as a baseline study for any future surveys which can provide further information of the nature and cause of deterioration, stability, new processes and biological factors affecting the wreck.

Over the past decade or so, equipment and methodological advances have resulted in MBES surveys presenting strong capabilities for identifying and mapping condition change on wreck sites. The results obtained through comparing datasets of the SS *Manchester Merchant* allowed the identification of changes in the condition of the wreck site over a 10-year period, and across smaller timeframes such as two years. This allowed the collection of data in target areas where the wreck site suffered the most change, such as the bow, stern and amidships. The ROV survey showcased the ability of such systems to undertake the visual inspection of these important sites and produce high-resolution 3D models, even under adverse survey conditions. The ROV and diver datasets are rich and can supplement datasets acquired from ship-based MBES imagery with higher-resolution models. The datasets can be utilised to estimate the degradation of the sites over time, given the results of this survey as an established baseline.

It is also worth noting that through the invaluable input of diver engagement with underwater cultural heritage, verbal and visual records of change are produced, and these were critical to the development of this study. This work can be used to further the understanding of and feed into wider studies on the impacts of climate change on Irish underwater cultural heritage. This work also informs the use of efficient and state-of-the-art underwater cultural heritage monitoring and recording methodologies. The collection of rich, metrically accurate datasets allows for the development of strong visualisations and representations of underwater cultural heritage. Mapping this change and visualising it are hugely beneficial in bringing this underwater resource into the public domain. The outputs of the work by CHERISH, such as 3D models, can be used as a tool to communicate change to the wider public, who normally do not have the opportunity to engage directly with underwater resources.

The understanding of natural systems is pivotal for assessing the sites at greatest risk from climate change, and allow for informed decisions concerning future risks faced at sites, the understanding of past processes and the sustainability and timescale of preservation actions (Howard 2013: 654). The identification of climate hazards which are known to be intensified and accelerated by climate change provided information on how Irish wreck sites are being and will continue to be impacted due to climate change. The development of such studies provides insights on other at-risk sites and enables the assessment of future impacts for sites. In nearly all instances, the breakdown and deterioration of the wreck was recorded, with instances of extreme loss recorded. Episodes of loss have the ability to negatively impact the value and significance of an archaeological site. Future projections due to the currently observed impacts and in consideration of climate projections suggest significant loss is occurring and will continue to occur to shipwrecks. The *Sunbeam* provided thought-provoking and surprising insights on the application of preservation measures, such as the building of defensive structures and the reburying of sites. The work described in this chapter presents the adaptation measure of management of loss through the creation of the archaeological record. In the face of climate change, this adaptation measure is likely to become the most commonly employed method in the management and implementation of adaptation strategies for at-risk coastal and underwater heritage, assisting in the preservation of these resources for future generations through the creation of site records.

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18

Blending WW2 history with the present in an interactive virtual heritage experience

Eike Falk Anderson and Thomas Cousins

Abstract: We have developed 'Exercise Smash', a virtual heritage experience which allows audiences to take part in a 1944 military exercise originally held in preparation of the D-Day landings in Normandy. Several participating amphibious tanks sank during the exercise, and our experience allows audiences to explore the present-day tank wrecks in a virtual dive to the seafloor.

The interpretation and presentation of archaeological artefacts frequently revolves around the two fundamental questions: 'what happened here?', and 'who did it happen to?'. Addressing these, we propose a mode of cultural heritage presentation using an interactive virtual environment, our 'Snapshot in History' time-travel paradigm for Virtual Heritage, which provides an innovative synthesis of tangible and intangible cultural heritage.

Audiences engage in a two-step interactive virtual experience which is ideally suited for the public presentation and dissemination of maritime archaeology, *e.g.* as an interactive museum exhibit. First, they experience the snapshot in history, taking part in the historical event which resulted in the submerged archaeology. The underlying story is conveyed through an interactive narrative, after which the audience are given the opportunity to explore the present-day archaeological site in an extension of the virtual dive trail concept.

'Exercise Smash' proves our concept, engaging audiences with this WW2 heritage. The audience first experience the story, then they are tasked with landing one of the swimming tanks on the beach without sinking it, and finally they explore the present-day wrecks within a detailed virtual environment populated with simulations of local marine life, which in the real world would be accessible only to divers.

Introduction

The public presentation of archaeology is a complex issue (Moshenka 2017) and of increasing importance, not the least because engagement with the public plays a major role in the dissemination of the results of research findings. With the rise of digital media over the past three decades, in recent years Virtual Heritage approaches—the use of interactive virtual environments for the presentation of cultural heritage—have become a popular medium for engaging the public.

The presentation of archaeology can involve different types of cultural heritage. Obvious among these is the 'tangible cultural heritage' which consist of archaeological finds and remains or their reconstructions; these tend to be (more or less) visible, and approaches to their presentation—after preservation—can be straightforwards, *e.g.* in museums. Requiring a much more complex approach for public presentation is the far less obvious and often invisible 'intangible cultural heritage' (UNESCO 2003), which encompasses oral traditions, performing arts, rituals and social practices but can also include personal stories such as memories of war (Jansen-Verbeke and George 2012) or memories by witnesses or survivors of a—potentially traumatic—historical event. Intangible cultural heritage frequently requires a means for interaction of the audience with dynamic objects in the virtual environment and sometimes also with virtual characters.

Our proposed approach towards the public presentation of archaeology aims to combine both tangible and intangible heritage to create a more holistic virtual heritage experience with the intention of improving audience engagement with the archaeology.

Related work

There exist many different types of Virtual Heritage applications for the presentation of cultural heritage, each providing their own sets of challenges. They are often concerned with the interactive visualisation of heritage sites which provide a means for exploration of digital reconstruction of lost or decayed objects and places, sometimes in museums (Deggim *et al*. 2017), requiring the provision of necessary infrastructure or hardware, or online (Firth *et al*. 2019), which can limit the extent of user interaction with the heritage artefacts. Sometimes these Virtual Heritage applications employ VR (virtual reality) to immerse users in the heritage sites (Duer *et al*. 2020), or they are enhanced with additional informative or educational content and more extensive user interaction. The latter can include serious games for cultural heritage (Anderson *et al*. 2010; Champion 2015). These can take the form of exploration games which take place in historical settings, such as 'Roma Nova' (Panzoli *et al*. 2010), or games set among the archaeological remains of historical settings, such as the virtual 'Priory Undercroft' game (Petridis *et al*. 2013).

The 3D reconstruction of archaeological or historical sites is often accompanied by the notion of time travel as a means to experience the past. This can take the shape of the virtual and interactive exploration of historical settlements as they existed in the past, such as the previously mentioned 'Roma Nova' (Panzoli *et al*. 2010) or 'Virtual Segeberg 1600' (Deggim *et al*. 2017). Sometimes they take the shape of a simulation which shows how an archaeological site or a historical building evolves and changes over time (El-Hakim *et al*. 2006, Laycock *et al*. 2008), although this type of visualisation is usually non-interactive, merely presenting the changes to a passive audience. One reason for this non-interactivity is the potential problem of role-playing 'time travel' in interactive scenarios, which could affect history in ways which could result in an alternative, counterfactual history (Champion 2015). The challenge which arises from this is to prevent the time-travelling user from making changes to the past without obviously restricting the user's interaction with the virtual world.

Public outreach in maritime archaeology

In recent years, the utilisation of interactive computer graphics, such as those employed by digital games, has become a frequently chosen approach for engaging the public with maritime archaeology (Beavis *et al*. 2021), utilising modern home computer technology to create new avenues for communicating archaeological finds to existing audiences and reaching out to new ones. There are now so-called 'Virtual Dive Trails' (James 2018), which allow for the exploration of submerged archaeology, such as protected wreck sites, either by members of the public who cannot dive, or in cases where sites are inaccessible to scuba divers. While originally in the form of labelled but static 3D models within an interactive viewer application, more recently such dive trails have also been implemented within fully interactive virtual environments (Bruno *et al*. 2017) or as VR experiences (Liarokapis *et al*. 2017), which can provide comprehensive virtual tours of maritime archaeology which can incorporate immersive diving experiences (Bruno *et al*. 2019) or which can be integrated with kiosk-style exhibits in museums (Sundén *et al*. 2017). Perez-Reverte *et al*. (2021) noted the development of virtual heritage experiences based on the 'virtual dive trail' concept can also be achieved by the use of 360 (panoramic) video, providing an alternative to employing a fully computer-generated virtual environment.

Lately, these fully computer-generated virtual dives have also included the simulation of marine life, including both marine fauna and flora, such as plants on the seabed or fish moving around the virtual environment. This can increase the perceived realism of the virtual environments (Stone *et al*. 2009; Kouřil 2017; Liarokapis *et al*. 2017), as was demonstrated by Costa *et al*. (2020) in an immersive VR virtual dive experience which allowed users to explore the wrecks of transport ships which had carried Sicilian marble blocks. In support of the creation of such immersive VR virtual dive tours, Plecher *et al*. (2022) explored the user interaction elements which are required to convey a diving experience in VR which is perceived as realistic, resulting in a modular conceptual framework which simplifies the adaptation of the VR diving experience to different maritime archaeology sites, speeding up the creation of virtual dive trails in VR. VR has been shown to be suitable not just for the public presentation of maritime archaeology, but also for the presentation of maritime history. An example of the latter is the VR simulation of the restored four-masted barque 'Peking' (Kersten *et al*. 2020).

One approach to engaging the public which has been popular in recent years is the development of so-called 'serious games' for promoting underwater cultural heritage. Serious games are computer games which not only provide entertainment but have a secondary purpose (Zyda 2005) such as education or public information. Cozza *et al*. (2021) explain the design and development of a serious game, 'Dive in the Past', for promoting underwater cultural heritage in the Mediterranean Sea. 'Dive in the Past' allows users to dive virtually to and then virtually explore underwater archaeological sites. Cozza *et al*. (2021) provide a detailed rationale for the design decisions they made during the development of their game.

Yamafune *et al*. (2017) detail the process of recording and processing underwater archaeology for use in virtual heritage experiences for public outreach, and they describe a methodology for recording and reconstructing maritime archaeological sites. Similarly, Tousant and Fai (2019) developed a detailed workflow for digitally recording (scanning) underwater archaeology and preparing the resulting 3D information for deployment in interactive virtual environments. Such digital recording and processing of underwater archaeology provides the basis for creating VR diving experiences, for which the integration of such processed maritime archaeology into interactive, immersive virtual environments has been comprehensively explained and demonstrated by Plecher *et al*. (2022).

The enhancement of virtual heritage experiences with a narrative, conveyed through interactive digital storytelling and facilitated by the integration of live-action recordings of real actors who provide information about the depicted heritage to users of VR heritage experiences, was explored by Škola *et al*. (2020). These authors created a virtual dive trail of a submerged Roman villa which allows users to visit a scenario in the past, during which they can tour the reconstructed villa at a time when it was above the surface and inhabited, where they can then interact with its inhabitants. The effectiveness of the user experience created by this approach in terms of user 'engagement', 'presence' and 'immersion', all of which feed into the perception of realism, was verified not only by employing a user questionnaire but also by recording neurophysiological brain activity as an objective measure. Related to the notion of perceived realism and immersion, it should be noted any type of virtual heritage experience depicting submerged archaeology must try to overcome the various issues identified by McAllister (2021), particularly in regards to the perceived realism of scanned 3D objects placed in an underwater virtual environment. To address issues of realism, McAllister provides a comprehensive set of guidelines for planning and executing photogrammetric surveys, the subsequent processing and evaluation of the resulting 3D data and the final dissemination of results.

A snapshot in history

One difference between many land-based archaeological finds and those discovered through maritime archaeology is that in the latter, the remains are often the result of a single identifiable event in history (*e.g.* such as a ship sinking in a storm). In some cases, there are official reports or recorded eyewitness accounts of the event, and in other cases—for example, among coastal communities—there are stories about these incidents which have been passed down through the generations, being memorialised and becoming intangible heritage (Kempe 2006).

Such instances of intangible cultural heritage which have resulted in tangible cultural heritage are not usually shown in virtual reconstructions of archaeological or culturally relevant sites. These omissions occur despite the potential for a virtual reconstruction within interactive virtual environments to provide the necessary infrastructure to create a view of a snapshot in time of an archaeological site which would allow audiences to experience the event creating the archaeological site, as well as the archaeological remains as they exist today.

One attempt at providing such a link between the past and the present is the 'HMS *Falmouth* dive trail' (Firth *et al*. 2019), which superimposes an annotated photogrammetric scan of the original shipbuilder's model over a recent and annotated 3D survey of the wreck on the seabed, allowing a direct comparison of the wreck site with how the ship would have looked when it was new. We propose to take this link between the past and present much further by splitting the presentation of the archaeological finds into two distinct parts. First, we emphasise the notion of time travel, which allows audiences to experience a snapshot in history depicting the specific event creating the archaeological remains being presented to the public, while simultaneously allowing the public to take part in history interactively without changing it. Second, we allow the audience to explore the archaeological site—which has been fully annotated with information derived from the archaeological investigation—as it exists today.

Our proposed approach is not limited to maritime archaeology but could also be used to depict archaeological sites which are the result of a single cataclysmic event (*e.g*. a battle or a natural catastrophe such as the eruption of Vesuvius which destroyed the Roman towns Pompeii and Herculaneum; Cooley and Cooley 2013).

Using this paradigm for the public presentation of archaeology and the results of archaeological evaluation, we have created 'Exercise Smash' as a proof of concept, providing audiences with an engaging virtual experience which allows the interactive exploration of the archaeological remains of the 1944 'Exercise Smash I' military training exercise by diving to the wrecks of the amphibious tanks. Our virtual heritage experience also presents the archaeological artefacts in their historical context in form of a serious game which allows the audience to take part in the military training exercise (Figure 18.1), using a screen-based virtual environment to immerse the 'visitors' to the past within the event in a similar manner to the immersive VR exhibit by Duer *et al*. (2020), who demonstrated that simple presence within a virtual representation of the past can facilitate the illusion of 'walking in the footsteps of others'.

Historical background

Lessons learnt from other amphibious operations such as Gallipoli in World War One and Dieppe in 1942 highlighted the need for armoured support when assaulting fortified positions. The allied solution was to establish the 79th Armoured Divisions, who developed a series of specialised fighting and support vehicles now commonly known as 'Hobart's funnies'. One of these vehicles was the Duplex Drive or DD Tank.

Originally Valentine, but later Sherman tanks were fitted with a watertight canvas skirt which displaced enough water to allow the vehicle to float. The drive of the tank was also modified so it could power a propeller at the stern of the vehicle, allowing them to sail under their own steam. The tanks could then be launched at sea to land on the beaches without risk to the landing craft, where the skirt would be dropped and the vehicle would operate as any other land tank of its class (Fletcher and Bryan 2006).

A series of live-fire rehearsals were held by allied forces in preparation for the D-Day landings in Normandy. One of these, 'Smash I', took place on 4 April 1944 in Studland Bay, Dorset (South West England, UK), where it was observed by VIPs from a specially built bunker—National Heritage List entry 1411809 (Historic England 2012). Although the beach and hinterland were not ideal in terms of geography, the site was relatively isolated for the South

Figure 18.1. Top: landing craft approaching Studland Bay during the Exercise Smash virtual experience; bottom: Swimming Valentine DD tanks trying to reach the beach. Image created by the Exercise Smash Development Team.

Coast of England, and it was therefore chosen to practise a full-scale multi-service beach assault.

The exercise plan was for the initial assault to be led by two squadrons of 4th/7th Dragoon Guards in their Valentine DD tanks. These were to launch 5,000 yards out from the beach, landing five minutes before the infantry. However, for reasons unknown, the tanks seem to have been launched in the wrong place and in unsuitable conditions, leading to the loss of six tanks and the deaths of six members of the crew. A seventh tank was also wrecked within Poole Bay; it was long thought to have been scuttled after the exercise, having run aground and drifted off at the next tide (Cousins *et al*. 2020), but new research is shedding doubt on this. In 1944, to avoid drawing attention to what was then a secret weapon, no efforts were made to recover the sunk tanks, and they remain on the seabed today.

In the post-war years, with the advent of scuba diving, the tanks soon became a popular and interesting dive site, and the majority of the non-ferrous metals and loose artefacts were salvaged by sports divers. The latter often included HE (High Explosive) ammunition, which were regularly left on Poole Quay. As a result, the MoD (Ministry of Defence) made the decision to render the wrecks 'safe' by blowing up the submerged tanks in 1987 (Philpott 2015). Two tanks were missed in this endeavour, but one was hit by a trawler in the 1980s, and the other was vandalised by unknown agents in 2022, leaving no complete tanks on the seabed today.

Poole's D-Day heritage–maritime archaeology

Without accurate navigation systems, the actual positions of most of the tanks were lost over time. In 2014, Bournemouth University's Maritime Archaeology department began a student project to locate and survey the remains of these vessels (Manousos 2014).

The first step for this project was to gather all of the reported positions for each tank (40 in total; BU Maritime Archaeology 2014) and input these into a geographic information system (GIS) for correlation with an accurate map of the seabed by the UKHO (UK Hydrology Office). This would enable an assessment of the known obstructions in the area, with the goal of reducing the number of potential targets.

Once a list of targets was produced, divers were sent down to survey the seabed and locate the obstructions, and for any found to be tanks, new confirmed positions were marked along with a basic record of the remains (MAST 2014).

The project resulted in the rediscovery of all of the tank wrecks (Cousins *et al*. 2020), and in 2018, during routine monitoring of the various wreck sites in Poole Bay, it was decided to create rapid photogrammetric models of the sites to act as a baseline for future surveys. As the sunk Duplex Drive tanks are among these heritage assets, Bournemouth University maritime archaeologists also returned to the tank wrecks and created photogrammetric models of the tanks (http://bumaritime.org/projects/duplex-drive-tanks/archaeology-of-dd-tanks/; also see Figure 18.2).

On 31 May 2019, Historic England—England's agency for the management and protection of historic sites, buildings and monuments—placed the sunk 'Valentine Tank Assemblage' (*i.e*. the remains of the Valentine tanks) on the National Heritage List for England as a scheduled monument (Historic England 2019), granting them protection by the state. Unfortunately, though, since the initial surveys in 2018, significant damage occurred to 'Tank 7' in 2019 and 'Tank 1' in 2022. This means the photogrammetric surveys from 2018 are now the most complete record of the sites which exist. As McAllister (2021) notes, an accurate photogrammetric record of an archaeological site can provide a valuable backup in cases where the original site has changed or been destroyed.

Exercise Smash virtual experience

We wanted to make these data available to audiences in a manner which improves on the traditional 'virtual dive trail' by employing our 'Snapshot in History' paradigm. Accordingly, in 2019, we initiated a student project (Anderson and Sloan 2020) to create the virtual heritage experience 'Exercise Smash'. This is organised as two scenarios presented to the audience/players. Implemented using the game engine Unreal Engine 4 (https://www.unrealengine.com), in the first scenario, the virtual heritage experience places audiences at the centre of the action of Exercise Smash I, challenging 'players' to launch a Valentine DD tank from a landing craft into Studland Bay and then 'swim' the tank to the beach, literally stepping into the shoes of the participants of the training exercise. In the second scenario, an immersive 3D virtual dive trail, audiences dive to the tank wrecks, where they can then explore the archaeological remains on the seabed. This is intangible-heritage-in-place (Kaufman 2013), which links places to intangible heritage such as memories of an event or oral histories. In the case of our virtual heritage experience, these are Studland Bay with the sites of the tank wrecks (place) and the story of the events of Exercise Smash (intangible heritage).

First scenario–a snapshot of 1944

As stated above, in the first scenario, 'players' taking part in the virtual experience find themselves in control of a Valentine DD tank on a landing craft in Studland Bay off Studland Beach, taking on the role of a soldier participating in Exercise Smash I. Their tasks are to launch the tank off the landing craft without damaging the canvas which keeps the tank afloat (DD tanks risked tearing their canvas if they hit the sides of the landing craft during launch) and then steer the tank towards the beach without it being swamped by waves and sinking (Figure 18.1).

Figure 18.2. Underwater Photogrammetry of the complete (before the damage that occurred during 2022) 'Tank 1' (Valentine MK-IX DD) at the bottom of Studland Bay (3D model of 3.3 million vertices in 6.6 million triangles). Without a fixed survey grid on the tanks, the 'rapid fire technique' developed by Daniel Pascoe (Pascoe Archaeology Services) and Bournemouth University was used, employing a goPro6 camera with a 105 degree fisheye lens. Four one-meter scale bars were placed around the site, and then with the goPro's time-lapse function, photos were automatically taken every second, with the diver slowly swimming over the site. The resulting photos were colour corrected using Adobe Photoshop and loaded into Agisoft Metashape where the images were further processed to mask out any undesirable features, such as the water column and fish, and to calibrate the lens to compensate for the wide angle which can cause issues with alignment. After processing and filtering with Metashape, the original photos were then used to create the texture-map. Finally, the model was scaled using the bars placed around the site during image acquisition before it was exported as a 3D object. Image created by the Exercise Smash Development Team.

Success or failure are not pre-determined, and depend on the interaction between the swimming tank, which a player controls, and the simulated waves of Studland Bay. Around the players, other tanks are being launched from landing craft and trying to make their way to the beach, with some of them sinking within the players' view; above them, fighter planes fly past, providing air cover for the exercise. The players see what the participants of Exercise Smash I would have seen; they experience what many participants of Exercise Smash I would have experienced, and, immersed in the scenario through this virtually shared experience, they gain an awareness of what happened back then and who this happened to.

To reconstruct the exercise as faithfully as possible, the construction of the scenario was guided by accounts of eyewitnesses to and participants of Exercise Smash, including oral histories, some of which have been previously reported (Cousins *et al*. 2020). The Valentine tank was modelled after reference drawings, blueprints and period photographs (Fletcher and Bryan 2006), as well as recent photographs of the only surviving Valentine DD in working condition (Figure 18.3), from which engine sounds were also recorded. The integration of the engine noise of a real Valentine DD tank facilitates a more authentic experience, one that is not just limited to 'sight' but which also includes 'sound' for greater immersion in the virtual scenario. Information about the landing craft involved in Exercise Smash—especially the tank transports—was taken from contemporary official documentation (ONI 1944).

For the creation of the interactive virtual environment, Studland Bay itself was modelled after maps, nautical charts and from visual references. The sea was added in-engine by applying an ocean shader which implements 'Gerstner Waves' (Williams 2017), allowing fine control over the roughness of the waves. For the interaction of the swimming tanks with the sea—*e.g*. splashes, as well as water breaching a tank's canvas and flooding the tank—a position-based fluid simulation (Macklin and Müller 2013) was used to pre-calculate cached animation sequences which are interpreted in-engine as geometry caches. These are instantiated in the scene, relative to the user-controlled tank, by triggers placed around the perimeter of the tank's canvas which detect collision with the ocean.

Second scenario–a virtual dive to the Valentine DD wrecks

In the second part of the virtual experience, users take a dive boat out into Studland Bay to dive to the tank wrecks, which they can then investigate (Figure 18.4). The navigation of the virtual underwater environment is not restricted, and players can freely explore it at their own pace. The wrecks are annotated with information about the archaeological remains, as well as historical facts about the use of DD tanks; this information is displayed to the user when an object in the virtual environment is selected. For this, the photogrammetric scans of the tank wrecks made in 2018 (Figure 18.2), as were mentioned in the section on 'Poole's D-Day heritage' above, were integrated into the virtual environment.

The photogrammetric scans of the tank models were of an extremely high resolution, so in order to integrate the archaeology into the virtual heritage experience, the 3D scans needed to be reduced to a more manageable topology for use in the virtual environment. To preserve visual fidelity, detail from the high-resolution tank models was baked into normal maps for in-engine use with these lower-resolution tank models. Distance field blending was used to create a smooth and unnoticeable transition between the scanned seafloor area around the tank wrecks

Figure 18.3. Top left: the last complete and working Valentine DD tank on Studland Beach in April 2019; top right: Valentine tank model (without canvas skirt); bottom right: Valentine DD model with deployed and fully raised canvas skirt. Image created by the Exercise Smash Development Team.

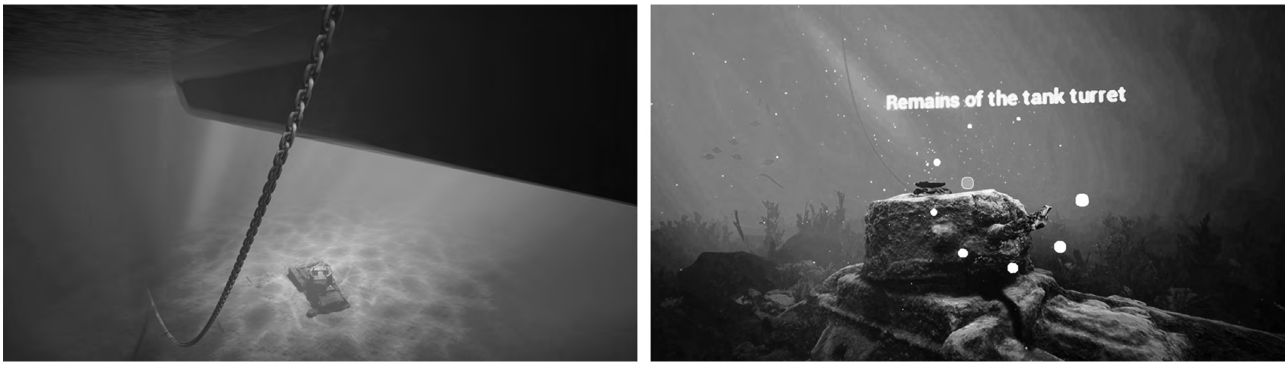

Figure 18.4. Left: view from the diving boat with the tank at on the sea floor below; right: investigating the wreck on the sea floor. Image created by the Exercise Smash Development Team.

and the remainder of the virtual seabed, where rocks and seaweed were placed to add realism to the environment using a simple procedural method based on pseudo-random number generation.

As the sea around the sunk tanks is rich in marine life and many of the species found in the neighbouring Poole Rocks Marine Conservation Zone (DEFRA 2019) are found around the tank wrecks, many of the marine species which inhabit the area around the tank wrecks were identified and modelled to provide a realistic impression of the virtual dive trail to players (Poole Rocks 2017). This made them a major feature of the underwater environment in the dive-trail scenario of our virtual heritage experience (Figure 18.5). To implement schools of these fish, similar to Liarokapis *et al*. (2017), we employed a Boids-style flocking algorithm (Reynolds 1987), with which we extended the Unreal Engine. Within the flocking system, fish models are animated as a looped swim-cycle using a motion path with a spine rig, with the fish models deforming by following this curve.

Discussion

While the project exists as a fully working prototype, it should be considered work in progress, as there are still a number of open questions and unresolved issues. The 'Exercise Smash' proof of concept was built without a specific means of deployment in mind, and with different possibilities kept open for future consideration, which use of the Unreal Engine 4 allows. This could be as a standalone computer game or even a VR experience—possibly set up as a kiosk-style system in a museum (Bruno *et al*. 2017, Deggim *et al*. 2017)—and deployment through a website, either as an online museum or as a virtual dive trail, is a distinct possibility. The virtual experience—especially the second part concerned with the virtual dive to the tank wrecks—was designed and built to present audiences with a rich and detailed virtual environment. This tends to require a fairly large display area, so typical screen size alone—not even taking into account the required GPU capabilities—would most likely be unsuitable for deployment of Exercise Smash as a mobile app for smartphones and tablet computers. The best mode of deployment may be determined by a future user study. Finally, since the development of our initial prototype, the more capable Unreal Engine 5 has been released, and porting the project to the newer engine might result in greater visual fidelity.

One benefit of choosing Exercise Smash as the content for our proof-of-concept prototype was the wealth of

Figure 18.5. Left: some of the distinctive marine animals that populate the sea around the tank wrecks: a) Black seabream (one of the most important species in the region), b) pouting fish / bib (found shoaling in large groups in the area), c) cuckoo wrasse, d) Dover sole, e) Baillon's wrasse, f) brown crab; right: several schools of fish, populating the virtual dive environment. Image created by the Exercise Smash Development Team.

information and documentation available on Valentine DD tanks, as technical drawings, photographs and moving images of Valentine DD tanks are available. Various military museums house intact Valentine tanks, and there even exists a Valentine DD tank in working condition (Figure 18.3), and some of the developers were able to take reference photographs of it, so there were no issues of reconstruction uncertainty when the submerged wrecks were reconstructed for the first part of the experience, presenting the snapshot in history. This circumstance was a luxury, when compared to many archaeological surveys such as marine excavations of unknown vessels which are hundreds of years old.

The choice of scenario was also fortuitous, as the subsequent damage to the wrecks in 2019/2020 and 2022 resulted in the photogrammetric surveys which were used as the basis for our virtual heritage experience. These provide the most complete archaeological record of the site, and they also now provide the only means for the public to experience the site in its original state—albeit virtually.

We presented the prototype of the 'Exercise Smash' virtual heritage experience at 'Tankfest 2019', a three-day event held at the Tank Museum (https://www.tankmuseum.org) in Bovington (Dorset, UK), where it was demonstrated to a large audience of museum visitors. The prototype generated a lot of interest among these visitors, especially the children, who were particularly fascinated by the first scenario (landing the tank on the beach). The positive reception the prototype received, along with the evident enjoyment of the people who engaged the virtual experience, was encouraging and inspiring for the development team. A further opportunity to demonstrate our prototype virtual heritage experience was the CAA-UK symposium (Anderson and Cousins 2019), where our prototype was experienced by other archaeologists.

The public demonstration was very useful, as—apart from the bugs which were discovered by the audience—it highlighted a number of issues for future consideration. For example, we quickly noticed the playtime was far too long for use in a public installation, as several children who were determined to drive the tank to the beach and `win the game' had to be convinced by their parents to leave before their tank reached the beach. The younger audience were particularly helpful in discovering bugs and game-play issues which should be addressed before the virtual heritage experience is finalised, such as player actions which had not been anticipated during development. For example, a bug which occurred when players tried to turn a tank on the landing craft before it had cast off the landing ramp was discovered by multiple children who tried out the prototype.

To provide an immersive experience of time travel, we believe, it is important to avoid mechanisms which obviously restrict the user's actions. This meant predetermined events had to be reduced to a minimum or their nature hidden. To achieve this in Exercise Smash, the determination of whether a user-controlled tank sinks or reaches the beach depends solely on the simulation of the sea in its interplay with the user's steering actions. By not specifying which historical tank is being controlled (*i.e.* a tank which sank or a tank which succeeded in reaching the beach), the problem of possibly altering history, as mentioned above, is avoided.

Conclusions and future work

We have proposed what we believe to be a novel mode of cultural heritage presentation using an interactive virtual environment which creates a strong synthesis of tangible and intangible cultural heritage, combining stories about and memories of a historical event with archaeological finds which are directly linked to the event. To prove the concept, we created 'Exercise Smash', providing audiences with the experience of taking part in the virtual recreation of the historical Exercise Smash I, a Second World War landing exercise with amphibious tanks, several of which sank during the exercise. The experience of actively participating in the (virtual) exercise keeps the memories of the event 'alive' by immersing audiences in it; they do not just passively witness it, but literally 'live' through it, thus virtually sharing the experiences of the soldiers who were there. The site of the present-day archaeological remains resulting from this event can then be virtually visited and explored during a virtual dive. As these archaeological remains have been damaged since the 3D data we used were recorded, the significance of our virtual heritage experience has increased, as it is based on data which provide the most complete record of the site.

Our approach extends beyond existing 'time travel' paradigms and has the potential to immerse audiences not only in history but in the resulting archaeology itself, creating a much richer virtual heritage experience. This type of 'Snapshot in History' makes use of and combines existing Virtual Heritage approaches in a similar manner to Duer *et al*. (2020), facilitating the experience of intangible-heritage-in-place (Kaufman 2013). Audiences are immersed in the past to convey the intangible heritage of a historical event, and in the present, they virtually explore a fully interactive related location, such as an archaeological site. We believe this approach can create new avenues for the public presentation, as well as dissemination of archaeology, and should be particularly suitable for maritime archaeology. Through this, we believe our 'Snapshot in History' paradigm can provide opportunities for advancing the field of maritime archaeology by explicitly linking the tangible heritage of the archaeological finds with intangible heritage of the history which created them. By experiencing the intangible heritage first hand—literally 'living' it—and actively engaging with the historical event, public audiences are given the opportunity to gain a better understanding of the history and the resulting archaeology, which, by extension, should lead to a better understanding of human life.

Future work on the 'Exercise Smash' project will, in its first step, consist of improvements to the virtual heritage experience by fixing the bugs and addressing the gameplay issues identified during the presentation of our prototype at 'Tankfest 2019'. For instance, during the public presentation of the virtual heritage experience, we noticed some interesting user behaviours when players engaged in the diving scenario, which suggested some form of disorientation, possibly due to the accurately simulated low-visibility underwater and a lack of kinaesthesia in terms of the viewer's position and orientation in the virtual environment. This warrants further investigation, as it has implications for scenarios dealing with virtual maritime archaeology, and might require a reduction of the simulated realism, sacrificing visual fidelity for the sake of 'playability' of the scenario. After this first step has been completed, we plan to conduct a set of focussed user studies to help decide the best possible form of deployment of our virtual heritage experience for public engagement, and to determine the efficacy of our 'Snapshot in History' approach on the public presentation of archaeology.

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Blue Growth meets Maritime and Underwater Cultural Heritage (MCH / UCH): overview of the situation of preventive archaeology in France

Nicolas Bigourdan

Abstract: This chapter presents an overview of how France has managed the protection of Maritime and Underwater Cultural Heritage (MCH / UCH) over the last three decades, in relation to the Marine Spatial Planning (MSP) and Blue Growth programmes, through developments in the field of maritime preventive archaeology.

In 2001, the National Assembly adopted a legal framework which defined the application of preventive archaeology on land and under water throughout the French territories. Initial cases were few, isolated and relatively unstructured; but some 10 years later, complex processes had been set in place, and the first official preventive maritime archaeology operation had been launched.

The implementation of MCH and UCH protection in a MSP and Blue Growth context has benefited from the contributions of operational teams, fieldwork means, procedures, technological advances and experience. Effective support of the mission of MCH and UCH protection in a MSP and Blue Growth context is a central objective of the programme in France, but increasing the cooperation, organisation, consideration and interaction among stakeholders is also crucial.

Introduction

The European Union (EU) defines Marine Spatial Planning (MSP) as *'a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives which are usually specified through a political process'* (Ehler and Douvere 2007: 13). This definition has created the framework within which Maritime Cultural Heritage (MCH) has developed its relationship with MSP. In this context, this chapter provides an overview of the path taken nationally by France over the last 30 years to develop the link between MSP and MCH through its preventive archaeology system and capabilities (within the maritime environment), which is also known as rescue archaeology or development-led archaeology.

The origin and definition of 'Blue Growth'

The term *'*Blue Growth*'* has never had an agreed-upon definition, despite its extensive use, because it has gathered a large and diverse set of meanings and approaches which vary according to context (Eikeset *et al.* 2018: 177). However, the origin of the concept is related to the idea of sustainable development which emerged internationally in the 1960s (Eikeset *et al.* 2018: 177). Following a series of major international conferences centred around this idea since the 1970s, in 2012 after the development of the concept of Green Growth, a similar term focussing on the ocean (Blue Growth) emerged. This term (which was derived from the larger concept of Blue Economy, an umbrella term for economic activities involving ocean resources) was initially used in Europe as part of the Europe 2020 strategy. The Blue Growth initiative began in 2014 when a directive from the European Parliament and the Council of the European Union established a framework which emphasized the importance of marine areas for innovation and growth in specific sectors and increased the focus on MSP and coastal protection (Legat *et al.* 2015: 13).

General context and limitation

In order to contextualise the activities under consideration, the European Commission identifies five main maritime sectors within the realm of Blue Economy or Blue Growth. These five sectors are renewable energy, mineral resources, aquaculture, tourism and biotechnology.

Unfortunately, from a heritage perspective, these large categories, as defined, make very little-to-no direct reference to the role and contribution of MCH to European Blue Growth (Firth 2015: 10). Indeed, in associating heritage with tourism, the European Commission has not positioned it with sufficient strategic importance. However, the diversity, nature and level of relationship between marine industries and MCH long predates the Blue Growth concept, and accordingly, it has been the subject of multiple mitigation strategies in many EU countries. This includes France, which has created a dense and centralised network with multiple diverse layers of stakeholders. Further, these relationships currently continue to evolve as part of the United Nations (UN) Decade for Ocean Science (2021–2030) initiative, which emphasises the importance of ocean science in sustainable development. As part of this multidisciplinary approach, archaeologists can take advantage of a larger and more influential engagement through the wider ocean scientific community in addressing more complex issues.

From global to national, and from terrestrial to maritime

On a global scale, the impact of development on cultural heritage has increased noticeably, and as a result, it started to be taken into account more actively in the 1980s. Within many European countries, regardless of the approach and pace chosen, rescue or development-led archaeology initially focussed on terrestrial cultural heritage, before adapting the terrestrial approach to MCH. In France, a strong legal turning point was provided by the 2001 inclusion of a detailed section on preventive archaeology within the Heritage Codex. Nonetheless, enforcement of the protection of MCH impacted by maritime development has generally been slower, compared to its terrestrial counterpart. The reason for this is simple: beyond the observable impact of maritime development on MCH, such industrial projects have offered and are offering within their geographical context new opportunities to access archaeological contexts, fund fieldwork operations, and make interesting discoveries. In addition to the 2001 legal evolution, the administrative processes surrounding this aspect of the archaeological discipline in France has been considerably strengthened since 2019/2020, allowing the system to function in a more satisfying manner. In addition, from an employment perspective, a steady growth has been observed in the number of professional archaeologists working in maritime preventive archaeology in both the public and private sectors.

The specificities of a French paradigm

General principles

In order to understand how France has tackled the necessary development of preventive archaeology, it is essential to emphasise that the French system for protecting cultural heritage from developmental impacts has been framed by two guiding principles. The first is the 'polluter pays principle', which is largely derived from environmental law. It was adopted by countries from the Organisation for Economic Co-operation and Development (OECD) at the first UN conference on sustainable development in 1972, and ratified by the EU in 1986 through the signing of the European Unique Act. France later introduced this concept into national law by including it in the 1997 Environment Codex. France adapted this notion to preventive archaeology, in order to make the party responsible for damaging the historic environment additionally responsible for paying for the damage done.

The second principle which has guided the development of the French legislative and administrative framework of preventive archaeology is the idea that as a discipline, it is fundamentally anchored to the economic life of the country. Despite multiple concerns and debates around the idea of including preventive archaeology into the realm of MSP, its inclusion was a real breakthrough because it permits archaeologist to participate actively in development projects without slowing them down. Consequently, this system allows archaeologists to study and safeguard cultural heritage as an active step of the economic development and growth. Linking preventive archaeology with the MSP process has provided archaeologists with extensive access to vast areas of investigation, affording the possibility of safeguarding numerous archaeological sites and artefacts for the public and future generations.

Critical juncture

Beyond the principles shaping the foundations of preventive archaeology in France, several additional factors have contributed towards the emergence of a new paradigm in the past several decades, resulting within the French Heritage Codes in the structure and framework of this discipline. These can be listed as follow:

- First, there was a need to end the legal uncertainties associated with the 1941 French law on 'rescue archaeology'. These uncertainties were creating conflict between stakeholders, weakening the entire system of safeguarding cultural heritage and not allowing sufficient opportunities for analysing archaeological results derived from rescue archaeology operations.
- Second, there was an obligation to ensure the stability, compatibility and transformation of the amateur rescue archaeology operational institution entitled Association Française pour l'Archéologie Nationale (AFAN). Since 1973, this organisation has been solely focussed on the implementation of rescue excavations.
- Third, France had the opportunity in 1992 to sign the European convention on the protection of archaeological heritage in order to build upon an agreed set of regulations. This convention was ultimately ratified by the EU in 1995 in Malta.
- Finally, the Competition Council and the Ministry of Culture both published studies on preventive archaeology in 1998. These studies highlighted an unnecessary and unhelpful monopoly situation, as well as the need to improve global heritage protection, public service and scientific objectives.

Legal and financial framework

Combined with the guiding principles mentioned above, these factors allowed for the formalisation of a section in the French Heritage Codex dedicated to creating a legal and administrative framework for preventive archaeology. Upon its adoption in 2001, this framework has shaped French law on preventive archaeology (Delestre 2021), through the creation of Section Five in the Heritage Codex.

Preventive archaeology is described in the Heritage Codex as a public service mission on land and under water which aims at detecting and preserving or safeguarding by study the elements of the archaeological heritage affected or likely to be affected by public or private development. Preventive archaeology also aims at ensuring the interpretation and dissemination of results obtained and their public release for the benefit and understanding of general audiences.

As a consequence, from a marine environment point of view, the French Ministry of Culture bears scientific responsibility for the study and conservation of MCH sites and artefacts preserved on nearly 18,000 km of coastline and the millions of square kilometres of open ocean (or sea) associated with mainland France and the French overseas territories. In the French maritime space, from coast to abyss, the Département des Recherches Archéologiques Subaquatiques et Sous-Marines (DRASSM) is the service which monitors submerged heritage on behalf of the State.

However, the initial application of the law was beset by several limitations and difficulties, including a high volume of activity, low financial support and insufficient interactions between stakeholders. Accordingly, the law had to be amended to address these issues. An updated version was signed in 2003, and it included the following necessary elements:

- an organisational structure which further detailed the State's role and control
- a financial structure which established adapted fees and support funds
- a monopoly status of the preventive archaeology operational institution modified to bring it into conformance with EU competition laws

Developing maritime preventive archaeology in France

2001–2003: A new era and new roles

As previously mentioned, the period 2001–2003 marked a crucial and essential turning point in protecting archaeological and cultural heritage impacted by terrestrial and maritime development across the French territories. Despite slow enforcement (especially in the maritime environment), these new rules have represented a positive development because they take into consideration the constraints and obligations of all stakeholders, including the State, local authorities, developers and archaeologists. Moreover, a network of archaeological scientific commissions (both national and regional) has become unavoidable, as the commissions provide essential expertise, advice and decisions at the heart of the French archaeological system, encompassing both planned and preventive archaeological initiatives as two faces of the same coin. In this context, preventive archaeology also has the mission of reconciling the requirements of scientific archaeological research and heritage preservation, without impacting economic growth or terrestrial, coastal or offshore development.

In France, DRASSM is the heart and soul of maritime archaeology. DRASSM was created in 1966 by the writer and intellectual André Malraux, who at the time was the French Minister of Culture. Since 1966, DRASSM has been responsible for archaeological scientific research and administration across the whole of the French maritime territory. This role includes the inventory, study, protection and conservation of all maritime heritage sites and artefacts throughout the world's second largest (after the United States of America) maritime space, an area which measures approximatively 11 million km2. As a consequence of the new framework created in the Heritage Codex, in 2001 the DRASSM formally assumed the new role of ensuring the implementation and execution of its legal obligations in preventive archaeology across the entire French maritime space. This new role implies that DRASSM administratively manages files related to development projects, investigates and analyses associated data and plans, implements scientific and technical control of archaeological operations (and to a certain extent, the conduct of some operations) and oversees the treatment of artefacts, materials and documentations collected.

2011–2021: New start for maritime preventive archaeology

Despite the official inclusion of maritime preventive archaeology within the new legal framework in place since 2001, the reality is that little activity occurred in this sector during the first 10 years. The main reason for this situation was the lack of human and technical resources dedicated to maritime preventive archaeology. However, the 2010 decade would prove to be very different. This was the result of strong structural changes which can be listed as follows:

- **2011:** Although a few development projects implying maritime preventive archaeological investigations have taken place in France since the period 2001–2003, one of the first truly important maritime development projects to receive substantial preventive archaeological attention began in 2011. This project consisted of a coastal road built partly over water in La Réunion, an island in the Indian Ocean, which is a French overseas territory. The size of the project raised sufficient concerns from local and national authorities that the decision was made to implement and closely follow the preventive archaeology framework for both the terrestrial and maritime components of the project.
- **2011:** The Institut National de la Recherche en Archéologie Préventive (INRAP), as the national operator, created a section for subaquatic operations. Within the context of the framework established by the 2001 Heritage Codex, this initiative provided a new, sustainable human resource dedicated to maritime preventive archaeology operations, which was the first of its kind to be stood up in France.

- **2012:** The DRASSM launched a new, large-scale (36 m) operation vessel, named the *André Malraux*, to respond to maritime operational needs for both planned and preventive archaeology. The *André Malraux* assumed the mission of a previous asset, the old and long-abandoned *Achéonaute*. In conjunction with this new asset, the DRASSM also created an active underwater robotics branch to develop new research and development (R&D) and innovative capabilities with the goal of reaching even deeper sites (ones well beyond the limits of human diving) with remotely operated vehicles (ROV) (Figure 19.1). Combined with appropriate geophysical tools, the *André Malraux* and the ROVs have provided DRASSM archaeologists with extended abilities in support of diverse endeavours, including preventive archaeology. My colleague Denis Dégez provides up-to-date details of these advances in a chapter in this volume.
- **2012–2014:** The initial launch and development of the Offshore Wind Farms (OWF) programme in France led to necessary changes within the Heritage Codex. Wind farms, as large-scale industrial projects, were recognised as having the potential to threaten the financial equilibrium of the maritime archaeology preventive system. Accordingly, in 2014, the DRASSM created and tested a new operational option, a more adaptable and flexible type of investigation called *'*evaluations*'*.
- **2014–2019:** A steady but constant increase in the volume of development projects being assessed archaeologically was observed as part of the maritime preventive archaeology framework. In 2019, INRAP, as an operator of diagnostics, initiated internal structural changes in the organisation of its subaquatic section, giving it renewed human resources and capabilities in order to respond to both the increased volume of activity and projected future challenges.
- **2021:** Following the *André Malraux* in 2012 and the 15 m *Triton* in 2015, the fleet welcomed a new 46 m vessel named the *Alfred Merlin*. The *Alfred Merlin* has the capability to travel to French overseas territories, as well as deploy ROVs to depths of more than 2000 m.

The operational procedures

To fulfil the obligations specified by the Heritage Codex, the French maritime preventive archaeology system offers three different types of procedures, which respond to various preventive archaeological scenarios. In general, these procedures allow either conservation by study or ensure that remains preserved in situ are avoided during development:

- **Diagnostics:** Established in 2001, diagnostics are generally put into place as part of the permit approval process as each new development project is authorised. When implemented, diagnostic procedures have the goal of detecting, identifying and characterising the presence of potential archaeological remains before any development take place. In the maritime environment, diagnostics are exclusively entrusted to INRAP, the national preventive archaeology operator, but they fall under the administrative and scientific control of DRASSM, the organisation responsible for prescribing diagnostic operations for the detection of archaeological heritage within the planned and expected footprint of a development project. Their implementation, which is similar to diagnostics applied in a terrestrial context, must follow predefined stages, including investigation, intervention proposal, operation and report. In a maritime context, these projects can concern port developments (as for example, the extension of Port-la-Nouvelle along the coast of the Mediterranean Sea), energy production and transport, telecommunications (such as the *'*Amitié cable*'* which lands on the coast near the Bordeaux region) and marine aggregate extraction.
- **Excavation ('Fouille'):** Also established in 2001, preventive excavation can be prescribed immediately or following the results of a diagnostic. To date (as of 2022), preventive excavations in the maritime environment have been prescribed but not implemented. However, they have been actively pursued since 2017, first in conjunction with a port development project in Corsica, followed by another port development project in Gironde near Bordeaux in 2021, and more recently with another port development project in Martinique (a French overseas territory in the Caribbean). Identical in structure to the terrestrial version, an excavation has the objective of collecting and analysing data about the site under investigation. Excavations are open to competition between public and private operators, and they may be conducted by INRAP, a commercial company or even a local public service as approved by the Ministry of Culture. They involve a strict step-by-step procedure including investigation, call for tender, operation and report.
- **Assessment ('Evaluation'):** Established in 2014, assessment is a procedure exclusive to the maritime environment. It is equivalent to a diagnostic as defined in the Heritage Codex, allowing the developer, when possible, to anticipate the formal procedure. Conducting an assessment is also equivalent to an *'*impact study*'* on cultural heritage according to the Environment Codex. Assessments concern only projects which cover an area beyond or crossing the first nautical mile zone (wind farm, energy cable, extraction, *etc.)* and which have, by their size, the potential to jeopardise the financial equilibrium of the system. This procedure is negotiated on a case-by-case basis by the DRASSM, and approved projects fall under its responsibility. Assessments combine the collection, study and analysis of geophysical survey data with in-situ expertise conducted either by ROV and/or divers. Assessments highlight and characterise the elements of the archaeological heritage potentially impacted by development, as well as define avoidance zones around the archaeological remains to preserve them from the

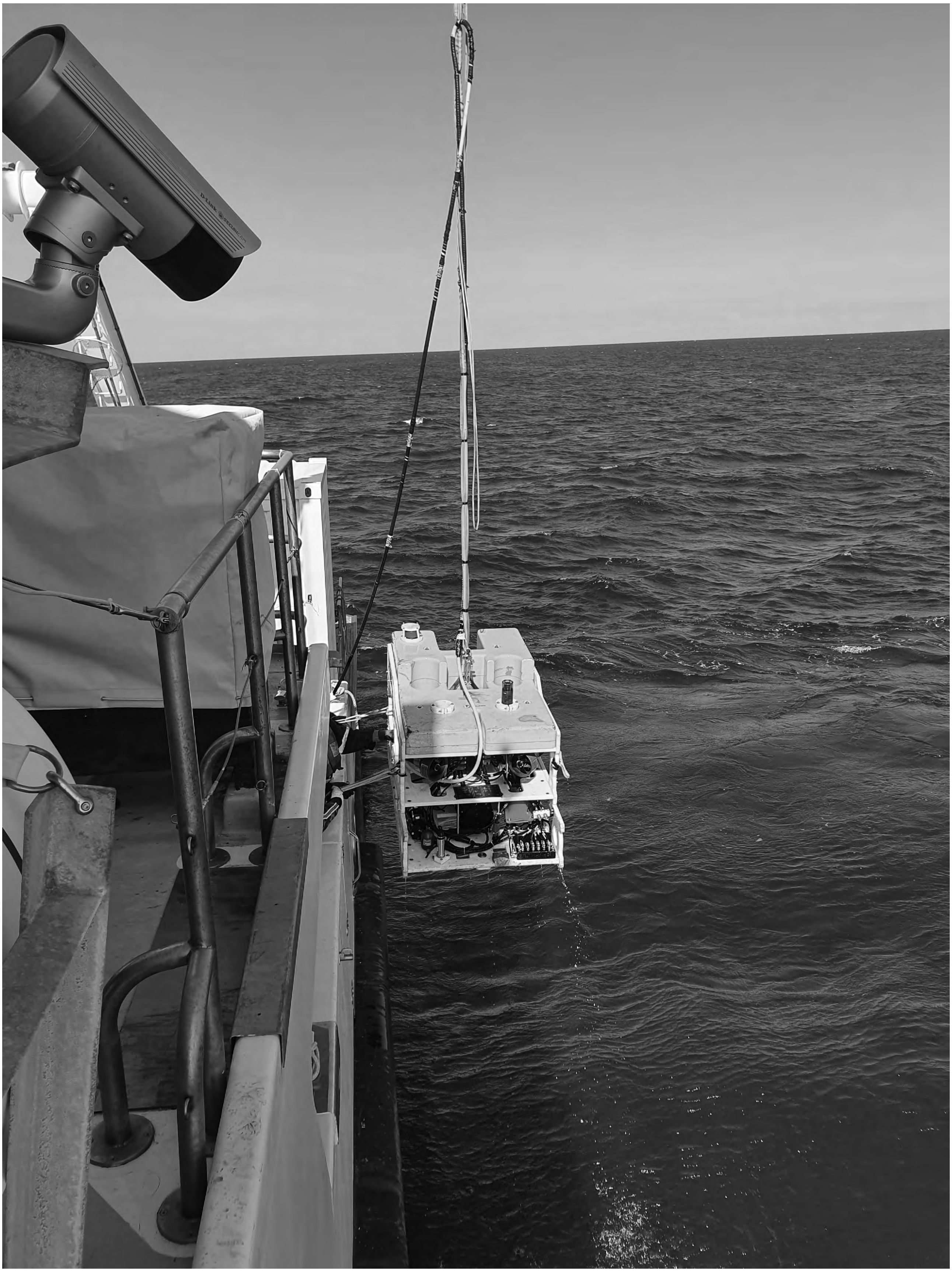

Figure 19.1. ROV being launched from the DRASSM ship *André Malraux* off the coast of Brittany in 2021. Image by N. Bigourdan, copyright DRASSM.

impact of development. For example, for the right-of-way of cables and wind turbines, the offshore project known as Île d'Yeu and Noirmoutier, off Saint-Nazaire (Figure 19.2), combined detection and verification of identified anomalies. Similar projects included the Courseulles wind farm in Normandy and a power cable in Corsica. Results are presented in a public report.

Projects and evolutions

Ports / wind farms / cables / aggregates

Given the many development projects along the country's coastline and maritime zone which are potentially subject to the implementation of the French maritime preventive archaeology system, the DRASSM has faced a diversity of challenges based on the different nature of each industrial infrastructure, which can be listed as follow:

- **Ports and coastal developments:** These projects tend to encompass a large diversity of infrastructure and activity types, including jetties, dredging, pontoons, moorings, *etc.* They also happen to have been the first type of maritime development taken into account within the context of the maritime preventive archaeology system, and as such, they have been subject to much attention over the last two decades. One of the earliest examples is the project of Le Havre Port 2000 in Normandy. Another, more recent example is the extension work of Port la Nouvelle near the city of Narbonne along the Mediterranean coast. Due to their location close to the coast, this type of project always and only falls under the diagnostic procedure, with the possibility of expanding efforts to a preventive excavation when the results of the diagnostic indicate the need for further investigation.
- **Offshore wind farms:** By their nature, location and size, these large-scale projects have precipitated the need to create a viable process which initiated the procedure of evaluations. Since 2022, new and similar projects have entered a new era, one characterised by higher volume. While the last decade saw tenders for only five projects, another five were recently announced, and there are more to come with a national scheme which aims to achieve energy independence within the next couple of decades. Among the first examples of OWF to have been launched are the ones near Saint-Brieuc (Brittany) and Noirmoutier (Vendée). As previously mentioned, because of their location and size, these projects are assessed archaeologically within a preventive context only through investigations undertaken as part of an evaluation.
- **Energy and telecom cables:** This new breed of maritime industrial project appeared on the scene of French maritime preventive archaeology in late 2019 as part of a new initiative to renew submarine telecom cables. Even if energy cables are slightly different (because of some legal exemptions), the challenge for

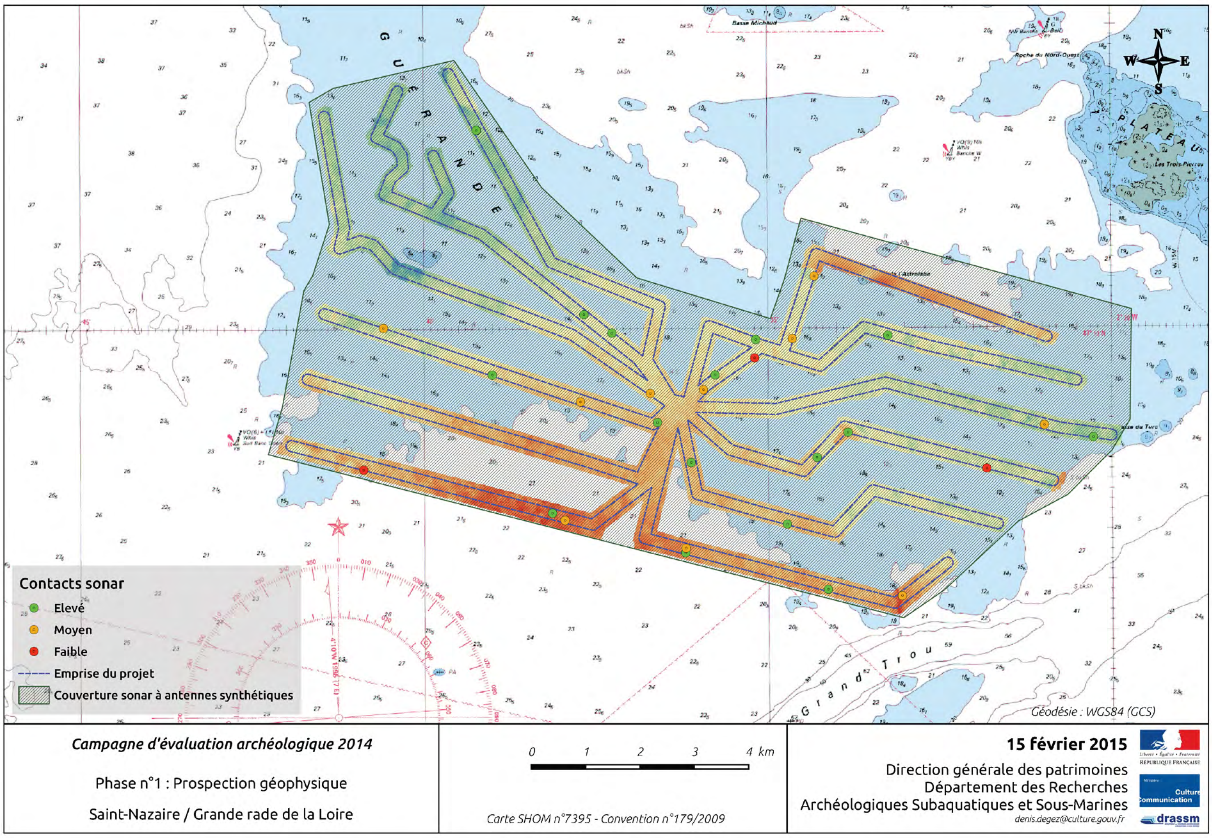

Figure 19.2. Map made in 2015 showing the location of geophysical anomalies over the area of a future offshore wind farm near the city of Saint-Nazaire. Image by D. Dégez, copyright DRASSM.

these projects emerges from the political weight and financial oversight of these international ventures, a circumstance which necessitates various levels of negotiation, as well as raising the awareness of the need for heritage protection among developers. The first example brought to DRASSM*'*s attention was the *'*Amitié*'* cable landing near Bordeaux. A more recent telecom example is the 2Africa cable system project in Marseille. Here again, because of the nature of this type of development project, the evaluation procedure is often the best option, even if circumstances and schedules sometimes allow only a diagnostic to be considered as an option.

- **Marine aggregates:** Marine aggregate projects are occurring where sand and gravel deposits are found on the inner continental shelf. Projects falling under this definition are appearing more often along the Atlantic and Channel coastlines. From its inception, this type of development has strongly resisted the idea of collaborating with scientific stakeholders of the maritime preventive archaeology system in France. The financial constraints claimed to be applied towards these ventures have often been brought forwards in order to gain wide political support for completing these projects, while at the same time avoiding interactions at all levels with the organisations which protect maritime heritage. Because of the lobbies, few archaeological investigations have been conducted. So far, no preventive archaeological responses have been implemented or even accepted by developers. There is a significant and pressing need to develop new ways of communicating and raising awareness of the value of MCH among marine aggregate developers. These mechanisms could help renew the dialogue and mutual understanding between stakeholders.

Geophysics / robotics / vessels

In order for DRASSM to fulfil its mission objectives, some of the operational challenges generated by the maritime preventive archaeology system have required the widening of an already diverse set of field implementations, including:

- **Geophysical capabilities** (Figure 19.3) were initiated over 20 years ago. However, they were firmly established for use as a part of preventive archaeology only in 2012, and they were later included as part of the evaluation process. The available technological resources (*e. g.* Side-scan Sonar, magnetometers,

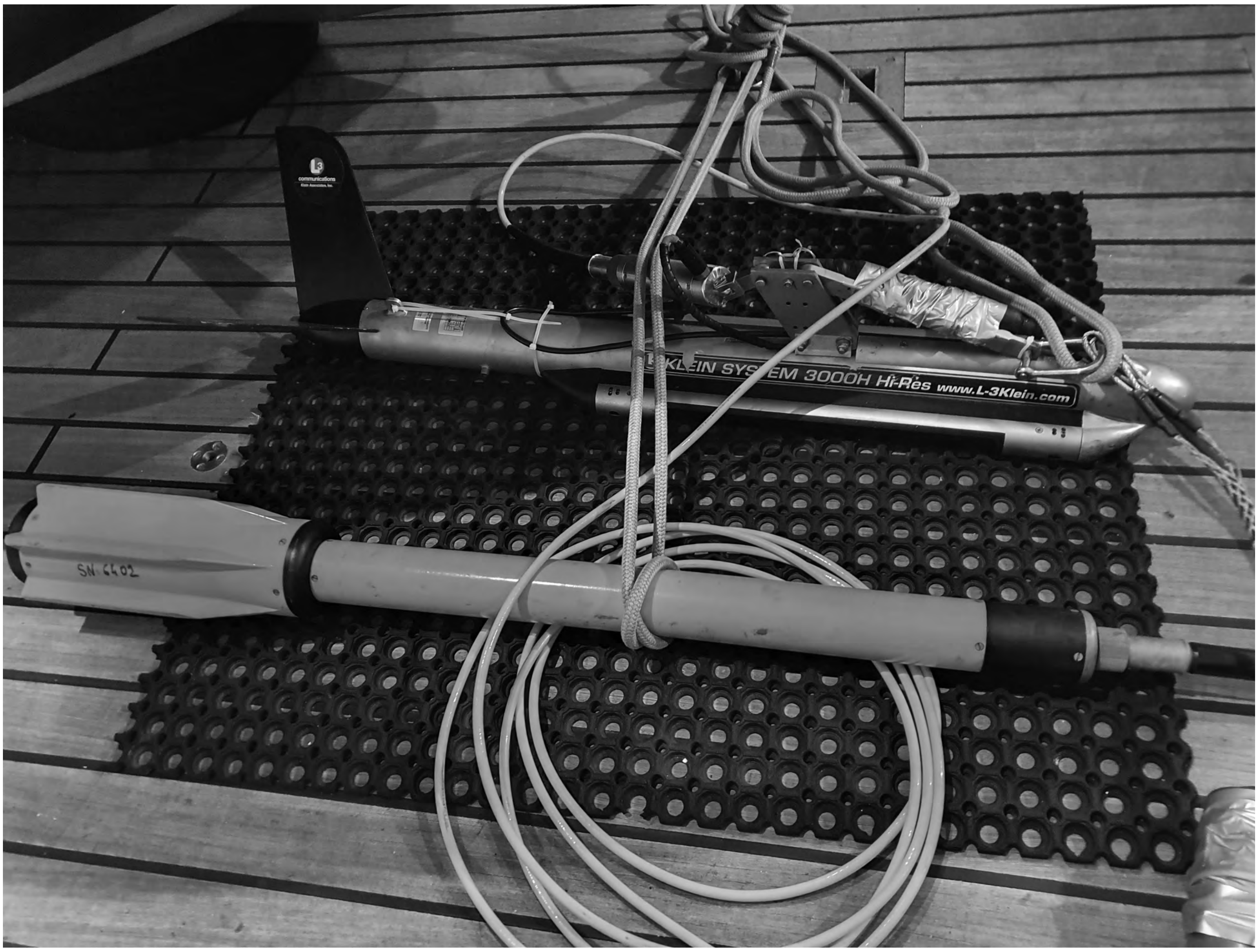

Figure 19.3. DRASSM's Side-scan Sonar and magnetometer on the rear deck of the *André Malraux* in 2022. Image by N. Bigourdan, copyright DRASSM.

Multibeam Echo Sounder) have been growing gradually but steadily, and the initially limited human resources were recently doubled. In term of remote sensing, developments include the recent addition of drones for survey, detection and photogrammetry along shallow waters.

- **Robotic capabilities** are a central component of a larger strategy initiated in 2006 which had the objective of increasing human abilities beyond their physiological limits. Through the collaborative efforts of several robotics university laboratories from France (*e. g.* LIRMM of Montpellier) and abroad (*e. g.* Stanford University), ROV and robots (including humanoid robots which provide their human pilots with haptic feedback, like OceanOne) have been created or are being developed. These assets are also being used regularly for the purposes of preventive archaeology. Recent technological advances have included an ROV with the ability to operate at greater depth.
- **The fleet of ships** are the heart of operations. The current fleet is the result of multiple, sustained efforts to secure the financial support necessary for building and operating three floating platforms. The launch of these three vessels has multiplied the capabilities of interventions throughout France, and they will soon support deployments to French overseas territories. Over the past 10 years or so, these vessels have met the challenges and strengthened the operational capacities of research conducted under the purview of the Ministry of Culture. Two deep-sea vessels, the *André Malraux* and *Alfred Merlin* (Figure 19.4), together with the small unit *Triton*, have been designed to support the prerogatives and goals of the State in terms of cultural heritage, particularly in the case of infrastructure installations and the exploitation of natural resources.

Results and perspectives

Avoidance and discoveries

Because the mitigation strategy aims to protect MCH while supporting industrial development, the easiest and often preferred option is implementing an avoidance zone around a site of archaeological interest discovered as part of a preventive investigation. But this is less true for the diagnostics process, where in-depth analyses tend to occur more often, than the evaluations process, where a sense of urgency may lead investigations towards simple characterisations.

Figure 19.4. The DRASSM ship *Alfred Merlin* entering the port of Marseille in 2021. Image by N. Bigourdan, copyright DRASSM.

However, during approximately 15 years of diagnostics and eight years of evaluations, almost 100 preventive archaeology operations have been implemented within a maritime context, of which more than 60% occurred in the last five years (Bigourdan and Leroy 2022: 250). This recent linear intensification of the volume of activity is accompanied by an increase in the number of finds and discoveries (Figure 19.5), including both sites and isolated objects, despite a slowly improving ratio between the areas investigated and discoveries. This point is explained by the intrinsic nature of this type of investigation, which does not target areas of archaeological interest but is rather orientated by the locations of the industrial projects.

Future developments, horizons of improvements and cooperation

This branch of preventive archaeology is dedicated to evaluating and mitigating the impact of development on heritage in the maritime environment. It is gaining momentum, mainly through structuring and the relations between actors in the sector (*e. g.* instructors, prescribers, operators, developers). However, it remains in a state of significant flux in striving to be able to respond effectively to all the identified challenges.

Figure 19.5. Stone anchor found during an evaluation operation off the island of Noirmoutier, photographed in 2019. Image by C. Lima, copyright DRASSM.

The forecast for future maritime developments in France shows a continuous increase in the number of planned OWF and submarine cable projects, as well as an increase in the diversity of project types with new technologies such as wave, tidal and current energy-collecting turbines. This trend will continue to increase the need for preventive archaeology to be implemented and maritime heritage to be protected over the next few years or even decades.

With an increase in the number and diversity of preventive archaeology projects, several complex cases have tested the limits of the system, and have also pushed DRASSM to find new solutions and analyse and learn from its past performance. One new horizon of improvement among others, already underway, is focussed on further developing the identification of paleo-environments as part of preventive archaeology investigations, through an increased inclusion of geotechnical and sub-bottom profiler data, and better collaboration with the marine aggregate industry.

Beyond the evolving field of French maritime preventive archaeology, the DRASSM's mission is and also remains to protect the maritime cultural heritage and to support the scientific aspects of these investigations. In this context, DRASSM also aims to promote and support archaeological research in a multidisciplinary way and with continuity between land and sea, as well as all the actors involved in the marine environment.

Conclusion

To conclude, it is important to remind the reader that the regulations relating to preventive maritime archaeology are binding on all developers, even if there are specific exemptions for fishing operations and the laying of communication cables. Funding for assessments, like excavations, is provided by the developers. Shipwrecks and coastal sites have been identified, and preventive excavations are looming. For the time being, project modifications or the avoidance of characterised anomalies have made it possible to preserve cultural heritage as it currently exists, without harming it, and thus preserve archaeological resources for the future.

Detecting, studying, documenting, preserving and promoting cultural heritage remains an ongoing challenge which takes on its fullest meaning in the context of regional planning and major consumers of non-renewable heritage (Garcia 2021). It is therefore no longer a question of a scientifically thematic choice, but of the application of a public research policy in the general interest. By small touches which are almost pointillism, cultural heritage is revealed in context. History thus resurfaces from the soil, between sea and land.

Acknowledgements

I would like to thank Hanna Hagmark, executive director of the Åland Islands Maritime Museum, whose words (posted at the entrance of the museum's main exhibition) inspired me to remember why I do what I do. I would like to quote what she said:

> 'We are the people of the sea; The sea is our way; We live with, off and on the sea; We know that the sea gives and takes, isolates and connect; The sea is in our past and in our future; The sea is here and now.'

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In the beginning was muteness: approaching an anonymous shipwreck via poetry

Katariina Vuori

Abstract: In this chapter, I present a poetic approach to examining meanings and verbalising affections in maritime cultural heritage. As an example, I explain the conduct of 'From wreck to poetry' workshops organised at the IKUWA7 Congress and how the poems and poetry can be analysed through a three-stage metaphor analysis and free association. My motivation was to explore how a structured-poetry exercise works when the subject of the poem is an old wreck. What would be the response to a mix of archaeology and poetry, and would a creative approach stimulate, inspire or change the descriptive vocabulary regarding a wreck? Can we use poetry to add meaningfulness to the extended biography of an archaeological object?

Workshop participants included experts of maritime and underwater cultural heritage management, maritime historians and underwater archaeologists. They found the method to be easy, useful and fun, and a great tool for bringing new insights on how the material culture can be approached and interpreted beyond the objective, academic tradition. A word analysis of the poems demonstrated that creativity increases the diversity of descriptive vocabulary and that metaphors allow the viewer to venture beyond the obvious materiality. This study suggests the structured-poetry method could facilitate a multilevel cultural heritage discourse among different stakeholders.

Introduction

My research object is a seventeenth-century shipwreck, the Hahtiperä wreck, discovered in Oulu, Northern Finland in August 2019. It is the oldest surviving wreck discovered in Northern Finland so far. Traditionally, the biography and storification of wrecks from a historical period are based on archaeological and multidisciplinary research and written sources. These processes sum up as a narrative, which can be told to other researchers and to the general public in a storytelling format. Such narratives traditionally justify the value, or lack thereof, of a relic.

The usual sources in wreck research for identifying and building up the biography of a vessel from a historical era include the physical remains and their context, typology, written documents such as customs declarations and interdisciplinary research such as dendrochronology for dating, as well as provenance and ethnography. Sometimes the wreck site includes artefacts or human and/or animal remains, which open up a whole range of interdisciplinary research methods (Muckelroy 1978; Rönnby 2014). A well-detailed, vivid and in some cases exciting background of a wreck profits the scientific field, adds to the object's value and helps in capturing the curiosity of the audience.

The Hahtiperä wreck is a mute, 'paperless' and anonymous passenger from the past. No cargo or written documents are related to it. In my research, I study whether creative methods can add substance to the extended object biography of the wreck, transfer knowledge and engage different stakeholders to express their subjective views on cultural heritage through personal encounters with the relic. In this chapter, my focus is on structured poetry generated through the image of this particular wreck, and on the literal or metaphorical meanings the workshop participants used to describe the wreck.

The combination of arts and creativity is an emerging transdisciplinary practice of experimental heritage work and museum pedagogy (*e.g.* Renfrew 2003; Van Dyke and Bernbeck 2015; Bailey 2017; Kavanagh 2019; Bailey *et al.* 2020; Petersson and Burke 2020). When I took on my dissertation work on the wreck of Hahtiperä in 2022, I wished to contribute to the 'afterlife'—the post-excavation period of the wreck's object biography—by engaging the general public in the creation of the wreck's narrative, its life story. I also hoped I could give the general public a chance to see authentic pieces of the wreck, interact with them through slow, sensory archaeology and add to the multivocality when assessing the values and meanings attached to the wreck.

'Slow archaeology' is a method for archaeological object observation (*e.g.* Caraher 2016; Mol 2021). The origin of the term is unknown, but the concept has emerged alongside a broader 'slow movement'—a cultural shift towards slowing down life's pace—and 'slow science', which is a counterreaction to the increasing requirement to produce scientific information faster (Caraher 2016: 422). Caraher calls for slowing down in archaeology, stating that modern digital appliances have changed how archaeologists document and explore excavation sites (Caraher 2016: 421).

Slow science is thought to have roots in Asian and especially Japanese way of focussing on objects (Mol 2021: 80). In my research, the concept of slow, sensory archaeology means prolonged lingering with authentic cultural heritage, using all senses and non-curated approaches.

Creativity enables nonintrusive exploitation of cultural heritage and creates a common, equal arena for the consumers of archaeology—experts and non-experts—to share their views of cultural heritage, values and signification. In my work, the ethical thinking is guided by UNESCO's Faro convention, also ratified by Finland. Article 4 states that 'everyone, alone or collectively, has the right to benefit from the cultural heritage and to contribute towards its enrichment', and the public should be allowed to approach the cultural heritage work in a versatile manner (Council of Europe 2005).

In this chapter, I first look at the object through traditional disciplinary lenses, and then I take a glimpse at the academic discourse around arts, creativity and archaeology. After that, I explain the conduct of structured-poetry exercise used in the IKUWA7 Congress and give an example of how we can process poetry through a word analysis. I end with a discussion of the broader implementation of the poetry exercise and how we can use poems to approach past societies.

Background and research environment

Paperless from the past

The wreck of Hahtiperä (Figure 20.1) was discovered in the city centre area of Oulu, Northern Finland during a hotel renovation in August 2019. The hotel had been built in the beginning of the 1970s. Part of the renovation plan was the renewal of heating and sewerage pipes. The construction area was the backyard of the Radisson Blu hotel, situated at the street address Rantakatu 1 in Oulu. In the vicinity are the main library of Oulu, the city theatre for performing arts and the market place.

Due to previous archaeological excavations (Kallio and Lipponen 2005; Pesonen *et al.* 2015) conducted nearby, it was expected that remains of old piers and waterfront storerooms might be found. In the spring of 2019, before the hotel renovation, the Finnish Heritage Agency carried out test excavations at the construction site. Older cultural strata and log structures of old piers were indeed detected (Riutankoski 2019: 2). Therefore, two archaeologists from the Finnish Heritage Agency were tasked to observe the construction project from its very beginning. On the second day of the project, pier planking was revealed, and carved and curved timbers emerged underneath. The digging was interrupted once the timbers were identified as a ship's hull.

Based on the location, depth of the items discovered and technical features of the wreck such as the use of wooden pegs and clenched iron nails to fasten the timbers, the wreck was estimated to date from the seventeenth to the eighteenth centuries. The shape and width of the hull structure, along with the thickness of the planks, provided preliminary indications of the type of vessel. The vessel was classified as a barge, a type of a cargo ship. The cultural heritage authorities of the Finnish Heritage Agency subsequently issued a protection decision for the wreck (Riutankoski 2019: 14).

Figure 20.1. The Hahtiperä wreck (two views) was discovered from Rantakatu 1, downtown of Oulu. The excavation took place in the backyard of the Radisson Blu hotel. The wreck was embedded in an ancient seabed of an old harbour, the Hahtiperä harbour. Photos by: Matleena Riutankoski, Finnish Heritage Agency.

The wreck was embedded in an ancient seabed of an old harbour, the 'Hahtiperä harbour'. The port was already in use by the time the city of Oulu was founded in 1605, and until 1724, it was the main port of Oulu and the main logistic centre of tar export in Northern Finland (Lithovius 1878: 2; Murman 1914; Hautala 1975: 7). Over the decades, the harbour shallowed due to land uplift and sediment which was carried to the harbour basin along the river Oulujoki and other minor waterways. In the nineteenth century, the harbour area was landscaped to be a recreational park (Hautala 1975: 64; Hautala 1976: 286). Due to the post submerging processes, the excavation of the wreck could be carried out by using land archaeology methods.

During the two weeks of fieldwork, a 10.5 metres-long and 4.4 metres-wide section was excavated and documented (Riutankoski 2019: 7). No mast, mastfoot or rigging was detected. The only artefacts found during the excavation were two pieces of chalk pipe, but it is unclear whether they were related to the wreck. Samples of the wreck were sawn at the site for dendrochronological analyses. The date of construction of the wreck was specified as after 1684. The trees used to build the ship were identified as pines. Based on the annual tree ring chronology, their provenance is Northern Finland, possibly Ostrobothnia or Northern Ostrobothnia more specifically (Aakala and Wallenius 2019: 3).

After excavations, all visible parts of the wreck were removed from the site. A so-called 'block piece', which displays the complete, remaining structure of four arched beams, the hull planking, keelson and bilge, is currently undergoing conservation process at the Finnish Heritage Agency's Conservation and Collection Centre in Vantaa (Riutankoski 2019: 16). The block piece will be set on a display in the museum of Northern Ostrobothnia in Oulu in 2026. The rest of the wreck pieces, numbering over a hundred, are not preserved and are not intended to be displayed.

The wreck of Hahtiperä is an anonymous wreck, 'paperless from the past': no artefacts have been identified to the wreck's context, and no written sources have been connected to the wreck. Its pre-excavation biography can only be narrated by reflecting on the general knowledge of the seventeenth and eighteenth centuries' Nordic clinker vessel building and seafaring history (see *e.g.* Kaila 1931; Greenhill 1976; Litwin 1991; Adams 2003; Eriksson 2010), together with information derived through archaeological and interdisciplinary research methods of the wreck's structure and building methods. In addition to on-site documentation, the wreck has undergone a thorough photographic, photogrammetry and scanning documentation and interdisciplinary research. Additional dendrochronological samples are to be taken to define the construction time more precisely. Additional information regarding the building techniques is expected to emerge through research lead by maritime archaeologist Minna Koivikko at the Finnish Heritage Agency.

Value-setting and narrative

What value does an anonymous, cargoless, mastless and humble barge hold in comparison to the 'treasure ships' and grand ships with interesting, well-detailed biographies? Traditionally, the value of an archaeological object largely depends on how well its history is known and whatever larger context it can be placed in. In wreck research and popularisation, the emphasis is frequently on large war or merchant ships with known historical background and/or valuable cargo. The most featured wreck in Finland—both in research articles and popular publications—is *Vrouw Maria* (Ilves and Marila 2021).

Many maritime related cultural resources are important to individuals or communities simply because of their existence (Claesson 2011: 68). Thus, maritime archaeological sites, shipwrecks, historic waterfronts, cultural landscapes and coastal and submerged prehistoric archaeological sites provide knowledge and understanding of socioeconomic and intercultural structures and processes. They also provide insights into the relationships between humans and the marine environment, to forest exploitation, trade, communication and shipbuilding techniques, as well as to relations between people and societies (Muckelroy 1978; Rönnby 2014; Lehtimäki *et al.* 2018).

Historic ships can be associated with symbolic significance and as embodiments of many of the qualities which modern societies want to project, such as entrepreneurship, inventiveness, technological knowhow, courage and globality. Nationally, maritime heritage can magnify the historical importance of a nation or a community (Wickler 2019: 435; Hickman 2020: 401–402, 411).

Economic value of cultural heritage can be counted in money: are there valuable metals or other goods involved? What is the economic value of cultural heritage when represented in a museum (Claesson 2011: 63)? Cultural heritage can also be valued through rarity, identity, its pedagogical possibilities or information produced by the object. Research can alter the nature of cultural heritage and its value classification, by either increasing or decreasing the value (Enqvist and Niukkanen 2007: 11–12; Mason 2008: 102, 104–105).

Cultural heritage can represent intangible, sentimental and long-term social and economic welfare benefits, as well as metaphorical and subjective values, interpretations and meanings. I attended the two-week excavation of the Hahtiperä wreck. For me the most memorable and striking feature of the wreck was the smell: the thick and smoky scent of tar oozing from the timbers. I thought I caught up something extraordinary from the past—namely, the very same scent experienced by those who applied the black gold some 300 years earlier.

Cultural resources retain a great deal of 'intrinsic historic, artistic, social, spiritual, and symbolic qualities valued by society, which are not readily observed in markets' (Claesson 2011: 63). Nonmarket values can be determined in large part by consultation with stakeholders (Claesson 2011: 67). In regards to ownership, cultural resources may be seen as public goods (Navrud and Ready 2002). This shared ownership of different interest groups—experts, general public and the cultural heritage object—can require some balancing when defining, interpreting, valuing and dictating cultural resources and cultural heritage. In the centre of the debate is the question as to what extent the experts alone should decide the museum parameters (Whitcomb 2003; L. Smith 2006; Simon 2007).

One solution to softening the boundaries between experts and lay communities is acknowledging there might be different interpretations—multiple ways of seeing, valuing and consuming cultural heritage (Scott-Ireton 2007: 20–21; Friel 2014: 9). By integrating creative and scientific visions to museum narratives, we can create an inspiring environment to express cultural pluralism (Wickler 2019: 437).

The function and essence of cultural resources should be non-exclusion, meaning the general public and communities should not be excluded or prevented from receiving benefits provided by a cultural resource (Claesson 2011: 64). Combining traditional value-setting and inclusive processes, both top-down (expert values) and bottom-up (public's values), adds transparency to decision-making regarding common cultural heritage (Claesson 2011: 74).

Anthropologist Janet Hoskins suggests the 'life story'—the way an object's biography is narrated which can even be partially fictional—can increase the object's value (Hoskins 2006: 81). Minna Koivikko examined wreck biography and related perspectives in her dissertation. She suggests the life story of a ship or wreck can continue in diverse manners, even after its 'death', and the discovery of a shipwreck can open up a whole new chapter (Koivikko 2017: 37).

Over hundred pieces of the Hahtiperä wreck will not be preserved or curated in a museum. Claesson (2011: 67) states that 'maritime cultural resources have few direct or extractive uses'. I suggest that non-intrusive, creative and public-engaging methods could be an ethical conduct to enrich the extended object biography, especially in the case of non-curated, perishable, organic and waterlogged timber, which will not last for future generations. Giving the public and community a chance to mingle with authentic products from the past could give them a sense of a personal interaction with past peoples and societies.

Poetry and creativity in archaeological narrativisation

Minna Koivikko's (2017: 37) notion of a 'wreck's afterlife' and how its post-excavational events can enrich its biography gave me the impetus to study the Hahtiperä wreck with the aid of creativity and, in this chapter more specifically, through structured poetry. Here, poetry and creativity have a dual role, first, as a facilitator and a form of expression when narrating cultural heritage, and second, as an output—narrative—for different stakeholders' thoughts and affects regarding cultural heritage, in this case, a nameless wreck.

It is impossible to benchmark the starting point of artists' getting inspiration from archaeology or when creative methods were used for the first time either in archaeologists' own research processes or as a bridge between the general public and cultural heritage. Stories have acted for thousands of years as vehicles for knowledge and beliefs, morality and both individual and collective identity (Kavanagh and Chodzinski 2004: 8).

Through art—in this case, word art—it is possible to strengthen and produce information which falls outside the traditional scientific discourse (Lehtimäki *et al.* 2018: 12). In poems and lyrical representations, we can express qualities of affect and complicated emotional experiences which are otherwise difficult or impossible to represent (Jones 2006: 789; Aitken 2014: 14, 21). In word art, the text is saturated through the life story of the writer. Poetics is a process of sensing 'who we are and where' (Rothenberg 1976: 10).

The functions and impacts of literature and writing—prose, poems, biographies, *etc.*—are related to selfhood, human and environmental relationships, consideration of ethical issues and the integration of previously learnt and experienced to new perceptions (Ihanus 2009: 20). Expressive writing and narrating help to process information that we receive through our senses. In words and sentences, we express our worldviews and compare our own perspectives to the perspectives of other people and society. When writing takes place in a group, the shared texts open up a platform for dialogue and a comparison of subjective experiences (Bamberg 2006; Ihanus 2009: 23, 25).

Archaeological research is often creative and has similarities with fictional narration: in the beginning, there is a mute object. Block by block, through research, a story starts to emerge. As archaeologist Rosemary A. Joyce (2008: 4) noted, 'Archaeology at its best is like storytelling'. Over the past decades, storytelling has gained awareness, especially in learning and education (Kavanagh and Chodzinski 2004: 8).

Collaboration and interchange between artists and archaeologists have proliferated from the beginning of the twenty-first century (Bailey 2017: 246–247, 249; see also Renfrew 2003; Van Dyke and Bernbeck 2015; Kavanagh 2019; Bailey *et al.* 2020; Petersson and Burke 2020). Bailey suggests that archaeologists themselves should also venture in their work past the discipline's boundaries, 'let-go beyond […] to find new places (both physical and conceptual) in which to work that were beyond the traditional limits, boundaries and discourses of archaeology but also of art. That other space has been poorly peopled' (Bailey 2017: 249).

Bailey encourages the use of archaeological artefacts appropriated from museums or other cultural heritage institutions as the raw material for artistic processes such as exhibitions, performances and publications which take place in non-academic locations (Bailey 2017: 255). Already, the wreck of Hahtiperä has experienced an extraordinary post-excavation life. Non-curated pieces of the wreck were lent to Oulu-based Flow productions and repurposed in an immersive performance 'HYLKY' in 2020. This kind of artistic use of cultural heritage is unusual in Finland, and it was made possible with the courageous and venturesome attitude of the Finnish Heritage Agency, and especially, the aforementioned Hahtiperä wreck's research project manager, Minna Koivikko.

The wreck of Hahtiperä has also given inspiration to two other artistic ventures: '20×26' Twitter artwork (Vuori 2019–2020; see also Vuori 2024) and artist Susanna Sivonen's paintings for the Radisson Blu Oulu hotel, in whose backyard the wreck was discovered. '20×26' Twitter artwork was implemented as a collaboration between the Oulu Writers' Association and Oulu2026 European Capital of Culture Foundation. Artist Susanna Sivonen's 'Osa sesonkia' (2020) painting for the Presidential Suite of the Radisson Blu hotel and digitalised prints of her paintings 'Radisson Bloom' (2020), 'Radisson Aurora' (2020), 'Radisson Huurre' (2020) and 'Radisson Cold' for the standard hotel rooms all include visual elements inspired by the wreck.

Alternative representations such as storytelling, visual arts and drama are all used to support traditional archaeological methods in conveying information to the non-specialist public (Van Dyke and Bernbeck 2015: 2). Memory, individual and collective, shapes the frames of an arena for cultural participation (Brockmeier 2002: 23). By adding creativity to the process of explaining or interpreting the past, we could have a bigger impact on contemporary communities and audiences (Bailey *et al.* 2020: 5).

When experts utilise experimental narrative methods in their own work, they challenge the traditional academic demand for the pursuit of objectivity. With the parallel use of creativity, they can find new answers to questions and ways of thinking—and notice, perhaps, there might be more than one story which fits the archaeological evidence (Praetzellis and Praetzellis 2015; Van Dyke and Bernbeck 2015: 3–4).

Sherry-Ann Brown (2015: 1) writes that poetry improves 'critical skills in imagery, metaphor, analogy, analysis, observation, attentiveness, and clear communication', and she points out these skills also aid in learning, problem-solving, processing observations and making assumptions. For generations, there have been rhymes and versed stories for the intention to transfer knowledge. Dante's 'La Divina Commedia' (1320) is a masterpiece of prose poem, but it is also flirtation between poetry and science: the afterlife described by Dante's verses is a representation of the Mediaeval worldview, the state of science in Dante's era.

The roots of scientific poetry are far reaching: the poems of the Roman philosopher Lucretius gravitate around the nature of the universe, and in the Romantic and Victorian eras, scientists frequently expressed scientific—also archaeological—observations in poetic form (see *e.g.* Midgley 2001; Jackson 2008; D. Brown 2013). In the twenty-first century, one can find poems on human anatomy, chemistry, astronomy or Earth science on the web (see *e.g.* Mr R.'s World of Science).

Poetry has been and is being used as a method—both in the research process and as an output: an abstract or an entire report can be formulated in the form of a poem (*e.g.* Langer and Furman 2004; Faulkner 2005; Neilsen 2008; Faulkner 2009; Illingworth 2016). In education and social work, poems have been used, for example, to express the emotions of a dead child (Jones 2006) or describe bicultural experiences (W.N. Smith 2002).

There are several neuroscience studies on the effects of poems in the brain (see Hough and Hough 2012; Vaughan-Evans *et al.* 2016). These studies reveal that poetry and the drama of poems not only benefit health, learning and personal growth, but also stimulate the right brain's area linked to autobiographical memory. Through poems, readers or listeners are able to reflect on their own experiences when reconstructing the knowledge gained from the poem.

Poetry workshops in IKUWA7

I organised five 'From wreck to poetry' workshops at the IKUWA7 International Congress for Underwater Archaeology. There were approximately 150 participants in the Congress, of whom 24 participated in the workshops (as discussed below). The workshops were part of the official congress schedule. Three of the workshops were organised in time slots between the main seminar programme, and two after the seminar sessions at the end of the day. The workshops were advertised in billboards of the venue site and in social media. The purpose of the workshops was to have a test run of the structured poetry method, to find out how it works when the focus is on a wreck, and how experts adapt to the poetic approach.

My professional background is in writing, poetry therapy and expressive arts, and I was therefore interested in exploring whether the combination of an anonymous wreck, creativity and expressive arts could open up new approaches and new ways to verbalise individual meanings and affects regarding the wreck. I think this is one way of preserving cultural heritage; 'verbal conservation'. In creative writing and poetry therapy, one of the goals is to verbalise feelings, life occurrences and life narratives, and reflect on the world around us. Writing is always a personal output, a valuable subjective work. When people write, they document life. In expressive arts—unlike the fine arts—the outcome is not subjected to artistic critique. The 'beauty' of the outcome is not what matters; more important are the process and the meaning of the outcome, and the types of ideas and interpretations, both individual and shared, the text brings up.

I wanted to opt for a creative writing method which would be best suited for the repeatable workshop purpose and for stakeholder groups of various backgrounds and ages. Fictional narrative texts (*e.g.* short stories) more or less based on historical facts seemed too heterogenous and too time consuming. Such texts would also have been too demanding as a tool for use by small children or people with no experience in writing fiction. I therefore decided to use the structured-poetry exercise. It is a relatively quick method and suitable for comparative research, since all the poems are created within the same parameters. Structured poetry is also easy: the youngest participants I have used it with were two years old. (Naturally, an adult wrote down the children's words.)

The interest in structured poetry lies in the words which describe the object of the poem. The object can be the writer himself or herself, another person, landscape, *etc.* In this case, the object is the Hahtiperä wreck. The poetic result can be words with literal and semantic meanings ('it is a wreck'), figurative parables ('it is sleeping') or metaphors ('she is autumn'). Figurative and metaphorical verbalisation is especially useful when we study, express or deal with abstract and emotional matters (Glucksberg 2008: 69; Lakoff 2008: 33).

To ensure the participants were familiar with and focussed upon the poem's object, the wreck of Hahtiperä, a four-

Verbal instructions:

The poem focuses on the wreck of Hahtiperä. The exercise starts with blank papers.

Writers are instructed to leave ca 10 cm marginal to the left side of the paper.

"I ask you to write down words that describe the wreck. Write down the first word that comes to your mind."

1. First line: write down **A NOUN** that describes the wreck.
2. Second line: Describe the wreck with **THREE ADJECTIVES**. Do not use a colour.
3. Third line: What does the wreck do? Write **TWO VERBS** with an -ing ending.
4. Fourth line: Write down **A COLOUR** that describes the wreck and **AN ANIMAL** it resembles.
5. Fifth line: Write down your **FAVOURITE SEASON** and your **FAVOURITE PLACE**.

When the five lines are ready, the participants are instructed to write **SHE/HE/IT IS** to the 10 cm blank marginal in the left side of the paper and **IN/ON/AT** on the fifth line between season and place.

(10 cm marginal)			
Line 1 (she/he/it IS)	A NOUN		
Line 2 (she/he/it IS)	1. ADJECTIVE	2. ADJECTIVE	3. ADJECTIVE
Line 3 (she/he/it IS)	1. VERB+ING	2. VERB+ING	
Line 4 (she/he/it IS)	1. COLOUR	2. ANIMAL	
Line 5 (she/he/it IS)	1. SEASON	**(IN/ON/AT)**	2. PLACE

Figure 20.2. Structured poetry exercise conducted in IKUWA7 Congress. Created by Katariina Vuori.

minute slideshow with details of the wreck and its discovery was shown at the beginning of the workshop. A timelapse video of the removal of the wreck (shot by Mika Friman from Museum and Science Centre Luuppi of Oulu) was part of the slideshow. This clip nicely showed the excavation site, as well as size, structure and condition of the wreck. To add a sensory dimension, the workshop room contained three authentic pieces of the wreck's planking with wooden pegs attached to them, as well as a bag with pitch and moss caulking from the wreck. Indeed, the pitchy caulking brought to the venue the scent of tar as was experienced in the excavation.

After the slideshow, the participants had a moment to study and interact with the authentic pieces of the wreck and smell the caulking before they were seated for the structured-poetry exercise. 'Privacy notice for scientific research' and 'Research participant consent' forms were distributed. The participants were instructed verbally through the exercise process.

There are many different structural-poem methods. The one I chose for this venue is a very simple one, in which words describing the wreck are written on lines. The last line is a personal one, adding a subjective dimension to the poem. When all the words have been written on the lines, a reference to the wreck ('she is', 'he is' or 'it is', depending on the participant's choice) is added to the beginning of each line. This addition changes the position of the object to the subject of the poem.

A total of 24 persons attended the workshop. Seventeen participants gave permission for their poems to be documented by photographing. The instructions were given in English. Six participants chose to write the poem in their native non-English language. When the poems were ready, the participants had the option of reading their poems aloud. Five declined to read. One participant asked me to video his performance of reading his poem aloud.

Analysing the poems

The poems are narrative data, which can be analysed and studied in diverse manners (Bengtsson 2016; Baranik *et al.* 2018; Bhatia 2020). Here, I will analyse the selected poems with two methods. First, I will focus on two poems and on one verse in each of them, and I will run them through Sam Glucksberg's metaphor analysis. Second, I will use free association on a selection of 17 poems. These methods are described below in greater detail.

The words the participants chose to describe the wreck could be analysed and processed further in various manners. In longer workshops, for example, the process could include discussion of the poems and the words, and their significance, themes and metaphors. A technique called

Figure 20.3. Three authentic plank pieces of Hahtiperä wreck and caulking material added a sensory dimension to the poetry workshop. Photos by Katariina Vuori.

Figure 20.4. Participants in the 'From wreck to poetry' workshop in IKUWA7. Twenty-four people attended the workshop. Photo by Katariina Vuori.

looping could also be included. In the looping technique, the written text is used as a material for successive texts. The writer could, for example, choose one verse from his or her poem, and then use it as a starting line for a new poem, short story, autobiography or even a novel.

Glucksberg's three-stage analysis

Since the process and sense of structured poems lie in the chosen words and what they represent or tell about the subject, I chose to analyse the poems with a three-stage word analysis formulated by Sam Glucksberg, a pioneer of psycholinguistics (Glucksberg 2008: 67–68). The three stages are: first, derive the literal meaning of the utterance; second, assess the interpretability of that meaning in the utterance context; and third, if the literal meaning does not make sense in context, search for a nonliteral meaning which does.

The following verses of two poems were used in this analysis:

Poem 1:

It is an assembly
It is waterlogged and fibrous
It is aging, floating, breathing
It is ocker [light brown] water dragon

Poem 2:

It is the sky
It is intense and profundo [deep]
It is sailing, swimming, living
It is a blue-green octopus

Let us focus on the first line of Poem 1: 'It is an assembly'. In the first stage (= derive the literal meaning of the utterance) of Glucksberg's three-stage analysis, we can agree the wreck is an assembly of carved timbers, planks, wooden pegs, wrought iron nails and caulking material. In the bigger picture, the wreck is an archaeological find, submerged in an old harbour, in the vicinity of the city centre of Oulu, situated in the shores of the Gulf of Bothnia.

We can go further and move towards a more holistic interpretation, even at a metaphorical level: the wreck could also be an assembly of knowledge, motivation and the knowhow of past humans, an assembly of cultural interaction, an assembly of old wood and modern archaeological interpretations, a manifestation of dreams, hopes and dormition, disappearance and forgetting.

When the words do not make literal sense, we can approach their meaning through a nominal metaphor survey (Glucksberg 2008: 68). We will focus on similes, and run the words through a comparative test. If we pick up the verse 'it is a green-blue octopus' and run it through Glucksberg's three-stage analysis, we can see the comparison is not true in a semantic sense. The subject of the poem is a barge type, clinker-built vessel, not an octopus. We can then open up a dialogue: what does the writer mean when she or he calls the wreck an octopus?

We know that octopuses are ocean creatures. They have eight limbs, a bulbous head and three hearts. They tend to hide and camouflage. They are predators. They are a little bit shy and mysterious. They have the intelligence of a four-year-old. We could discuss the possible similarities between a wreck and an octopus. Is it the head, the hiding or the camouflaging to the ground? Octopuses squirt black ink—could that be an allegory of the smoky tar applied on the ship's timber? How about the eight limbs? Could this detail lead to a dialogue about the complicated webs of seafaring, trade, forest exploitation, technology, shipbuilding knowhow, motivation, everyday life and the people behind this chipped, carved, joined, clinkered, tarred sea creature which once floated in the harbour of Oulu?

Free-association analysis

Next, I will go through some selected poems using the free-association analysis. I will focus on word choice and general feeling or ambiance, looking for differences and similarities. I will focus on lines 1–4, leaving out the last stanza where the author connects the essence of the wreck to the author's own favourite place and time of year.

The participants were asked to choose which personal pronoun (he, she, it) they wanted to use for the wreck. The most commonly chosen were 'it' (6) and the feminine 'she' (6), the neutral and genderless Finnish word 'hän' (3) and the masculine 'he' (2).

Instead of or in addition to the metaphor analysis, poems can be processed through free association of the thoughts evoked by words and their combinations, both spontaneously and affectively. The poems can be thought of having been born through the metapoetic reflection described by Gaston Bachelard (1993): the object of the description—in this case the wreck of Hahtiperä—is the base, principal element from which the mental images are created. The text has picked up ideas not only from

She is a dream
she is gentle and deep
she is gazing, thinking, rising
she is blue lion
she is Spring in a Greek island

She is wood
She is soft and old
She is hiding, sleeping, waiting
She is a brown cat
She is Summer under the water

It is a plank
it is thick and squared
it is sailing, running, floating
it is brown oak
it is Spring on a rocky beach

It is a plank
It is rotten, decayed
It is lying, resting and analyzing
It is brownish fungus
It is Autumn at coast

She is a sail
She is bold and old
She is missing, singing, sleeping
She is green blackbird
She is November in archipelago

It is a jigsaw
It is anticipating and hopeful
It is leaping up, embracing nervously
It is an orange crocodile
It is Autumn inside chessgame

She is timber
She is broken and musty
She is disintegrating, wallowing, hiding
She is a brown wombat
She is Summer in Cyprus

She is swamp moss
She is slick, smooth
She is gliding, glistening, sihhing
She is rusty orange goose
She is Summer in pool.

Figure 20.5. Examples of IKUWA7 poems. Copyright by the authors.

the wreck, but also from the author. The words have been filtered through sight, experience, knowledge, olfactory senses, cultural meanings and the author's personality. In exactly the same way, the gaze, touch, experience, knowledge and purpose of the ship's builders have been recorded on the form of the wreck: its shape, material, purpose and the traces of work visible on the surface of the wood, both successes and failures.

In free-association analysis, words can still be interpreted concretely or, for example, intertextually and symbolically. In free association, the outcome is the reader's own; there is no right or wrong. Next, I will go through a selection of poems verse by verse using free-association analysis.

Verse 1: The noun that describes the wreck, an idea of what the object is

The nouns used in the poems are varied by nature. Some words have concrete meanings and arise from matter or form (log, plank, timber, wood, assembly). Others are more abstract, metaphorical or symbolic words (sky, dream). The wreck is described as 'a puzzle', 'a city', 'swampmoss', 'a tree', 'a barn', 'a surprise', 'a teacher', 'a collection', 'a bed', 'a cobblestone' or 'a rattan chair'. None of the nouns refer to the essence of the subject (wreck) as a mode of transport (for example, 'ship', 'boat' or 'barge').

With the exception of four words (sleep, sky, surprise, teacher), all the nouns used were descriptions of matter, many of which were very strong and sturdy (wood, barn, cobblestone, log, plank). Puzzle, barn, rattan chair, city and collection have an air of complexity, and they consist of multiple parts. In one verse, '*he is a teacher*', a professional title is attached to the wreck, and the wreck is given the role of an information distributor and a pedagogue. Thinking more deeply, 'teacher' can also embody a life guide, a guardian of sorts: the wreck knows something more than the watcher, the archaeologist or the audience does. In viewing the wreck as a teacher, there is something that is meant to be shared: perhaps new knowledge, wisdom, experience or awakening?

The poem 'He is a teacher' continues:

'He is friendly and fresh
He is breathing, diving and relaxing
He is a light yellow snake'

When the words friendly and fresh, breathing, diving and relaxing are considered together with 'teacher', the wreck takes the character of a calm guide and mentor, with positive pedagogy and a sense of newness.

Nine of the nouns used in the first verse refer to material. In terms of material, the wreck is compared to wood, rattan, stone, sedge, swamp moss. Viewed through Glucksberg's (2008) metaphor analysis, log, wood and plank are true in a literal meaning, as they are concrete terms and describe the realistic manufacturing material of a wreck. 'Swampmoss' could be connected to the visuality of the wreck: the planks in the water containers are covered with fine, furlike fluff. The moss may also be traced back to the caulking which was seen and smelled in the poetry room.

'Stone' creates a static, stationary and strong stamp on the wreck. A stone does not float, but it sinks. Cobblestone also refers to walking: cobblestones are used to pave roads, and in the city where the wreck was found, Oulu, there are many cobblestone streets, including near the discovery site. Cobblestones have a practical meaning in walking, or perhaps they might pave the passage from present to past.

The Finnish word 'lätty' can refer to a pancake-like fried product, or also to flatness. When the lätty poem is examined for the second and third stanzas, its connection to the form is strengthened:

'He's a pancake
He is flat and moist
He hangs out, waits, has time
He's a cloudy flounder'

'He's flat' and 'He's a cloudy flounder' give the idea of a flat, platform-like shape. This form also came out in the video about the wreck: the wreck has decayed, and it lost the shape of a pod-like or an oblique vase-like ship. Just like the flounder, the wreck also lies flat in the bottom of the excavation site, cloudy and covered with sand. Lätty, flat and flounder make the wreck passive and perhaps also lazy. Lätty can also refer to something which has gone wrong: the ship is no longer doing its job, but has sunk.

Among the nouns, 'city' opens up many options for interpretation: is the wreck a complex, functional and scenic, logistical and multi-functional centre? Administrative region? Or can the 'city' be the cause and consequence of the wreck's activity: the wreck was discovered at a waterfront town, and it was built approximately a hundred years after the founding of the city of Oulu (1605). Proximity to the sea gave birth to the city, maintained it, helped it grow, created movement away from the city and into the city. As an idea, 'the wreck is a city' makes the wreck a public, functional, dynamic and changing urban manifestation. It connects the city to the shore and the continent, the state and its various functions: the economy, technology, knowledge and skill, the polyphony of society and numerous different levels, language and culture, structures, laws, people and the environment.

'Sleep' and 'sky' are essentially light and floating, limitless, self-determined, changing, but still permanent. Their materiality is difficult to touch, smell or taste. As a metaphor, the sky can refer to, for example, freedom, infinity, death and the afterlife, eternity, the condition of life through the air we breathe, permanence, gliding, flying and possibilities ('the sky is the limit').

'Sleep' is the opposite of waking. Before being discovered, the wreck was in a dark, dreamlike, lightless state. A dream is made by images, it is movie-like and produced by the subconscious. Often, we cannot remember it, or it returns to the mind only in fragments. A dream has its own mind and will. Sleep is nocturnal, and opposite to wakefulness. It cannot go on forever, unless sleep is used as a metaphor for death ('eternal sleep'). A dream is a state which is not real. A dream emanates from the one who 'sees' it, the dreamer. Dream is associated with visuality, inaccessibility and a kind of innocence. Dream is spoken of as an omen, but it can also be a repetition of things which have already happened. As a nightmare, it is distressing, persecution and fear.

'He is a surprise'. 'Surprise' as a noun describes the wreck as something dynamic, and positive rather than negative. Experiencing surprise requires an event, and the 'surprised', an outsider who experiences surprise. Or perhaps the wreck is the one which is surprised: it had slept, dreamed, lain flat for 300 years, but all of a sudden, there is light, the roaming of machines, the noise of people talking, touching, ripping it apart.

Maybe 'surprise' refers to the unexpected archaeological discovery, revelation from within the soil. The wreck's existence was not known until the earth had been sufficiently excavated. The surprise of the wreck takes the reader's thoughts to the enigmatic nature of the poem's subject and also the object. The wreck can be a phenomenon, as long as there is someone to experience the phenomenon. The encounter between the author of the poem and the wreck as a surprise could indicate a birth of a new idea.

This poem continues:

'He is a surprise
He is fragmentary and sympathetic
He is inspiring, disturbing, educating
He is a light blue Baobab'

Here the wreck has many faces: an object, a phenomenon and, as a surprise revealed from under the ground, the wreck also seems to have dimensions of human existence and humanity: he is 'fragmentary and sympathetic'. The sympathy attached to the wreck may be related to its appearance, which none of the participants describe as magnificent, ship-like, frigate or other words referring to large warships and merchant ships. As a sympathetic ship has hardly travelled at sea with war-like intentions, it is not offensive.

Verse 2: Describe the wreck with three adjectives

The adjectives in the second line of the poems move ambivalently between the concrete and the abstract. The wreck gets character traits and temperament (gentle, inspiring, bold, friendly). As in the first line, the writers do not describe the wreck as wicked or evil. Does gentleness and friendliness come from anonymity? Or from the fact the wreck is quite robust, very ordinary? Easy to relate to? But the wreck is not only sunken and failed: she is also 'bold'; she is still in one piece, heavy and sturdy.

'It is anticipating and hopeful.' What could an old wreck anticipate or hope for? That it will be fixed, that it will float, sail, swing and voyage again? Could this verse be interpreted through the allegory of the human being as a wreck? When we are hurt or broken or failed, we can be wrecked. When the healing starts, we are anticipating, slowly getting hopeful: it will be alright.

In the concrete allegory, the teeth of time gnaw the old wreck, just as has happened or is happening to it in real life: it is 'rotten and decayed', 'soft and old', 'waterlogged and fibrous', 'broken and musty', 'collapsed and heavy'. These lines describe the state of the wreck, its physical condition, perhaps its transience, organic weakness.

Verse 3: What does the wreck do?

Thus far, we have written and read aloud words up to the third verse. We have travelled through a city, planks, sleep, decay and inspiration. In the third verse, the wreck is resting, dreaming, lingering, decaying, hiding. The vessel's life has ended, the movement has ceased. The lack of urgency of the wreck is reflected in the verbs: it is no longer going anywhere, nor is it coming from anywhere. In one of the poems, it is diving; in another, sailing. In these two poems, it is associated with its own element, water. Water is one of the oldest cultural symbols, and water is tied to the flowing passage of time, rites, philosophy and world origin myths. Water is found in religions and in ethical and aesthetical allegories (Strang 2004; Lehtimäki *et al.* 2018).

Matt Edgeworth (2012) has pondered the idea of rhythm in archaeology, both as it relates to the archaeologist's working rhythm at an excavation, as well as the rhythm of the archaeological findings. Edgeworth argues that instead of tying archaeological interpretation too tightly to external theories, greater value should be 'accorded to interpretations made on the basis of engagements with archaeological evidence' (Edgeworth 2012: 91). In the third verse of the poems, the wreck of Hahtiperä gets its rhythm.

One of the poems—in which the wreck is also a city—presents the wreck as exceptionally active, highlighting the wreck's role in its past times:

'She is a city
She is strong and hard
She is transporting, connecting, travelling.'

In the poem, the themes of shipping and movement are connected to the wreck: transporting, connecting, travelling. It is seen as a vessel, not yet and no longer a wreck. It is part of the combination of land and sea, logistics, a cultural enterprise. In the poem, it still fulfils the mission for which it was once built. It is a city, it is strong and resilient, it is mobile and carries something. This poem combines many elements which encapsulate the meaning of the wreck, the reason for its existence. On the other hand, maybe she transports knowledge, connects us to the past, takes us on a voyage through times?

Verse Four: choose a colour and an animal that represent the wreck

At the colour level, we move in broken tones, shades of brown and orange. Sea and water are present in shades of blue, teal and green. The strong prevalence of earthly colours—brown and orange—could originate from the colour of the planks in the water cisterns: they are brownish-red in tone due to the corrosion of the rusted iron nails. The general colour of the wreck is brown. Blue and green locate the subject of the poems to the marine and watery element.

The sea—and more generally, water—has a great symbolic, metaphorical and also very realistic position on the scale of the entire planet. Water is not only a geographical and physical element, it has also always influenced and continues to influence cultural processes, social contexts and the environment. Water has social and cultural dimensions built of meanings and values given to water, and to water's ability to connect various things (Lehtimäki *et al.* 2018: 10). Water is a medium for similes, metaphors and allegories (Lehtimäki *et al*. 2018: 11).

Five of the animals in the fourth verse are water animals: water dragon, flounder, burbot, octopus and crocodile. It is interesting to note the last four of these—flounder, burbot, octopus and crocodile—move in a squirmy manner, staying fairly close to the ground, trying to be unnoticed. Water dragon throws us to a mythical world, to the era of maps in which the cartographer used more imagination than observations of reality. As a water dragon, the wreck has an air of something unknown, mysterious and mythical. It lives in tales.

Of the animals living on land, snake, bear, goose, lion, blackbird, wombat and cat are chosen for the poems. Snakes and wombats are slow, the bear and the lion are strong. Cat is fast, agile and gracious. Blackbird and goose have the ability to fly, a goose has a bit of plumpness in its looks and webbed feet. In literature, a blackbird symbolises something common, easy to ignore. The same could be true with barges in the wreck world: they are easily overlooked and forgotten in comparison to merchant and war ships. The blackbird and its symbolic meaning could stand as a starting point to the discourse of value setting.

Structured poetry as an experience

By observation, the result of the poem was a surprise to many of the participants. One of the joys of structured poems is that the poetry 'is born' when (in this case) 'she/he/it is' is added in front of the lines, and thus, the verses suddenly make sense. The participants were curious to hear what kind of poems the others had written. The chosen adjectives, nouns and verbs prompted vivid discussion of the variety and oddity of attributes or metaphors which people connected to the same wreck. The atmosphere was relaxed and somewhat hilarious. Many commented that writing a poem was not so terrible after all!

Table 20.1. Feedback keywords and their occurrence per 10.

Keywords	Occurrence of keywords per ten feedbacks
Fun	8
Easy	4
Surprising, unexpected result	5
Will try at own work	2
Relaxing	2
Suitable for non-specialists	3
Fascinating	3
Inspiring, new thoughts emerged	3

At the end of the workshops, I asked the participants to provide feedback. There were no structured questions for this. I received 10 written feedbacks, which are analysed by keywords in Table 1.

Two participants who did not leave written feedback said they planned to use the exercise in cultural heritage in their work with children. If there had been more time, a structured or semi-structured feedback form would have provided the opportunity to elicit more detailed answers to whether this kind of creative exercise can bring new ideas regarding the subject. Three participants thought the poems brought new ways to look at cultural heritage, inspired to new approaches and showed how varied were the perceptions of experts.

The organisers of the congress had a very positive attitude about adding the poetry workshop to the event. The archaeologists and conservators of the Finnish Heritage Agency chose suitable pieces of the wreck and transported them to the event. The organisers also aided in advertising and inviting people to participate the event. Organisers said the workshop and the poems created there were featured in the participants' social media during the Congress.

Discussion and further implementations of creative approaches

In 'Figuring it out' Colin Renfrew (2003: 7) writes: 'I have come to feel that the visual arts of today offer a liberation for the student of the past who is seeking to understand the processes that have made us what we are now.' I think that in addition to visual arts, all creative methods can add a new dimension to dealing with the relationship between a human being, nature, past and present, science and cultural perceptions. Fiction and symbolic, metaphorical language convey unconscious feelings and experiences through which we can explore what is in between subjectivity and the objectivity of science.

Creativity and poetry workshops can be used both for experts and in engaging general public in cultural heritage work and interpretation. Creativity offers ways to exploit non-curated material culture in an ethical, nonintrusive, fun and respectful manner. The Hahtiperä wreck is perishable, organic material and the non-preserved pieces will rot—fast. Soon the beautifully carved timbers will only remain in stories told by the ones who were lucky enough to see them. Utilisation of non-curated artefacts could also add accessibility: people with visual impairment, for example, can also take part in cultural heritage work by means of other senses.

Through slow and lingering creative workshops, I believe we can bring meaningfulness to the extended biography of an object, add ethical appreciation to both the afterlife of the object and the general public's right to participate in the cultural management discourse, and to feel cultural pride when included in value-setting. I think it is not only interesting, but also audience-friendly, to give general public a chance to mingle with non-curated cultural heritage. In museums, all the artefacts are labelled, 'pre-chewed'. When interacting with non-curated heritage material, people gain the experience the archaeologists get in the excavation: What is this? Where does this scent come from? The public have the freedom to work with their material imagination, come up with virgin interpretations, maybe get surprised.

Different kind of approaches, especially creative ones, can make people aware of their relation to cultural heritage. In combination with a wreck, creative methods can help people find their maritime 'identity-niches' (Dicks 2003: 28–29). Through creative activities, the general public is given a chance to explore subjective interpretations and verbalise their thoughts. In heritage management discourse, the focus is on objectivity. Maybe the dialogue between these two stakeholder groups could be facilitated by a joint creative poetry workshop: could the poems act as a mirror for meanings and hopes, narrow the discourse gap between general public and the experts?

As a writer, writing teacher and poetry therapist, I believe by adding creative, engaging activities, the afterlife of cultural heritage can be more meaningful to both cultural heritage and consumers. Creative methods not only allow people to experience the cultural heritage slowly, at a personal level and from various viewpoints, but they also facilitate the verbalisation of meanings, thoughts and affects towards cultural heritage, thereby giving everyone a voice in cultural pluralism. In this process, cultural heritage becomes part of people's own personal lifestory. Involvement and inclusion in the cultural heritage discourse can also add cultural pride and benefit to society.

What about them? Past people in a poetic mirror

... hand holding the tar brush
a blacksmith blowing his ember
an old woman plaiting a coarse rope
arms grabbing the pitch barrels
a sad wife longing for her seaman
a bourgeoise fond of Tellicherry Black pepper
a pretty young man addicted to Arabic coffee
an ugly lady petting Coromandel cotton
a snotty nosed girl begging for a penny in the harbor
a mouth chewing the salty dried pike
a priest who blessed them all to eternal sleep.
Me, when I think of you
all the time.

(An excerpt from the Poem biography of the wreck of Hahtiperä, section II: 'The ones who touched/were touched by her'; Vuori 2022.)

How can we approach the long-gone people who had carved, sewed, hammered, shaped or clipped the material remains that archaeologists use to understand and to interpret the past human behaviour? Instead of trying to look for these people by their names, occupations and home addresses, maybe we can try to approach them by thinking of the rhythm, the bodily movements they used to create the objects and how peoples' lives, near and far, were affected by the object, in this context ships of various status.

Speculative fictional narrative is criticised for making up things, being misleading (van Helden and Witcher 2021: 6). Many times, fictional novels and short stories of historical or prehistorical era include details we do no not know to be factually correct: sex, age, background, diet, personality, marital status, voice, *etc.* of a character. To use Bernbeck's (2015: 261) words, in fictional narratives the past people's right to speak for themselves is denied. I posit the language of poetry is more subtle. When we use poetry, we avoid the problems of speculative fiction. We can get closer to past people and yet not steal their own voice.

I repeated the IKUWA7 structured-poetry exercise with an archaeology graduate student at the University of Oulu. In this exercise, the focus was on the historical people who might have been in contact with the wreck of Hahtiperä before its demise. To orientate the student to the barge, I showed her the slideshow of the IKUWA7 poetry workshop. To mimic the authentic pieces, we examined photos of the timbers. When she observed the carving marks, she noted a certain level of closeness with the putative carpenter. She assumed that with the original logs, such a feeling of intimacy could have been stronger, the carpenter becoming more of an individual.

Having authentic archaeological objects in a creative workshop could lead to an even more profound 'from human to human' dimension. Through authenticity, public can conceptualise cultural heritage as a product of a human action. By letting the public get into a leisurely interaction with the objects, they can pay attention to the tool marks, whether skilful or rudimentary, aesthetic or ugly. This interaction can help people not only to see objects, but to see the past populated.

I instructed the student to 'focus on the people who built the barge'. The lines were the same as in the structured-poetry exercise described in this article (Fig. 1.), with one change: I replaced the fifth line ('your favourite season and your favourite place') with 'describe what they or he or she sensed'. The structured poem came out like this:

He is a book
He is strong and sweaty
He is sawing, pushing, dreaming
He is a brown woodpecker
He is hearing the forest.

After finishing the exercise, we talked about the thought associations which arise from the poem. The student said she focussed on a person who had gone to the forest to cut down the trees needed to build the vessel. She had some hesitation to use the noun 'he'. She would have rather used the Finnish gender-neutral 'hän', given the possibility that a woman or person of non-binary identity could have carried out the tree-felling task.

She sensed solitude and calmness when thinking of the person. A book which describes everyday chores, tragedies, joys, a lifetime was associated with the story. To be able to fell a tree and work on it, the person needed to be strong. Here, the writer pointed out, there were probably additional people involved, as the work was likely too much for just one person.

He is sweating, panting, grasping air. The movement of arm is 'pushing and then pulling' as he saws the tree. He dreams of a better life, getting nourished, returning from a wintery forest to a warm home. The allegory of a woodpecker leads to the sound: the clasping of an axe, the rhythmical echoing in the forest. In the verse 'he hears the forest', we can think of all the sensory elements of the surroundings: birds, breath, the crack of a tree branch, the crumbling voice of snow and even the deep silence when the work ceases.

With the combination of slow archaeology and poetry, I believe we can approach the people behind the objects sensitively. The language of poetry allows the expert or the public to cast out ideas about historical people, to draw a verbal picture in order to make them alive and vivid. We could even go further, go to the forest and include bodily writing to the poetry exercise by mimicking all the movements required to build the barge: pull, push, lift, peel, chip, chop, apply tar. Take off your shoes, smell, hear, feel and taste the forest. Write down everything you feel in your body, feel the ancient heartbeat in your chest. We are not that different, after all—are we?

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'The quality of the data and the research methods is excellent; this is reflected in the range and scope of the chapters, but also by a number of contributions which provide overviews of sites, issues and a wide array of data. The resulting volume is far, far more than a conference proceeding, or a themed issue. It truly is a reflection of new and important aspects of the discipline, and from a variety of regions that are not "usually" included in overviews.'

James P. Delgado, Simon Fraser University

Delivering the Deep: Maritime archaeology for the 21st century, originated from work presented at IKUWA 7 conference in Helsinki, and offers a comprehensive look at state-of-the-art research being undertaken by maritime scholars. A curated series of essays reviews change in the discipline over the past 50 years and highlights current trends. The wide range of themes presented underscores the changing nature of maritime archaeology, which has expanded from an initial focus on underwater archaeology and nautical technology to become a dynamic, interdisciplinary field encompassing all tangible and intangible elements of culture related to human activities on, in and around aquatic environments. Themes connected to theoretical frameworks, especially those focusing on maritime cultural landscapes, have increased in popularity, a sign of growth in theoretical insights and maturing research. This paves the way for a more nuanced understanding of past societies, their behaviours, technologies, economies, beliefs, and interactions with watery environments.

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